

**APPENDIX C**

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***FLOOD DAMAGE  
ANALYSIS***

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## APPENDIX C

### FLOOD DAMAGE ANALYSIS

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## CHAPTER I AVAILABLE FLOOD DAMAGE RECORDS

The Laoag River Basin suffers from severe flood damage every year. The flood damage records are usually collected and compiled by the Office of Civil Defense (OCD), the Provincial Planning and Development Council (PPDC), the Municipality Planning and Development Council (MPDC), and the Department of Social Welfare and Development (DSWD).

Flood damage records since 1984 are available from the above government offices. However, these records are incomplete except for 1992 (Typhoon Maring) and 1996 (Typhoon Gloring). The available flood damage records are presented in Table C.1.1.

The 1992 flood (Typhoon Maring) is one of the largest in recent years and flood damage is reported in a comparatively detailed manner. The reported damages are summarized below.

Affected Population	:	70,834 persons
Affected Family	:	15,738 families
Demolished House	:	79 houses
Casualty and Injury	:	6 persons
Damage Cost (in thousand pesos, 1992 price)	:	121,793
(1) Crop Damage	:	25,776
(2) Road and Bridge	:	36,857
(3) River Control Structures	:	19,400
(4) Irrigation System	:	38,220
(5) Other Public Facilities	:	1,540

Further, DSWD and the Provincial Government extended assistance to a considerable number of people in the Basin. In fact, they evacuated approximately 1,000 people and provided 29.6 tons of rice in the whole province [for details, see Table C.1.2(1)].

In July 1996, the Laoag River Basin was ravaged by Typhoon Gloring. The total flood damage in the basin has been preliminarily estimated as follows:

Affected Population	:	37,387 persons
Affected Family	:	9,456 families
Damaged House	:	787 houses
Casualty	:	2 persons
Damage Cost (in thousand pesos, 1996 price)	:	67,434
(1) Crop Damage	:	18,466
(2) Livestock Damage	:	301
(3) Infrastructure Damage	:	48,667
- Local Government Management	:	33,390
- DPWH Management	:	10,080
- NIA Management	:	5,197
Relief Cost (in thousand pesos, 1996 price)	:	138

For breakdown of the above damages by city/municipality, see Table C.1.2(2).

## CHAPTER II FLOOD DAMAGE SURVEY

The Study Team conducted a detailed flood damage survey of major floods in the past to supplement the available records. Data and information were obtained through interviews with the barangay captains in the flood prone areas. The survey covered the flood area, flood depth, affected population and flood damage cost in the past and also the existing assets such as houses, furniture, public buildings and infrastructures. The questionnaire for the interview survey is attached here. For the results of the interviews, please refer to the Data Book.

The floods caused by the 1967 Typhoon Gening, 1986 Typhoon Meding and 1992 Typhoon Maring were identified as the three (3) largest floods in the past. They caused heavy damages over the entire basin. Based on the interviews, the 1967 typhoon flooded 11,991 ha and affected 39,092 persons, the 1986 typhoon inundated 7,531 ha and damaged 52,513 people and the 1992 typhoon submerged 5,351 ha and inflicted damage to 36,399 people.

The flooded area and affected population by city/municipality are shown below.

Municipality	1967 Flood		1986 Flood		1992 Flood	
	Flooded Area (ha)	Affected Population	Flooded Area (ha)	Affected Population	Flooded Area (ha)	Affected Population
Laoag	957	5,944	767	6,118	560	9,722
San Nicolas	220	5,491	229	1,530	98	6,994
Sarrat	695	9,038	386	5,231	177	3,472
Dingras	2,031	6,544	1,369	12,984	2,227	7,265
Solsona	2,400	3,169	2,349	14,040	1,109	4,111
Piddig	122	1,352	190	1,452	88	3,006
Marcos	2,500	5,221	896	4,675	759	-
Banna	2,480	1,623	92	5,860	30	-
Nueva Era	586	710	1,253	623	303	1,829
<b>Total</b>	<b>11,991</b>	<b>39,092</b>	<b>7,531</b>	<b>52,513</b>	<b>5,351</b>	<b>36,399</b>

Note: The above figures cover only river floods and do not include internal (local) floods.

Tables C.2.1, C.2.2 and C.2.3 present the number of affected families, affected population and flood water depth by barangay. The inundation areas of the three (3) major floods were delineated as shown in Fig. C.2.1, C.2.2 and C.2.3. The area flooded by the 1996 Typhoon Gloring is shown in Fig. C.2.4.

To identify the problems in the direct impact area, the respondents in the six barangays were asked to mention problems. Around 92% of the respondents mentioned at least one problem, and the first seven ranking problems are as follows:

Item	Data
Flood	89%
Typhoon	3%
Irrigation Water during dry season	3%
Others (crime, gambling, livelihood, health center)	5%
<b>Total</b>	<b>100%</b>

None is mentioned more frequently than flooding which is ranked first with 89%. Other problems are typhoons, irrigation water, crime, gambling, livelihood and health centers.

Table C.2.4 shows the results of interview survey on the flood in 1996. Around 90% of the households in the six barangays surveyed were affected by the flood in 1996. The flood lasted for an average of 3.8 days. The average depth of floodwaters around the houses of respondent households was 0.8 meters. About 52% of the respondents said the flood came in July, although 36% gave a wider time frame of July -October.

Floods in the six barangays appear to be closely associated with typhoons as pinpointed by around 40% of the respondents. Some 22% consider river overflow as the cause of flooding, while 21% believe that the river channels are already so filled up with sediment that water naturally spills. Deforestation is also blamed by 9%.

Warning against the 1996 flood was reportedly issued and reached 75% of the households. Among the households who heard the warning, 92% identified the radio as the source. The barangay officials are credited by 8%.

The warning was effective in prompting the households into taking a precautionary measure against the flood. A measure was undertaken by 97%. Around 46% of them collected their household stuff and 21% moved their stuff to a location of higher elevation. Other measures taken were the construction of makeshift dike, transfer of domestic animals to safer areas and the strengthening of houses.

There were very few households who escaped from the damage brought about by the flood. The children were the first to suffer with 62% of the households having at least one child absent from school. The average duration of absence was 4.3 days. The absence was because roads were damaged by flood and the river was impassable when water swelled. When the water subsided and the roads were opened to traffic, classrooms were found to be damaged.

The farm produce is the next in line with 54% of the households being hit. The flood wiped out the crops just about to be harvested. This made farming in the six barangays a big gamble. Damage to houses accounted for 47% and farmlands by 43%. Rocks and gravel covered farmlands and destroyed both the crops and the farm.

Since there is always the possibility of future occurrence of big floods and subsequent damage of existing cultivated areas, some measures to protect the expansion of non-cultivable areas were requested by the surveyed barangays.

Table C.2.5 shows that the measure requested by most of the barangays is dredging of the river (35%), followed by bank protection (22%) and general river control (17%). The barangay people are very receptive to any project that will mitigate flooding in Laoag River Basin. Details are tabulated in Attachment B.



## CHAPTER III POPULATION AND ASSETS IN THE POTENTIAL FLOOD AREA

### 3.1 General

The data and information contained in this chapter represent those collected through the interview and questionnaire survey conducted by the JICA study team in 1996. These are important to clarify the actual socio-economic conditions in the potential flood area. However, the data are insufficient due to limited past records of actual floods. The potential flood area was delineated on the basis of the information gathered during the survey.

### 3.2 Potential Flood Area

The potential flood area is about 19,900 ha, equivalent to 14.9% of the total drainage area of 133,210 ha of the basin. The potential flood areas by city/municipality are presented and compared to the total area as shown below.

Municipality	Flooded Barangay (No.)	Flood Area (ha)	Total Area (ha)	Ratio (%)
Laoag	10	1,200	6,200	19.4
San Nicolas	6	300	4,930	6.1
Sarrat	18	700	8,070	8.7
Piddig	7	300	15,080	1.9
Carasi	0	0	5,020	0
Vintar	0	0	5,190	0
Dingras	26	4,200	10,020	41.9
Solsona	21	4,500	16,350	27.5
Marcos	10	3,900	7,320	53.6
Banna	11	3,500	68,700	49.2
Nueva Era	6	1,300	48,040	2.7
<b>Total</b>	<b>115</b>	<b>19,900</b>	<b>133,210</b>	<b>14.9</b>

In total, 115 barangays are fully or partly located in the potential flood area. Their names are listed in Table C.3.1. The potential flood area is delineated as shown in Fig. C.3.1.

### 3.3 Population in the Potential Flood Area

The total population and households in the Laoag River Basin in 1990 were 233,342 and 46,533, respectively. About 104,661 or 45% of the total population and 20,683 or 44% of the total households are located in the potential flood area.

The population and households by city/municipality in 1990 are shown in the following table along with the total population and households.

Municipality	Population (1990)			Household (1990)		
	Flood Area	Total	Ratio (%)	Flood Area	Total	Ratio (%)
Laoag	9,618	83,756	11.5	1,909	16,866	11.3
San Nicolas	6,925	27,632	25.1	1,406	5,523	25.5
Sarrat	17,339	21,272	81.5	3,533	4,369	80.9
Piddig	3,963	17,078	23.2	802	3,466	23.1
Carasi	0	632	0	0	130	0
Dingras	26,149	30,519	85.7	5,084	5,942	85.6
Solsona	18,119	18,883	96.0	3,569	3,720	95.9
Marcos	9,982	12,990	76.8	1,953	2,532	77.1
Banna	9,233	15,342	60.2	1,761	2,947	59.8
Nueva Era	3,333	5,238	63.6	666	1,038	64.2
<b>Total</b>	<b>104,661</b>	<b>233,342</b>	<b>44.9</b>	<b>20,683</b>	<b>46,533</b>	<b>44.4</b>

The population and households by barangay in 1990 are shown in Table C.3.1. The occupations of people living in the potential flood area are classified below.

	(Unit: %)					
	Farmer	Public Official	Restaurant Worker	Shop Worker	Laborer	Others
Urban Area	47.0	22.5	1.2	1.3	17.0	11.0
Rural Area	84.0	6.0	0	0.2	5.0	4.7

### 3.4 Assets in the Potential Flood Area

The existing assets in the potential flood area were determined through interview surveys. They include house buildings, furniture, roads, bridges, irrigation systems, crops, public buildings and livestock.

#### (1) Assets of House Building

The number of existing house buildings is nearly equal to the number of households. It is estimated that 20,683 house buildings were located in the potential flood area in 1990. The breakdown by city/municipality is shown in previous Section 3.2. For the number of house buildings by barangay, refer to Table C.3.1.

The average value of a house building by city/municipality is estimated as follows:

(at 1996 prices)					
Municipality	Value (P)	Municipality	Value (P)	Municipality	Value (P)
Laoag	230,000	Piddig	210,000	Marcos	220,000
San Nicolas	205,000	Dingras	207,000	Banna	210,000
Sarrat	205,000	Solsona	204,000	Nueva Era	200,000

#### (2) Assets of Furniture

The major furniture surveyed are chest of drawers, TVs, carpets, dressers, living sets, stereos, cabinets, tables/chairs and refrigerators. The average number of each furniture owned by one family is shown in Table C.3.2. The average value of each furniture is shown in Table C.3.3. From these two tables, the total value of furniture owned by one family is calculated as shown in Table C.3.4 and summarized below.

(at 1996 prices)

Municipality	Value (P)	Municipality	Value (P)	Municipality	Value (P)
Laoag	46,227	Piddig	33,673	Marcos	30,381
San Nicolas	44,100	Dingras	33,228	Banna	35,560
Sarrat	43,367	Solsona	34,992	Nueva Era	35,317

(3) Assets of Roads and Bridges

The existing road length in the potential flood area reaches 933 km. The length of national, provincial, municipal and barangay roads by each city/municipality is summarized below.

Municipality	Road					Bridge (No.)
	National	Provincial	Municipal	Barangay	Total	
Laoag	25.0	4.8	9.5	44.5	83.8	12
San Nicolas	6.7	2.7	1.8	14.9	26.1	9
Sarrat	52.5	26.1	12.4	68.7	159.7	33
Piddig	3.5	0	5.0	23.8	32.3	7
Dingras	20.5	18.0	24.9	120.6	184.0	39
Solsona	18.0	31.1	22.0	119.8	190.9	80
Marcos	11.8	14.8	0	117.7	144.3	7
Banna	17.5	8.0	6.0	51.5	83.0	62
Nueva Era	0	4.0	10.2	15.0	29.2	-
Total	155.5	109.5	91.8	576.5	933.3	(249)

Note: Bridge data for Nueva Era are not available.

The length of national, provincial, municipal and barangay roads by barangay is shown in Table C.3.5.

Further, the average unit construction costs of national, provincial, municipal and barangay roads by pavement method in 1996 were obtained from DPWH and shown below.

(at 1996 prices)

	Asphalt (P/m)	Concrete (P/m)
National Road	2,805	2,992
Provincial Road	2,550	2,972
Municipality Road	2,318	2,701
Barangay Road	1,160	482

The above unit costs will give a basis for the estimation of road assets in the potential flood area.

The existing bridges in the potential flood area total 250. They are broken down by city/municipality as shown also in the above table. The bridges by barangay are shown in Table C.3.6. The estimated values of some bridges are also given in Table C.3.6.

(4) Irrigation Area

The existing major irrigation areas in the Laoag River Basin are estimated at 20,530 ha broken down by city/municipality and shown below.

Municipality	Area (ha)	Municipality	Area (ha)	Municipality	Area (ha)
Laoag	3,800	Piddig	170	Marcos	4,920
San Nicolas	1,140	Dingras	3,960	Banna	1,800
Sarrat	400	Solsona	4,070	Nueva Era	270

The preceding figures cover only the NIA irrigation area including INIP but excluding the CIS irrigation area.

(5) Cultivation Area and Crop Production

A total area of 8,830 ha is cultivated in the potential flood area. This area is broken down into the respective city and municipalities as shown below.

Municipality	Area (ha)	Municipality	Area (ha)	Municipality	Area (ha)
Laoag	700	Piddig	90	Marcos	1,820
San Nicolas	180	Dingras	1,500	Banna	1,800
Sarrat	510	Solsona	1,800	Nueva Era	430

The above farmlands are cultivated for such crops as rice, corn, root-crop, legume, tobacco, garlic and vegetable. Their typical cropping calendars are shown in Table C.3.7. In flood season (June to November), rice is mainly cultivated; however, upland crops are planted in some areas.

The weighted cropping pattern in the potential flood area by city/municipality is calculated as shown in Table C.3.8. The unit production values of the crops are also shown in Table C.3.9. From these two tables, the present unit production values of the cultivated area by city and municipality in 1996 are estimated as follows:

Municipality	Unit Production Value (P/ha)	Municipality	Unit Production Value (P/ha)
Laoag	41,435	Solsona	53,702
San Nicolas	55,236	Marcos	43,406
Sarrat	81,998	Banna	44,696
Piddig	49,143	Nueva Era	45,780
Dingras	43,098	Average	50,944

(6) Public Building

The public buildings surveyed were barangay halls, municipal halls, hospitals, health centers, schools, chapels/churches and others. The number of public buildings by city/municipality is summarized below.

Municipality	Barangay Hall (No.)	Hospital/Health Center (No.)	School (class)	Other Public Bldg. (No.)
Laoag	9	12	63	2
San Nicolas	3	2	120	4
Sarrat	19	11	182	3
Piddig	7	2	32	0
Dingras	24	16	226	9
Solsona	22	11	240	8
Marcos	10	8	87	6
Banna	11	5	87	1
Nueva Era	5	3	50	1
<b>Total</b>	<b>110</b>	<b>70</b>	<b>1,087</b>	<b>34</b>

Note: Other public buildings include chapels/churches, municipal halls, public markets, etc.

For details of the above public buildings, see Tables C.3.10, C.3.11, C.3.12 and C.3.13. Further, these tables include the estimated values of some public buildings. Their average value is estimated at 1996 prices as follows:

Barangay Hall	:	P179,000/unit
Hospital/Health Care	:	P97,000/unit
Elementary School	:	P200,000/class
High School/College	:	P220,000/class
Municipal Hall	:	P11,000/m <sup>2</sup>

#### (7) Livestock

One farmer raises one (1) carabao, one (1) cow and several chickens on the average. Further, farmers in Solsona Municipality feed one (1) pig each. The number of livestock is estimated according to the number of farmers. The number of livestock by municipality is summarized as follows:

Municipality	Carabao (head)	Cow (head)	Chicken (head)	Pig (head)
Laoag	896	896	2,688	NS
San Nicolas	189	189	567	NS
Sarrat	2,707	2,707	8,121	NS
Piddig	630	630	1,890	NS
Dingras	2,695	2,695	8,085	NS
Solsona	3,259	3,259	9,777	3,259
Marcos	1,809	1,809	5,427	NS
Banna	1,458	1,458	4,374	NS
Nueva Era	512	512	1,536	NS
<b>Total</b>	<b>14,155</b>	<b>14,155</b>	<b>42,465</b>	<b>3,259</b>

Note: NS means negligibly small.

The number of livestock by barangay are given in Table C.3.14. Their average unit prices are estimated at 1996 prices as follows:

Carabao	:	P19,000/head
Cow	:	P20,000/head
Chicken	:	P110/head
Pig	:	P7,000/head

### 3.5 Relation Between Water Depth and Damage Rate

Flood damage generally is proportionate to flood water depth. The relation between water depth and damage rate was analyzed for the affected assets based on the actual damages and water depth of past floods obtained through interview survey.

