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The state of water resources in the Philippines

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Cover photo: Young boys pick up empty plastic bottles floating on a river in Bacoor, Cavite, south of Manila, as a way to earn a living. Many rivers in Luzon are considered biologically dead because of industrial and municipal pollution. ©Lino Escandor, 2007.

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Definition of terms

Aquifer - a geologic formation that will yield water to a well in sufficient quantities to make the production of water from this formation feasible for beneficial use; permeable layers of underground rock or sand that hold or transmit groundwater below the water table

Beneficial use - use of the environment or any element or segment thereof conducive to public or private welfare, safety and health; and shall include, but not be limited to, the use of water for domestic, municipal, irrigation, power generation, fisheries, livestock raising, industrial, recreational and other purposes.

Use of water for domestic purposes - utilization of water for drinking, washing, bathing, cooking, or other household needs, home gardens and watering of lawns or domestic animals;

Use of water for municipal purposes - utilization of water for supplying water requirements of the community;

Use of water for irrigation - utilization of water for producing agricultural crops;

Use of water for power generation - utilization of water for producing electrical or mechanical power;

Use of water for fisheries - utilization of water for the propagation of culture of fish as a commercial enterprise;

Use of water for livestock raising - utilization of water for large herds or flocks of animals raised as a commercial enterprise;

Use of water for industrial purposes - utilization of water in factories, industrial plants and mines, including the use of water as an ingredient of a finished product; and

Use of water for recreational purposes - utilization of water for swimming pools, bath houses, boating, water skiing, golf courses, and other similar facilities in resorts and other places of recreation.

Biological Oxygen Demand (BOD) - rate at which organisms use the oxygen in water or wastewater while stabilizing decomposable organic matter under aerobic conditions. BOD measurements are used as a measure of the organic strength of wastes in water; the greater the BOD, the greater the degree of organic pollution.

Classification/Reclassification of Philippine Waters - categorization of all water bodies taking into account, among others, the following: (1) existing quality of the body of water; (2) size, depth, surface area covered, volume, direction, rate of flow, and gradient of stream; (3) most beneficial existing and future use of said bodies of water and lands bordering them, such as for residential, agricultural, aquacultural, commercial, industrial, navigational, recreational, wildlife conservation, and aesthetic purposes; and (d) vulnerability of surface and groundwater to contamination from pollutive and hazardous wastes, agricultural chemicals, and underground storage tanks of petroleum products.

Clean Production - a way of redesigning products and product systems so that they are in harmony with natural ecological cycles

Coliform - a type of bacteria. The presence of coliform-group bacteria is an indication of possible pathogenic bacteriological contamination. The human intestinal tract is one of the main habitats of coliform bacteria. Coliform may also be found in the intestinal tracts of warm-blooded animals, and in plants, soil, air, and the aquatic environment. Fecal coliforms are those coliforms found in the feces of various warm-blooded animals.

Effluent - discharges from known sources passed into a body of water or land, or wastewater flowing out of a manufacturing or industrial plant, or from domestic, commercial and recreational facilities

Freshwater - water containing less than 500 ppm dissolved common salt, sodium chloride, such as that in groundwater, rivers, ponds, and lakes

Groundwater - a subsurface water that occurs beneath a water table in soils and rocks, or in geological formations

Groundwater recharge - inflow to a groundwater reservoir

Groundwater reservoir - an aquifer or aquifer system in which groundwater is stored. The water may be placed in the aquifer by artificial or natural means.

Hydrologic cycle - natural pathway water follows as it changes between liquid, solid, and gaseous states. This biogeochemical cycle moves and recycles water in various forms through the ecosphere. (Also called the water cycle.)

Indicator organisms - microorganisms, such as coliforms, whose presence is indicative of pollution or of more harmful microorganisms

Leachate - water containing contaminants which leaks from a disposal site such as a landfill or dump.

Non-point source - any source of pollution not identifiable as point source to include, but not be limited to, runoff from irrigation or rainwater which picks up pollutants from farms and urban areas

Per Capita Water Availability (per year) - water available per person per year

Point source - any identifiable source of pollution with specific point of discharge into a particular water body

Receiving Water - a river, stream, lake, ocean, or other surface of groundwater into which treated or untreated wastewater is discharged

Recharge - refers to water entering an underground aquifer through faults, fractures, or direct absorption

Renewable Resource - resource that potentially cannot be used up because it is constantly or cyclically replenished

Reservoir - a pond, lake, tank, or basin (natural or human-made) where water is collected and used for storage. Large bodies of groundwater are called groundwater reservoirs; water behind a dam is also called a reservoir of water.

River basin - area drained by a river and its tributaries. A principal river basin has a drainage area of at least 40 km^2, while a major river basin has a drainage area of more than 1,400 km^2.

Runoff - surface water entering rivers, freshwater lakes, or reservoirs

Surface water - all water which is open to the atmosphere and subject to surface runoff. Also defined as water that flows in streams and rivers and in natural lakes, in wetlands, and in reservoirs constructed by humans.

TDS (total dissolved solids) - sum of all inorganic and organic particulate material. TDS is an indicator test used for wastewater analysis and is also a measure of the mineral content of bottled water and groundwater. There is a relationship between TDS and conductivity. People monitoring water quality can measure electrical conductivity quickly in the field and estimate TDS without doing any lab tests at all.

Wastewater - waste in liquid state containing pollutants

Water quality - a term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a particular use

Watersheds - regional basins drained by or contributing water to a particular point, stream, river, lake, or ocean. Watersheds range in size from a few acres to large areas of the country.

Water table - upper level of a saturated formation where the water is at atmospheric pressure, or the upper surface of an unconfined aquifer.

Withdrawal - water removed from the ground or diverted from a surface water source for use

50% Dependability - maximum limit to which water resources should be exploited through provision of storage-type dams for regulating flow in each region

80% Dependability - probability of hydrologic conditions by which the maximum capacity of water resources development projects under the run-of-the river type is usually determined

Abbreviations and acronyms

ADB	Asian Development Bank
AEIP	Asian Environmental Improvement Project
APO	Asian Productivity Organization
BOD	Biochemical Oxygen Demand
BFAR	Bureau of Fisheries and Aquatic Resources
BSWM	Bureau of Soils and Water Management
CEPZA	Cavite Export Processing Zone
CDO	Cease and Desist Order
CPC	Certificate of Public Convenience
CP	Clean Production
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
DPWH	Department of Public Works and Highways
DILG	Department of Interior and Local Government
DENR	Department of Environment and Natural Resources
DANIDA	Danish International Development Agency
DAO	DENR Administrative Order
DOH	Department of Health
DO	Dissolved Oxygen
DTI-BSMBD	Department of Trade and Industry - Bureau of Small and Medium Business Development
EMB	Environmental Management Bureau
EMS	Environmental Management Systems
ENSO	El Niño – Southern Oscillation
EUF	Environmental User's Fee
IEPC	Industrial Efficiency and Pollution Control
IISE	Industrial Initiatives for a Sustainable Environment
IPCC	Industrial Pollution Control in Cebu
JICA	Japan International Cooperation Agency
LGU	Local Government Unit
LLDA	Laguna Lake Development Authority
LWUA	Local Water Utilities Administration
MEIP	Metropolitan Environmental Improvement Project
MGB	Mines and Geosciences Bureau
MCM	Million Cubic Meters
MIWD	Metro Iloilo Water District
MWSS	Metropolitan Waterworks and Sewerage System
MTPDP	Medium Term Philippine Development Plan
NWRB	National Water Regulatory Board

NCR	National Capitol Region
NPC	National Power Corporation
OA	Organic Agriculture
PRRP	Pasig River Rehabilitation Program
POPs	Persistent Organic Pollutants
PNSDW	Philippine National Standards for Drinking Water
PBE	Philippine Business for the Environment
PRIME	Private Sector Participation in Managing the Environment
PEPP	Philippine Environment Partnership Program
SA	Sustainable Agriculture
SME	Small and Medium Enterprises
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UNEP	United Nations Environment Program
UNICEF	United Nations Children Fund
UNIDO	United Nations Industrial Development Organization
USEPA	US Environmental Protection Agency
VOCs	Volatile Organic Chemicals
WB	World Bank
WHO	World Health Organization

Introduction

This report gathers available information regarding water resources in the Philippines, focusing on the issues of pollution, especially of drinking water and freshwater sources, and water scarcity. It also reviews the country's existing legal and policy frameworks for water use, quality control, and management.

In an attempt to capture the complexity surrounding the status of water resources, this report is presented in six parts. The first section focuses on the general status of availability of freshwater resources, both surface waters (rivers, lakes, and reservoirs) and groundwater sources. Section 2 follows with a discussion on water quality. This consists of the following sub-topics: classification of surface waters, standards used in classification and subsequent monitoring of water bodies, impacts on health and the environment, and efforts to address problems on water quality. This part of the report also presents 'pollution hotspots'--areas that generate the highest volume of water pollution and/or are severely affected by water pollution.

The status of water use and supply is presented in Section 3. This part of the report focuses on actual usage of water resources by different consumers. Different issues pertaining to water use are also identified, including the issue on access to potable drinking water itself. Over and above these problems, the report presents in this section other factors that threaten not only water supply but also threaten the availability of water sources from which supply is withdrawn.

Section 4 presents a review of the existing legal and policy frameworks for water resources in the Philippines. This includes a discussion on existing guidelines and standards used to regulate water use and supply, ensure water quality, and presents the status of the enforcement of these policies and guidelines.

Efforts to initiate and implement Clean Production (CP) programs are then presented in Section 5, which includes a list of key CP initiatives and concerned agencies/institutions involved in this endeavor.

