Annex D

Environmental Impact Assessment (EIA)

Annex D ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

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Annex D ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

D1 Introduction

D1.1 EIA Approach

The Initial Environmental Examination carried out during the Phase 1 identified the following environmental and social/resettlement issues relative to the Agos River development that are to be addressed in the Environmental Impact Assessment (EIA) study.

River Environment	Natural Environment	Social Aspects incl. Resettlement
• Need of watershed management in the Kaliwa River Basin to reduce sediment deposit in reservoir • Reduction of sediment release, which may cause lowering of downstream river bed level and change of shape of lower alluvial plains/delta and coastal lines especially the sand dunes in the Agos River estuary • Reduction of river flow in the lower Agos due to water supply for Metro Manila • Reduction of flood flow in downstream reach	• Protection of rare and endangered flora and faunal species, such as Philippine eagle, Philippine deer, etc. • Possible water pollution due to human settlements and agro-industries in the upper Kaliwa River Basin • Siting of quarry sites/ borrow areas • Obstruction to migration of catandromous species, such as prawns, eels	• Relocation of about 300 families may be required depending on actual altitude of Brgy. Daraitan and height of proposed dam • Inundation of livelihood area of Indigenous People (IP) • Initial opposition of the people of Barangay Daraitan to inundation of their village • Inundation of Tinipak/limestone caves, IPs worship places in the Kaliwa River Basin and IPs cultural sites such as Tigbak , burial site in Kanan River Basin • People have fears for safety of dam • Dam will be a barrier for log transportation (illegal logging is a major source of income for some families)

For water conveyance route, the following issues were raised.

Waterway Route Environment	Natural Environment	Social Aspects incl. Resettlement
• Disturbance of traffic during pipeline construction • Construction of long tunnel • Construction of water treatment plant in a large area (about 70 ha) • Construction of 2 service reservoirs	• Disturbance of wildlife due to blasting and quarrying • Disconnection of stream flow if work is improperly planned	• Relocation of about 50 families, mostly situated in the water treatment plant site • Compensation for agro-industrial facilities, such as livestock farms, warehouses, factories • Acquisition or lease of lands in pipe-laying area

The above-mentioned issues and other issues that were identified/raised in the course of conducting the EIA study were further examined.

In addition, the preparation of this EIA study basically conformed to the regulatory requirements of the Philippine Environmental Impact Statement (EIS) System. Hence, the surveys and studies were also conducted as required by the System. A local environmental firm, TEST Consultants, was contracted to carry out this EIA study under the supervision of the Environmental Expert and Resettlement Planner of the JICA Study Team.

The conduct of this EIA involved two stages: the Basic Study Stage and the Detailed Study Stage. The Basic Study Stage involved the collection of secondary data and conduct of site reconnaissance for data validation. The Detailed Study Stage involved field surveys for both natural and social environment. Public consultations and workshops were also held during this stage.

D1.2 EIA Study Modules

The EIA covers the following major study modules: i) Terrestrial Ecology/ Watershed Study, ii) Aquatic Ecology Study, iii) River Use Study, iv) Air Quality and Noise Study, v) Geology/Geohazard Study, vi) Coastal Sedimentation Study, vii) Sociology/Resettlement Study, viii) Resettlement Site Development Planning, ix) Community Development/Communication Study, and x) Public Consultations/ Workshop

D1.3 Methodology of Study Modules

(1) Terrestrial Ecology/Watershed Study

Literature review of previous works was undertaken in relation to floral, faunal and watershed attributes of the Kaliwa, Kanan and Agos Riverine areas. In particular, the recent JICA Interim Report on Water Resources Development for Metro Manila and the IEE Report were primary sources of information. Other sources include works by NGOs, DENR–CENRO and PENRO offices including DENR Research Bureau. Available maps from NAMRIA–DENR offices and other reports were also used. These maps were made to show the boundaries of each ecosystem and watershed to include the forest, savannah, grassland, riparian, riverine (floodplain), agroforestry (agro-ecosystem), and the coastal zone.

From these maps, the area and number of plots/transects for assessing the floral and faunal attributes of each ecosystem were determined. For floral assessment, transect lines were drawn at regular interval to serve as guide to determine the placing of quadrants. For faunal population, the time area count method was used to list down the animal species encountered in the entire watershed including the vast mangrove forest.

(2) Aquatic Ecology Study

A total of ten sampling stations was established in the Kaliwa-Kanan-Agos Rivers to represent the aquatic profile of the river system: three in Kaliwa River; two in Kanan River; and five in Agos River as reflected in the table below. Figure D1.1 provides the sampling location map. Collection of plankton and benthos, and interviews with the locals regarding the fishery resources and fishing gear they commonly use were conducted in each station. To verify fish species, which are present in the river system, samples were collected in Barangay Pagsangahan.

Sampling Stations in the Kaliwa-Kanan-Agos River, May 2002

River	Station No.	Sitio/Barangay
Agos River	1	Brgy. Boboin
	2	Brgy. Pinaglapatan
	3	Brgy. Banugao
	4	Brgy. Mahabang Lalim
	5	Brgy. Pagsangahan
Kaliwa River	6	Sitio Mabagkoy
	7	Sitio Pinoban
	8	Sitio Queborosa
Kanan River	9	200 m upstream from Barangay. Pagsangahan
	10	450 m upstream of Barangay. Pagsangahan

Sampling techniques/methodologies for each identified parameter for aquatic ecology study are briefly described as follows:

Sampling Methodologies for Aquatic Ecology Study

Phytoplankton	One liter of water samples were collected from about 0.5m depth from the water surface and fixed with formalin (3% v/v). The samples were allowed to settle for a week and then concentrated to about 50ml prior to enumeration. Sub-samples were observed and counted using a hemacytometer. Appropriate taxonomic keys were used to identify the organisms in the samples, up to the lowest taxa possible.
Zooplankton	Zooplankton samples were collected by passing 100 L of river water through a 56 µm plankton net. Backwashing was done three times to ensure the collection of all organisms that has entangled in the mesh of the net. The plankton samples were fixed in formalin (3 % v/v) in the field. In the laboratory, the samples were allowed to settle for a week prior to concentration. Sub-samples of 1 ml were observed and counted in a counting chamber. Appropriate taxonomic keys were used to identify the zooplankton to the lowest taxa level possible.
Benthic Community	Four liter (4 L) composite sediment samples were collected from each sampling site. In case the sediments vary, two samples were collected to represent the different substrates in the area. The sediments were sieved on-site using U.S. Standard metal sieve with 249 mesh size. All organisms collected were preserved in 70% ethyl alcohol. In cases where the sediments cannot be sieved on site, the sediments were fixed initially in formalin (10% v/v). Sorting, identification and counting were done in the laboratory.
Riverine Fishery Resources and Fishing Activity	Survey of the fishermen was conducted to determine the fishery resources and fishing activity in the river system. To supplement the structured interviews conducted by the Socio-economic Team, informal interviews and focus group discussions with the fishermen and local folks were conducted in the communities along the riverbank. Some fish samples were brought to the National Museum for species identification.
Coastal Flora and Fauna	For mangroves and other coastal plants, Quadrant Sampling Technique using a 10m x 10m quadrant was used to study the vegetation along the coastal areas of Infanta. Standard vegetation analysis parameters were taken into consideration such as species identity, diameter at breast height (DBH), and quantitative structural analysis parameters in order to determine the Relative Dominance, Relative Density, Relative Frequency and Important Value. Likewise, Shannon-Wiener Index of Diversity and Evenness Index were also determined.
Coastal Fishery Resources and Fishing Activity	Interviews with sustenance fishermen in three coastal areas (Binulasan, Langgas, and Libjo) were conducted to determine the near-shore catch composition. Secondary data on offshore fishery resources were verified with the landed catch survey conducted in Brgy. Dinahican, the major fish landing port of Infanta.
Freshwater Aquaculture	Interview with a fishpond operator in Bgy. Langgas was conducted to supplement the secondary data on the aquaculture practices in Infanta.

(3) River Use Study

Information on river water use and peoples' dependence on rivers in the proposed Agos Reservoir area and along the river reaches downstream from the Agos Dam was obtained through the focus group discussions (FGD), observations and interviews (refer to the location of FGDs for the riverine areas covered in the survey). All significant activities were indicated in the map. Such activities included:

i) Domestic (laundry, bathing, drinking water source, sewage disposal, etc.),
ii) Agricultural (irrigation, washing/ bathing of carabaos, fishing, canals, etc.),
iii) Recreation (swimming, etc.),
iv) Transport (people, forest and agricultural products, goods and services), and
v) Commercial (sand and gravel quarrying, etc.).

During the FGD, the perceived problems affecting the rivers and their livelihood were also investigated.

(4) Air Quality and Noise Study

Ambient air samples for the determination of the concentration levels of NO_2 and SO_2 in the environment were obtained using a Kimoto Handy Di- Gas Bubbler Sampler. On the other hand, an Extech High Volume Sampler was used for the collection of dust or Total Suspended Particulates (TSP) suspended in environmental air.

Laboratory analysis for the concentration of NO_2 was done using the Griess Saltzmann method. The Pararosaniline colorimetric method using a Milton Roy Spectrophotometer was used in the laboratory analysis of the concentration of SO_2 in the air sample. The gravimetric method determined the level of TSP concentration.

Noise level determination was made using a portable Extech Sound Level Meter for ten minutes at each site. The noise intensity is measured in decibels.

Six (6) sampling stations in close proximity to sensitive receptors in the project site were chosen as shown in Figure D1.2. Wherever applicable, the air sampling stations were strategically located in areas near sensitive receptors such as highly populated residential communities, public places like schools, day care centers, hospitals and churches.

The following gives the air quality and noise level measurement locations and brief description of the stations.

Sampling Stations for Air and Noise Level Measurement

Station	Location	Date of Sampling	Remarks
1	Daraitan Elementary School area, Tanay	4/04 to 4/05/02	Sampling station was located in front of Daraitan Elementary School in Tanay Rizal, northeast of Mount Daraitan.
2	Agos Dam community area, Infanta	4/06 to 4/08/02	Sampling station was about 10 meters away North of dirt road and 100 meters away South of Agos River.
3	Mabangkoy Elementary School, Brgy. Pagsangahan, Gen. Nakar	4/07/02	Sampling station was about 60 meters away northwest of Kaliwa River and 100 meters away of Kanan River.
4	Sitio Buhangin, Brgy. San Jose, Antipolo City	4/16 to 4/17/02	Sampling station was located about 40 meters northeast of nearby densely populated receptors. About 750 meters southwest of Solid Cement and about 1000 meters west of Limestone Quarry.
5	Brgy. San Luis, Antipolo City	4/16 to 4/17/02	Sampling station was located about 150 meters southwest of former Antipolo Garbage site in Brgy. San Luis, Antipolo City.
6	Sitio Doña Ana, Brgy. Maybangcal, Morong, Rizal	4/18 to 4/19/02	Sampling station was located near the boundary of the proposed Water Treatment Plant in Sitio Doña Ana in Brgy. Maybangcal, Morong, Rizal. To the west is the Foremost farm about 2.5 km. away and to the Northwest is the Coral farm at about 1.0 km. distance.

(5) Geology/Geohazard Study

The study on the geology and geohazard of the project site is part of the preparation of the Engineering, Geological and Geo-hazard Assessment (EGGA) report as required by DENR-DAO 2000-28. The methodology used for assessing the probable risks related to geohazards for this project was three-fold. First was ocular geological investigation; second was the assessment of available secondary data and references on matters related to the geohazard assessment work; and third was the collation and interpretation of data

Information on the existing site conditions therein were gathered during the geological investigation with special emphasis on the potential hazards, physiography, geology, hydrology, vegetation and recent anthropogenic activities, among others.

(6) Coastal Sedimentation Study

Soil-sand sediment samples were taken at strategic locations from Barangay Pamplona in General Nakar to Barangay Dinahican in Infanta as shown in Figure D1.3. The following provides the soil sampling locations, date of sampling and brief description of sampling stations/sites:

Soil Sampling Stations in the Kaliwa-Kanan-Agos River Basin

River	Station No.	Location	Date of Sampling	Remarks
Agos River	1	Brgy. Magsaysay, Infanta	4/6/02	Sampling stations were located along the shore of the Agos River. During sampling activities, sediments were found deposited from the upper watersheds.
	2	Brgy. Mahabang Lalim, Gen. Nakar	4/6/02	
	3	Brgy. Magsaysay, Infanta	4/6/02	
	4	Brgy. Mgsaysay Health Center, Infanta	4/6/02	
	5	Brgy. Batangan, Gen. Nakar	4/6/02	
Kaliwa River	1	Brgy. Daraitan, Tanay	4/29/02	Sampling station was located on the right side bank of the upper reach of the Kaliwa River. The area was denuded by "kaingin" farming which likely contributed to sediments in the rainy season.
	2	Sitio Cablao, Brgy. Pagsangahan, Gen. Nakar	4/29/02	Sampling station was located at the school grounds in Sitio Cablao close to the proposed area of the Kaliwa Low Dam.
	3	Sitio Neo, Brgy. Magsaysay, Infanta	4/29/02	Sampling station was located on the right side bank of the Kaliwa River.
	4	Sitio Alasasin	4/29/02	
Kanan River	1	Sitio Pangatloan, Mahabang Lalim, Gen. Nakar	4/29/02	Sampling station was located at the east bank of the Kanan River in a sandy bank closed to the gauging station installed by the JICA Study Team. The bank consists mostly of stones and boulders.
	2	Sitio Pangatloan & Ilamban, Brgy. Mahabang Lalim, Gen. Nakar	4/29/02	Sampling station was located on the west bank of the Kanan River in sandy bank at the edge of the stone pile deposits.
	3	Sitio Ilamban, Brgy. Mahabang Lalim, Gen. Nakar	4/29/02	Sampling station was located about 1km from Sta. No. 4. The vicinity of the bank was rocky and stony with lush vegetation.
	4	Sitio Ilamban, Brgy. Mahabang Lalim, Gen. Nakar	4/29/02	Sampling station was situated on the right side bank near the proposed resettlement area. The banks are mostly stony and rocky with sparse sandy bank deposits.

Soil Sampling and Analysis

A total of 12 soil samples were obtained from uncovered and exposed areas in the watershed of the rivers. In addition, sand-soil samples were also obtained at 5 strategic locations along the coast.

Water Sampling and Analysis

The water sampling locations, date of sampling and brief description of sampling stations/sites are as follows:

Water Sampling Stations

Sample Type	Station	Location	Date of Sampling	Remarks
Coastal Water	1	Brgy. Pamplona, Gen. Nakar	4/05/02	Sampling station was near residential areas. The shore was lined with coconut, vines crawl along the sandy beach. Beach slopes around 45^{O}. Sample was obtained at the breaking waves area where the water was observed to be a little cloudy with greenish white color.
	2	Brgy. Boboin, Infanta	4/05/02	Sampling station was established on the northern bank of the mouth of the Agos River; Water was very clear at this location being influenced by the Agos River discharge, that was taken at around 1-1.5m from the sandbar bank.
	3	Brgy. Libjo, Gen. Nakar	4/05/02	Sampling station was located closest to the Ugnayan" house, about 50m south of the embarkation for passengers going to Polillo Island. Water was a little cloudy.
	4	Brgy. Binulasan, Infanta	4/05/02	The sampling station was near the house of the current Barangay chairman and the Blue Pacific Resort. Vegetation exists along the coast. Stones exist along the beach.
	5	Sitio Parola, Brgy. Dinahican,	4/05/02	Sampling station was about 20m east of lighthouse. Water sample was taken at the breaking wave area. The water seemed clear as seen through the sampling bottle.
River/Coastal Water	S-1	Brgy. Magsaysay, Infanta	07/21/02	Sampling station was located around 30-50m from the confluence of the Kaliwa and Kanan Rivers. It was observed that water coming from the Kaliwa River was murkier than that coming from the Kanan River.
	S-2	Brgy. Magsaysay, Infanta	07/21/02	Sampling station was located about 500 to 600m from the confluence point of the Kaliwa and Kanan Rivers. It was assumed that waters from both rivers have already mixed and a lesser concentration was expected with combined flow.
	S-3	Brgy. Boboin, Infanta	07/21/02	Sampling station was located downstream near the mouth of the Agos River.
	S-4	Brgy. Binulasan, Infanta	07/21/02	Additional water samples were taken along the coast of Infanta, Quezon.
	S-5	Sitio Parola, Brgy. Dinahican,	07/21/02	

The water samples were used to determine the volume of materials and the density of each settled and suspended materials to be taken.

(7) Sociology/Resettlement Study

1) The Socio-Economic Inventory and Household Survey (SES) and Inventory of Losses (IOL)

The SES was conducted to ascertain the socio-economic and environmental conditions of the people and communities in four primary impact areas, namely the Kanan River area, the Kaliwa River area, the Agos River area and the mangrove area. The SES endeavored to provide a 100% level of coverage in the primary impact area, and a 10% sampling for the households

in the designated secondary impact area. The SES also described the traditions, beliefs and lifestyles of the PAF/PAPs with particular emphasis on the indigenous members of the community.

The IOL was carried out simultaneously with the social surveys. The survey team worked closely with the officials from the respective Barangays and also attempted to have the presence of the Barangay officials during the said activities. In addition, a replacement cost study was also undertaken in order to calculate all losses such as land, structures, reflecting replacement cost or current market values.

There were four survey and inventory teams that had five or six member-enumerators each. There was a total of 18 enumerators, residents from the different Barangays in Infanta and General Nakar and Daraitan, Rizal. They were recommended by their Barangay captains from a list submitted by ICDAI, an NGO based in Infanta, Quezon. The enumerators underwent a two-day training-seminar and a post training field work before the actual conduct of the socio-economic survey.

Total Number of Respondents for the SES

The surveys were conducted in both the designated primary and secondary impact areas. The surveys in the primary impact area involved a total of 602 respondents, as shown below:

Number of Affected Families in the Primary Impact Area as per the SES

Barangay	Surveyed/Affected Families	No. of Total HH	% to Total Population1/
Magsaysay	240	321	74.7
Mahabang Lalim	158	108	(-1.47)
Pagsangahan	204	483	42.2
Total	602	912	45.9

1/ Source: MPDOs of General Nakar and Infanta, as of May 2000

Surveys were also undertaken in designated secondary impact areas. The total number of respondents was 688, that is breakdown as shown in the table below:

Total Number of Respondents in the Secondary Impact Areas for SES

Barangay	No. of Respondents	Total HHs[1]	Barangay	No. of Respondents	Total HHs[1]
Daraitan	98	1,000	Pinaglapatan	12	126
Pesa	35	146	Libjo	35	359
Batangan	18	180	Boboin	24	248
Maigang	8	83	Abiawan	23	234
Minahan Sur	20	204	Binulasan	23	390
Minahan Norte	5	5	Dinahican	100	1,037
Anoling	30	362	Antikin	14	140
Poblacion	10	192	Alitas	12	124
Pamplona	23	224	Balobo	8	87
Banglos	15	150	Binonoan	19	194
Ilog	24	244	Anibong	25	250
Banugao	47	474	Langgas	30	300
Silangan	14	147	TOTAL	688	6,899

1/ Source: MPDO of Infanta and General Nakar, as of May 2000

2) The Barangay Meetings

The Barangay meetings were conducted in three major Barangays primarily affected by the project-Magsaysay (Infanta) and Pagsangahan and Mahabang Lalim (General Nakar). The meetings were attended by representatives of the Barangay councils and the people's organizations. Its purpose was to inform the local officials and key leaders of the data gathering methodologies that will be conducted by the different components of study, in addition to the seeking their active participation and support

The schedule of the meetings and its corresponding attendees are shown below:

Schedule of Barangay Meetings

Barangay	Date of Meeting	No. of Participants
Magsaysay	March 9, 2002	30
Pagsangahan	April 6, 2002	30
Mahabang Lalim	April 13, 2002	Council members

3) The Focus Group Discussions (FGD)

The focus group discussions (FGSs) were held in 33 Sitios located in four Barangays, namely Magsaysay, Pesa, Mahabang Lalim and Pagsangahan. Although not originally included, Barangay Pesa was added to the list because it is found between Mahabang Lalim and Pagsangahan, although at a higher elevation. The FGDs were conducted within a six-week period, from April 12-May 24, 2002. The FGD discussions run, on the average, for about an hour-and-fifteen minutes.

(a) Discussion Framework of FGD

The FGDs followed a discussion framework to ensure that biases were minimized by avoiding factors that might have a significant influence in both process and outcome. Nevertheless, flexibility was also observed owing to the unique setting and composition of the group in each of the Sitios.

The discussion was carried out by utilizing these steps: (a) Introduce the participants (facilitators and members of the group); (b) Fill up the attendance sheet; (c) Explain the general objective of the FGD; (d) Introduce the Project (project brief and probable questions of the potentially affected population and responses); (e) Cite the three specific objectives of the FGD; (f) Discuss the specific objectives by group (consensus not necessary); (g) Summarize group discussion output; (h) Counter check the attendance sheet (must be completely filled up and signed) (i) Inform the group about the Public Consultation by Barangay and the availability of the minutes of discussion.

The FGD is a free-wheeling discussion where the participants were made to voice out their opinions. It is a tool designed to generate as many opinions as possible from the participants regarding a critical issue. It is not designed to record or survey the opinion of every participant; instead discussions and

exchanges are encouraged among them until a certain level of agreement is attained.

The results of the FGD were processed using basic percentage analysis on the common response and issues raised by the participants for each major question/topic during the discussion. The framework in analysis of results should be seen in the light of the nature of FGD as participatory a tool.

(b) Specific Objectives and Outputs of the FGD

The specific objectives, issues and concerns which guided data gathering and analysis are detailed in the table below:

Specific Objectives and Target Outputs[1/]

Objectives	Major Questions	Target Outputs
1. To assess the socio-economic and environmental situation in the area	a. What are the major uses of the river to the community and related problems, if any? b. What are the five major problems in the area? c. What are the existing community development activities/livelihood projects/participation programs within the study area? d. What are the three priority development projects proposed by the community?	• List of major river uses and related problems, if any. • Present activities that destroy the river and livelihood • Five major problems (ranked by the group) identified with details and background of each problem • Present activities that destroy the environment and people's livelihood • Listing of existing development activities, projects; objectives; beneficiaries; funding source; implementers; duration; description of community participation; scope/location • Three priority development projects and proposed nature of community involvement
2.To gather perceptions and attitudes on resettlement of Project-Affected People (PAP)	a. Are the members of the group willing to be compensated and assisted to move to other areas? b. What kind of assistance is proposed? c. How would they like to be compensated? d. Specify proposed area(s) for relocation, if any.	• Number/percentage of those who are willing and not willing and list of possible reasons why or why not. • List of proposed assistance needed for relocation • List of suggestions for compensation • List of proposed area(s) for relocation, if any and reasons • Any other opinions related to the relocation.
3. To identify probable nature and level of community involvement in the possible Project	a. If the Project will proceed, how would you like to be involved in the process (planning, implementation, monitoring) b. What do you require for effective participation?	• Specific stages of the Project which the group proposed to be involved with • Nature of involvement (consultation, indigenous knowledge-sharing, manpower) • Capacity-building required by the community for effective participation • Requirement from the project implementers for effective participation
4. To document concerns not captured by the questions	Are there any other concerns/ opinions regarding the Project?	List and description of other major concerns/opinions about the Project

1/ Table translated in Filipino during the actual FGD.

(c) Distribution of FGD Participants per Barangay

There was a total of 424 FGD participants, which ranged from three to 25, depending on the size of the community. Based on year 2000 statistics, the

FGD participants represented about eight percent of the total household population in these four Barangays.

Distribution of FGD Participants per Barangay

	Magsaysay	Pesa	Mahabang Lalim	Pagsangahan	Total
No. of Sitios	16	2	8	7	33
No. of Participants	183	50	90	101	424
Total HH Population	1,896	790	676	2,027	5,389
% over Total HH Population	9.65%	6.33%	13.31%	4.98%	7.87%
Total No. of HH1	321	146	108	483	1,058

1/ Source: MPDOs of Infanta and General Nakar, as of May 2000

Since the FGDs were small group discussions, these were conducted on a per Sitio basis. This made the discussions more manageable and the handling of sensitive issues better controlled.

4) The Key Informant Interview

Key informant interviews were conducted with representatives of eight out of 15 people's organizations operating in the study area. The FGD instrument was utilized as the discussion guide during the said interviews.

Complete List of Peoples' Organizations in the Project Area

Name of Organization/Representative	Type	Project Areas Covered
Samahang Mahalin and Kalikasan (SAMAKA)	Environmental	Magsaysay, Mahabang Lalim, Pagsangahan, Pesa
Sapang Balite Farmers	Upland Farmers	Magsaysay, Mahabang Lalim, Pesa
Kaisahan ng mga Layunin na Nakaugat sa Gawaing Nag-uugnay (Kanlungan)	Upland Farmers	Magsaysay, Mahabang Lalim, Pesa
Samahang Magsasaka ng Bantay Bayan, Inc. (SAMAKABAY)	Upland Farmers	Magsaysay, Mahabang Lalim, Pesa
Samahan ng Magsasaka sa Bundok na Dahilig ng Sierra Madre Inc. (SMBDSM)	IP Farmers	Pagsangahan (Sitio Lagmak)
First Infanta Magsaysay Tricycle Operators and Drivers Association (FIMATODA)	Tricycle Operators and Drivers	Magsaysay
Infanta-Magsaysay Operators and Drivers Association (IMODA)	Jeep Operators/ Drivers	Magsaysay
Kilos Unlad ng Mamamayan ng Real (KUMARE)	Women	Magsaysay
Ilamban Livelihood Cooperative (ILLICO)[1]	Upland Farmers Cooperative	Mahabang Lalim
Dapyag Cooperative (CADAPCO)[1]	Farmers Cooperative	Magsaysay
Bukang Liwayway[1]	Upland Farmers	Magsaysay
Kababaihan	Women's Group	Pagsanganhan
Munting Sambayanang Kristiyano	Church-Organized Group	Magsaysay, Mahabang Lalim, Pesa
Social Action Center	Church-Based Organization	Infanta
Infanta Integrated Community Development Assistance Inc. (ICDA)	Non-government Organization	Real, Infanta, Nakar

[1/] Inactive organizations

5) Resettlement Site Development Planning

The relocation of PAPs entails that suitable resettlement site(s) be identified and planned/developed. The methodologies used were: (1) review of

resettlement planning team survey reports; (2) reconnaissance surveys; (3) site selection and evaluation; (4) conduct of space programming; and (5) development of conceptual and schematic site plan.

The Resettlement Site Development Plan (RSD) also took into careful consideration the desires and perceptions of the potential PAFs as expressed in the various fora. It also took note of the number of PAFs to be resettled and the preliminary inventory of losses made. The RSD is a part of the Resettlement Plan for this Project.

6) Community Development/Communication Study

The strategic communications analysis was conducted to identify the strategic audiences through interest group analysis in order to identify the strategic messages that will have to be developed and communicated. This was done through the employment of SIAM or Strategic Impact and Assumptions Identification Method.

Thus, the directly affected communities, as well as the IP communities have been identified as needing special strategic communications attention. The Strategic Communications Plan (SCP) considered the type of message, media and provided for a budget for a specific implementation period that runs parallel to the activities in this project. The SCP is also a part of the Resettlement Plan for this Project.

7) Public Consultations/Workshop

The public consultations were held in three locations. The general objectives of the public consultations were broadly categorized into information, communication and education. The specific objectives are: (a) To present information on the project-its goals, major components and different activities; (b) To educate the participants on the project development cycle, so as to provide them with the basic background on how projects of this nature are developed, thus serving as a jumping board for understanding where this project stands; (c) To provide a venue where two-way communication can flow – that is, NWRB/JICA giving their message(s) and the participants conveying issues and concerns for resolution.