House buildings, furniture and crops in the upstream reaches are more prone to heavy damages than those in the downstream reaches under the same water depth. It is because flood water in the upper reaches has a higher velocity and brings more sediment deposits.

Therefore, damage rate/water depth analysis was conducted separately for the two reaches. The downstream reaches cover the flood areas of Laoag City, San Nicolas, Sarrat and Dingras. The upstream reaches include areas in Piddig, Solsona, Marcos, Banna and Nueva Era.

#### (1) House Damage Rate

The relation between damage rate and water depth for house building including composition of sediment deposits found in the houses in the downstream reaches is shown in Fig. C.3.2. Those in the upstream reaches are shown in Fig. C.3.2.

As evident in the above figures, house buildings in the upstream reaches are subject to more severe damages. Sediment deposits in the houses are larger in size.

#### (2) Furniture Damage Rate

The relation between damage rate and water depth for furniture is shown in Fig. C.3.3. Composition of the sediment deposits are the same as that in the house.

Furniture damages are considered more severe in the upstream reaches than in the downstream reaches.

#### (3) Crop Damage Rate

The relation between damage rate and water depth for crops in the downstream and upstream reaches is given in Fig. C.3.4. The composition of the sediment deposits on the farmlands for the respective reaches is shown also in the same figure. Likewise crop damage rate in the upstream reaches is more severe than in the downstream reaches.

## CHAPTER IV FLOOD SIMULATION

### 4.1 Flood Simulation Model

#### 4.1.1 Methodology

The inundation areas and depths by floods of 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return periods were simulated by using the Two-Dimensional Unsteady Flow Model. The simulation was conducted by dividing the flood prone area into mesh blocks of 500 m by 500 m and putting hydraulic and topographic data into each mesh. The average ground height of each mesh was calculated based on the topographic map with a scale of 1/10,000 prepared in this Study.

#### 4.1.2 Two-Dimensional Unsteady Flow Model

##### (1) Basic Equations

The basic equations applied to the model are derived from the following equations:

##### (a) Euler's Equation of Motion

$$\begin{aligned}\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} + w \frac{\partial u}{\partial z} &= X - \frac{1}{\rho} \frac{\partial P}{\partial X} \\ \frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} + w \frac{\partial v}{\partial z} &= Y - \frac{1}{\rho} \frac{\partial P}{\partial Y} \\ \frac{\partial w}{\partial t} + u \frac{\partial w}{\partial x} + v \frac{\partial w}{\partial y} + w \frac{\partial w}{\partial z} &= Z - \frac{1}{\rho} \frac{\partial P}{\partial Z}\end{aligned}$$

where,

$u, v, w$  : velocity of  $x, y$  and  $z$  directions  
 $X, Y, Z$  : gravity of  $x, y$  and  $z$  directions  
 $\rho$  : water density ( $=1.0 \text{ ton/m}^3$ )  
 $P$  : pressure

##### (b) Equation of Continuity

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

##### (2) Applied Equations

For actual application to the Two-Dimensional Model, the above equations are expressed as follows:

(a) Equation of Motion

$$\frac{1}{gA_x} \frac{\partial Q_x}{\partial t} - \frac{Q_x B_x}{gA_x^2} \frac{\partial H}{\partial x} + \frac{\partial H}{\partial x} + \frac{|Q_x| Q_x}{F_x^2} = 0$$

$$\frac{1}{gA_y} \frac{\partial Q_y}{\partial t} - \frac{Q_y B_y}{gA_y^2} \frac{\partial H}{\partial y} + \frac{\partial H}{\partial y} + \frac{|Q_y| Q_y}{F_y^2} = 0$$

$$F_x = \frac{1}{n} R_x^{2/3} A_x$$

$$F_y = \frac{1}{n} R_y^{2/3} A_y$$

(b) Equation of Continuity

$$\frac{\partial (Bh)}{\partial t} + \frac{\partial Q_x}{\partial x} + \frac{\partial Q_y}{\partial y} = 0$$

where,

- $Q_x, Q_y$  : discharge of x and y directions ( $m^3/s$ )
- $A_x, A_y$  : current area of x and y directions ( $m^2$ )
- $B_x, B_y$  : width of x and y directions (m)
- $R_x, R_y$  : hydraulic depth of x and y directions (m)
- $g$  : acceleration gravity ( $9.8 m/s^2$ )
- $n$  : Manning's roughness coefficient
- $H$  : water level (m)
- $h$  : water depth (m)

The above equations are finally transformed into finite difference form for numerical computation, as follows:

(a) Finite Difference Form of Equation of Motion

$$\frac{1}{gA_{IJ}^{n-1/2}} \frac{Q_{IJ}^n - Q_{IJ}^{n-1}}{\Delta t} - \frac{\left( \frac{Q_{IJ}^n - Q_{IJ}^{n-1}}{2} \right) \cdot \Delta y}{g \cdot \left( A_{IJ}^{n-1/2} \right)^2} \frac{H_{IJ}^{n-1/2} - H_{IJ}^{n-2/3}}{\Delta x} + \frac{H_{IJ}^{n-1/2} - H_{IJ}^{n-2/3}}{\Delta x} + \frac{|Q_{IJ}^{n-1}| Q_{IJ}^n}{\left\{ \frac{1}{n} \left( \frac{A_{IJ}^{n-1/2}}{\Delta y} \right) \cdot A_{IJ}^{n-1/2} \right\}^2} = 0$$



(b) Finite Difference Form of Equation of Continuity

$$\frac{(Bh)_{IJ}^n - (Bh)_{IJ}^{n-1}}{\Delta t} + \frac{Q_{I+\frac{1}{2},J}^{n-\frac{1}{2}} - Q_{I-\frac{1}{2},J}^{n-\frac{1}{2}}}{\Delta x} + \frac{Q_{I,J+\frac{1}{2}}^{n-\frac{1}{2}} - Q_{I,J-\frac{1}{2}}^{n-\frac{1}{2}}}{\Delta y} = 0$$

where,  
 suffix  $I, J$  : mesh number of  $x$  and  $y$  directions  
 suffix  $n$  : computative time step number

#### 4.1.3 Initial Condition for Computation

The computation was conducted based on the following assumptions.

- (1) Inundation is caused only by the flood discharge exceeding the flow capacity of the major river channels of Bongo, Papa, Madongan, Solsona, Cura/Labugaon, Guisit and Laoag. Inundation due to local flood is neglected.
- (2) The existing dikes of the Solsona, Madongan and Papa rivers are not expected to confine floodwaters, because they are considered as temporary structures and, in fact, have been breached at many locations.
- (3) Blocking of the flow-down of inundation water by such structures as roads is taken into consideration in the simulation as if there are weirs between the mesh blocks.

The probable flood hydrograph at the apex of alluvial fan is shown in Fig. C.4.1.

#### 4.2 Inundation Analysis

##### 4.2.1 Results of Inundation Analysis

The inundation areas and inundation depths corresponding to the probable flood hydrographs of 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return period were simulated by the aforementioned inundation model. Each simulated inundation area is illustrated in Fig. C.4.2.

The simulated inundation area was divided into 19 sub-districts by flood water source and land use condition. The inundation area by a 25-year return period flood is shown in Fig. C.4.3.

The simulated inundation area is tabulated in Table C.4.1 and summarized as follows:

Return Period (Year)	2-yr.	5-yr.	10-yr.	25-yr.	50-yr.	100-yr.
Inundation Area (ha)	12,800	14,800	15,950	17,290	18,990	20,220

##### 4.2.2 Verification of Flood Inundation Model

The simulated inundation area of 202 km<sup>2</sup>, by a 100-year flood as shown in Fig. C.4.4, is evaluated to be adequate compared with the potential flood area which covers 199 km<sup>2</sup> (19,900 ha) as estimated in Subsection 3.1, Potential Flood Area, and shown in Fig. C.3.1. The simulated inundation area by a 100-year flood well coincides with the potential flood area; thus, the adequacy of the inundation model is verified.

## CHAPTER V PROBABLE FLOOD DAMAGE

### 5.1 Components of Flood Damage

The economic losses due to flooding are divided into two main sections, namely:

- (1) Losses due to damage to existing facilities and suspension of business activities because of inundation; and
- (2) Expenses in emergency activities to aid flood victims during and after inundation.

From the economic point of view, there are three types of damage to existing facilities, and these are:

- (1) Damage losses to properties of economic entities

These losses consist of (a) accumulated properties and structures such as buildings, machinery, equipment and irrigation facilities and (b) inventory stock and products such as finished products, works-in-process, raw materials, goods for resale and crops under cultivation.

- (2) Opportunity losses

These losses consist of two parts: (a) expected profits through damaged products and merchandise and (b) suspension of business or production activities and profits lost during restoration of damaged facilities and infrastructure.

- (3) Cultivated field loss

In the upstream of Laoag river basin, cultivated agricultural lands were lost and could not have been utilized for crop cultivation purposes thereafter due to sedimentation of rocks and sand.

From the social standpoint, the losses come in two forms, and these are:

- (1) Damage to dwelling units, which include household effects as well as residential buildings; and
- (2) Damage to infrastructure which consist of (a) social infrastructure (schools and medical facilities) and (b) physical infrastructure (transportation, potable water, electricity, telephone, irrigation facilities and river structures).

These components of damage losses are illustrated in relation to each other in Fig. C.5.1. Taking this structure into consideration, flood damage is estimated by the following items:

- (1) Direct damages, which are divided into four representative items:

- (a) Dwelling units which include the building itself and the indoor movables or household effects in it.
- (b) Industrial establishments
  - (i) Manufacturing establishments consisting of factory building, machinery, equipment for production, inventory stock such as finished products, works-in-process, raw materials and goods for resale, and expected profit through production.
  - (ii) Trading establishments including store, furniture, equipment, inventory stock such as merchandise and materials for sale, and expected profit through damageable inventory of stock.

- (c) Palay production consisting of accumulated production cost and expected net income. Production of some other important crops such as corn, garlic, tobacco, mango, and tomato. Irrigation facilities are considered to be a physical infrastructure.
  - (d) Infrastructure damages
    - (i) Social infrastructure: educational and medical facilities, damageable assets of which consists of building, furniture and equipment, and inventory stocks in them. Besides, barangay halls, churches, recreation and sports facilities are affected by flood disaster.
    - (ii) Physical infrastructure: roads, water, electricity, telephone, irrigation facilities and river facilities are listed as damageable assets.
- (2) Indirect damages
- (a) Opportunity losses of business and production activities because of flood inundation: Business losses to the affected establishments in the manufacturing and services sectors are taken into account. The losses which accrue from stoppage of infrastructures are also taken into consideration.
  - (b) Emergency activities: Emergency activities such as evacuation and relief of flood victims are done during flood disaster and just after the disaster. These activities are usually executed by the public sector or by social welfare bodies.
  - (c) Medical care for victims suffering from waterborne diseases because of flood inundation: Even after flood disaster, some victims could suffer from waterborne diseases, so public hygiene should be maintained in flood prone areas.
  - (d) Prevention activities against crimes: Crimes such as robbery and pilferage during confusion at the scene of flood should be prevented, in addition to evacuation and relief activities.

## 5.2 Damageable Assets and Their Values

The potential flood area is approximately 240 km<sup>2</sup> of lowland, which occupies around 18% of the basin area (1,332 km<sup>2</sup>). A mesh block of 500 m interval squares was superimposed on the map with each square representing 25 ha. Through the mesh analysis, the respective damageable assets were specified and are discussed in the following sections. Likewise, their present values are also discussed.

### 5.2.1 Housing Units

The number of dwelling units is enumerated by mesh block on the basis of the 1990 barangay census. The number of dwelling units is considered to be the same as the number of households. It is estimated to be 15,600 units in the 1990 census and since it has grown at 1.73% per annum, it is predicted to increase to 17,300 units in 1996.

Housing units are classified into four types, as mentioned in Section 2.3 of Appendix A. According to Table C.5.1, unit construction cost (pesos per m<sup>2</sup>) of a new house for one family ranges as follows: 3,000 pesos for Type I, 2,580 pesos for Type II, 2,020 pesos for Type III, and 690 pesos for Type IV. The average floor area is 42 m<sup>2</sup>, referring to Table A.2.7. Then, the new dwelling unit costs 126,000 pesos for Type I, 108,360 pesos for Type II, 84,840 pesos for Type III and 28,980 pesos for Type IV. According to the 1990 census, the average age of dwelling units is 23 years as seen in Table A.2.6. Then, its depreciated value might be 33% for Type I, 48% for Type II 67% for Type III and 82% for Type IV, referring to the schedule of depreciation in municipalities in Fig. C.5.2. Accordingly, the average market

value is estimated at 84,400 pesos for Type I, 56,400 pesos for Type II, 28,000 pesos for Type III and 5,200 pesos for Type IV.

According to Table A.2.5, there were 13,991 units or 29% of the total units of Types I/II, 20,624 units or 42% of Type III and 13,987 units or 29% of Type IV in 1990. Applying this distribution data to the above value information, the weighted average market value is estimated at 33,700 pesos per unit, as shown in the following table.

Building Type	Type I/II	Type III	Type IV
Unit Value (pesos)	70,400	28,000	5,200
Distribution	29%	42%	29%
Weighted Average (pesos)	33,700		

Incidentally, the above market value of dwelling units was evaluated by the City Assessor for taxation purposes. Table C.5.2 shows the distribution of the assessed market value regarding dwelling units in Laoag City and the related five municipalities in 1995. The average value of the entire units was 113,900 pesos in Laoag City and 25,400 pesos in municipalities. The above estimated average of 33,700 pesos is lower than the average market value in Laoag City and higher than that of municipalities.

It is said that the assessed value for taxation purposes is smaller than the actual market value. The discrepancy between these assessed value and actual market value is not clear. Although it is shrinking gradually, the difference between the two is still 50% to 100%, according to one authority. In this study, thus, the actual market value of dwelling units is assumed to be 50,000 pesos, which is 50% higher than the estimated average value of 33,700 pesos.

Indoor movable or household effects in an average family are estimated in the maximum value of 46,200 pesos in Laoag City and the minimum value of 30,400 pesos in the municipality of Marcos. Its average value is 37,400 pesos. These values are based on the unit prices of new commodities. Then, supposing that the actual value is half of the above estimate, the entire average value of household effects is calculated at 18,700 pesos. Incidentally, the average annual family expenditure in Ilocos Norte Province was 45,000 pesos in 1991 as shown in Table A.4.12. At that time, an average family is expected to stock around 14,600 pesos of clothes and food stuff. This stock value is reevaluated as 19,000 pesos in 1996, applying the consumer index (130%) between 1991 and 1996. Accordingly, the indoor movable value was estimated at 37,700 pesos in 1996. In this current study, thus, the actual market value of indoor movables is assumed to be 38,000 pesos.

### 5.2.2 Agricultural Production

As discussed in Section 4.1 of Appendix A, the main crops in the basin are palay, corn, garlic, tobacco, tomato, onion and mango. Palay and garlic are selected as representative crops since their production values are prominent. In the potential flood area there are approximately 12,700 has. of crop cultivation areas. Most palay fields are irrigated and only 2% of the crop fields are rainfed.

The degree of crop damage varies from month to month, depending on the cropping stage and timing of flood occurrence. Therefore, the annual average damage value of crop per hectare is estimated as the aggregate of expected net income and accumulated expenditure for production until the time flood occurs. In this case, flood frequency and planted area cultivated in each month have to be taken into account as well. It is expressed by the following formula:

$$DV = \sum_{i=1}^{D_{yr.}} CA_i \cdot FF_i \cdot (AC_i \cdot PC_i + NI)$$

where;

*DV* : damageable value (Pesos/ha)

*CA* : cultivated area (%)

*FF* : flood frequency (%)

*AC* : accumulated cost (%)

*PC* : production cost (Pesos/ha)

*NI* : net income (Pesos/ha)

Production cost (*PC*) of palay and garlic is tabulated in Table C.5.3. Palay is estimated to be 17,970 pesos per ha for irrigated field and 14,761 pesos per ha for non-irrigated field. Garlic is estimated at 45,650 pesos per ha.

Gross income is a product of farm gate price and crop production. Farm gate price of major crops is listed in Table C.5.4. The table shows the trend for the last five years. The farm gate prices of palay and garlic is set at 8 pesos per kg and 110 pesos per kg, respectively. In economic evaluation, these prices should be converted to economic value. As a reference, the economic value of palay is estimated in Table C.5.5, which is referred to the world market price in Bangkok.

The yield of palay is assumed at 3.8 tons per ha in wet season, 4.2 tons per ha in dry season and 2.4 tons per ha for non-irrigated field, referring to Table A.4.2. In the same manner, the yield of garlic is assumed at 3.0 tons per ha.

Net income (*NI*) is estimated gross income minus production cost. Thus, the net income of palay in irrigated field during wet season and dry season, palay in non-irrigated field, and garlic is estimated at 12,430 pesos per ha, 15,630 pesos per ha, 4,439 pesos per ha and 284,350 pesos per ha, respectively. They are calculated in Table C.5.7 to C.5.9.