The sixth topic, which is the last section of this report, contains the list of available reports on water in the Philippines and materials that may be used as reference for future studies.

I. Surface water and groundwater resources

The Philippines obtains its water supply from different sources. These include: rainfall, surface water resources, i.e. rivers, lakes, and reservoirs, and groundwater resources. It has 18 major river basins and 421 principal river basins as defined by the National Water Regulatory Board (NWRB).

The Bureau of Fisheries and Aquatic Resources (BFAR) reports that there are 79 lakes in the country, mostly utilized for fish production. Laguna Lake is the country's largest lake with a total area of 3,813.2 sq km and is also one of the largest lakes in Southeast Asia. Lake Lanao, the largest lake in Mindanao, is one of the 17 ancient lakes on earth (Environmental Management Bureau, 2006).

In terms of groundwater, the country has an extensive groundwater reservoir with an aggregate area of about 50,000 sq km. Data from the Mines and Geosciences Bureau (MGB) show that several groundwater basins are underlaid by about 100,000 sq km of various rock formation and that these resources are located in:

Northeast Luzon
Central Luzon
Laguna Lake basin
Cavite-Batangas-Laguna basin
Southeast Luzon
Mindoro Island
Negros Island
Northeast Leyte
Ormoc-Kananga basin
Agusan-Davao basin
Occidental Misamis basin
Lanao-Bukidnon-Misamis basin

Groundwater resources are continuously recharged by rain and seepage from rivers and lakes (PEM, 2003; EMB, 2006).

As a tropical country, rainfall in the Philippines ranges from 1000 to 4000 mm per year, of which 1,000-2,000 mm are collected as runoff by a natural topography of more than 421 principal river basins, some 59 natural lakes and numerous small streams, with significant variation from one area to another due to the direction of the moisture-bearing winds and the location of the mountain ranges (Kho, J., 2005; NWRB, 2003).

Overall, the Philippines' total available freshwater resource is at 145,900 MCM/year based on 80 percent probability for surface water, and groundwater recharge or extraction at 20,000 MCM/year (NWRB-SPM, 2003; PEM, 2003; ASEAN, 2005).

Theoretically, the freshwater storage capacity and the high rate of precipitation assure the country an adequate supply for its agricultural, industrial and domestic uses. However, seasonal variations are considerable and geographic distribution is biased, often resulting in water shortages in highly populated areas, especially during the dry season.

Data from the Philippines Environment Monitor (PEM) show that while some regions are endowed with high potential source of surface water, others have limited supplies, as shown in the table below.

Water Resources Region	Groundwater Potential	Surface Water Potential	Total Water Resources Potential
X Northern Mindanao	2,116	29,000	31,116
XII Southern Mindanao	1,758	18,700	20,458
VI Western Visayas	1,144	14,200	15,344
XI Southeastern Mindanao	2,375	11,300	13,675
IX Western Mindanao	1,082	12,100	13,182
VIII Eastern Visayas	2,557	9,350	11,907
II Cagayan Valley	2,825	8,510	11,335
III Central Luzon	1,721	7,890	9,611
IV Southern Tagalog	1,410	6,370	7,780
I Ilocos	1,248	3,250	4,498
V Bicol	1,085	3,060	4,145
VII Central Visayas	879	2,060	2,939
TOTAL	20,200	125,790	145,990

Table 1. Water availability, in MCM

(Source: Philippines Environment Monitor 2003)

The report also mentions that groundwater contributes 14 percent of the total water resource potential of the country.

As noted in the table above, Region II or Cagayan Valley has the highest potential source of groundwater, while Region X or Northern Mindanao has the highest potential source of surface water. On the other hand, Central Visayas has the lowest potential source for both groundwater and surface water.

This same report projects that by year 2025, water availability deficit would take place in several river basins such as in Pampanga and Agno, in Pasig-Laguna, in Cagayan Valley, all other regions in Luzon, in Jalaur and Ilog Hilabangan, and in the island of Cebu in Visayas.

In general, water deficits are said to be time and site-specific.

Data from the JICA Master Plan on Water Resource Management in the Philippines estimate that only 1,907 cubic meters of fresh water would be available to each person each year, making the Philippines second to the lowest among Southeast Asian countries with fresh water availability (PEM 2003).

II. Quality of water resources

The Philippine Clean Water Act of 2004 defines water quality as the characteristics of water that define its use and measured in terms of physical, chemical, biological, bacteriological, or radiological characteristics by which the acceptability of water is evaluated, to classify water resources and their beneficial use.

A number of ambient standards for measuring water quality have been formulated by the Department of Environment and Natural Resources (DENR). DAO 34, issued in 1990, includes classifications for both surface and coastal water. For each classification, current beneficial use (e.g., drinking water, etc.) is given. It also contains water quality criteria for each class appropriate to the designated beneficial use.

According to EMB, under this DAO, 33 parameters define the desired water quality per water body classification. However, in the absence of a water quality index, EMB also mentioned that certain parameters may be used in the interim. These parameters include:

- dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), and heavy metals for inland surface waters; and
- fecal coliform, nitrates, and salinity (chloride content) for groundwater as defined in the Philippine National Standards for Drinking Water (PNSDW).

While salinity is not directly related to pollution, it is also used as a common parameter for groundwater quality assessment to measure the level of contamination from saline water.

Water quality criteria defined in each of these parameters serve as benchmark against which monitoring data are compared to assess the quality of water bodies based on established classifications (EMB, 2005).

A. Water quality classification (for surface waters)

Data from the EMB show that as of 2005, it has classified 525 water bodies in terms of best usage and water quality, representing 62.5 percent of the inventoried water bodies in the country. Of these water bodies, 263 are principal rivers, 213 are minor rivers, seven are lakes, and 42 are coastal and marine waters.

Of the classified inland surface water bodies, five are Class AA, 203 are classified as Class A, 149 are Class B, 231 are Class C, and 23 are Class D. Table 2 presents this breakdown of classified inland surface water bodies in the country. Of the 525 water bodies, 133 have distinct classification based on their upstream, midstream, and downstream sections, hence, the total number of classifications made reach 611.

Classification	Number
Class AA Waters intended as public water supply requiring only approved disinfection to meet the PNSDW	**5**
Class A Waters suitable as water supply requiring conventional treatment to meet the PNSDW	**203**
Class B Waters intended for primary contact recreation (e.g. bathing, swimming, skin diving, etc.)	**149**
Class C Waters for fishery, recreation/boating, and supply for manufacturing processes after treatment	**231**
Class D Waters intended for agriculture, irrigation, livestock watering, etc.	**23**

Table 2. Number of classified inland surface water bodies

(Source: EMB National Water Quality Status Report, 2006)

This means that only 39 percent of the 525 water bodies may be considered as potential sources of drinking water.

B. Water quality assessment

For the period 2001 to 2005, the EMB monitored a total of 196 inland surface waters: 192 rivers and four lakes. Of the 196 monitored water bodies, only 127 met the required four sampling events and were included in the analysis. Data on the status of water quality contained in the EMB National Water Quality Status Report using each of the parameters mentioned earlier are presented below.

Dissolved oxygen (DO)

Dissolved oxygen (DO) is the amount of oxygen that is dissolved in water and is essential to healthy streams and lakes. Dissolved Oxygen is one of the water quality parameters used as an indication of how polluted the water is and how well the water can support aquatic plant and animal life. A higher dissolved oxygen level usually indicates better water quality. If dissolved oxygen levels are too low, some fish and other organisms may not be able to survive (Stevens Institute of Technology, The Global Water Sampling Project 2007).

Generally, the national standard for DO is 5 mg/L, except for water bodies classified as Class D and Class SD, with standards set at 3 mg/L and 2 mg/L, respectively (PEM, 2004).

Low DO levels may be found in areas where organic material (dead plant and animal matter) is decaying, as bacteria require oxygen to decompose organic waste, thus, depleting the water of oxygen. Areas near sewage discharges sometimes have low DO levels due to this effect (Stevens Institute of Technology, The Global Water Sampling Project 2007).

Furthermore, low concentrations of DO, when combined with the presence of toxic substances may lead to stress responses in aquatic ecosystems because the toxicity of certain elements, such as zinc, lead and copper, is increased by low concentrations of dissolved oxygen (Enderlein *et al*., 1996).

The EMB report on monitoring of DO levels shows that approximately 47 percent of 127 water bodies are found to have good water quality and could be tapped as sources for water supply.

Forty percent recorded fair water quality, which means that the water bodies partially comply with the designated water quality criteria but do not support its intended beneficial use in 50 to 97.99 percent of sampling instances.

Thirteen percent, however, showed poor water quality. These include the four rivers in NCR – San Juan River, Parañaque River, Navotas-Malabon-Tullahan-Tenejeros River, and Pasig River; Guadalupe River in Region VII; Meycauayan and Bocaue Rivers in Region III; and Calapan River in Region IV-B.

Data in the PEM 2004 issue states, however, that as of 2004, 15 rivers nationwide have dissolved-oxygen at or below zero, indicating that they are "dead" during the dry months. In addition, Environment Secretary Angelo Reyes also mentioned in a published news article early this year (2007) that as many as 50 of the 421 rivers in the country can be considered "biologically dead" (Gaylican, C, PDI, 2007).

Biochemical oxygen demand (BOD)

Biochemical oxygen demand, or BOD, measures the amount of oxygen consumed by microorganisms in decomposing organic matter in stream water. BOD parameter measures the organic strength of wastes in water; the greater the BOD, the greater the degree of organic pollution.