A content guide was prepared for the presenters, the JICA Study Team's representatives; the project proponents or the NWRB representatives; and the representatives from TEST Consultants, the consulting firm that prepared the EIA. The guide was derived from the issues and concerns raised during the focused group discussions. Each presenter thus prepared a short project explanation based on research work findings, and also incorporated into the briefing the answers to questions which have already been brought up in other venues.

The Barangay chairmen assisted in identifying the Sitio leaders and PO representatives to whom the invitations were issued. Coordination was also made with the LGUs from whom presence was requested. Letters were also sent to the political leaders, such as the Congressmen and Governors of the

provinces concerned to inform them of the public consultations. The contractor made all the required arrangements for the conduct of the public consultations; while NWRB was responsible for the invitations, being the project study implementer. A total of 148 participants attended the 3 public consultations.

There were four topics tackled – the project overview, the features of the project, the results of the EIA for the natural environment, and the results of the EIA for the social environment. After the end of the presentations, there was an open forum where the participants were encouraged to ask clarificatory questions as well as give suggestions that would be beneficial to the project.

Two workshops were also conducted last 09 October 2002 and 14 February 2003, which was attended by 94 participants and 90 participants, respectively. In both workshops, the participants were representatives from the principal LGU stakeholders, the concerned national/regional government officials, the private sector, the academe, and the civil society (POs/NGOs). The objectives of the 1st workshop were: (a) to present the interim result of the Study including advance information on the main features of the contemplated project; and (b) to elicit the general opinions of the participants about the Study. While, the aim of the 2nd workshop was to explain the proposed features of the project and to collect extensively the participants' opinions to be reflected in the subsequent proceeding of the project implementation.

The same process flow was adopted in both workshops. It involved 3 major activities: project presentation, open forum, group discussion and plenary session. After the Project presentation by the JICA Study Team and the open forum, the participants were broken-up into 2 groups: one for the dam concerns, and the other for the waterway concerns. Each group identified and discussed the questions/issues and concerns of the proposed development. Recommendations were formulated for each underlying issues and concerns with qualifications as to why such recommendations were made. The selected representative of each group then presented these recommendations in the Plenary Session.

D2 Baseline Environmental Consideration

D2.1 Natural Environment

D2.1.1 Terrestrial Ecology/Watershed Study

(a) Terrestrial Flora

(1) Kaliwa River Watershed

Ecosystem Types

There are seven major ecosystem types identified in the Kaliwa watershed, namely: forest, savannah, grassland, streambank, agroforest, floodplain and riparian. Forest ecosystem forms the major and dominant area in the whole landscape followed by the combination of savannah/grassland ecosystem and agro-forest. River and streambanks are the ecosystems just beside the floodplain where water-loving plants predominate. Classifying the major plant groups by ecosystem is vital as it governs their state of health in terms of productivity. Noticeable among those ecosystem types is floodplain where it occupies a sizeable area of the whole landscape.

Vegetation Types

The current ecosystem types in the watershed are shown in the table below:

Current Vegetation Types Formed Based on Existing Ecosystem

Vegetation/Ecosystem	Watershed		
	Kaliwa	Kanan	Agos
Ridge Forest	✓	✓	-
Savannah	✓	✓	✓
Grassland	✓	✓	✓
River/Streambank	✓	✓	✓
Floodplain/Riparian	✓	✓	✓
Agro-forest	✓	✓	✓
Coastal	-	-	✓

The top/ridge and hilly type of vegetation is characterized with the dominance of the climax tree species, the dipterocarps. This is similar and may even approach to the residual forest type. From the ridge (uppermost) vegetation types, it generally shifts to hilly type mainly due to sharp changes in elevation and concentration and pool of organic material especially at the valley of each hillside slope. The open spaces left by commercial and illegal logging activities are gradually invaded by low-lying type of lifeforms e.g. grass, legume and vine, which eventually formed into grasslands and brush lands. The trees, which are formed side by side with grasses became savannah vegetation. This type of vegetation is characterized by the presence of few scattered trees growing in the grasslands. Further, this is often visited by wildfire due to its proximity to cultivated farmlands and agro-forest areas. Built-up areas normally overlap with cultivated farmlands and agro-forest. These areas form part of the agro-ecosystem type of vegetation.

At the bottom of the hills are gullies formed by continuous run-off and drains off to the river bed inundated by sediments and silts. These areas are formed

normally during high flows where enormous amount of run-off laden with sediments/sands are trapped along the stretch of the river. Floodplain, as it is called, is the wettest part of the landscape such that a riparian type of vegetation is formed. A combination of aquatic and water loving plants dominates this ecosystem intersperse with shrub type group of vegetation. Down below, where all water from Kaliwa and Kanan watersheds drain are heaps of accreted soil that were formed into beach and collectively called coastal zone. The beach type forest and mangrove forest are the vegetation that was formed in an estuary environment within the coastal zone.

Plant Species Composition

In total, Kaliwa River watershed is composed of 94 plant species belonging to 43 families and 85 genera representing various lifeforms such as tree, shrub, forb, grass, vine and fern.

Distribution of Families, Genera and Lifeforms for Kaliwa and Agos River Watersheds

Particular	Watershed	
	Kaliwa	Agos River Area
1. Family	43	41
2. Genera	85	83
3. Lifeform		
a. Tree	66	79
b. Shrub	7	7
c. Forb	4	7
d. Grass	15	9
e. Vine	1	3
f. Fern	1	1

(2) Kanan River Watershed

Ecosystem Types

The entire Kanan River Watershed is mostly forested with small patches of grassland/savannah and agro-ecosystem areas. Riparian and streambank ecosystems are part of the main and sub-tributaries with narrow and fringe type floodplain ecosystem.

Vegetation Types

The various vegetation types present are: Malabayabas-dipterocarp forest, mixed broad leaved-dipterocarp forest, old growth dipterocarp forest and combination of agro-forest-savannah vegetation. Dipterocarps are found in almost all types of vegetation except for the agro-forest and savannah forest. It can also be seen in association with Malabayabas (Tristaniopsis decorticate). Genus Shorea, e.g., White or Red lauan, are both found to be the dominant species. These groups of plants are all found in Barangay Mahabang Lalim in Sitios Pagsaliwan, Tuno, Kuyod and Balangkalaw.

Species and Plant Composition

The Kanan River Watershed is composed of 346 vascular plant species belonging to 246 genera and 105 families as shown in the Table below. There is relatively high endemicity with 41% and 9 threatened species, which are

dominated by Non-timber Forest Product (NTFP). In summary, the threatened and vulnerable plant species are presented in the table below:

Summary of Floral Composition, Species and Status

Parameters	Number/Statistics
Number of families	105
Genera	246
Vascular Plant	346
Endemic Species	141
Endemicity	41%
Indigenous Species	36%
Immediate threatened or Vulnerable (ITV) species	9
Rare Species	2

It is noticeable, however, that Rattan *(Calamus sp.)* is the most vulnerable and threatened species due to incessant wild extraction by the Dumagats which is one of their sources of income. Dumagats are the only indigenous group of people that are seen roaming the pristine dipterocarp forest in search of highly priced rattan and resin from Almaciga *(Agathis philippinensis).* These commodities are highly sought species due to its high demand in the market. Not so common in terms of endemicity are the *Dorystephania luzoniensis* and *Podochilus intricatus.* These species are also found in Luzon specifically in the stretch of Sierra Madre and part of Rizal and Bataan provinces. Some distantly similar species can also be found in the mountain ranges of Davao, Bukidnon (Mt. Kitanglad), Agusan and Basilan.

Threatened or Vulnerable Species in Kanan Watershed

Common Name	Scientific Name
Rattan Species 1	*Calamus dimorphocanthus*
Rattan Species 2	*Calamus discolor*
Rattan Species 3	*Calamus merrilli*
Rattan Species 4	*Calamus ornatus*
Rattan Species 5	*Calamus reyesianus*
Rattan Species 6	*Alamus daemonorops mollis*
Rattan Species 7	*Calamus E. ochrolepis*
Bago	*Gnetum gnemon*
Almaciga	*Agathis philippinensis*

(3) Agos River Watershed/Basin

Vegetation Type

The vegetation types in the Agos River Watershed are similar to that of the Kaliwa and Kanan River watersheds due to continuum of landscape. Field verification has simplified the vegetation types into plants in hillside and top/ridge area, streambank/riverbank vegetation, floodplain (riparian) type and the coastal type of vegetation, namely: beach and mangrove forests.

Plant Species Composition

In situ survey in both sides of the Agos River revealed that in total, there are 106 plants species represented by 41 families and 83 genera under six (6) lifeforms, namely: tree, shrub, forb, grass, vine and fern. The streambank

and riverine areas are home of Buslot *(Syzygium linnatum)* under the family Myrtaceae which littered the whole stretch of the river from the Kaliwa to the Agos River and part of the Kanan River.

(a) Beach Vegetation

Taxonomic Diversity and Distribution

A total of 16 species belonging to 14 families and 17 genera were recorded. *Family Fabaceae* is the highest in terms of the number of representative species, with 2 species represented. The most widely distributed species include *Terminalia catappa, Cocos nucifera, Casuarina equisitefolia* and *Pandanus tectorius.*

Nipa Stands

Just like in other areas, nipa (Nypa fruticans) stands in Infanta, Quezon are found in the upstream/headwater of the rivers draining into the Lamon Bay in the Infanta, Quezon side. In one of the samplings done in Barangay Abyawin, a pure stand of nipa stretches adjacent to the beach fronts/coasts. The average DBH is about 10 cm and the mean basal area is about 78.54 cm^2 with a density of 10 stems per 100 m^2.

Mangrove Forest

A total of 26 species belonging to 19 genera and 17 families was recorded in the various mangrove stands of Infanta, Quezon. Of this number, 14 are true mangroves and the rest are associates. As expected, family Rhizophoraceae is the most dominant family in terms of number of species, followed closely with family Avicenniaceae.

Of the total 26 species encountered, the most widely distributed species are *Rhizophora mucronata* and *Scyphiphora hyrophyllacea* followed by *Avicennia officinalis, Aegiceras floridum, Ceriops ta*gal and *R. apiculata*. Some of the species with very limited distribution are *Tristellateia australasiae, A. corniculatum, Bruguiera parviflora* and *R. stylosa.*

Based on the number of species recorded during the sampling work, the area is host to a number of economically important species of trees and other plant forms. From the map obtained in the area, the total area of mangrove forest in Infanta, Quezon was estimated at 1004.8 ha.

This area is quite large at the first glance but during the survey, the cutting of mangroves for the development of fishponds is rampant. Remnants of *Sonneratia alba* as well as *Avuicennia marina* and *A. officinalis* are found in the established fish ponds. Along the stretch of rivers are thin strips of mangrove stands adjacent to wide fishponds that were once covered with mangroves. The total area of the fishponds was estimated at 478.98 ha. This is not surprising. This is a common scenario in the mangrove areas of the country.

Despite the mushrooming of the many fishponds in the area, the level of diversity is still high on the average with the species as fairly distributed. If

the trend will continue, i.e., the fish ponds increase in area at the expense of the mangroves, the level of diversity will decrease in the coming years.

(b) Terrestrial Fauna

(1) Kaliwa River Watershed

Number and diversity of wildlife are common indicators of the state of health and stability of the ecosystem. They are either migratory or permanent resident depending on the species and abundance of food in their respective habitat. The disturbance and destruction of their habitat has dwindled through time. Recent field ocular verification and focus group discussion among local leaders and farmers of Barangay Daraitan revealed that there is a significant decrease of sightings and even volume of animal catch, in case of Baboy damo (*Sus celebensis)* and Labuyo *(Gallus gallus)*, have been confirmed. The table below shows the threatened wildlife species seen and observed in the Kaliwa watersheds at the time of the ocular inventory. While there had been several reports of sightings by the local resident, Philippine eagle (*Pithecophaga jeferrjii*) has not been observed in the course of The Study. Be that as it may, Philippine eagle still remains an elusive property of the people even though it was declared as threatened species by IUCN Red List (2000).

Threatened Wildlife in Kaliwa Watershed

Common Name	Scientific Name	Status
Bleeding heart pigeon	*Gallicolumba luzonica*	Resident
Civet cat/Musang	*Viverra tangalunga*	Resident
Fruit bat	*Cynopterus brachyotic var. luzoniensis*	Resident
King fisher	*Alcedo athis*	Resident
Labuyo	*Gallus gallus*	Resident
Lawin	*Halicistus indus intermedius*	Resident
Monitor lizard	*Varanus Salvador*	Resident
Palm civet cat	*Paradoxurus philippinensis*	Resident
Philippine Bulbul	*Hypsipetes philipinnus*	Resident
Pulanga	*Pycnonotus goiavier*	Resident
Tariktik	*Penelopides panini*	Resident
Tikling	*Rallus striatus var. striatus*	Resident
Wild boar(Baboy damo)	*Sus celebensis var. philippinensis*	Resident

(2) Kanan and Agos Watershed

Compared to the Kaliwa Watershed, the Kanan and part of the Agos River Watersheds are relatively not disturbed and destroyed in terms of plant biomass utilization. With this condition, expectedly population of wildlife would also be diverse. The NPC report of 1994 shows a listing of threatened/rare or uncommon wildlife in the watershed as shown in the table below:

List of Threatened/Rare/Uncommon Wildlife Species Observed in the Kanan System and its Vicinity

Species	Common Name	Status	Occurrence
Class: AMPHIBIA			
Platymantis cornutus	Horned Forest Frog	Endemic	Rare
Rana magna	Philippine Bullfrog	Endemic	Threatened
Class: REPTILIA			
Crytodactylus philippinus	Phil. Bent-toed Gecko	Endemic	Rare
Calotes marmoratus	Common Anglehead	Endemic	Uncommon
Tropidophorus grayi	Common Waterside Skink	Endemic	Uncommon
Dryophis prasinus	Common Vine Snake	Resident	Uncommon
Elaphe erythrura	Red-tailed Rat Snake	Resident	Uncommon
Class: AVES – BIRDS			
Anas luzonica	Philippine Mallard	Endemic	Uncommon
Gallicolumba luzonica	Bleeding Heart Pigeon	Endemic	Uncommon
Loriculus philippensis	Philippine hanging parakeet	Endemic	Uncommon
Centropus viridis	Philippine Coucal	Endemic	Uncommon
Eudynamys scolopacea	Koel	Resident	Uncommon
Phoenicophaeus cumingi	Scale-feathered Cuckoo	Endemic	Uncommon
Phoenicophaeus superciliosus	Rough-crested Cuckoo	Endemic	Uncommon
Bubo philippines	Philippine Horned Owl	Endemic	Uncommon
Ninox scutulata	Philippine Hawk-owl	Endemic	Uncommon
Otus bakkamoena	Philippine Screech Owl	Endemic	Uncommon
Eurostopodus macrotis	Philippine Eared Nightjar	Endemic	Uncommon
Hemiprocne comata	Lesser Tree Swift	Endemic	Uncommon
Hirundapus celebensis	Purple Needle-tail Swift	Endemic	Uncommon
Harpactes ardens	Philippine Trogon	Endemic	Rare
Alcedo atthis	Common River Kingfisher	Endemic	Uncommon
Alcedo cyanopectus	Indigo Banded River Kingfisher	Resident	Uncommon
Actenoides lindsayi	Spotted Wood Kingfisher	Endemic	Uncommon
Ceyx argentatus	Silver River Kingfisher	Endemic	Uncommon
Halcyon smymensis	White-throated Kingfisher	Endemic	Uncommon
Buceros hydrocorax	Rufous Hornbill	Endemic	Threatened
Penelopides panini	Tarictic Hornbill	Endemic	Threatened
Dryocopus javensis	White-bellied Woodpecker	Endemic	Uncommon
Mulleripicus funebris	Sooty Woodpecker	Endemic	Uncommon
Pitta erythrogaster	Red-bellied Pitta	Endemic	Uncommon
Pitta sordida	Hooded Pitta	Endemic	Uncommon
Riparia paludicola	Plain Sand Martin	Resident	Uncommon
Corvus enca	Lesser Crow	Resident	Uncommon
Copsychus luzoniensis	White-eyebrowed Shama	Endemic	Uncommon
Zoothera dauma	Golden Ground Thrush	Endemic	Uncommon
Phylloscopus trivirgatus	moutain leaf Warbler	Endemic	Uncommon
Pachycephala cinerea	White-bellied Whistler	Endemic	Uncommon
Pachycephala philippensis	Yellow-belied Whistler	Endemic	Uncommon
Sarcops calvus	Coleto or Bald-Headed Starling	Endemic	Uncommon
Aethopyga flagrans	Flaming Sunbird	Endemic	Uncommon
Prionichilus olivacous	Olive-backed Flowerpecker	Endemic	Uncommon
Class: MAMMALIA-MAMMALS			
Pteropus leucopterus	White-winged Flying Fox	Endemic	Rare
Phloemys cumingi	Slendered-Tailed Cloud Rat	Endemic	Rare
Paradoxurus hermaphroditus	Palm Civet Cat	Resident	Threatened
Viverra tangalunga	Civet cat	Resident	Threatened
Sus philippinensis	Luzon Wildpig	Endemic	Threatened
Cervus marianus	Philippine deer	Endemic	Threatened

D2.1.2 Aquatic Ecology Study

(a) Freshwater Ecosystem

Rivers serve as the main navigational route especially in the upstream sections of Kaliwa and Kanan. It is used for domestic purposes such as washing clothes, bathing,

and general cleaning. In the Barangays in the upstream section of Agos, Kaliwa, and Kanan Rivers, the locals depend on the rivers for fish food. The most common gears used are gillnet, hook and line, manual push net and fish traps. Electrofishing, although banned, is commonly resorted to because of the ease in capturing the stunned fish.

Stretches with calm to sluggish flow generally have dense mats of filamentous blue-green algae, which give the distinctive blue-green coloration. The relatively elevated levels of phosphate is shown in Table D2.2 (Water Quality Section) enhances algal growth since phosphate is a limiting nutrient. Kaliwa River drains a portion of the Rizal watershed, which is partly agricultural and partly urbanized. Domestic and agricultural wastes may have possibly contributed to the elevated nutrient levels.

(1) Phytoplankton

The phytoplankton community of the Kaliwa-Kanan-Agos River System is composed of blue-green algae (Cyanophyta), green algae (Chlorophyta), and diatoms (Bacillariophyta). The predominating phytoplankton among the eight freshwater stations (Stns 3 to 10) shifts, blue-green algae were predominant at 38% in Sitio Pinoban (Kaliwa River), whereas green algae were predominant at 46% in the next station upstream, Sitio Mabagkoy. The diatoms were predominant in all the other stations along Kaliwa (43% at Sitio Queborosa), Kanan (64% - 73%), and Agos Rivers (83% at Pagsangahan, 62% at Mahabang Lalim, and 73% at Banugao).

The generally sluggish flow along Kaliwa River have favored the build-up of phytoplankton biomass. Hence, stations along Kaliwa River have relatively higher phytoplankton density than those in either Agos and Kanan Rivers that have relatively faster water flow. The existing dissolved inorganic substances content of the water provided the necessary nutrients such as phosphates that are relatively elevated in Kaliwa and Agos Rivers.

(2) Zooplankton

Zooplankton observed in the Kaliwa-Kanan-Agos River System belongs to two Phyla, Rotifera and Arthropoda, with species belonging to Phylum Rotifera (81% - 100%) predominating in all freshwater stations. The rotifers are represented by at least seven (7) families with Family Lecanidae accounting for 41% to 71% of the total rotifers observed in seven out of eight stations. The genera *Lecane* is well represented in lotic habitats with richly vegetated backwaters and in this study represented by at least eight species including *Lecane bulla*, and *L. luna*. The predominance of rotifers is quite interesting because the zooplankton community is commonly composed of rotifers, copepods, and cladocerans, with the latter generally observed in relatively clean waters.

The zooplankton serves as food to most fish, especially during the fry stage. In fact, some species of the Family Brachionidae are being cultured in fish hatcheries to be used as the natural food. The abundant growth in the rivers

will be enhanced further when the ecosystem shifts from a running water ecosystem to a standing water ecosystem. The abundant supply of plankton biomass, both phytoplankton and zooplankton, will be able to support a significant planktivorous or omnivorous fish population.

(3) Fish

Table below shows the fish species present in the Kaliwa-Kanan-Agos River System based on interviews and samples collected. At least ten fish species belonging to eight families are freshwater species, two species are marine species that enter freshwaters, and at least three species are migratory. The migratory species exhibit catadromous migration, the movement of fish from freshwater where they grow until sexual maturity returning to the sea to spawn.

Fish Species Present in the Kaliwa-Kanan-Agos System, May 2002

Family	Scientific name	Common Name	Local Name	Reference
Anguillidae	*Anguilla marmorata*	Freshwater Eels*	Palos	Collection
Ophichthidae		Snake Eels		Collection
Congridae		Pike Eel*	Usok	Collection
Hemiramphidae	*Hemiramphus*	Halfbeaks	Siliw	Collection
Channidae		Snakehead	Dalag	Interview
Cyprinidae	*Cyprinus carpio*	Minnows, Carps	Karpa	Collection
Clariidae	*Clarias batrachus*	Air breathing Catfishes	Hito	Interview
Terapontidae	*Mesopristes cancellatus*	Grunters	Migek	Collection
Cichlidae	*Oreochromis niloticus*	Cichlids	Pla-pla	Collection
Scatophagidae	*Scatophagus argus*	Scats	Kitang	Interview
Mugilidae		Mullets*	Banak	Collection
Eleotrididae		Sleepers, Gudgeons	Bayaksan	Collection
			Bakyu	Collection
			Manontok	Collection
Gobiidae	*Glossogobius giurus*	Gobies	Mori	Collection

** Migratory groups*

Most of the fish species collected from the Kaliwa-Kanan-Agos River System are commonly found in most Philippine rivers except the theraponid, *migek*, and the eleotrid species, *bayaksan, bakyu, and manontok.* Although all fish species except snake and pike eels are eaten, the *bakyu* and *migek* are valued by the locals for their flavor. Both fish are said to be very abundant in Kanan River than in Kaliwa or Agos River.

(b) Estuarine

Marine waters enter the Agos River up to Pinaglapatan during high tide. This section is generally sandy with mangrove patches. Agos River divides into two sections, with the river exiting through Barangay Boboin and Pinaglapatan.

(1) Phytoplankton

The phytoplankton community present in the estuarine section of Agos River is composed of green algae (Chlorophyta), euglenoids (Euglenophyta), diatoms (Bacillariophyta), and dinflagellates (Pyrrophyta) as observed in Barangay Pinaglapatan. Higher diversity as reflected in the number of

phytoplankton divisions observed is expected since the estuarine environment is an ecotone where conditions are intermediate between freshwater and marine environments. Further, the presence of dinoflagellates only in this river stretch signifies the contribution by the marine environment to species diversity in the area.

(2) Zooplankton

The zooplankton community at the estuarine section of Agos River is composed of several species belonging to three Phyla, Rotifera, Arthropoda, and Mollusca. Rotifers and arthropods were observed in both Sitio Pinaglapatan and Boboin, gastropod larvae were observed only in the latter. This, plus the observation of dinoflagellates in Sitio Boboin, confirms the entry of marine water up to this stretch of Agos River.

(3) Fish

The estuarine environment serves as the breeding and nursing grounds of fish. Hence, estuaries are virtual feeding grounds where carnivorous fish can frequent in search of food. However, very few frequent the area for fishing simply because fish is more plentiful in coastal waters. In most cases, fishing in estuaries is for home consumption. For commercial purposes, it is the source of fry and fingerlings for grow-out in fishponds.

Based on interviews conducted, species belonging to four families: Carangidae (jacks and trevallies), Lutianidae (snappers), Siganidae (rabbitfishes) and Monocanthidae (filefishes) are caught from the estuarine area. Generally, these fish species are only visitors or transients in the area looking for food.

(4) Aquaculture

Being near the coast, there are about 1,177 hectares of fishponds, 56% are in private lands and 44% covered by Fishpond Lease Agreements. Bangus is the main fish species being cultured. In polyculture systems, the operators combine prawn, mudcrab, and bangus in the fishponds. Some fishpond operators also culture rabbitfish fingerlings (*samaral*).

(c) Marine Ecosystem

A sandy beach borders Infanta and General Nakar. There are no indications of significant coral formations, only seagrass beds that extend to about 500 m from the shoreline. Four seagrass species were reported in three sampling sites and these are Cymodocea serrulata, Halodule uninervis, Halophila ovalis, and Halophila minor.

The composition of fish caught by municipal fishermen is dependent on the fishing gear and accessories being used. That is, fishermen in Binulasan using hook and line catch the bigger pelagic fish species. The schooling fish are caught by beach seiners from Libjo and gill netters from Langgas. Libjo is also the only site where bangus fry are collected.

D2.1.3 River Use Study

Current river uses were identified during Focus Group Discussions (FGDs) activities as reflected in Table D2.1. Bathing is a regular use of the river especially for nearby households. As expected the clear and cool water also invites outsiders for swimming and picnics especially during summer. But some specific spots along the river are not exempted from pollution problem due to domestic and human waste disposal, which apparently is also considered as a major use of river particularly in Bgys. Magsaysay and Mahabang Lalim.

Fishing, although not indicated as source of income, is a major activity of the participants. Most of the people are engaged in fishing for subsistence as noted in the 88% of the FGDs conducted. However, the most common problem raised in relation to fishing is the practice of illegal/dynamite fishing by outsiders in most of the impact areas resulting in the decline of fish catch.

Although water pollution has become a problem in certain areas, the upper portion of the river still serves as source of drinking water, particularly in selected *Sitios* in Barangay Pagsangahan.

Source of water for irrigation is another major benefit derived from the river given that most of the households are engaged in farming. However, the participants realized the impact of forest degradation leading to low water level especially during summer. This results in the lack of water to irrigate low land farms. Receding water level has also been cited as one of the common problems for fishing and recreation.

Specific problems identified were presence of leeches and weeds, erosion, illegal logging activities and increasing population, among others.

Water Quality

In relation to the river use study, secondary data on water quality were collected to evaluate the existing water quality of the rivers in the basin.

Surface waters in the Philippines are classified by the Department of Environment and Natural Resources (DENR) for different beneficial uses based on the existing water quality. For each category, a set of standards is given to ensure that the water is safe and suitable for the prescribed use. As a source of raw water for drinking, a surface water or river may be classified either as Class AA or A depending on the treatment required. Class AA waters will require minimal disinfection procedures, whereas Class A will require complete treatment such as coagulation, sedimentation, filtration and disinfection. After treatment, the water should conform to the stricter standard set by the Department of Health (DOH).

Table D2.2 shows the results of water quality studies in the Kaliwa-Kanan-Agos River System from 1978 to 2002. From 1978 to 1994, the water generally meets the standard set for Class A waters except for some parameters in 1994. The nitrate (40-50 mg/L) and copper (1.7 mg/L) were beyond the standard (10 mg NO_3/L and 1 mg Cu/L) in Mahabang Lalim. Chromium (0.1-.18 mg/L) and phosphate (0.2-1.2 mg/L) were also beyond the standard (0.05 mg/L and 0.1 mg PO_4/L) in all the rivers in 1994.

In 2001, the analysis of water samples collected from the rivers showed better values with respect to all water quality parameters. Hence, the water can be classified as Class A, which is suitable as a source of raw water for drinking. Since color and turbidity as required for drinking should be 5 Pt Co and 5 NTU, respectively, the water has to be treated because of its relatively higher levels (15-40 Pt Co and 25-43 NTU).

