Part-G

Environmental Study

Part-G: ENVIRONMENTAL STUDY

Table of Contents

List of Tables

List of Figures

List of Plates

List of Appendices

Part-G: ENVIRONMENTAL STUDY

G1 General

Environmental aspects were considered in this Master Plan Study that supports an immediate and long term water supply development project to create improvements in public health and quality of life of the people in Metro Manila and its surrounding cities and towns. With this concern, an affordable solution to the problems of water supply brought about by increased demands arising from the growth in population can be catered for without harming the environment or imposing unsustainable financial burdens on the facility users. For this Master Plan, a preliminary environmental evaluation is undertaken to lessen, to the greatest extent possible, further environmental degradation and likewise promote environmental enhancement of the study area.

The Master Plan entails the study of five (5) potential water resources development sites and seven (7) schemes of water conveyance routes as reflected in Figure G1.1. The identified water resources development sites are:

Kaliwa River	Kanan River	Agos River
1. Laiban Dam	3. Kanan Dam (either Kanan No.1 or Kanan No.2 mutually exclusive of each other)	5. Agos Dam
2. Kaliwa Low Dam 2	4. Kanan B1	

The water conveyance schemes are:

Conveyance Waterways	Interbasin Tunnels
1. Laiban Intake-Pantay-Taytay (WCS-1) 2. Kaliwa Intake-Tanay-Laguna Lake (WCS-2) 3. Kaliwa Intake-Tanay-Angono(WCS-3) 4. Kaliwa-Abuyod-Angono (WCS-4) 1/ 5. Laiban-Tanay-Angono (WCS-5)	6. Kanan-Kaliwa Interbasin Tunnel (WCT-1) 7. Kanan-Laiban Interbasin Tunnel (WCT-2)

Notes: Conveyance waterway represents the section from intake to main service reservoir. From the latter, water is further conveyed to Metro Manila for distribution.
1/ The proposed facilities have been realigned and referred to as Kaliwa-Taytay Waterway in the F/S.

The environmental assessment began with a review of existing conditions of the study area covering the sub-basins of Kaliwa and Kanan rivers and the Agos River mainstream including the estuary as reflected in Figure G1.2. This review entailed evaluation of previous and existing studies and reports including environmental criteria and standards, as well as laws, rules and regulations relevant to the proposed development. On-site inspection was conducted to assess prevailing conditions in the study area. Initial discussions with officers and staffs of institutions involved in environmental protection and conservation as well as some officials of concerned local government units and members of the community where the different schemes are to be located were undertaken for collection of additional information. An environmental evaluation followed for the different

water resources development and water conveyance schemes. Mitigating measures were provided for identified negative effects/impacts to the environment. Based on the evaluation, a proposed combination option was assessed from an environmental viewpoint.

As part of the environmental survey in the Master Plan Study, an Initial Environmental Examination (IEE) for the Agos River Basin was carried out by MADECOR Environmental Management Systems, Inc. (MEMSI) for the main purpose of identifying the natural and social environmental problems and issues on each of the schemes and recommending corresponding mitigation measures. The result forms part of the basis of the evaluation of alternatives.

G2 Philippine Environmental Legal Framework Relevant to the Project

A strong environmental legal and regulatory framework and the establishment of standards and criteria are necessary so as to achieve the desired outcomes to effect environmental protection.

The following summarize the specific legal framework of these Acts/Regulations, which has impact on the proposed water supply development and the receiving environment.

G2.1 Regulatory Framework for Environmental Impact Assessment (EIA)

(1) Philippine Environmental Policy of 1977 (Presidential Decree No. 1151)

PD 1151, otherwise known as the "Philippine Environmental Policy" is the first policy issuance on Environmental Impact Statement (EIS) in June 6, 1977. It requires that "all agencies and instrumentalities of the national government, including government-owned and controlled corporations, as well as private corporations, firms and entities to prepare and file an Environmental Impact Statement (EIS) in every action, project or undertaking which significantly affects the quality of the environment".

(2) Philippine Environmental Impact Statement (EIS) System of 1978 (Presidential Decree No. 1586)

By virtue of PD No. 1586, the Philippine Environmental Impact Statement (EIS) System was formally established in June 11, 1978. Reiterating the policy statement under PD 1151, it categorized environmentally critical projects (ECPs) and projects within environmentally critical areas (ECAs) as projects which require the submission of an EIS.

(3) Proclamation of Certain Areas and Types of Projects as Environmentally Critical and Within the Scope of the Environmental Statement System of 1981 (Proclamation No. 2146)

The major categories of ECPs and ECAs were identified through Presidential Proclamation No. 2146 series of 1981. ECPs category has high potential for negative environmental impacts. These include heavy industries, resource extractive industries and infrastructure projects. Major dams are classified as infrastructure projects under the ECPs.

ECAs category covers projects located in areas that are considered ecologically sensitive and other areas declared by the President as environmentally critical. Appendix G-1 provides the list of ECPs and ECAs covered by the Philippine EIS System.

(4) Revising DENR AO No. 21, series of 1992, to Further Strengthen the Implementation of the Environmental Impact Statement System (DENR Administrative Order No. 37, series of 1996)

The EIS system has undergone several refinements to make it a more effective planning, management, and regulatory tool in addressing environmental problems.

The latest of this effort is the Department of Environment and Natural Resources (DENR) Administrative Order (DAO) No. 37, series of 1996, which attempt to further streamline the EIS system and strengthen the processes for its implementation. In consonance with the basic policy, DAO 37 seeks to address the following objectives:

- Ensure that environmental considerations are incorporated at the earliest possible stage of project development;
- Further streamline the current procedures in the conduct of the Environmental Impact Assessment (EIA) in order to improve its effectiveness as a planning, regulatory and management tool;
- Enhance maximum public participation in the EIA process to validate the social acceptability of the project or undertaking so as to ensure the fullest consideration of the environmental impact of such project or undertaking.

Figure G2.1 shows the proposed EIA process flow diagram.

G2.2 Regulatory Standards and Criteria Applicable to the Proposed Development

(1) Philippine Environment Code of 1988 (Presidential Decree No. 1152)

PD No. 1152, otherwise known as the Philippine Environment Code, was approved on June 6, 1988. It prescribes management guidelines aimed to protect and improve the quality of Philippine water resources through classification of Philippine waters, establishment of water quality standards, protection and improvement of the quality of Philippine water resources and responsibilities for surveillance and mitigation of pollution incidents.

(2) Revised Water Usage and Classification/Water Quality Criteria Amending Section Nos. 68 and 69, Chapter III of the 1978 NPCC Rules and Regulations (DENR Administrative Order No. 34, series 1990)

It is within the framework of PD 1152 that the DENR DAO 34 was strictly enforced. DAO 34, series of 1990 embodies the water beneficial usage and classification. Classification refers to current best beneficial use that is expected to last, at least, for the next 10 to 20 years. The following provides the water usage and classification for fresh surface and coastal/marine waters relevant to the proposed development:

Classification of Water and Beneficial Use

Fresh Surface Waters (Rivers, lakes, reservoirs, etc.)		**Coastal and Marine Waters**	
Classification	Beneficial Use	Classification	Beneficial Use
Class AA Class A	Public Water Supply Class I. This class is intended primarily for waters having watersheds which are uninhabited and otherwise protected and which require only approved disinfection in water to meet the Philippine National Standards for Drinking Water (PNSDW) Public Water Supply Class II. For sources of water supply that will require complete treatment (coagulation, sedimentation, filtration and disinfection) in order to meet the PNSDW.	Class SB Class SC	• Recreational Water Class I (Areas regularly used by the public for bathing, swimming, skin-diving, etc.) • Fishery Water Class I (Spawning areas for Chanos - chanos (Bangus) and similar species • Recreational Water Class II (e.g., boating, etc.) • Fishery Water Class II (Commercial and sustenance fishing) • Marshy and/or mangrove areas declared as fish and wildlife sanctuaries

DAO 34 further provides minimum water quality criteria for both surface and coastal waters. This includes standards for raw water used for drinking, standards for protection of aquatic ecosystem both coastal/marine waters and freshwater, standards for recreation, aesthetic values, navigation, etc. This regulatory instrument is essential in maintaining water quality of waterbodies and in pollution control and is used to evaluate if a certain waterbody has already exceeded its acceptable limits for its intended use. Appendix G-2 shows a copy of DAO-34 detailing the water usage and classification as well as the water quality criteria for each of the classification.

(3) Philippine National Standards for Drinking Water 1993 (DOH Administrative Order No. 26-A, series of 1994)

This PNSDW 1993 revises and updates the 1978 National Standards for Drinking Water to guide the waterworks officials, developers and operators of water supply systems, health and sanitation authorities and the general public.

The Standards cover requirements for the acceptable values of the determined water quality parameters: microbiological, physical, chemical and radiological compositions of the water. Also, the Standards define values established in conforming to the medical and health implication of the parameters as opposed to values established to meet aesthetic requirements. Appendix G-3 provides the standard parameters and values for drinking-water quality.

G2.3 Other Laws Related to the Proposed Development

(1) Declaration of National Park, Wildlife Sanctuary and Game Preserve a Certain Parcel of the Land of the Public Domain Embraced and Situated in the Provinces of Bulacan, Rizal, Laguna and Quezon, Island of Luzon (Proclamation No. 1636)

This Proclamation withdraws from sale, settlement, exploration or exploitation and set aside and declare as National Park, Wildlife Sanctuary and Game Reserve, subject to private rights, if any, a certain parcel of land of the public domain in Bulacan, Rizal, Laguna and Quezon. It should be noted that portions of the study area are covered by this Proclamation (refer to Figure G1.1).

The following are among the prohibited acts within the protected area: i) the hunting, wounding, taking or killing of wild animals or birds and/or the destruction of any vegetation or any act causing disturbances to the habitat of the wildlife protected; ii) mutilating, defacing or destroying objects of natural beauty, or objects of interest to cultural communities (of scenic value); damaging and leaving roads and trails in a damaged condition; and iii) construction or maintaining any kind of structure, fence or enclosures, conducting any business enterprise without a permit.

Appendix G-4 presents the Proclamation No. 1636 delineating the area of the reservation.

(2) National Integrated Protected Areas Act (Republic Act No. 7586 of 1992)

The Act provides for the establishment and management of national integrated protected areas system to ensure the protection, sustainable development, and rehabilitation of protected areas for the conservation of biological diversity and enjoyment. The protected areas cover proclaimed national parks, game refuge, bird and wildlife sanctuaries, wilderness areas, strict nature reserves, watersheds, mangrove reserves, fish sanctuaries, natural and historical landmarks, protected and managed landscapes and seascapes as well as identified virgin forests.

For each of the protected areas, a site specific management plan shall be formulated to address the following: i) promoting the adoption and implementation of innovative management techniques, such as management zones, buffer zones for multiple use and protection, habitat conservation and rehabilitation, biodiversity management, community organizing, socio-economic and scientific researches, site-specific policy development, pest management and fire control; ii) providing for the protection of indigenous cultural community domains and interests and for the rights of tenured migrants; and iii) creating closer coordination between and among the DENR, local government, the private sector, and the general public.

(3) Republic Act No. 2152

An act which provides priority of preference when the waters of any source of supply are not sufficient for the service of all those desiring the use of the same, and when priority of appropriation can not be established the order of preference shall be as follows:

- Domestic purposes,
- Agricultural purposes or power development for agricultural purposes,
- Industrial purposes,
- Ponds for fisheries, and
- Mining purposes or milling connected with mining purposes

(4) Republic Act No. 2056

An act to prohibit, remove and/or demolish the construction of dams, dikes or any works in public navigable waters or waterways and in communal fishing grounds, to regulate works in such waters or waterways and in communal fishing grounds, and to provide penalties for it violation and for other purposes.

(5) Act Amending Section 90 of Commonwealth Act No. 141-Public Land Act (Republic Act No. 1273)

Section 1 of RA No.1273 otherwise known as an Act to amend Section 90 of Commonwealth Act No. 141 (Public Land Act) mandates that a strip of 40 meters wide starting from the bank on each side of any river or stream that may be found on the land applied for shall be demarcated and preserved as permanent timberland to be planted exclusively to trees of known economic value. Further, the applicant shall not make any clearing thereon or utilize the same for ordinary farming purposes even after patent shall have been issued to him or a contract lease shall have been executed in his favor.

(6) Forestry Code (Presidential Decree No. 705)

Section 16 (Paragraph 7 and 8) of PD No. 705, otherwise known as "Forestry Code", provides:

- 20 meter strips of land along the edge of the normal high waterline of rivers and streams with channels of at least five meters wide;
- Strips of mangrove or swamplands at least 20 meters wide, along shorelines facing oceans, lakes and other bodies of water and strips of land at least 20 meters facing lakes.

(7) Water Code of the Philippines (Presidential Decree No. 1067)

PD No. 1067, otherwise known as "Water Code of the Philippines", revised and consolidated the laws governing the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources.

Article 51 of this Decree states that the banks or rivers and streams and the shores of seas and lakes throughout their entire length and within a zone of three meters in urban areas, 20 meters in agricultural areas and 40 meters in forest areas, along their margins, are subject to the easement of public use in the interest of recreation, navigation, flotage, fishing and salvage. No person shall be allowed to stay in this zone longer than what is necessary for recreation, navigation, floatage, fishing or salvage or to build structures of any kind.

(8) Procedures in the Retention of Areas within Certain Distances along the Banks of Rivers, Streams, and Shore of Seas, Lakes and Oceans for Environmental Protection (DENR AO No. 05, series of 1997)

It has been observed that in the processing and subsequent approval of isolated and cadastral survey and patents, the provisions of Republic Act (RA) 1273, PD 705 and PD 1067 have not been followed. These areas are crucial to ensure environmental protection, hence, DENR DAO No. 05, series of 1997 was promulgated. DAO 05 embodies the procedures in the retention of areas within certain distances along the banks of rivers, streams, and shore of seas, lakes and oceans in order to promote ecological balance and protection of the environment.

(9) Indigenous Peoples Right Act of 1997 (Republic Act No. 8371)

The Act recognizes the importance and rights of indigenous cultural communities/ indigenous peoples (ICCs/IPs) to preserve their culture. It emphasizes the indigenous concept of ownership that "sustains the view that ancestral domains and all resources found therein shall serve as material basis of their cultural integrity." The rights of ownership and possessions of ICCs/IPs to their ancestral domains shall include lands, bodies of water traditionally and actually occupied by ICCs/IPs, sacred places, traditional hunting and fishing grounds, and all improvements made by them at any time within the domains.

The Act further provides conditions when relocation of IPs is considered necessary. Said relocation should take place only with the free and prior consent of the concerned IPs with the following conditions:

- Relocation to a site, which shall, in all possible cases, be of equal quality and legal status as what previously occupied, and which shall be suitable to provide for their present needs and future development;
- Security of tenure over lands to which they will be resettled or relocated; and
- Compensation for loss, injury or damage as a consequence of such relocation or replacement.

G3 Site Reconnaissance, Data Collection and Initial Environmental Examination (IEE) Study

G3.1 Results of the Reconnaissance Surveys

(1) General

Five (5) observation points were established in the potential impact area of the Kaliwa Low Dam. These are at the following:

- confluence of Kaliwa and Sapang Bukas rivers (Sta. 1)
- upstream of Kaliwa River and/or Sta. 1 (Sta. 2)
- downstream of Kaliwa River and/or Sta.1 (Sta. 3)
- downstream of Kaliwa River and/or Sta. 3 (Sta. 4)
- downstream of Kaliwa River and/or Sta. 4 (Sta. 5)

Another two (2) observation points in the potential impact area of the Agos Dam were establihed:

- confluence of Kaliwa, Kanan and Agos rivers (Sta. 6)
- Kaliwa River upstream of the confluence (Sta. 7)

At the lower Agos River mainstream, one (1) station was established at the on-going bridge construction (Station 8). The estuary (sand dunes) and mangrove areas of Infanta were also covered.

Sites for possible access road to the proposed Kaliwa Low Dam No.2 site were also inspected:

- intersection of Marcos Highway and Sitio Silangan, Barangay Santiago/Saksak, Santa Maria, Laguna (Sta. 9)
- intersection of Marcos Highway and Sitio Cueba, Barangay Santiago/Saksak, Santa Maria, Laguna (Sta. 10)
- intersection of Marcos Highway and Sitio Kamagong/Little Baguio, Barangay Magsaysay, Infanta, Quezon (Sta. 11)

Refer to Figure G1.2 for the site survey points.

For water conveyance, the portions of the routes of the following schemes were traversed:

- Scheme No. 1 Laiban Intake-Pantay-Taytay-Metro Manila (WCS-1)
- Scheme No. 2 Kaliwa Intake-Tanay-Laguna Lake-Metro Manila (WCS-2)
- Scheme No. 3 Kaliwa Intake-Tanay-Northern Coast of Laguna Lake-Metro Manila (WCS-3)
- Scheme No. 4 Kaliwa Intake-Abuyod-Angono-Metro Manila (WCS-4)[1]

[1] Referred to as the Kaliwa-Taytay Waterway in the Feasibility Study (2002).

(2) Reconnaissance Survey of the Kaliwa Low Dam/Agos Reservoir Area

Barangay Daraitan is one of the communities that will mostly be affected by the development of the Kaliwa Low Dam and the Agos Dam.[2] The Barangay is part of the Kaliwa Watershed that was classified as a forest reserve under Proclamation No. 573 in 26 June 1969 and also within the declared National Park and Wildlife Sanctuary under Proclamation No. 1636 of 18 April 1977. Under the law, the DENR-Provincial Environment and Natural Resource Office (PENRO) of Rizal represented by the Community Environment and Natural Resources Office (CENRO) of Antipolo City has the jurisdiction, both administration and management, of the area but with close coordination with the local government unit (LGU) of Tanay. Based on the municipal plan, the designated dominant land uses of Brgy. Daraitan are: forest protection/development, agriculture and human settlement. A small portion of the Barangay, Sitio Tinipak, is planned for eco-tourism development. Tinipak is about an hour walk through a footpath on the left side bank of Kaliwa River (facing downstream). Its major attractions are large limestone outcrops, pristine water and cool, invigorating climate.