BOD also directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD are similar as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die.

National standards for BOD vary from 1 to 15 mg/L based on beneficial water usage and classification.

For this parameter, 47 percent of the 107 water bodies with at least four sampling events were found to show good water quality, 41 percent have fair water quality, while the remaining 12 percent have poor water quality with the highest BOD recorded at the downstream section of Bulua Creek in Region X. According to the report, this indicates high organic discharges from manufacturing facilities, runoff from livestock production, and discharges from households.

The EMB Report further mentions that there are three rivers that recorded zero percent compliance of all samples with the BOD criterion.

Total suspended solids (TSS)
TSS parameter measures the amount of undissolved solid particles in water such as level of siltation, decaying plant and animal matter, and domestic and industrial wastes. For water bodies used for water supply the standard for TSS is 25 mg/L for Class AA and 50 mg/L for Class A (EMB, 2006).

Out of forty-six Class A/AA water bodies monitored for TSS, about 23 percent have good water quality, 69 percent have fair water quality, and eight percent have high TSS levels, indicating poor water quality. Among those with poor water quality are: Pampanga River in Region III, Bicol River in Region V, and Iponan and Alubijid Rivers in Region X.

According to EMB, the presence of a high percentage of TSS confirms the effects of sand and gravel quarrying activities and runoff from denuded forests and agricultural lands.

Total dissolved solids (TDS)
TDS is generally used as an aggregate indicator of the presence of a broad array of chemical contaminants. The primary sources of TDS in receiving waters are agricultural runoff, leaching of soil contamination, and point source water pollution from industrial or domestic sewage (EMB, 2006).

For water bodies classified as Class AA, the standard for TDS levels is expected not to exceed 500 mg/L and 1,000 mg/L for both Class A and D waters.

Of the 30 monitored Class AA/A water bodies, three have two classifications; hence, a total of 33 classifications. About 55 percent have good TDS levels, which mean that these water bodies comply with set water quality criteria based on their intended beneficial use. Forty-two percent have fair TDS levels and only Marilao River has poor water quality, with annual average TDS levels ranging from 1,785 to 3,265 mg/L.

Heavy metals
EMB reports that heavy metals are parameters included in monitoring activities only for receiving water bodies where mining, electroplating, tanning, and other similar activities are operating.

Among inland surface waters, only Meycauayan, Bocaue, and Marilao Rivers have been monitored. Annual average monitoring results of Meycauayan River in 2001, 2003, and 2004 show an excess (based on minimum criteria and value) for chromium (2001), cadmium (2001), and lead (2004) (EMB, 2006).

Monitoring results of Bocaue River indicate that the River met the criteria for chromium, copper, and cadmium. However, it showed high lead concentrations in all its sampling stations particularly during the dry season in 2004. The Marilao River showed similar excess (relative to existing standards) in lead and cadmium in its Class A and C waters. Potential sources of heavy metals are tanneries, electroplating, and other similar industries located in nearby areas.

The Marilao River was the subject of two Greenpeace reports in 1996 ("Lead Overload: Lead Battery Waste Trade and Recycling in the Philippines) and, again, in 2003 (Toxics Reloaded: Revisiting the Impacts of Lead Battery Waste Trade and Recycling in the Philippines) for lead contamination. Effluent samples taken from a discharge canal of the Philippine Recyclers, Incorporated (PRI) had lead levels of 190 ppm or 3,800 times higher than the 0.05 ppm or mg/L standard set for lead in effluent from old and existing industries.

Continuous monitoring of mercury and cyanide levels in rivers and creeks traversing Small Scale Mining Areas in some parts of Eastern Mindanao is being undertaken by the MGB and EMB. MGB Region XI reported in December 2003 that mercury levels were found to be beyond the 0.002 mg/L criterion in filtered water samples in some monitoring locations in Naboc River. Likewise, cyanide was detected in the mixing zone at Sitio Deptro, Upper Ulip (EMB, 2006).

In October 2005, mine tailings from the operations of Lafayette Philippines Inc. spilled into creeks in Rapu Rapu Island causing massive fishkills in the receiving marine waters. On July 18, 2006 while on a test run that would eventually lead to the full resumption of its operations, another fishkill was reported. Greenpeace took samples of water from the Mirikpitik Creek in August 2006 and found cadmium, copper and zinc levels that were many hundreds of times higher than typical background concentrations (Lafayette causes pollution during 30-day trial run).

The PEM 2003, on the other hand, reported that heavy metals and toxic pollutants from industrial sources were found to contribute to pollution in Metro Manila, Central Luzon, Southern Tagalog, Cebu and mining sources in the Cordillera Autonomous Region and CARAGA.

C. Groundwater quality assessment

In assessing quality of groundwater resources, the standard for TDS is 500 mg/L and a "negative" for coliform. "Negative" means total coliform must not be detectable in any 100 ml sample, while "positive" means the presence of total coliform in the water sample (PEM, 2003).

Data from the PEM showed that up to 58 percent of groundwater sampled is found to be contaminated with coliform bacteria, and needs treatment. This, however, is based on data from the NWRB-NWIN Project and compiled data from various Feasibility Studies of water districts with the Local Water Utilities Administration (LWUA) for the period 1990 - 1997.

A more updated data, though limited in number of samples, is the result of the 2005 Tapwatch Monitoring Program by the EMB. From the 88 wells monitored in depressed areas in the country, the project found 21 sites with potable groundwater, while 27 sites were found to be contaminated with fecal coliform. The remaining 40 other sites required further testing to confirm potability (EMB, 2006). The sampling sites found not potable are located in the following:

Region I - San Fernando, La Union
Region II - Cagayan, Nueva Viscaya
Region III - Pampanga
Region IV-B - Oriental Mindoro
Region VI - Iloilo City
Region VII - Cebu City
Region VIII - Leyte
Region IX - Zamboanga City
Region XI - Davao City

D. Pollution hot spots

Reviewed materials from the DENR and the PEM series identified three main sources of pollution: domestic wastewater discharges (also called 'municipal'), agricultural wastewater, and industrial wastewater.

These were further classified as either 'point sources', those which emit harmful substances directly into a particular water body, or 'non-point sources', which have no identifiable source but are scattered with pollutants delivered indirectly. Table 3 presents the data from PEM 2003 and those presented in the EMB 2001-2005 National Water Quality Status Report.

	PEM 2003	EMB 2001-2005 Status Report
Point Sources:		
- Domestic Wastewater	**48 %**	**33 %**
- Agricultural Wastewater	**37 %**	**29 %**
- Industrial Wastewater	**15 %**	**27 %**
Non-point sources	**Not included**	**11 %**

Table 3. Pollution from key potential sources

Although accounts of key sources of pollution for the two reports are both based on BOD load, these reports represent two different sets of references. One is based on data compiled from 1995 – 2001 (PEM 2003 report), and the other is based on results of their assessment for 2001 - 2005 (EMB Status Report).

<u>Domestic wastewater</u>
Domestic effluents are generated from activities such as bathing, laundry, cleaning, cooking, washing, and other kitchen activities. This contains a large amount of organic waste with suspended solids and coliforms. Calculations made based on available data show that half the organic waste is from the domestic sector (PEM, 2003).

As stated in the EMB report, domestic wastewater discharges contribute highest to the BOD load as the lack of sewage treatment system allows more than 90 percent of inadequately treated domestic sewage to be discharged into surface waters, which contain bacteria and viruses that threaten human life.

Geographically, data show that one-third (30 percent) of BOD generation comes from Metro Manila and Region IV alone, at 18 and 15 percent, respectively (PEM, 2003).

Agricultural wastewater

Agriculture and livestock activities include the raising or production of hogs, chicken, cattle, and other dairy farming activities, all of which generate high organic wastewater. A number of these farms, including backyard animal farms, have no appropriate wastewater treatment facilities. This is considered as the major source of pollution in rural areas (EMB, 2006; PEM, 2003).

Data also show that the major sources of agricultural runoffs include organic wastes such as decayed plants, livestock manure, and dead animals; soil loss in the form of suspended solids; and pesticides and fertilizer residues (PEM, 2003).

Apart from pollution of surface waters, there are studies that show the impacts of using agrochemical inputs on groundwater resources, especially during the wet season (Varca, L, 2002).

Regions IV and I generate the highest load of agricultural BOD accounting for 13 and 12 percent of the total agricultural BOD generation, respectively (PEM, 2003).

Industrial wastewater

Reports show that the volume and characteristics of industrial effluents vary by type of industry and are influenced by different factors such as production processes and the scale of production used.

Industries that are found to be water-intensive, i.e. food and dairy manufacturing, pulp, paper and paperboard products, and textile products, correspondingly discharge large amounts of wastewater (PEM, 2003).

Most of the water pollution-intensive industries are in National Capital Region, Calabarzon, and Region III. Food manufacturing industries, piggeries, and slaughterhouses are the main sources of organic pollution (PEM, 2004).

A report from a study conducted by the United Nations Industrial Development Organization (UNIDO) in 1999 emphasizes that the situation is even more critical with regard to hazardous wastes. In the said report, approximately 2,000 cubic meters of solvent wastes, 22,000 tons of heavy metals, infectious wastes, biological sludge, lubricants, and intractable wastes, as well as 25 million cubic meters of acid/alkaline liquid wastes are improperly disposed of annually in the Metro Manila area alone.

A study by the Japan International Cooperation Agency (JICA) conducted in 2001 (as cited in National Economic Development Authority's document on the Medium Term Philippine Development Plan 2004-2010) states that around 700 industrial establishments in the Philippines generate about 273,000 tons of hazardous wastes per annum. It was further estimated that with 5,000 potential hazardous waste generators, about 2.41 million tons of hazardous wastes will be generated.