Similarly, in August 2002, results of water analysis from the rivers showed values within the standard set for drinking water, except for color and turbidity parameters where the values exceeded the maximum levels in the Kaliwa and Agos Rivers.

D2.1.4 Air Quality and Noise Study

Gathering of the baseline data on the present condition of atmospheric air and the noise levels in the vicinity of the Project area was undertaken through actual on-site one-hour grab sampling over a twenty four-hour period. The ambient air quality assessment process consists of air sampling and testing for the level of concentration of three common air contaminants, Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Total Suspended Particulates (TSP). The results of the ambient air quality and noise determination were compared to the DENR standard limits as given in the Tables below.

Ambient air samples were obtained in succession using one hour averaging time for morning, daytime, evening and nighttime periods in conformity to the DENR's National Ambient Air Quality Standards (NAAQS). A ten- minute averaging period was used for noise measurement as per DENR standard method.

Table below shows the results of the chemical analyses for SO_2 and NO_2 concentrations in ambient air, and the result of the gravimetric determination of the concentration of TSP, while the succeeding Table gives the noise levels measured at the various stations.

Results of Ambient Air Quality Sampling

No.	Date	Time		Wind		Cloud	Pollutant Conc. (ug/Ncm)		
		Start	End	Dir	Speed (mps)	(okta)	TSP	SO_2	NO_2
1	4-5 Apr 02	4 Apr 1455	5Apr 1040	-	Calm	Clear	2.4	8.37	5.0
2	6-8 Apr 02	6 Apr 0940	8 Apr 0800	NE	1	Partly cloudy	2.7	6.45	9.72
3	7 Apr 02	0500	2200	NW	1	Partly cloudy	6.0	ND	12.85
4	15 -16 Apr 02	15 Apr 1530	16 Apr 1200	NE	1	3	3.87	11.07	15.85
5	16 -17Apr 02	16 Apr 1530	17 Apr 1200	NE	1	1	13.5	13.87	16.75
6	18-19 Apr 02	18 Apr 1100	19 Apr 0500	-	Calm	2	6.98	17.45	13.15
DENR Standard Limits For Criteria Pollutants							180	150	230

Results of Noise Level Determination

Sampling Station	Date	Time		Noise Level, dB(A)
		Start	End	
1	4-5Apr-02	4 Apr/1455	5 Apr/1040	44
2	6-8Apr-02	6 Apr/0940	8 Apr/0800	47
3	7-Apr-02	7 Apr/0500	7 Apr/2200	47
4	15-16Apr-02	15 Apr/1530	16 Apr/1200	54
5	16-17Apr-02	16 Apr/1530	17 Apr/1200	48
6	12-19Apr-02	18 Apr/1100	19 Apr/0500	40

The Project area is typically rural hence, the very low concentration of the various air pollutants compared to the DENR standard limits for criteria pollutants as shown. The detected low levels of NO_2 and SO_2 may have come only from the emissions of the naturally decaying plant biomass and some motor vehicles passing by at the time of observation.

National Ambient Air Quality Standards for Criteria Pollutants From Mobile And Stationary Sources

DAO 14 Series of 1993

Pollutant	Concentration			Method of Measurement
	ug/Ncm	PPM	Ave. Time	
Nitrogen Dioxide	150	0.08	24 hrs	Gas Bubbler and Griess Saltzmann
Sulfur Dioxide	180	0.07	24 hrs	Gas Bubbler and Colorimetric Pararosaniline
Total Suspended Particulate	230		24 hrs	High Volume and Gravimetric
Particulate Matter (TSP)	300		1 hr	

In so far as noise is concerned, these are also low as compared to the limits specified by DENR.

D2.1.5 Geology/Geohazard Study

(Note: Chapter 4 of Volume IV provides a detailed description of the geology of the Study Area.)

(a) Tectonic Setting

The study area is embraced by the region comprising the Philippine Mobile Belt. It is sandwiched between the western tectonic belt consisting of the Manila-Negros-Cotabato trenches and the eastern tectonic belt controlled by the East Luzon-Philippine trenches. In-between these belts and in marked parallelism with the trenches is the Philippine Fault Zone which longitudinally bisects the archipelago.

In the eastern belt, the Philippine Sea Plate is subducting beneath the Proto-Philippine Arc, while at the western belt, the Eurasian Plate moves down into the Proto-Philippine Arc Plate. These plate motions are the causes of most earthquakes and volcanic eruptions in the Philippines. The 1990 Luzon earthquake was generated by the rupture event along a splay of the Philippine Fault in northeastern Luzon and the Philippine Fault in the town of Rizal, Nueva Ecija.

(b) Geomorphology

The various geomorphologic features that could be observed within and around the project site are: lake, flatlands, gently sloping to rolling terrain, mountainous terrain, and drainage pattern.

Laguna Lake is a large, fresh water body and is a productive fishery area. Extensive flatlands are developed at the Infanta Spit, along the floodplains of Agos River, along the coast of the lake in Baras – Tanay area, and in the Antipolo – Teresa valley. They roughly coincide with the areas underlain by Quaternary alluvium in the accompanying geologic map. These are largely utilized for rice production and for settlement centers.

Gently sloping to rolling terrain are mostly found between Antipolo and Baras towns. The proposed location of the Morong Water Treatment Plant is characterized by this geomorphologic feature. Broad, broken/short ridges that are preferentially oriented in a northwest – southeast direction and with elevations between 90 and 235 meters above sea level (masl) are prevalent in this type of terrain around the study area. They are utilized largely for upland agriculture as well as for residential purposes.

A hilly to mountainous topography is developed at the areas between Infanta and Baras. They are underlain essentially by the Cretaceous sequences and limestones. The ridges of this terrain are disposed roughly along north – south direction.

Karstic feature is also evident on the Masunguit Rock. These are large, closed depressions developed through the dissolution of some parts of the limestone by acidic waters.

The regional drainage pattern around the project area is dendritic-rectangular. This pattern implies the strong influence of lithology and geologic structures in their development.

(c) Structural Geology

Several NE-SW trending faults could be observed in the areas north of Laguna de Bay and on Tayabas Isthmus, but not all of them extend nor pass through the project site. The distribution of active faults in southern Luzon, however, amplifies their locations dispositions. The Valley Fault System (VFS), formerly known as the Marikina Valley Fault System, is about 22 km west of the project site while the southern terminus of the Infanta Segment of the Philippine Fault Zone (PFZ) lies about 8 km to the east of the proposed Agos Dam axis, while the offshore projection of the PFZ is also located about 25 km to the east of the same dam axis. An unnamed, assumed active fault system transversal to and between the VFS and PFZ cuts through the project area. On the other hand, the Lubang Fault which pass in the offshore areas between Mindoro and Batangas provinces lies about 125 km to the south.

These faults could be grouped into three (3) general sets according to their direction of disposition, such as: the northeast-southwest set, the northwest-southeast set and the "sinuous" set. The northeast-southwest and the "sinuous" sets are older and are cut by the younger northwest-southeast set. A left-lateral (sinistral) sense of

displacement is indicated on the NE-SW and NW-SE sets, while the "sinuous" set reflects a normal sense of displacement; that is, the hanging wall moved down relative to the footwall. These faults are assumed to be active faults because they affected or cut through Quaternary and older rocks, which denotes that they were generated during the Quaternary.

(d) Seismicity

Some of the active earthquake generators that are likely to affect the project area are briefly discussed as follows:

Philippine Fault Zone

The Philippine Fault Zone (PFZ) is about 1200 km long geologic structure traceable from Luzon to Mindanao. The main fault and its splays are mainly sinistral oblique faults whose horizontal components are much greater than the vertical components of displacements. The nearest segment of this fault to the project site is the Infanta Segment, which is about 7 km to 8 km east of the proposed Agos Dam axis. Historical and instrumentally recorded earthquakes provide evidence that the fault is active and that it has generated numerous large earthquakes in the past (Rimando, R.E., 1994). One of the PFZ-generated earthquakes was the catastrophic Ms 7.8 Luzon Earthquake that occurred on July 16, 1990 with its epicenter at Rizal, Nueva Ecija, which took a heavy toll on lives and properties. Although the Infanta Segment of the PFZ has not moved for a long time, it is referred to by PHILVOLCS (Daligdig and Besena, 1993) as one of the seismic gaps along the fault zone. Seismic gaps are potential sources of high magnitude earthquakes in the future, as stresses are stored along the locked segments of the fault.

Valley Fault System

The Valley Fault System (VFS) formerly called the Marikina Valley Fault System (MVFS) consists of two northeast-trending structures that bound the Marikina Valley on the west and east. The fault trace on the west of the Marikina Valley, called the West Valley Fault, was mapped from Rodriguez town (formerly Montalban) in the north and passes through west of Laguna de Bay and then extends southwards possibly up to Tagaytay Ridge (PHILVOLCS, 2000). On the east of the valley is the East Valley Fault (EVF) that runs from Barangay San Rafael, Rodriguez in the north, then passes through Pasig City and then up to the northern portion of Laguna de Bay. The VFS is an active fault based on recent PHILVOLCS mapping and trenching studies (PHILVOLCS, 2000). This potential earthquake generator lies about 22 km to the west of the proposed Antipolo Reservoir.

D2.1.6 Coastal Sedimentation Study

(a) Riverine and Coastal Sedimentation

Ocular assessment shows that silt accumulates at the mouth of Agos River as the river flow is decelerated by the waves of the sea. The sand bars formed along the coast show that littoral drift or long shore currents are oriented in the southeast direction. Some of the beach structures along the coast have also been undermined and were dislodged from the main beach to the surf zone. During the storm day, the

sand bars are submerged and wide spread and seemed to fan out into the Pacific Ocean.

(b) Sediments Analysis

In the assessment of the Agos Dam Project, the area was assumed to be composed of medium soil. This assumption is based on the knowledge about the geologic conditions in the area where it was observed that the thickness of the Pleistocene or older deposits were often greater than 10 meters, the thickness of the Holocene deposits such as alluvial valley fills were often less than 10 m and the thickness of soft deposits were often less than 5 m. Thus, the assumption that medium soil covers the whole region was considered reasonable, since major part of Quezon Province is underlain by sedimentary and volcanic rocks from Cretaceous to Miocene. Only small patches of alluvial fill can be found within the Agos watershed and in the low-lying areas near the confluence of Kanan and Kaliwa Rivers and on the flood plain of the Agos River.

Water samples from the rivers were obtained a day after a significant storm. Analysis of the samples revealed that the TSS ranges from 6 – 90 mg/l, with an average of 41.6 mg/l., as indicated in the Table below. During the stormy day, Kaliwa River is the most murky and the combination of the water from Kaliwa and Kanan Rivers into Agos River would have a reduction in concentration as less murky waters from Kanan River dilutes that coming from Kaliwa River. The TSS is verified near the mouth of Agos River and was found out to be not varying. Along the coastal waters there seemed to be a steady reduction of TSS as it gets farther from the mouth. It is noted here that there is a drop to 50% TSS compared to that at the mouth of Agos River indicating considerable dilution and dispersion of sediment.

Water Sample Analysis for TSS Concentration (Stormy Weather/River and Coastal Waters)

Water Sample Location	TSS Concentration
Sta. S-1	90 mg/l
Sta. S-2	50 mg/l
Sta. S-3	50 mg/l
Sta. S-4	12 mg/l
Sta. S-5	6 mg/l
Average	41.6 mg/l

D2.2 Social Environment

D2.2.1 Sociology/Resettlement Study

a) The Socio-economic Situation of Villages in the Project Area

The socio-economic situation of the Barangays/Sitios in the project area can best be gleaned from the responses provided in the SES, cross-referenced with the results of the FGDs. Using the estimated 159 m as the Full Supply Level (FSL) at the dam reservoir areas, the primary impact areas or directly affected Barangays are Barangays Pagsangahan and Mahabang Lalim in General Nakar and Barangay Magsaysay in Infanta, all in the province of Quezon.

(1) The Socio-Economic Profile of the Directly Affected Project Areas (Dam Reservoir) as per the SES

The SES provides the most comprehensive profile of the project affected areas because of the 100% enumeration of a bigger number of SES respondents (419 respondents), which, however, includes the smaller number of the 186 now-identified PAFs (including the 12 households in the afterbay weir).

(a) Demographic Profile

The male population slightly favors the female population at 52%. Thirty-eight percent has household members between four and six followed by those with larger families with more than seven people at 36%. More than a quarter (26%) of respondents has less than three members in the family.

More than a third (37%) belongs to the population who are 10 years old and below. Those who are between 11-20 and 21-30 years of age are at 23% and 17% respectively. Some 10% belong to the 31-40 age bracket and 13% of the population are more than 41 years of age.

Majority of the population are Tagalogs (83%). Some 10% are originally from Bicol. A small percentage of the population (three percent) belongs to the indigenous group (Dumagats, Tingguians, Remontados). Households who are Visayans, Ilocanos and Palawanons constitute the remaining population.

(b) Education

There is a very high proportion of household members who have no formal education and those who have not completed their schooling at 67%. Households without formal education and who are elementary undergraduates are at 29% and 26% respectively; while some 10% are high school undergraduates. Only 24 household members (one percent) are college undergraduates.

Household members who graduated from elementary are at 14%; while a small proportion, or four percent, are high school graduates. Only four household members graduated from college while six household members claimed that they have post graduate degrees.

(c) Sources of Income

Major source of income are derived from illegal logging and farming. Some eight percent belong to the industry/construction sectors. Majority of the respondents claimed that they earn not more than PhP5,000 per month.

As discussed in the earlier sections, fishing is a major activity in the areas. Fishing gears used are spears, gill nets, and goggles. Most of their catch is shrimp, *bakyo, karpa, palos* and *migik*. Household members who claimed that they have been fishing for more than ten years are at 57%.

For households who are into livestock and poultry activities, pigs, carabaos and chicken are commonly raised in the areas. The average number of

livestock and poultry per household are as follows: pigs (13), carabao (2) and chicken (32).

(d) Health and Sanitation

Most common types of illnesses in the areas are fever at 40%, cough at 20%, colds at nine percent, and flu at eight percent. Majority or 76% of the respondents opt to self-medicate while some 20% seek professional help from doctors and Barangay health workers.

Fifty percent claimed that there are no Barangay Health Centers in their respective Barangays; but the majority stated that there are Barangay health workers in the area. Health workers, according to 45% of the respondents, visit them at least once a month. Services provided by rural doctors are very low at 2%.

(e) Housing and Lot Characteristics and Living Conditions

Out of the 419 respondents interviewed, under half, or 48% claimed ownership to their lots where their houses are built. Thirty percent have Original/Transfer Certificate of Titles as proof of ownership and some 24% claimed that they have tax declarations. Thirty nine percent responded that they have other house and lot outside their Barangay.

The type of dwellings is single-detached. Based on the results of the census and preliminary measurement surveys, the average house floor area is 25.51 sq.m. Wood planks for walls and *pawid* and Galvanized iron for roofs are predominantly used materials in the area.

Majority or 87% of the respondents use kerosene as their source of lighting while only six percent use the local power grid. Wood and charcoal are widely used for cooking (90%). Some nine percent use LPG/gas stove.

Most or 66% of the respondents draw water from the springs while 32% derive their water from a Level II water supply system.

(2) The Socio-Economic Profile of the Directly Affected Areas (Dam Reservoir) as per FGDs

The FGDs also provide vital information of the situation prevailing in the project affected areas. Thus, an examination of the profile of those that attended the FGD would give a stronger input to the conditions existing in said areas.

(a) Demographic Profile

The FDGs were attended by both the men and women members of the communities, in terms of gender, the men outnumbered the women at 61% and 39% respectively. The greater majority of the participants were Tagalogs at 61%, while the indigenous people, mostly from the Dumagat and Tingguian tribes accounted for 11% of the ethnic breakdown. Almost 70% of the attendees came from the 20-50 years' age group.

Profile of the FGD Participants by Barangay

Profile	Magsaysay	Pesa	Mahabang Lalim	Pagsangahan	Total
GENDER DISTRIBUTION					
Men	50%	72%	55%	65%	61%
Women	50%	28%	45%	35%	39%
ETHNIC ORIGIN					
Tagalog	83%	78%	70%	43%	69%
Indigenous People	1%	4%	11%	28%	11%
Others	16%	18%	19%	29%	20%
AGE DISTRIBUTION					
<20 years old	9%	4%	5%	1%	5%
20-30 years old	22%	18%	30%	22%	23%
31-40 years old	24%	22%	31%	32%	27%
41-50 years old	19%	28%	15%	18%	20%
>50 years old	23%	22%	14%	11%	18%
Not identified	3%	6%	5%	16%	8%
NUMBER OF YEARS IN THE AREA					
<5 years	8%	8%	6%	5%	7%
5-10 years	11%	6%	4%	15%	9%
11-20 years	19%	14%	21%	27%	20%
21-30 years	25%	18%	28%	25%	24%
>30 years	38%	54%	35%	18%	36%

(b) Sources of Income

More than half of the participants, mostly the men, are engaged in farming. Most women, on the other hand, indicated housekeeping as their major task. The rest were paid labor. But based on secondary sources, quite a number of the participants engaged in logging, although they indicated farming or being a laborer as their primary or secondary occupation.

Around one-fourth the participants of the FGDs are also active in people's organizations, at 26%. Some are health workers. But the majority is not members of any organization.

Occupation and Membership Profile of FGD Participants

Occupation/Membership	Magsaysay	Pesa	Mahabang Lalim	Pagsangahan	Total
OCCUPATION					
Farmer	42%	54%	54%	60%	52%
Laborer	2%	8%	8%	7%	69%
Housekeeper	32%	26%	26%	29%	28%
Others	11%	2%	9%	2%	6%
None	71%	53%	71%	2%	7%
MEMBERSHIP IN ORGANIZATIONS					
Brgy Health Worker	2%	-	-	-	0.6%
People's Organization	24%	43%	26%	11%	26%
Barangay Council	1%	2%	3%	1%	2%
Others	1%	2%	-	7%	2.6%
None	71%	53%	71%	81%	69%

(3) Socio-Economic Profile of the Secondary Impact Areas as per SES

The project under study will indirectly affect 18 Barangays in three municipalities. A sample population (871 households) representing 10% of the total number of households were collected during the SES.

Number of PAPs Surveyed in Secondary Impact Areas

Municipality/Barangay	Classification	Total Number of HH	HH Surveyed
General Nakar, Quezon[1/]			
Pagsangahan	along Kaliwa and Kanan rivers	483	101
Mahabang Lalim	along Kanan and Agos rivers	108	31
Pesa	along Agos river	146	35
Batangan	along Agos river	180	18
Maigang	along Agos river	83	8
Minahan Sur	along Agos river	204	20
Minahan Norte	along Agos river	51	5
Anoling	along Agos river	362	30
Poblacion	along Agos river	192	10
Banglos	along Agos river	150	15
Pamplona	Agos river mouth	224	23
11		2,183	296
Infanta, Quezon[2/]			
Magsaysay	along Kaliwa and Agos rivers	321	51
Banugao	along Agos river	474	47
Ilog	along Agos river	244	24
Pinaglapatan	river mouth/coastal	126	12
Boboin	coastal/mangrove	248	24
Libjo	coastal	359	35
Abiawan	coastal/mangrove	234	23
Binulasan	coastal/mangrove	390	39
Dinahican	coastal/mangrove	1,037	100
Silangan	mangrove	147	14
Antikin	mangrove	140	14
Balobo	mangrove	87	8
Alitas	mangrove	124	12
Binonoan	mangrove	194	19
Anibong	mangrove	250	25
Langgas	mangrove	300	30
16		4,675	467
Tanay, Rizal[3/]			
Daraitan	along Kaliwa river	1,000	98
1		1,000	98
18		7,858	871

[1/] Source: MPDC, General Nakar, Quezon as of May 1, 2000
[2/] Source: MPDC, Infanta, Quezon as of Year 2001
[3/] Source: Barangay Captain of Barangay Daraitan

(a) Demographic Profile

The total household population is 4,598. Fifty seven percent of the households have members between four and six. A quarter has more than seven members in the family while the remaining 20% are less than three household members. The male population slightly outnumbers the female population at 51%. The population age bracket below 10 years of age is almost 30% followed by those who are between 11-20 years old at 22%. Household members who are between 31-40 years old are at 12%.

The areas are mostly inhabited by the Tagalogs (87%). A small proportion represents the IP communities (Dumagats/ Remontados) at six percent.

(b) Education

Among the household respondents, only four percent have reached college level; 28% have graduated from high school. Also at 28% are those who are elementary graduates. Some 9% did not have formal education.

(c) Sources of Income

Half of the total number of household members in the secondary impact areas is employed. In terms of sources of income, 24% are engaged in agriculture, those who are from trading/business and fishing are both at 14%. Some 13% are still engaged in forest activities. A third has full-time work while 13% are working on part time basis. Those who have regular jobs are at 17% while 27% are seasonal. Majority is working within the province of Quezon at 78%.

In terms of monthly income, 83% of the household members have incomes below PhP 5,000 per month. Eleven percent of these households are earning between PhP5,000-PhP10,000 per month.

In terms of fishing activities, 38% of the households are engaged in fishing. About 52% claimed that they have been fishing for not more than 10 years followed by those who have been fishing between 11-20 years at 31%.

Some 27% of households are engaged in livestock raising while 10% are engaged in poultry raising.

Of the 343 households who are living along the coastal and mangrove areas, 65% responded that they are using the mangrove areas. Mangrove areas according to them are source of housing materials, food and condiments, decorations and medicines. However, it is perceived by the households that mangroves are now declining in abundance.

(d) Health and Sanitation

Fever, coughs, cold and flu are the common types of sickness among the sample population. Sixty-eight percent stated that they cure their illnesses through self-medication. Majority of the respondents claimed that there are health workers in their areas. Fifty two percent responded that rural doctors provide health services to them and the said respondents stated that doctors visit them on a monthly basis at 53%. Barangay health workers are also present in the area. Only 24% claimed that Barangay health workers visit their areas every month.

(e) Housing and Lot Characteristics and Living Conditions

Sixty percent of the respondents claimed ownership to the land where their houses are built. Forty percent stated that they have OCT/TCT as proof of ownership while some 20% have tax declarations. More than three quarters of them claimed that they do not own other lots. Those who own lots are mostly situated within the province of Quezon. The type of dwelling units is single detached.

More than half (55%) depends on the local power grid for their lighting still 38% use kerosene. Majority (71%) use wood or charcoal while some 20% use LPG/gas stove for cooking.

In terms of source of water for domestic use, 43% have privately owned jetmatic water pump system while 24% get their water source from spring. Some 19% derive their water from a communal water supply system.

(4) Socio-Economic Profile in the Proposed Water Treatment Plant as per SES

Data were gathered from 25 households during the social survey at the proposed water treatment plant site. The area is located at Barangay Maybangcal, Morong Rizal. There are 18 claimants/beneficiaries of the 75.6 has. of land which is under the Comprehensive Agrarian Reform Program of the Department of Agrarian Reform. The 25 households identified are not part of the 18 beneficiaries of CARP. These households are permitted to occupy the said land by the claimants free of charge.

(a) Demographic Profile

The total population is 111. Forty four percent (44%) of the households have one to three household members followed by 36% whose households are between four and six members. Some 20% have more than seven household members. The male population is at 52%.

Majority (93%) of the households are Tagalog. Six (6) households are Visayans while one household is Ilocano. More than half are below 20 years of age. Those who are between 21 to 40 years old are at 30%. The remaining 18% constitutes the total population.

(b) Education

More than a third (34%) did not complete their formal education while some 16% had no formal education.

(c) Sources of Income

There is a high proportion of unemployment among the household members at 77%. Of those who are employed, 60% belongs to the industry/construction sectors, 20% in agriculture and some 13% are semi-workers (helper/driver/gardener). Most of them are employed in Rizal at 87% while the rest go to work in Metro Manila. Majority (87%) claimed that they earn less than PhP5,000 per month.

(d) Health and Sanitation

Fever, cough, cold and flu are common sicknesses among the household population. Majority stated that they self-medicate at 76%. Eighty four percent (84%) claimed that they have a Barangay health center in the area while more than half (56%) claimed that there are rural doctors in their Barangay. Forty percent (40%) stated that rural doctors provide services every month. For health workers, 80% claimed that health workers provide services in their Barangay. Monthly visits of Barangay health workers are at 84%.

(e) Housing and Lot Characteristics and Living Conditions

The households use s*awali*, plywood and CHB materials for their walls. Galvanized irons and *anahaw* are used for their roofs. The average house floor area is 31.36 sq.ms. All are single-detached types of dwellings. Of the 25 households identified in the area, only two households stated that they have other land located within the province of Rizal.

Majority (80%) depend on kerosene for lighting while the remaining 20% use batteries. For cooking, 68% use wood/charcoal, while those who use LPG/gas stove is at 28%.

Under half (44%) have their own water pump while 24% derive their water from the communal water supply system. Those who use spring water as their source is also at 24%.

(5) Socio-Economic Profile in the Proposed Antipolo Service Reservoir as per SES

(a) Demographic Profile

The proposed 7 has. reservoir is located at Barangay Luis, Antipolo City. The said area is owned by a private individual (5 has.) while the 16 has. of land is owned by the LGU-Antipolo City. There are 47 households, considered as informal settlers, identified in the social survey. The total population is 221. Male and Female ratio is 1:1. The total population who are below ten (10) years of age is at 40%. Thirty percent are household members who are between 21 and 40 years old. Almost a quarter (24%) belongs to the 31-50 age bracket.

Fifty six percent of the population are Visayans. Tagalogs are at 35%. Bicolanos, Capampangans, Waray and Ilonggos constitute the remaining population.

(b) Education

The education level of the population is very low. Forty three percent did not complete their schooling and 31% do not have formal education.

(c) Sources of Income

Of the 47 household members who are currently employed, their sources of income are derived from the construction/industry sectors at 51%. Those who are employed as helpers, drivers, gardeners are at 30%. Forty percent of the employed population works on a part-time basis while 34% are contractuals. Their place of employment is mostly within Rizal province. Seventy percent claimed that they earn less than PhP5,000 per month.

(d) Health and Sanitation

Common sicknesses such as fever, cough and cold are prevalent in the areas. Majority (94%) of these households are into self-medication. Majority (94%) stated that there are Barangay health centers in the area. Sixty two percent responded that there is a rural doctor assigned in their Barangay while 94 % answered that Barangay health workers are also assigned in their

area. In terms of visits, the Barangay health workers visit the area once a month at 94%.

(e) Housing Facilities and Living Conditions

Majority of the houses are made up of makeshift materials. The average house floor area is 23.6 sq.m.

Sixty four percent use kerosene for lighting purposes while 28% are connected to the local power grid. For cooking, majority (83%) use wood or charcoal as fuel while some 11% use LPG/gas stove.

In terms of source of water supply, 52% derive their water from spring source while 34% subscribe to the local water service provider.

(6) Socio-Economic Profile in the Proposed Pumping Station as per SES

(a) Demographic Profile

The proposed pumping station is estimated to affect about 9 ha of land. The area in Barangay San Jose, Antipolo City is owned by two private individuals. A total of 16 households was identified during the survey. The total population is 82. The male population is at 55%. Households who have members between four and six are at 55%. A quarter of households have less than three members and 19% are those who have more than seven members in the family.

Under half (44%) are household members who are less than 20 years of age. Those who fall within the 21-40 age bracket are at 35%. The remaining 20% are those who are 41 years of age.

Household members are Tagalogs at 41%, followed by the Bicolanos at 35%. Some 5% are Ilonggos and Visayans.