There is also a plan to put up a "hanging" bridge over Daraitan River because during the months of September and October, flooding usually occurs and this isolates the Barangay. At present, the LGU of Tanay is actively promoting Brgy. Daraitan as one of the major tourist spots in Tanay. The area has a very high potential for tourism development as an outdoor recreation and ecological destination project. Furthermore, Daraitan River was adjudged as the "cleanest river" of the province in 2000.[3]

The Municipality of General Nakar in Quezon Province has a pending boundary dispute with Tanay, Rizal and the area being disputed is Barangay Daraitan. At present, Tanay assumes political and administrative jurisdiction over the Barangay.

Diarrhea, intestinal parasitism and skin diseases are among the notifiable water-related diseases in Tanay.[4] Lately, blood test positive for malaria is found. A midwife is assigned to the Barangay to cater to the health services needs of the population but her schedule is irregular. Water vector diseases associated with dam construction are malaria, filariasis, and dengue or H-fever. The control and prevention of these diseases and the prevention of an introduced water-based diseases, e.g., schistosomiasis should be taken into account including the provision of sanitary latrines and promotion of proper hygiene practices.

Indigenous peoples (IPs) in Brgy. Daraitan are the Dumagats and Remontados. The latter are half-breds as a result of intermarriage between a Dumagat and a lowlander. Sitio Magata has the highest percentage of IPs with 90% of its population belonging to this group. During the feasibility study stage, a census of the indigenous peoples (IPs) who would be affected by the proposed development

[2] The EIA Study carried out in the F/S stage indicated that the residential area of Brgy. Daraitan would not be submerged.
[3] Pers. communication, Engr. A. Sunga-Municipal Planning and Devt. Coordinator of Tanay, Rizal.
[4] Pers. communication, Ms. N. Galeno-Nurse, Rural Health Unit of Tanay, Rizal.

shall be conducted in line with the Indigenous Peoples Right Act of 1997 (R.A. No. 8371- Part II, Section 4 of the Implementing Rules and Regulations).

NGOs present in Brgy. Daraitan that are involved in environmental activities are:

- Sierra Madre Multi-purpose Cooperative, accredited to participate in the DENR Community Based Forestry Management Program involving 200 hectares. Contract period is 25 years.
- Sultan Kudarat Farmers Cooperative, plans to involve in 150ha forest development activities. Its application is still being process.

(a) Station 1-Confluence of Kaliwa and Sapang Bukas rivers (Plates 1 and 2)

This Station is located at coordinates 14^{o} 35' 46.8" latitude and 121^{o} 25' 39.5" longitude.

Riverine Ecosystem

At this junction, the economic importance of Kaliwa River is primarily for sustenance fishing of families and used as a transport mode. Major species caught are: tilapia (*Tilapia sp.*), carp (*Cyprinus sp.*), catfish (*Clarias*) and mudfish (*Ophiocephalus*). However, there are times when catch would yield about 20kg and this would be sold to the neighborhood. Fishing activities are usually done during dry season when there is absence of strong currents. From an interview with a fisherman, it was reported that migratory species of fish such as eel (*Anguilla sp.*) and mullet (*Mugli sp.*) reached this area.

The river manifested a proliferation of filamentous blue-green algae indicative of high organic loading in the water column. It was found out that this phenomenon only occurs during the months of May and June when water level is low and flow is sluggish. These algal blooms are usually flushed out at the onset of the rainy season when there is high water discharge. According to the residents, the river water becomes clear again of these nuisance organisms.

Sapang Bukas (a tributary of Kaliwa River) is sometimes called Sapang Alas-Asin by the residents of Brgy. Daraitan. (referred to as Sabalanasasin River in the NAMRIA map). One of the rivers that fed Sapang Bukas River is Sampaloc River. This river traverses the populated area of Barangay Sampaloc and the military camp of Camp Capinpin. These areas are possible sources of organic pollution. In the over-all development strategy of the Municipality of Tanay, Brgy. Sampaloc has been designated as the next major urban center and an agro-forestry processing center. With its role, additional pollution load to its ecosystem is expected.

Terrestrial Ecosystem

Patches of upland agricultural areas planted to corn (*Zea mais*) in steep/hilly areas were observed. This agricultural practice often results to soil erosion and the eventual siltation of the river.

Natural vegetation can still be found in the hills consisting mostly of

shrubs/brushes and secondary growth forest. Cogon grasses (*Imperata sp.*) have supplanted natural vegetation where shifting cultivation or remnants of overlogged areas have previously existed.

An eagle (*Pithecophaga jeferryie*), a bird of prey, was seen flying, an indication of a balance ecosystem. The Philippine eagle is listed as rare and endangered specie by the PAWB/DENR and the International Union for the Conservation of Nature and Natural Resources. A complete list of rare and endangered species of wildlife is shown in Appendix G-5.

(b) Station 2-Upstream of Kaliwa River and/or Station 1 (Plates 3 and 4)

This Station is located at coordinates latitude 14^{o} 36' 34.6" North and longitude 121^{o} 25' 26.1" East.

Riverine Ecosystem

Observed river uses in this portion are for washing of clothes, bathing and navigation of illegally cut logs or aptly termed "small-scale community logging" being practiced by the residents for lack of alternative livelihood. Log ponds for storing these logs prior to transport by land can also be observed. Since the major activity in this section of the river is riverine transport of logs, fishing activity is minimal.

Dense mats of filamentous blue-green algae are also observed in this area. Agricultural inputs, e.g., fertilizers to ricelands upstream of Kaliwa River and domestic wastewater from settlements (about 7 Barangays) can be major sources of organic pollution load of the river.

Terrestrial Ecosystem

Grasses (parang type) are the land dominant vegetation within the vicinity of the area. Soil erosion is observed in rolling and hilly areas where population pressure for housing is being experienced. Application of appropriate control measures, e.g., vegetatively or mechanically, can minimize further soil losses and reduce siltation of waterways.

With the volume of cut logs being transported daily in the river, uncontrolled illegal logging in Kaliwa watershed led to forest denudation. It was reported that the old growth forest (primary growth of dipterocarp trees) has been depleted to a mere 9% of the watershed's original forest cover within 20 years time (27,600ha. in 1979 to only 2,479ha. in 1999).5 Destruction of forest cover results to wildlife habitat loss, and consequently diminishing biodiversity and wildlife. The DENR-Forest Management Bureau (FMB) through its Water Resources Development Project/Watershed Management Improvement Component has drawn out a watershed development and management plan for the Kaliwa catchment basin. One of the Plan's objectives is "to formulate strategies to rehabilitate, manage and restore the productive and protective functions of the Kaliwa Watershed".

[5] 1979 data from Synergistics Consultants, Inc. and 1999 data from REECS.

(c) Station 3-Downstream of Kaliwa River and/or Station 1 (Plates 5 and 6)

This Station is located at coordinates latitude 14° 36' 1" North and longitude 121° 25' 58.5" East.

Riverine Ecosystem

The blue green algae still pre-dominates the river water and in areas where there are no algae, the water is clear. Bathing and washing of clothes of residents living nearby are observed. The vegetation on both sides of the banks serves as filter to eroded soils.

The amount of suspended solids or sediment loads entering the river must be controlled. The possible sources of siltation are from the surface run-offs of the developed land (housing and farms) and the upper slopes of the hills/mountains.

Terrestrial Ecosystem

Fruit tree farms for citrus production and mixed orchard land dominate the land use of the flat and gently rolling areas. At the hillside, grazing and "kaingin" (slash and burn farming) making in the reproduction brush and grassland areas can be observed. Some of the species found are anabiong (*Trema orientalis*), tibig (*Ficus nota*), and takip-asin (*Macaranga tanarius*). The importance of these species is mostly for ecological diversity.

Bamboo plants (*Bambusa sp.*) along the river bend are present and control the erosion of the banks. Thick secondary forest is observed at the ridges of the hills/mountains. The source of income of some families in this area is gathering of rattan poles, a forest product from the Kanan watershed.

(d) Station 4-Downstream of Kaliwa River and/or Station 3 (Plates 7 and 8)

This Station is located at coordinates latitude 14° 36' 17.3" North and longitude 121° 26' 30.8" East.

Riverine Ecosystem

Water striders (*Gerridae*) can be seen at the water surface. Dense mats of filamentous blue-green algae are still observed in this section of the river. No economic activity was observed in this part of the river.

Limestone outcrops in the riverbed have been quarried/mined using power drills as manifested in the drilled blocks left behind. Mining has already been stopped due to the issuance of the DENR-DAO No. 34, series of 1993, nullifying the Authority to receive application and issue mining/quarrying permits covering the areas embraced by Proclamation Nos. 1636 and 1637 without clearance from the Parks and Wildlife Bureau and the Housing Land Use Regulatory Board. Small-scale mining/quarrying for landscaping of gardens has also been practiced. In the past, in spite of being located within a Protected Area, there has been indiscriminate limestone mining/quarrying.

Terrestrial Ecosystem

The ridge and mid-level of the mountains are covered by residual forest composed of dipterocarps, non-dipterocarps, and lesser known species. This vegetation cover is still home to some migratory and permanent endangered faunal species: Philippine eagle (*Pithecophaga jeferryii*)[6], deer (*Cervus marianus*), wild pig *(Sus philippinensis*), monitor lizard (*Varanus salvator*) and kalaw (*Buceros hydrocorax*).[7] These species are important components in the stability and productivity of the ecosystem.

(e) Station 5-Downstream of Kaliwa River and/or Station 4 (Plates 9 and 14)

This Station is located at coordinates latitude 14^{o} 36' 11.3" North and longitude 121^{o} 26' 39.7" East.

Riverine Ecosystem

Location of Tinipak Spring along the riverbank. The spring is the source of drinking water for the residents of Daraitan during water shortage/drought. It has an estimated catchment area of 42 sqm. Another unnamed spring is also located in the vicinity. The site of the proposed eco-tourism development of the LGU is upstream of this spring.

The dried-up portion (occurs during summer only) of the riverbed is covered by weeds: cogon (*Imperata cylindrica*) and talahib (*Saccharum spontaneum*). The economic importance of these species is for roof thatches and for pasture grass.

Seven fishermen were observed spear fishing. Caught species were carp (*Cyprinus*), tilapia (*Tilapia*) and mudfish (*Ophicephalus*).

Terrestrial Ecosystem

Vegetation type in the steep slopes of the mountains is of residual forest, composed mostly of dipterocarps such as white lauan (*Shorea contorta*), tanguile (*Shorea polysperma*), bagtikan (*Parashorea malaanonan*), and guijo (*Shorea guiso*). These species are used for timber.

Patches of introduced species such as ipil-ipil (*Leucaena leucocephala*), mahogany (*Swietenia macrophylla*) and yemane (*Gmelina arboea*) are found in the banks. About a kilometer from this spring is a commercial fruit tree farm planted to mangoes (*Mangifera indica*).

(3) Reconnaissance Survey of the Agos River Confluence

(a) Station 6- Confluence Point of Kaliwa, Kanan and Agos Rivers (Plates 15 and 16)

This Station is located at coordinates latitude 14^{o} 41' 22.3" North and longitude 121^{o} 31' 43.4" East.

[6] No sighting was observed during the conduct of the EIA Study.
[7] MEMSI IEE Report, 2001.

Riverine Ecosystem

Agos River functions as navigational route, fishery ground and sources of domestic water (bathing, washing and livestock raising) and agricultural water. Fishes caught are ayungin (*Hypothalmicthys*), banaks (*Elops sp*.), gurami (*Trichogaster sp*), tilapia (*Tilapia*), goby (*Gobiidae*), hito (*Clarias sp*.), eel (*Anguilla sp*) and other economically important species. Prawns (*Macrobrachium*) and freshwater shrimps (*Palaemon*) are also caught in marketable quantities.

Prawns (local name: ulang) and eel (local name: palos) are considered as catandromous species, i.e., adults migrating to river mouths to mate and lay their eggs and the young migrating upstream to grow.

The presence of benthos from the two orders of insect larvae (*Trichoptera* and *Ephemeroptera*) is an indicator of a well-aerated water and a manifestation of good water quality.[8] Filamentous blue-green algae are also found at the edge of the river where flow is sluggish. The quantity is smaller compared to the upstream portion of Kaliwa River.

Terrestrial Ecosystem

Extensive logging at the Kanan River watershed as indicated in the amount of logs being transported at the confluence posed a serious threat to the primary (old growth) forest. Although the existing natural vegetation is enduring pressure from the unabated logging operation, the watershed still harbors high species diversity. Nine (9) floral immediately threatened or vulnerable species were listed.[9] These include: trees of premium timber, almaciga (*Agathis philippinenses*) and bago (*Gnetum gnemon*), rattan (*Calamus sp*.); and rare species, *Dorystephania luzoniensis* (an orchid) and *Podochilus intricatus*. Likewise, a number of faunal rare and endangered species were observed: horned forest frog (*Platymantis cornutus*), Philippine bullfrog (*Rana magna*), Philippine bent-toed gecko (*Crytodactylus philippinicus*), Philippine trogon (*Harpactes ardens*), rufous hornbill (*Buceros hydrocorax*), tarictic hornbill (*Penelopides panini*), white-winged flying fox (*Ptenochirus jagori*) and Philippine deer (*Cervus marianus*).[10]

At the confluence itself, hardwood forest still remains along the steep slopes, while along the riverbanks of both Kanan and Agos rivers, cash crops such as coconuts (*Cocus nucifera*), bananas and other fruit trees were commonly observed.

(b) Station 7- Kaliwa River Upstream of the Confluence (Plates 17 and 18)

This Station is located at coordinate latitude 14° 41' 17.1" North and longitude 121° 31' 33.6" East.

[8] ibid
[9] Ibid.
[10] NPC Report

Riverine Ecosystem

Filamentous blue green algae can be observed along the riverbank where the flow of water is sluggish. At the central portion where the current is strong, "bakyo", a goby can be caught in marketable quantity. This fish specie stays on fast current and feeds on algae thriving on rocks.[11]

Terrestrial Ecosystem

The main settlement of Barangay Pagsangahan, Gen. Nakar, Quezon is situated on the upper portion of the bank of Kaliwa River (west side facing downstream). It lies on a gently sloping area cultivated to coconuts and fruit trees. In areas where steep slopes exist, old growth forest predominates. As part of the Kanan watershed, the same biological diversity subsists in the area, although to a lesser extent, due to diminishing forest cover.

Barangay Pagsangahan has a total of 571 households based on its 2001 census. The Barangay has 5 big upland Sitios. Only the Barangay proper (main settlement) with around 60 houses is located near the bank of Kaliwa River. At the Barangay proper, there is a primary school, a Barangay health station and a church. All these structures are made of concrete materials with GI roofings.

(4) Reconnaissance Survey of the Lower Agos River, Estuary and the Mangrove Area in the Northern Part of Lamon Bay

(a) Station 8-Lower Agos River Mainstream (Plates 19 and 20)

This Station is located at coordinates latitude 14°45'5.4" North and longitude 121°37'9.6" East and the site of an on-going bridge construction.

Riverine Ecosytem

From the confluence, the Agos River is primarily used for navigation and irrigation. Other than the gravel road (passable only during summer) that runs parallel with the river in Barangay Magsaysay, Infanta, the transport of goods and farm products to and from the upland communities/settlements, including forest products is being done in Agos River. Also, the Agos River Irrigation System of NIA supplies irrigation water to 1,280 ha of farmlands with a flow requirement of 2.4 m^3/sec. or about 3% of the average flow of the river.

Other beneficial water uses of Agos River are for fisheries and domestic uses such as bathing, washing and livestock raising. Sand quarrying is also practiced.

Terrestrial Ecosystem

Along the bank are built-up areas of the riverine Barangays of Infanta, namely; Magsaysay, Banugao, Catambungan, Ilog, Pilaway, and

[11] Pers. communication, a fisherman from the lower reaches of Kaliwa River.

Pinaglapatan and of Gen. Nakar; Mahabang Lalim, Batangan, Maigang, Minahan Sur, and Anoling. Portions of some of these Barangays are covered by Proclamation No. 1636. Because these areas have already been settled and/or farmed, an application to DENR for micro-zonation was submitted to determine which portion of the protected area should be preserved for their environmental values.

The current land uses of these Barangays include riceland, orchards and settlements.

(b) Coastal Areas of Infanta

The coastal zone of Infanta comprises of three distinct ecosystems: i) the sand dunes at the estuary, ii) the coastal mangrove area, and iii) the area near coastal waters which is usually inundated one or more times in any given year.

Estuarine Ecosystem

A notable sub-system within the shoreland is the sand dune system at the Agos River mouth that provides special habitats for crustaceans and shellfish as well as support for the shoreline. The formation of such sand dunes is a result of continuous deposition of sand from the Agos River directly affecting Brgy. Pinaglapatan and other nearby Barangays in the Infanta plain. The river carries an appreciable volume of sand and soil. Data from the Banugao Gauging Station in the Agos River estimated an average yield of sediment load of 557 m^3/km^2/year (estimate in 1981 JICA study). As a result, sand and gravel quarrying are regular economic activities in the area.

The beach type grass predominates the vegetation in these dry sandy beaches. A few stumps of mangrove trees are observed indicative that the area has been heavily logged-over.