At present, the report added, there is no integrated treatment facility for hazardous wastes in the country although there are about 95 small to medium-scale treatment facilities that treat hazardous wastes (i.e., used oil, sludge). There is approximately 50,000 tons of hazardous wastes stored on or offsite due to lack of proper treatment, recovery and recycling facilities. Sometimes they end up being recycled in backyard operations further putting at risk workers and communities hosting these informal recycling facilities. Other hazardous wastes are exported to other countries for recovery and disposal (i.e. metal bearing sludge, used solvents and electronic wastes) and treatment (e.g. PCB).

Non-point sources

Data on water pollution from non-point sources are often excluded in terms of official statistics. The PEM 2003 even mentions that the technology to monitor and control point sources has been well developed, while non-point sources are found to be difficult to monitor and control.

If solid waste, for instance, is not collected, treated and disposed properly, the organic and toxic components of household, industrial, and hospital waste are mixed with rain and groundwater. It has also been established that this creates an organic and inorganic mixture, composed of heavy metals and poly-organic and biological pathogenic toxins, which causes illness and even deaths (PEM, 2001).

However, monitoring of non-point sources, especially the contribution of solid waste, is scarce, and no attempt has been made thus far to create an inventory. The common non-point sources are urban runoff and agricultural runoff (PEM, 2003; EMB, 2006).

Table 4 (shown in next page) illustrates the distribution of BOD generation for the different regions. As shown in this table, reduced quality of water resources had been observed especially in densely populated areas, and regions of industrial and agricultural activities.

In both reports (PEM 2003, EMB 2006), four regions were found to have an unsatisfactory rating for the water quality criteria. These include the National Capital Region (NCR) or Metro Manila, Southern Tagalog Region (Region IV), Central Luzon (Region III), and Central Visayas (Region VII). The Ilocos region (Region I) is also highlighted in this table as it is one of the highest contributors to agricultural BOD generation.

In addition, the Philippines has also experienced major water-related incidents that impact on water quality and the water resources itself. The EMB reported that from 2001 to 2005, several water-related incidents occurred, which include oil/chemical spills, mine tailings spill incidents, and illegal dumping of wastes, which resulted in fish kills and water body contamination.

Region	No. of Households	Domestic BOD Generation	No. of Mfg. Establish-ments	Industrial BOD Generation	Agriculture Land Area (in km2)	Agricultural BOD Generation
NCR Metro Manila	2,132,989	**17.6%**	7,774	**42.5%**	0	0
CAR-Cordillera Administrative Region	263,816	1.7%	88	0.6%	190,235	2.3%
I Ilocos	831,549	5.2%	344	3.3%	415,434	**11.5%**
II Cagayan Valley	554,004	3.5%	146	0.2%	709,964	6.1%
III Central Luzon	1,632,047	**9.9%**	1,840	**9.0%**	653,607	**9.1%**
IV Southern Tagalog	2,410,972	**14.6%**	3,806	**14.1%**	1,410,315	**13.3%**
V Bicol	891,541	5.8%	234	3.1%	1,004,425	5.4%
VI Western Visayas	1,211,547	**7.7%**	580	5.1%	889,549	8.1%
VII Central Visayas	1,129,317	7.1%	1,432	**7.4%**	665,446	**10.6%**
VIII Eastern Visayas	715,025	4.5%	169	1.1%	957,329	2.6%
IX Western Mindanao	595,728	3.8%	238	3.3%	763,796	5.2%
X Northern Mindanao	542,075	3.4%	311	2.2%	828,515	**9.1%**
XI Southern Mindanao	1,066,199	6.4%	727	6.6%	1,103,297	8.6%
XII Central Mindanao	501,915	3.2%	186	0.5%	706,472	3.9%
ARMM - Autonomous Region in Muslim Mindanao	393,269	3.0%	13	0	-	3.0%
CARAGA	393,362	2.6%	144	0.9%	-	1.2%

Table 4. BOD generation per region

(Source: Philippines Environment Monitor 2003

E. Health and environmental problems

Pollution of rivers, streams, and lakes contaminate ground and surface waters, thus exposing the population to environmentally-related diseases. The relationship between polluted water and disease has now been firmly established and accepted.

Much of the surface water in urban areas is a public health risk while rural surface waters are also sources of disease. The World Bank estimates that exposure to water pollution and poor sanitation account for one-sixth of reported disease cases, and nearly 6,000 premature deaths per year. The cost of treatment and lost income from illness and death due to water pollution is pegged at PHP6.7 billion (US$134 million) per year (PEM 2006).

Pollution of our water resources such as untreated wastewater discharges affect human health through the spread of disease-causing bacteria and viruses. Some known examples of diseases that may be spread through wastewater discharge are gastro-enteritis, diarrhea, typhoid, cholera, dysentery, hepatitis, and, recently, Severe Acute Respiratory Syndrome (SARS) (PEM 2003).

According to the World Bank, just under a third, or 31 percent of illnesses in the country, monitored for a five-year period were caused by water-borne pathogens.

In the agriculture sector, application of agrochemicals (i.e. fertilizers, herbicides, pesticides) remains a common practice among farmers in rural areas. Intensive use of agrochemicals has been known to create and result to both environmental problems and diseases. The hazards accompanying this practice, especially those associated with persistent organic pollutants or POPs have been known for years and the knowledge of the extent of harm they cause has increased.

According to a study by Dr. N. Maramba (1996), most farmers may be aware that pesticides are hazardous but there is a lack of awareness of exposure risks. Pesticide handlers are the ones most heavily exposed. In addition, exposure of households in farming communities may occur due to spray drift from nearby fields. This exposure is further enhanced by farmers' practice of washing their sprayers near, or in, irrigation canals, which may then become part of agricultural runoff. They also use this water source for washing of hands and feet, clothes, and to some extent, for taking a bath.

Several cases were cited in the study concerning organochlorine poisonings, aplastic anemia, eye, skin, nail, pulmonary, renal, and neurological problems found to be significantly associated with pesticide exposure.

Maramba's report further mentions that groundwater near rice paddies may at times contain pesticide residues. While levels detected were below the allowable limit, this may present long-term chronic exposure problems.

Problems caused by exposure, the report stipulates, are further aggravated by the fact that very few epidemiological studies on human populations have been designed to investigate pesticide exposure and pesticide-related illnesses among affected populations, resulting in possible health risks for the broader population.

An article by Juan Mercado in the Philippine Daily Inquirer last February 22, 2007, highlights the threats of aerial spraying of pesticides over Mindanao banana plantations. He mentioned that around 13.5 metric tons of toxic mercury is being washed yearly into major rivers, from Naboc to Kinking, which then flows into the Davao Gulf. Lead tailings poison the Hijo, Matiao, Masara, Batoto, and Manat Rivers. Mercury-laced waters, from Compostela Valley, seep into tributaries, as they drain into Butuan Bay. Mercury-stained stream sediments also threaten the Agusan River.

In another study conducted on banana production in Mindanao, soil analysts reported that intensive land cultivation and overuse of chemicals gravely damaged the land of banana growers in Davao, Philippines. Most banana companies are now said to be on the lookout for more land because the existing plantations have become less productive through the years, a consequence of intensive use of fertilizer and chemicals (JCDB, 1979 as cited in Calderon and Rola, 2003).

Agrochemicals not only pollute surface waters. A study conducted by Leonila Varca, “Impact of Agrochemicals on Soil and Water Quality”, concludes that long-term use of pesticides to control pests and diseases, especially in rice production, may actually contribute to the contamination of soil and groundwater with their residues.

Contamination from industrial sources is also a common source of diseases caused by toxic substances. This includes heavy metal contamination from mining activities, which leads to elevated levels of mercury causing gingivitis, skin discoloration, neurological disorders, and anemia. Water contamination from electronic manufacturing, for example from chemicals such as trichloroethylene such as recorded in an incident in Las Piñas City in 2007, lead to dizziness and headaches as well as cancer (PEM 2006).

The PEM 2004 report also warns that exposure to chemicals from industrial effluents may result in a range of health effects including headache, nausea, blurring of vision, poisoning, male sterility, and immune system impairment.

Amidst this warning are several cases that have been reported in the past few years. One of these was an incident in December 2006 in Barangay Prenza, in Marilao, Bulacan. According to news reports, the residents were suddenly awakened in the early dawn with the stench of chemicals dumped in the nearby irrigation canal by men said to be hired by the CFS Waste and Recycling Management Co. in Valenzuela City (Reyes, C, PDI, December 7, 2006). Many residents vomited and fainted and were rushed to the hospital. Nearly half of the village’s 3,000 residents had to evacuate to escape toxic asphyxiation (PDI, December 6, 2006).

In May 2006, the Sun Star Bacolod reported that residents of Barangay Mansilingan in Bacolod City were complaining of the foul odor allegedly being emitted by Coca-cola Bottlers Philippines Inc. in their area. The community has initiated efforts to file their complaints and have a dialogue with concerned local government officials as well as the management of said corporation.

Another case of chemical waste spill was also reported in Lucena City in March 2006 (Mallari, D, PDI, 2006). Chemical wastes from a soap factory located at the outskirts of this city has spilled into the Alitao River, causing serious water pollution that is affecting the lives of thousands of people who depend on the river, including an indigenous Aeta community.

In March 2007, the DENR warned of groundwater contamination in Pamplona, Las Piñas. Tricholoroethylene (TCE), a carcinogen, was found in 19 out of 102 wells tested in the vicinity of a Philips Corporation facility. The water was rendered unfit for human consumption (GMANews.TV, 21 March 2007).