(b) Education

The education level is very low. Forty five percent of the total population did not finish their education while 20% had no formal education.

(c) Sources of Income

Only 17 household members have sources of income. They are employed as helpers, drivers, gardeners and laborers at 70%. Majority of them (59%) are contractual workers. Almost half (47%) are employed within the Rizal province. Twenty three percent works in Metro Manila. More than half (53%) of the employed population claim that they earn between PhP5,000 and PhP10,000 per month. Under half (41%) have earnings below PhP5,000 per month. Six percent did not provide information.

(d) Health and Sanitation

Respondents stated that fever, cough and cold are common illnesses in the area. Three quarters self-medicate as a means of curing such ailments. Almost all stated that there is a Barangay health center in the area. Forty four percent responded that there is rural doctor assigned in the area compared to the 81% who claimed the presence of a Barangay health worker in the area.

(e) Housing and Lot Information and Living Conditions

Houses are single-detached types. Materials are mostly makeshift and some are CHB materials for walling. For roofing materials, galvanized iron is commonly used. In terms of land ownership, a third claim ownership to the land. However, these claimants cannot provide any proof of ownership. Only three households stated that they have other land located within the Rizal province.

Eighty one percent use the local water grid for lighting while the remaining 18% use kerosene. For cooking, 56% use LPG/gas stove. Those who use kerosene and wood charcoal are both at 19%.

Majority (81%) derives their domestic water supply from cooperative-owned water supply system. One household has their own water pump while another household is connected to the water district.

(7) Socio-Economic Profile in the Proposed Taytay Service Reservoir as per SES

(a) Demographic Profile

For the proposed service water reservoir in Taytay, Rizal, a total of 15 households were surveyed in Sitio Manga, Barangay Dolores (3) and Sitio Pugad Lawin, Barangay San Juan (12). The total household population is 96. Households who have more than seven (7) household members are at 40% followed by those who have less than three (3) household members at 33%. The female population outnumbers the male population at 54%.

Fifty seven percent are household members who are less than 20 years old. More than a quarter (27%) belong to the 21-40 age bracket while some 16% are household members who are more than 41 years of age.

Majority of the population are Tagalogs (73%). Bicolanos are at 11% followed by Visayans at 10%.

(b) Education

Data indicated that more than a quarter (36%) had not completed their schooling while 22% had no formal education at all. Those who completed primary school are at 32%. Some 5% are college undergraduates. Only one (1) had a college degree.

(c) Sources of Income

More than a third (36%) are employed. Forty one percent are engaged in industry/ construction and 18% are farmers. The remaining 41% are employed as care takers, vendors, office employee, security guard, and driver (41%). Almost half (44%) are contractual employees, 31% are regular employees. Some 18% are engaged on a seasonal basis while only 6% are employed on a part-time basis. The area of employment is within the province of Rizal (82%). Twelve percent are based in Manila while some 6% work in Quezon province.

With regard to estimated monthly income, 65% earn less than PhP5,000 per month. Those who earn between PhP5,000 to PhP7,500 per month and PhP7,500-PhP10,000 per month are both at 18%.

(d) Health and Sanitation

Fever, cough and cold are common illnesses in the area. About 52% self-medicate while 26% stated that they go to their respective Barangay health center. Of the 12 households who responded, only 33% stated that there is a Barangay health center in their Barangay. Forty two percent claimed that there is a rural doctor in the Barangay while that of Barangay health workers are also at 42%.

(e) Housing and Lot Information and Living Conditions

All houses are single-detached types. Walling materials are mostly made from makeshift or salvageable materials while GI sheets are used for roofs. More than a quarter (27%) claim ownership to the land. Of the four (4) households or claimants, only three (3) households have certificates of land ownership as proof. Majority (87%) stated that they have no other land compared to the 13% who claimed that they have land in Rizal province.

Kerosone is commonly used for lighting at 87% while some 13% are connected to the local power grid. For cooking, majority (87%) use wood/charcoal while some 13% use LPG/gas stove.

Majority of the households (93%) derive their domestic water supply from spring while only one (1) household owns a water pump.

(8) Socio-Economic Profile in the Proposed Conveyance Areas as per SES

(a) Demographic Profile

The proposed conveyance will traverse five (5) Barangays in the municipalities of Teresa and Morong and the City of Antipolo. A total of 103 households, with a total population of 470 were identified during the survey. The Table below shows the breakdown of households per Sitio/Barangay.

Number of Households and Population Along the Conveyance Route

City/Municipality	Barangay	Sitio	Number of Households	Total Household Population
Antipolo City	San Luis	Aranda Compd.	10	34
	San Jose	Pag-Asa	11	48
	San Jose	Tagbak	24	124
Morong	Maybangcal	Talaga	8	35
Teresa	Dalig	Pantay	6	32
	May-Iba	Uno	17	78
	May-Iba	Burol	27	119
3	5	7	103	470

In the city of Antipolo, there is a high proportion of households in Barangay San Luis and Sitio Pag-Asa who have more than seven household members at 60% and 73% respectively. In Morong, households who have less than three (3) members in the family are at 62.5%. Majority of the households in the

three (3) Sitios of Teresa have household members between 4 and 6: Sitio Uno: 67%, Sitio Uno: 59% and Sitio Burol:70%.

Sitios that slightly outnumber the male population are Sitio Tagbak, Sitio Uno, and Sitio Burol at 51%. Sitio Aranda and Sitio Pantay have female:male ratio of 1:1. High proportion of households whose members are 20 years old and below are found in the Sitios of Pantay (59%), Tagbak (52%), Talaga (43%) and Pag-Asa (40%). Sitios with high proportion of households with age brackets between 21and 40 are in Sitios Uno, 49%; Aranda (38%) and Burol (38%).

Household members who are Tagalogs are dominant in Sitios Uno (83%), Burol (71%), Tagbak (56%), Pantay (53%). Under half of the population of Tagalogs are found in Sitios Aranda (48%) and Pag-Asa (44%). Sitio Pantay has 45% of Bicolanos.

(b) Education

In terms of education, the proportion of those who did not complete their education or had no formal education is very low in Sitio Aranda (9%). For the rest of the Sitios, the proportion varies from 30 % to 43%.

(c) Sources of Income

There is a high rate of unemployment in Sitios Pag-Asa, 69%; Burol, 61%; Talaga, 61%; Tagbak, 56%; and Pantay, 54%. In Sitios Uno and Aranda, households who are employed or have sources of income are at 52% and 54% respectively.

The proportion of households members who derive their income from the construction/industry sectors are high in Sitios Tagbak, 58%; Pag-Asa, 53%, and Pantay, 50%. Almost half of household members who are employed as employees, security guards, teachers are found in Sitio Burol (47%) and Talaga (44%). In Sitio Aranda, half of those employed are vendors while the proportions of those engaged in the industry/construction and those who derive their income from selling are at 32% and 28% respectively.

Household members whose place of employment is outside their respective municipality or city is high in Sitio Uno (Pampanga-92%). Sitio with the highest proportion of household members earning less than PhP5,000 per month is Sitio Talaga at 78% followed by Sitio Aranda at 68%, Sitio Pantay (68%) and Sitio Uno at 56%. Sitio Burol is at 44% for household members who earn not more than PhP5,000. Data on monthly income were not provided by households in Sitio Pag-Asa.

(d) Health and Sanitation

Fever, cough, cold and flu are common illnesses cited in all Sitios. Self-medication is high in Sitios Tagbak (74%), Burol (63%), Aranda (61%), and Talaga (58%). With the exception of Sitio Talga, survey shows that the presence of Barangay health centers and provisions of services from Barangay health workers in their respective Barangays are quite high in all Sitios.

(e) Housing and Lot Information and Living Conditions

All households in Sitio Pag-Asa claimed that they own the lot where their houses are built. There are also high proportion of land ownership in Sitio Uno and Sitio Tagbak at 65% and 67% respectively. Documents such as CLOA and OCT/TCT are their proof of ownership. Households who are occupying free of charge are found In Sitio Pantay (100%), Talaga (62%) and Aranda (60%). Households in Sitios Talaga, Aranda, Pantay and Pag-Asa claimed that they do not own any land. There are also very low percentage of households who claim that they have own land outside their place of residence: Sitios Tagbak (25%), Burol (15%) and Uno (1%).

Types of dwelling units are mostly single-detached. High proportions of households who use salvageable materials for walling are in Sitios Pantay and Aranda. Almost all houses in all Sitios use GI sheets for roofing.

All households in Sitios Pag-Asa and Aranda are all connected to the local power grid while all households in Sitio Uno use kerosene for lighting. For the remaining four (4) Sitios, majority of households are connected to the local power grid.

With the exception of Sitio Talaga who use wood/charcoal for cooking (56%), almost all households use LPG/Gas stove for cooking. Sitios who have high proportions of households who own their water pump are found in Sitios Pag-Asa (91%), Pantay (67%), Tagbak (67%)and Uno (59%).

D2.2.2 Resettlement Planning

The persons to be affected by the Agos Dam/Reservoir area were given opportunities to air their concerns and sentiments during the conduct of the SES and the FGD. These perceptions were powerful insights and were taken into consideration in the preparation of the resettlement and compensation plan for this study. These perceptions/concerns include awareness of the respondents/participants of the Study/Project, reactions of the affected people toward possible relocation, requirements and assistance during relocation, views on compensation and compensation procedure, proposals on the relocation site, views on PAFs involvement in the project, perceptions of POs and NGOs on the project, and IPs' perceptions and concerns on the project.

(1) Potential Resettlement Area

The potential resettlement areas were pinpointed as a result of the perceptions and subsequent suggestions of the project affected people. Thus, this project endeavors that the project affected people will be relocated within the same Barangays to reduce the psychological traumas associated with involuntary displacement.

a) Site Selection

<u>Resettlement Site No. 1</u>

Located in Barangay Magsaysay on the eastern bank of the Kaliwa River, this site is approximately 3 kilometers south of the confluence. A major asset of this site is the presence of an existing logging road that connects it to other

communities on the south and on the east. This site would serve as the relocation site for the 79 households residing in the primary impact areas of the same Barangay and the 3 households from Barangay Mahabang Lalim. The minimum area requirement of this site is 31.58 hectares.

Resettlement Site No. 2

Resettlement Site No. 2 is in Sitio Kiragpan in Barangay Pagsangahan. It is approximately 8 km southeast of the confluence of Kaliwa River and Kanan River. Of the two sites, this is the least rugged, with most of its area highly suitable for residential development. Located 6 km. east of Daraitan, this site is nestled on a cove in the Agos reservoir. Such a feature could encourage residents to resort to fishing as a means of livelihood.

This site is best suited to serve the 93 affected families from Barangay Pagsangahan. The minimum area requirement of this site is 40.34 hectares.

b) Site Development Cost

The cost estimates for Resettlement Site No. 1 and No. 2, including land acquisition and site development, are PhP 279,437,810 and PhP 299,232,100, respectively. This brings to a total estimate of PhP 578,669,910 for the resettlement/relocation area.

Cost of Site Development - Resettlement Site No. 1

Development Component	Qty.	Unit Price (PhP)	Total (PhP)
A. Land Acquisition	31.581 ha.	10,000	315,810
B. Land Development (Built-up Area)	6.58 ha	3,500,000	23,030,000
C. Land Development (Agr'l Area)	25 ha.	2,000,000	50,000,000
D. Utilities (Power & Water)	1 lot	20,000,000	20,000,000
E. Gravel Road	2.880	3,500,000	10,080,000
F. Drainage	5.760	1,200,000	6,912,000
G. Community Facilities			
- Community Center	1000 sq. m.	7,000	7,000,000
- Basketball Court	1 lot	100,000	100,000
- Day Care Center	500 sq.m.	7,000	3,500,000
- Elementary/Secondary School	1500 sq. m.	7,000	10,500,000
- Church	1000 sq. m.	7,000	7,000,000
H. Housing Units (single-detached)	94 d.u.	1,500,000	141,000,000
		T OT A L	279,437,810

Cost of Site Development - Resettlement Site No. 2

Development Component	Qty.	Unit Price (PhP)	Total (PhP)
A. Land Acquisition	40.34 ha.	10,000	403,400
B. Land Development (Built-up Areas)	6.84 ha.	3,500,000	23,940,000
B. Land Development (Agr'l Areas)	33.5 ha	2,000,000	67,000,000
C. Utilities (Power & Water)	1 lot	20,000,000	20,000,000
D. Gravel Road	3.693 km	3,500,000	12,925,500
E. Drainage	7.386 km	1,200,000	8,863,200
F. Community Facilities			
- Community Center	1000 sq. m.	7,000	7,000,000
- Basketball Court	1 lot	100,000	100,000
- Day Care Center	500 sq.m.	7,000	3,500,000
- Elementary/Secondary School	1,500 sq. m.	7,000	10,500,000
- Church	1000 sq. m.	7,000.00	7,000,000
G. Housing Units (single-detached)	92 d.u.	1,500,000.00	138,000,000
		T OT A L	299,232,100

Copies of the Resettlement Site Development Plan (a product from the EIA), which contains the methodology in which the plan was formulated, the design and space requirements, the site selection and analysis, the conceptual land use plans of each site, and the cost of development including drawings, can be found at the offices of NWRB and MWSS.

(2) The Resettlement Plan (RP)

The number of persons directly affected by the Kaliwa Low Dam and the Agos Reservoir is considered significant requiring a full resettlement plan. The following describe the main aspects of the proposed resettlement plan. (Copies of full RP as an output from EIA can be found at the offices of NWRB and MWSS).

The resettlement effects are the loss of productive and other assets such as land where many do not have legal title to their assets. There is also the loss of incomes and livelihoods; the loss of housing, community structures, systems and services; and the loss of household or community resources, and sites. The project would also affect a number of indigenous peoples many of whom are nomadic and who have their means of subsistence within the project area.

The requirement for the RP is to compensate those directly affected at replacement cost and institute sustainable income restoration measures. There may be an urgent need to provide relocation, transfer assistance, and provide for measures to restore the living standards of those affected. Special measures are required for the IPs.

The prepared RP includes the socio-economic conditions of the study area; the census, inventory of losses and preliminary measurement surveys; the legal framework, principles and objectives of the project; the approaches to ensure consultation and people's participation; and mechanisms for grievance redressal. The RP also provides for resettlement strategies, the organizational framework for implementation, a general implementation schedule and the system of supervision, monitoring and evaluation. Finally, initial cost estimates are provided on the affected land and land improvements, loss of houses, public and community structures, relocation and rehabilitation assistance, and other costs.

The basic information on the RP is contained in the following paragraphs.

(a) Project Principles and Objectives

The principles and objectives of this RP have been built upon the existing laws and legislations of the Government of the Philippines (GOP), ADB's Policy on Involuntary Resettlement (1995); JBIC's Policy on Resettlement; and the World Bank's Operational Policy and Bank Policy (OP and BP) 4.12 (December 2001) on Involuntary Resettlement, Indigenous Peoples Operational Directives 4.10 (Draft-June 1999), and Cultural Property Operational Policies 4.11.

The RP for the project will abide by principles and conditions that will be approved by the Funding Agency and Executing Agency. If there are any gaps between the Funding Agency and the Government policy, the policy of the Funding Agency supersedes. The principles and objectives are to ensure that all PAPs will be compensated for their losses at replacement cost and provided with rehabilitation measures so as to assist them to improve, or at least maintain, their pre-project living standards and income earning capacity.

(b) Legal Framework

There are a number of legislative acts and decrees enacted that address some aspects of Involuntary Resettlement, Compensation and Indigenous Cultural Communities such as: (a) The Bill of Rights under the Constitution of the Philippines; (b) Executive Order 1035 (Series of 1985); (c) Executive Order 228 (July 1997); (d) Republic Act 7160, known as the Local Government Code of 1991; (e) Republic Act No. 8371, known as Indigenous Peoples Rights Act of 1997; (f) Republic Act 8974; (g) Urban Development and Housing Act of 1992 (RA 7279 or UDHA); (h) Cultural Properties Preservation and Protection Act or Republic Act 4846; (i) and the Draft National Resettlement Policy.

(c) Project Affected Families (PAFs)

The project affected families (PAFs) include the following persons to be identified during census where there is land, property, asset acquisition or resettlement involved:

- Persons whose agricultural, residential, or commercial land is in part or in total affected (temporarily or permanently) by the Project;
- Persons whose houses and other structures are part or in total affected (temporarily or permanently) by the Project;
- Persons whose businesses or source of income are part or in total affected (temporarily or permanently) by the Project;
- Persons whose crops (annual and perennial) and trees are affected by the Project; and
- Persons whose other assets are part or in total affected (temporarily or permanently) by the Project.

(d) Project Principles and Objectives

For this Project, the basic principles and objectives are:

- Acquisition of land and other assets, and resettlement of people will be minimized as much as possible.
- The census or inventory of losses to be carried out as part of the resettlement planning process will represent the cut-off date for eligibility. Eligible persons are entitled to be provided with compensation and rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income earning capacity and production levels.
- Lack of formal legal rights to the assets lost will not prevent PAPs from compensation and rehabilitation measures.
- Plans for acquisition of land and other assets and provision of replacement land and rehabilitation measures will be carried out in consultation with the PAPs to ensure minimal disturbance.
- Compensation rates for physical assets (land, house/building/other structures) and non-physical assets (lost income from productive assets or jobs) will be calculated at replacement cost or at current market value at the time of compensation.
- Affected populations that stand to lose only part of their physical assets will not be left with a proportion that will be inadequate to sustain their current standard of living such a minimum size being identified and agreed during the resettlement planning process.
- Affected populations will be systematically informed and consulted about the Project, the rights and options available to them and proposed mitigating measures, and to the extent possible be involved in the decisions that are made concerning their resettlement.
- The consultative process will include not only those affected, but also representatives of the local governments of the areas in which the Project is located, host communities' community leaders, civil society organizations such as NGOs, and members of local people’s organizations.
- Existing cultural and religious practices shall be respected and, to maximum extent practical, preserved.
- Special measures shall be incorporated in the resettlement plan to protect socially and economically vulnerable groups such as the indigenous peoples, women-headed households, children, and elderly people without support structures and people living in extreme poverty.
- The previous level of community services and resources shall be improved after resettlement.

- There shall be effective mechanisms for hearing and resolving grievances during the implementation of the Resettlement Plan.
- The compensation, resettlement and rehabilitation activities will be satisfactorily completed before a No-Objection from the funding agency will be provided for award of contract of civil-works under each sub-component project.
- The Executing Agency (EA) will see that institutional arrangements are in place to ensure effective and timely design, planning, consultation and implementation of the land acquisition, compensation, resettlement, and rehabilitation program.
- Where a host community is affected by the resettlement of others into that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.
- Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition and resettlement within the agreed implementation period. Clear budget commitments are required for critical activities such as formal detailed physical surveys and administrative functions associated with compensation and resettlement.
- Appropriate reporting, monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external monitoring group shall be hired by the Project and the said group shall evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities. Monitoring reports shall be forwarded directly to the funding agency.
- Construction activities will not commence until the required lands have been fully acquired and affected population appropriately compensated and relocated in accordance with these principles.

(e) Eligibility and Entitlement

Only inventoried and identified PAPs are eligible and entitled to compensation. The cut-off date of eligibility for entitlement under the RP is the date of the "Official Census and Inventory of Losses (IOL)" and the "Detailed Measurement Surveys (DMS)" are completed. As for this stage of the project study, only preliminary and initial IOL and DMS were made to come up with cost estimates. The executing or implementing agency, together with the LGUs and PAPs and other concerned groups will agree when the official census, IOL and DMS will be undertaken, with full information before the start of the official activities. Persons who encroach the area after the cut-off date will not be entitled to compensation or any form of resettlement assistance.

Entitlement Matrix

Type of Loss	Entitled Persons	Compensation and Rehabilitation Measures	Implementation Issues
I. LOSS OF LAND			
A.Temporarily Affected Agricultural, Residential or Commercial Land	Legal owners or occupants identified during the census	Cash compensation for loss of income, standing crops and trees, and restoration of land to its previous or better quality by providing measures to improve land quality in cases of land being adversely affected (during construction).	If temporary disturbance is more than one (1) year, the PAPs have the option to sell the land to the Project at replacement cost or at current market value.
B.Permanently Affected Agricultural, Residential or Commercial Land	Legal owners or occupants identified during the census	a) As a priority, compensation will be through "land for land arrangements" satisfactory to PAPs. (for agricultural land – equal size and productive capacity ; for residential land – equivalent size ; and for commercial land – equal size and accessibility to customers.) b) Cash compensation for affected houses and structures at replacement cost without deduction for depreciation or salvageable materials c) Cash compensation for crops and trees at current market values.	If the impact on land is minor or less than 10% of the total landholdings, PAPs may opt for cash compensation for the affected land equivalent to replacement cost at current market value. The Project will develop resettlement site/s for PAPs who will be directly affected by the Project and who opt to relocate in groups.
II. LOSS OF HOUSES & OTHER STRUCTURES			
Affected Houses and Structures	Owners identified during the census Tenants renting houses or structures	a) Cash compensation for affected houses and structures equivalent to replacement cost for materials and labor without deduction for depreciation and/or salvageable materials. b) Tenants renting structures are entitled to three months' rent at prevailing market rate in the area and assistance to identify alternative accommodation and transport allowance and transition allowance.	
III. LOSS OF CROPS AND TREES			
Crops and Trees	Owner or person with customary usage right	For annual crops, PAPs will be given 2 months notice that the land on which their crops are planted will be used by the Project and that they must harvest their crops in time. If standing crops are ripening and cannot be harvested, eligible PAPs can be compensated for the loss of the unharvested crops at current market value. For perennial crops and trees, PAPs will be compensated based on the current market value of the province or city where the affected land is located.	

Type of Loss	Entitled Persons	Compensation and Rehabilitation Measures	Implementation Issues
IV. LOSS OF COMMON PROPERTY RESOURCES			
Common Property Resources	Affected communities or concerned government agencies	a) Restoration of affected community properties to at least previous condition; OR b) Replacement in areas identified in consultation with affected communities and relevant authorities; c) If income loss is expected (e.g. irrigation, community forest, community grazing land), the Barangay is entitled to compensation for the total production loss (over 3 years).	The compensation will be used collectively for income restoration measures and/or new infrastructure
V. REHABILITATION ASSISTANCE			
Disturbance Compensation	Relocating PAPs	The amount will be equivalent to the daily minimum wage in the project area multiplied by 60 days.	
Financial Assistance	PAPs who opted to relocate on their own	Financial Assistance will be provided in order for PAP to buy a residential lot.	
Regional Development Projects	Affected Communities	Projects will be determined during detailed design and in consultation with PAPs.	
Rehabilitation Assistance and Income Restoration Programs		The grant of rehabilitation assistance (e.g. livelihood programs, skills training, credit facilities) will depend on the needs and priorities of PAPs and will only be determined during the detailed design phase. The IA and the LGUs will coordinate closely with concerned line agencies and NGOs that have the mandate and the expertise to undertake the design and implementation of such programs.	

(f) Consultation and Participation

Information dissemination to, consultation with, and participation of PAPs and various stakeholders maintain transparency of the Project, reduce potential conflicts, minimize the risk of Project delays, and enable the Project to design the resettlement and the rehabilitation programs as a comprehensive development program to suit the needs and priorities of the PAPs.

Extensive consultation and participation programs will continue throughout the duration of the Project. This RP will be updated taking into consideration the careful assessment and planning specifically on relocation income and livelihood issues as it may pose some conflicts to existing development efforts or social interventions in the area by both the government and non-government organizations.

Community participation is vital to the successful implementation of the project. The people must be involved and one way is providing employment

to many unproductive household heads whose main livelihood is illegal logging, and whose skills can be upgraded. Social development can be realized through participatory community development measures, and this participation has been manifested and expressed in various fora through empowering the communities to make decisions on many matters that affect them, such as the choice of relocation, compensation procedures and livelihood.

Participation can be invoked by effective strategic communication, where a separate Strategic Communication Plan (SCP) has been prepared. (Copies of the SCP can be found at the offices of NWRB and MWSS).

The technical feasibility of the project is a major assumption in the following recommendations.

- Sincerity in looking at the welfare especially of the primary impact communities must be evident both in terms of the approaches and content in dealing with them. The people in the area have a lot of similar experiences and have become cautious about their level and nature of participation.
- Encourage sense of ownership early on in the project cycle. Carefully consider the demands and issues raised by the communities either by acting on those demands or otherwise laying down the appropriate explanations. Be willing to extend project planning until community support is established. Carefully study other unique contributions that maybe derived from the community aside from mere source of data and information.
- Carefully study and consult the concerned government and non-government agencies regarding the existing development initiatives in the area particularly those pertaining to forest management and the indigenous peoples' rights.
- Invest on community development efforts especially as an alternative to stop dependence of the community on illegal logging activities, which will also affect the project operation. Support community-organizing activities and coordinate with the NGOs and POs in the area. Sustainability of any community development intervention must be ensured to promote self-reliance among community people.
- Continue to hold public consultations prior to the implementation of the Project, where project implementer can discuss the project details and related issues with the representatives of the communities and the IP sector. A separate dialogue with the IP sector will also be conducted as necessary.

(g) Grievance Redressal Mechanism

The main objectives of the grievance procedure are to provide a mechanism to ensure that the compensation and resettlement programs have been

implemented accurately and fairly, to mediate conflict and to avoid lengthy litigation that can delay the Project.

The PAPs will be made fully aware of their rights to grievance and the procedures by doing so verbally and in writing during consultation, census and survey and time of compensation. The PAPs may present their complaints to the concerned LGUs. The complaint can be filed first at the Barangay level and can be elevated to the provincial or judicial level if the PAPs are not satisfied with the decisions made at the Barangay/municipal level. The PAPs will be exempted from all taxes and administrative fees.

The concerned LGUs at each level will settle the issue within 15 days. The Social and Resettlement Division (SRD) of the IA will also act as grievance officers and will assist the PAPs and attempt to settle the issues at the Barangay level through community consultation. The Project will also request the involvement of NGOs as required and concerned local-based organizations.

Experiences show that not all PAPs have writing skills and the ability to express grievances verbally. Therefore, the PAPs are encouraged to seek assistance from the family members, NGOs or community organizations in order to have their grievances recorded in writing and to ensure that all disputes are properly recorded and resolved in a participatory manner.

(h) Supervision, Monitoring and Evaluation

The objectives of the monitoring program are to (i) ensure that the standard of living of PAPs are restored or improved; (ii) monitor whether the overall project and resettlement objectives are being met; (iii) assess if rehabilitation measures and compensation are sufficient; (iv) identify problems or potential problems; and (v) identify methods of responding immediately to mitigate problems.

A monitoring and evaluation program will be implemented to record and assess project inputs and the number of persons affected and compensated, and confirm that former subsistence levels and living standards are being re-established.

The range of activities and issues that would therefore have to be recorded and checked, include: Land acquisition and transfer procedures; Compensation payments; Construction of replacement houses by PAPs; Re-establishment of PAPs and business enterprises; Reaction of PAPs, in particular, to resettlement and compensation packages; and Re-establishment of income levels.

(i) Resettlement Plan (RP) Cost Estimates

The RP budget can only be considered as estimates and will have to be continually revised and/or updated to achieve the resettlement objectives. All estimates are in Philippine Peso (PhP).

Affected Land

The scale of land acquisition at the dam structure and water conveyance scheme areas can only be determined during detailed design. For PAPs that will be affected by the Project, land-for-land arrangements will be applied as a priority. The Project will develop resettlement sites for PAPs. For PAPs who opt to relocate outside the developed resettlement site, financial assistance will be provided which is equivalent to 200 sq.m. residential lot in the area.