Coastal Mangrove Ecosystem

The municipality of Infanta has a large tidal flat covering the coastal Barangays of the northern part of Lamon Bay, namely: Silangan, Tudturan, Maypulot, Antikin, Cawayanin, Balobo, Langgas, Alitas, Anibong, Binonoan, Amolongin, Pulo and Bacong. Barangay Silangan has a large tract of riceland on its western side, while its eastern side has a thick vegetation of mangrove forest. The rest of the Barangays basically exhibits a swampland ecosystem with thick nipa palm (*Nypas fruticans*) and mangrove cover as one approach seaward. Small streams and creeks that traverse these Barangays drain into Lamon Bay.

Agos River does not drain directly into this swampland/mangrove area. However, during Agos River overflow, floodwaters reach this area. Sediments carried by the floodwater provide additional nutrients in the area, which adds to the productivity of the ecosystem.

Swamplands/mangrove ecosystem provides shellfish, crustaceans breeding and nursery ground as well as food source for fish and other marine

organisms. This ecosystem also acts as a buffer to wave action regarding in-coming waves, the mangrove fringe acts as a sediment trap that slows out-flowing waters, thereby allowing sediments to settle out.

The most part of the mangrove forest nearest the land area seems to be affected by population pressure. Rapid encroachment/conversion of these mangrove areas was considered severe as observed (base reference: NAMRIA map and interviews). Development includes conversion to riceland, cocoland, fishpond and housing. Conversion of mangroves into fishpond should be controlled partly because the preservation of mangroves as spawning ground for many fish species determine to a great extent the viability of municipal and near-shore fisheries. The other reason is the existence of nipa palm-based livelihood activities. These include small-scale distilleries producing nipa liquor ("lambanog"), vinegar and palm juice tappers. Nipa shingles are also produced by some families and are additional sources of income.

Nearshore Coastal Ecosystem

The nearshore coastal Barangays facing Polilio Strait are: Boboin, Libjo, Bantilan, Abiawin, Binolasan and Dinahican. These areas are usually inundated when there is high tide water level coupled with heavy rains and strong winds. The shoreline is characterized by sandy beaches and in between residential and resort developments are patches of beach-type grasses and coconut plantations. At the right side of the national road facing seaward, the low-lying areas are planted to rice and interspersed with nipa palms. At Brgy. Dinahican, the Philippine Fisheries Development Authority (PFDA) has recently completed the municipal fishing port. The PFDA has programmed the construction in Infanta because the fishing ground in the area is one of the very few fishing grounds in the Philippines considered as unexploited. The fishing area consists of Polilio Strait, Lamon Bay and its offshore waters, the Philippine Sea/Pacific Ocean. Infanta also supports extensive brackishwater fisheries.

(5) Reconnaissance Survey of the Possible Access Road to Kaliwa Low Dam NO.2 Area

(a) Station 9-Intersection of Marcos Highway and Sitio Silangan, Barangay Santiago/Saksak, Santa Maria, Laguna - Alternative 1

The verified location is at coordinates latitude 14^{o} 33' 48.4" North and longitude 121^{o} 27' 40" East.

This unused logging road is presently the access to reach the Sitio Queborosa, Brgy. Magsaysay, Infanta, Quezon, about 2.5 to 4 hrs walk from Sitio Silangan or through horseback riding. Road length is about 8 km. The terrain is rugged with a "parang" type of vegetation.

(b) Station 10-Intersection of Marcos Highway and Sitio Cueba, Barangay Santiago, Santa Maria, Laguna - Alternative 2

The verified location is at coordinates latitude 14^{o} 32' 20.5" North and

longitude 121° 28' 49.6" East.

This is also an old logging road already supplanted by tall grasses (*Saccharum*). The unused road is about 11.5 km from the intersection of Marcos Highway and the footpath going to Sitio Cueba. This road needs scraping in areas that are eroded and is more appropriate to rehabilitate compared to the other two (2) options.

(c) Station 11-Intersection of Marcos Highway and Sitio Kamagong/New Little Baguio, Barangay Magsaysay, Infanta, Quezon - Alternative 3

The verified location is at coordinates latitude 140° 33' 28.7" North and longitude 121° 28' 59.9" East.

This alternative is about 8 km from the Marcos Highway to Sitio Queborosa. Only 2 km is developed which was formerly used as quarry road and with the remaining 6 km still undeveloped with stiff slope. Shrubs and bushes cover the undeveloped portion.

(5) Reconnaissance Survey of the Proposed Routes of the Water Conveyance

The descriptions presented herein for the proposed water conveyance routes are general in nature since no detail plans have yet been drawn (to be prepared during feasibility study). Descriptions are just indicative of the environmental setting as the bases are plans drawn only on a map of 1:50,000 scale and aerial photos. Only accessible areas were traversed and evaluated.

(a) Laiban Intake-Pantay-Taytay (WCS-1)

The tunnel route would pass from the Laiban Intake across Mt. Kamunay, a part of the Marikina watershed and then through Mount Balidbiran and Mt. Tanauan. Water is treated at the Pantay Water Treatment Plant and from Pantay, the pipeline passes through grassland/ shrubs and agricultural lands. The tunnel then crosses the southern part of Antipolo City and traverses middle class subdivisions until it reaches the boundary of Taytay where the treated storage reservoir is proposed to be located. After which, the conveyance passes through the densely populated area of Taytay running parallel to the roadways. The waterway route corresponds to the Alternative Plan A studied in Part E of this Volume.

(b) Kaliwa Intake-Tanay-Laguna Lake (WCS-2)

The north-easternmost segment of the proposed tunnel (from the intake structure) is located in Brgy. Magsaysay, Infanta, Quezon until it reaches the boundary of Tanay, Rizal. It passes through the Marcos Highway-Daraitan Junction to the lowlands of Tanay. The tunnel route passes through forested areas grown with dipterocarps and fruit trees and through grassland and open spaces. This route also runs through Sitio Agoho, Brgy. Sampaloc, Tanay.

From Tanay, a submarine pipeline is installed that will pass through Laguna de Bay. The lake is classified as Class C waters suitable for fishery and aquaculture development. At present, however, the lake is a multi-use

resource; it functions as source of raw domestic water supply, transport and navigational route, recreational ground, source of industrial and agricultural waters, hydropower and as a receiving environment for domestic and industrial waste water. As a receptor of high pollution load, deep sediments that have accumulated characterize the lake substrate. The pipeline passes through these areas and also through numerous fishpens and fishcages.

This waterway route was conceived during the Inception Report preparation and has now been dropped in the present study.

(c) Kaliwa Intake-Tanay-Angono (WCS-3)

The same configuration exists as WCS-2 except that the transmission pipeline route passes through the northern coast of Laguna Lake then Metro Manila. From the Kaliwa Intake in Brgy. Magsaysay, Infanta, Quezon, the waterway traverses through Tanay, Rizal (Marcos Highway Daraitan Junction, Sitio Agoho, Sampaloc), Bry. San Lorenzo, Pililia, Barangays. San Guillermo and Prinza in Morong, Rizal.

The pipeline runs parallel to the existing national highway in Tanay and upon reaching Morong, it traverses Brgys. San Guillermo and Prinza. The vicinity land uses of these areas are ricefields and residential uses. In Morong, conversion from agricultural to residential use was observed by the presence of emerging subdivisions along the highway.

This waterway route corresponds to the alternate waterway Plan B1-a studied in Part E. This plan was also finally abandoned from further study.

(d) Kaliwa-Abuyod-Angono or Kaliwa-Taytay Waterway (WCS-4)12

From the proposed Kaliwa Low Dam, the tunnel passes through shrubs/ grasslands and agricultural land with an undulating and sloping terrain. It cuts across several creeks before finally traversing the Maharlika (Marcos) Highway upon reaching the northern portion of Barangay Cuyambay. The tunnel traverses further through grassland/agricultural area within the undulating hills and mountains. Upon reaching Lagundi (Morong) where the proposed water treatment plant is located, treated water is conveyed to the service reservoirs of Taytay and Antipolo and then distributed to Metro Manila and Antipolo.

The route corresponds to alternative Plan B1-c, which is envisaged under several Development Scenarios examined in Part E.

(e) Laiban-Tanay-Angono (WCS-5)

From the proposed Laiban Low Dam, the tunnel will pass through relatively thin ridges of forest/shrub land and agricultural land with an undulating and sloping terrain. The tunnel will cut across upper reach of Tanay river before reaching a powerhouse located on the right bank of the Tanay river. Water is then conveyed through pipelines and a tunnel to a water treatment

[12] Refer to Footnote 1.

plant located north of Karan Batu. Present land use of the water treatment plant site is plantation of fruits, coffee and other agricultural crops. Then, water is further conveyed to a service reservoir at Angono by pipeline and tunnel.

This waterway is proposed for Alternative Development Scenario H. The route after the water treatment plant corresponds to alternative Plan B1-c examined in Part E.

G3.2 Data Collection and Meetings with Various Government Agencies and Communities Involved

(1) Review of Existing Environmental Studies

A review of the various project reports and documents prepared by MWSS, DENR, JICA, NPC and other agencies related to the proposed development was undertaken. The following provides brief assessment of each document.

(a) Manila Water Supply III Project (Appendix E, Environmental Studies), Presidential Inter-Agency Committee for the Re-Study of the Marikina River Project, Electrowatt Engineering Services, Ltd., et al, December 1979

This study was conducted to assess qualitatively the existing environmental conditions of the Kaliwa and Marikina River Watersheds and determine possible environmental impacts of constructing dams across Marikina and Kaliwa Rivers. The study mainly dealt with collation and analysis of primary data on socio-economics, vegetation, land use, wildlife and pedology and secondary data on geology, hydrology, meteorology and water quality.

Various impacts of the proposed dam construction were presented using the suggested format by the then National Environmental Protection Council (NEPC) of the Ministry of Human Settlements for the preparation of Initial Environmental Examination (IEE) report.

The IEE provides discussions on the identified environmental impacts and the corresponding mitigating measures. Based on the results of analysis, the proposed action would result to impacts ranging from low negative to high positive environmental impacts on the physical and biological systems. However, high negative cultural impacts are predicted to occur, particularly on the life styles and population density.

The proposed action is expected to involve extensive physical development, thus natural conditions of the sites will be disturbed. Change in land use features such as the inundation of the reservoir area is likewise expected. Impoundment will also affect the water quality especially in view of existence of a number of agro-industrial farms in the watershed. However, it was noted that there are no unfavorable effect foreseen on the present fish population. Also, the vegetation types to be affected are those of poorer ecological quality and the displaced fauna will be able to re-establish themselves in the immediate surroundings of the project site

On the socio-cultural aspect, the proposed action was predicted to cause involuntary changes in the present lifestyle of the people residing in the area. Their living conditions, beliefs, norms, standards will greatly change in accordance with their new environment. Eventually, an accompanying decrease in population density was expected to take place as a consequence of relocation of human settlements in the project site. However, the study did not mention any relocation plan for the affected residents especially those occupying the reservoir areas.

(b) Laiban Dam Project, MWSS, 1986

The MWSS undertook an environmental impact assessment of the proposed Manila Water Supply Project III in 1986. The Environmental Impact Statement (EIS) Report conformed to the requirements of the NEPC in applying for the Environmental Compliance Certificate (ECC). Generally, the EIS structure also complied with the World Bank and Asian Development Bank guidelines but identification and assessment of environmental impacts were not treated in sufficient details to satisfy the standards of the banks.

The 1986 EIS identified environmental impacts of all components of the proposed development, including the dam, reservoir, pipelines, tunnels, hydroelectric plant, water treatment plant, water storage basins and pump stations. Impacts predicted ranged from low negative to high positive environmental impacts. Similar to the IEE conducted in 1979, the proposed project was predicted to have high positive impacts on mineral resources, soils and occurrence of erosion.

NEPC issued an ECC to Metropolitan Waterworks and Sewerage System (MWSS) for the Manila Water Supply Project III in August 1986. The ECC specified nine conditions that include biological controls for malaria and other insect-related diseases, epidemiological monitoring, seismic monitoring, livelihood assistance for displaced minorities, resettlement management, implementation of specified sludge disposal methods, submission of contingency plans, application of soil erosion controls and adoption of air, water and noise impact mitigation measures during the construction phase.

(c) Kaliwa Watershed Rehabilitation and Management Plan, Province of Rizal and Quezon, Forest Management Bureau and Resources, Environment and Economic Center for Studies, Inc. (REECS), December 1999

A Plan/Study to develop and manage the Kaliwa Watershed was prepared in 1999, in recognition of the paramount importance to mitigate the adverse impacts of the water crisis in the country. Its primary objective was to organize, mobilize and capacitate the watershed stakeholders to become active partners of the FMB in implementing re-vegetation and sustainable management strategies transforming the watershed as a productive area.

Part of the Plan/Study is the presentation of the present socio-institutional,

economic, biophysical and environmental characteristics of the watershed area.

The Study identified the following existing problems in the Kaliwa watershed: illegal timber poaching, continuous grazing, illegal gathering of fuelwood, kaingin making and forest fires.

(d) Laiban Dam Project, Final Report on Environmental Appraisal of Project, GHD, Ltd. et al, July 2000

This environmental appraisal in July 2000 was conducted to re-examine the potential environmental impacts of the proposed water supply project. The appraisal presented the scope of EIS and findings as well as the conditions of ECC issued in 1986 for the project. Due to the lapse in time and modifications to the project, the ECC is considered to be no longer valid. A new ECC should therefore be obtained and the existing EIS need to be updated. During this stage, the DENR required preparation of a new EIS to allow proper assessment of the environmental impact of the proposed development.

The appraisal also provides the identification and assessment of environmental issues. Recommended actions followed every status of existing physical, biological and human environment presented in the 1986 EIS. Current geological study, description of topography, mineral resources, current analyses of water samples, more detailed study on the species of fish, terrestrial vertebrate, description of the location of the main population centers, extent of land ownership and presence of indigenous cultural communities or indigenous people within the watershed are among the recommended actions enumerated in this Appraisal.

The appraisal further recommended action to update the anticipated environmental impacts and mitigation measures listed in the 1986 EIS. Among which include the provision for active protection of the watershed from illegal activities which may degrade the quality of water in the reservoir, implementation of surface water protection strategies during construction and operation of the dam and other project components such as protection of surface waterways from sediments in runoff water, inclusion of Barangays. Pintung Bocawe and Daraitan in the relocation census, as residents of these Barangays may need to be relocated, archaelogical artifacts survey in the affected areas and identification of requirements of grave sites in areas to be flooded or disturbed regarding relocation of the graves.

(e) EIS for Kanan B1 Hydroelectric Power Project, National Power Corporation, MEMSI, October 1994

The EIS of the proposed Kanan B1 Hydroelectric Power Project was undertaken to establish potential significant impacts that may result from the proposed action and feasible alternatives and recommends

environmental protection measures and propose management plans to mitigate significant adverse impacts.

Results of the study revealed that there were five critical environmental issues: construction hazards, resistance to the project, fear of dam failure, loss of income from illegal logging and inundation of settlements and food source areas of 25 Dumagats.

Construction hazards may be due to blasting and hauling of spoils that could affect the health and safety of workers and nearby residents. The Study recommended environmental protection measures that include the use of proper blasting techniques, containment of spoils and the construction of check dams and silt control devices.

During the "Awareness and Perception on the Project" survey conducted for the Study, a substantial proportion of residents of the affected Barangays did not favor the project. Major reasons for the resistance to the project include fear of dam failure, prohibition of access to forest products, which are their main source of livelihood and alleged insincerity of government agency in compensating the affected community for losses due to construction of project facilities. To address such issue, the Study recommended a concrete demonstration of intent to honor commitments regarding compensation for losses due to project and the immediate and extensive implementation of communication strategy.

The Study also revealed that 90 percent of the total income derived from forest-based income was from illegal logging. Once operational, the dam will present a physical barrier thus logging will be significantly affected and river navigation of the logged timber will be impaired. The catchment area upstream of the dam will be protected from logging. The Study recommended development of livelihood programs in order to mitigate or offset such impact. The program will include training component that will prepare the affected community in alternative livelihood schemes and will provide seed money to start micro enterprises.

The economic losses to the 25 Dumagats families living or cultivating in the potential dam area include those arising from the inundation of their makeshift houses and crops and improvements. A resettlement plan and payment packages were proposed to mitigate and offset this impact.

On the other hand, the Study presented the predicted economic and social benefits of the Kanan B1 Project. These benefits include watershed protection, mandatory payments and benefits, improvement of agricultural production and other positive externalities on local economy and environment.

The Study concluded that there were no significant hazards that may endanger the environment provided that the proposed environmental protection measures will be effectively implemented during the different phases of the project. Benefits of the project will be more than enough to

offset the economic and social costs to the affected people and the environment.

(f) Pre-Feasibility Study for the Agos River Multi-Purpose Development (Preliminary Environmental Examination, Draft Report), MWSS-EDCOP, May 2001

This preliminary environmental investigation/study presents the general environmental conditions of the project area, impact prediction and evaluation and proposed mitigation and enhancement measures. Majority of baseline data presented in this Study, e.g., physical and biological environments, were taken from secondary data, specifically from the Kaliwa Watershed Management Programme Report of the FMB/REECS and Reconnaissance Survey Report of Kanan Watershed of the DENR Region IV-A.

Based on the preliminary investigation/study, implementation of the proposed project would result to significant negative environmental impacts such as loss of agricultural and forest lands/deforestation, disruption of biological productivity and diversity in the area, alteration of hydrology and limnology of the river system and possible inundation of Barangay Daraitan. Potential positive impacts were also presented in the Study, which include the hydropower generation, more reliable and higher quality of water supply, reduced burden on forestlands and employment generations.

Likewise, preliminary investigation/study presented proposals in mitigating the significant impacts of the proposed development. Environmental and social management measures include the establishment of compensatory parks or reserved areas that will make up for the loss of wild lands and wildlife habitat, protection of remaining agricultural and/or forestlands, maintenance of minimum flow for fisheries and provision of fish ladders and other means of passage, protection of spawning grounds, and development and implementation of a resettlement plan to relocate the affected people to a suitable area.