Official documentation of water pollution shows that the major pollutants, including BOD, DO, coliform, nitrates, and suspended solids, have increased steadily in Philippine rivers. It was observed, however, that official Philippine data tend to emphasize BOD and other biological pollutants to the exclusion of other—more industrial and more toxic—pollutants, hence, do not clearly identify concrete impacts of these more hazardous wastes on health and the environment.

Toxic incidences and impacts of polluted water bodies only come to public attention when a relatively huge number of the population is involved and if the effects on health are graphic and immediate.

In 2007, a broad study was carried out by Greenpeace to investigate the quality of various surface and ground water systems in four countries, including the Philippines. Water from the systems investigated is known to be abstracted for distribution as drinking water, generally following purification treatments that include chlorination. Treated waters are supplied either via piped distribution networks or as bottled water. However, many of these river and canal systems also receive inputs of potentially contaminated wastewaters either from point sources and/or diffuse run-off from agricultural land. These and other sources may also be contributing to contamination of groundwater aquifers in their vicinity, some of which are used untreated as drinking water. (See Annex 1)

In another Greenpeace report released in February 2007, water samples taken from industrial estates in the Philippines were studied. The results showed varying degrees of contamination from different hazardous chemicals, including volatile organic compounds (VOCs) and heavy metals. VOCs are known to affect the kidneys, the central nervous system and the liver, and are potentially carcinogenic. All sites notably contained chlorinated VOCs, toxic solvents or degreasers used in "cleaning" semiconductors and other electrical equipment. Water samples taken from the Cavite Export Processing Zone (CEPZA) in Rosario, Cavite, in particular, contained tetrachloroethene at nine times above the WHO guidance values for exposure limits, and 70 times the US Environmental Protection Agency maximum contaminant level for drinking water. Elevated levels of metals, particularly copper, nickel and zinc, were also found in groundwater samples in other sites, also within the province (Cutting Edge Contamination: A Study of Environmental Pollution during the manufacture of Electronic Products, 2007). As yet, no health cases have been directly linked to the contamination. (See also Annex 2).

However, The World Health Organization (WHO) and the United Nation's Children's Fund (UNICEF) in their publication "Promoting and Protecting Human Health", states that "(…) *Anthropogenic chemical pollution of surface waters, mainly by industry and agricultural runoff, is a health hazard, but the impacts on* *health (for example, malignant tumors) generally occur only after extended periods of exposure and are difficult to attribute accurately to specific environmental or lifestyle factors*."

F. Efforts to address problems

Various efforts have been and are being undertaken to address the problems on water pollution, especially chemical pollution.

Adoption of sustainable agriculture (SA) and/or organic agriculture (OA) is one of the several efforts that have been and are being undertaken to address the problems of chemical pollution. There is a common notion about sustainable and/or organic agriculture – people generally say that it is the use of compost and animal manure as organic fertilizers. However, the essence of OA is best described by a farmer who has already established a real organic farm. For him, organic farming focuses on process rather than product. Hence, an organic farm is an outcome of several years of operating a farm plan designed to pursue economic benefits while nurturing the farm's natural resources (soil, water, plants, animals, microorganisms) (UNESCAP, 2000).

SA / OA practitioners attest to experiencing various types of benefits from their practice which include reduced cost of production with the decrease in the volume of chemical fertilizers, herbicides, and pesticides being used. Environmental benefits include improvement of soil fertility, better soil quality, conservation of soil and water, and enhanced biodiversity on the farm. These are some of the benefits of operating an economically viable farm without being dependent on synthetic agrochemicals. Health benefits from organic products are also the reason why hospitals, medical practitioners, and health experts recommend organic food.

Executive Order 481 or the "Promotion and Development of Organic Agriculture in the Philippines was issued by Malacañang in December 2005, providing a policy environment conducive for the implementation of organic agriculture programs. In September 2006, the Department of Agriculture approved and released the Implementing Rules and Regulations (IRR) for this law.

Another approach to address pollution problems is the introduction of "pollution prevention" and "waste minimization" practices. Traditionally, effluents and emissions discharged by most manufacturing firms in the country into the air, waterways, ground water and land are given end-of-pipe treatment characterized by the collection of waste material, and applying treatments such as dilution, detoxification, solidification, and in many cases, containment of the pollutants in barrels and placing them in landfills (USAID, 2000). Projects such as the IEMP or *Industrial Environmental Management Project* are designed to reduce pollution at its source by improving "industrial housekeeping", or changing industrial production processes, and reducing and reclaiming industrial waste. These also promote the adoption of cost-effective pollution abatement technologies.

The Department of Science and Technology, through its *Integrated Program on Cleaner Production Technologies*, encourages the adoption of clean technologies by providing support mechanisms for the industrial sector for the identification, evaluation, selection, and acquisition of cost-effective technologies for cleaner production.

Part of government's response to the problem is the formulation of various policies, monitoring and analysis, researches, and capacity building among key stakeholders as part of their regular functions, and through the different programs implemented by concerned agencies.

Alternatives to conventional sewage treatment are now being introduced. Wetlands are being designed to serve as simple and low-cost wastewater treatment plants that use natural processes for filtration and cleaning. Partially treated sewage can also be used for fish propagation (EMB, 2006).
(While this inexpensive, low-maintenance technology is reportedly in high demand in Central America, Eastern Europe, and Asia. However, in the United States, treatment-wetland technology has not yet gained national regulatory acceptance (Cole, Stephen; "*Emergence of Treatment Wetlands*", 1998).

In part, this reluctance exists because the technology is not yet completely understood. Knowledge of how the wetland works is not far enough advanced to provide engineers with detailed predictive models. And, being natural systems, their performance is variable, subject to the vagaries of changing seasons and vegetative cycles. These treatment wetlands also pose a potential threat to wildlife attracted to this new habitat--an ecosystem exposed to toxic compounds (Cole, S, 1998).

(Another concern expressed by some experts is the nitrogen removal process, as this is considered a serious drawback in using constructed wetlands for wastewater treatment (Simons, J., 2000).)

III. Status of water use and supply

A. Leading consumers or users of water

The country's major water users are the agricultural sector which accounts for 85.27 percent of the total water supply, the industrial sector which consumes 7.46% and lastly the domestic users which use the remaining 7.27percent (PEM, 2003; 2004).

In the Philippines, agriculture as a whole is the greatest consumer of water. Irrigation constitutes a large portion of total water consumption by agriculture; it is considered the biggest water user in the country, notwithstanding the fact that only 47 percent of the potentially irrigable area of 3.16 million hectares is irrigated. About 95 percent of the irrigated area is devoted to paddy and about 70 percent of paddy production comes from irrigated lands (Dayrit, H., The Philippines: Formulation of a water vision, NWRB).

Based on 2003 data, 63 percent of groundwater is consumed by the domestic sector and the remaining is shared by agriculture (17 percent), industry (13 percent), and other sectors (7 percent) (PEM, 2004). PEM 2003, on the other hand, reports that about 86 percent of piped-water supply systems use groundwater as source.

Estimated water withdrawals as of 2003, based on water-right grantees registered with NWRB is 77,456 MCM/year. About 60 percent of groundwater extraction is without permit, resulting in indiscriminate withdrawal. Over-abstraction from 6,441 registered wells has led to the lowering of aquifers, resulting in saline intrusion and ground subsidence in some areas.

B. Access to drinking water

According to the "2005 Little Green Data Book" of the World Bank, one out of five Filipinos does not get water from formal sources. Only 77 percent of the rural population and 90 percent of those in urban areas have access to an improved water source and only 44 percent have direct house connections. Those without house connections access water from wells, springs, communal faucets, and/or from small scale informal providers (Madrazo, A., 2002).

In the Philippines, supply and delivery of potable water in different parts of the country is the responsibility of various government agencies and water utilities. Metro Manila is being served primarily by the Metropolitan Waterworks and Sewerage System (MWSS) through its two private concessionaires, the Maynilad Water Services, Inc. and the Manila Water Company, and by some private companies serving subdivisions. Water supply comes mainly from surface water.

Metro Manila has four water treatment plants, namely: Balara Treatment Plants I and II, and the La Mesa Water Treatment Plants I and II.

In other urban and fringe areas outside of Metro Manila, service is provided by a total of 594 water districts and 250 subdivisions with Certificates of Public Convenience (CPC). As of December 2004, other private suppliers and providers issued with CPC include: a total of 321 out of an estimated potential 1,780 water service providers granted CPC, 500 Rural Water and Sanitation Associations (RWSA), 21 out of 156 water cooperatives, nine economic zones, four private utility operators, and 46 peddlers/ship chandlers. These water districts and private utilities operating in different provinces are monitored and administered by the LWUA and NWRB.

The provincial rural areas are primarily served by the Local Government Units and cooperative water associations, with assistance from the Department of Interior and Local Government (DILG), Department of Public Works and Highways (DPWH), and Local Water Utilities Administration (LWUA) (Jamora, L., 2002).

Water supplied by all sources in the Philippines is considered unsafe for drinking without further treatment. Outside of Metro Manila, there are water treatment plants in Metro Roxas, San Jose Del Monte, Leyte, Iloilo, Zamboanga, Bongao in Tawi-tawi, Pagsanjan, Santiago City in Isabela, Albay, and Candon City in Ilocos Sur. Most of the water districts use chlorination for treatment.

Almost all households incur additional expenditures on water treatment and for bottled water. Such expenditures are substantially higher than what is paid to the water utility. Urban households also spend a substantial amount on bottled water as manifested by the proliferation of "drinking water stations" all over the country. However, "drinking water stations" are in need of improved regulation as the quality of water does not have to meet any standards at present (Madrazo, 2002).