Table C.5.6 shows the cropping calendar in the basin. Most irrigated palay fields are utilized for double cropping. Some special areas are used for three times of cropping. Garlic is produced in irrigated fields during dry season. The total area for garlic production is nearly 20% of the entire cultivated area in dry season. The three cropping systems are set for the estimation of damageable value. They are: (1) double cropping for palay only; (2) double cropping of palay and garlic; (3) palay production of rainfed field. The damageable value in the respective systems are enumerated in Tables C.5.7 to C.5.9. The damageable values in financial terms are 18,000 pesos per ha for System (1); 32,400 pesos per ha for System (2); and 13,700 pesos per ha for System (3).

### 5.2.3 Manufacturing Industry

The existing number of manufacturing establishments is 221 as shown in Table A.4.5 of Appendix A. This number accounted for 70% of the total (317) of business establishments in the province. Of the total number of 221 in the basin, 82 establishments or 37% are located in Laoag City. Other 139 establishments are scattered in the other ten municipalities. In the potential flood area, there are only 87 establishments. They were identified through the directory presented by DTI, so most of them are accounted in the basin mesh map. Most of them are small manufacturing industry.

According to the discussion in Section 4.2 of Appendix A, an average annual output of a small scale establishment was 97,800 pesos on average in 1991. Its value added (*VA*) was 52,800 pesos. Its fixed assets and inventory stock, which were damageable assets of factory,

were estimated as 2,000 pesos and 5,000 pesos, respectively. Applying price index (130% of 1996 to 1991) to these values, the fixed assets and inventory stock were reevaluated as 2,600 pesos and 6,500 pesos in 1996, respectively.

The report did not have any records regarding building of the manufacturing establishments. In this current study, a factory building was assumed to have a value of 50,000 pesos, which was the same as an average value of residential building. Thus, the damageable value of fixed assets was set up as 53,000 pesos in total.

The above estimated value of 6,500 pesos for the inventory stock seems to be too small as compared with the value of fixed assets. On the other hand, the inventory stock was estimated at 63,000 pesos on average for both large and small scale manufacturers in Region I, according to the data of Table A.4.6. Then, the value was assumed to be 65,000 pesos for the inventory stock in this current study.

As a result of analysis, the damageable values of fixed assets and inventory stock of manufacturing establishments were set up as 53,000 pesos and 65,000 pesos, respectively.

#### 5.2.4 Trading Industry

The existing number of trading establishments was 1,441 in Laoag River Basin in 1996. This number accounted for 63% of the total number (2,289) of business establishments in the province. Of the 1,441 in the basin, 628 establishments or 44% are located in Laoag City. Moreover, 791 or 55% are small scale stores called as sari-sari stores. Among the 1,441 stores, wholesale traders are only 77 or 5%. Of the 1,364 retail traders, 907 or 66% are classified into food shops or food related stores.

In the potential flood area, there were around 420 establishments in 1996. Their location is not clear even in the directory provided by DTI. Thus, these stores were distributed in proportion to population. For instance, since there were 77 stores in Dingras and at that time its population was projected at 18,700 the average of 4.1 stores were considered to exist in a block of 1,000 people. Applying this rate to the municipality of Dingras, the stores were distributed in the basin mesh map. In the same way, all stores were distributed in the potential flood area.

In the basin, most are retail traders, so management indices of retail trading sector were applied to estimate fixed assets and inventory assets. As discussed in Section 4.3 of Appendix A, the average annual sales of a retail trade establishment was 10.0 million pesos on average in 1989. Its value added (VA) was 0.98 million pesos. Its fixed assets and inventory stock, which are damageable assets were estimated at 59,000 pesos and 2.31 million pesos, respectively. However, the value of inventory stock looks too large and not realistic because the rate of stock-turn is only 4 times a year. Instead of this regional information, the national average was used to estimate damageable assets. The fixed assets and inventory stock were estimated at 8,900 pesos and 123,200 pesos, respectively. Applying price index (170%) of 1996 to 1989 to these values, the fixed assets and inventory stock were reevaluated for 1996 as 15,100 pesos and 209,400 pesos respectively. The fixed assets included the value of building, which was evaluated at 4,350 pesos in 1989. It was reevaluated at 7,400 pesos in 1996.

As a result of analysis, the damageable values of fixed assets and inventory stock of trading establishments were set up at 15,000 pesos and 210,000 pesos, respectively.

## 5.2.5 Infrastructure

Infrastructure is generally classified into two categories: (1) social infrastructure, i.e., educational facilities, medical facilities, etc.; and (2) physical infrastructure, i.e., transportation, water supply, irrigation, electricity, telephone, river structures, etc.

### (1) Social Infrastructure

Social infrastructure is represented by educational and medical facilities in this study because they exist in large number and their damageable values are comparatively larger than the other social infrastructures such as barangay hall, chapels and sports facilities. Their damageable assets consists of building, furniture and equipment, and also inventory stock.

#### (a) Educational Facility

In the potential flood area, there are 107 educational facilities in total, which are broken down as follows

Level	Laoag River Basin	Potential Flood Area
Pre-school	65	26
Elementary	187	61
Secondary	32	16
Tertiary	4	4

The population bracket of elementary school (ages 7 to 12 years) was estimated at 30,000 or 15% of the basin population (206,000). Then, there would be 600 classes in the basin, since the number of pupils for a class is less than 50. Since there are 187 elementary schools in the basin, it should have four classrooms on average. Besides classrooms, it installs a multipurpose workshop, a faculty room and toilet facility. It costs nearly 3.0 million pesos in case it is newly constructed. Besides, it requires furniture and equipment. For this type of school, the cost is estimated at 5.0 million pesos. Accordingly, the actual damageable value of the school is assumed to be half of the above value, that is 1.75 million pesos considering its depreciation.

#### (b) Medical Facilities

In the potential flood area, there are 29 medical facilities, which are broken down as follows:

Facility	Laoag River Basin	Potential Flood Area
Hospital	13	6
Barangay Health Station	54	19
Rural Health Unit	13	4

A hospital has 19 beds on average. According to the Health Information Service of DOH, a 25 bed hospital costs around 31.4 million pesos in 1996. It has a total of 2,243 m<sup>2</sup> of floor area, comprising of 2,066 m<sup>2</sup> of hospital itself and 183 m<sup>2</sup> of support buildings such as morgue, motorpool, powerhouse and staff house. Besides, a hospital has to install equipment and furniture. According to the same source, standard equipment for a ten bed municipal hospital costs around 4 million pesos in 1996. Accordingly, a hospital having 19 beds in the basin is estimated at around 32 million pesos by applying unit

cost (1.66 million per bed) of building and equipment. Therefore, the actual damageable value of a hospital is supposed to be half of the above value, say 16 million pesos considering also depreciation.

For Barangay Health Stations, as well as Rural Health Units, the Health Information Service of DOH furnished the following unit construction costs. A standard barangay health station with a floor area of 50.4 m<sup>2</sup> costs 705,000 pesos for the building itself. It requires medical equipment which costs around 20,000 pesos, according to the provincial office of DOH. Thus, it costs 725,000 pesos in total in case it is newly constructed. Accordingly, the actual damageable value of the station is said to be half of the above value, say 362,500 pesos, considering depreciation. Besides, an inventory stock such as medicines and medical tools is estimated at 0.3 million on average. The damageable value is broken down as 352,500 pesos for building, 10,000 pesos for equipment and 300,000 pesos for inventory stock.

In the same manner, a standard rural health unit of 144 m<sup>2</sup> costs 2.04 million pesos, comprising of 2 million pesos for the building and 40,000 pesos of furniture and equipment. The damageable value of the rural health unit is assumed to be 1.02 million pesos. An inventory stock such as medicines and medical tools is estimated at 600,000 pesos.

(2) Physical Infrastructure

Physical infrastructure in the Laoag river basin consists of roads, water supply systems, electricity supply network, telephone lines, irrigation facilities, river facilities and so on, all of which are enumerated as damageable assets. Among them, road system and irrigation facilities are vulnerable to flood disaster and are more costly structures. Thus, these facilities are individually probed in terms of their inventory and damage records. The diffusion of these physical infrastructures in the province is discussed in Section A.5.3.

(a) Road System

The road density in the potential flood area is shown in Table A.5.3 and Section 8.2.2 of Appendix A. The length of roads in the respective districts is estimated as a product of municipal road density and land area in the district. The total length of road in the flood inundation area for a 100 year return period is estimated at 676 km.

The construction costs of new roads are shown below.

	(Unit: pesos/m)			
	National	Provincial	City/Municipal	Barangay
Concrete	2,992	2,972	2,701	1,482
Asphalt	2,805	2,550	2,318	1,160

The present damageable value of the respective roads is considered to be half of the above value taking depreciation into account.

(b) Irrigation Facility

Most crop fields in the basin are irrigated as mentioned in Appendix A. Floods have damaged not only crop production but also the irrigation facilities. In particular, sedimentation of rocks and sand has decreased the effectiveness of the irrigation system.



The construction cost of new irrigation system is estimated on the basis of the following prevailing standard: 91,000 pesos per ha for irrigation system and 2,600 pesos per ha for on-farm facilities.

### 5.3 Distribution of Damageable Assets

#### 5.3.1 Inventory of Damageable Assets

Distribution of damageable assets is worked out in the form of grid information. A mesh block of 500 m interval squares is formed. The inventory of damageable assets in every square is estimated considering land use, topographic and administrative boundary maps and socio-economic data.

With regard to dwelling units, the distribution was figured out through the following procedure. Dwelling units in a barangay are assumed to be distributed equally all over built-up areas. Hence, the number of dwelling units is assumed to be the same as the number of households. The number of existing dwelling units in a mesh block is calculated as a product of a dwelling density of the barangay and an area built-up for urban activity in the mesh block. Finally, the number of dwelling units by mesh block is counted up in the entire potential flood area.

In the potential flood area, there are only 87 manufacturing establishments. They are identified through the directory presented by DTI, so most of them were directly allotted in the basin mesh map.

Trading firms are basically established in densely inhabited areas. They are established not only in the town proper but also in rural inhabited areas. Thus, they were assumed to be distributed in accordance with the trading firm density, i.e., the number of trading firms to population in a municipality.

The distribution of crop cultivation lands are figured out on the basis of land use map. In principle, there are no buildings such as dwelling units and industrial establishments in agricultural lands.

The total road length in the respective districts is estimated at 676 km. The road distribution in the respective districts is estimated by means of road density.

The distribution of the aforesaid facilities and lands by district for 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return periods are shown in Tables C.5.10 to C.5.15. Hence, the district and the potential flood areas of the respective return periods were defined in the previous chapter and illustrated in Fig. C.4.2. The following table summarizes the total inventory of the respective facilities in the potential flood area.

Item	Return Period					
	2-years	5-years	10-years	25-years	50-years	100-years
Inundation Area (km <sup>2</sup> )	128.0	148.0	159.5	172.9	189.9	202.2
Population (1000)	35.5	45.4	50.8	61.1	72.8	78.9
Dwelling Units (1000)	6.9	9.0	10.0	12.1	14.4	15.6
Agricultural Lands (km <sup>2</sup> )	7.7	9.4	10.0	11.1	12.3	12.7
Irrigated Fields	7.6	9.2	9.8	10.8	12.1	12.4
Rainfed Fields	0.1	0.2	0.2	0.2	0.2	0.3
Manufacturing Establishments	21	28	33	54	72	87
Trading Firms	144	200	232	311	380	424
Educational Facility	43	66	76	85	98	107
Medical Facility	9	17	18	21	24	29
Road Length (km)	404	472	514	560	631	676

### 5.3.2 Value of Existing Damageable Assets

The present value of existing assets at 1996 market value is calculated as a product of inventory of assets and damageable value which was discussed in the previous section. The total value in the potential flood area for 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return periods was estimated at 1.3 billion pesos, 1.8 billion pesos, 1.9 billion pesos, 2.2 billion pesos, 2.6 billion pesos and 2.8 billion pesos, respectively. These were broken down in Tables C.5.16 to C.5.21. The following table summarizes the total value of the respective facilities in the potential flood area.

(Unit: Million Pesos at 1996 Market Prices)

Item	Return Period					
	2-years	5-years	10-years	25-years	50-years	100-years
Dwelling Units	609	789	884	1,066	1,270	1,375
Crop Production	161	194	207	228	256	263
Manufacturing Industry	3	3	4	6	9	10
Trading Firms	32	45	52	70	86	95
Educational Facility	75	116	133	149	171	293
Medical Facility	4	53	55	71	103	105
Road and Irrigation	457	551	590	650	731	761
<b>Total</b>	<b>1,340</b>	<b>1,751</b>	<b>1,925</b>	<b>2,240</b>	<b>2,625</b>	<b>2,832</b>

### 5.4 Probable Flood Damage

The direct damages are calculated as a product of the existing number of damageable assets, the market value of inundated property in the area and the damage rate in accordance with inundation depth. The inundation depth for every mesh was given by the area-depth analysis in Chapter 4. The inventory of damageable assets and their financial values were mentioned in the previous section. The damage rates were set based on the analysis of the flood damage survey, which was discussed in Section 3.4 of this Appendix. Since the damage rates of industrial, educational and medical facilities could not be established due to data insufficiency, the rates developed by the Ministry of Construction in Japan was modified and applied for the damage estimation. The damage rates applied are shown in Table J.1.2 of Appendix J.

The probable flood damages in the potential flood area for 2-year, 5-year, 10-year, 25-year 50-year and 100-year return periods were estimated at 301 million pesos, 459 million pesos, 559 million pesos, 696 million pesos, 831 million pesos and 914 million pesos, respectively. These were broken down in Tables C.5.22 to C.5.27. Hence, the physical infrastructure damage is assumed to be 20% of the other direct damages, referring to similar projects in the Philippines. The indirect damage is assumed to be 10% of both direct damages and infrastructure damages. The following table summarizes the total value of the respective facilities in the potential flood areas.

(Unit: Million Pesos at 1996 Market Prices)

Item	Return Period					
	2-years	5-years	10-years	25-years	50-years	100-years
Direct Damage	274	417	508	633	756	831
Agricultural Production	68	91	102	117	132	147
Housing Units	107	168	208	267	323	357
Industry	13	22	26	33	39	44
Infrastructure	86	137	172	215	262	283
Social Infrastructure	40	67	87	110	136	145
Physical Infrastructure	46	70	85	105	126	138
Indirect Damage	27	42	51	63	76	83
Total	301	459	559	696	831	914

The annual flood mitigation benefit, i.e., annualized damage reduction by the designed works, is calculated in Table C.5.28. The definition of the annual benefit is explained in detail in Appendix J. The annual benefit is estimated at 278 million pesos under present socio-economic condition for the 25-year return period flood protection works, as shown in the table.

***TABLES***

Table C.1.1 Flood Damage Records in the Past

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Lobby	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record
	Agriculture	No Record	No Record	No Record	No Record	No Record	No Record	6,416,675	2,825,389	247,150	No Record	868,978	1,535,100
	Affected per	No Record	No Record	No Record	No Record	No Record	0	28,000	No Record	No Record	No Record	No Record	19,847
San Nicolas	Affected Family	No Record	No Record	No Record	No Record	No Record	0	0	6,525	No Record	0	No Record	4,620
	Infrastructure	No Record	No Record	No Record	No Record	No Record	1,000,000	10,000,000	4,000,000	No Record	2,500,000	No Record	8,400,000
	Agriculture	No Record	No Record	No Record	No Record	No Record	3,000,000	1,997,700	391,350	36,750	No Record	80,650	708,540
Sarat	Affected per	No Record	No Record	No Record	No Record	No Record	0	2,426	2,019	No Record	3,600	No Record	No Record
	Affected Family	No Record	No Record	No Record	No Record	No Record	0	523	1,083	80	1,150	No Record	No Record
	Infrastructure	No Record	No Record	No Record	No Record	No Record	400,100	800,000	400,000	No Record	1,000,000	No Record	1,100,000
Public	Agriculture	No Record	No Record	No Record	No Record	No Record	1,501	1,574	1,066	192,800	0	187,000	1,188,790
	Affected per	No Record	No Record	No Record	No Record	No Record	0	1,574	1,066	0	0	No Record	27
	Affected Family	No Record	No Record	No Record	No Record	No Record	313	355	1,022	0	0	No Record	No Record
Drapier	Infrastructure	No Record	No Record	No Record	No Record	No Record	2,000,000	No Record	No Record	No Record	No Record	No Record	1,980,000
	Agriculture	No Record	No Record	No Record	No Record	No Record	4,131,910	1,328,550	0	0	384,400	No Record	No Record
	Affected per	No Record	No Record	No Record	No Record	No Record	42	1,419	4,931	0	0	No Record	1,739
Thompson	Infrastructure	No Record	No Record	No Record	No Record	No Record	1,900,400	No Record	6,340,000	No Record	4,250,000	No Record	4,210,000
	Agriculture	No Record	No Record	No Record	No Record	No Record	No Record	4,528,165	6,249,378	120,000	4,933	No Record	1,494,900
	Affected per	No Record	No Record	No Record	No Record	No Record	126	1,792	5,758	640	4,933	No Record	12,042
Volcano	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	907	16,820	No Record	347	No Record	No Record
	Agriculture	No Record	No Record	No Record	No Record	No Record	312	987	16,820	No Record	1,211	No Record	3,684,100
	Affected per	No Record	No Record	No Record	No Record	No Record	29	403	1,133	128	1,652	No Record	3,092
Nixon	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	0	No Record	No Record
	Agriculture	No Record	No Record	No Record	No Record	No Record	9,011,100	2,547,250	632,750	0	1,705,970	No Record	No Record
	Affected per	No Record	No Record	No Record	No Record	No Record	11	1,260	1,531	0	0	No Record	No Record
Hana	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	1,816,000	No Record	1,650,000	7,450,000	No Record	No Record
	Agriculture	No Record	No Record	No Record	No Record	No Record	No Record	1,006,650	5,916,290	931,500	0	No Record	No Record
	Affected per	No Record	No Record	No Record	No Record	No Record	3	1,198	4,118	1,090	0	No Record	No Record
New's Via	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	0	No Record	No Record
	Agriculture	No Record	No Record	No Record	No Record	No Record	No Record	2,557,350	21,850	0	1,212,500	0	No Record
	Affected per	No Record	No Record	No Record	No Record	No Record	0	4,198	4,118	0	0	No Record	No Record
DPWH	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record
	Agriculture	No Record	No Record	No Record	No Record	No Record	No Record	1,026,100	571,313	0	48,750	0	No Record
	Affected per	No Record	No Record	No Record	No Record	No Record	4	1,190	2,623	746	10	No Record	No Record
Iloilo	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record	No Record
	Agriculture	No Record	No Record	No Record	No Record	No Record	11,200,000	48,097,200	30,100,000	20,100,000	1,040,000	2,890,000	41,470,000
	Affected per	No Record	No Record	No Record	No Record	No Record	0	15,142,720	25,775,617	2,045,650	0	4,810,000	5,192,490
Pinaric	Infrastructure	No Record	No Record	No Record	No Record	No Record	No Record	14,145,000	11,500,960	11,500,960	7,628,000	11,500,960	18,465,940
	Agriculture	No Record	No Record	No Record	No Record	No Record	6,000,000	20,000,000	18,800,000	540,000	0	0	17,187
	Affected per	No Record	No Record	No Record	No Record	No Record	0	1,452	4,556	11,726	2,627	2,264,875	17,187