As earlier stated, the affected land estimated is based only on the information provided by PAPs in the socio-economic surveys. Hence, these areas will still be verified and finalized during detailed design where further research on land ownership/rights, conduct of census and tagging and detailed joint measurement surveys will be carried out.

For budget purposes, the amount applied for the primary impact areas, water treatment plant, reservoir and pumping station were based on the BIR zonal valuation. For the service reservoirs and conveyance areas, selling/buying rates in the area will be applied. Cost estimates allocated for land is PhP 633,540,000.

Cost Estimates: Affected Land

Facility	Affected Land (hectares)	Cost per Hectare [1/]	Total Cost Estimate (PhP)
Dam/Reservoir	[2/] 123.0	30,000	3,690,000
Water Treatment Plant	100.0	2,500,000	250,000,000
Antipolo Pump Station	9.0	5,000,000	45,000,000
Antipolo Service Reservoir	7.0	10,050,000	470,350,000
Taytay Service Reservoir	20.0	5,000,000	100,000,000
Pipeline 1	12.3	5,000,000	61,500,000
Pipeline 2	10.3	10,000,000	103,000,000
Total			633,540,000

[1/] Cost figure used is the higher value of land, either the latest buying/selling rate, or the BIR zonal valuation.

[2/] Estimated area of lands directly related to the 174 PAFs. Other affected lands (reservoir, dam construction area, access roads, etc.) are separately estimated.

Affected Houses / Loss of Structures

Replacement costs for affected houses and structures are equivalent to the current market value of materials and labor costs in the area without deduction for depreciation and/or salvageable materials. For this estimate, the cost for houses and structures within the primary impact areas will be included. If the PAP opts to relocate at the developed resettlement site, house differential will be applied. The cost estimate for affected houses and structures is PhP 12,817,566.

Cost Estimates for Affected Houses and Structures

Type of Structures	Dam/ Reservoir	Water Treatment Plant	Pumping Station	Antipolo Service Reservoir	Taytay Service Reservoir	Waterway	Total Cost (PhP)
House	4,913,483	639,000	644,000	741,000	109,000	4,837,000	11,883,483
Small hut	185,473	6,000			3,000	208,000	402,473
Toilet	70,852			6,000	6,500	89,000	172,352
Small store	22,700					41,000	63,700
Ricemill shed	114,234						114,234
Pigpen	78,123	11,700			5,000	40,000	134,823
Chicken pen	27,947					2,600	30,547
Warehouse	11,438					5175000	11,438
Fish pond	4,516						4,516
Cost	5,428,766	656,700	644,000	747,000	123,500	5,217,600	12,817,566

Public or Communal Structures

Replacement Costs for public or communal structures are equivalent to the current market value of materials and labor costs in the area without deduction for depreciation and/or salvageable materials. The cost estimate for public or communal structures is PhP 1,403,800.

Cost Estimate for Public or Communal Structures

Name of Structure	Ownership	Location	Total Cost Estimate (PhP)
I. Schools			
1. Cacawayan Elem. School	Government-DECS	Sitio Cacawayan, Magsaysay	366,100
2 Pangatloan Elem. School	Government-DECS	Sitio Pangatloan, Mahabang Lalim	160,000
3 Mabagkoy Elem. School	Government-DECS	Pagsangahan Proper, Pagsangahan	305,500
4. Miyunod Elem. School	Government-DECS	Sitio Miyunod, Magsaysay	330,000
		Sub-total	*1,161,600*
II. Day Care/Multi-Purpose Center			
1. Day Care Center	Government-DSWD	Sitio Cacawayan, Magsaysay	34,500
2. Multi-Purpose Brgy. Hall	Government-LGU	Sitio Pangatloan, Mahabang Lalim	68,100
3. Evacuation Center	Government-DSWD	Pagsangahan Proper, Pagsangahan	14,600
		Sub-total	*117,200*
III. Waiting Shed			
1 Waiting Shed	Government-LGU	Sitio Cacawayan, Magsaysay	15,800
		Sub-total	*15,800*
IV. Church/Chapel			
1. Roman Catholic Church	Private	Sitio Cacawayan, Magsaysay	32,400
2. Roman Catholic Church	Private	Pagsangahan Proper, Pagsangahan	36,300
3. Born Again Christian Chapel	Private	Sitio Taramtam, Pagsangahan	37,500
		Sub-total	*106,200*
V. Basketball Court			
1. Dirt Basketball Court	Communal	Sitio Miyunod, Magsaysay	3,000
		Sub-total	*3,000*
Total			1,403,800

Affected Crops and Trees

The number and types of affected crops and trees will only be determined during the detailed design stage. Market rates will be applied to reflect replacement costs for such losses.

Relocation and Rehabilitation Assistance

Regional development projects and rehabilitation assistance, including income restoration programs can only be prepared during the detailed design stage. Extensive consultation and participation programs will be designed and implemented based on the needs and priorities of the affected communities.

As for disturbance compensation and financial assistance, this is calculated at PhP 35,945,200.

(a) Disturbance Compensation

All relocating PAFs will be entitled to Disturbance Compensation equivalent to the minimum wage per day in area (PhP145/day) multiplied by 60 days. The cost for disturbance compensation is estimated at PhP 3,445,200.

Cost Estimate for Disturbance Compensation

Disturbance Compensation	No. of PAFs	Minimum Wage Per Day @ 60 Days	Total Cost Estimates (PhP)
Dam/Reservoir	174	8,700	1,513,800
Water Treatment Plant	25	8,700	217,500
Pumping Station	16	8,700	139,200
Antipolo Service Reservoir	47	8,700	408,900
Taytay Service Reservoir	31	8,700	269,700
Waterway Facilities	103	8,700	896,100
Total	396		3,445,200

(b) Financial Assistance

The PAFs identified at the water treatment plant, Antipolo service reservoir, pumping station, Taytay service reservoir and the conveyance routes are house owners who are occupying private/public land free of charge. To ensure that PAFs will not be left landless because of the Project, financial assistance will be provided in order for PAFs to purchase residential lots. The size of residential lot will be 200 sq.m. in rural areas, 120 sq.m in semi-urban areas and 90 sq.m. in highly urbanized areas.

Cost Estimates: Financial Assistance

Financial Assistance		No. of PAFs	Amount/sq.m. (PhP)	Residential Lot Area	Total Cost Estimates (PhP)
Water Treatment Plant		25	300	200	1,500,000
Pumping Station		16	2,000	120	3,840,000
Antipolo Service Reservoir		47	500	120	2,820,000
Taytay Service Reservoir		31	500	200	3,100,000
Conveyance	- May-iba	44	2,000	120	10,560,000
	- Dalig	6	500	200	600,000
	- Maybangcal	8	300	200	480,000
	- San Luis	10	1,000	120	1,200,000
	- San Jose	35	2,000	120	8,400,000
Total		222			32,500,000

Over-all Cost for the Resettlement Plan

The overall total cost estimate for this Project includes the cost of losses such as affected land, houses and structures, community/public structures, and the

cost of compensation and assistance. It also takes account the cost of the resettlement site development and that of strategic communications.

Administrative/operational costs, external monitoring activities and contingency costs will be included in the overall project cost upon the updating of this RP.

The overall cost for the RP is estimated to be PhP 1,269,264,000.

Overall Cost Estimate for the Resettlement Plan

Items	Total Cost Estimates (PhP)
Affected Land	633,540,000
Houses and Structures	12,818,000
Communal/Public Structures	1,404,000
Disturbance Compensation	3,446,000
Financial Assistance	32,500,000
Cost of Resettlement Site Development	578,670,000
Cost of Strategic Communications	6,886,000
RP Cost Estimates	1,269,264,000

The costs estimated above represent those directly related to the resettlement. The total cost of land acquisition and resettlement is separately estimated incorporating other land acquisition cost (e.g. reservoir area, construction areas, etc.) and contingencies for miscellaneous items which are unpredictable at this study stage.

D2.2.3 Community Development/Communication Study

Key Informant Interview with the People's Organizations and NGO

Another set of opinions on the possible project and the relocation issue of the primary affected households is based on the key informant interview of the existing People's Organization and an NGO working in most of the areas under study.

Essentially similar attitudes were recorded during the interviews, except only for SAMAKA representative who was optimistic about the contribution of the dam project to the national development. Other specific issues raised were the following:

- prioritizing local demand for water
- conflict with existing development initiative particularly the Community-Based Forestry Management (CBFM) by the SAMAKABAY, an upland farmers organization
- conflict with the Indigenous Peoples' Rights Act (IPRA 8371)/ SMBDSM, farmers organization IP communities
- real concern for the welfare of the poor people who will be affected
- possibility of looking for other sites for the project

Likewise, only the SAMAKA expressed willingness to be relocated provided the site is suitable and beneficial to the poor. There was also no specific site recommended for resettlement but some stated preference to places within Gen. Nakar and Infanta or within the Quezon province. Note again that the proposal for a relocation site cannot be equated with the willingness to transfer as previously explained in the case of the FGDs.

Furthermore, proposed assistance or requirements for an acceptable relocation site also include sustainable source of income/employment opportunities, own house and lot, presence of basic infrastructure and services and monetary form of compensation. Consistently, the IP group (SMBDSM) refused to give any suggestion but requested for a dialogue with the project implementer on this sensitive issue.

D2.2.4 Public Consultations/Workshops

In the public consultation meetings in Barangay Daraitan, General Nakar and Infanta, the attendees expressed a number of views and opinions on the proposed project as well as perceptions on resettlement. The following are the highlights:

Major Issues/Questions Raised in the Public Consultation Meetings

Items	Issues/Questions
On project features/ proposed structures	▪ Study to consider protection of the watershed. ▪ Conflict between local and national interest. Project focus is provision of water for Metro Manila and not for the Study Area. ▪ Study to take into account the Comprehensive Land Use Plans of the municipalities concerned. ▪ Need to include riverbank protection/ flood control works both upstream and downstream of the proposed dam to control flash floods.
On project impacts	▪ Gen. Nakar considered as "*Biologically Hot Spot*". Impact of the loss and introduction of new species be carefully studied. ▪ Effect of sanitation/pollution from settlements and agro-farms to the proposed reservoir ▪ Access to and from Sitios would be difficult because of river widening. ▪ LGU has to know the infrastructure/community facilities/areas to be directly affected so that it can proceed with its programs accordingly or plan for relocation of basic service facilities, if necessary. ▪ Long term effects to indirectly affected people be as well as specific mitigation measures due to impairment of both fishing and farming activities during the 8-year construction period. ▪ Fishing area and activities will be limited as well as having a lower catch. ▪ Commitment of funding and implementing agencies to prioritize the welfare of the people is important.
On economic revenue (royalty) for the LGU	▪ Economic revenue for the LGUs from the operation of the dam, which will utilize local water resource.
On local water supply	▪ Assurance that local water supply be sufficient to meet long-term water demands by the LGU, particularly for irrigation. ▪ To include improvement of the irrigation system as component of the project.
On livelihood and employment opportunities	▪ Assurance that local people be considered in employment opportunities. Local people not skilled in construction works and not fitted as project laborers. ▪ People will only be assured about the social development plans if livelihood activities will first be implemented before the project commences. ▪ Proposed livelihood projects/employment opportunities may be inappropriate with the present skills of people. ▪ Source of funding of livelihood component; support for affected families sustainable not only during construction. ▪ Consider population increases in livelihood assistance. ▪ Possibility of fishing in the dam.
On compensation of affected residential and agricultural lands	▪ Compensation procedure for affected agricultural lands. Assurance that the owners will be compensated. Phase of the project that compensation be made. ▪ Method of compensation to consider not only market value but also sense of security (sentimental value) that goes with it.
On relocation site	▪ Possibility of people to remain in the area even with the project. If allowed, assurance that no forced resettlement will occur in the future. ▪ Relocation site location and assurance that people have a better quality of life.

Items	Issues/Questions
	▪ Sustainability of social assistance be taken into consideration as PAF will increase in the future.
On public consultation process	▪ Project to consider rights of IPs over their ancestral domain. Implementers to consider recommendations during public consultations. ▪ PAF must again be consulted to avoid misinterpretation. Number of public consultations to be conducted; If people can request for such activity? ▪ If majority of the people disagree, will the project be implemented? ▪ Failure of implementers to consider recommendations during public consultation; Government to realize recommendations made.

The 1st workshop, which was attended by representatives from the LGUs, the government agencies, the private sector and the NGOs presented their general opinions and recommendations about the study as follows:

Issues/Concerns Raised During the 1st Workshop Regarding the Dam/Reservoir Structures and Corresponding Recommendations

Item	Issues/Questions	Recommendations/Countermeasures
On project features/proposed structures	1. Need for an intensive information campaign to disseminate the project to all affected people.	A continuing Information, Education and Communication (IEC) should be pursued using tri-media approaches and by holding more public hearing and consultation activities at Barangay and municipal levels
	2. Formulation of Relocation Plan (RP)	- To formulate an effective RP taking into consideration the towns' - Comprehensive Land Use Plan (CLUP) and Zoning Ordinances as well as the different Proclamations (# 1636, 7586, and 196) that govern the land use of the watershed. - Basic services should be provided in the relocation site - Site should be accessible and near their means of livelihood/alternative livelihood
	3. Dam stability	- Proper designing - To draw up an effective monitoring system during construction with LGU participation - Proper dam management
	4. Planning of hydro-power facilities	- To consult with concerned agencies on the long-term energy requirements for Metro-Reina area
	5. Need for erosion control facilities	- Construction of erosion control dikes along Infanta and Gen. Nakar area
	6. Need for municipal water supply systems in Infanta and Gen. Nakar	- To consider provision of water supply systems in the 2 towns
	7. Need for road improvement to affected areas	- Provision and improvement of access roads to dam and affected communities
	8. Downstream water requirement	- To provide sufficient irrigation water requirement and necessary river training, dredging and diversion works

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Item	Issues/Questions	Recommendations/Countermeasures
On natural, social, economic and institutional aspects	1. Economic revenue for the host municipalities from "structural taxes" and national wealth share	- Review and research on existing policies/laws, if none, there should be a body to initiate formulation of such policies/laws - Formulation of such policies in close coordination with concerned agencies/LGUs
	2. Social acceptability	- Their should be a "win-win" solution
	3. Siltation effect	- Provide measures to mitigate siltation in order to protect fish sanctuary
	4. Indigenous People concern	- Strict compliance on the provision of Free and Prior Consent and Indigenous Peoples' Rights Act (RA 8371)
	5. Need for watershed protection	- Watershed program should be coordinated closely with Multi-sectoral Watershed Management Council - Assigning forest guards - Intensive reforestation - Should not be the site for relocation
	6. Environmental Compliance Certificate Requirement before start of construction	- Consent of Barangays, municipalities through resolutions - MOA/MOU with various concerned agencies e.g., environmental guarantee funds, monitoring funds
	7. Lessons learned from Laiban project	- Close coordination with concerned agencies and the respective LGUs

Issues/Concerns Raised During the 1st Workshop Regarding the Waterway Facilities and Corresponding Recommendations

Item	Issues/Questions	Recommendations/Countermeasures
On project features/proposed structures	1. Resettlement	- Provide relocation site with livelihood component
	2. Right of way (ROW)	- Provision of sufficient funding/compensation for ROW, both for under and above ground structures
	3. Presence of faultline	- Proper seismic evaluation for consideration on the structure design
	4. Extension of water supply line to eastern part of Rizal from WTP	- Provision of water supply line to these municipalities
	5. Economic revenue for Barangays	- For further study
	6. Possibility of constructing WTP in Brgy. Sampaloc, Tanay	- JICA ST has to identify the best location for WTP
On natural, social, economic and institutional aspects	1. Denudation of forest	- Mitigation and rehabilitation of affected areas - Provision of buffer zone around water treatment plant
	2. Spoils Disposal	- Identify areas and get consent from LGU concerned
	3. Legal issues on land use/zoning: Lungsod Silangan, CARP, Zoning Ordinances	- MOA between concerned agencies - Amendment of zoning ordinances and CLUP
	4. Management of water system in municipalities of Rizal	- MOA between implementing agency and water districts

A general consent was given by the participants in regard to the two basic matters presented in the workshop, except for Item No. 1(a), which has a condition, that is, that the issues and concerns raised during this workshop and succeeding consultations thereof should be given due consideration.

The following are the 2 basic matters presented to the participants:

1) No particular opposition to the necessity of the Proposed Project: where the necessity is expressed as:

   a) Necessity of water supply to Metro Manila and partial areas of Cavite and Rizal Provinces, in order to sustain the required level of hygienic conditions in the areas, which will otherwise be seriously worsened if adequate water supply is not implemented.

   b) Effective use of hydropower development potential created by the Agos Dam (Agos Power Plant) and the Kaliwa-Morong-Waterway (Lagundi Power Plant), for the benefit to national economy as well as for securing stable power supply sources in the vicinity

   c) Preservation of sufficient water resources requisite for sustaining the long-term livelihood of the people residing in the Agos River Basin, including indigenous People (IP)

2) Principles of the Implementation of Relocation Plans:

   The Study recommends that the relocation plans will be implemented in line with the rules and guidelines set forth in the relevant laws and orders, which principles may be understood as: i) community participatory approaches; ii) provision of well-planned resettlement sites; iii) resettlement procedures in line with the pre-established rules; and need of income restoration and livelihood supporting the programs for the PAFs.

On the other hand, the 2nd workshop, which was attended by representatives from the LGUs, the government agencies, the academe, the private sector and the NGOs/POs presented their general opinions and recommendations about the study as follows:

Issues/Concerns Raised During the 2nd Workshop Regarding the Dam/Reservoir Structures and Corresponding Recommendations

Issue/Question	Recommendation/Countermeasure
Manifestation as a proof of the issues and concerns raised	Prepare a manifesto signed by the group participants from Gen. Nakar, Infanta and Tanay with assurance that this will be presented to project proponent and be given due consideration (The Manifesto was submitted to the Study Team as part of the results of the Workshop No. 2)
Legal basis on revenue	There should be a Memorandum of Agreement in order to implement and execute whatever benefit and revenue that the LGUs can get from the project based on the provisions of RA 7160 (Local Government Code and its Implementing Rules and Regulations)
Fluctuation of streamflow	Irrigation will be the priority in the allocation of water during water shortage and to provide primary and permanent structures for the fluctuation of streamflow in Agos mainstream

Issue/Question	Recommendation/Countermeasure
Preservation of native fish	The project proponent must provide measures or devices that will ensure the free movement of the native fish from the reservoir down to estuary.
Assurance/guarantee for power benefits	There should be a Memorandum of Agreement in order to implement and execute whatever benefits and revenues that the LGUs can get from the project based on the provisions of RA 9136 (EPIRA)
Safety during the operation of the dam	Provide safety measures and facilities for the safety of the people downstream during the operation of the dam
Employment opportunities during construction and operation of the dam	There should be a Memorandum of Agreement between the project proponent and the LGUs of Gen. Nakar, Infanta and Tanay indicating the priority for training and employment opportunities during the construction of the dam and operation of the dam

Issues/Concerns Raised During the 2nd Workshop Regarding the Waterway Facilities and Corresponding Recommendations

Issue/Question	Recommendation/Countermeasures
Share/in lieu of LGUs	A specific bill must be submitted to Congress providing for a concrete formula on determining the rightful share/in lieu of LGUs which host the dam, watershed and other facilities. The proposed bill will be requested by the LGUs through the DILG Secretary
Boundary issue particularly Tanay, Rizal and Sta. Maria, Laguna	Respective provincial board of the two provinces must address the issue
Information gap on the part of LGUs on the results of the studies conducted by JICA-NWRB	LGUs must be provided with copies of the reports
Benefit to existing water districts	Availment of raw/treated water
Calamities and natural disasters like earthquakes and floods	Conduct extensive consultation with stakeholders and LGUs
Spoils disposals	Identify areas and get consent from the concerned LGUs
Effect of pipelines to existing structures	Provide clear compensation package
Exclusion of Laguna and Quezon as water service area	Inclusion of Laguna and Quezon as water service area

As with the 1st workshop, the general consent was given by the participants in regard to the two basic matters presented in the workshop, provided that all issues and concerns are properly and justly considered; and the principles of the implementation of relocation plans, need of income restoration and livelihood supporting the programs should be strictly adhered.

D3 Impact Assessment and Mitigation/Enhancement Measures

Impacts of the proposed project were identified for each major ecosystems: river environment, natural environment and the social environment including resettlement. Mitigating and enhancement measures are presented (*in Italics*) following the discussion of impact identification.

D3.1 Natural Environment

D3.1.1 Terrestrial Ecology/Watershed

1) Flora

The preparation for the construction of dams entails already an enormous spatial disturbance on the biological materials such as removal of trees and disturbance/dislocation of wildlife habitat. Activities such as construction and/or improvements of road networks and building of construction camps can also significantly affect the health of the ecosystem specific to the impacted area.

The loss of standing timber near and within the construction areas and camps is inevitable to give space to equipment pool and aggregates required for construction. Plants of other life forms near the construction site that are sensitive to dust are also in great danger as their stomata are clogged or nearly clogged thereby reducing the ability of the plant to produce carbohydrates required for their growth.

Route and road improvement to increase access to construction of tunnel and conveyance route plus erection of dams would entail complete decimation of the standing plant biomass. The removal, however, is basically confined only in areas where construction will be made. The effect on plants may be severe but since the area in question is small and confine, plants around the site can easily inch and creep in the open areas. Invasion through natural succession is gradual but ultimately revegetation is completed initially by low-lying plants (e.g. grass, vines, forbs and herb) and finally the group of shrubs and small trees follow.

Since the disturbance is only interim in nature, biological materials can easily rebound through natural succession starting from invasion of low stature plants followed by shrub typed group of plants. Immediate rehabilitation can also be employed by planting species that are endemic in the area as they are well adapted in that site condition.

During the operational phase, following are the identified adverse impacts on the endangered flora.

<u>Decimation and Death of Plants Due to Inundation of the Dam Reservoir</u>

Plants that are put underwater for a long time are subject to decimation due to inability to photosynthesize and the gradual disintegration and decomposition of plant biomass. The death is almost instant to grass, vines and other low statured plants that lack enough biomass for food storage. For trees, however, the death would be gradual due to enough food to sustain the requirements of the biomass.

Other plant species that are used to riparian environment could survive and may eventually be adapted in due time. Dam height of 25 m and 125 m (above riverbed level) for Kaliwa Low Dam and Agos Dam, respectively, would definitely inundate riverine, streambank and hilly land plants.

While dipterocarps may not be affected, at least those species that are under the premium group can be saved by collecting the germplasm materials. Species such as Molawin (Vitex parviflora), Narra (Pterocarpus indicus), and Banaba (Lagerstroemia speciosa), among others. Wildlings and seeds can be collected in their natural habitat prior to starting the filling-up of the reservoir. Wildlings can be collected bare root and directly transplanted in degraded and open areas not reach by or affected by the highest water dam level. Areas with low tree density can be subjected to enrichment planting or simply allowing assisted natural regeneration to operate. Vacant spaces can be planted with more than two species to promote and maintain species diversity in the area. To assure high level of survival, wildlings, seeds, or stem cutting shall all be raised in nursery for a couple of months before out planting. The same protocol shall also be applied for non-tree lifeforms that will be affected by inundation. This includes low statured species that are used as forage crops, source of medicinal and handicraft raw materials, among others.

Loss of Standing Biomass/Timber and Decline of Plant Biodiversity and Composition

Wanton loss and death of plants are inevitable with inundation. The death of plants under all lifeforms clearly indicates the decline of plant diversity and composition as well.

To maintain the level of diversity an ex-situ protocol should be employed. This includes the transplantation of rare and endangered plant species through collection of their germplasm prior to inundation of the dam reservoir. This could be done by establishment of a nursery or genebanks for all the selected plants that require propagation. They shall be established strategically in the entire stretch of the dam. To effect success of the rehabilitation/reforestation efforts, the local stakeholders shall be encouraged to be part of the activities such as co-managing the protection of the area within their jurisdiction. Rehabilitation efforts require sizeable funds and this could be provided by the proceeds of the timber harvested in the area affected by inundation. Prior to filling up of the reservoir, salvage cutting of trees with commercial height and diameter can be employed. This is to utilize the standing biomass that would only be wasted if left underwater.

Increase/Reduce Log and Other Forest Product Poaching

Navigation of the entire stretch of the dam/reservoir will be a lot easier with inundation using mechanized sea craft, if its usage is left uncontrolled. Improvement of access to the forested areas would be greatly improved thus more people could come in. This could be an avenue for exposing precious tree volume and Non-Timber Forest Products (NTFP) to wild extraction and poaching.

This could be mitigated by deputation of Environment and Natural Resource Officers for Forest Protection (DENRO) or simply deputize the local communities, e.g.

Dumagats, to apprehend poachers. On the other hand, increased visibility of people/tourist in the area could also reduce or prevent poaching of forest products. Protection could also be enhanced by effective monitoring system of the entire watersheds by the national government through the DENR and LGUS in and around the watersheds.

Disrupt the Ecology and Productivity e.g. Nutrient Cycling of the Affected Plant Community

The death of the plants due to flooding of the reservoir will definitely disrupt and even stop the ecological processes of the plant community thus impacting primary and secondary productivity. The removal and/or gradual death of plant materials at the edge of the reservoir would reduce the nutrient requirements of residual plants such that they have to contend to available nutrient loading from the upper forest tiered. The disruption could be permanent in nature but gradual adaptation of plants along the shorelines into riparian environment could help rebound the lost nutrient supply due to improved biomass production and consequently plant diversity.

To help improve and enhance the overall ecology of the affected plant group, restoration and rehabilitation measures shall be in order. Spaces between existing vegetation, of all lifeforms, can be planted with indigenous species in the site plus introduction of new adapted ones that require similar site quality requirements.

Influence on Mangrove Forest Ecosystem

One of the requirements for maintaining the luxuriant growth and productivity of mangrove plants is the supply of freshwater. Based on the existing tributary systems of the whole watersheds, there is no direct connection of the Agos River flow into the Infanta mangrove forest and yet, Infanta mangroves have high diversity indices and diversity per unit area. The situation is not unique because mangrove plant has the ability to adopt to their environment so quickly. An atoll mangrove type can be a classical example. Even though they are bounded by saltwater, robust growth can still be achieved as freshwater is supplied through open precipitation. The same situation also exists under Infanta mangrove forest condition where freshwater is provided by bulk precipitation and water from small streams feed from lowland irrigation.

While there is no direct relationship between the hydrology of the Agos River and mangrove forest state of health, current situation indicates that the coastal forest really need some restoration and rehabilitation efforts. The extensive area devoted to aquaculture plus the threat of the community are some of those stressors need to be addressed. To mitigate the situation, enrichment planting of less dense part of the forest and adoption of Assisted Natural Regeneration (ANR) strategy can be employed. Abandoned fishponds shall be planted with species Rhizophoraceae, namely; Bakauan lalaki (Rhizophora mucronata), Bakauan babae (R. apiculata), and Bakauan bato (R. stylosa). Collected propagules can be directly out planted in designated areas. To assure high survival, propagules shall be raised first in the nursery for 3 to 5 months before out planting. Other equally important mangrove species for rehabilitation includes: Busain (Bruguierra gymnorrhiza); Api-api

(Avicennia officinalis); Bungalon (A. marina) and Pagatpat (Sonneratia alba), among others.

2) Fauna

Wildlife Disturbance Due to Site Clearing

During site preparation and clearing, particularly along conveyance route, the removal of all standing plants of all lifeforms in each landing site and construction camp would have a direct effect on wildlife resident to the site. This disturbance could be interim in nature and will not pose a permanent damage to their biology as they easily scamper away from the impacted area.