C. Water shortage and scarcity

NWRB has identified nine water-critical urbanized areas where water is consumed intensively. This includes: Metro Manila, Metro Cebu, Davao, Baguio City, Angeles City, Bacolod City, Iloilo City, Cagayan de Oro City, and Zamboanga City.

Cases of water scarcity and shortages have been documented and reported in various publications, among which are the following:

In the summer of 2007, a news article reported that water suppliers in the Visayas are facing supply problems because of the drying up of water sources due to climatic changes. According to Melchor Bibanco, president of the Visayas Association of Water Districts, in an interview, most water districts were experiencing supply problems, especially during the summer season. However, he also observes that this is getting worse each year. He attributed the depletion of water sources to the El Niño weather phenomenon as part of the global climatic changes (Tupas, 2007).

Same article reports that in Iloilo, the Metro Iloilo Water District (MIWD) has started rationing water supply to consumers because of the expected increase in demand and the low water level of its source. The MIWD extracts water from the Tigum River through an intake dam in Barangay Daja in Maasin town, 29.5 kilometers northwest of Iloilo City. It also gets its supply from seven pumping stations in deep wells in Oton and San Miguel.

In its report, the DENR identified Davao as among the major cities in the country suffering from a shortage in fresh water supply. A critical number of communities in the second district are perennially suffering less supply of water. The city of Tagum and its nearby towns in the province of Davao del Norte also suffer the same problem (Tupas, J, 2007).

From a little over 190 meters by the end of March 2004, Angat Dam's water level dropped to a critical mark to 170 meters in August due to a prolonged dry spell attributed to climate change. This prompted government to stop using water reserves for irrigation in some areas (Espada, D., 2004).

The Greenpeace report *Crisis or Opportunity: Climate change impacts and the Philippines* (2005) written by the former head of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) Dr. Leoncio Amadore also identifies the Southern Mindanao Drought of 1988 as a case in point. According to this report, the El Nino that occurred in 1997 to 98 was one of the most severe ENSO event to hit the country. Beginning July 1997, some parts of the Philippines were already experiencing below normal rainfall. By October of the same year, practically the whole country experienced a drastic drop in rainfall, leaving rice and corn production at risk. The peak of the dry spell had ravaged the country until June of the next year (CAB T.P. No 2001-7, as cited in the report).

Experts project that by year 2025, water availability deficit would take place in several river basins such as in Pampanga and Agno, in Pasig-Laguna, in Cagayan Valley, all other regions in Luzon, in Jalaur and Ilog Hilabangan, and in the island of Cebu in Visayas (PEM 2003).

D. Major problems concerning water use and scarcity

The discussion below summarizes the major problems concerning water use and scarcity identified in NWRB's report on “Challenges to Water Resource Management in the Philippines”, World Bank's “Water Resource Assistance Strategy 2003”, the report contained in the PEM 2004 issue, and selected news articles from the national dailies.

<u>Disparities between water supply and demand</u>
Despite the abundant water resources in the Philippines, distribution of these resources varies widely in time and place as a result of the different geographic and climate conditions prevailing in different parts of the country (Barba, P, 2003).

Water resources are unevenly distributed throughout the country, often resulting in water shortages in highly populated areas, especially during the dry season. Several river basins (Pampanga, Agno, Pasig-Laguna, and on the island of Cebu) are also experiencing generalized water scarcity (PEM, 2004).

<u>Lack of water allocation formula</u>
Most of the problems encountered in the water sector today arise from an issue of conflicts of use and water allocation. With the increase of population coupled with worsening pollution of water, lack of infrastructure and facilities result in allocation issues and conflicting rights over limited water supply. The principle in the Water Code of "first in time priority in right" may no longer be an equitable approach in resolving such conflicts.

In times of drought or emergency, a national policy exists wherein domestic water supply gets priority over all others within the limits of its water rights (National Water Resources Board, 1976, as cited in Jose, A. and Cruz, N., 1999). Conflicts arise, as in the case of the Angat Reservoir, when the MWSS withdraws water from the reservoir over and above its existing water rights, and in the process expropriating a portion of the National Irrigators Association's (NIA) water rights (Jose, A. and Cruz, N., 1999).

In a news report, former DENR Secretary Angelo Reyes mentions that there is now a need to review this policy in the light of sectoral 'conflicts' in the use of water resources (Gaylican, 2007).

Corporations also directly compete with the people for the control and use of available freshwater resources

For instance, Benguet Corporation, a U.S. mining firm which is now venturing into the water business, holds 65 water appropriation permits issued by the NWRB. The permits cover major creeks, springs, and rivers in the municipality of Itogon in Benguet province that communities use for their domestic and agricultural needs. In San Pablo City, Laguna, farmers and residents complain of declining water availability and blame the operation of a mineral water plant by Nestle Philippines, Inc. (Padilla, A., 2007).

Weak water use regulation and enforcement

The investigation and processing of water permit applications constitute the type functions for which NWRB is not properly equipped in terms of either manpower or resources.

Inefficient water use

There is tremendous waste of water in distribution lines, irrigation canals, and at homes. Inefficiency in water usage was exacerbated by the absence of regulations, economic incentives, and institutional arrangements needed to promote water conservation and rational use of water.

Apart from increasing industrial and domestic demand, another contributing factor to the water shortage in Metro Manila is the high level of water loss due to leaking pipes and illegal connections.

Depletion of groundwater resources

Indiscriminate groundwater abstraction resulting to salt-intrusion are noticeable in Metro Manila and Cavite (Region IV), Iloilo (Region VI), and Cebu (Region VII). The indiscriminate use of groundwater wells for residential and industrial areas due to the failure of major utility providers to service these areas is the major cause for the depletion of the groundwater resources in the country.

Fragmented management

One of the most critical issues confronting the Philippine water sector is the lack of an appropriate institutional framework to address issues of development and management of water and related resources. At present, there are over 30 government agencies and departments separately dealing with water supply, irrigation, hydropower, flood control, pollution, watershed management, etc. It is this fragmented approach to water management which causes an overlap of work and conflicts among agencies and results in a fractional water management plan that does not adequately meet the requirements for sustainability (Barba, 2005).

E. Other threats to water availability

The situation presented earlier clearly shows how various problems on water use and distribution lead to water scarcity in different areas in the country.

There are other factors, however, that need greater attention now as these affect not only the supply but the availability of water resources itself. One of these is the significant decline and deterioration of watersheds. Excessive logging and shifting cultivation in the watersheds trigger widespread degradation and subsequent erosion and siltation of rivers, lakes, and reservoirs (Santos 1997, as cited in Jose and Cruz, 1999).

Reports from several studies mention that most of the watersheds in the Philippines are in critical condition as manifested by recent and recurring calamities such as flashfloods in Southern Leyte and Northern Mindanao and an increase in frequency of El Niño events in Luzon which reduces water levels in dams. The World Bank also cites deteriorating watersheds as one of the reasons for the increase in flooding in recent years (WB, 2003).

The report *Crisis or Opportunity* cites data that shows how extreme climate events/variability, such as floods, droughts, forest fires, and tropical cyclones have increased in temperate and tropical Asia in the past few decades. In some regions, such as parts of Asia and Africa, the frequency and intensity of droughts have also increased. The El Niño phenomenon has been more frequent, persistent and intense since the mid-1970s.

The report also presents data on extreme climatic events that occurred in the country since 1970, impelling us to recognize that earth's climate is indeed changing.

- The Great Luzon Floods in 1972 is a typical example of heavy flooding caused by heavy, persistent precipitation.
- The Southern Mindanao Drought of 1998 was one of the most severe El Niño Southern Oscillation to hit the country.
- Landslides, triggered by earthquake or heavy rainfall, were aggravated by man-made causes, i.e. forest denudation, modification of slope of the terrain, and others. From 1989 to 1999, landslides occurred almost every year in the Cordillera Administrative Region. The highest number occurring during the La Niña period of 1996 to 1999, which recorded annual total of 17 to 29 events that followed after a heavy rainfall.
- The Ormoc catastrophic flash flood in 1991 wherein more than 5000 people perished was also cited
- Camiguin flashflood in 2001, Southern Leyte, and Surigao disaster in 2003, and the Aurora/Infanta floods which came after 20 days of moderate to heavy rainfall were caused by four successive tropical cyclones towards the end of 2004.

Based on this study, it is anticipated that flood magnitude and frequency are projected to increase, affecting many regions as a consequence of repeated heavy precipitation events, which can increase runoff in most areas as well as groundwater recharge in some floodplains.

Occurrences of extreme climatic events like droughts and floods have serious negative implications for major water reservoirs in the country as well, as shown in a study conducted in five major reservoirs in Luzon and one reservoir in Mindanao (Crisis and Opportunity).

More cold, La Niña-type episodes were observed during the 70s, while the 80s and 90s were characterized by the occurrence of four strong, warm periods (1982-83, 1986-87, 1991-92 and the 1997-98 El Nino events) causing consistent negative anomalies of rainfall and inflow.

The expected climate changes that could affect rainfall distribution will ultimately affect runoff to rivers and lakes. On the other hand, decrease in runoff because of frequent drought episodes, would mean more serious problems in water availability.

IV. Legal and policy framework relating to water quality control, use and management

A. Policies pertaining to water use and management

One of the earliest attempts at systematic management of water has been the adoption of a National Water Code in 1976 Presidential Decree 1067 (1976) (EMB, Philippine Country Assessment, p. 3).