The preliminary investigation/study further recommended the establishment of environmental and socio-economic units on the project site to collaborate with counterpart units within the river basin authority or similar agency so that specific river basin-wide environmental management initiatives can be drawn up and implemented for the long term management of environmental impacts.

(2) Baseline Data Collection

Data collection, both secondary and primary, was undertaken parallel to interviews with key informants. Baseline secondary information on the physical, biological and socio-economic characteristics of the study area was gathered from the various studies and reports generated since 1979 including the most recent study, the Initial Environmental Examination, conducted by MEMSI last July 2001 for this

particular Master Plan. The information was used, along with the primary data, in the situational analysis and impact identification.

These existing secondary data were supplemented by actual field investigations (refer to G2.1 above). The investigations added information for an assessment of impacts to the physical, biological and socio-economic environment arising from the proposed development. Among the investigations conducted for such purpose include the following: i) ground trothing, ii) field consultations, and iii) expert opinions.

Reports obtained during the course of this investigation and used in the preparation of this preliminary environmental report are listed in the References.

(3) Interviews with Key Informants and Meetings with Various Government Agencies and Stakeholders

Prior to impact identification, interviews with key informants were conducted to obtain opinions and concerns regarding the proposed development.

(a) Meeting with Tanay LGU Officials

The Municipal Mayor of Tanay expressed concern of the proposed Laiban Dam Project that will eventually inundate seven of the 18 Barangays of Tanay. With the master plan study, he is optimistic that other options will be studied and considered in the development of water supply for Metro Manila. Another concern that he brought up was the proposed relocation site for the affected families of the Laiban project which, he said, is outside his administrative and political jurisdiction. The proposed site is within the jurisdiction of Antipolo City. He recommended that the study would consider a site within Tanay because this is what his constituents wanted.

Another meeting was held with the Municipal Planning and Development Coordinator. His main concern was the eventual inundation of an eco-tourism site as well as a "spiritual" place for the Dumagats if the downstream portion of Kaliwa River and Agos River will be tapped as water source. He further stated that Brgy. is part of the National Park and Wildlife Sanctuary under Proclamation 1636 and therefore any development intervention in the area would need an approval/endorsement from the Protected Area Management Board (PAMB).

(b) Attendance to Barangay Magsaysay Council Meeting, Infanta, Quezon

The Barangay council meeting is held once in every two months and attended by the Barangay Captain and the Barangay Kagawads or Councilmen representing the different Sitios. The Team briefly presented the objectives of the master plan study and informed the body that public consultations will be conducted with regards to the proposed development if its Barangay will be affected.

As a support activity to watershed rehabilitation, the Barangay is currently implementing the Community Based Forestry Management Program of the DENR participated in by a people's organization (PO), the "Kaisahan ng

Mga Gawain Nakaugat sa Gawain Nag-uugnay". At the moment, the organization is applying to the DENR for the allocation/ reclassification of a portion of the designated forest reserve to multiple-use/buffer since Brgy. Magsaysay is covered under Proc. 1636 that declares the area as a National Park or a watershed reserve. Another NGO, the "Infanta Integrated Community Development Assistance (IICDA)", is also accredited to participate in the program covering Infanta-Real-Gen. Nakar area.

(c) Meeting with Infanta LGU Officials

The meeting with the Municipal Mayor of Infanta included the Barangay Captain of Binolosan. The problem presented was the "illegal" conversion of the mangrove area into fishponds in Brgy. Binolosan, one of the coastal Barangays of Infanta and has a total area of approximately 400 ha. About two thirds (265 ha) of this area is tidal flats characterized by the presence of mangrove and nipa (palm) vegetation. A total of 15 ha have already been converted into fishponds without the necessary permits. The Barangay has filed a complaint to CENRO-Infanta and CENRO has already issued a Cease and Desist Order (CDO) to the effect. Still, continued development is taking place up to this time, hence the meeting with the Mayor. The agreed course of action was to bring the case to the DENR Secretary.

G3.3 The Initial Environmental Examination Study

In May 2001, the JICA Study Team contracted out MEMSI to undertake an Initial Environmental Survey. The main objective of the Survey is to prepare the Initial Environmental Examination (IEE) for each of the candidate schemes for water resources development in the Agos River basin and water conveyance for Metro Manila. The IEE is aimed to identify the natural and social environmental problems and issues on each of the candidate schemes. The scope of work entails the following:

- collection of baseline data;
- field investigation including the conduct of "hearing" survey in the three concerned municipalities of Tanay (Rizal), Infanta and Gen. Nakar (Quezon), and also in Barangay Daraitan (Tanay);
- identification of natural and social environmental problems and issues;
- screening and scoping of environmental items for each of the schemes; and
- preparation of the IEE Report.

The IEE also provided recommendations to mitigate negative impacts and environmental protection measures.

The following provides a description of the Agos River basin, the study area for the water resources development.

The basin is fed by two major watersheds: the Kanan and Kaliwa. The Kanan watershed has a mountainous terrain with elevations ranging from 100 to 200

meters above sea level (masl) in the river valley and up to approximately 1000 masl at the ridges' summits. The slopes are predominantly covered by primary forest and few "kaingin" farms (slash and burn farming) are found along the river. The thick forested area is still a habitat of rare and endangered species such as the birds of prey (*Pithecophaga jeferryie*), the Philippine deer, and other species. Its drainage area is approximately 393 km^2 with the river valley generally steep winding with several rapids throughout its length.

The topography of Kaliwa Watershed is generally rolling with slopes varying from 8% to 50%. Two sub-watersheds feed the Kaliwa River: Limutan in Quezon Province and Lenatin in Rizal Province. Limutan is mainly characterized by thick vegetation, while cultivated areas and tracks of grassland predominate the vegetation cover of Lanatin.

The study area for water resources development schemes covers 17 rural Barangays in the municipalities of Tanay (Rizal), and Infanta and Gen. Nakar (Quezon). For water conveyance schemes, the study area covers the municipalities of Infanta and Gen. Nakar (Quezon), Tanay, Baras, Morong, Binangonan, Angono, and Pililla (Rizal), and the cities of Antipolo and Metro Manila.[13]

Varying degrees of physical, biological and socio-economic impacts are expected to occur as a result of the different development schemes. Major issues identified with water resource development schemes were downstream flow reduction/change in flow regime, impact on precious and indigenous species, resettlement of the affected residents and impact on indigenous people. The downstream flow reduction/change in flow regime is considered as trade-off of the project; allocating the water resource particularly for domestic supply for the "public good", out-weighs the negative impact on resource use. It was recommended that appropriate compensation, e.g. in the form of royalty, must be provided to the affected sector of society.

Resettlement issues include the number of households to be affected and the selection of resettlement site. In terms of impact magnitude, Laiban Dam is the most serious, followed by Agos Dam, Kanan B1 Dam, Kaliwa Low Dam and Kanan No.1 and No.2 Dams. Likewise, the indigenous peoples, particularly the Dumagats will be affected by any of the five schemes. It was recommended that specific program must be formulated to lessen the cultural impact of the project to this particular group (refer to Part H of this Volume for the detailed discussion on the resettlement issues).

Moderate impacts identified were:

- modification of aquatic ecosystem through: temporary increase in turbidity and nutrient loading in the aquatic ecosystems; migratory pattern of catandromous species such as the *Anguilla* and *Macrobrachium* would be severely affected; attraction of species that are normally hosts of water-

[13] The waterway facilities are to be located in the municipalities of Tanay (Tunnel #1), Morong, Teresa, Taytay and the city of Antipolo, all in the province of Rizal as per F/S .

borne diseases. Negative impact of fish migration would be mitigated with provision of fish stairs and ladders on the design of the dams.

- improvement of land transportation: improve the flow of traffic and delivery of basic goods and services; also perceived to worsen illegal logging activities in the area. Mitigating measure is the formulation of a watershed management plan that can provide alternative livelihood activities such as agro-forestry.
- increased waste/discharges production during project construction: waste generated by construction workers, if not properly disposed, can result to health and sanitation problems. Measure to mitigate the problem is by proper coordination with the contractors and the workers to ensure proper waste disposal.
- air pollution; exhaust fumes and odors: earthwork during project construction will increase dust particle levels in the air coupled with the operation of construction machinery that will also increase carbon monoxide levels. Mitigation measure identified is by maintaining moist environment in work sites to minimize suspension of dust particles.
- noise pollution: increased noise levels in the area due to operation of construction machineries and vehicles. Earplugs should be provided in order to minimize the sound levels impacting on the workers' ears.

The IEE study indicated that the Kanan No.1 and 2, as well as Kanan B1 would have relatively high social acceptability compared to the other two schemes considering all the above identified issues. However, the LGU of Gen. Nakar has plans to utilize Kanan river as source for hydroelectric power generation. As such, an agreement between MWSS and the LGU will have to be worked out.

For water conveyance schemes, the major environmental issue identified is the disturbance of wildlife due to blasting and quarrying. Vibrations on the ground will also affect ground-dwelling wildlife species, although temporary. The highly mobile wildlife can move to other undisturbed areas.

From the IEE, the significant social issues for the water conveyance schemes are acquisition of right-of-way (ROW) and disruption of community services and facilities along congested route during construction. Acquisition of ROW is identified as the most serious in WCS-1 and WCS-3, involving middle-class subdivisions in Morong, Teresa, Antipolo City and Taytay. It was recommended that for these two schemes, if relocation is involved, resettlement plans and provision of adequate financial compensation packages and support mechanisms must be addressed. WCS-4 was predicted to have the least social and environmental effects. For WCS-2, the lake ecology has to be studied in detail to determine the effects of partly dredging the lake bed for pipe laying to the ecosystem, particularly the benthos organisms and the fishery industry.

Over-all, the IEE concluded that the Kaliwa Low Dam, the Kanan B1 and the Kanan No.1 and 2 are predicted to have lesser environmental impacts compared

with the Agos and the Laiban dam for the water resources development schemes. WCS-4 is the preferred option for water conveyance route having the least environmental and social costs.

An Environmental Management Plan (EMP) was formulated as part of the IEE to ensure that environmental mitigation and enhancement measures are properly implemented.

G3.4 Outline of the Environment Affected by the Proposed Development

The existing environmental conditions vary widely for each of the sub-watersheds: the Kaliwa watershed, the Kanan watershed, and the watershed of the Agos river mainstream. This conspicuously varies with the biological, social and economic features of the area. In general, Kaliwa watershed is experiencing great pressure on its natural vegetation. Settlements and farmlands have replaced its forest areas. High level of water pollution is imminent if uncontrolled development is pursued. On the other hand, Kanan watershed is still covered with thick primary growth forest. Because of its rugged terrain, human intrusion is quite difficult. However, to protect this important habitat of endangered species of wildlife, illegal logging needs to be controlled. The watershed of the Agos river mainstream is also experiencing the same problems as that of the two watersheds: encroachment of human activities to its forested area, and illegal logging.

Table G3.1 outlines the environmental conditions of the study area.

G3.5 Significant Environmental Issues Identified

The significant environmental issues and concerns identified during this evaluation are categorized into project phases, e.g., project siting, design, construction and maintenance phases. After which, some of these issues/concerns are translated into specific impacts of the candidate schemes to each of the environmental aspects.

(1) Issues Relating to Project Siting

- Impounding of surface water conflicting with other beneficial uses; influence on the lowermost water use due to reduction of river flow;
- Encroachment into precious ecology zones. Influence on valuable, rare and endangered wildlife. Any development in a designated Protected Area must first secure a permit/approval from the PAMB. Being located within a national park, activities/projects shall not be allowed without the Environmental Compliance Certificate (ECC);
- Influence on sand dunes at the river mouth due to reduction of sediment supply from the upstream;
- Influence on the swampy area at the estuary including flooding;
- Impairment of cultural areas/monuments and ancestral domains of the Indigenous Peoples (IPs);

- Irreversible loss of agricultural resources and scenic spots in Barangay Daraitan, Tanay;
- Possible pollution of water supply source from Kaliwa River: Tanay is envisioned as an agro-industrial center in the Metro Manila-Rizal-Laguna-Quezon (MARILAQUE) Growth Area Framework. Also, from the 1999 Comprehensive Development Plan of Tanay, the municipality is the site of a 315 ha Rizal Industrial Estate that will position light to medium industries; and
- Resettlement of families residing in the reservoir area.

(2) Issues Relating to Design

- Inadequate protection of water source (reservoirs) from surface runoff pollution;
- Excessive growth of algae in reservoirs;
- Unsatisfactory raw water quality due to excessive turbidity and other constituents present at concentrations above acceptable limits;
- Inadequate buffer zone around pumping and treatment plants as needed for alleviating noise and other possible nuisances to neighboring properties and for protecting these facilities from damage by outsiders;
- Impairments commonly associated with transmission lines and access roads; and
- Continuing soil erosion from exposed areas not resurfaced or revegetated.

(3) Issues During Construction Stage

- Damage to waterbodies due to erosion and silt runoff during construction: The project construction plan should include provision to limit damage to waterbodies and control silt runoff during the construction stage that could adversely affect the beneficial uses or property values;
- In particular, it should be noted that reduction of sand and soil deposition to the sand dunes/bars ecosystem might result to erosion of coastal shoreland of Infanta and Gen. Nakar;
- Resurfacing of exposed areas: The construction plan should include provision for resurfacing/replanting of exposed areas that will otherwise result in continuing excessive erosion and silt runoff and in continuing depreciation of environmental aesthetics;
- Monitoring: The construction plan should include provision for monitoring during the construction period to ensure contractor’s compliance with specified constraints; and
- Quarry areas and borrow pits should be identified on the basis of least environmental sensitivity.

(4) Issues Resulting from O&M Inadequacies

- Delivery of water which is unsafe due to poor O&M of treatment processes (especially mud accumulations in filters) and inadequate chlorination;
- Lack of adequate monitoring of chlorine residuals as a check on safety of water; and
- Disposal of wastewater from treatment plant including sludge disposal management.

G4 Analysis of Alternative Development Plans

The main options that need to be considered are for water resources development schemes and for water conveyance schemes.

G4.1 Assessment Criteria

The approach used to assess the significance of the potential impacts is to apply "significance ratings" to each impact using objective criteria, such as magnitude, extent and duration of that impact to yield a final evaluation of the significance of impacts. The impacts were classified into: A - serious (major), B - to some extent (moderate), C - unknown, and D - none.[14] The use of significance ratings reduces the number of variables that must be considered by the decision-makers, while providing pertinent information about the implications of the various schemes. Corresponding numerical value was assigned to each category (4 - A, 3 - B, 2 - C and 1 - D) in order to come up with numerical rating for the evaluation of the alternatives.

G4.2 Evaluation of Alternatives

(1) Evaluation of Environmental Impacts on the Alternatives Considered for the Water Resources Development

The environmental impacts, either positive or negative, arising from the five water source development schemes are described in a tabular form. Some of the environmental impacts identified are indicative in nature due to lack of adequate data and details yet available at this stage, e.g., extent of areas to be flooded, inventory of biological resources, etc. A more detailed evaluation of positive and negative environmental and socio-economic impacts, which might be expected, will be provided during the Feasibility Study.

Table G4.1 presents the potential impacts conceivable at this study stage for each of the water resources development schemes.

(2) Evaluation of Environmental Impacts on the Alternatives Considered for the Water Conveyance Routes

The same process used for the evaluation of water resources development was applied to the evaluation of water conveyance routes. Again, the evaluation is just indicative, since the present plans are drawn only on a small-scale map of 1:50,000 with little information as to the exact location of the routes.

The potential positive and negative environmental impacts (physical, biological and socio-economic) arising as a result of the various options for water conveyance routes is presented in Table G4.2.

[14] JICA IEE Checklist.

G4.3 Tentative Combination Options for the Water Resources Development

(1) Combination Options for the Water Resources Development

The least environmentally and socially sensitive option for water resources development is the Kaliwa Low Dam No.2 scheme. The Kaliwa Low Dam No.2 scheme, due to its nature of run-of river scheme, posses significant advantages compared to the other reservoir options, notably the magnitude of the structure that will entail a lesser area to be inundated and therefore to some extent, lesser impact on the encroachment of productive ecological systems.

Among the reservoir schemes, Kanan No.1 and Kanan No.2 schemes will have a lesser extent of socio-environmental impacts in view particularly smaller relocation requirement. Common to both the Kanan No.1 and No.2 Dams, the reservoir will inundate a settlement area located in upper part of watershed (appearing on 1:50,000 map). Although the number of relocation of households is not known, it is conservatively estimated to be around 100. This is less than the relocation requirement in Laiban Dam (3,000 families) and Agos Dam (300-700 families varying by FSL proposed).

On one hand, an overall comparison of alternative development scenarios has revealed that Scenario B consisting of the Kaliwa Low Dam and Agos Dam would be most favorably evaluated in term of unit water cost.

The analysis of alternative water conveyance routes provides that the land-based options (WCS-4, WCS-1 and WCS-3) are seen to have the least environmental cost compared to the lake-based option (WCS-2). WCS-4 is the preferred option having the least environmental and social costs. The displacement of families as a result of acquisition of ROW seems to be least in the case of WCS-4.

(2) Impact Mitigation Measures

The main purpose of the mitigation plan for this Study phase is to provide a strategy for environmental protection whereby all negative activities are identified and rectified to prevent damage to the environment. This mitigation plan addresses specific negative impacts and corresponding mitigation/enhancement measures and does not yet identify the person/institution responsible and timing for the effective implementation of the Plan. If some issues have been overlooked, the mitigation plan should be updated during the feasibility study.

Table G4.3 provides the specific impacts and the corresponding mitigatory actions, where the proposed schemes are assumed to be Kaliwa Low Dam, Agos Dam and WCS-4.