Table C.1.2(1) Flood Damage of 1992 Typhoon Maring

Population Affected

	Affected Population		House		Casualty	Injury
	Family	Person	Totally	Partially	Person	Person
Laoag City	6,525	28,000	0	0	1	3
San Nicolas	1,000	4,007	3	0	0	0
Sarrat	1,022	3,066	0	0	0	0
Piddig	1,194	4,931	0	0	0	0
Carasi	161	647	0	0	0	0
Dingras	1,122	5,702	11	0	0	0
Solsona	2,465	16,231	36	23	0	1
Marcos	413	1,520	3	0	0	0
Banna	1,090	4,107	3	0	0	0
Nueva Era	746	2,623	0	0	1	0
<b>Total</b>	<b>15,738</b>	<b>70,834</b>	<b>56</b>	<b>23</b>	<b>2</b>	<b>4</b>

Damage Cost

unit : peso

Category	Cost	Remarks
National & Provincial Roads & Bridges	11,200,000	
Barangay Roads & Bridges	25,000,000	
Municipal Streets	657,000	
School Buildings	127,000	
River Control	19,400,000	
Public Buildings	703,200	
Water Supply	710,000	
Crops Damage	25,775,617	
Irrigation System		
NIA & INIP	34,820,000	
CIS	3,400,000	
<b>TOTAL</b>	<b>121,792,817</b>	

Evacuation Cost

Category		Cost	unit	Remarks
DSWD	Family Served	22,632	pesos	Whole Province
	Person Served	101,085	pesos	Whole Province
	Rice	165	sacks	Whole Province
	Sardines	48	cases	Whole Province
	Used Clothing	54	sacks	Whole Province
	Pork & Beans	8	cases	Whole Province
	Ready to eat food	310	boxes	Whole Province
	ARGO	52	cases	Whole Province
PROVINCIAL GOVERNMENT				
	Rice	427	sacks	Whole Province
	Sardines	11,500	tin	Whole Province

\*Rice : 1 sack / 50kg

Table C.1.2(2) Flood Damage of 1996 Typhoon Gloring by City/Municipality

Item	Laoag	San Nicolas	Sarrat	Piddig	Dingras	Soisona	Marcos	Banna	Nueva Era	Total
Affected Barangay(nos)	60	ND	2	13	31	14	ND	10	11	141
Affected Population(nos)	19,857	ND	27	1,739	12,602	ND	ND	246	2,916	37,387
Affected Family(nos)	4,620	ND	7	464	3,092	593	ND	63	617	9,456
Damaged House(nos)	36	ND	7	10	41	13	ND	63	617	787
Casualty(nos)	0	1	0	0	0	1	ND	0	0	2
Crop Damage(P)	3,535,100	769,550	1,188,790	ND	3,595,900	8,604,100	ND	772,500	ND	18,465,940
Livestock Damage(P)	ND	17,000	14,000	ND	132,500	120,500	ND	17,000	ND	301,000
Infrastructure Damage(F)	ND	8,600,000	5,100,000	1,980,000	4,210,000	9,283,000	ND	1,410,000	2,807,100	33,390,100
Sub Total(P)	3,535,100	9,386,550	6,302,790	1,980,000	7,938,400	18,007,600	ND	2,199,500	2,807,100	52,157,040
Relief Cost(P)	ND	ND	2,000	79,643	ND	ND	ND	10,779	45,973	138,395

Note: 1) The table covers only the reports from the city/municipalities but excluding the data of other agencies.

2) ND : no data

Table C.2.1(1) Affected Family and Population by 1967 Flood

Typhoon	Date	Municipality	Barangay	Affected Family	Affected Pop.	Flood Depth(m)	Remarks
Gening	June 28-30, 1967	Laog City	1 San Lorenzo (Pop.)	332	1375	1.5	Above the street level
			30-a Suvo	86	433	0.5	Above the street level
			30-b Santa Maria	145	714	1.5	Above the street level
			34-b Gabu Norte East	129	632	1.5	Above the street level
			43 Cavit (4)	127	533	0.65	Above the street level
			45 Tangid	123	523	0.6	Above the street level
			51-b Nangalisan West	116	540	0.8	Above the street level
			53 Rioeng	174	772	0.7	Above the street level
			54-b Camangaan	103	422	0.5	Above the street level
			1 San Francisco (Pop.)	165	945	3	Above the street level
			24 Santa Monica (Nagrebuan)	134	824	0.8	Above the street level
			San Baltazar (Bo.2) (Pop.)	92	530	1.5	Above the street level
			San Barolome (Bo.4) (Pop.)	80	448	1.2	Above the street level
			San Ildefonso (Bo.3) (Pop.)	172	984	1.2	Above the street level
		San Juan Bautista	298	1760	1	Above the street level	
		San Agustin (Pop.)	106	525	1	Above the street level	
		San Andres	147	708	0.3	Above the street level	
		San Antonio	170	828	0.7	Above the street level	
		San Felipe	152	675		Below the street level	
		San Isidro	147	640		Below the street level	
		San Joaquin (Pop.)	175	861	0.3	Above the street level	
		San Jose	189	915	3	Above the farmland	
		San Leandro (Pop.)	174	903	2	Above the street level	
		San Lorenzo	115	556	0.5	Above the street level	
		San Manuel	81	422	0.7	Above the provincial road	
		San Marcos	172	789	3	Above the street level	
		San Vicente (Pop.)	132	610	1	Above the street level	
Santo Tomas	126	606	1	Above the street level			
Piddig			Bimmanga	38	176	1.2	Above the street level
			Callusa	72	364	1.2	Above the street level
			Dupitac	88	453	0.7	Above the street level
			Gayamat	74	359	0.3	Above the farmland



Table C.2.1(2) Affected Family and Population by 1967 Flood

Typhoon	Date	Municipality	Barangay	Affected Family	Affected Pop.	Flood Depth(m)	Remarks	
Gening	June 28-30, 1967	Dingras	Albano (Pop.)	85	464			
			Bagut	115	570			
			Bungcag	70	358			
			Dancei	70	381			
			Elizabeth	115	684			
			Guerrero (Pop.)	147	810			
			Lumbad	93	513			
			Madamba (Pop.)	230	1219		Worst	
			Mandaloque	74	389	2	Above the street level	
			Puruganan (Pop.)	88	525		Worst	
			Ver	115	631			
			Solsona	Aguitap	88	466	0.7	Above the ground of barangay hall
				Barcelona	136	749	2	Above the existing street level
		Mariquet		106	535	0.3	Above the existing road	
		Putiao		121	633	0.5	Above the existing road	
		San Julian		34	154	0.3	Above the existing road level	
		Santa Ana		118	632	0.3	Above the farmland	
		Cacafean		20	86	1.75	Before relocating the barangay	
		Daquioag		159	757	0.8	Above the street level	
		Elizabeth (Culao)		120	592	2.4	Above the farmland	
		Escoda		184	912	0.8	Approximate	
		Marcos	Ferdinand	89	437	0.7	Above the existing road	
			Fortuna	121	630	0.1	Above the street level	
Santiago	94		450	1.5	Above the street			
Tabucuc (Ragas)	162		820	1.5	Above the existing road			
Valdez	111		537	1.1	Above the street level			
Bugasi	101		519	1	Above the existing road			
Caesteaban	98		514	0.65	Above the street level			
Valdez	115		590	0.5	Above the existing road			
Acnam	53		294					
Caray	56		263	1	Above the street level			
Nueva Era	Santo Nino	27	153	1.3	Above the street level			
	Total	7,747	39,092					

Table C.2.2(1) Affected Family and Population by 1986 Flood

Typhoon	Date	Municipality	Barangay	Affected Family	Affected Pop.	Flood Depth(m)	Remarks
Meding	Aug.30-Sep.3, 1986	Laoag City	1 San Lorenzo (Pop.)	399	1876	0.9	Above the street level
			30-a Suyo	103	592	0.4	Above the street level
			34-b Gabu Norte East	155	863	0.7	Above the street level
		45 Tangid	148	714	0.4	Above the street level	
		51-a Nangalisan East	196	1019	1	Above the street level	
		53 Riocong	209	1054	0.4	Above the street level	
		San Nicolas	24 Santa Monica (Nagrebuan)	191	991	0.8	Above the street level
			San Bartolome (Bo.4) (Pop.)	114	539	1.2	Above the street level
		Sarrat	San Andres	180	890	0.3	Above the street level
			San Lorenzo	142	699	0.3	Above the street level
			San Manuel	100	531	0.3	Above the provincial road
			San Marcos	211	991		
			San Nicolas	293	1470	0.5	Above the street level
			Santa Barbara (Pop.)	134	650	0.6	Above the street level
			Dupitac	112	588	0.5	Above the street level
		Piddig	Libnaoan	88	423	1.2	Above the street level
			Mangitayag	97	441	1.5	Above the street level
		Dingras	Albano (Pop.)	128	620	1	Above the national road
			Bagut	164	763	1	Above the barangay road
			Bungcag	100	478	1.2	Above the national road
			Dancel	100	509	1	Above the national road
			Guerrero (Pop.)	210	1084	1.5	Above the national road
			Lumbad	132	687	0.3	Above the national road
			Madamba (Pop.)	329	1631	0.5	Above the national road
			Medina	106	874	0.6	Above the existing provincial road
			Peralta (Pop.)	207	1026	1	Above the national road
			Puruganan (Pop.)	126	702	0.45	Above the national road
			Root (Baldias)	109	593	1	Above the barangay road
			Sagpatan	132	645	1.5	Above the road level
			San Esteban	113	512	1	Above the road level
		San Marcos	122	609	0.3	Above the road level	
		Sulquiano	242	1221	0.3	Above the existing road level	
		Suyo (3)	204	1032	0.12	Above the national road	

Table C.2.2(2) Affected Family and Population by 1986 Flood

Typhoon	Date	Municipalit	Barangay	Affected Family	Affected Pop.	Flood Depth(m)	Remarks			
Meding	Aug-30-Sep.3, 1986	Solsona	Agutap	128	654	1	Above the ground of barangay hall			
			Bagbag	103	498	1	Above the barangay street			
			Bagbago	144	763	0.65	Above the existing road			
			Barcelona	196	1050	2	Above the existing street level			
			Bubuos	120	626	1	Above the barangay road			
			Catangaran	176	888	1.5	Abv the farmland /0.5m abv the street			
			Juan (Pop.) (1)	349	1676	0.65	Above the existing road			
			Laurita (Pop.)	212	1122	0.5	Above the street level			
			Lipay	83	375	0.7	Abv the ground of the barangay hall			
			Manalpac	262	1412	0.6	Above the national road			
			Mariquet	153	751	0.3	Above the existing road			
			Nagpatpatan	88	436	0.3	Above the provincial road			
			Nalasin	130	641	1	Above the farmland			
			Putao	175	887	0.5	Above the existing road			
			San Juan	73	380	0.6	Above the ground of the barangay hall			
			San Julian	48	217	0.7	Above the existing road level			
			Santa Ana	171	886	0.3	Above the farmland			
			Talugtog	155	778	1.2	Above the ground of barangay hall			
			Daquioag	239	1179	0.2	Above the street level			
			Ferdinand	133	680	0.7	Above the existing road			
			Santiago	142	702	0.3	Above the street			
			Tabucbuc (Ragas)	243	1277	0.3	Above the existing road			
			Valdez	167	837	1	Above the street level			
			Banno							
			Balioeg	149	842	1	Abv the bgy road/ 0.3m abv the provl road			
			Bugasi	136	679	1	Above the existing road			
			Cataguaguen	163	901	0.7	Above the street level			
Hilario (Pop.)	151	820	1.5	Above the brgy road						
Macavepyep	177	897	0.5	Above the brgy road						
Sinamar	160	810	0.65	Above the street level						
Tababagan	170	911	2	Abv farm land (0.3m abv the house floor)						
Cariy	91	394	1	Above the street level						
Santo Nino	44	229	0.6	Above the street level						
Total		10,327	52,513							

Table C.2.3(1) Affected Family and Population by 1992 Flood

Typhoon	Date	Municipality	Barangay	Affected Family	Affected Pop.	Flood Depth(m)	Remarks
Maring	September 20, 1992	Laoag City	1 San Lorenzo (Pop.)	428	1997	0.8	Above the street level
			30-a Suvo	110	630	0.4	Above the street level
			34-b Gabu Norte East	166	919	0.7	Above the street level
			45 Tangid	159	760	0.4	Above the street level
			51-a Nangalisan East	210	1085	1	Above the street level
			51-a Nangalisan West	154	784		
			53 Rioeng	224	1122	0.5	Above the street level
			Camangaan	136	614	0.5	
			Cavit	168	774		
			Santa Maria	192	1037		
		San Nicolas	1 San Francisco	254	1204	1	
			24 Santa Monica (Nagrebann)	202	1049	1	Above the street level
			San Baltazar	142	675	1	
			San Bartolome (Bo.4) (Pop.)	120	571	1	Above the street level
		Sarrat	San Idelfonso (Bo.3) (Pop.)	260	1253	1	Above the street level
			San Juan Bautista	458	2242	1	
		Piddig	San Andres	186	922	0.3	Above the street level
			San Marcos	218	1027		
			San Nicolas	302	1523	0.2	Above the street level
		Dingras	Bimmanga	51	240	1	
			Dupitac	119	617	1	
			Estancia	259	1242	1	
			Libnaoan	92	444	2	Above the street level
Mangitavag	101		463	0.9	Above the street level		
Barong	384		1933				
Foz	149		756				
Ver	Guerrero (Pop.)	220	1135				
	Lumbad	139	719	0.3	Above the street level		
	Mandalogue	112	545	0.65	Above the street level		
	Root	117	621				
	Sagpatan	139	673				
Ver	172	883		Above the street level			

Table C.2.3(2) Affected Family and Population by 1992 Flood

Typhoon	Date	Municipality	Barangay	Affected Family	Affected Pop.	Flood Depth	Remarks
Maring	September 20, 1992	Solsona	Darasdas	220	1146	0.15	Above the basketball court in front of B.H
			Aguitap	143	705		
			Santiago	158	754		
			Lipay	93	405		
			Nalasin	146	691		
			San Juan	79	410		
			Acnam	98	493		
			Caray	103	442		
			Santo Nino	49	257		
		Cabittauran	134	637			
		Total	7,366	36,399		0.1	Above the ground of the brgy hall

**Table C.2.4 Interview Survey Results on Flooding Experience in 1996**

Item	Data
(1) Percentage of households experiencing flood 1996	90 %
(2) Average no of days of the last flood experienced	3.8 days
(3) Average depth of flood waters in housefront at its peak (in meters)	0.8 m
(4) Percentage of respondents by month flood is experienced	
May - October	36 %
July	52 %
August	12 %
Total	100 %
(5) Percentage of respondents by cause identified for flooding	
Typhoon / heavy rainfall	40 %
River overflow	22 %
Shallow water channel	21 %
Deforestation	9 %
Others	8 %
Total	100 %
(6) Percentage of households who heard flood warning	75 %
(7) Percentage of respondents by warning source	
Radio	92 %
Barangay captain	8 %
Total	100 %
(8) Percentage of households who took precaution	97 %
(9) Percentage of households by type of precaution done	
Collected household items	46 %
Transferred things at higher elevation	21 %
Constructed a dike	12 %
Secured the domestic animals	9 %
Strengthen the house	5 %
Others	7 %
Total	100 %
(10) Percentage of households affected by flood (multiple response)	
Injury	8 %
Sickness	25 %
House damage	47 %
Furniture damage	18 %
Appliance damage	11 %
Vehicle damage	5 %
Farm land damage	43 %
Farm produce damage	54 %
Livestock loss	13 %
Poultry loss	33 %
Fishpond loss	1 %
School absences	62 %
Work absences	40 %
Business closure	9 %