According to this report, the Code defines the following:

1. the basic principles and structural framework relating to appropriation, control, conservation, and protection of water resources to achieve their optimum development and efficient use to meet present and future needs;

2. the scope of the rights and obligations of water users and provides for the protection and regulation of such rights; and

3. the necessary administrative machinery.

Other related laws are outlined in Table 5 (next page).

Laws	Description
Republic Act No. 8041, National Water Crisis Act of 1995	Addresses the issues of water supply, privatization of state-run water facilities, protection and conservation of watersheds and the waste and pilferage of water
Republic Act No. 198, Creation of Provincial Water Utilities (1973)	Authorizes the creation of local water districts to operate and administer water supply and wastewater disposal systems in the provincial areas
Presidential Decree No. 1586, Environmental Impact Statement System (1978)	Mandates the conduct of environmental impact assessment studies for all investments undertaken by the government and private sector
Presidential Decree No. 424	Creation of the National Water Resource Council
Republic Act No. 7160, Local Government Code	Devolves enforcement of laws on sanitation to LGUs and the provision of basic services such as water supply, sanitation and flood control

Table 5. Laws pertaining to water use and management

B. Laws pertaining to water quality control

The Philippine Environment Code (PD 1151) defines the basic elements of a regulatory program, with regulatory functions consisting of discharge standards, permits, monitoring, and enforcements. In addition, there are national laws that define policy and deal with the abatement, control, and water quality management, as shown in the table below.

Related Policies	Brief Description
R.A. No. 9275, Clean Water Act (2004)	• Provides for a program and regulations for the abatement and management of water pollution from point and non-point sources • Introduces market-based instruments (MBIs) such as the wastewater charge system that imposes fees based on the volume of effluents discharged • Strengthens enforcement by providing stiffer penalties for violations of standards • The permitting system has been modified to accommodate the fee system based on amount of pollution discharged
Commonwealth Act 383, Anti-Dumping Law (1938)	• Prohibits dumping of refuse, waste matter or other substances into rivers
Presidential Decree 984, Pollution Control Law (1976)	• Provides guidelines for the control of water pollution from industrial sources and sets penalties for violations, also requires all polluters to secure permits
Republic Act No. 9003, Ecological Solid Waste Management Act of 2000	• Calls for the institutionalization of a national program that will manage the transfer, transport, processing, and disposal of solid waste in the country • Sec. 40 sets the criteria for siting landfills to ensure that their operation do not affect aquifers, groundwater reservoirs or watersheds.

Republic Act 6969, Toxic Substances & Hazardous & Nuclear Wastes Control Act	• Mandates the control and management of the import, manufacturing, processing, distribution, use, transport, storage, treatment, and disposal of toxic substances and hazardous and nuclear wastes
Republic Act 4850 (1966), Laguna Lake Development Authority Act, as amended by PD 813	• Regulates and controls the pollution of the Laguna de Bay Region, including sewage works and industrial waste disposal systems
Republic Act 6234, Creation of Metro Waterworks and Sewerage System (1971)	• Constructs, operates, and maintains water systems, sewerage and sanitation facilities in the Metro Manila area
Presidential Decree 281, Creation of the Pasig River Development Council (1973)	• Regulates and controls pollution of the Pasig River
DENR Administrative Order No. 90-34, Revised Water Usage and Classification / Water Quality Criteria	• Section 68 defines classification of water bodies according to their best usage; • Section 69 identifies the different parameters and criteria for water quality required for each type of classification
DENR Administrative Order No. 90-35, Revised Effluent Regulations of 1990	• Prescribes the standards for discharge of effluents to the different classifications of water bodies
DENR Administrative Order No. 94-26A, Philippine National Standards for Drinking Water	• Provides the different parameters and value for drinking water quality • Defines guidelines for assessing water quality for drinking water
Presidential Decree No. 856, Sanitation Code of the Philippines	• Covers solid and liquid waste disposal • Prescribes standards for sewage collection and refuse and excreta disposal • Assigns to cities and municipalities the responsibilities to provide for efficient and proper disposal, and to handle nuisance and offensive trades and occupations
DENR Administrative Order No. 97-39, Chemical Control Order for Mercury and Mercury Compounds	• Regulates the importation, manufacture, distribution and use of mercury and mercury compounds and the storage, transport, and disposal of their wastes
DENR Administrative Order No. 2000-18, Chemical Control Order for Cyanide and Cyanide Compounds	• Identifies requirements and procedures pertaining to the importation, manufacture, distribution, and use of cyanide and cyanide compounds and the storage, transport and disposal of their wastes
DENR Administrative Order No. 98-58, Priority Chemical List	• Identifies existing and new chemicals that the DENR has determined to potentially pose unreasonable risk to public health, workplace, and the environment. • Requires all manufacturers, distributors, users, and importers of chemicals included in the PCL to submit bi-annual reports

Table 6. Laws pertaining to water quality control

C. Ambient water quality standards

The Clean Water Act defines ambient water quality as the average water purity, which is distinguished from discharge measurements taken at the source of pollution. It is the general amount of pollution present in a broad area.

According to EMB, Philippine water quality is assessed based on set beneficial use as defined in the DENR Administrative Order (DAO) 34, Series of 1990. It further mentions that DAO 34 contains 33 parameters that define the desired water quality per water body classification.

For purposes of classification or reclassification, the following minimum water quality parameters are often used:

- Dissolved Oxygen (DO)
- pH
- Biochemical Oxygen Demand (BOD)
- Total Coliform organisms

These parameters appear to be applicable only for classification or reclassification of surface waters (i.e. rivers, lakes, reservoirs) and do not apply to groundwater resources. Instead, the Philippine National Standards for Drinking Water or PNSDW is used as the standard for assessing the quality of groundwater resources (EMB, 2006).

The PNSDW of 1993 outlines various parameters to be used in the analysis of drinking water quality. There are currently 56 bacteriological, physical, chemical, radiological, and biological parameters to be monitored (WHO, 2002). However, the relevant parameters used for groundwater quality assessment are: fecal coliform, nitrates, and salinity or chloride content (EMB, 2006).

The standard for TDS is 500 mg/L and a “negative” for Coliform. “Negative” means total coliform must not be detectable in any 100 ml sample, while “positive” means the presence of total coliform in the water sample (PEM, 2003).

Particular standards for bottled water have also been formulated. These provisions are found in the Bureau of Food and Drugs Administrative Order 18-A, 1996 or the Standards of Quality and Requirements for the Processing, Packaging and Labeling of Bottled Drinking Water. This Administrative Order states that particular consideration should be given to the following potential pollutants: bacteria, viruses, parasites, fertilizers, pesticides, hydrocarbons, detergents, phenolic compounds, heavy metals, radioactive substances, and other soluble organic and inorganic substances. It includes rules and regulations that cover not only the quality of the product itself, but includes provisions addressing the quality of source, production processes and facilities, including handling and use of particular labels.

D. Standards for wastewater emissions

The standards for discharge of effluents to the different classifications of water bodies are prescribed in DENR AO 35. These effluent standards consist of a set of water quality parameters and their corresponding numerical limits that any wastewater discharge coming from a point source (i.e. industrial plants and municipal sewerage systems) are required to meet.

The following tables present the Effluent Standards for different water quality parameters based on pollution sources.

Parameter	Unit	Protected Waters Category I (Class AA & SA)		Protected Waters Category II (Class A,B & SB)		Inland Waters Class C		Marine Waters Class SC		Marine Waters Class SD	
		OEI	NPI	OEI	NPI	OEI	NPI	OEI	NPI	OEI	NPI
Arsenic	mg/L	(b)	(b)	0.2	0.1	0.5	0.2	1.0	0.5	1.0	0.5
Cadmium	mg/L	(b)	(b)	0.05	0.02	0.1	0.05	0.2	0.1	0.5	0.2
Chromium (hexavalent)	mg/L	(b)	(b)	0.1	0.05	0.2	0.1	0.5	0.2	1.0	0.5
Cyanide	mg/L	(b)	(b)	0.2	0.1	0.3	0.2	0.5	0.2	-	-
Lead	mg/L	(b)	(b)	0.2	0.1	0.5	0.3	1.0	0.5	-	-
Mercury (Tot.)	mg/L	(b)	(b)	0.005	0.005	0.005	0.005	0.005	0.005	0.05	0.01
PCB	mg/L	(b)	(b)	0.003	0.003	0.003	0.003	0.003	0.003	-	-
Formaldehyde	mg/L	(b)	(b)	2.0	1.0	2.0	1.0	2.0	1.0	-	-

Table 7. effluent standards: toxic and other deleterious substances (maximum limits for the protection of public health)
Industrial and other effluents when discharged into bodies of water classified as Class A, B, C, D, SA, SB, SC, and SD should not contain toxic substances greater than those indicated below.

Effluents from domestic sewage and industrial wastewater treatment plants when discharged into receiving waters classified as Class A, B, C, D, SA, SB, SC, and SD should not contain pollutants in concentration greater than those indicated in Tables 8 and 9 (following page).