G5 Specification for Environmental Impact Assessment (EIA) Survey to be Carried Out in the Feasibility Study

G5.1 The EIA Requirements

The EIA is a multi-disciplinary activity requiring specialists on terrestrial ecology, aquatic/coastal ecology, water quality, air/noise, geology, social, etc. These specialists shall be collectively known as the Project EIA Team. These people shall be involved in the conduct of EIA for the project until such time that the Environmental Compliance Certificate (ECC) is issued.

G5.2 Surveys, Sampling and Analysis

In the preparation of an EIA, field surveys and detailed site assessments are required. These surveys will serve as primary baseline data in evaluating the impacts of the proposed project. Detailed site assessments shall cover biophysical aspects of the existing environment where the project would be located. The following are the important surveys, sampling and analysis:

- Terrestrial survey;
- Aquatic/Coastal ecology survey;
- Sedimentation study (to be inputted by the Engineering group);
- Geotechnical investigation including Topographic survey (to be inputted by the Engineering group);
- Water quality sampling and analysis;
- Air quality sampling and analysis/Noise measurements; and
- Environmental health impact assessment

G5.3 Community Participation

Apart from the above requirements, one of the critical aspects in the EIA process is social acceptability. The environment involves not only the biophysical aspects but also the socio-economic dimension of a proposed development. People are part of the environment and are often the subject of or directly affected by projects or undertakings.

Community participation is the most effective process to determine social acceptability of the project, which is a decision criterion in the issuance of ECC. It is important that involvement of key stakeholders such as the local residents, LGUs, non-government organizations (NGOs) and community leaders be identified as soon as it is practically possible and the process and the decisions be transparent. The project proponent, the Metropolitan Waterworks and Sewerage System (MWSS) shall be the main driver in the community participation process with practical advice and insight from the EIA Team.

(1) Social Preparation

Social preparation is a process of informing and generating awareness and understanding of the concerned public about the project in a manner that will enable them to effectively participate and make informed and guided decisions. An information drive is an effective tool for social preparation.

(a) Information Campaign

A framework plan for the Information, Education and Communication (IEC) of the Project shall be developed by the EIA Team in coordination with the MWSS. The MWSS in coordination with the EIA Team shall immediately initiate efforts to gradually inform the general public about the advantages and usefulness of the project including its benefits to human health and measures to mitigate disruption of the affected ecosystems. One approach is to develop simplified yet "catchy" IEC resource materials, e. g., primer, flyers, billboards, etc., for information of the general public.

Information materials shall be used to introduce the proposed project to the stakeholders and to gain support for the Project.

(b) Socio-economic/Perception Survey

The objective of the perception survey is to determine the level of knowledge of the people, especially those that will be directly affected by the Project. One aspect of the perception survey is the view on resettlement issues. This is important in evaluating the viability of the proposed project.

The survey is also expected to establish the basis for identifying potential social impacts of project activities and on finding socially acceptable and economically rewarding mitigating and enhancement measures.

(c) Workshops/Orientation

Another way of conducting social preparation is through the conduct of workshops and orientation where the participants will come from the affected areas, for them to be informed, set directions, level-off plans and get involve in activity planning including formulation of necessary support programs. To realize this, the MWSS with the technical assistance from the EIA Team shall work together towards the awareness process of the affected communities.

(2) Conduct of Scoping

Under the revised DENR DAO 96-37, a formal scoping is required to commonly agree on the priority issues and concerns that should be addressed by the EIA. The agreed upon scope shall be recorded and approved by DENR and shall serve as the basis for the EIA and the consequent review of the EIS Report.

A series of scoping sessions is to be conducted to capture all the issues and concerns of the project stakeholders. In this case, involvement of a qualified Community Organizer is necessary. Conduct of scoping for the proposed project

should be led by the MWSS, being the project proponent, with the assistance from the EIA Team.

(a) Public Consultation

Public consultation is a form or stage of public participation that involves information dissemination and gathering of public opinion. It is a form of participation where citizens can directly be involved in planning or decision-making. It aims to produce the widest and most diversified public debate possible involving people directly affected by the project. The NWRB shall initiate the conduct of public consultation to ensure that the concerns of the public are fully integrated into the EIA process.

(b) Pre-scoping/Leveling-off with the LGU Key Officials and Concerned Government Officials

The first scoping session shall involve the concerned local government officials. The session would involve consultative orientation and leveling-off. The said activity shall be initiated by the MWSS with participation from officials of concerned LGUs (provincial, municipal and Barangay levels), PAMB, various CENRO/PENRO and EMB-Region IV.

(c) 1st Level Scoping Session with the DENR-EMB

Prior to the formal scoping sessions, the MWSS (Project Proponent), the EIA Team, DENR-EMB and members of the EIA Review Committee (EIARC) shall meet and agree on the technical and substantive scope of EIA study for the Project. Aside from the brief project information, the MWSS/EIA Team shall present to DENR-EMB and the EIARC the activities being undertaken for the project, e.g., social preparation, feasibility study, etc., and the proposed activities, e.g., formal scoping sessions, engineering surveys and other works related to the completion of the EIA study.

(d) Formal Scoping Sessions with the Project Stakeholders

The formal scoping session shall be conducted in accordance with the recommendation of the MWSS/EIA Team as affirmed by the DENR-EMB/EIARC during the 1st level scoping. The meeting shall be held preferably at the project site.

Issues and concerns of the project stakeholders such as the affected community including its leaders, non-government organizations, people's organization, etc. shall be gathered during the formal scoping sessions. These issues and concerns shall be properly addressed by the MWSS and the EIA Team during the EIA process and documented in the EIS Report.

After completion of the scoping sessions, a Scoping Report shall be prepared and signed by representatives of the MWSS, EIA Team, EIARC and stakeholders. The Scoping Report, which contains the technical and substantive scope agreed during the 1st level scoping and issues and

concerns raised during the formal scoping, will serve as basis for the review of the EIS Report.

G5.4 Project Monitoring

The momentum gained with community participation in the scoping and conduct of EIA should be sustained until the monitoring phase. The vigilance of stakeholders in the construction and operational phases is much more important in monitoring compliance of the project with the conditions of the ECC and commitments made in the EIS Report.

A multi-partite environmental monitoring team (MEMT) shall be created to regularly monitor compliance of the project with the government laws, policies and standards. MEMT shall be organized for the purpose of encouraging public participation, greater stakeholders' vigilance and provide appropriate check and balance mechanisms in the monitoring of project implementation. However, the establishment of the MEMT does not preclude the DENR from conducting its own monitoring or inspection of the project, as deemed necessary.

G5.5 Environmental Management Plan

The Environmental Management Plan (EMP) for the project is an integral part of the EIS Report. The EMP presents detailed plan of the proponent to mitigate or enhance potential impacts of the proposed project including the proposed implementation schedule, manner of implementation, responsible party, etc. It is actually a commitment of the Project Proponent that such EMP would be properly implemented during the construction and operational phases of the Project.

Tables

Table G3.1 Environmental Conditions of the Study Area, Agos River Basin (1/4)

Resource Environment		Laiban Dam / Kaliwa Low Dam 2	Kanan 1/Kanan 2 / Kanan B1	Agos Dam
		Kaliwa Watershed	**Kanan Watershed**	**Agos (Mainstream) Watershed**
PHYSICAL	Land	• Area covered by the watershed, to which Kaliwa River locates, is 27,608 ha. and is part of the Sierra Madre Mountain Range. • The river system of Kaliwa River watershed traverses Barangays Sta. Ines, Cayabu, Mamuyao, Sto. Niño, Tinukan, San Andres, Laiban and Daraitan in Tanay, Rizal and Barangay Limutan in General Nakar, Quezon. • The different geologic units found in Kaliwa Watershed consist of alluvium in the downstream areas, pyroclastic, volcanic, clastic-volcanic rocks and limestones in the upland. • High rate of sedimentation due to deforestation.	• Area covered by the watershed, to which Kanan River locates, is about 38,500 ha. Portion of the area is categorized as National Park or watershed reserve. • Kanan River traverses Barangay Pagsangahan, General Nakar, Quezon. • Major geologic units in the Kanan watershed belong to Tignoan and Kanan Formations. • Active sedimentation occurs along parts of the Kanan River. Erosion is mainly from run-off during rainfall.	• Agos River traverses Barangays Mahabang Lalim, Batangan, Maigang, Minahan Sur and Anoling in General Nakar and Barangays Magsaysay, Banugao, Catambungan, Ilog, Pilaway, Pinaglapatan and Boboin in Infanta. • Tignoan Formation underlies Agos River. Alluvial deposits also fill the floodplains of the river. • Sedimentation is most active on the coastal part of the Agos River.
	Water	• Mean monthly discharge is 23.4 m^3/sec for the Laiban Dam and 27.9 m^3/sec for Kaliwa Low Dam 2. • Some parts of Kaliwa River are used for navigational purposes. Households used the river for fishery. It is also used for bathing, washing and livestock raising. • Water quality analysis undertaken in May 1994 revealed that the following parameters exceeded DENR criteria for Class A waters: - Phosphate (0.28 mg/l); - Turbidity (25 NTU)	• Mean monthly discharge is 55.0 m^3/sec for Kanan No.2 site. • The whole stretch of Kanan River is commonly used for navigation. Households used the river for fishery. It is also used for bathing, washing and livestock raising. • Water quality analysis undertaken in May 1994 revealed that the following parameters exceeded DENR criteria for Class A waters: - Nitrate (1.06 mg/l)	• Mean monthly dischange is 113.6 m^3/sec at Agos Dam site. • Agos River is mainly used for irrigation. It supplies irrigation requirement of 23 barangays in General Nakar and Infanta. It is also used for navigation, bathing, washing, livestock raising, fishery, and quarrying. • Water quality analysis undertaken in May 1994 revealed that the following parameters exceeded DENR criteria for Class A waters: - Phosphate (0.2 mg/l); - Turbidity (43 NTU)

Table G3.1 Environmental Conditions of the Study Area, Agos River Basin (2/4)

Resource Environment		Laiban Dam / Kaliwa Low Dam 2	Kanan 1/Kanan 2 / Kanan B1	Agos Dam
		Kaliwa Watershed	**Kanan Watershed**	**Agos (Mainstream) Watershed**
PHYSICAL	Climate	• Falls under Type II Climate characterized by no distinct dry season and pronounced rainy period. - Experienced relatively higher temperature than the Kanan River due to poor vegetation cover. - Relative humidity is 83%; - Moderate and uniform rainfall. Monthly rainfall ranges from 170 to 200mm; - Winds come predominantly from the north	• Falls under Type IV Climate characterized by evenly distributed rainfall throughout the year. - Annual mean temperatures reach 27^{O}C; - Relative humidity is 83%; - Moderate and uniform rainfall. Average monthly rainfall ranges from a low 160mm (June) to 1,000mm (November); - Winds come predominantly from the north;	• Expected temperatures may be 3^{O}C higher or lower than Kanan River due to difference in elevation; • Other climate parameters may be similar to that of Kanan River/Watershed.
	Air Quality/ Noise	• Main sources of air pollution/ emissions are fires from "kaingin" patches and domestic sources, e.g., cooking by the use of firewood. • Natural and minor sources of noise are river rapids, domestic animals and wild fauna. Other noise sources include public vehicles, chain saws, etc.	• Main sources of air pollution/emissions are fires from "kaingin" patches and domestic sources, e.g., cooking by the use of firewood • Natural and minor sources of noise are river rapids, domestic animals and wild fauna. Other noise sources include public vehicles, chain saws, etc.	• Main sources of air pollution/emissions are fires from "kaingin" patches and domestic sources, e.g., cooking by the use of firewood • Natural and minor sources of noise are river rapids, domestic animals and wild fauna. Other noise sources include public vehicles, chain saws, etc.
BIOLOGICAL	Terrestrial Flora and Fauna	• Vegetation cover in the area consists of old growth, residual and mossy forest, bare or rocky, reproduction bush and agricultural area. • The western portion of the watershed is considered deforested while eastern portion is covered with residual and old growth forest. • Common vegetation found near the riverbanks includes species tolerant of swampy areas such as "lumanay" and bamboo trees. • Endangered fauna species are observed within the Kaliwa watershed area.	• Vegetation cover in the watershed consists of old growth and second growth forest, reproduction brush and cultivated areas. • Endangered flora and fauna species are observed.	• Portions of the riverbanks are planted to agricultural crops, mainly corn. Tree ferns are observed at higher elevations. • Endangered flora and fauna species are observed.

Table G3.1 Environmental Conditions of the Study Area, Agos River Basin (3/4)

Resource Environment		Laiban Dam / Kaliwa Low Dam 2	Kanan 1/Kanan 2 / Kanan B1	Agos Dam
		Kaliwa Watershed	Kanan Watershed	Agos (Mainstream) Watershed
BIOLOGICAL	Aquatic Flora and Fauna	• At least six economically important species are found in Kaliwa River which include eel (Anguilla), tilapia (Tilapia), catfish (Clarias), goby (Glossogobius), ulang (Macrobrachium) and slipper snails (Vivipara).	• At lease 15 economically important species are found in Kanan River, among which include lulong (Elops), goramy (Trichogaster), ayungin (Hypothalmicthys), snakehead (Ophiocephalus), etc.	• Major fish caught in Agos River includes tilapia (Tilapia), carp (Carpa), Mullet (Mugle), shrimp (Palaemon), etc.
LAND USE	Land Use/Zoning	• Most common land uses of Kaliwa watershed are grassland, grazing and upland agriculture. Planted crops include cassava, sweet potato, bananas and vegetables. • Kaliwa Watershed was classified as a forest reserve under Proclamation No. 573. Portion of the watershed was declared as National Park (Proclamation No. 1636); • Stock farm with an area of 3,131 ha was proclaimed under Proclamation No. 982 for the use of the Bureau of Animal Industry for its animal research. However, it has not been used for its purpose.	• Some 12,935 hectares or 33.6% of the Kanan watershed area are categorized as National Park (Proclamation No. 1636) or watershed reserve. Remaining area is mostly forest land.	• Built up areas along the riverbanks. Portions of the barangays are covered by Proclamation No. 1636 or watershed reserve. Other uses include riceland and orchards.
SOCIO–ECONOMY	Population, Household Size and Density	• The municipality of Tanay has a total population of 78,096 (NSO, 2000); • Average population increase of Tanay is 3.44%; • Total number of households is 15,709; • Average household size is 4.97.	• The municipality of General Nakar has a total population of 23,678 (NSO, 2000); • Population steadily increased with an average of 3.85% substantial annual growth rate; • Total number of households is 4,568; • Average household size is 5.18; • Population density of the municipality is 18 persons/km^2	• The municipality of Infanta has a total population of 50,992 (NSO, 2000); • Annual population growth rate of Infanta was 2.49%; • Total number of household is 10,220; • Average household size is 4.99; • Population density of the municipality is 197 persons/km^2

Table G3.1 Environmental Conditions of the Study Area, Agos River Basin (4/4)

Resource Environment		Laiban Dam / Kaliwa Low Dam 2	Kanan 1/Kanan 2 / Kanan B1	Agos Dam
		Kaliwa Watershed	**Kanan Watershed**	**Agos (Mainstream) Watershed**
SOCIO–ECONOMY	Sources of Income	• Major sources of income in Tanay include fishing (63.45%), forestry (32.35%) and agriculture/farming (4.2%).	• Major sources of income in General Nakar include agriculture/farming (70.9%), forestry (21.27%) and fishing (7.9%).	• Major sources of income in Infanta include agriculture/farming (42%), forestry (26.7%) and fishing (5.3%).
	Infrastructure and Public Utilities	• Almost half of the households in Tanay are served by the Tanay Water District. • Tanay has a total of 185km road network. National and provincial roads are made of either concrete or gravel while most municipal roads are of concrete. • MERALCO provides 24 hours of electricity to the households of Tanay	• General Nakar is served by the Infanta-General Nakar Water District; • General Nakar has a total road network of 63km; Only 5% of the roads are concrete paved. • Only 9 of the 19 barangays in General Nakar are provided with electricity by the QUEZELCO.	• Infanta is served by the Infanta-General Nakar Water District; • Infanta has more than 80km of road network; All national and provincial roads are made of gravel. Most of municipal roads are made of concrete while barangay roads are of gravel and earthfill; • Electricity in Infanta is also provided by QUEZELCO. All 36 barangays of the municipality are now served by the power supply cooperative.
	Health & Education	• Leading causes of morbidity in Tanay include acute respiratory infection, diarrhea, parasitism, vitamin deficiency and influenza; • Leading causes of mortality include Pneumonia, disease of the heart, PTB, cancer and accidents/wounds. • Tanay has one physician, one dentist, two nurses, 11 midwives and one sanitary inspectors. • Tanay has 22 elementary, five secondary and three tertiary schools.	• Leading causes of morbidity in General Nakar include upper respitatory infection, skin problems, pneumonia, wounds and gastroenteritis; • Leading causes of mortality include PTB, CVA, senility, pneumonia and cancer. • General Nakar has one physician, three nurses, 17 midwives, one dentist and one sanitary inspector. • General Nakar has 27 primary, five secondary and two pre-schools;	• Leading causes of morbidity in Infanta include acute respiratory infection, vitamin deficiency, parasitism, skin diseases and musculo-skeletal disease; • Leading causes of mortality include CVA, degenerative disease, pneumonia, PTB and cancer; • A rural health unit in Infanta is manned by one doctor, one nurse, one medical technologist, nine midwives, one nursing aide and one sanitary inspector. • Infanta has six pre-schools and five high schools.