Table C-2.5 Number of Requests for Structural Measures of Flood Mitigation by Barangays

REQUEST	LAOAG CITY	PIDDIG	SAN NICOLAS	SARRAT	ESPIRITU MARCOS	DINGRAS	SOLSONA	NUEVA ERA	TOTAL
Construction of embankment			3	1	1	2	2		9
Construction of spur dike	4	2			2	6	1		15
Dredging of the river	4	5	5	13	9	23	21	5	94
Forestation of mountain area	1						4		5
Bank protection	3		2	10	7	15	14	3	59
Cut-off channel or re-channeling of river			4	7	1	3	5		23
General river control	2	8	3	9	9	5	5	2	45
Maintenance of present bank and river		1				3	2		6
Construction of sabo dam							3		4
Repair of irrigation channel			2						5
Others	1			4					6

Table C.3.1(1) Population and Households in the Potential Flood Area

Municipality	Barangay	Household '90	Population '90	Flood Area (ha)
Laoag City	1 San Lorenzo (Pob.)	423	1,976	1,200
	30-a Suyo	109	623	
	30-b Santa Maria	185	1,026	
	34-b Gabu Norte East	164	909	
	43 Cavit (4)	162	766	
	45 Tangid	157	752	
	51-a Nangalisan East	208	1,073	
	51-b Nangalisan West	148	776	
	53 Rioeng	222	1,110	
	54-b Camangaan	131	607	
	subtotal 1	1,909	9,618	
San Nicolas	1 San Francisco (Pob.)	247	1,192	300
	24 Santa Monica (Nagrebcan)	200	1,039	
	San Baltazar (Bo.2) (Pob.)	138	668	
	San Bartolome (Bo.4) (Pob.)	119	565	
	San Ildefonso (Bo.3) (Pob.)	257	1,241	
	San Juan Bautista	445	2,220	
	subtotal 2	1,406	6,925	
Sarrat	San Agustin (Pob.)	135	684	700
	San Andres	186	922	
	San Antonio	216	1,078	
	San Cristobal	351	1,733	
	San Felipe	193	879	
	San Francisco (Pob.)	211	969	
	San Isidro	186	834	
	San Joaquin (Pob.)	222	1,121	
	San Jose	240	1,192	
	San Leandro (Pob.)	220	1,176	
	San Lorenzo	146	724	
	San Manuel	103	550	
	San Marcos	218	1,027	
	San Nicolas	302	1,523	
	San Roque	139	671	
	San Vicente (Pob.)	167	794	
	Santa Barbara (Pob.)	138	673	
	Santo Tomas	160	789	
	subtotal 3	3,533	17,339	



Table C.3.1(2) Population and Households in the Potential Flood Area

Municipality	Barangay	Household '90	Population '90	Flood Area (ha)
Piddig	Bimmanga	50	238	300
	Callusa	95	492	
	Dupitac	116	613	
	Estancia	253	1,233	
	Gayamat	97	486	
	Libnaoan	91	441	
	Mangitayag	100	460	
	subtotal 4	802	3,963	
Dingras	Albano (Pob.)	127	646	4,200
	Bagut	171	794	
	Baresbes	291	1,395	
	Barong	374	1,922	
	Bungcag	104	498	
	Dancel	104	530	
	Elizabeth	168	953	
	Foz	145	752	
	Francisco	289	1,534	
	Guerrero (Pob.)	219	1,128	
	Lanas	153	859	
	Lumbad	138	715	
	Madamba (Pob.)	343	1,698	
	Mandaloque	111	542	
	Medina	173	910	
	Parado (Bangay)	190	1,126	
	Peralta (Pob.)	216	1,068	
	Puruganan (Pob.)	131	731	
	Root (Baldias)	114	617	
	Sagpatan	138	669	
	San Esteban	118	533	
	San Marcelino (Padong)	503	2,672	
	San Marcos	128	634	
	Sulquiano	252	1,271	
	Suyo (3)	213	1,074	
	Ver	171	878	
	subtotal 5	5,084	26,149	

Table C.3.1(3) Population and Households in the Potential Flood Area

Municipality	Barangay	Household '90	Population '90	Flood Area (ha)
Solsona	Aguitap	137	700	
	Bagbag	111	533	
	Bagbago	155	817	
	Barcelona	210	1,124	
	Bubuos	129	670	
	Capurictan	180	936	
	Catangraran	189	951	
	Darasdas	218	1,137	
	Juan (Pob.) (1)	375	1,794	
	Laureta (Pob.)	227	1,201	
	Lipay	89	402	
	Maananteng	203	1,014	
	Manalpac	281	1,512	
	Mariquet	164	804	
	Nagpatpatan	94	467	
	Nalasin	140	686	
	Puttao	188	950	
	San Juan	78	407	
	San Julian	52	232	
	Santa Ana	183	949	
Talugtog	166	833		
	subtotal 6	3,569	18,119	4,500
Marcos	Cacafean	32	143	
	Daquioag	254	1,257	
	Elizabeth (Culao)	192	983	
	Escoda	295	1,515	
	Ferdinand	142	725	
	Fortuna	194	1,047	
	Pacifico (Agunit)	256	1,311	
	Santiago	151	748	
	Tabucbuc (Ragas)	259	1,361	
	Valdez	178	892	
		subtotal 7	1,953	
Banna	Balioeg	155	884	
	Bugasi	142	713	
	Caestebanan	138	707	
	Caribquib	149	772	
	Catagtaguen	170	946	
	Hilario (Pob.)	157	861	
	Lorenzo (Pob.)	160	789	
	Macayepyep	184	942	
	Sinamar	167	851	
	Tabtabagan	177	957	
	Valdez	162	811	
		subtotal 8	1,761	
Nueva Era	Acnam	93	476	
	Barikir	83	426	
	Cabittauran	129	611	
	Caray	98	426	
	Poblacion	216	1,143	
	Santo Nino	47	248	
		subtotal 9	666	
	Total	20,683	104,661	19,900

Table C.3.2 Average Number of Furniture Owned by One Family

	Chest of drawers	T.V.	Carpet	Dresser	Living Set	Stereo	Cabinet	Table and Chair	Refrigerator
Laoag City	0.800	0.655	0.040	0.865	0.945	0.850	0.950	1.000	0.570
San Nicolas	0.150	0.875	0.000	0.683	0.958	0.975	0.875	1.000	0.600
Sarrat	0.633	0.642	0.006	0.719	0.872	0.950	0.950	1.000	0.431
Piddig	0.571	0.293	0.014	0.743	0.614	0.750	0.721	0.900	0.286
Dingras	0.263	0.320	0.001	0.507	0.778	0.739	0.793	0.983	0.275
Solsona	0.279	0.408	0.060	0.554	0.711	0.864	0.758	0.999	0.328
Marcos	0.345	0.355	0.000	0.750	0.645	0.715	0.570	0.730	0.253
Banna	0.000	0.464	0.000	0.732	0.891	0.905	0.766	0.927	0.273
Nueva Era	0.680	0.330	0.000	0.840	0.650	0.820	0.740	0.896	0.212

Table C.3.3 Average Value of Furniture

	Chest of drawers	T.V.	Carpet	Dresser	Living Set	Stereo	Cabinet	Table and Chair	Refrigerator
Laoag City	7,400	7,500	1,600	7,400	9,600	7,000	7,700	8,000	8,000
San Nicolas	4,250	7,500	1,600	4,250	5,300	7,000	4,583	5,533	8,000
Sarrat	4,944	7,500	1,600	4,944	5,833	7,000	5,056	6,361	8,000
Piddig	5,643	7,500	1,600	5,643	9,571	7,000	6,214	6,143	8,000
Dingras	5,222	7,500	1,600	5,222	5,039	7,000	3,548	4,172	8,000
Solsona	4,400	7,500	1,600	4,400	5,233	7,000	4,590	6,253	8,000
Marcos	3,650	7,500	1,600	3,650	6,222	7,000	3,350	7,100	8,000
Banna	3,950	7,500	1,600	3,950	5,100	7,000	4,045	5,045	8,000
Nueva Era	5,400	7,500	1,600	5,400	8,300	7,000	5,900	8,300	8,000

(unit : peso)

Table C.3.4 Total Value of Furniture Owned by One Family

(unit : peso)

	Chest of drawers	T. V.	Carpet	Dresser	Living Set	Stereo	Cabinet	Table and Chair	Refrigerator	Total
Laoag City	4,320	4,913	64	4,671	7,844	5,950	5,605	8,300	4,560	46,227
San Nicolas	810	6,563	0	3,688	7,951	6,825	5,163	8,300	4,800	44,100
Sarrat	3,418	4,815	10	3,883	7,238	6,650	5,605	8,300	3,448	43,367
Piddig	3,083	2,198	22	4,012	5,096	5,250	4,254	7,470	2,288	33,673
Dingras	1,420	2,400	2	2,738	6,457	5,173	4,679	8,159	2,200	33,228
Solsona	1,507	3,060	96	2,992	5,901	6,048	4,472	8,292	2,624	34,992
Marcos	1,863	2,663	0	4,050	5,354	5,005	3,363	6,059	2,024	30,381
Banna	0	3,480	0	3,953	7,395	6,335	4,519	7,694	2,184	35,560
Nueva Era	3,672	2,475	0	4,536	5,395	5,740	4,366	7,437	1,696	35,317

Table C.3.5(1) Existing Road Length by Barangay in Potential Flood Area  
National Road

Municipality	Barangay	Length(km)	Sub Total	Total
Laoag City	1 San Lorenzo (Pob.)	4	25	
	30-b Santa Maria	2		
	43 Cavit (4)	1.5		
	51-a Nangalisan East	1		
	51-b Nangalisan West	15		
	53 Rioeng	1.5		
San Nicolas	1 San Francisco (Pob.)	1	6.7	
	24 Santa Monica	3		
	San Baltazar (Bo.2) (Pob.)	0.1		
	San Bartolome (Bo.4) (Pob.)	0.7		
	San Ildefonso (Bo.3) (Pob.)	0.4		
	San Juan Bautista	1.5		
Sarrat	San Agustin (Pob.)	15	52.5	
	San Cristobal	3		
	San Felipe	2		
	San Isidro	4		
	San Joaquin (Pob.)	2		
	San Leandro (Pob.)	0.5		
	San Lorenzo	3		
	San Marcos	4.5		
	San Nicolas	1.5		
	San Vicente (Pob.)	2		
	Santa Barbara (Pob.)	15		
	Piddig	Callusa		1
Estancia		2.5		
Dingras	Albano (Pob.)	2	20.45	
	Buncag	1.2		
	Dancel	1.3		
	Foz	0.05		
	Francisco	4		
	Guerrero (Pob.)	1.5		
	Lumbad	2.5		
	Madamba (Pob.)	3		
	Peralta (Pob.)	0.8		
	Puruganan (Pob.)	0.4		
	Root (Baldias)	1.2		
	Suyo (3)	2.5		
Solsona	Bagbag	1	18	
	Bagbago	1		
	Barcelona	3		
	Juan (Pob.) (1)	4		
	Manalpac	2		
	Mariquet	3		
	Santiago	4		
Marcos	Daquioag	3	11.8	
	Fortuna	1.3		
	Tabucbuc (Ragas)	5		
	Valdez	2.5		
Banna	Balioeg	3.5	17.5	
	Caribquib	2		
	Catagtaguen	2		
	Hilario (Pob.)	3		
	Lorenzo (Pob.)	2		
	Macayepyep	2.5		
	Sinamar	1.5		
	Tabtabagan	1		
Nueva Era	Poblacion		0	155.45

Table C.3.5(2) Existing Road Length by Barangay in Potential Flood Area  
Provincial Road

Municipality	Barangay	Length(km)	Sub Total	Total
Laoag City	30-a Suyo	1.8	4.8	
	54-b Camangaan	3		
San Nicolas	1 San Francisco (Pob.)	0.5	2.7	
	24 Santa Monica	1.2		
	San Baltazar (Bo.2) (Pob.)	0.2		
	San Idefonso (Bo.3) (Pob.)	0.6		
	San Juan Bautista	0.2		
Sarrat	San Agustin (Pob.)	0.5	26.05	
	San Andres	1		
	San Felipe	3		
	San Francisco (Pob.)	0.45		
	San Manuel	1.5		
	San Marcos	1.5		
	San Nicolas	1		
	San Roque	2		
	San Vicente (Pob.)	0.1		
	Santa Barbara (Pob.)	15		
Dingras	Bagut	2	17.95	
	Baresbes	2.5		
	Barong	2.5		
	Mandaloque	1.25		
	Medina	1.5		
	Parado(Bangay)	2		
	Sagpatan	2.2		
	San Marcelino (Padong)	2.5		
	Suyo (3)	1.5		
Solsona	Bagbag	1.5	31.05	
	Capurictan	2		
	Juan (Pob.) (1)	2.25		
	Laureta (Pob.)	10		
	Lipay	1		
	Manalpac	1.5		
	Nagpatpatan	3		
	Nalasin	2.5		
	San Julian	2.5		
Santa Ana	1.3			
Talugtog	3.5			
Marcos	Escoda	5	14.8	
	Ferdinand	1.8		
	Pacifico (Agunit)	6		
	Santiago	2		
Banna	Caestebanan	3	8	
	Catagtaguen	1.5		
	Hilario (Pob.)	1.5		
	Lorenzo (Pob.)	1		
	Tabiabagan	1		
Nueva Era	Cabittauran	4	4	109.35

Table C.3.5(3) Existing Road Length by Barangay in Potential Flood Area  
Municipality Road

Municipality	Barangay	Length(km)	Sub Total	Total
Laoag City	1 San Lorenzo (Pob.)	7	9.5	91.75
	34-b Gabu Norte East	1		
	43 Cavit (4)	1.5		
San Nicolas	1 San Francisco (Pob.)	0.2	1.8	
	San Ildefonso (Bo.3) (Pob.)	1.5		
	San Juan Bautista	0.1		
Sarrat	San Antonio	1.5	12.35	
	San Francisco (Pob.)	1.85		
	San Joaquin (Pob.)	2		
	San Leandro (Pob.)	5		
	San Vicente (Pob.)	2		
Piddig	Estancia	4	5	
	Mangitayag	1		
Dingras	Albano (Pob.)	3	24.9	
	Dancel	2.4		
	Guerrero (Pob.)	3		
	Madamba (Pob.)	10		
	Peralta (Pob.)	2.5		
	Puruganan (Pob.)	4		
Solsona	Juan (Pob.) (1)	4	22	
	Laureta (Pob.)	18		
Banna	Hilario (Pob.)	2.5	6	
	Lorenzo (Pob.)	3.5		
Nueva Era	Acnam	3	10.2	
	Caray	2.2		
	Poblacion	5		

Table C.3.5(4) Existing Road Length by Barangay in Potential Flood Area  
Barangay Road - I

Municipality	Barangay	Length(km)	Sub Total	Total
Laoag City	30-a Suyo	3.5	44.5	
	30-b Santa Maria	8		
	34-b Gabu Norte East	4.5		
	43 Cavit (4)	3.5		
	45 Tangid	10		
	51-a Nangalisan East	3		
	51-b Nangalisan West	5		
	53 Rioeng	5		
	54-b Camangaan	2		
San Nicolas	1 San Francisco (Pob.)	0.35	14.85	
	24 Santa Monica	6		
	San Baltazar (Bo.2) (Pob.)	1.2		
	San Bartolome (Bo.4) (Pob.)	6		
	San Ildefonso (Bo.3) (Pob.)	0.3		
	San Juan Bautista	1		
Sarrat	San Agustin (Pob.)	3	68.724	
	San Andres	6		
	San Antonio	1.5		
	San Cristobal	13		
	San Felipe	3		
	San Francisco (Pob.)	5		
	San Isidro	1		
	San Jose	6		
	San Leandro (Pob.)	1.5		
	San Lorenzo	1.5		
	San Manuel	3.3		
	San Marcos	4.5		
	San Nicolas	9		
	San Roque	2.5		
	San Vicente (Pob.)	0.224		
	Santa Barbara (Pob.)	2.5		
	Santo Tomas	5.2		
Piddig	Bimmanga	3	23.78	
	Callusa	1		
	Dupitac	8.28		
	Gayamat	6		
	Libnaoan	3		
	Mangitayag	2.5		
Dingras	Bagut	8.11		
	Baresbes	0.9		
	Baresbes	10		
	Barong	15		
	Bungcag	2.2		
	Elizabeth	15		
	Foz	3		
	Francisco	6		
	Guerrero (Pob.)	1		
	Lanas	5.2		
	Lanas	5		
	Lumbad	3.5		
	Madamba (Pob.)	1		
	Mandaloque	1.5		
	Medina	2.3		
	Parado(Bangay)	1.2		
	Peralta (Pob.)	1		
	Puruganan (Pob.)	1.5		
	Root (Baldias)	2.5		