Since the area subject to disruption is relatively small, noise disturbance can be mitigated by installing muffling devices or sound barrier to absorb and deflect sound waves.

Effect of Blasting

However, during major construction activities, e.g., blasting and quarrying, the primary effect on wildlife is disturbance. Blasting results in sudden tremendous explosion that will surprise and greatly disturbed the wildlife in the vicinity of the blasting area. Regular blasting will drive any wildlife within the vicinity of one-kilometer radius from the blasting site. Vibrations on the ground will also affect ground dwelling wildlife species. However, as explosion and ground vibration alone do not directly threatened the lives of individual wildlife species as wildlife will learn to adjust and may ignore the disturbance created by the explosion.

Blasting as source of disturbance is only critical on the first phase of tunneling. When the tunneling activity goes below ground, the sound created by the explosion is muffled and ground vibration is minimal as tunneling goes deeper. The initial blasting has the most impact on wildlife, because this has an element of surprise, the loud noise will be heard for the first time by the wildlife in the area. The succeeding explosions will have less effect, as wildlife is already adjusted to the regular disturbance.

As the blasting activity goes below ground, the impact of the explosion will lessen. When the tunneling is done, gradually wildlife will return to the area, as disturbance is no longer present. Quarrying affects wildlife in a very limited way. Directly, it is the noise created by the heavy equipment and machines in quarrying that affect wildlife.

To mitigate the effect of the first blast, trees around blasting site should not be cut, as these trees will help in muffling the sound. Also, temporary construction of sawali walls along the sides of the blasting site will muffle the spread of the sound. Prior to blasting, fire crackers and whistle bombs should be exploded to serve as a warning noise to the wildlife in the vicinity. There should be a five to ten minutes interval between the explosion of firecrackers and the actual blasting to give time for wildlife to escape.

Wildlife Disturbance Due to Rising Water Level

Microhabitat destruction will be a direct impact on wildlife followed by disturbance caused by rising water level. Occasionally some wildlife species such as wild pig, deer, civet cat, among others, come to the river to drink and even immerse to cool and clean themselves. Due to gradual inundation process, the survival of these species is not threatened as they can easily withdraw from the rising water level. Flooding may also affect the burrows of small rodents and shrews but being very mobile animals they can easily escape the inundated areas as filling up of the reservoir may take some time.

Frog and reptiles are not so much affected, as these animals are mostly amphibious. Frogs need aquatic environment for their tadpole stage and breeding areas. Some lizards such as the "Bayawak" or Monitor lizards *(Varanus Salvator)* are semi-aquatic and is not threatened by rising water levels. Some snakes even occasionally swim in riverbanks feed on rodents and other small wildlife species.

Birds and bats are not affected as these animals have ability to fly. They can easily escape rising water levels. Some birds and bats are even provided with an advantage because of the widening of the river's surface area. Birds and bats that drink over the surface while flying do not have to maneuver skillfully in order not to hit trees and branches as they dive towards the river. Some birds may even be provided with increased feeding areas, such as kingfishers along the banks, rails and herons. The pondage area will not only provide benefits to existing birds but will attract other species not presently recorded in the area.

To enhance and help safeguard the wildlife population, the following protection measures, among others can be adopted: a) conduct periodic wildlife census to determine the population status of endemic, rare and endangered/threatened species. The information could be used for formulation of conservation and protection measures; b) Arrest poachers and hunters of wildlife species especially those listed under CITES II. c) Deputize local inhabitants as partners in the conservation and protection of wildlife in their own localities. d) Conduct IEC campaign in and around the watershed area on the value of animals and explain policies of the government regarding wildlife conservation.

D3.1.2 Aquatic Ecology and Water Quality

Reduction of Available Oxygen Underwater Thus Affecting Aerobic Dependent Organisms

Too many biomasses that are submerged in water are subject to decomposition process. The use of oxygen by plant biomass decomposers normally depletes the available oxygen thus reducing the productivity of pythomass and other aquatic resources including fish and plankton.

One practical way to reduce the depletion and/or maintain the available oxygen levels for optimal productivity is simply harvest or conduct salvage cutting all the wood or timber biomass that can still be used either for lumber, construction of bunkhouses or simply source of fuel wood.

Change of the Micro-habitat and Reduction of Population of Some Wildlife Species

The sudden reduction on the volume of water on the lotic ecosystem would directly impact the biology of fish and other aquatic fauna thereby affecting their ability to procreate. Similarly, those plants that are adapted and growing on riparian environment would also be affected especially their growth and capacity to produce biomass.

Among the fish species that will be affected will be the migratory ones. Since these fish species require a freshwater habitat for growth and sexual maturity, the barrier poised by the dam will prevent the migratory species such as mullets (*banak*) and eels (*palos*) to reach the upstream sanctuary of the Kaliwa and Kanan Rivers. This break in their life cycle will obviously result to gradual extinction of the species from the upper Kaliwa-Kanan River Systems. Since none of the fish species identified are endemic only to this river system, the extinction may be localized.

Also, the fish specie of *migek* may also be the most vulnerable species. According to the locals, it feeds mainly on planktonic organisms carried by the fast flowing water. The grunters (*migek*) together with the scats (*kitang*), which enter the river system, will be limited to the lower reaches.

To mitigate the situation, constant flow of water from dam in terms of volume and regimen should be maintained in order to provide breathing space and environment conducive for their existence.

There will be a change from a riverine ecosystem to a lacustrine ecosystem. Experiences with dam operation in the Philippines showed that fish production has been favored. In some instances, the increased fish production from open water seeding by tilapia has added another alternative livelihood to the locals as in Angat Dam.

Increase Influence of Salinization in Estuary Environment

The significant reduction of normal riverflows/streamflows of the Agos River into the estuary area would mean increasing the influence of saline environment. This may not be felt at once but would likely be one issue in the future use of the water resource. Recharge of aquifer could be contaminated with marine water intrusion due to increased estuary surface area hence affecting domestic use of ground water. On the same vein, the receding influence of fresh water would likely change and even reduce the composition of aquatic fauna.

There is no hard fast rule to reduce the invasion of marine environment in estuary area at the moment, but this could be remedied by maintaining the release of water, in terms of volume and regimen, from the dam.

The increase of space previously occupied by riparian and floodplain species can be utilized for cash crop production due to soil silty materials laden with organic nutrients. Planting of shrubs and small trees along the banks can also help stabilize the soil thus maintaining diversity of plant composition.

Water Quality

Domestic and agricultural wastes may have possibly contributed to the elevated nutrient levels since Kaliwa River drains a portion of the Rizal watershed, which is partly agricultural and partly urbanized. Poor sanitation condition and uncontrolled disposal of wastes in the area may also add up to the pollution level of Kaliwa River.

Changes in the existing landuse should be strictly regulated expecially in areas adjacent to the bodies of water. Proposed land development must be compatible with the existing landuse plan and should not, in anyway, pollute Kaliwa River. Adequate waste treatment facilities must be instituted in any proposed development.

Improvement of the sanitation condition may be undertaken by the provision of adequate sanitation facilities in areas where people have no access to sanitation. This, however, must be coupled with proper education to encourage the people make cleanliness and sanitation as a way of life. The detailed plan/programs should be drawn up after a sanitation survey has been conducted in the Kaliwa River Basin. This is to ascertain the existing sanitation facilities and to determine what type and level of treatment is required.

The generated amount of water pollution load in terms of BOD5 by the households living upstream of the proposed dam has minor adverse impact considering the volume of water that the reservoir holds. The degree of the contribution for water pollution of an estimated population of 28,000 in the Kaliwa watershed was established at 0.24kg/ha/day. This concentration is negligible compared to the expected carrying capacity of the reservoir due to its area and the regular release of water.

D3.1.3 Air and Noise Quality

Some of the activities during the site preparatory phase of the Project such as the survey and identification of access roads will not have any significant impact on the quality of air and noise in the area.

During the construction phase of the project, the primary air pollutants, which are of concern, are the total suspended particulates (TSP) or fugitive dusts, as a consequence of ground preparation, which would entail digging, grading, and transport of debris. The use of earth moving implements and heavy equipment will also result in the generation of dusts and increase in noise levels as well.

As observed during construction in other projects, such activities during peak times could cause the one-hour TSP concentration to reach 300 µg/Ncm beyond the DENR Criteria standard for TSP (230 µg/Ncm) if not mitigated. However, this impact is only within 200 - 300 meters of the project site and is only temporary while the ground preparation is in progress.

There could also be a little increase in the level of concentration of sulfur dioxide and nitrogen dioxide in the air as a result of engine exhaust emissions coming from motor vehicle activities as well as the operation of heavy equipment. However, these are expected to be very minimal.

Noise levels during maintenance and construction of new ones will surely be apparent. Noise levels could be above the DENR limits during peak activity and could reach over 80 dB(A) in areas close to the site. However, sound waves travel in straight lines longitudinally and the propagation is affected by the physical property of the medium. Hence, as the distance traveled increased, the noise levels are attenuated. As such, the noise levels during construction are expected to be within acceptable levels within about 200-300 meter-radius beyond the construction site even without mitigation.

During the regular operation of the dam, the negative impact on the air quality and noise in the area is expected to be very minimal and within the limits set by the DENR.

The increase in dust concentration will be abated by the use of a water lorry to sprinkle water in the immediate area being cleared. During weak winds and calm days, the effect of the increase in TSP will be negligible since the Project areas are quite far away from densely populated communities.

Although petroleum based fuel will be used to operate the service vehicles and maintenance equipment, the proper scheduling of operations and regular maintenance of the equipment will minimize the possibility of significantly increasing the amount of gaseous emissions, hence, the concentration of pollutants in the air.

The use of appropriate mufflers for heavy equipment and motor vehicles will reduce the noise generation. Furthermore, since forest trees are very efficient sound buffers, the noise to be generated by the equipment will be significantly attenuated.

D3.1.4 Geohazards

Natural or geohazards consist of earthquake-related hazards, volcanic eruption-related hazards, flood-related hazards, landslides and typhoon winds.

Earthquake-related hazards such as earthquake landslide and flood hazards (only in Agos River Delta) would significantly affect the environment of the Project study area.

Earthquakes generate shocks or ground shaking due to the release of strain energy stored within elastic rocks by tectonic stresses. Following are the identified hazards from earthquakes and the proposed management measures:

1) Ground Shaking

The quantification of seismic risks is focused primarily on ground shaking because seismic shaking is considered to be the most widespread and damaging earthquake-related hazard. The procedure of quantitatively estimating the hazard of earthquake ground shaking involves analysis of the time, space and size or magnitude frequency distribution of earthquakes; evaluated using a distance-dependent attenuation model for seismic energy. The probabilistic approach was used and this took into account the distance of the site to the various earthquake source regions, the location and

magnitude of historical earthquakes as listed in the USGS and PHILVOLCS catalogs, the character of the soil or rock which underlies the site, and the rate of attenuation of amplitude of acceleration applicable to local conditions.

Thenhaus published seismic hazard maps (G-Factor) showing the attenuation of maximum amplitude of ground motion for 50 years return period and 90% probability of non-exceedance of Ms or surface wave magnitude of 7.00 for soft, medium and stiff soil or rocks. Engineering infrastructures designed for lower acceleration of ground motion face the possibility of ground failure or collapse of buildings causing death and injuries to people and work animals. Failure is also due to weak foundation materials with low shear and bearing strengths.

Adopt proper G-factor for geological condition of foundation material at project site or use stronger foundation material. After a strong earthquake, inspect structures for damages and determine if structures can be rehabilitated or be condemned. Residual impact will be insignificant.

2) Ground Rupture

Earthquakes with surface wave Magnitude Ms greater than 6.5 can cause ground displacement occurring along the fault that generated the earthquake. Trenches and the Philippine Fault are considered as the most active earthquake generators. The rupture length of the July 16, 1990 Central Luzon Earthquake was 120 km or 10% of the total fault length of 1,200 km for the Philippine Fault. Engineering structures and buildings on the ground rupture were displaced horizontally, vertically or obliquely, and causing panic, injury/death from falling materials. Dams and hydro-electric facilities inadequately designed or on poor foundation materials may be damaged due to ground rupture, causing power failure and water facilities to be damaged causing failure to convey the necessary water and power.

Set up rescue centers and local disaster management control centers. Proper type of dam infrastructure and buildings must be constructed. Structures should be sited at least five (5) m from the fault trace. Avoid constructions and location of structures on or near ground-ruptured faults, which should be properly suited for parks or open-land. Residual impact will be insignificant.

3) Tectonic Deformation

Tectonic deformation causes geomorphologic changes such as fault scarp landslide scarp, variation in slope gradients, river morphology, erosion/ siltation rates and land use. Since earthquakes are not predictable as to when, and where it will occur, and how strong or destructive will the event be, the degree of environmental deformation will vary depending on the elastic strength of the rock and soil.

Geotechnical soil/rock tests and seismic wave velocity tests indicate the rocks that have high wave velocities equal or greater than 2.5 km/s are strong rocks/soils for foundation and construction purposes.

4) Susceptibility to Liquefaction

Except for the floodplains and delta of the Agos River, no other areas within the project were noted to be underlain by thick unconsolidated alluvium. With this finding, it follows that only such floodplains and delta have high susceptibility to liquefaction hazard.

This assessment correlates well with the studies of PHILVOLCS, which shows that the Quezon Province section of the project area with the exception of the Agos River flood plains and delta is outside the liquefaction-prone areas.

Avoid construction with shallow piles within the liquefiable soil or the piles must be anchored to bedrock. Residual impact will be insignificant.

5) Landslide Hazard

Landslides are characterized by the downward sliding or downslope movement of a mass of rock or unconsolidated debris, under the influence of gravity. The occurrence of earthquake-induced landslide is controlled by the intensity of ground shaking, geology and geologic structures, steepness of slope, vegetation, increase of saturation by infiltration of run-off, and degree of alternation of the natural slope conditions by man's actions. The process involves the source of the landslide, its path and the destination of the sliding mass. To identify landslide susceptible areas, the following parameters are taken into account.

- Slope stability – most landslides occur on steep slopes of 25 % or greater (equivalent to 14^{o}), or sites with slopes greater than 10 % that are near slope-disturbing excavations such as mountain roads and quarries for construction and rock aggregates. At lower slopes, saturated loose rocks/soils may move downslope and the phenomena be called mass movement.
- Land use or ground cover – unvegetated steep slopes are susceptible to landslide as the slope surface is easily infiltrated by surface run-off, thus increasing the internal water pressure or be saturated.
- Hydrology – nearness to drainage systems leads to shallow water table that increases and hasten water saturation of rocks/soils and increase the driving force relative to the shear resistance.
- Rock and soil features such as permeability, porosity and hydraulic conductivity affect the density of the overlying rock mass.
- Proximity to slope destabilizing structures such as excavation for roads and quarries, and earth piles lead to slope instability.

Landslides will occur when either the driving force acting on the movable overlying rock mass is increased in weight or the shear resistance or resisting force beneath the slip surface is reduced. Strong earthquakes trigger off the slide of saturated rock masses situated in unstable slopes.

Avoid construction near the cliff of steep slopes or mountain ridges or steep riverbanks or the toe of the landslide-prone area. It will cost less to avoid landslide-prone areas than to control, rehabilitate or to stop the landslide.

Knowing the causes of the landslide, appropriate engineering measures must be adopted such as to drain the pore water, to reduce the slope to stability gradient, to armour the surface by vegetation or cement geomat or impermeable surfacing material to prevent the infiltration of rain water and surface run-off into the landslide mass, and to divert run-off flow from the landslide mass by intercepting trenches and use light weight overload materials to prevent excessive overload weight above the slip surface. For road cutting of steep slopes, the dip and direction of dip of the rock formation must be opposite to the slope face of the road-cut. Residual impact will be insignificant.

D3.1.5 Coastal Sedimentation

Based on the water sample analysis, the current sedimentation rate along the shore of Infanta is not very alarming. However, massive earth movement associated with the project may reach alarming rate if not controlled properly.

Avoid extensive grading and earthwork in erosion prone areas. This can be done by carefully examining the contour of the area and avoid large earth and soil disturbance. As much as possible preserve the original relief and take advantage of the natural and stable slope configuration.

Water is the primary agent of erosion. Points of confluence can be the spots where the erosive action of the water is at its greatest. The drainage lines and other hydraulic appurtenances should be constructed adequately and preferably at the start of the project development.

Keep runoff velocities low by keeping milder slope or breaking the slope, providing drops and energy dissipaters to decrease the erosive force of water.

Divert runoff away from steep slopes and denuded areas by constructing interceptor drains and berms. The denuded areas should be protected from excessive runoff. Construct sediment basins to prevent eroded soil or sediment from leaving the site. Sedimentation basins can trap large volumes of sediments and in anticipation of the large volumes of silt that will go with runoff. This can protect the beach areas from being murky or silted.

Native vegetation has primary roots already holding soil mass in place. They have also the capacity to regenerate and improve their erosion control capability. However, if vegetation must be removed, clear the site in small workable increments. Limit the duration of exposure. During construction it is prudent to plan the bulk of the earthmoving during the non-rainy season so as to avoid large exposed or vegetation stripped areas during the rainy season. If this cannot be avoided, the duration of exposure should be lessened during the rainy season such as constructing the planned facilities or buildings or revegetating the area.

Vegetation affects both the surficial and mass stability of slopes in significant and important ways. The stabilizing or protective benefits of woody vegetation depend both on the type of vegetation and type of slope degradation process. As part of the monitoring activities, the vegetation should be ensured of lush growth in the project area.

In the case of mass stability, the protective benefits of woody vegetation range from mechanical reinforcement and restraint by the roots and stems to modification of slope hydrology as a result of soil moisture extraction via evapotranspiration. Caution and prudence should be exercised in ensuring that trees are conserved in the project area for general slope stability.

D3.2 Social Environment

The impacts to the socio-economic environment are considered significant due to the land area and number of families and structures directly affected by the Project. These include families living within the directly affected areas, situated in Barangays Pagsangahan and Mahabang Lalim (Gen. Nakar, Quezon), Barangay Magsaysay (Infanta, Quezon) and the Barangays in the waterway facilities (Tanay, Morong, Teresa, Taytay, Antipolo City, all in Rizal province). These families will be displaced and will be required to relocate to other sites. With the displacement are the accompanying impacts as presented in the succeeding discussion.

1) Permanent Loss of Agricultural, Residential and Commercial Lands

Affected lands include those claimed by PAFs in the areas. This does not include yet the National Commission on Indigenous People's claim for Certificate of Ancestral Domain Claim (CADC) of 71,000 hectares and current application for the CBFM in the watershed areas under the Protected Areas Management Plan of 72,000 hectares. The extent of impact on land among PAFs can only be determined during census tagging. Whether the land is private or public land, all PAFs, whether with formal legal title or not, are entitled to compensation and rehabilitation.

Compensation shall be provided to owners of agricultural, residential and commercial lands. For residential land owners, compensation will be through the provision of "land-for-land" arrangements of equivalent size satisfactory to PAFs. The project will develop a resettlement site in consultation with PAFs (only for dam/reservoir PAFs). For agricultural landowners, compensation will be through the provision of "land-to-land" arrangements of equal productive capacity of the lost land satisfactory to PAFs. For commercial landowners, compensation will be through the provision of alternative business or commercial site of equal size and accessibility to customers satisfactory to PAFs.

The Resettlement Plan provides, among others, details of entitlements for the permanent loss of agricultural, residential and commercial lands.

Since displacement cause undue pressures and traumas, counseling must be part of the entire resettlement process. It is not enough to provide disturbance compensation, or even financial assistance. The presence of social workers,

counselors, or psychologists would make resettlement smoother on the part of the PAFs.

2) Permanent Loss of Houses/Structures

Houses and structures e.g., small huts, pigpens, toilets, institutional and public/communal structures will also be affected by the Project. These were identified during the inventory of losses (IOL) survey .

Measures to mitigate the impact of displacement is the formulation and implementation of a comprehensive Resettlement Plan (RP), which is considered to be the most important measure to mitigate the significant effects of displacement. The RP defines policies and strategies to compensate those directly affected at replacement cost, e.g., cash compensation for affected structures at full replacement cost without deduction for depreciation or salvageable materials. It also provides specific measures to institute sustainable income restoration. Thus, the RP provides actual relocation to a site selected by the PAFs. It also provides transfer assistance, and measures to restore the living standards of those affected.

Another measure to ensure that all stakeholders are informed of other major and minor impacts of the project to the natural and social environment is the formulation and implementation of Strategic Communication Plan. This will prepare the mindset of the PAFs, and of the other stakeholders. It will be a venue for two-way communication, where the government shows its sincere concern for the welfare of the PAFs.

Participatory community development will mitigate the feeling of exclusion of affected people on a project that directly affects them. Through participatory community development processes, the affected people will decide what is best for themselves, such as deciding on the resettlement site, what livelihood projects would be implemented, and the manner or procedures for compensation, among others.

3) Loss of Income/Livelihood Sources

Sources of income in the directly affected areas are primarily derived from forest sources and agriculture. As identified during the SES, only about 50% of household members (at dam/reservoir area) have sources of income. Majority earn not more than PHP5,000 per month. Displacement of the PAFs would mean displacement of livelihood sources. Hence, loss of income is a major impact of the project.

Income restoration is a principal strategy to restore the PAP's standard of living, or even uplift or upgrade the existing economic status of those to be affected by the project. Livelihood projects must be planned in a participatory manner, and must be provided with sustainable mechanisms. Furthermore, livelihood programs must be within the resources locally available, with the provision of training for new skills development.

Since many of the women are also income earners, then vocational skills training for women must be considered.

In addition to livelihood is the provision of access to financial assistance for projects that the PAFs may want to get into. This has been identified as one way to ensure that livelihood projects become sustainable.

4) Impact to the Indigenous People/Communities

A special sector, which has to be carefully considered in the planning given the nature of their existence and their legal claim on the area, is the Indigenous communities settled in Barangays Mahabang Lalim and Pagsangahan.

IPs concerns shall be addressed through the preparation and implementation of the Indigenous People Development Plan (IPDP). The overall objective of the IPDP is to avoid and minimize the negative cultural effects among the IPs through identification and provision of rehabilitation measures. More specifically, the objective is to ensure that IPs will benefit from the wider long-term socio-economic opportunities the Project may bring, by improving earning potential on a sustainable basis. However, the preparation of an IPDP can only be carried out during the detailed design stage.

5) Risks Associated with Blasting

The potential health risk arising from the project during construction phase is the dust/gaseous emissions and excessive noise and vibration that will be generated by the blasting resulting to tremendous explosion. The workers are expected to be the most directly affected. Therefore, provisions to reduce the impacts of blasting should be implemented properly.

Other safety concerns during the entire construction activities should also be properly addressed to minimize impacts and ultimately prevent loss of lives and properties.

To minimize the impacts of blasting, workers, particularly those involved in blasting activities/operations shall be provided with personal protective equipment. Reduction of working hours and/or introduction of short pauses during the working day may also reduce the blasting effect or consequences.

6) Employment Generation

The construction phase will require construction workers of varied skills. A significant number of jobs available to qualified local residents in the affected communities will substantially reduce the unemployment rate in the area. This will be a significantly positive impact (during construction phase) that will also provide a boost to the local economy.

Furthermore, additional employment opportunities would be generated for suppliers and subcontractors of the project. Indirect employment opportunities would also be created for service-oriented activities such as food stalls or restaurant business, security agency, etc.

The effects of additional employment generated by the project during construction phase will have cascading effect on the economy as a whole. The affected population will have more income at their disposal.

Prior to construction activities, directly affected Barangays shall be provided with advance notice of hiring. Contractors shall be required to coordinate with the Barangay officials. Furthermore, contractors shall be required to give priorities to the qualified local workforce in hiring. Skills training of local residents will also be provided.

7) Increased Business Oppurtunities

In addition to the impact on employment, the project will also trigger other economic impacts. One of the more significant aspects of these impacts is the generation of additional or associated opportunities. Additional livelihood opportunities will be created for ambulant peddlers or vendors that will cater to the construction workers such as food and cigarette vendors.

Another indirect economic impact would be increased revenue collection for the municipalities from increased economic activities in the area. Associated businesses are also expected to benefit from the construction. Examples of such businesses are suppliers of water-saving devices, floor tiles, lighting fixtures, and other construction-related enterprises.

Contractors shall be required to coordinate with the municipal officials in the operation of small businesses in the construction site (e.g., food vending). Also, contractors shall be required to give priority to competent or qualified suppliers locally based.

8) Improved Lifestyles

With the construction of the Dam, qualified residents in the area, particularly in Infanta and General Nakar in Quezon and those in the neighboring Rizal Province can be employed to work. With sufficient earnings, their living conditions will improve.

With the completion of the Agos Dam, a large water reservoir will be established in the area, which could store domestic water sufficient for the use Rizal and Metro Manila. Hence, the perennial threat of water shortage for domestic use in these localities will be alleviated. With further development, hydropower can also be tapped from the completed dam that could provide ample electric power supply to nearby provinces/cities.

Thus, with the development of the Project in the Agos Basin, it is foreseen that there will be sufficient supply of water and electricity in the provinces around Metro-Manila. This will redound to the development of more industries and factories that are dependent on the supply of power and water, thus more people will be employed and earn sufficient enough to uplift their socio-economic condition. The government can collect more revenues from industrial and commercial taxes, as well as from personal income taxes of the residents around the area.

D3.3 Summary Matrix of Impacts and Mitigation/Enhancement Measures

Table D3.1 provides the summary matrix of potential environmental and social impacts and mitigation/enhancement measures identified for the project. The matrix provides classification, duration, nature and degree of impacts.

D4 Environmental Management and Monitoring Plan

This Environmental Management and Monitoring Plan (EMMP) presents the environmental policy and objectives of the environmental management system, the development guidelines covering water, soil, biological environment and socio-economic parameters and development guidelines along with various elements of the Social Development Plan, and the institutional aspect. The EMMP also provides a program and an action plan for the scoping of the environmental management system. This includes a matrix consisting of mitigative measures for each specific negative impact, responsibilities and authorities, monitoring including time frame, and cost estimates related to mitigating measures.

It should be noted that this EMMP is tentative, subject to further refinement in the full-blown EIA preparation.

D4.1 Environmental Management System (EMS)

Consistent with the Government's effort in promoting environmental protection as embodied in its Constitution, the Study strives to achieve a "low environmental impact" project within the context of sustainable development. It aims to operate the project as an environmentally sound facility. The environmental policy is therefore directed towards:

- Procedures to implement sound environmental management and monitoring practices that allow for continued improvement within the EMS.
- Services that maximize the use of environment friendly facilities or the use of environmentally sound technologies that conserve the natural resources.
- Methods to incorporate design and practice for environmental consciousness in the delivery of services.

D4.2 Environmental Management and Monitoring Plan (EMMP)

This EMMP is formulated to ensure that construction and operation activities adhere to the environmental objectives of the project. It shall embody the commitments of the project proponent and delineate sphere of responsibilities of key actors.

The environmental objectives of the Project include the following:

- To promote protection of the environment and socio-economic upliftment through sustainable economic activities;
- To comply with all applicable environmental standards set by the government;
- To ensure transparency and involvement of the contractors and operators on environmental issues;
- To guarantee the submission of all reports on the environmental performance of the project required by the different government agencies, and
- To maintain active involvement of stakeholders in water management and environmental awareness.

In line with these objectives, the EMMP is deemed an effective tool in managing environmental performance. The formulation of the EMMP will enable the identification of critical environmental issues, the development of action plans to address these issues, the establishment of environmental performance indicators, and raising environmental awareness among staff, contractors and the eventual users, as well as providing appropriate training and strategic communication plan or an information, education and communication interventions.