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (1/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
P H Y S I C A L	Land	*Pre-construction/ Construction Phase*					
		Modification of land forms	Permanent disappearance of natural landscapes within the dam reservoir and disappearance of natural waterscapes due to inundation. Modification of terrain due to borrow pits and quarry site that will have to be excavated. Volume of soil that will be cut/displaced due to the construction of structure will be dumped to the adjacent areas which may cause runoffs during rainy seasons	Permanent disappearance of natural landscapes within the dam reservoir and disappearance of natural waterscapes due to inundation Minimal modification of terrain due to borrow pits and quarry site that will have to be excavated. Minimal volume of soil that will be cut/displaced due to the construction of structure will be dumped to the adjacent areas which may cause runoffs during rainy seasons	Permanent disappearance of natural landscapes within the dam reservoir and disappearance of natural waterscapes due to inundation Modification of terrain due to borrow pits and quarry site that will have to be excavated. Volume of soil that will be cut/displaced due to the construction of structure will be dumped to the adjacent areas which may cause runoffs during rainy seasons	Permanent disappearance of natural landscapes within the dam reservoir and disappearance of natural waterscapes due to inundation Modification of terrain due to borrow pits and quarry site that will have to be excavated. Volume of soil that will be cut/displaced due to the construction of structure will be dumped to the adjacent areas which may cause runoffs during rainy seasons	Permanent disappearance of natural landscapes within the dam reservoir and disappearance of natural waterscapes due to inundation. Modification of terrain due to borrow pits and quarry site that will have to be excavated. Volume of soil that will be cut/displaced due to the construction of structure will be dumped to the adjacent areas which may cause runoffs during rainy seasons
		Soil erosion/sedimentation	Soil and sediment wash into waterways causing turbidity and potential blockages of water flow due to earth moving, land clearing, road construction and excavation during construction	Soil and sediment wash into waterways causing turbidity and potential blockages of water flow due to earth moving, land clearing, road construction and excavation during construction	Soil and sediment wash into waterways causing turbidity and potential blockages of water flow due to earth moving, land clearing, road construction and excavation during construction	Soil and sediment wash into waterways causing turbidity and potential blockages of water flow due to earth moving, land clearing, road construction and excavation during construction	Soil and sediment wash into waterways causing turbidity and potential blockages of water flow due to earth moving, land clearing, road construction and excavation during construction

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (2/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
PHYSICAL	Land	Change in physical and chemical properties of soil	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction
		Siting of structures in hazard prone areas particularly earthquake	Presence of assumed active faults	Presence of assumed active faults but less hazardous because of dam height .	Presence of assumed active faults	Presence of assumed active faults	Presence of assumed active faults. High risk due to Highly populated downstream
		Operational/ Maintenance Phase					
		Introduction of geologic hazards that maybe caused by the project	High risk area due to presence of dam within the vicinity of an assumed active fault.	Moderate risk area due to presence of dam within the vicinity of an assumed active fault.	High risk area due to presence of dam within the vicinity of an assumed active fault.	High risk area due to presence of dam within the vicinity of an assumed active fault.	High risk area due to presence of dam within the vicinity of an assumed active fault.
		Pre-construction/ Construction Phase					
	Water	Change in hydrologic pattern	Reduced downstream flow Temporary water diversion would impact adjacent vegetation. Increase turbulance at the downstream tailrace Moderating effects on flood levels	Reduced downstream flow Temporary water diversion would impact adjacent vegetation. Increase turbulance at the downstream tailrace Moderating effects on flood levels	Reduced downstream flow Temporary water diversion would impact adjacent vegetation. Increase turbulance at the downstream tailrace Moderating effects on flood levels	Reduced downstream flow Temporary water diversion would impact adjacent vegetation. Increase turbulance at the downstream tailrace Moderating effects on flood levels	Reduced downstream flow Temporary water diversion would impact adjacent vegetation. Increase turbulance at the downstream tailrace Moderating effects on flood levels

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (3/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
P H Y S I C A L	Water	Change in quality of surface water	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.. Decrease of nutrient input from the river's sediment load Sedimentation upstream of dam	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.. Decrease of nutrient input from the river's sediment load Sedimentation upstream of dam	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.. Decrease of nutrient input from the river's sediment load Sedimentation upstream of dam	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.. Decrease of nutrient input from the river's sediment load Sedimentation upstream of dam	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.. Decrease of nutrient input from the river's sediment load Sedimentation upstream of dam
		Operational/ Maintenance Phase					
		Increase in surface runoff	Increase in the river discharge and depth during releases	No increase in river discharge due to nun-of-river scheme	Increase in the river discharge and depth during releases	Increase in the river discharge and depth during releases	Increase in the river discharge and depth during releases
		Decrease in flooding and the serviceability of the watershed and rivers	Downstream flood flow reduction Reduction of nutrient loading deposited in rivers, estuaries and mangrove areas	No significant effect to downstream flood flow reduction Reduction of nutrient loading deposited in rivers, estuaries and mangrove areas.	Downstream flood flow reduction Reduction of nutrient loading deposited in rivers, estuaries and mangrove areas.	Downstream flood flow reduction Reduction of nutrient loading deposited in rivers, estuaries and mangrove areas.	Downstream flood flow reduction Reduction of nutrient loading deposited in rivers, estuaries and mangrove areas.

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (4/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
P H Y S I C A L	Water	Euthrophication of reservoir water	Increase decomposition of organic matter from cut vegetation may result in higher DO, BOD and nutrients.	Increase decomposition of organic matter from cut vegetation may result in higher DO, BOD and nutrients.	Increase decomposition of organic matter from cut vegetation may result in higher DO, BOD and nutrients.	Increase decomposition of organic matter from cut vegetation may result in higher DO, BOD and nutrients.	Increase decomposition of organic matter from cut vegetation may result in higher DO, BOD and nutrients.
		Change in water temperature	Low water temperature in deeper part of reservoir	Minimal due to continuous recharge and release of water	Low water temperature in deeper part of reservoir	Low water temperature in deeper part of reservoir	Low water temperature in deeper part of reservoir
		Siltation and sedimentation of reservoir	Accumulation of silt and sediments resulting to decreased efficiency of the dam	Accumulation of silt and sediments resulting to decrease efficiency of the dam	Accumulation of silt and sediments resulting to decrease efficiency of the dam	Accumulation of silt and sediments resulting to decrease efficiency of the dam	Accumulation of silt and sediments resulting to decrease efficiency of the dam
		Contamination and depletion of surface water	Accidental or improper releases of domestic and agricultural/ industrial waste will affect the water quality	Accidental or improper releases of domestic and agricultural/ industrial waste will affect the water quality	Accidental or improper releases of domestic and agricultural/ industrial waste will affect the water quality	Accidental or improper releases of domestic and agricultural/ industrial waste will affect the water quality	Accidental or improper releases of domestic and agricultural/ industrial waste will affect the water quality
		Possible decrease in coastal water productivity	Decrease of nutrient input from the river's sediment load	No particular impact due to run-of-river scheme	Decrease of nutrient input from the river's sediment load	Decrease of nutrient input from the river's sediment load	Decrease of nutrient input from the river's sediment load
	Climate and Air Quality	*Pre-construction/ Construction Phase*					
		Air pollution generation	Dust generation resulting from earthworks, and other construction related activities Increase traffic along the access road delivering construction materials on site.	Dust generation resulting from earthworks, and other construction related activities Increase traffic along the access road delivering construction materials on site.	Dust generation resulting from earthworks, and other construction related activities Increase traffic along the access road delivering construction materials on site.	Dust generation resulting from earthworks, and other construction related activities Increase traffic along the access road delivering construction materials on site.	Dust generation resulting from earthworks, and other construction related activities Increase traffic along the access road delivering construction materials on site.

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (5/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
PHYSICAL	Climate and Air Quality	Increase concentration of gas pollutants	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment used in the construction site. Increase incidence of respiratory related and skin diseases	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment used in the construction site. Increase incidence of respiratory related and skin diseases	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment used in the construction site. Increase incidence of respiratory related and skin diseases	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment used in the construction site. Increase incidence of respiratory related and skin diseases	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment used in the construction site. Increase incidence of respiratory related and skin diseases
		Operational/ Maintenance Phase					
		Dust generation due increase in traffic volume	Increase incidence of respiratory related diseases among nearby communities.	Increase incidence of respiratory related diseases among nearby communities.	Increase incidence of respiratory related diseases among nearby communities.	Increase incidence of respiratory related diseases among nearby communities.	Increase incidence of respiratory related diseases among nearby communities.
		Change in air quality due to operation of power generators	Generation of exhaust/fumes leading to increase incidence of respiratory related diseases	Generation of exhaust/fumes leading to increase incidence of respiratory related diseases	Generation of exhaust/fumes leading to increase incidence of respiratory related diseases	Generation of exhaust/fumes leading to increase incidence of respiratory related diseases	Generation of exhaust/fumes leading to increase incidence of respiratory related diseases
	Noise/Vibration	*Pre-construction/ Construction Phase*					
		Increase of noise level due to vehicles and noise/vibration producing equipment	Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife. Excessive vibrations maybe experienced as a result of the use of heavy equipment such as compactor, etc.	Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife. Excessive vibrations maybe experienced as a result of the use of heavy equipment such as compactor, etc.	Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife. Excessive vibrations maybe experienced as a result of the use of heavy equipment such as compactor	Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife. Excessive vibrations maybe experienced as a result of the use of heavy equipment such as compactor	Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife. Excessive vibrations maybe experienced as a result of the use of heavy equipment such as compactor

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (6/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
PHYSICAL	Noise/ Vibration	*Operational/ Maintenance Phase*					
		Increase in noise level	Potential nuisance and disturbance to human as well as wildlife during the operation of power and water treatment plants	Potential nuisance and disturbance to human as well as wildlife during the operation of power and water treatment plants	Potential nuisance and disturbance to human as well as wildlife during the operation of power and water treatment plants	Potential nuisance and disturbance to human as well as wildlife during the operation of power and water treatment plants	Potential nuisance and disturbance to human as well as wildlife during the operation of power and water treatment plants
BIOLOGICAL	Terrestrial Flora and Fauna	*Pre-construction/ Construction Phase*					
		Disturbance/Destruction of wildlife	Disturbance/Destruction of rare and endangered species such as birds of prey and Philippine deer	Disturbance/Destruction of rare and endangered species such as birds of prey and Philippine deer	Disturbance/Destruction of rare and endangered species such as birds of prey and Philippine deer	Disturbance/Destruction of rare and endangered species such as birds of prey and Philippine deer	Disturbance/Destruction of rare and endangered species such as birds of prey and Philippine deer
		Encroachment on precious ecosystems	Moderate destruction/removal/ submergence of natural vegetation	Moderate destruction/removal/ submergence of natural vegetation	Highly significant destruction/removal/ submergence of natural vegetation	Highly significant destruction/removal/ submergence of natural vegetation	Moderate destruction/removal/ submergence of natural vegetation
		Disturbance and loss of habitat	Inundation of second growth forest, agricultural and fresh water ecosystem.	Inundation of second growth forest, agricultural and fresh water ecosystem.	Inundation of primary and secondary forest and fresh water ecosystem	Inundation of primary and secondary forest and fresh water ecosystem	Inundation of secondary growth, agricultural and fresh water ecosystem.
		Operational/ Maintenance Phase					
		Impacts of the project operation on the biology, reproduction and feeding habits of wildlife	Disappearance of important habitat such as forest land, agricultural land and fresh water ecosystem Intensification of agro-forestry practices in the watershed	Disappearance of important habitat such as forest land, agricultural land and fresh water ecosystem Intensification of agro-forestry practices in the watershed	Disappearance of important habitat such as primary forest and fresh water ecosystem Intensification of agro-forestry practices in the watershed	Disappearance of important habitat such as primary forest and fresh water ecosystem. Intensification of agro-forestry practices in the watershed	Disappearance of important habitat such as secondary growth, agricultural and fresh water ecosystem Intensification of agro-forestry practices in the watershed

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (7/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
B I O L O G I C A L	Terrestrial Flora and Fauna		Increase illegal logging activities due to improvement of roads	Increase illegal logging activities due to improvement of roads	Increase illegal logging activities due to improvement of roads	Increase illegal logging activities due to improvement of roads	Increase illegal logging activities due to improvement of roads
		Decrease in agriculture production	Inundation of agricultural areas	Inundation of fruit tree farms, orchards	Inundation of agricultural lands supposedly to exist in upper watershed(appearing on 1:50,000map)	Inundation of fruit tree farms.	Inundation of agricultural areas inc. rice
	Aquatic Flora and Fauna	*Pre-construction/ Construction Phase*					
		Encroachment of aquatic ecosystem	Disturbance of migrating species such as eel and shrimp	Disturbance of migrating species such as eel and shrimp	Disturbance of migrating species such as eel and shrimp	Disturbance of migrating species such as eel and shrimp	Disturbance of migrating species such as eel and shrimp
		Removal of natural vegetation	Destruction of aquatic plant life as a result of dam construction	Minor destruction of aquatic plant life as a result of dam construction	Destruction of aquatic plant life as a result of dam construction	Destruction of aquatic plant life as a result of dam construction	Destruction of aquatic plant life as a result of dam construction
		Operational/ Maintenance Phase					
		Impacts on the project operation on the biology, reproduction and feeding habits of wildlife	Colonization of aquatic and hydrophilic species on flooded areas Proliferation of cold water fish species	Colonization of aquatic and hydrophilic species on flooded areas Proliferation of cold water fish species	Colonization of aquatic and hydrophilic species on flooded areas Proliferation of cold water fish species	Colonization of aquatic and hydrophilic species on flooded areas Proliferation of cold water fish species	Colonization of aquatic and hydrophilic species on flooded areas Proliferation of cold water fish species
		Increase in habitat of wildlife	Favorable to aquatic species	Favorable to aquatic species but lesser area	Favorable to aquatic species	Favorable to aquatic species	Favorable to aquatic species
		Change in aquaculture production	Development of inland fish production	Development of inland fish production	Development of inland fish production	Development of inland fish production	Development of inland fish production
		Disruption of fish migration and spawning	Minor effect because the remaining river stretch can sustain the fish population of catandromous species	Minor effect because the remaining river stretch can sustain the fish population of catandromous species	Minor effect because the remaining river stretch can sustain the fish population of catandromous species	Minor effect because the remaining river stretch can sustain the fish population of catandromous species	Minor effect because the remaining river stretch can sustain the fish population of catandromous species

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (8/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
BIOLOGICAL	Aquatic Flora and Fauna	Creation of habitat for disease vectors	Potential occurrence of water-related diseases such as malaria, schistosomiasis	Potential occurrence of water-related diseases such as malaria, schistosomiasis	Potential occurrence of water-related diseases such as malaria, schistosomiasis	Potential occurrence of water-related diseases such as malaria, schistosomiasis	Potential occurrence of water-related diseases such as malaria, schistosomiasis
		Generation of aquatic plants	Proliferation of algal blooms if high level of nutrient is introduced	Proliferation of algal blooms if high level of nutrient is introduced	Proliferation of algal blooms if high level of nutrient is introduced	Proliferation of algal blooms if high level of nutrient is introduced	Proliferation of algal blooms if high level of nutrient is introduced
LAND USE & IMPORTANT SITES	Land Use/ Zoning	*Pre-construction/ Construction Phase*					
		Change in land use	Change in land use from a forest, agricultural and river to a infrastructure-related use	Change in land use from a forest, agricultural and river to a infrastructure-related use	Change in land use from a forest, agricultural and river to a infrastructure-related use	Change in land use from a forest, agricultural and river to a infrastructure-related use	Change in land use from a forest, agricultural and river to a infrastructure-related use
		Change of the aesthetic character of the area	Construction of structure will render an unaesthetic impact due to damaged areas and excavated materials dumped in the vicinity. Inundation of caves along Limutan River.	Construction of structure will render an unaesthetic impact due to damaged areas and excavated materials dumped in the vicinity. Inundation of "tinipak" and caves along Kaliwa River	Construction of structure will render an unaesthetic impact due to damaged areas and excavated materials dumped in the vicinity. Inundation of old growth forest.	Construction of structure will render an unaesthetic impact due to damaged areas and excavated materials dumped in the vicinity. Inundation of old growth forest	Construction of structure will render an unaesthetic impact due to damaged areas and excavated materials dumped in the vicinity. Inundation of "tinipak" and caves along Kaliwa River
	Archaeolo-gical/ Historical Sites	*Pre-construction/ Construction Phase*					
		Destruction of important and cultural sites	Not known	Loss of worship place for Dumagats	Not known	Inundation of a pre-World war II foundation of early house, Dumagat burial sites, historical site located at Tigbak	Loss of worship place for Dumagats

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (9/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
S O C I O - E C O N O M Y	Population	*Pre-construction/ Construction Phase*					
		Displacement of household	Displacement of households in Brgy. Cayabu, Mamuyao, Sto. Nino, Tinukan, San Andres, Sta. Inez, Laiban (see details in Supporting Report H)	No displacement will occur.	No displacement will occur. Settlement is located upstream of the watershed. No. of displacemend is nit known, but conservatively assumed to be some 100. They are presumably Dumagat.	Displacement of 25 Dumagats	Displacement of households in Brgys. Magsaysay (Infanta) Pagsangahan and Mahabang Lalim (Gen. Nakar). (see details in Part H)
		Increase in population due to migration of people could trigger social conflicts between residents and construction worker	Competition of migrants and locals for the employment opportunities Rapid increase of migrants, e.g., construction workers and families, will result to greater demand for basic services, which may bring concern to local communities.	Competition of migrants and locals for the employment opportunities Rapid increase of migrants, e.g., construction workers and families, will result to greater demand for basic services, which may bring concern to local communities.	No major impact will likely occur	Competition of migrants and locals for the employment opportunities Rapid increase of migrants, e.g., construction workers and families, will result to greater demand for basic services, which may bring concern to local communities.	Competition of migrants and locals for the employment opportunities Rapid increase of migrants, e.g., construction workers and families, will result to greater demand for basic services, which may bring concern to local communities.
		Operational/ Maintenance Phase					
		Increase in the population of the area due to migration of workers	Increase of population due to improved access, which may cause some conflicts with local people.	No noteworthy impact in view of isolated small facilities	Increase of population due to improved access, which may cause some conflicts with local people.	Increase of population due to improved access, which may cause some conflicts with local people.	Increase of population due to improved access, which may cause some conflicts with local people.