Table C.3.5(5) Existing Road Length by Barangay in Potential Flood Area  
Barangay Road - 2

Municipality	Barangay	Length(km)	Sub Total	Total
Dingras	Sagpatan	1.5	120.56	
	San Esteban	7.25		
	San Marcelino (Padong)	10.2		
	San Marcelino (Padong)	3		
	Sulquiano	4		
	Suyo (3)	3.5		
	Ver	5.2		
Solsona	Bagbag	3	119.8	
	Bagbago	5		
	Barcelona	9.7		
	Bubuos	3.8		
	Capurictan	5		
	Catangraran	3		
	Darasdas	6		
	Darasdas	7		
	Juan (Pob.) (1)	3.5		
	Laureta (Pob.)	6		
	Lipay	6.5		
	Maananteng	7.8		
	Manalpac	7		
	Mariquet	4		
	Nagpatpatan	5.5		
	Nalasin	5		
	Pultao	6		
	San Juan	4.5		
	San Julian	3		
	Santa Ana	3.5		
Santiago	1			
Talugtog	14			
Marcos	Cacafean	6	117.7	
	Daquioag	10		
	Elizabeth (Culao)	10		
	Escoda	40		
	Ferdinand	8		
	Fortuna	14		
	Pacifico (Agunit)	12		
	Santiago	7.7		
	Tabucbuc (Ragas)	5		
	Valdez	5		
Banna	Balioeg	5.5	51.5	
	Bugasi	7.5		
	Caestebanan	5.5		
	Caribquib	2		
	Catagtaguen	5		
	Hilario (Pob.)	2.5		
	Lorenzo (Pob.)	2.5		
	Macayepyep	4		
	Sinamar	7		
	Tabtabagan	5		
Valdez	5			
Nueva Era	Acnam	2	15	576.414
	Cabittauran	6		
	Caray	3		
	Santo Nino	4		

Table C.3.6(1) Existing Bridge in Potential Flood Area

## Bridge - 1

Municipality	Barangay	Number	Value(P)	Unit	Remarks
Laoag City	30-b Santa Maria	3			Irrigation Bridge
	43 Cavit (4)	1	2,600,000	1 unit	Cavit Bridge
		1	300,000	1 unit	Cavit Bridge(steel)
	51-a Nangalisan East				Gilbert Bridge
	53 Rioeng	5			Irrigation Bridge
	54-b Camangaan	1	50,000	1 unit	Balodavid Bridge
San Nicolas	24 Santa Monica (Nagrebcan)	1			B=5, L=8m
		1			B=4, L=6m
	San Juan Bautista	6			B=1, L=3m B.C.
	San Bartolome (Bo.4) (Pob.)	1			B=1, L=6m
Sarrat	San Andres	1			B=4, L=4m B.C.
	San Cristobal	4			B=1.5, L=3.5m
		4			B=1.5, L=4m
	San Felipe	3			
		2			B=4, L=5m B.C.
	San Francisco (Pob.)	1			Spanish Bridge B=3.5, L=5m
	San Joaquin (Pob.)	1			RCDG San Joaquin
		1			B=2, L=3m B.C.
	San Jose	1			B=1.5, L=3m
	San Leandro (Pob.)	1			B=4, L=5m B.C.
	San Lorenzo	7			B=4, L=4m B.C.
	San Marcos	1			B=1.5, L=1.5m B.C.
	San Nicolas	1			San Nicolas RCBG B=6, L=7.5m
	San Roque	1			B=2.5, L=12m
		1			B=2.5, L=13m
		1			Sagsagang Brdg. B=6, L=10m
	Santa Barbara (Pob.)	1			B=2.5, L=3m B.C.
1				B=4, L=3m B.C.	
1					
Piddig	Callusa	1			L=50m Callusa Bridge
		1			L=10m Naganakan Bridge
	Estancia	1			Dingris Bridge L=25m
	Gayamat	2			L=8m Concrete
	Libnaoan	1			Diblibo Bridge (Timber)
	Mangitayag	1			Mangitayag Bridge

Table C.3.6(2) Existing Bridge in Potential Flood Area

## Bridge - 2

Municipality	Barangay	Number	Value(P)	Unit	Remarks
Dingras	Albano (Pob.)	1			L=10m national road
	Bagut	2			L=4 barangay road
		1			L=40 provincial road
		1			L=10 provincial road
		1			L=6 barangay road
		1			L=10 barangay road
		1			connecting Laureta
	Baresbes	1			
	Bungcag	1	150,000	1 unit	L=5, B=4m
		1	50,000	1 unit	L=10m, B=2m
	Dancel	1			L=10m national road
	Foz	1			1*1 Box culvert
		1			dia 60cm RCP
	Francisco	1			Sitio Tagtagot
		1			Sitio Sorate
	Lanas	4			L=5m
		1			L=10m
		1			L=6m
	Lumbad	2	250,000	1 unit	L=8m a long national road
		1			L=9m, wooden Brdg. old
	Mandaloque	1			Brgy Bridge B=6, L=12m
		1			Spanish Bridge B=3, L=6m
	Peralta (Pob.)	1	200,000	1 unit	L=5m, B=8m (1979)
		1	200,000	1 unit	L=8m, B=5m
	Puruganan (Pob.)	1		1 unit	L=10, B=5m old
		1			L=6, B=3m old
	Root (Baldias)	1	200000	1 unit	L=14, B=4m
		1			L=4, B=4m
	Sagpatan	1			3.5*3.5 BC
		1			Spanish Bridge
		2			L=6.5m
	San Esteban	1	150,000	1 unit	L=18m
	Suyo (3)	1			L=24, B=8m national road
1				L=20, B=6m barangay road	
Solsona	Bagbag	1			3*6m
		1			L=20m, B=8m
		1			L=150m, B=8m
		1			L=20, B=3m
	Bagbago	1			4*6m B.C.
	Barcelona	1			L=40m
		1			L=30m
	Bubuos	1			L=10m, B=3m
	Capurictan	1			L=6, B=4.5m
		2			L=4, B=4.5m
		3			L=6, B=5m
		1			L=4, B=4m
	Catangraran	1			2*5m for irrigation
		1			5*7m
		1			4*5m
1				3*4m	

Table C.3.6(3) Existing Bridge in Potential Flood Area

## Bridge - 3

Municipality	Barangay	Number	Value(P)	Unit	Remarks	
Solsona	Darasdas	5			1*1 B.C.	
		5			2*5 B.C.	
	Juan (Pob.) (I)	2			L=50, B=10m	
		7			4*7m B.C.	
		1			L=25, B=10m	
	Laureta (Pob.)	6			B=4, L=6m	
	Lipay	1	200,000	1 unit	Hemejing Bridge L=80m (Foot)	
	Manalpac	1			L=5m, B=3m	
		1			L=120, B=6m concrete	
		1			L=10, B=6m	
		15			4*4m	
	Mariquet	5			1*4m B.C.	
	Nagpatpatan	1			L=15, B=10m B.C.	
		1			L=100, B=6m	
	Puttao	1			3*5m B.C.	
		2			2.5*4m B.C.	
	San Juan	1			San Juan Sur L=4m	
		1			San Juan Bridge L=12m	
	Santa Ana	1			L=6m B.C.	
		1			L=10m B.C.	
		2			L=8m B.C.	
	Marcos	Daquioag	2			L=5m
			1			Kalipayan Bridge L=10m
Fortuna		1			L=6m	
Santiago		1			L=6m B.C.	
Valdez		2			L=6m	
Banna	Balioeg	1			B=3, L=6m	
		2			B=4, L=8m B.C.	
		1			B=5, L=100m	
		1			B=1, L=4m	
		2			B=5, L=10m	
	Bugasi	8			4*4m B.C.	
	Caestebanan	4			B=4.5, L=5m	
		1			B=8, L=50m	
		4			B=4, L=4m	
	Caribquib	1			B=6, L=10m baragay road	
		1			B=6, L=8m baragay road	
	Catagtaguen	1			B=4, L=10m B.C.	
		4			B=1, L=4m B.C.	
	Hilario (Pob.)	1			B=6, L=10m	
	Lorenzo (Pob.)	2			B=2, L=6m B.C.	
		1			B=5, L=100m	
	Sinamar	6			B=2, L=4m B.C.	
		3			B=5, L=10m	
	Tabtabagan	1			L=120, B=4m	
		5			4*4m B.C.	
		1			L=10, B=5m	
	Valdez	11			4*4m B.C.	

Table C.3.7 Cropping Calendar

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
*Irrigated Rice	Dry						Wet				Dry	
Corn												
Vegetables												
Legumes												
Root Crops												
Tobacco												
Cotton												
*Rainfed Lowland Rice												
Corn												
Vegetables												
Legumes												
Root Crops												
Tobacco												
Cotton												

Table C.3.8 Weighted Cropping Pattern by City/Municipality in Flood Season  
(unit : Ratio)

	Irrigated Rice	Non-irr. Rice	Corn	Root-Crop	Legume	Tobacco	Garlic	Vegetable	Total Price
Laoag City	0.82	0.00	0.17	0.00	0.01	0.00	0.00	0.00	1.00
San Nicolas	0.45	0.20	0.13	0.08	0.12	0.00	0.02	0.00	1.00
Sarrat	0.38	0.24	0.06	0.00	0.09	0.00	0.10	0.13	1.00
Piddig	0.60	0.31	0.00	0.02	0.04	0.00	0.00	0.03	1.00
Dingras	0.81	0.10	0.08	0.00	0.01	0.00	0.00	0.00	1.00
Solsona	0.85	0.02	0.03	0.04	0.02	0.00	0.00	0.04	1.00
Marcos	0.06	0.89	0.01	0.01	0.01	0.00	0.00	0.02	1.00
Banna	0.72	0.14	0.09	0.01	0.03	0.00	0.00	0.01	1.00
Nueva Era	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

Table C.3.9 Unit Production Value by Crop

	Irrigated Rice	Non-irr. Rice	Corn	Root-Crop	Legume	Tobacco	Garlic	Vegetable	unit
Price(1)	10.5	10.5	6.6	14	30	85	110	15	peso/kg
Production(2)	4,560	3,790	3,130	11,796	1,280	1,875	2,805	10,000	kg/ha
(1)*(2)	45,780	39,795	20,658	165,144	38,400	159,375	308,550	150,000	peso/ha

Table C.3.10(1) Existing Barangay Hall in Potential Flood Area

## Barangay Hall - I

Municipality	Barangay	Value(P)	Unit	Remarks
Laoag City	1 San Lorenzo (Pob.)	400,000	1 unit	B.H. with Day Care
	30-a Suyo	280,000	1 unit	B.H.
	30-b Santa Maria	350,000	1 unit	B.H.
	43 Cavit (4)			B.H.
	45 Tangid	150,000	1 unit	B.H.
	51-a Nangalisan East	150,000	1 unit	B.H. with Health Center
	51-b Nangalisan West			B.H.
	53 Rioeng	200,000	1 unit	B.H.
	54-b Camangaan	150,000	1 unit	B.H.
	San Nicolas	24 Santa Monica	70,000	1 unit
San Bartolome (Pob.)		250,000	1 unit	B.H.
San Juan Bautista		120,500	1 unit	B.H.
Sarrat	San Agustin (Pob.)	48,000	1 unit	B.H. with Day Care
	San Andres			B.H.
	San Antonio	80,000	1 unit	B.H.
	San Cristobal	120,000	1 unit	B.H.
	San Felipe	100,000	1 unit	B.H.
	San Francisco (Pob.)	80,000	1 unit	B.H.
	San Isidro	100,000	1 unit	B.H. with Day Care
	San Joaquin (Pob.)	50,000	1 unit	B.H.
	San Jose	100,000	1 unit	B.H.
	San Leandro (Pob.)			B.H.
	San Lorenzo	100,000	1 unit	B.H.
	San Manuel	50,000	1 unit	B.H.
	San Marcos	100,000	1 unit	B.H.
	San Nicolas	200,000	1 unit	B.H.
	San Roque	350,000	1 unit	B.H.
	San Vicente (Pob.)	100,000		B.H.
	San Vicente (Pob.)			M.H.
	Santa Barbara (Pob.)	250,000	1 unit	with Day care, Com.learning center
	Santo Tomas	120,000	1 unit	B.H.
	Piddig	Bimmanga	70,000	1 unit
Callusa		300,000	1 unit	B.H. with Day Care
Dupitac		65,000	1 unit	B.H.
Estancia		100,000	1 unit	B.H.
Gayamat		150,000	1 unit	B.H.
Libnaoan		100,000	1 unit	B.H.
Mangitayag		60,000	1 unit	B.H. with Day Care
Dingras	Albano (Pob.)	40,000	1 unit	
	Bagut	200,000	1 unit	
	Baresbes	200,000	1 unit	B.H.
	Barong	350,000	1 unit	B.H.
	Bungcag	110,000	1 unit	B.H. with Day care
	Dancel	10,000	1 unit	B.H.
	Elizabeth	45,000	1 unit	B.H.
	Foz	250,000	1 unit	BH with health centre
	Francisco	180,000	1 unit	B.H.
	Lanas	8,000	1 unit	Brgy Hall
	Lanas	140,000	2 unit	B.H. construct self-help
	Lumbad	200,000	1 unit	
	Madamba (Pob.)			Escoda H.
	Madamba (Pob.)			M.H.
	Mandaloque			B.H.
	Medina	110,000	1 unit	B.H.
Parado(Bangay)	30,000	1 unit	B.H.	

Table C. 3.10(2) Existing Barangay Hall in Potential Flood Area

## Barangay Hall - 2

Municipality	Barangay	Value(P)	Unit	Remarks
Dingras	Root (Baldias)	113,000	1 unit	
	Sagpatan	60,000	1 unit	Brgy Hall
	San Esteban	100,000	1 unit	Brgy Hall
	San Marcelino	150,000	1 unit	B.H.
	Sulquiano	180,000	1 unit	
	Suyo (3)	200,000	1 unit	
	Ver	110,000	1 unit	
Solsona	Bagbag			B.H.
	Bagbago	100,000	1 unit	
	Barcelona	300,000	1 unit	B.H.
	Bubuos	75,000	1 unit	B.H.
	Capurictan	60,000	1 unit repired	B.H.
	Catangraran	8,000	1 unit	B.H.
	Darasdas	150,000	1 unit	B.H.
	Darasdas	200,000	1 unit	with H.C.
	Juan (Pob.) (1)	80,000	1 unit	B.H.
	Laureta (Pob.)			M.H.
	Lipay	250,000	1 unit	B.H.
	Meantanteng	200,000	1 unit	with day care and H.C.
	Manalpac	300,000	1 unit	B.H.
	Mariquet	100,000	1 unit	B.H.
	Nagpatpatan	100,000	1 unit	B.H.
	Nalasin	250,000	1 unit	B.H.
	Puttao	100,000	1 unit	B.H.
	San Juan	150,000	1 unit	B.H.
	San Julian	78,000	1 unit	B.H.
	Santa Ana	120,000	1 unit	B.H. with health Center
Santiago	100,000	1 unit	B.H.	
Talugtug	366,000	1 unit	B.H.	
Marcos	Cacafean			
	Daquioag	120,000	1 unit	B.H.
	Elizabeth (Culao)	140,000	1 unit	B.H.
	Escoda	60,000	1 unit	B.H.
	Ferdinand	110,000	1 unit	B.H.
	Fortuna	70,000	1 unit	B.H.
	Pacifico (Agunit)	200,000	1 unit	B.H.
	Santiago	100,000	1 unit	
	Tabucbuc (Ragas)	140,000	1 unit	
Valdez	10,000	1 unit	in 1982	
Banna	Balioeg	150,000	1 unit	B.H.
	Bugasi	1,000,000	1 unit	including basketball court
	Caestebanan	200,000	1 unit	B.H.
	Caribquib	500,000	1 unit	B.H.
	Catagtaguen	170,000	1 unit	B.H.
	Hilario (Pob.)	300,000	1 unit	B.H.
	Lorenzo (Pob.)	1,000,000	1 unit	B.H.
	Macayepyp	150,000	1 unit	B.H.
	Sinamar	200,000	1 unit	B.H.
	Tabtabagan	200,000	1 unit	B.H.
Valdez	100,000	1 unit	B.H.	
Nueva Era	Acnam	90,000	1 unit	B.H.
	Cabittauran	50,000	1 unit	B.H.
	Caray	60,000	1 unit	B.H.
	Poblacion	1,500,000	1 unit	B.H.
	Santo Nino	500,000	1 unit	B.H.