D4.3 Development Guidelines in Water and Soil Management (WSMP)

The primary focus of the WSMP is the management and control of sediments within the catchment area. The sediments will shorten the reservoir's life span, may cause flooding further upstream of the potential reservoir area and they are the vehicle by which some of the undesirable materials will be transported to the dam's reservoir.

The components of the WSMP are the following:

a) Rehabilitation of high-erosion areas on, near or along the faults, road cuts, excavations, denuded slopes, gullies and stockpiles which release large amounts of sediments to the watershed during rains. A landslide inventory should be conducted in order to identify some of the high-erosion areas. High-erosion areas have driving forces in excess of resisting forces. Rehabilitation methods seek to reduce the driving forces or increase of resisting forces or both, include quite a number of techniques that can be resorted to by engineers. To complement the rehabilitation of high-erosion areas are mitigating measures downstream. Examples of which are check dams that will contain the coarse sediments and some of the fines flowing downstream, or by dredging portions of the Agos River in order to increase the river's channel carrying capacity and to reduce the incidence of flooding.

b) Reforestation to reduce soil erosion of the watershed and

c) Hydraulic and sediment control structures and measures for built up areas.

Guidelines

The following are general guidelines that can be adapted to lessen the effect of erosion during construction of the project:

a) Fit the development plan to the site. Avoid extensive grading and earthwork in erosion prone areas. This can be done by carefully examining the contour of the area and avoid large earth and soil disturbance. As much as possible, preserve the original relief and take advantage of the natural and stable slope configuration.

b) Install hydraulic conveyance facilities to handle increased runoff. Water is the primary agent of erosion. Points of confluence can be the spots where the erosive action of the water is at its greatest. The drainage lines and other hydraulic appurtenances should be constructed adequately and preferably at the start of the project development.

c) Keep runoff velocities low. This can be done by keeping milder slope or breaking the slope, providing drops and energy dissipaters to decrease the erosive force of water

d) Divert runoff away from steep slopes and denuded areas by constructing interceptor drains and berms. This measure can be done during the construction phase of the project. The denuded areas should be protected from excessive runoff.

e) Save native site vegetation whenever possible. Native vegetation have their primary roots already holding soil mass in place. They have also the capacity to regenerate and improve their erosion control capability.

f) If vegetation must be removed, clear the site in small workable increments. Limit the duration of exposure. During construction it is prudent to plan the bulk of the earthmoving during the non-rainy season so as to avoid large exposed or vegetation stripped areas during the rainy season. If this cannot be avoided, the duration of exposure should be lessened or limited during the rainy season such as constructing the planned facilities or buildings or revegetating the area.

g) Protect cleared areas with mulches and temporary, fast growing herbaceous covers. As much as possible and as early as possible all cleared areas should be planted right away or landscaping plants planted to cover the cleared areas.

h) Construct sediment basins to prevent eroded soil or sediment from leaving the site. Sedimentation basins can trap large volumes of sediments and this can be constructed during the construction phase and in anticipation of the large volumes of silt that will go with runoff. This can protect the beach areas from being murky or silted.

i) Install erosion control measures as early as possible. Structural as well as vegetal control measures should be implemented way ahead in anticipation of the erosion problems during the rainy season.

j) Inspect and maintain control measures. After construction or implementation of construction measures, these should be inspected for maintenance, site or hydrologic adaptation or improvement of performance.

During the implementation of the project, the general guideline covers the use of natural vegetation and/or bioengineering measures including the use of bamboo and vetiver grass, a tropical grass (*Vetiveria zizanioides*).

Use of Natural Vegetation

The use of natural vegetation as an erosion control measure is particularly recommended for this project. Vegetation affects both the surficial and mass stability of slopes in significant and important ways. The stabilizing or protective benefits of woody vegetation depend both on the type of vegetation and type of slope degradation process. As part of the monitoring activities, the vegetation should be ensured of lush growth in the project area.

In the case of mass stability, the protective benefits of woody vegetation range from mechanical reinforcement and restraint by the roots and stems to modification of

slope hydrology as a result of soil moisture extraction via evapotranspiration. Caution and prudence should be exercised in ensuring that trees are conserved in the project area for general slope stability.

The right choice of plant materials is critical. A tight, dense cover of grass herbaceous vegetation for example, provides one of the best protections against surficial rainfall and wind erosion. Conversely, deep-rooted, woody vegetation is more effective for mitigating or preventing shallow mass movement.

Certain types of plants are intrinsically better suited than others for specific stabilization objectives. Woody vegetation is stronger and deeper rooted than herbaceous plants and grasses and provides greater mechanical reinforcement and buttressing action at depth. Accordingly, woody plants are superior for mass stability. Grasses and herbaceous vegetation, on the other hand, grow close to the surface and provide a tight, dense ground cover. They tend to be superior. Therefore, in intercepting rainfall and preventing surficial erosion, shrubs are not as deep rooted as trees nor can they be expected to provide as much buttressing restraint. On the other hand, shrubs are more flexible, have less aboveground biomass, and exert less surcharge on a slope. They may be preferable, accordingly, in riverbank; and levee stabilization, where these attributes would be advantageous.

Bioengineering Measures

Bioengineering is a method of construction using different live plants, either alone or in combination with other materials, organic or inorganic, to produce living, functioning systems for engineering applications.

Bioengineering in soil erosion and soil stabilization application is specifically referred to as soil bioengineering. It is somewhat unique since it utilizes parts of plants, e.g. roots and stems, which serve as structural and mechanical elements in a slope protection system. Parts of plants such as live cuttings and rooted plants are embedded into the soil in a certain arrangement that they serve as soil reinforcements, hydraulic wicks (or drains), and barriers to earth movement. It provides for sufficient stability so that native vegetation and surrounding plants gain foothold and takeover this function.

The use of live plants in bioengineering adds structural strength to the soil. Success depends on the care of plants before and during planting. It is a cost effective and environmentally acceptable alternative in providing slope protection and preventing sediment erosion especially on streams and riverbanks, lakeshore, and hill slope situations.

There are several techniques used in bioengineering. These techniques have been designed to specifically address the different kinds of erosion situations. These are:

a) Brush matting - A method used in protecting stream banks. This is done by putting a mattress-like layer of branches over the soil or bank to protect the soil and slow water velocity.

b) Contour wattling - This method is used to control surface erosion by breaking long slopes into shorter slopes with the use of wattles.

c) Live cuttings - These can be from 18 inches to 4 feet in length. Short cuttings are used for plantings. Long cuttings are used for live staking of wattles.

d) Trench packing - A method used to slow or spread water by placing live plants in a trench perpendicular to the flow.

e) Coir fascines - These are wattles made from fibrous outer husks of coconuts. They help stabilize banks and establish wetland plants.

f) Prevegetated mats - These are live plants grown on a movable mat of organic material. They are grown in nurseries for up to a year to provide a good plant stand. These mats are usually used in wetland or lakeshore environments so wetland plants are commonly used for this purpose.

g) Staking - This method is used extensively in bioengineering practice. Stakes can be live or dead materials. Live stakes, often done with willows, are used to stabilize soil or to stake other materials in place.

h) Combination – using wattles, and live plants or stakes. Combination of the different bioengineering techniques is done for a more effective and creative way of containing loose surface soils.

i) Mulching - This is a temporary erosion control technique using loose mulch. Loose mulches do not resist wind or water flow well so they are most suitable for areas undergoing mild erosive force, such as flat or slightly sloping terrain of 5:1 (horizontal: vertical) or less.

j) Use of meshes - Erosion control meshes are open weave geotextiles consisting of jute, coconut or polypropylene, which may last for 1 to 5 years depending on the material.

k) Use of Erosion Control Blankets - These can be used on sites where slopes range from gentle to steep, or where high flow channels or highly erodible areas are present.

l) Use of Geosynthetic Turf Mats - These materials offer a high degree of erosion control in areas where flow channels or steep slopes exposed to large volumes of runoff require permanent support

m) Use of Pre-seeded Blankets - These are blankets with double-sided synthetic netting in which seeds have been incorporated in a cellulose fiber growth medium that adheres together when water is absorbed and biodegrades.

n) Rolled Fiber Modules - These devices help stabilize soils and facilitate revegetation where steepness or exposure to waves cause instability. Used as wave stilling devices, the rolls are placed offshore to break the waves and initiate sedimentation process that facilitates the establishment of vegetation that can dissipate wave energy.

o) Bamboo - A peerless erosion control agent, its net like root system create an effective mechanism for watershed protection, stitching the soil together along fragile riverbanks, deforested areas, and in places prone to earthquakes and mud

slides. Because of their wide-spreading root system, uniquely shaped leaves, and dense litter on the forest floor, the sum of stem flow rate and canopy intercept of bamboo is 25% which means that bamboo greatly reduces rain run off, preventing massive soil erosion and keeping up to twice as much water in the watershed. Bamboo is a pioneering plant and can be grown in soil damaged by overgrazing and poor agricultural techniques. Bamboo has an interlocking rhizome (root) system that holds the earth together providing earthquake protection.

p) Vetiver Grass - Deep root system and its sturdy character make vetiver grass widely applicable to various erosion and slope stability problems. Vetiver is a tropical grass (Scientific name: *Vetiveria zizanioides*), which grows under a wide range of temperature fluctuations and soil conditions. This grass has a vigorous, strong, long, and massive root system that can penetrate up to 5 meters underground depending on soil conditions. These massively thick root systems reinforces the soil and at the same time makes it very difficult to dislodged under high velocity flows. It has stiff and erect systems, which form dense hedges when planted close together. These hedges can stand up to relatively deep-water flow, reducing water velocity, thus, trapping sediments. The grass is highly resistant to pests, fire, and diseases.

D4.4 Development Guidelines for Biological Environment Management

The project will have impacts on the biological environment especially to the rare and endangered flora and fauna. In order to protect the biological environment, the following guidelines are proposed for adoption:

- Immediate rehabilitation of areas that were during construction by planting species that are endemic in the area as they are well adapted in that site condition.
- Establishment of a genebank by collecting and saving germplasm materials of rare and endangered plant species. Wildlings and seeds will be collected in their natural habitat prior to starting the filling-up of the reservoir. To assure high level of survival, wildlings, seeds, or stem cutting shall all be raised in nursery for a couple of months before out planting. Transplantation of these species shall be strategically established in the entire stretch of the Agos reservoir. The same protocol shall also be applied for non-tree lifeforms that will be affected by inundation. This includes low statured species that are used as forage crops, source of medicinal and handicraft raw materials, among others.
- Local stakeholders shall be encouraged to be an active participant in the reforestation activities and co-managing the protection of the area within their jurisdiction. Prior to filling up of the reservoir, salvage cutting of trees of commercial value shall be undertaken. Sales from the timber harvested in the area affected by the inundation shall be used for the rehabilitation and reforestation activities. The harvesting of all wood and timber biomas also

assist in reducing oxygen depletion and thus maintaining the available levels for optimal productivity of aquatic resources.

- In the rehabilitation efforts, spaces between existing vegetation can be planted with indigenous or endemic species in the project site and also introduced species that require similar site quality requirements.
- Prior to blasting operations, small explosions (whistle bombs, firecrackers) shall be exploded to serve as a warning noise to the wildlife in the vicinity. This would give time for wildlife to escape before the actual blasting.
- To enhance and protect the wildlife population in the project area, conduct of an information, education and communication campaign in and around the watershed area on the value of these animals, particularly the rare and endangered species and explain policies of the government on wildlife conservation.

D4.5 Social Development Guidelines/Plans and Programs

D4.5.1 Resettlement Plan

The comprehensive resettlement plan (RP) is the most important measure to mitigate the significant effects of displacement. The resettlement plan provides for policies and strategies to compensate those directly affected at replacement cost. It also provides specific measures to institute sustainable income restoration. Thus, the RP will provide actual relocation to a site selected by the PAPs. It will also provide transfer assistance, and measures to restore the living standards of those affected.

The prepared RP includes the socio-economic conditions of the study area; the census, inventory of losses and preliminary measurement surveys; the legal framework, principles and objectives of the project; the approaches to ensure consultation and people's participation; and mechanisms for grievance redressal. The RP also provides for resettlement strategies, the organizational framework for implementation, a general implementation schedule and the system of supervision, monitoring and evaluation

D4.5.2 Strategic Communication Program

The strategic communications program (SCP) is a measure to ensure that all stakeholders are informed of other major and minor impacts of the project to the natural and social environment. This will prepare the mindset of the PAPs, and of the other stakeholders. It will be the venue for two-way communication, where the government shows its sincere concern for the welfare of the PAPs.

The SCP focuses on the following:

- Development of various methods and approaches to enhance the awareness of PAPs and other identified strategic stakeholders' towards generating support and social acceptability for the project
- Ensuring that the PAPs and other strategic stakeholders are properly informed on issues, concerns and problems, and solutions and conclusions that may arise as a consequence of project implementation

- Engagement of project stakeholders in information dissemination, awareness building, public consultations and consensus building.

D4.5.3 Participatory Community Development

Participatory community development will mitigate the feeling of exclusion of affected people on a project that directly affects them. Through participatory community development, the affected people will decide what is best for themselves, such as that of deciding on the resettlement site, what livelihood projects would be implemented, and the manner or procedures for compensation, among others.

D4.5.4 Income Restoration or Livelihood Projects

Income restoration is a principal strategy to restore the PAP's standard of living, or even uplift or upgrade the existing economic status of those to be affected by the project. According to the PAFs, livelihood projects must be planned in a participatory manner, and must be provided with sustainable mechanisms. They suggested that these livelihood programs must be within the resources locally available, with the provision of training for new skills development, should they lack these skills.

Since many of the women are also income earners, then vocational skills training for women must be considered.

It was also suggested that if the project will see implementation, then the locally affected people must have priority in the employment.

In addition to livelihood is the provision of access to financial assistance for projects that the PAPs may want to get into. This has been identified as one of the ways to ensure that livelihood projects become sustainable.

D4.5.5 Counseling

Since displacement cause undue pressures and traumas, counseling must be part of the entire resettlement process. It is not enough to provide disturbance compensation, or even financial assistance. The presence of social workers, counselors, or psychologists would make resettlement smoother on the part of the PAPs.

D4.6 Institutional Guidelines

This institutional arrangement of the EMMP will be prepared as soon as the institutional set up of the project has been finalized.

Tentatively, the following functions are proposed for the Environmental Unit (EU):

- Oversee that the environmental/technical requirements and administrative policies and recommendations are properly integrated in the development and planning as well as during construction and operation activities of the project;
- Ensure that applicable guidelines and criteria on environment are complied;
- Conduct regular monitoring activities during construction and operation phases of the project;

- Ensure that mitigating measures and preventive activities are properly implemented; and
- Prepare regular report on the activities undertaken and the result of monitoring for submission to appropriate authorities.

The EU shall also be responsible in the implementation of the SCP. The main thrust under this mode is the integration of the issues and concerns arising from the different stakeholders. Partnership will be forged to facilitate actions on environmental matters in the area.

D4.7 Environmental Monitoring Plan

As a precautionary measure against adverse/negative impacts of the development and operation of the Agos Dam and its associated infrastructures, the Project Proponent would lead in the organization of a Multi-partite Environment Monitoring Team (MEMT). The Team shall be composed of representatives from the Project Proponent, the local government unit (LGU) concerned, the non-government organization (NGO), the Department of Agriculture (DA) and headed by a representative from the Department of Environment and Natural Resources (DENR).

Monitoring of the environmental conditions in the Project area shall commence upon the issuance of the Environmental Compliance Certificate (ECC) by the DENR. Monitoring shall be scheduled quarterly for the first year, and bi-annually thereafter, in order to detect any changes in the environment brought about by the project.

Among others, the MEMT shall monitor the following environmental parameters, which involved terrestrial and aquatic flora and fauna, surface riverine waters, occurrence of floods, and the socio-economic condition of the inhabitants, particularly in the Agos River Basin resulting from the establishment of the Agos Dam reservoir:

- Changes in the dam structure, breaching and/or scouring, sediment deposition, occurrence of water overflows particularly during heavy rainfalls;
- Water quality, particularly turbidity/sedimentation, DO, BOD, pH, trace metals and bacteriological contamination;
- Water movement in the rivers, streams, creeks and other waterways caused by the development of the reservoir; land submergence in some areas, and development of built-up areas;
- Occurrence of flooding to detect water flow obstructions and/or breaks in the river embankments;
- Regular inspection, maintenance, reinforcement of riverbanks to ensure that they remain adequate to provide protection against flooding and overflows;
- Regular inspection of the coastal and downstream section of Agos River to ensure that there is sufficient volume of water flowing to maintain aquatic fauna in this part of the reservoir;

- Revegetation growth along the riverbanks and in the watershed to restore the habitat, nesting sites and nooks of birds, insects and wildlife, to hasten their colonization of the area;
- Establishment of sampling stations where terrestrial and/or aquatic data will be collected regularly for monitoring of the environmental conditions in the Project site by the Environmental Monitoring Team. Air quality data on possible gas emissions from the reservoir, such as carbon dioxide, nitrous oxide and sulfuric oxide will be monitored during and after construction of the Dam.

Summary matrix of the Environmental Management Plan is presented in Table D4.1, while the Environmental Monitoring Plan is in Table D4.2.

Tables

Table D2.1 Major Uses of River Cited

River Name	Location	Uses									
		Fishing	Bathing/Picnic Area	Irrigation	Laundry	Transporting Logs	Source of Drinking Water	Human Waste Disposal	Source of Gravel & Sand	Means of Transporation	Other Domestic Uses
Agos River	**Barangay Magsaysay**										
	- Km 1		●	●	●				●		
	- Km 2	●	●	●	●				●		
	- Km 3	●	●	●		●					
	- Km 4	●		●		●	●				
	- Km 5	●	●	●	●	●	●				
	- Km 6	●	●		●		●	●			
	- Km 7		●	●	●					●	
	- Km 8	●	●	●	●						
	- Km 9		●	●	●	●					
	- Km 10	●	●	●	●	●					
	- Km 11	●									
	- Km 12 (Itaas)			●		●				●	
	- Km 12 (Ibaba)	●	●	●	●	●					
	Barangay Pesa										
	- Centro	●	●	●		●	●				
	- Kidadayaig	●		●		●	●				●
	Barangay Mahabang Lalim										
	- Bantayan	●	●	●	●	●					
	- Kalumpit	●	●	●	●	●		●			
	- Pangabukutan	●	●	●	●	●					
	- Gatuan	●	●	●	●	●	●	●	●		
	- Magipang	●	●	●	●	●					
	- Pangatloan	●	●	●	●	●	●	●		●	
	- Banaaw	●	●		●		●				
Kanan River	**Barangay Mahabang Lalim**										
	- Ilamban	●				●		●			●
	Barangay Pagsangahan										
	- Kakamanaswan	●				●	●				
	- Puro	●	●	●	●	●	●				
	- Makalya	●		●	●	●	●				
	- Lagmak	●	●	●		●	●				
	- Mabilog	●	●				●				
Kaliwa River	**Barangay Magsaysay**										
	- Miyunod	●	●		●						
	- Kirosep	●									
	- Kiborosa	●									
	Barangay Pagsangahan										
	- Mabagkoy	●	●	●	●	●	●				
	- Neo	●	●		●						

Table D2.2 Water Quality of the Kaliwa-Kanan-Agos River System

Category	Unit	DENR Standard[1]		DOH Standard[2]	Kanan River								Agos River	
					May 1994[a]			August 1994[a]			2001[b]	Aug. 2002[b]	2001[b]	Aug. 2002[b]
		Class AA[3]	Class A[4]		Kanan	Pagsangahan	Mahabang Lalim	Kanan	Pagsangahan	Mahabang Lalim	Kanan	Kanan	Agos	
Inorganic Constituents														
Arsenic	mg/L	0.05	0.05	0.01	-	-	-	-	-	-	0.0015	0.0006	0.0013	0.0021
Bicarbonate	mg/L	ns	ns	ns	-	-	-	-	-	-	149	68	123	106
Cadmium	mg/L	0.01	0.01	0.003	-	-	-	-	-	-	<0.001	<0.002	<0.001	<0.002
Calcium	mg/L	ns	ns	ns	-	-	-	-	-	-	38	17.3	47	31.2
Chromium	mg/L	0.05	0.05	0.05	0.06	0.12	0.14	0.08	0.18	0.1	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	ns	ns	250	-	-	-	-	-	-	2.1	3.7	2.1	7.5
Copper	mg/L	1	1	1	0.06	0.2	0.01	0.45	0.8	1.7	<0.02	<0.02	<0.02	<0.02
Cyanide	mg/L	0.05	0.05	0.07	-	-	-	-	-	-	0.002	<0.001	0.002	<0.001
Fluoride	mg/L	ns	ns	1	-	-	-	-	-	-	<0.02	0.28	<0.02	<0.02
Iron	mg/L	ns	ns	1	0	0.02	0.03	0.05	-	-	6.6	<0.06	9.4	0.78
Lead	mg/L	0.05	0.05	0.01	-	-	-	-	-	-	<0.002	<0.005	<0.002	<0.005
Manganese	mg/L	ns	ns	0.5	-	-	-	-	-	-	0.12	0.22	0.18	28
Mercury	mg/L	0.002	0.002	0.001	-	-	-	-	-	-	<0.0002	<0.0002	<0.0002	<0.0002
Nitrogen as Nitrate	mg/L	1	1	50	1	1	0.8	14	5.4	40	1.06	0.45	0.851	0.51
Nitrogen as Ammonia	mg/L	ns	ns	ns	-	-	-	-	-	-	<0.01	9.81	0.75	
Phosphate	mg/L	nil	0.1	ns	0.4	0.2	0.3	0.6	1.2	1	<0.01	5.66	0.23	8.07
Sodium	mg/L	ns	ns	200	-	-	-	-	-	-	6.3	11.6	6.1	6.0
Sulfate	mg/L	ns	ns	250	0	5	3	12	10	22	4.9	0.02	3.9	13.2
Zinc	mg/L	ns	ns	5	-	-	-	-	-	-	0.12		0.038	<0.02
Other Parameters														
Dissolved Oxygen	mg/L	5	5	ns	6	6.6	6.6	6	6	6.4	-		-	
TDS	mg/L	500	1000		62	81	84	69	93.3	105.1	150		215	
Conductivity	S/cm	ns	ns	ns	140	162	165	147	188.8	213	-	7.05	-	
pH		6.5-8.5	6.5-8.5	6.5-8.5	6.7	6.52	6.8	6.4	7	8.4	8	21.0	7.6	6.76
Temperature	^{o}C	3^{o}C max rise	3^{o}C max rise	ns	26.5	25	26.5	30.7	30.7	30.8	28.2		28.8	22.0
Color	PtCo	15	15	5	40	30	18	0	30	20	15	0.3	40	
Turbidity	NTU	ns	ns	5	5	3	2	0	8	5	0.6	46	43	11.3
Hardness	mg/L	ns	ns	300	-	-	-	-	-	-	116	30.0	142	88.9
COD	mg/L	ns	ns	ns	5	0	5	10	0	0	<5	5.0	<5	19.0
BOD_5	mg/L	1	5	ns	0	0	0	6.4	0	0	1		2.4	3.0
Oil and Grease	mg/L	nil	1	ns	nil	nil	nil	nil	nil	nil	-		-	
Total Coliform	MPN/100L	50	1000	ns	1600+	-	-	990	-	-	-		-	
Fecal Coliform	MPN/100L	20	100	ns	0	-	-	350	-	-	-		-	

[a] Kanan B-1 Hydroelectric Power Project, 1994 [b] This Study [ns] no standard [1] AO # 34, Water Usage and Classification/Water Quality Criteria
[2] Philippines National Standards for Drinking Water (NSDW) [3] Intended primarily for waters which require only approved disinfection to meet the NSDW [4] Sources of water supply that will require complete treatment

Table D3.1 Summary Matrix of Potential Environmental and Social Impacts and Mitigation/Enhancement Measures (1/5)

Environmental Component	Potential Impact	Classification	Duration	Nature	Degree	Mitigating Measures
Geology & Geohazards	Engineering infrastructures designed for lower acceleration of ground motion, weak foundation materials with low shear and bearing strengths face the possibility of ground failure or collapse of buildings causing death and injuries to people and work animals.	(-)	LT	D	M	• Adopt proper G-factor for geological condition of foundation material at project site or use stronger foundation material. • After a strong earthquake, inspect structures for damages and determine if structures can be rehabilitated or be condemned.
	Dams and hydro-electric facilities inadequately designed or on poor foundation materials maybe damaged due to ground rupture, causing power failure and water facilities to be damaged causing failure to convey the necessary water and power.	(-)	LT	D	M	• Proper type of dam infrastructure and buildings must be constructed. • Structures should be sited at least five (5) m from the fault trace. • Avoid constructions and location of structures on or near ground-ruptured fault, which should be properly suited for parks or open-land.
	Tectonic deformation causes geomorphologic changes such as fault scarp, landslide scarp, variation in slope gradients, river morphology; erosion/siltation rates.	(-)	LT	D	M	• Locate foundation structures in strong rocks/ soils that have high wave velocities equal or greater than 2.5 km/s.
	Floodplains and delta underlain by thick unconsolidated alluvium, such as the delta of the Agos River, have high susceptibility to liquefaction hazard.	(-)	LT	D	M	• Avoid constructions with shallow piles within the liquefiable soil or the piles must be anchored to bedrock.
	Strong earthquakes trigger off the slide of saturated rock masses situated in unstable slopes.	(-)	LT	D	M	• Reduction of slope to stability gradient, armour the surface by vegetation, cement geomat or impermeable surfacing material to prevent the infiltration of rain water and surface run-off into the landslide mass, diversion of run-off flow from the landslide mass by intercepting trenches, etc.
	Massive earth movement associated with the project may contribute to the potential erodible soils in the watershed. The erosive power of flowing water increases with velocity. Hence, riverbanks, stream banks and levees are subjected to erosion and scour by flowing water.	(-)	ST	D	Mo	• Avoid extensive grading and earthwork in erosion prone areas. As much as possible preserve the original relief and take advantage of the natural and stable slope configuration.

Table D3.1 Summary Matrix of Potential Environmental and Social Impacts and Mitigation/Enhancement Measures (2/5)

Environmental Component	Potential Impact	Classification	Duration	Nature	Degree	Mitigating Measures
						• Divert runoff away from steep slopes and denuded areas by constructing interceptor drains and berms. This measure can be done during the construction phase of the project. The denuded areas should be protected from excessive runoff. • Construct sediment basins to prevent eroded soil or sediment from leaving the site. • A common design practice is to construct widely spaced, vegetated levees. A mixture of plants, including reeds, grasses, and trees, is used with riprap and other standard engineering control measures to retard erosion.
Air & Noise	The use of earth moving implements and heavy equipment will result in the generation of dusts.	(-)	ST	I	Mi	• Use of a water lorry to sprinkle water in the immediate area being cleared.
	A slight increase in motor vehicle activity in the area during construction of access roads will cause slight increase in gaseous emissions.	(-)	ST	I	Mi	• Proper scheduling of operations and regular maintenance of the equipment will minimize the possibility of significantly increasing the amount of gaseous emissions.
	The use of earth moving and heavy equipment will result in noise level increase.	(-)	ST	I	Mi	• The use of appropriate mufflers for heavy equipment and motor vehicles will reduce the noise generation. • Planting of forest trees to serve as sound buffers, to significantly attenuate noise generated by the equipment.
Terrestrial Flora	Preparation for the construction of dams entails an enormous spatial disturbance on the biological materials such as removal of trees.	(-)	ST	D	Mo	• Immediate rehabilitation can be employed by planting species that are endemic in the area as they are well adapted in that site condition.
	Plants that are put underwater for a long time are subject to decimation due to inability to photosynthesize and the gradual disintegration and decomposition of plant biomass.	(-)	LT	D	Mi	Wildlings can be collected bare root and directly transplanted in degraded and open areas not reach by or affected by the highest water dam level. Areas with low tree density can be subjected to enrichment planting or simply allowing assisted natural regeneration to operate. Vacant spaces can be planted with more than two species to promote and maintain species diversity in the area.