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (10/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
S O C I O - E C O N O M Y	Labor and Employment	*Pre-construction/ Construction Phase*					
		Generation of employment and other economic activities	Increase income and improve standards of living	Increase income and improve standards of living	Increase income and improve standards of living	Increase income and improve standards of living	Increase income and improve standards of living
		Change in the economic activities during construction	Change from agriculture/forestry based economic activities to construction services	Change from agriculture/forestry based economic activities to construction services	Change from agriculture/forestry based economic activities to construction services	Change from agriculture/forestry based economic activities to construction services	Change from agriculture/forestry based economic activities to construction services
		Operational/ Maintenance Phase					
		Generation of employment and other economic services	Increase income and improve standards of living	Increase income and improve standards of living	Increase income and improve standards of living	Increase income and improve standards of living	Increase income and improve standards of living
		Change in revenue generation of the community	Expected increase in employment opportunities will result to increase in revenue of the community	Expected increase in employment opportunities will result to increase in revenue of the community	Expected increase in employment opportunities will result to increase in revenue of the community	Expected increase in employment opportunities will result to increase in revenue of the community	Expected increase in employment opportunities will result to increase in revenue of the community
	Housing and Social Services	*Pre-construction/ Construction Phase*					
		Change in house facilities and change in usage of public utilities due to relocation	Relocation of households in Brgy. Cayabu, Mamuyao, Sto. Nino, Tinukan, San Andres, Sta. Inez, Laiban (see details in Supporting Report H)	No relocation	Settlement is located upstream of the watershed, which will he submerged by the reservior. Relocation of households is conservatively estimeated to be around 100.	Relocation of 25 Dumagats	Relocation of households in Brgys. Magsaysay (Infanta) Pagsangahan and Mahabang Lalim (Gen. Nakar).

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (11/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
S O C I O - E C O N O M Y	Housing and Social Services	*Operational/ Maintenance Phase*					
		Change in housing facilities and usage	New housing site development and houses will be constructed complete with health and education services/facilities in San Ysiro, Antipolo City		New housing site to be around the original setlements.	New housing site development and houses will be constructed complete with health and education services/facilities preferably within Kanan watershed	New housing site development and houses will be constructed complete with health and education services/facilities preferably near the vicinity of their original settlements
		Change in education and health service	Disturbance in schooling of children of relocated families Creation of habitat for disease vectors/pathogens Introduction of disease carrying vectors due to poor maintenance of reservoir Need for additional/new social services	Disturbance in schooling of children of relocated families Creation of habitat for disease vectors/pathogens Introduction of disease carrying vectors due to poor maintenance of reservoir Need for additional/new social services	Condition not known	Creation of habitat for disease vectors/pathogens Introduction of disease carrying vectors due to poor maintenance of reservoir Need for additional/new social services	Disturbance in schooling of children of relocated families Creation of habitat for disease vectors/pathogens Introduction of disease carrying vectors due to poor maintenance of reservoir Need for additional/new social services
	Culture and Lifestyle	*Pre-construction/ Construction Phase*					
		Change in cultural practices and beliefs (Indigenous peoples, Minority groups, Nomads)	Cultural erosion due to loss of interaction of Dumagats from Limutan with the 7 affected barangays	Cultural erosion due to inundation of their place of worship (Kaliwa River)	No major impact will likely occur since the affected village is distant from the construction area.	Cultural erosion due to inundation of settlement and some part of their ancestral land	Cultural erosion due to inundation of their place of worship (Kaliwa River)

Table G4.1 Predicted Impacts of Water Development Schemes on Natural and Social Environment (12/12)

Resource Environment		Likely Impacts	Kaliwa River		Kanan River		Agos River
			Laiban Dam	Kaliwa Low Dam 2	Kanan-1/ Kanan -2	Kanan B1 Dam	Agos Dam
		Operational/ Maintenance Phase					
		Change in cultural aspects of people in the affected communities due to relocation and loss of source of livelihood	Living conditions in the resettlement site is different from the existing lifestyle of the communities	Living conditions in the resettlement site is different from the existing lifestyle of the communities	No significant impact in view of relocation to nearby area.	Living conditions in the resettlement site is different from the existing lifestyle of the communities	Living conditions in the resettlement site is different from the existing lifestyle of the communities
WASTE MNGT.		*Pre-construction/ Construction Phase*					
		Solid waste generation and problems of storage/ disposal	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas
		Wastewater generation	Increased waste generation by workers and construction equipment during construction including oil and gasoline spills	Increased waste generation by workers and construction equipment during construction including oil and gasoline spills	Increased waste generation by workers and construction equipment during construction including oil and gasoline spills	Increased waste generation by workers and construction equipment during construction including oil and gasoline spills	Increased waste generation by workers and construction equipment during construction including oil and gasoline spills
		Operational/ Maintenance Phase					
		Solid waste generation and problems of disposal	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas	Generation of soil spoils from excavated areas
		Wastewater generation and disposal	Waste generation by wastewater treatment plant with high TDS and silt content	Waste generation by wastewater treatment plant with high TDS and silt content	Waste generation by wastewater treatment plant with high TDS and silt content	Waste generation by wastewater treatment plant with high TDS and silt content	Waste generation by wastewater treatment plant with high TDS and s16ilt content

Table G4.2 Predicted Impacts of Water Conveyance Schemes on Natural and Social Environment (1/4)

Resource Environment		Likely Impacts	WCS-1	WCS-2	WCS-3	WCS-4	WCT-1	WCT-2
P H Y S I C A L	Land	Modification of land forms	Disturbance of landscape at the tunnel entrance	Disturbance of landscape at the tunnel entrance	Disturbance of landscape at the tunnel entrance	Disturbance of landscape at the tunnel entrance	Disturbance of landscape at the tunnel entrance	Disturbance of landscape at the tunnel entrance
		Soil erosion and sedimentation	Waste soil and sediment washed into waterways and storm drains with potential for causing blockages of existing infrastructure	Waste soil and sediment washed into waterways and storm drains with potential for causing blockages of existing infrastructure	Waste soil and sediment washed into waterways and storm drains with potential for causing blockages of existing infrastructure	Waste soil and sediment washed into waterways and storm drains with potential for causing blockages of existing infrastructure	Waste soil and sediment washed into waterways and storm drains with potential for causing blockages of existing infrastructure	Waste soil and sediment washed into waterways and storm drains with potential for causing blockages of existing infrastructure
		Siting of tunnels in hazard prone areas particularly earthquake	Presence of assumed active faults	Presence of assumed active faults	Crossing fan assumed active fault	Presence of assumed active faults	Presence of assumed active faults	Presence of assumed active faults
		Change in physical and chemical properties of soil	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction	Potential contamination of soil due to fuel and oil spills during construction
	Water	Change in quality of surface water	Sediments settling out from turbid water or deposited directly can affect benthic organisms that may result to habitat disappearance Accidental or unforeseen releases of domestic waste from construction sites will led to pollution	Disruption of Laguna bottom sediments in lake and increase in particulate matter suspension Accidental or unforeseen releases of domestic waste from construction sites will led to pollution	Sediments settling out from turbid water or deposited directly can affect benthic organisms that may result to habitat disappearance Accidental or unforeseen releases of domestic waste from construction sites will led to pollution	Sediments settling out from turbid water or deposited directly can affect benthic organisms that may result to habitat disappearance Accidental or unforeseen releases of domestic waste from construction sites will led to pollution	Sediments settling out from turbid water or deposited directly can affect benthic organisms that may result to habitat disappearance Accidental or unforeseen releases of domestic waste from construction sites will led to pollution	Sediments settling out from turbid water or deposited directly can affect benthic organisms that may result to habitat disappearance Accidental or unforeseen releases of domestic waste from construction sites will led to pollution

Table G4.2 Predicted Impacts of Water Conveyance Schemes on Natural and Social Environment (2/4)

Resource Environment		Likely Impacts	WCS-1	WCS-2	WCS-3	WCS-4	WCT-1	WCT-2
PHYSICAL		Water transfer	Reduction of river water flow due to Laiban intake	Reduction of river water flow due to Kaliwa intake	Reduction of river water flow due to Kaliwa intake	Reduction of river water flow due to Kaliwa intake	Decreased quantity of Kanan River due to water transfer to Kaliwa River	Decreased quantity of Kanan River due to water transfer to Laiban Dam
	Climate and Air Quality	Air pollution generation	Dust generation resulting from earthworks and other construction related activities Gas (SO_2), NO_2) emissions and increased concentration of CO resulting from operation of heavy equipment during construction	Dust generation resulting from earthworks and other construction related activities Gas (SO_2), NO_2) emissions and increased concentration of CO resulting from operation of heavy equipment during construction	Dust generation resulting from earthworks and other construction related activities Gas (SO_2), NO_2) emissions and increased concentration of CO resulting from operation of heavy equipment during construction	Dust generation resulting from earthworks and other construction related activities Gas (SO_2), NO_2) emissions and increased concentration of CO resulting from operation of heavy equipment during construction	Dust generation resulting from earthworks and other construction related activities Gas (SO_2), NO_2) emissions and increased concentration of CO resulting from operation of heavy equipment during construction	Dust generation resulting from earthworks and other construction related activities Gas (SO_2), NO_2) emissions and increased concentration of CO resulting from operation of heavy equipment during construction
	Noise/ Vibration	Increased noise level due to vehicles and to noise/vibration producing equipment	Noise generation is expected in any construction activity causing nuisance and disturbance to human and wildlife Excessive vibrations may be experienced as a result of the use of heavy equipment	Noise generation is expected in any construction activity causing nuisance and disturbance to human and wildlife Excessive vibrations may be experienced as a result of the use of heavy equipment	Noise generation is expected in any construction activity causing nuisance and disturbance to human and wildlife Excessive vibrations may be experienced as a result of the use of heavy equipment	Noise generation is expected in any construction activity causing nuisance and disturbance to human and wildlife Excessive vibrations may be experienced as a result of the use of heavy equipment	Noise generation is expected in any construction activity causing nuisance and disturbance to human and wildlife Excessive vibrations may be experienced as a result of tunneling	Noise generation is expected in any construction activity causing nuisance and disturbance to human and wildlife Excessive vibrations may be experienced as a result of tunneling

Table G4.2 Predicted Impacts of Water Conveyance Schemes on Natural and Social Environment (3/4)

Resource Environment		Likely Impacts	WCS-1	WCS-2	WCS-3	WCS-4	WCT-1	WCT-2
BIOLOGICAL	Terrestrial Flora and Fauna	Disturbance and loss of habitat	Minimal disruption of habitat of wildlife as result of digging trench to lay pipelines	Disruption of habitat of wildlife as a result of tunneling and digging trench to lay pipelines	Disruption of habitat of wildlife as a result of tunneling and digging trench to lay pipelines	Disruption of habitat of wildlife as a result of tunneling and digging trench to lay pipelines	Disturbance of habitat of endangered wildlife as a result of tunneling	Disturbance of habitat of endangered wildlife as a result of tunneling
		Encroachment on precious ecosystem	Minimal removal of natural vegetation	Clearing of natural vegetation at the tunnel entrance and access road	Clearing of natural vegetation at the tunnel entrance and access road	Clearing of natural vegetation at the tunnel entrance and access road	Clearing of natural vegetation at the tunnel entrance and access road	Clearing of natural vegetation at the tunnel entrance and access road
	Aquatic Flora and Fauna	Disturbance of and loss of habitat	Disruption of benthic infaunal communities due to sediments generated by earth works	Disruption of benthic infaunal communities in Laguna lake bed	Disruption of benthic infaunal communities due to sediments generated by earth works	Disruption of benthic infaunal communities due to sediments generated by earth works	No potential impact identified	No potential impact identified
SOCIO-ECONOMY	Population	Displacement of household	Displacement of some 300 household in pipelines and at water treatment plant site(approx.estimate)	Displacement of some 300 household in pipelines and at water treatment plant site(approx. estimate)	Displacement of some 300 household in pipelines and at water treatment plant site(approx. estimate)	Displacement of some 222 households in pipelines and water treatment plant site.	No foreseen displacement in as much as tunneling is at a depth of 200m.	No foreseen displacement in as much as tunneling is at a depth of 200m.
		Increase in population due to migration of workers	Competition of migrants and locals for employment opportunities Increase of migrants will result to greater demand for basic services, which may bring concern to local communities	Competition of migrants and locals for employment opportunities Increase of migrants will result to greater demand for basic services, which may bring concern to local communities	Competition of migrants and locals for employment opportunities Increase of migrants will result to greater demand for basic services, which may bring concern to local communities	Competition of migrants and locals for employment opportunities Increase of migrants will result to greater demand for basic services, which may bring concern to local communities	Competition of migrants and locals for employment opportunities Increase of migrants will result to greater demand for basic services, which may bring concern to local communities	Competition of migrants and locals for employment opportunities Increase of migrants will result to greater demand for basic services, which may bring concern to local communities

Table G4.2 Predicted Impacts of Water Conveyance Schemes on Natural and Social Environment (4/4)

Resource Environment		Likely Impacts	WCS-1	WCS-2	WCS-3	WCS-4	WCT-1	WCT-2
SOCIO-ECONOMY	Labor and Employment	Generation of employment and other economic activities	Increased income and improved standards of living	Increased income and improved standards of living	Increased income and improved standards of living	Increased income and improved standards of living	Increased income and improved standards of living	Increased income and improved standards of living
	Infrastructure	Disruption of community services and facilities	Disruption of traffic, pedestrians, etc., along congested route Damage to road, pavements, irrigation channels as a result of digging a trench for pipeline Potential damage to other key infrastructural lines, e.g., telephone, water supply	Disruption of traffic, pedestrians, etc., along congested route Damage to road, pavements, irrigation channels as a result of digging a trench for pipeline Potential damage to other key infrastructural lines, e.g., telephone, water supply	Disruption of traffic, pedestrians, etc., along congested route Damage to road, pavements, irrigation channels as a result of digging a trench for pipeline Potential damage to other key infrastructural lines, e.g., telephone, water supply	Disruption of traffic, pedestrians, etc., along congested route Damage to road, pavements, irrigation channels as a result of digging a trench for pipeline Potential damage to other key infrastructural lines, e.g., telephone, water supply	No impact likely to occur since it is an undeveloped land	No impact likely to occur since it is an undeveloped land

Notes:
- WCS-1: Laiban Intake-Pantay-Taytay
- WCS-2: Kaliwa Intake-Tanay-Laguna Lake
- WCS-3: Kaliwa Intake-Tanay-Angono
- WCS-4 Kaliwa Intake-Abyodo-Angono/Kaliwa Intake-Taytay Waterway
- WCT-1 Kanan-Kaliwa Interbasin Tunnel
- WCT-2 Kanan Intake-Laiban Interbasin Tunnel

Table G4 .3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (1/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
		Pre-construction/ Construction Phase				
P H Y S I C A L	Land	Modification of land forms	Permanent disappearance of natural landscapes within the dam reservoir and disappearance of natural waterscapes due to inundation. Minimal modification of terrain due to borrow pits and quarry site that will have to be excavated. Minimal volume of soil that will be cut/displaced due to the construction of structure will be dumped to the adjacent areas which may cause runoffs during rainy seasons.	Permanent disappearance of natural landscapes within the dam reservoir and disappearance of natural waterscapes due to inundation Modification of terrain due to borrow pits and quarry site that will have to be excavated. Large volume of soil that will be cut/displaced due to the construction of structure will be dumped to the adjacent areas which may cause runoffs during rainy seasons.	Disturbance of landscape in the tunnel entrance.	Grading/excavation will be concentrated on the areas around the structures. Care should be taken in grading/excavating so as not to cause significant impact to the terrain. Construction of protective measures such as embankments, rip-rap and the seeding of indigenous grasses to significantly reduce land modification in and around the construction site.
		Soil erosion/sedimentation	Soil and sediment wash into waterways causing turbidity and potential blockages of water flow due to earth moving, land clearing, road construction and excavation during construction.	Soil and sediment wash into waterways causing turbidity and potential blockages of water flow due to earth moving, land clearing, road construction and excavation during construction..	Waste soil and sediments washed into waterways and storm drains with potential for causing blockages of existing infrastructure.	Soils that will be displaced will be used to cover low-lying areas. Top layers of the soils will be set aside and eventually placed in greening areas. Provision of slope protection measures such as embankments, silt curtains to prevent occurrence of slides and slumps and increase stability of shoreline.
		Change in physical and chemical properties of soil	Potential contamination of soil due to fuel and oil spills during construction.	Potential contamination of soil due to fuel and oil spills during construction.	Potential contamination of soil due to fuel and oil spills during construction.	