Table C.3.11(1) Existing Hospital and Health Center in Potential Flood Area

Hospital					
Municipality	Barangay	Number	Value(P)	Unit	Remarks
Laoag City	30-b Santa Maria	1	150,000	1 unit	Day Care
	34-b Gabu Norte East	1	200,000	1 unit	Day Care with Health C.
	43 Cavit (4)	1			Day Care
	45 Tangid	1	100,000	1 unit	Day Care
	51-a Nangalisan East	1	50,000	1 unit	Day Care
	51-b Nangalisan West	1			Day Care
	53 Rioeng	1	50,000	1 unit	Day Care
	54-b Camangaan	1	100,000	1 unit	Day Care
San Nicolas	1 San Francisco (Pob.)	1			Day Care
	24 Santa Monica	1			Day Care
Sarrat	San Francisco (Pob.)	1			Day Care
	San Joaquin (Pob.)	1	25,000	1 unit	Day care
	San Jose	1			Day Care
	San Leandro (Pob.)	1			Day Care
	San Lorenzo	1	100,000	1 unit	Day Care
	San Manuel	1	30,000	1 unit	Day Care
	San Marcos	1			Day Care
	San Nicolas	1	150,000	1 unit	with Health Center
	Santo Tomas	1			Day Care
	Piddig	Dupitac	2	103,000	2 unit
Gayamat		1	50,000	1 unit	Day Care
Dingras	Albano (Pob.)	1			RHU old
	Bagut	1	120,000	1 unit	with farmers training center
	Guerrero (Pob.)	1	200	1 month (rental)	Day Care (temporary)
	Lanas	1	40,000	1 unit	day care
	Lumbad	1	68,000	1 unit	Day Care
	Mandaloque	1			Day Care
	Root (Baldias)	1	80,000	1 unit	Day care
	Suyo (3)	1	100,000	1 unit	Day Care with YMCA
	Ver	1	30,000	1 unit	day care
Solsona	Bagbag	1			Day Care
	Bagbago	1	50,000	1 unit	Day Care
	Bubuos	3	24,000	1 unit	Day Care
	Manalpac	1	100,000	1 unit	Day Care
	Mariquet	1	200,000	1 unit	Day Care
	Puttao	1	30,000	1 unit	Day Care
	San Juan	1	150,000	1 unit	
	San Julian	1	26,000	1 unit	Day Care
Marcos	Cacafean	1			
	Daquioag	1	20,000	1 unit	Day care
	Elizabeth (Culao)	1	80,000	1 unit	Day care
	Ferdinand	1			
	Fortuna	1	134,000	1 unit	Day Care under constructor
	Santiago	1	50,000	1 unit	Day care
	Tabucbuc (Ragas)	1	50,000	1 unit	Day care
	Valdez	1	26,000	1 unit	in 1985
Banna	Balioeg	1			Day Care
	Hilario (Pob.)	1	100,000	1 unit	Day Care
	Macayepyep	1			Day Care
	Tabtabagan	1	150,000	1 unit	D.O.H. Center
	Valdez	1	35,000	1 unit	Day Care
Nueva Era	Cabittauran	1	60,000	1 unit	Day Care
	Poblacion	1	100,000	1 unit	Day Care
	Santo Nino	1	60,000	1 unit	Day Care

Table C.3.11(2) Existing Hospital and Health Center in Potential Flood Area

Health Center				
Municipality	Barangay	Value(P)	Unit	Remarks
Laoag City	30-a Suyo	150,000	1 unit	
	43 Cavit (4)			
	51-b Nangalisan West			
	54-b Camangaan	50,000	1 unit	
Sarrat	San Felipe	75,000	1 unit	
	San Roque			
Dingras	Bagut	150,000	1 unit	
	Baresbes	200,000	1 unit	
	Barong	250,000	1 unit	
	Lanas	250,000	1 unit	
	Medina	50,000	1 unit	
	Francisco	250,000	1 unit	
	San Marcelino (Padong)	250,000	1 unit	
Solsona	Darasdas	75,000	1 unit	
	Laureta (Pob.)			
	Lipay	90,000	1 unit	

Table C.3.12(1) Existing School in Potential Flood Area

## College

Municipality	Barangay	Nos. of Class	Value(P)	Unit	Remarks
Dingras	Madamba (Pob.)	4			college
	Root (Baldias)	1			Bible school (private)

## High School

Municipality	Barangay	Nos. of Class	Value(P)	Unit	Remarks
Laoag City	34-b Gabu Norte East	12			
San Nicolas	24 Santa Monica (Nagre	35			San Nicolas
	San Ildefonso (Bo.3) (Po	20			
Sarrat	San Francisco (Pob.)	38			Sarrat National High School
	San Nicolas	16			
Piddig	Estancia	10			
Dingras	Madamba (Pob.)	12		1 building	1 building with 12 rooms
	Madamba (Pob.)	16			Public high school
	San Marcelino (Padong)	6	2,400,000	1 building	
	Sulquiano	7	1,500,000	1 building	
	Suyo (3)	8			
Solsona	Bagbag	6			
	Juan (Pob.) (1)	15			
	Manalpac	20	10000000	1 building	
	Talugtog	18	5,400,000	1 building	
Marcos	Santiago	7			
Banna	Catagtaguen	12			
Nueva Era	Poblacion	13			

## Elementary School - I

Municipality	Barangay	Nos. of Class	Value(P)	Unit	Remarks
Laoag City	1 San Lorenzo (Pob.)	13			
	30-a Suyo	8			
	43 Cavit (4)	10			
	45 Tangid	10			
	53 Rioeng	10			
San Nicolas	24 Santa Monica (Nagre	11			
	San Ildefonso (Bo.3) (Po	30			
	San Juan Bautista	24			
Sarrat	San Antonio	11			
	San Cristobal	18			
	San Felipe	10			
	San Francisco (Pob.)	18			
	San Jose	6			
	San Leandro (Pob.)	25			
	San Lorenzo	10			
	San Manuel	8			
	San Marcos	12			
	San Roque	10			
Piddig	Dupitac	6			
	Gayamat	2			
	Libnaoan	4			
	Mangitayag	10			

Table C.3.12(2) Existing School in Potential Flood Area

## Elementary School - 2

Municipality	Barangay	Nos. of Class	Value(P)	Unit	Remarks
Dingras	Albano (Pob.)	4	2,000	1 month (rental)	
	Baresbes	8	2,000,000	1 building	
	Barong	4			
	Barong	2	300,000	1 building	by CCC
	Barong	4	800,000	1 building	by JICA
	Foz	11			unit of N=class
	Francisco		1,200,000	3 buildings	unit = buildings
	Guerrero (Pob.)	20			old
	Lanas	2	450,000	1 building	
	Lanas	10	2,500,000	1 building	
	Madamba (Pob.)	18			
	Mandaloque	10	2,200,000	1 building	
	Parado(Bangay)	10	2,000,000	1 building	
	Peralta (Pob.)	12			old
	Peralta (Pob.)	3	450,000	1 building	
	Sagpatan	9			RP-u.s BLDG old
	San Esteban	4	500,000	1 building	
	San Marcelino (Padong)	12	2,400,000	1 building	
	Sulquiano	13	2,800,000	1 building	
	Suyo (3)	10			
Ver	6				
Solsona	Bagbag	10			
	Bagbago	10			
	Barcelona	11	2,200,000	1 building	
	Capurictan	10			old
	Catangraran	4			old
	Catangraran	4	400,000	1 building	
	Darasdas	13	2,860,000	1 building	
	Darasdas	9	9,700,000	1 building	
	Juan (Pob.) (1)	11			
	Laureta (Pob.)	25			
	Lipay	10	2,500,000	1 building	
	Maananteng	15	220,000	1 class	
	Mariquet	11	2,400,000	1 building	
	Nagpatpatan	6			old Marcos type
	San Juan	3	660,000	1 building	
	Santa Ana	7	1,540,000	1 building	
	Santiago	12			
	Talugtug	10	3,000,000	1 building	

Table C.3.12(3) Existing School in Potential Flood Area

## Elementary School - 3

Municipality	Barangay	Nos. of Class	Value(P)	Unit	Remarks
Marcos	Cacafean	2			
	Daquioag	14			
	Elizabeth (Culao)	10			
	Escoda	11			
	Ferdinand	2			
	Fortuna	6			
	Pacifico (Agunit)	10			
	Santiago	6			
	Tabucbuc (Ragas)	9	1,900,000	1 building	
	Valdez	10			
	Banna	Balioeg	6		
Bugasi		3			
Caestebanan		12			
Caribquib		12			
Catagtaguen		11			
Hilario (Pob.)		6			
Lorenzo (Pob.)		3			
Macayepyep		7			
Sinamar		3			
Tabtabagan		6			
Valdez		6			
Nueva Era		Cabittauran	9		
	Caray	4			
	Poblacion	18			
	Santo Nino	6			

Table C.3.13 Other Public Buildings in Potential Flood Area

Chapel/Church

Municipality	Barangay	Number	Value(P)	Unit	Remarks
San Nicolas	San Ildefonso (Bo.3) (Pob.)	1			catholic
	San Ildefonso (Bo.3) (Pob.)	1			aglipayan
Sarrat	San Vicente (Pob.)	1			
Dingras	Madamba (Pob.)	1			
	San Marcelino (Padong)	1			
Solsona	Laureta (Pob.)	1			
	Lipay	2	1,000,000	2 unit	

Municipality Hall

Municipality	Barangay	Number	Value(P)	Unit	Remarks
Dingras		1	11,000	per m2	
Solsona		1	11,000	per m2	

Others

Municipality	Barangay	Number	Value(P)	Unit	Remarks
Laoag City	30-a Suyo	1	50,000	1 court	Basketball Court
	30-b Santa Maria	1	70,000	1 unit	MPCL COOP
San Nicolas	1 San Francisco (Pob.)	1			Basketball Court
	San Ildefonso (Bo.3) (Pob.)	1			Public Market
Sarrat	San Vicente (Pob.)	1			Public Market
	San Vicente (Pob.)	1			Tennis Court
Dingras	Dancel	1	1,500	1month (rental)	Agrarian Office
	Madamba (Pob.)	1			Justice Hall
	Bungcag	1	40,000	1 unit	Multipurpose Bldg.
	Madamba (Pob.)	1			Penalty court
	Madamba (Pob.)	1			Police Station
	Madamba (Pob.)	1			Telephone Office
Solsona	Nalasin	1	70,000	1 unit	Barangay Market
	Laureta (Pob.)	1			Basketball court
	Lipay	1	50,000	1 court	Basketball court
	Juan (Pob.) (1)	1			Public Market
Marcos	Daquioag	6	48,000	6 units	Dap-Ayan Center
Banna	Bugasi	1			NIA working Sta. old
Nueva Era	Caray	1	40,000	1	Brgy. Market & Multipurpose

Table C.3.14(1) Existing Livestock in Potential Flood Area						
Municipality	Barangay	Number of Farmer with livestock	Carabao	Cow	Chicken	Swine
Laoag City	1 San Lorenzo (Pob.)	23	23	23	69	0
	30-a Suyo	112	112	112	336	0
	30-b Santa Maria	315	315	315	945	0
	34-b Gabu Norte East	146	146	146	438	0
	43 Cavit (4)	9	9	9	27	0
	45 Tangid	102	102	102	306	0
	51-a Nangalisan East	21	21	21	63	0
	51-b Nangalisan West	13	13	13	39	0
	53 Rioeng	125	125	125	375	0
	54-b Camangaan	30	30	30	90	0
	Subtotal 1		896	896	896	2,688
San Nicolas	1 San Francisco (Pob.)	23	23	23	69	0
	24 Santa Monica (Nagrebcan)	87	87	87	261	0
	San Baltazar (Bo.2) (Pob.)	15	15	15	45	0
	San Bartolome (Bo.4) (Pob.)	13	13	13	39	0
	San Ildefonso (Bo.3) (Pob.)	11	11	11	33	0
	San Juan Bautista	40	40	40	120	0
	Subtotal 2		189	189	189	567
Sarrat	San Marcos	181	181	181	543	0
	San Agustin (Pob.)	85	85	85	255	0
	San Andres	237	237	237	711	0
	San Antonio	196	196	196	588	0
	San Cristobal	338	338	338	1,014	0
	San Felipe	140	140	140	420	0
	San Francisco (Pob.)	202	202	202	606	0
	San Isidro	75	75	75	225	0
	San Joaquin (Pob.)	247	247	247	741	0
	San Jose	120	120	120	360	0
	San Leandro (Pob.)	176	176	176	528	0
	San Lorenzo	140	140	140	420	0
	San Manuel	4	4	4	12	0
	San Nicolas	175	175	175	525	0
	San Roque	130	130	130	390	0
	San Vicente (Pob.)	69	69	69	207	0
	Santa Barbara (Pob.)	20	20	20	60	0
Santo Tomas	172	172	172	516	0	
Subtotal 3		2,707	2,707	2,707	8,121	0
Piddig	Binmanga	30	30	30	90	0
	Callusa	83	83	83	249	0
	Dupitac	41	41	41	123	0
	Estancia	210	210	210	630	0
	Gayamat	110	110	110	330	0
	Libnaoan	65	65	65	195	0
	Mangitayag	91	91	91	273	0
Subtotal 4		630	630	630	1,890	0

Table C. 3.14(2) Existing Livestock in Potential Flood Area						
Municipality	Barangay	Number of Farmer with livestock	Carabao	Cow	Chicken	Swine
Dingras	Albano (Pob.)	45	45	45	135	0
	Bagut	109	109	109	327	0
	Baresbes	290	290	290	870	0
	Bungcag	68	68	68	204	0
	Dancel	39	39	39	117	0
	Francisco	365	365	365	1,095	0
	Guerrero (Pob.)	160	160	160	480	0
	Lumbad	125	125	125	375	0
	Madamba (Pob.)	137	137	137	411	0
	Mandaloque	113	113	113	339	0
	Parado(Bangay)	105	105	105	315	0
	Peralta (Pob.)	161	161	161	483	0
	Puruganan (Pob.)	92	92	92	276	0
	Root (Baldias)	9	9	9	27	0
	San Marcelino (Padeng)	510	510	510	1,530	0
	Sulquiano	70	70	70	210	0
	Suyo (3)	160	160	160	480	0
	Ver	137	137	137	411	0
		<b>Subtotal 5</b>	<b>2,695</b>	<b>2,695</b>	<b>2,695</b>	<b>8,085</b>
Solsona	Bagbag	113	113	113	339	113
	Bagbago	90	90	90	270	90
	Barcelona	267	267	267	801	267
	Capurictan	385	385	385	1,155	385
	Catangaran	180	180	180	540	180
	Darasdás	250	250	250	750	250
	Juan (Pob.) (1)	182	182	182	546	182
	Laureta (Pob.)	129	129	129	387	129
	Lipay	60	60	60	180	60
	Manalpac	252	252	252	756	252
	Mariquet	171	171	171	513	171
	Nagpatpatan	76	76	76	228	76
	Nalasin	157	157	157	471	157
	Puitao	333	333	333	999	333
	San Juan	86	86	86	258	86
	San Julian	57	57	57	171	57
	Santa Ana	194	194	194	582	194
	Santiago	147	147	147	441	147
	Talugtog	130	130	130	390	130
	<b>Subtotal 6</b>	<b>3,259</b>	<b>3,259</b>	<b>3,259</b>	<b>9,777</b>	<b>3,259</b>



Table C.3.14(3) Existing Livestock in Potential Flood Area						
Municipality	Barangay	Number of Farmer with livestock	Carabao	Cow	Chicken	Swine
Marcos	Cacafean	22	22	22	66	0
	Daquioag	222	222	222	666	0
	Elizabeth (Culao)	209	209	209	627	0
	Escoda	254	254	254	762	0
	Ferdinand	105	105	105	315	0
	Fortuna	190	190	190	570	0
	Pacifico (Agunit)	306	306	306	918	0
	Tabucbuc (Ragas)	333	333	333	999	0
	Valdez	168	168	168	504	0
	<b>Subtotal 7</b>	<b>1,809</b>	<b>1,809</b>	<b>1,809</b>	<b>5,427</b>	<b>0</b>
Banna	Balioeg	131	131	131	393	0
	Bugasi	162	162	162	486	0
	Caestebanan	133	133	133	399	0
	Caribquib	162	162	162	486	0
	Cataglaguen	147	147	147	441	0
	Hilario (Pob.)	141	141	141	423	0
	Lorenzo (Pob.)	48	48	48	144	0
	Macayepyep	110	110	110	330	0
	Sinamar	152	152	152	456	0
	Tabiabagan	120	120	120	360	0
	Valdez	152	152	152	456	0
	<b>Subtotal 8</b>	<b>1,458</b>	<b>1,458</b>	<b>1,458</b>	<b>4,374</b>	<b>0</b>
Nueva Era	Acnam	51	51	51	153	0
	Acnam	87	87	87	261	0
	Cabittauran	139	139	139	417	0
	Caray	108	108	108	324	0
	Poblacion	127	127	127	381	0
		<b>Subtotal 9</b>	<b>512</b>	<b>512</b>	<b>512</b>	<b>1,536</b>
<b>TOTAL</b>		<b>14,155</b>	<b>14,155</b>	<b>14,155</b>	<b>42,465</b>	<b>3,259</b>

**Table C.4.1 Simulated Inundation Area for Each Return Period**

(ha)