Table D3.1 Summary Matrix of Potential Environmental and Social Impacts and Mitigation/Enhancement Measures (3/5)

Environmental Component	Potential Impact	Classification	Duration	Nature	Degree	Mitigating Measures
	Loss of standing biomass/timber and decline of plant biodiversity and composition.	(-)	LT	D	Mi	• Transplantation of rare and endangered plant species through collection of their germplasm prior to inundation of the dam reservoir.
	Improvement of access to the forested areas would be an avenue for exposing precious tree volume and Non-Timber Forest Products (NTFP) to wild extraction and poaching by the people.	(-)	LT	D	Mi	• Employ DENRO for Forest Protection or deputize the local communities, e.g. Dumagats, to apprehend poachers. • Implementation of an effective monitoring system of the entire watersheds by the national government through the DENR and LGUs in and around the watersheds.
	Death of plants due to flooding of the reservoir will disrupt and even stop the ecological processes of the plant community thus impacting primary and secondary productivity.	(-)	LT	D	M	• Spaces between existing vegetation, of all lifeforms, can be planted with indigenous species in the site plus introduction of new adapted ones that require similar site quality requirements.
Terrestrial Fauna	Blasting results in sudden tremendous explosion that will surprise and greatly disturbed the wildlife in the vicinity of the blasting area.	(-)	ST	D	Mo	• To mitigate the effect of the first blast, trees around blasting site should not be cut, as these trees will help in muffling the sound. • Temporary construction of “sawali” walls along the sides of the blasting site will muffle the spread of the sound. • There should be five to ten minutes interval between the explosion of firecrackers and the actual blasting to give time for wildlife to escape.
	Rising water level/Flooding may affect the burrows of wildlife species, small rodents and shrews but being very mobile animals they can easily escape the inundated areas as filling up of the reservoir may take some time.	(-)	LT	D	M	• Formulation and implementation of wildlife conservation and protection plan to enhance and help safeguard the wildlife population. • Deputize local inhabitants as partners in the conservation and protection of wildlife in their own localities to apprehend poachers.
Aquatic Ecology	Reduction of available oxygen underwater thus affecting aerobic dependent organisms including fish and plankton.	(-)	LT	D	Mo	• Harvest or conduct salvage cutting all the wood or timber biomass that can still be used either for lumber, construction of bunkhouses or source of fuel wood.
	The sudden reduction on the volume of water on the lotic ecosystem would directly impact the biology of fish and other aquatic fauna thereby affecting their ability to procreate.	(-)	LT	D	Mo	• Constant flow of water from dam in terms of volume and regimen should be maintained in order to provide breathing space and environment conducive to their existence.

Table D3.1 Summary Matrix of Potential Environmental and Social Impacts and Mitigation/Enhancement Measures (4/4)

Environmental Component	Potential Impact	Classification	Duration	Nature	Degree	Mitigating Measures
	The significant reduction of normal river flows/stream flows of the Agos River into the estuary area would mean increasing the influence of saline environment. The receding influence of fresh water would likely change and even reduce the composition of aquatic fauna.	(-)	LT	I	Mi	• Maintain the release of water, in terms of volume and regimen, from the dam to reduce the invasion of marine environment in estuary area.
Socio-Economy	Approximately, a total of 230 hectares of land consisting of agricultural, residential and commercial lands will be directly affected by the Project.	(-)	LT	D	M	• Formulation and implementation of Resettlement Plan (RP) for the Project. This Plan shall provide details of compensation package and entitlement for the permanent loss of agricultural, residential and commercial lands.
	Displacement of a total of 186 PAPs, 79 structures (small huts, toilets, etc.), 1 fishpond and 26 institutional and public/communal structures.	(-)	LT	D	M	• Formulation and implementation of a comprehensive RP to mitigate the significant effects of displacement. • Formulation and implementation of Strategic Communications Program, which may serve as the venue for two-way communication, where the government shows its sincere concern for the welfare of the PAPs. • Conduct participatory community development to mitigate the feeling of exclusion of affected people on a project that directly affects them.
	Loss of income/livelihood sources of the directly affected PAPs.	(-)	LT	D	M	• Undertake income restoration to reinstate the PAP's standard of living, or uplift/upgrade the existing economic status of the affected PAPs. • Identification and provision of sustainable livelihood projects through participatory approach and within resources locally available must be undertaken. • Conduct of vocational skills training for women. • Provision of access to financial assistance for projects that maybe identified by the PAPs.
	Impact to the Indigenous People/Communities	(-)	LT	D	M	• Preparation and implementation of the Indigenous People Development Plan (IPDP) to avoid and minimize the negative cultural effects among the IPs through identification and provision of rehabilitation measures.
	Potential risks arising from the project during construction phase, especially the excessive noise and vibration that will be generated by the blasting/explosion.	(-)	ST	D	M	• Workers, particularly those involved in blasting activities/operations shall be provided with personal protective equipment to reduce the effect of blasting/explosion.

Table D3.1 Summary Matrix of Potential Environmental and Social Impacts and Mitigation/Enhancement Measures (5/5)

Environmental Component	Potential Impact	Classification	Duration	Nature	Degree	Mitigating Measures
						• Reduction of working hours and/or introduction of short pauses during the working day may also reduce the blasting effect or consequences.
	Availability of significant number of jobs due to the proposed construction and implementation of the Project. Similarly, additional employment opportunities would be generated for suppliers and subcontractors of the project. Indirect employment opportunities would also be created for service-oriented activities such as canteens or restaurant business, security agency, etc.	(+)	ST	D	M	• Prior to construction activities, directly affected barangays shall be provided with advance notice of hiring.
						• Contractors shall be required to coordinate with the barangay officials. • Contractors shall be required to give priorities to the qualified local workforce in hiring.
	Additional or associated livelihood opportunities will be created for ambulant peddlers or vendors that will cater to the construction workers such as food, "balut" and cigarette vendors.	(+)	ST	D	M	• Contractors shall be required to coordinate with the municipal officials in the operation of small businesses in the construction site (e.g., food vending). Contractors shall also be required to give priority to competent or qualified suppliers locally based.
	Increased revenue collection for the municipalities resulting from the increased economic activities in the area.	(+)	ST	D	M	Municipalities shall improve tax collection efficiency especially that more business opportunities are expected from this Project.
	Future developments such as improvement of access roads or navigation on the reservoir will stimulate human activities in the upper watershed and may further pose threats to the Kanan-Agos Watershed Ecosystem.	(-)	LT	I	Mi	• In order not to cause any adverse effects to Kanan and Agos basins, which are designated s protected areas, planning and design of the project should take into account adequate precautionary measures (e.g., implementation of a comprehensive watershed management plan).

Legend:

LT- Long Term
ST- Short Term
D-Direct
ID-Indirect
(-) – Negative
(+)- Positive
M-Major
Mi-Minor
Mo-Moderate

Table D4.1 Summary Matrix of Environmental Management Plan (1/4)

Environmental Component		Potential Impact	Environmental Management Plan				
			Mitigating/Enhancement Measures	Estimated Cost of Mitigation/Enhancement	Institutional Plan	Schedule	Guarantee
Physical Environment	Geology/ Geohazard	Engineering infrastructures designed for lower acceleration of ground motion, weak foundation materials with low shear and bearing strengths face the possibility of ground failure or collapse of buildings causing death and injuries to people and work animals.	• Adopt proper G-factor for geological condition of foundation material at project site or use stronger foundation material. • After a strong earthquake, inspect structures for damages and determine if structures can be rehabilitated or be condemned.	To be covered by the cost of detailed engineering design. Part of the Environmental Monitoring/Guarantee Funds (to be drawn up during ECC application)	Implementing Agency-(IA), Multi-Partite Monitoring Team (MMT) IA/MMT	Detailed engineering design stage Operational stage	Geo-technical investigation Report; Design Report Quarterly Report
		Dams and hydro-electric facilities inadequately designed or on poor foundation materials maybe damaged due to ground rupture, causing power failure and water facilities to be damaged causing failure to convey the necessary water and power.	• Proper type of dam infrastructure and buildings must be constructed. • Structures should be sited at least five (5) m from the fault trace. • Avoid constructions and location of structures on or near ground-ruptured fault, which should be properly suited for parks or open-land.	To be covered by the cost of detailed engineering design. No cost implication No cost implication	Implementing Agency (IA) IA/MMT IA/MMT	Detailed engineering design stage Detailed engineering design stage Detailed engineering design stage	Design Report Design Report/Plans Design Report/Plans
		Tectonic deformation causes geomorphologic changes such as fault scarp, landslide scarp, variation in slope gradients, river morphology; erosion/siltation rates.	• Locate foundation structures in strong rocks/ soils that have high wave velocities equal or greater than 2.5 km/s.	No cost implication	IA/MMT	Detailed engineering design stage	Design Report/Plans
		Floodplains and delta underlain by thick unconsolidated alluvium, such as the delta of the Agos River, have high susceptibility to liquefaction hazard.	• Avoid constructions with shallow piles within the liquefiable soil or the piles must be anchored to bedrock.	To be covered by the cost of detailed engineering design.	IA/MMT	Detailed engineering design stage/Construction stage	Geo-technical investigation Report; Design Report
		Strong earthquakes trigger off the slide of saturated rock masses situated in unstable slopes.	• Appropriate engineering measures must be adopted. These may include reduction of slope to stability gradient, armour the surface by vegetation, cement geomat or impermeable surfacing material to prevent the infiltration of rainwater and surface run-off into the landslide mass, diversion of run-off flow from landslide mass by intercepting trenches, etc.	Cost to be determined during detailed engineering design stage	IA/MMT	Detailed engineering design stage	Design Report/Plans
	Soil Erosion and Sedimentation	Massive earth movement associated with the project may contribute to the potential erodible soils in the watershed. The erosive power of flowing water increases with velocity. Hence, riverbanks, stream banks and levees are subjected to erosion and scour by flowing water.	• Avoid extensive grading and earthwork in erosion prone areas. As much as possible preserve the original relief and take advantage of the natural and stable slope configuration. • Divert runoff away from steep slopes and denuded areas by constructing interceptor drains and berms. This measure can be done during the construction phase of the project. The denuded areas should be protected from excessive runoff. • Construct sediment basins to prevent eroded soil or sediment from leaving the site.	To be covered by the cost of detailed engineering design. To be covered by the cost of detailed engineering design. To be covered by the cost of detailed engineering design.	IA/Contractor IA/Contractor IA/Contractor	Construction stage Construction stage Construction stage	Design Report/Plans Design Report/Plans Design Report/Plans

Table D4.1 Summary Matrix of Environmental Management Plan (2/4)

Environmental Component		Potential Impact	Environmental Management Plan				
			Mitigating/Enhancement Measures	Estimated Cost of Mitigation/Enhancement	Institutional Plan	Schedule	Guarantee
Physical Environment			• A common design practice is to construct widely spaced, vegetated levees. Mixture of plants, including grasses and trees (bamboo, balete, vetivier), is used with riprap and other standard engineering control measures to retard erosion.	P100 Million (Total Watershed Management Cost) ***(a)***.	Local Government Unit (LGU)/Forest Management Bureau (FMB)-Department of Environment and Natural Resources (DENR)	Construction/Operation Stages	Watershed Management/ Monitoring Report
	Air Quality	Use of earth moving implements and heavy equipment will result in generation of dusts.	• Use of a water lorry to sprinkle water in the immediate area being cleared.	Part of Contractor's contract cost	Contractor	Construction stage	Contract
		A slight increase in motor vehicle activity in the area during construction of access roads will cause slight increase in gaseous emissions.	• Proper scheduling of operations and regular maintenance of equipment will minimize possibility of significant increase of gaseous emissions.	Part of Contractor's contract cost	Contractor	Construction stage	Contract
	Noise	The use of earth moving and heavy equipment will result in noise level increase.	• The use of appropriate mufflers for heavy equipment and motor vehicles will reduce the noise generation.	Part of Contractor's contract cost	Contractor	Construction stage	Contract
Biological Environment	Terrestrial Flora	Preparation for the construction of dams entails an enormous spatial disturbance on the biological materials such as removal of trees.	• Immediate rehabilitation can be employed by planting species that are endemic in the area as they are well adapted in that site condition.	Refer to item ***(a)***	LGU/FMB-DENR	Construction/Operation Stages	Contract
		Plants that are put underwater for a long time are subject to decimation due to inability to photosynthesize and the gradual disintegration and decomposition of plant biomass.	• Wildlings can be collected bare root and directly transplanted in degraded and open areas not reach by or affected by the highest water dam level. Areas with low tree density can be subjected to enrichment planting or simply allowing assisted natural regeneration to operate. Vacant spaces can be planted with more than two species to promote and maintain species diversity in the area.	Refer to item ***(a)***	LGU/FMB-DENR	Construction/Operation Stages	Contract
		Loss of standing biomass/timber and decline of plant biodiversity and composition.	• Transplantation of rare/ endangered plant species by collection of their germplasm prior to inundation of the dam reservoir.	Refer to item ***(a)***	LGU/FMB-DENR	Construction/Operation Stages	Contract
		Improvement of access to the forested areas would be an avenue for exposing precious tree volume and Non-Timber Forest Products (NTFP) to wild extraction and poaching by the people.	• Employ more forest guards or deputize the local communities, e.g. Dumagats, to apprehend poachers. • Implementation of an effective monitoring system of the watersheds by national government through the DENR and LGUs in and around the watersheds.	P14 Million/year (O & M Cost for Watershed Management Plan) ***(b)*** Refer to item ***(b)***	LGU/FMB-DENR LGU/FMB-DENR	Construction/Operation Stages Construction/Operation Stages	Contract Contract
		Death of plants due to flooding of the reservoir will disrupt and even stop the ecological processes of the plant community thus impacting primary and secondary productivity.	• Spaces between existing vegetation, of all lifeforms, can be planted with indigenous species in the site plus introduction of new adapted ones that require similar site quality requirements.	Refer to item ***(a)***	LGU/FMB/MMT	Construction/Operation Stages	Contract
	Terrestrial Fauna	Blasting results in sudden tremendous explosion that will surprise and greatly disturbed the wildlife in the vicinity of the blasting area.	• To mitigate the effect of the first blast, trees around blasting site should not be cut, as these trees will help in muffling the sound.	No cost implication	Contractor/MMT	Construction stage	Contract

Table D4.1 Summary Matrix of Environmental Management Plan (3/4)

Environmental Component		Potential Impact	Environmental Management Plan				
			Mitigating/Enhancement Measures	Estimated Cost of Mitigation/Enhancement	Institutional Plan	Schedule	Guarantee
Biological Environment			• Temporary construction of "sawali" walls along the sides of the blasting site will muffle the spread of the sound. • There should be five to ten minutes interval between the explosion of firecrackers and the actual blasting to give time for wildlife to escape.	Part of Contractor's contract cost No cost implication	Contractor/MMT Contractor/MMT	Construction stage Construction stage	Contract Contract
		Rising water level/Flooding may affect the burrows of wildlife species, small rodents and shrews but being very mobile animals they can easily escape the inundated areas as filling up of the reservoir may take some time.	• Formulate and implement wildlife conservation and protection plan to enhance and help safeguard the wildlife population including periodic wildlife census survey. • Deputize local inhabitants as partners in the conservation and protection of wildlife in their own localities to apprehend poachers.	Refer to item ***(a)*** Refer to item ***(b)***	LGU/FMB-DENR/MMT IA/LGU	Operational stage Operational stage	Contract Contract
	Aquatic ecology	Reduction of available oxygen underwater thus affecting aerobic dependent organisms including fish and plankton.	• Harvest or conduct salvage cutting all the wood or timber biomass that can still be used either for lumber, construction of bunkhouses or source of fuel wood.	No cost implication	Contractor	Construction stage	Contract
		The sudden reduction on the volume of water on the lotic ecosystem would directly impact the biology of fish and other aquatic fauna thereby affecting their ability to procreate.	• Constant flow of water from dam in terms of volume and regimen be maintained in order to provide breathing space and environment conducive to their existence.	Part of O & M Cost for the Project	IA/MMT	Operational stage	O & M Monitoring Report
		The significant reduction of normal river flows/stream flows of the Agos River into the estuary area would mean increasing the influence of saline environment. The receding influence of fresh water would likely change and even reduce the composition of aquatic fauna.	• Maintain the release of water, in terms of volume and regimen, from the dam to reduce the invasion of marine environment in estuary area.	Part of O & M Cost for the Project	IA/MMT	Operational stage	O & M Monitoring Report
Socio-Economic Environment	Land, Household & Population	Approximately, a total of 300 hectares of land consisting of agricultural, residential and commercial lands (excluding forestland in reservoir area), will be directly affected by the Project.	• Formulation and implementation of Resettlement Plan (RP) for the Project. This Plan shall provide details of compensation package and entitlement for the permanent loss of agricultural, residential and commercial lands.	P1.8 Billion (Total cost of Resettlement Plan) ***(c)***	IA/MMT	Pre-construction stage/Construction/Operation Stages	Resettlement Plan
		Displacement of a total of 400 PAFs, 79 structures (small huts, toilets, etc.), and 12 institutional and public/communal structures.	• Formulation and implementation of a comprehensive RP to mitigate the significant effects of displacement. • Formulation and implementation of Strategic Communications Program as venue for two-way communication, where government shows its sincere concern for the welfare of the PAPs. • Conduct participatory community development to mitigate the feeling of exclusion of affected people on a project that directly affects them.	Refer to item ***(c)*** Refer to item ***(c)*** Refer to item ***(c)***	IA/MMT IA/MMT IA/MMT	Pre-construction stage/Construction/Operation Stages Pre-construction stage/Construction/Operation Stages Pre-construction stage/Construction/Operation Stages	Resettlement Plan Resettlement Plan Resettlement Plan

Table D4.1 Summary Matrix of Environmental Management Plan (4/4)

Environmental Component		Potential Impact	Environmental Management Plan				
			Mitigating/Enhancement Measures	Estimated Cost of Mitigation/Enhancement	Institutional Plan	Schedule	Guarantee
Socio-Economic Environment		Loss of income/livelihood sources of the directly affected PAPs.	• Undertake income restoration to reinstate the PAP's standard of living, or uplift/upgrade the existing economic status of the affected PAPs.	Refer to item ***(c)***	IA/MMT	Pre-construction stage/Construction/Operation Stages	Resettlement Plan
			• Identification and provision of sustainable livelihood projects through participatory approach and within resources locally available must be undertaken.	Refer to item ***(c)***	IA/MMT	Pre-construction stage/Construction/Operation Stages	Resettlement Plan
			• Conduct of vocational skills training for women.	Refer to item ***(c)***	IA/MMT	Pre-construction/Construction/ Operation Stages	Resettlement Plan
			• Provision of access to financial assistance for projects maybe identified by PAPs.	Refer to item ***(c)***	IA/MMT	Pre-construction/Construction/ Operation Stages	Resettlement Plan
	Indigenous People (IPs)	Impact to the Indigenous People/Communities	• Preparation and implementation of the Indigenous People Development Plan (IPDP) to avoid and minimize the negative cultural effects among the IPs through identification and provision of rehabilitation measures.	Cost to be determined during ECC application	IA/MMT	Pre-construction stage/Construction/Operation Stages	IPDP
	Health & Safety	Potential risks arising from the project during construction phase, especially the excessive noise and vibration that will be generated by the blasting/explosion.	• Workers, particularly those involved in blasting activities/operations be provided with personal protective equipment to reduce the effect of blasting/explosion.	Part of Contractor's contract cost	Contractor/MMT	Construction stage	Contract/ Quarterly Monitoring Report
			• Reduction of working hours and/or introduction of short pauses during the working day may also reduce the blasting effect or consequences.	No cost implication	Contractor/MMT	Construction stage	Contract/ Quarterly Monitoring Report
	Socio-economic activities	Availability of significant number of jobs due to the proposed construction and implementation of the Project. Also, additional employment opportunities be generated for suppliers and subcontractors of the project. Indirect employment opportunities be created for service-oriented activities such as canteens or restaurant business, security agency, etc.	• Prior to construction activities, directly affected barangays shall be provided with advance notice of hiring.	No cost implication	Contractor/MMT/Barangay Officials	Pre-construction stage	Contract/ Quarterly Monitoring Report
			• Contractors shall be required to coordinate with the barangay officials.	No cost implication	Contractor/MMT/Barangay Officials	Pre-construction stage	Contract/ Quarterly Monitoring Report
			• Contractors shall be required to give priorities to the qualified local workforce in hiring.	No cost implication	Contractor/MMT/Barangay Officials	Pre-construction stage	Contract/ Quarterly Monitoring Report
		Additional or associated livelihood opportunities will be created for ambulant peddlers or vendors that will cater to the construction workers such as food and cigarette vendors.	• Contractors shall be required to coordinate with the municipal officials in the operation of small businesses in the construction site (e.g., food vending). Contractors shall also be required to give priority to competent or qualified suppliers locally based.	No cost implication	Contractor/MMT/LGUs	Pre-construction stage	Contract/ Quarterly Monitoring Report
		Increased revenue collection for the municipalities resulting from the increased economic activities in the area.	• Municipalities improve tax collection efficiency especially more business opportunities are expected from the Project.	No cost implication	LGUs	Pre-construction/construction stage	Contract/ Quarterly Monitoring Report
		Future developments such as improvement of access roads or navigation on the reservoir will stimulate human activities in the upper watershed and may further pose threats to the Kanan-Agos Watershed Ecosystem.	• So as not to cause any adverse effects to Kanan/Agos basins that are protected areas, planning/design of the project should take into account adequate precautionary measures, e.g., implementation of a comprehensive watershed management plan.	Refer to item ***(a)***	IA/MMT/LGUs	Pre-construction/construction/ Operational stage	Contract

Table D4.2 Matrix of Environmental Monitoring Plan

Environmental Component		Indicator Parameter	Planned Area of Monitoring	Monitoring Frequency
Physical Environment	Soils & Land Use	Soil erosion, volume/amount of sedimentation, area utilized for the project/change in land use, land submergence.	Around the perimeter of the work/project site	Monthly during construction stage; Quarterly during operational stage
	Water/Water Quality	Water movement in the river, river flow, water quality, e.g., DO, BOD, TSS, trace metal and bacteriological contamination, occurrence of flooding	All bodies of water affected by the work/project site	Monthly during construction stage; Quarterly during operational stage
	Air & Noise	Dust emission, gaseous emissions (SO_2, NO_x, CO, CO^2), noise level	At the nearest dwelling from the work site; gaseous emissions at the reservoir area	Monthly during construction stage; Quarterly during operational stage
Biological Environment	Terrestrial Flora	Loss/diminished plants and trees; Removal of grasses and vegetation	Around the work/project site	Monthly during construction stage; Quarterly during operational stage
	Terrestrial Fauna	Decreased faunal species in the project sites	Around the work/project site	Monthly during construction stage; Quarterly during operational stage
	Aquatic ecology	Diminished aquatic population	All bodies of water affected by the work/project sites	Monthly during construction stage; Quarterly during operational stage
Socio-economic Environment		No. of structures demolished; No. of PAPs/PAFs relocated; Safety standards;	All areas affected by the project; project working area.	Monthly during construction stage; Quarterly during operational stage

Figures

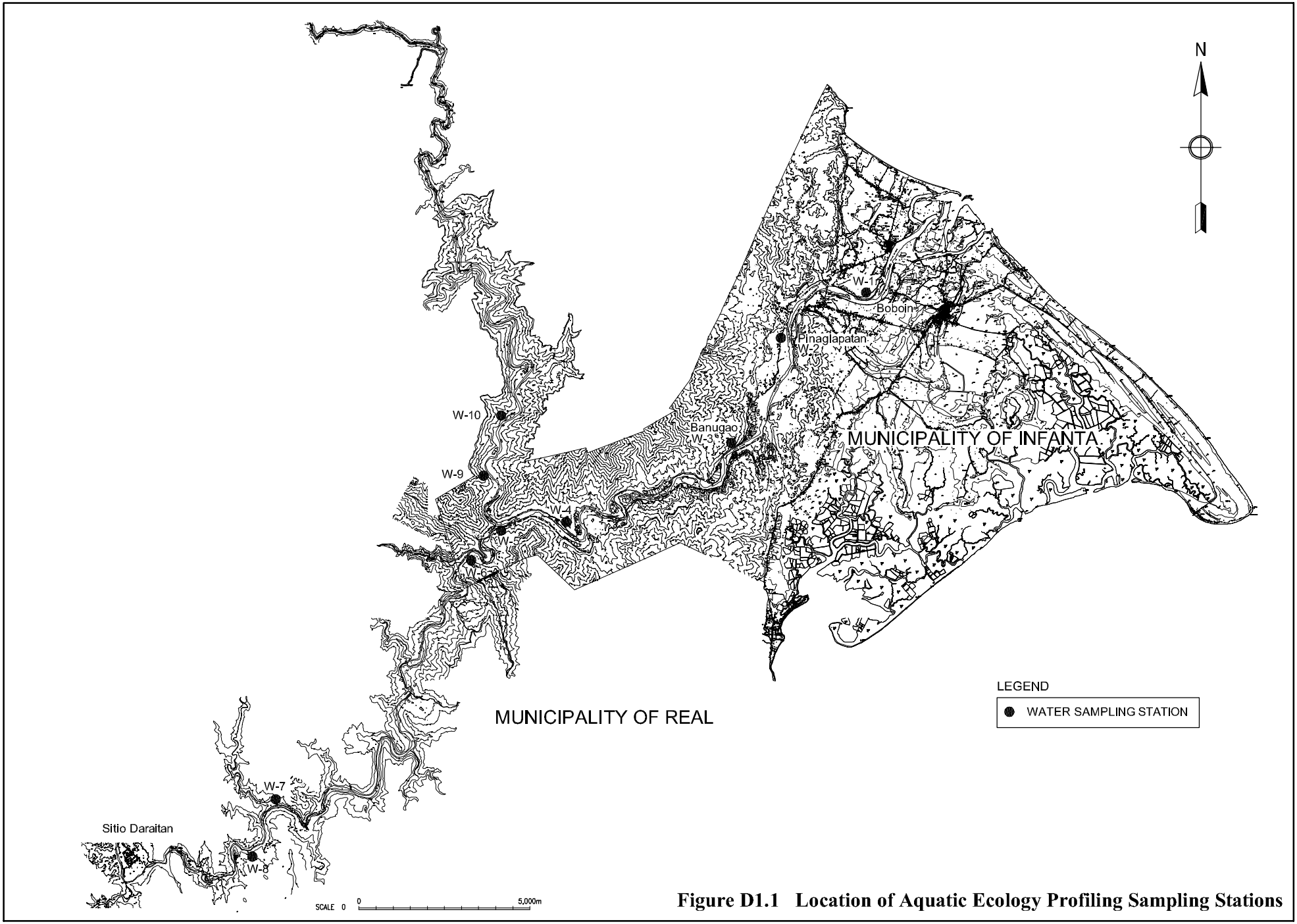

Figure D1.1 Location of Aquatic Ecology Profiling Sampling Stations