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (2/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
P		Siting of structures in hazard prone areas particularly earthquake	Presence of assumed active faults but less hazardous because of dam height.	Presence of assumed active faults. High risk due to highly populated downstream.	Crossing of an assumed active faults.	
		Operational/ Maintenance Phase				
		Introduction of geologic hazards that maybe caused by the project	Moderate risk area due to presence of low dam within the vicinity of an assumed active fault.	High risk area due to presence of dam within the vicinity of an assumed active fault.		
H	Water	*Pre-construction/ Construction Phase*				
Y		Change in hydrologic pattern	Reduced downstream flow of Agos River. Temporary water diversion would impact adjacent vegetation. Increase turbulence at the downstream tailrace. Moderating effects on flood levels.	Reduced downstream flow of Agos River. Temporary water diversion would impact adjacent vegetation. Increase turbulance at the downstream tailrace. Moderating effects on flood levels.	Reduction of river water flow due to Kaliwa intake (water transfer)	Provision of slope protection measures such as embankments, silt curtains to prevent occurrence of slides and slumps and increase stability of shoreline.
S		Change in quality of surface water	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.	Sediments settling out from turbid water or deposited directly can affect organisms living on the bottom that may result to disappearance of habitat Accidental or unforseen releases of domestic waste will affect the water quality.	No household or business establishments shall be allowed to discharge any sullage or wastewater directly to the waterbody.
I						
C						
A						
L						

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (3/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
P H Y S I C A L	Water		Decrease of nutrient input from the river's sediment load. Sedimentation upstream of dam.	Decrease of nutrient input from the river's sediment load. Sedimentation upstream of dam.		Regular monitoring of water quality shall be undertaken.
		Operational/ Maintenance Phase				
		Increase in surface run-off	No increase in river discharge due to run-of-river scheme	Increase in the river discharge and depth during releases.		
		Decrease in flooding tand he serviceability of the watershed and rivers	No significant effect to downstream flow reduction Reduction of nutrient loading deposited in rivers, estuaries and mangrove areas.	Downstream flood flow reduction at Agos River Reduction of nutrient loading deposited in rivers, estuaries and mangrove areas.		
		Euthrophication of reservoir water	Increase decomposition of organic matter from cut vegetation may result in higher DO, BOD and nutrient levels.	Increase decomposition of organic matter from cut vegetation may result in higher DO, BOD and nutrient levels.		
		Change in water temperature	Minimal due to continuous recharge and release of water.	Low water temperature in deeper part of reservoir		
		Siltation and sedimentation of reservoir	Accumulation of silt and sediments resulting to decrease efficiency of the dam.	Accumulation of silt and sediments resulting to decrease efficiency of the dam.		
		Contamination and depletion of surface water	Accidental or improper releases of domestic and agricultural/ industrial wastes will affect the water quality.	Accidental or improper releases of domestic and agricultural/ industrial wastes will affect the water quality.		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (4/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
		Possible decrease in coastal water productivity	No particular impact due to run-of-river scheme	Decrease of nutrient input from the river's sediment load.		
P H Y S I C A L	Climate and Air Quality	*Pre-construction/ Construction Phase*				
		Air pollution generation	Dust generation resulting from earthworks, and other construction related activities. Increase traffic along the access road delivering construction materials on site.	Dust generation resulting from earthworks, and other construction related activities. Increase traffic along the access road delivering construction materials on site.	Dust generation resulting from earthworks, and other construction related activities.	Regular watering and/or sprinkling of excavated portion of land to lessen resuspension of dust particulate. All excavated soil material must be released on site or compacted in only one place. Paving and revegetation will commence soon after completion of construction activity.
		Increased concentration of gas pollutants	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment used in the construction site. Increase incidence of respiratory related and skin disease.	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment used in the construction site. Increase incidence of respiratory related and skin diseases	Gas (SO_2, NO^x) emissions and increase concentration of CO resulting from the heavy equipment during construction.	Heavy equipment will be kept well-maintained to limit gaseous emissions. All equipment will be installed with air pollution device, if necessary.
		Operational/ Maintenance Phase				
		Dust generation due to increase in traffic volume	Increased incidence of respiratory related diseases among nearby communities.	Increased incidence of respiratory related diseases among nearby communities.		
		Change in air quality due to operation of power generators	Generation of exhaust/fumes leading to increase incidence of respiratory related diseases.	Generation of exhaust/fumes leading to increase incidence of respiratory related diseases.		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (5/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
P H Y S I C A L	Noise/ Vibration	*Pre-construction/ Construction Phase*			Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife Excessive vibrations maybe experienced as a result of the use of heavy equipment.	All equipment should conform to the noise limitation standards of the Government. Use of properly maintained motor engine and other mechanically moving parts of heavy equipment. Provisions of enclosures/ baffles at the construction sites. Construction activities will take place during normal working hours especially at sites near housing areas. Equipment should be mounted on shock absorbing mountings such as cork set on reinforced concrete foundation set on piles. Buffer zone planted to trees and shrubs shall be adequately provided to lessen noise.
		Increase of noise level due to vehicles and noise/vibration producing equipment	Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife Excessive vibrations maybe experienced as a result of the use of heavy equipment such as compactor, etc.	Noise generation is expected in any construction activity causing nuisance and disturbance to human as well as wildlife Excessive vibrations maybe experienced as a result of the use of heavy equipment such as compactor		
		Operational/ Maintenance Phase				
		Increase in noise level	Potential nuisance and disturbance to human as well as wildlife during the operation of power and water treatment plants.	Potential nuisance and disturbance to human as well as wildlife during the operation of power and water treatment plants.		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (6/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
B I O L O G I C A L	Terrestrial Flora and Fauna	*Pre-construction/ Construction Phase*			Disruption of habitat of wildlife as a result of tunneling and digging trench to lay pipelines. Clearing of natural vegetation at the tunnel entrance and access road.	Removal of forest and/or vegetation cover shall be kept to a minimum. Regulatory procedures for cutting of trees shall be strictly followed.
		Disturbance/Destruction of wildlife	Disturbance/destruction of rare and endangered species such as birds of prey and Philippine deer.	Disturbance/destruction of rare and endangered species such as birds of prey and Philippine deer.		
		Encroachment on precious ecosystems	Moderate destruction/removal/submergence of natural vegetation.	Moderate destruction/removal/submergence of natural vegetation.		
		Disturbance and loss of habitat	Inundation of second growth forest, agricultural and fresh water ecosystem.	Inundation of primary and secondary forest and fresh water ecosystem.		
		Operational/ Maintenance Phase				
		Impacts of the project operation on the biology, reproduction and feeding habits of wildlife	Disappearance of important habitat such as forest land, agricultural land and fresh water ecosystem. Intensification of agro-forestry practices in the watershed.	Disappearance of important habitat such as primary forest and fresh water ecosystem. Intensification of agro-forestry practices in the watershed.		
			Increased illegal logging activities due to improvement of roads	Increased illegal logging activities due to improvement of roads		
		Decrease in agricultural production	Inundation of fruit tree farms, orchards	Inundation of agricultural area incl. rice field		
	Aquatic Flora and Fauna	*Pre-construction/ Construction Phase*			Disruption of benthic infaunal communities in streams due to sediments generated frpm earth works.	
		Encroachment of aquatic ecosystem	Disturbance of migrating species such as eel and shrimp	Disturbance of migrating species such as eel and shrimp		
		Removal of natural vegetation	Minor destruction of aquatic plant life as a result of dam construction	Destruction of aquatic plant life as a result of dam construction.		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (7/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
B I O L O G I C A L	Aquatic Flora and Fauna	*Operational/ Maintenance Phase*				
		Impacts on the project operation on the biology, reproduction and feeding habits of wildlife	Colonization of aquatic and hydrophilic species on flooded areas. Proliferation of cold water fish species.	Colonization of aquatic and hydrophilic species on flooded areas. Proliferation of cold water fish species.		
		Increase in habitat of wildlife	Favorable to aquatic species but lesser area.	Favorable to aquatic species.		
		Change in aquaculture production	Development of inland fish production.	Development of inland fish production.		
		Disruption of fish migration and spawning	Minor effect because the remaining river stretch can sustain the fish population of catandromous species.	Minor effect because the remaining river stretch can sustain the fish population of catandromous species.		
		Creation of habitat for disease vectors	Potential occurrence of water-related diseases such as malaria, schistosomiasis.	Potential occurrence of water-related diseases such as malaria, schistosomiasis.		
		Generation of aquatic plants	Proliferation of algal blooms if high level of nutrient is introduced.	Proliferation of algal blooms if high level of nutrient is introduced.		
L A N D U S E	Land Use/ Zoning	*Pre-construction/ Construction Phase*				Modification on the present land use are predicted to be positive. Access road will pave the way to furthet encroachment of people in search of possible livelihood and other economic activities.
		Change in land use	Change in land use from a forest, agricultural and river to a infrastructure-related use	Change in land use from a forest, agricultural and river to a infrastructure-related use.		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (8/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
& IMPORTANT SITES		Change of the aesthetic character of the area	Construction of structure will render an unaesthetic impact due to damaged areas and excavated materials dumped in the vicinity. Inundation of "tinipak" and caves along Kaliwa River.	Construction of structure will render an unaesthetic impact due to damaged areas and excavated materials dumped in the vicinity. Inundation of "tinipak" and caves along Kaliwa River.		Protective wall/enclosures shall be provided in all excavated portions of the areas. Proper procedures for disposal of construction debris shall be implemented to keep the areas as orderly as possible to prevent any unaesthetic effects as well as pollution.
	Archaeolo-gical/ Historical Sites	*Pre-construction/ Construction Phase*				
		Destruction of important and cultural sites	Loss of worship place for Dumagats.	Loss of worship place for Dumagats.		
SOCIO-ECONOMY	Population	*Pre-construction/ Construction Phase*			Displacement of some 222 households along pipeline route and at water treatment plant site estimate) Competition of migrants and locals for the employment opportunities Increase of migrants will result to greater demand for basic services, which may bring concern to local communities.	Relocation sites will be properly planned to conform to the needs of the displaced communities. Top priority in hiring will be given to the local workforce. A local employment program shall be adopted and implemented both during construction and operational phases of the project.
		Displacement of household	No displacement.	Displacement of households in Brgys. Magsaysay (Infanta) Pagsangahan and Mahabang Lalim (Gen. Nakar). (see details in Part H H)		
		Increase in population due to migration of people could trigger social conflicts between residents and construction worker	Competition of migrants and locals for the employment opportunities Rapid increase of migrants, e.g., construction workers and families, will result to greater demand for basic services, which may bring concern to local communities.	Competition of migrants and locals for the employment opportunities Rapid increase of migrants, e.g., construction workers and families, will result to greater demand for basic services, which may bring concern to local communities.		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (9/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
S O C I O - E C O N O M Y	Population	*Operational/ Maintenance Phase*				Capability building program shall be formulated to ensure local residents will be given ample opportunities for employment placement.
		Increase in the population of the area	No noteworthy impact in view of isolated small facilities	Increase of population due to improved access, which may cause some conflicts with local people		
	Labor and Employment	*Pre-construction/ Construction Phase*			Increase income and improve standards of living.	
		Generation of employment and other economic activities	Increase income and improve standards of living.	Increase income and improve standards of living.		
		Change in the economic activities during construction	Change from agriculture/forestry based economic activities to construction services.	Change from agriculture/forestry based economic activities to construction services.		
		Operational/ Maintenance Phase				
		Generation of employment and other economic services	Increase income and improve standards of living	Increase income and improve standards of living		
		Change in revenue generation of the community	Expected increase in employment opportunities will result to increase in revenue of the community	Expected increase in employment opportunities will result to increase in revenue of the community		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (10/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
S O C I O - E C O N O M Y	Housing and Social Services	*Pre-construction/ Construction Phase*				
		Change in house facilities and change in usage of public utilities due to relocation	No relocation of households.	Relocation of households in Brgys. Magsaysay (Infanta) Pagsangahan and Mahabang Lalim (Gen. Nakar).		Relocation sites will be properly planned to conform to the needs of the displaced communities.
		Operational/ Maintenance Phase				
		Change in housing facilities and usage		New housing site development and houses will be constructed complete with health and education services/facilities preferably near the within the vicinity of their original settlements	Disruption of traffic, pedestrians, etc., along congested route. Damage to road, pavements, irrigation channels as a result of digging a trench for pipeline. Potential damage to other key infrastructural lines, e.g., telephone, water supply.	Enclosures/walls around the excavated portion of the road shall be provided. Signs, warning devices and other protective means shall be placed in conspicuous places within the working area.
		Change in education and health service/ Infrastructure	Disturbance in schooling of children of relocated families Creation of habitat for disease vectors/pathogens Introduction of disease carrying vectors due to poor maintenance of reservoir Need for additional/new social services	Disturbance in schooling of children of relocated families Creation of habitat for disease vectors/pathogens Introduction of disease carrying vectors due to poor maintenance of reservoir Need for additional/new social services		
	Culture and Lifestyle	*Pre-construction/ Construction Phase*				
		Change in cultural practices and beliefs (Indigenous peoples, Minority groups, Nomads)	Cultural erosion due to inundation of their place of worship (Kaliwa River).	Cultural erosion due to inundation of their place of worship (Kaliwa River).		

Table G4.3 Predicted Impacts of Proposed Options on Natural and Social Environment of Water Development Schemes and Water Conveyance Scheme and Its Mitigation/Enhancement Measures (11/11)

Resource Environment		Likely Impacts	Water Resource Development Schemes		Water Conveyance	Mitigation / Enhancement Measures
			Kaliwa Low Dam 2	Agos Dam	WCS-4	
		Operational/ Maintenance Phase				
		Change in cultural aspects of people in the affected communities due to relocation and loss of source of livelihood	Living conditions in the resettlement site is different from the existing lifestyle of the communities.	No impact will likely occur since there are no affected communities.		
W A S T E M N G T.	Waste Management	*Pre-construction/ Construction Phase*				Identification of low-lying areas to serve as dump site for soil spoils. Provision of temporary sanitation facilities for the construction workers such as portalets, bathing area, etc.
		Solid waste generation and problems of storage/ disposal	Generation of soil spoils from excavated areas.	Generation of soil spoils from excavated areas.		
		Wastewater generation	Increased waste generation by workers and construction equipment during construction including oil and gasoline spills.	Increased waste generation by workers and construction equipment during construction including oil and gasoline spills.		
		Operational/ Maintenance Phase				
		Solid waste generation and problems of disposal	Generation of soil spoils from excavated areas.	Generation of soil spoils from excavated areas.		
		Wastewater generation and disposal	Waste generation by wastewater treatment plant with high TDS and silt contents.	Waste generation by wastewater treatment plant with high TDS and silt contents.		

Figures

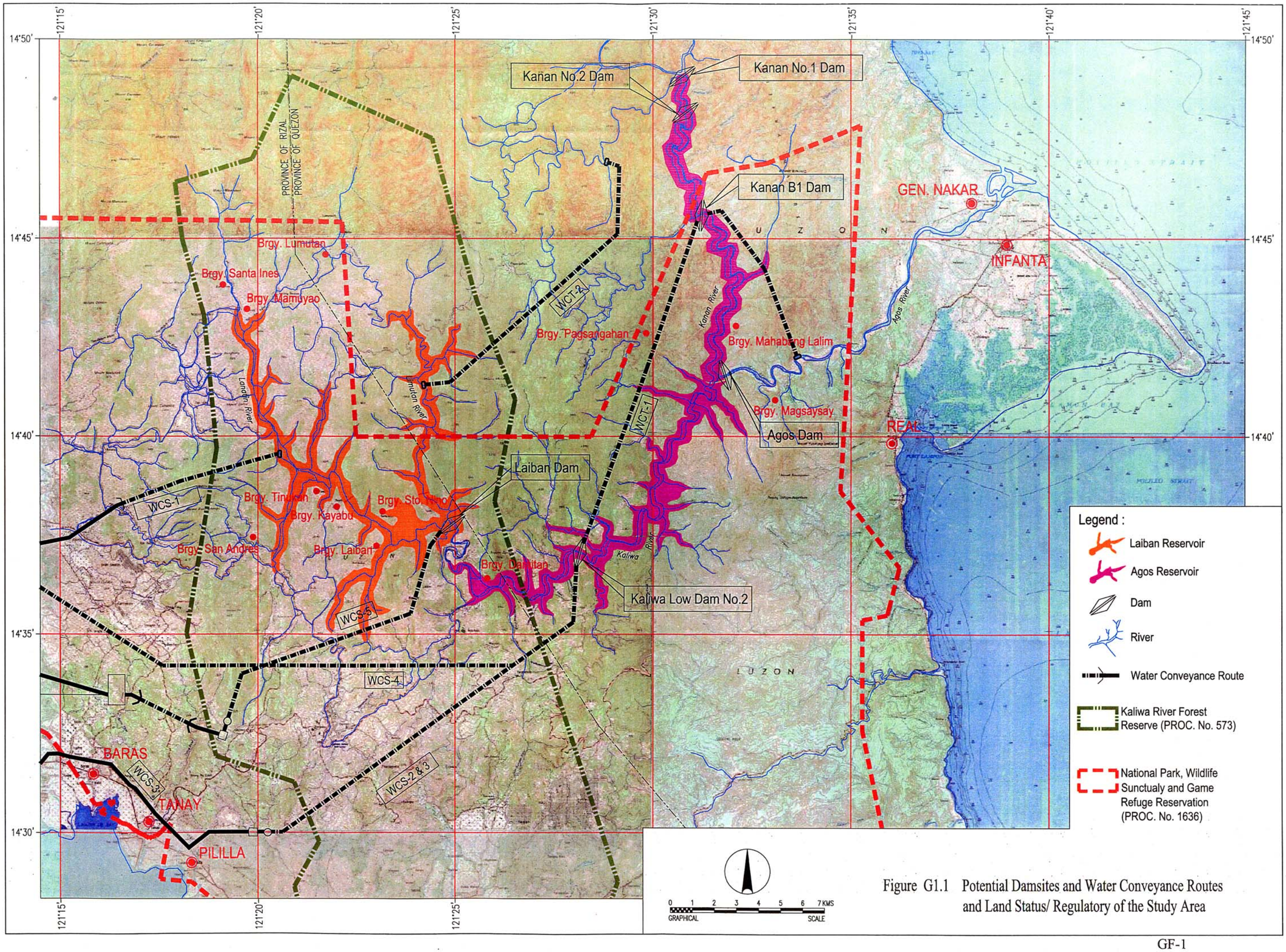

Figure G1.1 Potential Damsites and Water Conveyance Routes and Land Status/ Regulatory of the Study Area