	Return Period (Year)					
	2	5	10	25	50	100
Tangid, Laoag	130	400	550	600	1,050	1,300
Suyo, Laoag	30	130	150	200	230	230
Poblacion of Laoag	30	50	100	130	150	180
Camangaan, Laoag	180	250	250	480	630	780
Poblacion of San Nicolas	100	150	180	230	580	830
San Manuel, Sarrat	100	150	180	550	550	650
San Felipe, Sarrat	-	50	80	100	130	130
Sto. Tomas, Sarrat	100	100	130	150	150	180
San Marcos, Sarrat	-	30	30	30	30	30
San Cristobal, Sarrat	30	50	80	80	80	80
Guist River / Mandaloque	510	560	630	730	730	760
Suyo, Dingras	150	150	200	200	200	200
Poblacion of Dingras	80	280	480	550	780	780
Cura River Basin	3,350	3,630	3,750	3,900	3,980	4,000
Solsona River Basin	1,900	2,150	2,230	2,280	2,300	2,550
Madongan River Basin	3,700	3,930	4,130	4,180	4,280	4,380
Papa River Basin	1,730	1,880	1,900	1,950	1,980	2,000
Lower Bongo	330	380	400	400	430	430
Upper Bongo	350	480	500	550	730	730
<b>Total</b>	<b>12,800</b>	<b>14,800</b>	<b>15,950</b>	<b>17,290</b>	<b>18,990</b>	<b>20,220</b>

Table C.5.1 Unit Construction Cost of Buildings by Type in Laoag City: 1996

Type of Building	(Unit: Pesos/m <sup>2</sup> )			
	Type I	Type II	Type III	Type IV
1. Dwelling Unit				
1) One-Family	3,000	2,580	2,020	690
2) Duplex	2,900	2,480	2,060	-
3) Apartment	2,730	2,400	-	-
2. Industrial Building	2,200	1,920	-	-
3. Commercial Building	2,890	2,470	-	-
4. Office Building	3,400	3,050	-	-
5. School Building	2,650	2,480	-	-
6. Hospital Building	3,400	3,050	-	-

Source: Unit Cost in Laoag City, 1996, City Assessor of Laoag City

Note: Classification of Buildings are defined referring to their structural characteristics, as follows:

Type I (Reinforced Concrete): all structures by reinforced concrete or only walls are hollow blocks

Type II (Semi-Concrete): concrete/ brick/ stone walls and galvanized iron/ aluminum/ tile/ clay tile/ semi-concrete roofing

Type III (Strong material): Wood/ semi-concrete/ brick/ stone walls and wood roofing

Type IV (Temporary and Makeshift structure): Other structures

Table C.5.2 Present Assessed Value of Building Units by Assessor: 1995

Property Item	Number of Units (Units)	Market Value (Pesos)	Average Market Value (Pesos/Unit)
<b>Laoag City</b>			
<b>1. Taxable Assets of Buildings</b>			
a. Residential	2,372	823,172,930	347,037
b. Agricultural	68	2,709,370	39,844
c. Commercial	1,099	443,539,300	403,584
d. Industrial	14	10,438,240	745,589
e. Hospital	30	18,370,920	612,364
f. Recreational	11	6,144,750	558,614
g. Residential of No Tax Level*1	11,601	768,143,690	66,214
Average of Entire Residential Buildings (a. & g.)			113,885
<b>2. Tax Exempt Facilities</b>			
a. Government	183	99,296,500	542,604
b. Religious	90	46,104,590	512,273
c. Educational	284	120,563,660	424,520
<b>Municipalities *2</b>			
<b>1. Taxable Assets of Buildings</b>			
a. Residential	6,651	193,343,866	29,070
b. Agricultural	0	0	-
c. Commercial	178	8,351,023	46,916
d. Industrial	4	593,220	148,305
e. Hospital	2	281,530	140,765
f. Recreational	0	0	-
g. Residential of No Tax Level	1,208	6,153,000	5,094
Average of Entire Residential Buildings (a. & g.)			25,385
<b>2. Tax Exempt Facilities</b>			
a. Government	204	17,824,296	87,374
b. Religious	55	6,615,550	120,283
c. Educational	112	23,643,947	211,107

Source: (1) Report on the Assessment of Real Property by Property Classification, June 1996, Laoag City  
 (2) Report on the Assessment of Real Property by Property Classification, March 1996, Carasi  
 (3) Report on the Assessment of Real Property by Property Classification, June 1996, Dingras  
 (4) Report on the Assessment of Real Property by Property Classification, June 1996, Banna  
 (5) Report on the Assessment of Real Property by Property Classification, March 1996, Marcos  
 (6) Report on the Assessment of Real Property by Property Classification, March 1996, Nueva Era

Note: \*1 A residential building assessed as less than 175,000 pesos of fair market value is not taxable under the Local Government Code 1991, R.A. 7160 and Philippine Constitution.

\*2 The following five municipalities are involved: Carasi, Dingras, Banna(Espritu), Marcos and Nueva Era.

Table C.5.3 Production Cost of Major Crops: 1995-1996

Cost Item	Palay*1		Garlic	Tobacco
	Irrigated	Rainfed	*2	*3
<b>I. Production Cost in 1995-96 *4 (Pesos per ha)</b>				
1. Seeds/Planting Materials	761	959	14,185	2,184
2. Fertilizers	1,540	1,198	2,991	3,962
3. Agro-chemicals	376	279	660	1,703
4. Animal and Machine	1,522	830	3,317	10,605
5. Hired Labor	10,259	8,570	18,968	15,327
6. Others	3,512	2,925	5,528	2,570
7. Total	17,970	14,761	45,650	36,351
<b>II. Unit Production</b>				
1. Yield per Hectare (tons)	3.02	2.41	2.86	1.86
2. Cost per Ton (Pesos)	5,950	6,125	15,962	19,544

Source: (1) BAS, Central Office and Provincial Office in Ilocos Norte  
 (2) National Tobacco Administration, Farm Development Department

Note: \*1 Modified from data in 1995 in Ilocos Norte Province

\*2 Modified from data in 1994 in the national average

\*3 Modified from data in 1994 in Ilocos Norte Province

\*4 Applied wholesale price indices in Table A4-9 for modification

Table C.5.4 Prices of Selected Agricultural Commodities: 1991-1995

Item	Unit	1995												Dec. Average					
		1991	1992	1993	1994	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.		Sep.	Oct.	Nov.		
I. Retail Prices (Annual/Monthly Average) at Laoag City Public Market																			
1.	Rice, special	kilo	9.39	9.93	10.70	11.72	10.54	10.83	11.38	12.21	12.98	13.73	13.99	16.49	18.43	17.88	16.91	16.00	14.31
2.	Corn, yellow	kilo	7.05	8.96	8.34	9.86	11.65	9.83	8.91	8.32	8.97	9.10	9.87	10.00	9.44	9.42	10.28	11.08	9.67
3.	Garlic	kilo	80.84	100.04	61.66	76.30	130.92	91.00	76.37	86.00	96.43	102.92	118.08	134.00	150.08	181.92	194.00	214.00	131.04
4.	Tomato	kilo	15.67	17.18	15.99	16.94	7.28	6.10	4.64	6.74	14.28	27.77	24.78	26.09	25.00	31.52	35.25	33.83	20.31
5.	Onion	kilo	21.82	21.46	19.36	24.79	15.35	13.08	13.29	14.42	13.73	19.68	23.00	23.42	24.00	23.26	25.20	21.27	22.18
II. Farmgate Prices (Annual/Monthly Average)																			
1.	Palay	kilo	4.70	4.60	5.81	6.32	6.30	6.38	6.84	6.93	7.62	7.94	8.24	11.08	10.50	8.04	8.20	8.56	8.06
2.	Corn, yellow	kilo	5.02	6.82	6.22	7.17	6.52	6.59	6.80	6.72	6.62	6.58	6.56	6.14	6.17	6.97	9.97	9.42	7.09
3.	Garlic	kilo	61.21	70.84	38.78	52.00	59.69	49.08	51.20	67.79	66.16	91.61	97.50	112.77	141.22	190.93	204.65	192.05	110.39
4.	Tomato	kilo	8.45	10.09	6.69	8.12	4.28	3.03	4.23	5.55	13.40	-	-	-	-	-	-	15.58	8.01
5.	Onion, multiple kilo	kilo	15.69	12.36	11.88	15.58	8.22	8.01	9.44	10.98	12.49	-	-	-	-	-	-	13.05	10.36
6.	Mango	kilo	13.08	12.85	13.14	8.94	-	12.31	10.32	12.25	12.09	-	-	-	-	-	-	-	11.74
7.	Tobacco, native kilo	kilo	-	-	67.37	70.12	76.63	78.39	64.10	70.65	60.50	62.76	67.79	68.62	71.75	70.40	70.76	72.00	69.54

Source: Provincial Agriculture Office, BAS

Table C.5.5 Farmgate Price of Palay

Item	International Value (US\$)	(Unit: per ton)	
		Local Value	Economic Value (US\$)
1. World Market Price *1	277		
FOB, Bangkok, 5% broken milled white rice.			
Price projected in 1996 at 1990 constant prices.			
With 20% discount for quality	222		
World Market Price *2	259		
Price projected in 1996 at 1996 prices.			
2. Freight (Bangkok to San Fernando Port)	18		
3. CIF Philippines	277		
Peso Equivalent for Financial Value		7,209	277
4. Port Handling & Warehouse Charge, etc.		1,250	34
5. Transport & Handling *4		195	5
6. Wholesale Price		8,654	317
7. Milling Cost		460	13
8. Palay Equivalent (Yield of Rice from Paddy) *5		5,326	198
9. Transport & Handling Cost for Milling *6		180	5
10. Farmgate Price of Palay		5,146	193
Peso Equivalent *3	( =	5,100	6,000 )

Source: (1) The Panay River Basin-wide Flood Control Study, Supporting Report II, 1985, JICA  
 (2) Study on Ilog-Hilabangan River Basin Flood Control Project, Interim Report, 1991, JICA  
 (3) Feasibility Study on the Improvement of Major Road Sections in Luzon, Visaya, DPWH

Note: \*1 Commodity Markets and the Developing Countries, A World Bank Quarterly, Feb. 1996, World Bank

\*2 Applied 116.70 of US GDP deflator (1990=100)

\*3 Conversion rate of P26.00 per US\$1.00 was applied for financial value and that of P31.20 per US\$1.00 was applied for economic value as shadow exchange rate.

\*4 Charged based on average distance of 50km at P.4/ton-km.

\*5 65% of yield of rice based on average of private mills.

\*6 Charged based on average distance of 10km at P.4/ton-km.

Table C.5.6 Cropping System in Laoag River Basin

Item	Location*1	Upper: Jan.- June	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.		
1. Cereals	All Municipalities	All Municipalities														
2. Major Crops	All Municipalities	All Municipalities														
Garlic	1-8, 10	None														
Tobacco	1-9	None														
Tomato	All Municipalities	1-3, 6, 8, 10														
Onion	2, 3, 7, 9, 10	9														
Mango	1-9	None														

Source: BAS, Provincial Office

Note: \*1 Index number indicates the following municipality.

- 1. Dingras
- 2. Banna (Espiritu)
- 3. Laoag City
- 4. Marcos
- 5. Nerva Era
- 6. Piddig/Carasi
- 7. San Nicolas
- 8. Sarrat
- 9. Solsona
- 10. Vintar



**Table C.5.7 Average Damageable Value of Palay Production in Irrigated Field**

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Crop Calendar												
2. Planted Area (%)						35	70	100	100	65	30	
1st Crop												
2nd Cro	90	100	75	50	25	10				25	50	75
3. Accumulate Cost (%)						4	12	29	51	73	89	62
1st Crop												
2nd Cro	59	76	64	46	24	10			3	9	21	39
4. Flood Frequency (%)	0	0	0	1	4	10	24	24	26	9	1	0
5. Damageable Value *1 (Pesos/ha)						512	2,971	5,194	6,631	1,663	71	0
1st Crop	0	0	0	0	0							
2nd Cro	0	0	0	119	199	174	0	0	0	387	97	0
<b>Financial Terms</b>												
		<u>Ist Crop</u>			<u>2nd Crop</u>			<u>Total/Average</u>				
6. Yield (ton/ha)		3.8			4.2			4.0				
7. Farmgate Price (Pesos/ton)		8,000			8,000			8,000				
8. Gross Income (Pesos/ha)		30,400			33,600			64,000				
9. Production Cost (Pesos/ha)		17,970			17,970			35,940				
10. Net Income (Pesos/ha)		12,430			15,630			28,060				
11. Damageable Value (Pesos/ha)		17,041			977			18,019				(= 18,000 )
<b>Economic Terms</b>												
		<u>Ist Crop</u>			<u>2nd Crop</u>			<u>Total/Average</u>				
12. Yield (ton/ha)		3.8			4.2			4.0				
13. Economic Farmgate Price (Pesos/ton)		6,000			6,000			6,000				
14. Gross Income (Pesos/ha)		22,800			25,200			48,000				
15. Production Cost (Pesos/ha)		14,735			14,735			29,471				
16. Net Income (Pesos/ha)		8,065			10,465			18,529				
17. Damageable Value (Pesos/ha)		13,974			802			14,775				(= 14,800 )

Source: (1) Quarterly Review of Commodity Market, Fourth Quarter 1992, World Bank  
(2) The Panay River Basin-wide Flood Control Study, Supporting Report II, 1985, JICA  
(3) Study on Ilog-Hilabangan River Basin Flood Control Project, Interim Report, 1991, JICA  
(4) Feasibility Study on the Improvement of Major Road Sections in Luzon, Visaya, DPWH  
(5) SCF is assumed to be 0.82.

Note: \*1 (2)\*(4)\*{(3)\*(8)+(9)}

**Table C.5.8 Average Damageable Value of Palay and Garlic Production in Irrigated Field**

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Crop Calendar												
2. Planted Area (%)												
1st Crop						35	70	100	100	65	30	
2nd Cro	90	100	75	50	25	10				25	50	75
3. Accumulate Cost (%)												
1st Crop					4	12	29	51	73	89	62	30
2nd Cro	59	76	64	46	24	10			3	9	21	39
4. Flood Frequency (%)	0	0	0	1	4	10	24	24	26	9	1	0
5. Damageable Value *1 (Pesos/ha)												
1st Crop	0	0	0	0	0	512	2,971	5,194	6,631	1,663	71	0
2nd Cro	0	0	0	1,527	2,953	2,889	0	0	0	6,488	1,470	0

**Financial Terms**

	Ist Crop	2nd Crop	Total/Average
6. Yield (ton/ha)	3.8	3	3
7. Farmgate Price (Pesos/ton)	8,000	110,000	.
8. Gross Income (Pesos/ha)	30,400	330,000	360,400
9. Production Cost (Pesos/ha)	17,970	45,650	63,620
1 Net Income (Pesos/ha)	12,430	284,350	296,780
1 Damageable Value (Pesos/ha)	17,041	15,327	32,368 (= 32,400)

**Economic Terms**

	Ist Crop	2nd Crop	Total/Average
1 Yield (ton/ha)	3.8	3	3
1 Economic Farmgate Price (Pesos/ton)	6,000	90,200	.
1 Gross Income (Pesos/ha)	22,800	270,600	293,400
1 Production Cost (Pesos/ha)	14,735	37,433	52,168
1 Net Income (Pesos/ha)	8,065	233,167	241,232
1 Damageable Value (Pesos/ha)	13,974	12,568	26,542 (= 26,500)

Source: (1) Quarterly Review of Commodity Market, Fourth Quarter 1992, World Bank

(2) The Panay River Basin-wide Flood Control Study, Supporting Report II, 1985, JICA

(3) Study on Ilog-Hilabangan River Basin Flood Control Project, Interim Report, 1991, JICA

(4) Feasibility Study on the Improvement of Major Road Sections in Luzon, Visaya, DPWH

(5) SCF is assumed to be 0.82.

Note: \*1 (2)\*(4)\*{(3)\*(8)+(9)}

**Table C.5.9 Average Damageable Value of Palay Production in Rainfed Field**

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Crop Calendar												
2. Planted Area (%)					50	100	100	100	100	50		
3. Accumulate Cost (%)				5	18	38	63	83	95	50		
4. Flood Frequency (%)	0	0	0	1	4	10	24	24	26	9	1	0
5. Damageable Value *1 (Pesos/ha)	0	0	0	0	140	997	3,280	3,988	4,800	532	0	0
<b>Financial Terms</b>												
		1st Crop			2nd Crop			Total/Average				
6. Yield (ton/ha)		2.4			-			2.4				
7. Farmgate Price (Pesos/ton)		8,000			-			8,000				
8. Gross Income (Pesos/ha)		19,200			-			19,200				
9. Production Cost (Pesos/ha)		14,761			-			14,761				
1 Net Income (Pesos/ha)		4,439			-			4,439				
1 Damageable Value (Pesos/ha)		13,737			-			13,737				( = 13,700 )
		1st Crop			2nd Crop			Total/Average				
1 Yield (ton/ha)		2.4			-			2.4				
1 Economic Farmgate Price (Pesos/ton)		6,000			-			6,000				
1 Gross Income (Pesos/ha)		14,400			-			14,400				
1 Production Cost (Pesos/ha)		12,104			-			12,104				
1 Net Income (Pesos/ha)		2,296			-			2,296				
1 Damageable Value (Pesos/ha)		11,265			-			11,265				( = 11,300 )

Source: (1) Quarterly Review of Commodity Market, Fourth Quarter 1992, World Bank  
 (2) The Panay River Basin-wide Flood Control Study, Supporting Report II, 1985, JICA  
 (3) Study on Ilog-Ilibangan River Basin Flood Control Project, Interim Report, 1991, JICA  
 (4) Feasibility Study on the Improvement of Major Road Sections in Luzon, Visaya, DPWH  
 (5) SCF is assumed to be 0.82.

Note: \*1 (2)\*(4)\*{(3)\*(8)+(9)}