Parameter	Unit	Protected Waters				Inland Waters	
		Category I		Category II			
		(Class AA & SA)		(Class A, B & SB)		Class C	
		OEI	NPI	OEI	NPI	OEI	NPI
Color	PCU	(b)	(b)	150	100	200c	150c
Temperature (max rise in deg. Celsius in RBW)	°C rise	(b)	(b)	3	3	3	3
pH (range)		(b)	(b)	6.0-9.0	6.0-9.0	6.0-9.0	6.5-9.0
COD	mg/L	(b)	(b)	100	60	150	100
Settleable Solids (1-hour)	mg/L	(b)	(b)	0.3	0.3	0.5	0.5
5-Day 20 oC BOD	mg/L	(b)	(b)	50	30	80	50
Total Suspended Solids	mg/L	(b)	(b)	70	50	90	70
Total Dissolved Solids	mg/L	(b)	(b)	1,200	1,000	-	-
Surfactants (MBAS)	mg/L	(b)	(b)	5.0	2.0	7.0	5.0
Oil/Grease (Petroleum Ether Extract)	mg/L	(b)	(b)	5.0	5.0	10.0	5.0
Phenolic Substances as Phenols	mg/L	(b)	(b)	0.1	0.05	0.5	0.1
Total Coliforms	MPN/100 mL	(b)	(b)	5,000	3,000	15,000	10,000

Table 8: Effluent standards: conventional and other pollutants affecting aesthetic and oxygen demand in protected waters

Notes: (b) Means discharge of sewage and/or trade effluents are prohibited or not allowed; "OEI" means Old and Existing Industries; "NPI" means New/Proposed Industry or wastewater treatment plants to be constructed.

Parameter	Unit	Inland Waters		Coastal Waters		Class SD & Other Coastal Waters	
		(Class D)		(Class SC)		Not Classified	
		OEI	NPI	OEI	NPI	OEI	NPI
Color	PCU	---	---	(c)	(c)	(c)	(c)
Temperature (max. rise in deg. Celsius in RBW)	°C rise	3	3	3	3	3	3
pH (range)		5.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	5.0-9.0	5.0-9.0
COD	mg/L	250	200	250	200	300	200
5-Day 20 ^{o}C BOD	mg/L	150 (d)	120	120 (d)	100	150 (d)	120
Total Suspended Solids	mg/L	200	150	200	150	(g)	(f)
Total Dissolved Solids	mg/L	2,000 (h)	1,500 (h)	-	-	-	-
Surfactants (MBAS)	mg/L	-	-	15	10	-	-
Oil/Grease (Petroleum Ether Extract)	mg/L	-	-	15	10	15	15
Phenolic Substances as Phenols	mg/L	-	-	1.0(i)	0.5(i)	5.0	1.0
Total Coliforms	MPN/100 mL	(j)	(j)	-	-	-	-

Table 9. Effluent standards: conventional and other pollutants in inland waters (Class D, coastal waters, class SC and SD) and other coastal waters not yet classified

Notes:
(c) Discharge shall not cause abnormal discoloration in the receiving waters outside of the mixing zone
(d) For wastewaters with initial BOD concentration over 1,000 mg/L but less than 3,000 mg/L, the limit may be exceeded up to a maximum of 200 mg/L or a treatment reduction of ninety (90) percent, whichever is more strict. Applicable to both old and new industries.
(f) Not more than 30 mg/L increase (dry season)

(g) Not more than 60 mg/L increase (dry season)
(h) If effluent is the sole source of supply for irrigation, the maximum limits are 1,500 mg/L and 1,000 mg/L, respectively, for old industries and new industries.
(i) Not present in concentration to affect fish flavor or taste or tainting.
(j) If effluent is used to irrigate vegetable and fruit crops which may be eaten raw, Fecal Coliforms should be less than 500 MPN/100 mL

Industry Classification Based on BOD of Raw Wastewaters Produced	**Maximum Allowable Limits in mg/L, according to Time Period and Receiving Body of Water**			
	Effectivity date - Dec. 31, 1991		**Jan. 1, 1992-Dec. 31, 1994**	
	Inland Waters Coastal Waters		**Inland Waters Coastal Waters**	
	(Class C & D)	**(Class SC & SD)**	**(Class C & D)**	**(Class SC & SD)**
1. Industries producing BOD within 3,000 to 10,000 mg/L	320 or 95% removal	650 or 90% removal	200 or 97% removal	320 or 95% removal
2. Industries producing BOD within 10,000 to 30,000 mg/L	1,000 or 95% removal	2,000 or 90% removal	600 or 97% removal	1,000 or 95% removal
3. Industries producing more than or 30,000 mg/L	1,500 or 95% removal	3,000 or 90% removal	900 or 97% removal	1,500 or 95% removal

Table 10. Interim effluent standards for BOD applicable to old or existing industries producing strong industrial wastes (1990 to1994)

Industry Classification Based on BOD of Raw Wastewater	**Maximum Allowable Limits in mg/L Based on Receiving Body of Water**	
	Inland Waters (Class C & D)	**Coastal Waters (Class SC & SD)**
1. Industries producing within 3,000 to 10,000 mg BOD/L	130 or 98% removal	200 or 97% removal
2. Industries producing within 10,000 to 30,000 mg BOD/L	200 or 99% removal	600 or 97% removal
3. Industries producing more than 30,000 mg BOD/L	300 or 99% removal	900 or 97% removal

Table 11. Effluent standards for new industries producing strong wastes (including old or existing industries producing strong waste whose wastewater treatment plants are still to be constructed)

A report by the United Nations Industrial Development Organizations (UNIDO) mentions that while there are several standards already developed, the Philippine system of industrial effluent standards appears to be relatively insensitive to actual ambient conditions and to different cost structures due to their use of concentration-based standards.

The report observes that this situation allows polluters to meet standards by dilution and encourage the over-extraction of ground water in heavily industrialized areas (UNIDO, 1999).

In addition, these standards do not adequately assess today's water quality especially with the proliferation of toxic chemicals used for and as a byproduct of modern-day production processes and other economic activities. Beryllium, copper, nickel, tin, vanadium and zinc and many of the volatile organic chemicals (VOCs) are being used by the semiconductor and electronics industries, one of the country's biggest export earners, but they are not included in the Philippine water standards. Thus, they are not routinely tested. Furthermore, there are no existing facilities in the country that are able to test and monitor the industrial pollutants that come with more modern technologies and production processes.

E. Government agencies involved in regulating water use, water quality control, and management

More than 30 government agencies and offices are said to be involved in performing the different aspects or components of water resources management and development in the country. These agencies function separately dealing mainly with each of the sectors of water supply, irrigation, hydropower, flood control, pollution, and watershed management (Dayrit, H, 2001).

According to Madrazo in her paper entitled "Water Issues in the context of Sustainable Development", at the national level, the NWRB is responsible for policy formulation, administration and enforcement of the Water Code of the Philippines. In this paper, it was observed that other agencies perform policy formulation as it relates to their mandates. She then identifies the following eight agencies that have water related mandates:

- Department of Public Works and Highways (DPWH) for flood control and drainage (this responsibility has recently been transferred to the Metro Manila Development Authority)
- Department of Health (DOH) for sanitation
- Department of Environment and Natural Resources (DENR) for watershed protection and water quality
- Department of Interior and Local Government (DILG) for LGU-managed water supply, and sewerage and sanitation systems and capability building
- National Power Corporation (NPC) for hydropower development
- National Irrigation Administration (NIA) and Bureau of Soils and Water Management (BSWM) for irrigation development
- Metropolitan Waterworks and Sewerage System (MWSS) for water supply, sewerage, and sanitation in Metro Manila and, partially, in its neighboring provinces; and
- Local Water Utilities Administration (LWUA) for the Water Districts which manage water supply and sewerage systems.

Madrazo also mentions that the existing regulatory set-up in the Philippines is quite complicated and poses problems on conflicts of interests and possible overlapping of responsibilities that hinders effective water resources management.

A similar view is shared by NWRB's Executive Director, Hector Dayrit, with the following observations:

"…Fragmentation among water-related agencies is evident in three areas of concern: water supply and distribution, economic and resource regulation, and planning and policy formulation."

In a report, Dayrit mentioned the following agencies that are involved in water supply and distribution:

- the Metropolitan Waterworks and Sewerage Services (MWSS) and its two concessionaires (after it was privatized in 1997) for Metro Manila;

- the Local Water Utilities Administration (LWUA) and its water district offices for other cities and municipalities, servicing 58 percent of the total urban population within its area of responsibility; and

- the Departments of Interior and Local Government (DILG) and Public Works and Highway (DPWH) and local governments which manage community water systems (usually involving point sources and piped systems with communal faucets).

In addition, private systems, mostly residential areas and industrial parks which have their own systems installed, have to regulate themselves since there are no existing laws or regulations that govern performance of public utilities.

Based on the paper, Formulation of a National Water Vision, Dayrit identified the following agencies that have the same function as resource regulators:

- The Department of Environment and Natural Resources (DENR) formulates policies for the enforcement of environmental protection and pollution control regulations. It is primarily responsible for the preservation of watershed areas and ensures water quality with respect to rivers, streams and other sources of water.

- The Department of Health (DOH) is responsible for drinking water quality regulation and supervision of general sanitation activities.

According to this report, a similar function as resource regulator is also performed by LGUs, as the Local Government Code of 1991 (Republic Act No. 7160) devolved to local governments the power to discharge functions and responsibilities of national agencies and offices such as the provision of basic services and facilities including water supply systems (Section 17).

Numerous agencies are involved in planning and policy formulation, which include the National Economic Development Authority (NEDA), NWRB, LWUA and local government units. NEDA serves as the highest socio-economic planning and policymaking agency of government. It ensures that programs of government agencies are consistent with the government programs as laid out in the Medium-term Development Plan, the Long-term Development Plan (also known as Plan 21) and the Medium-term Public Investment Programme.

The National Irrigation Administration (NIA), the National Power Corporation (NPC) and the Department of Energy are also involved in planning and water infrastructure development with respect to the requirements of their respective sectors (Dayrit, H, 2001).

F. Issues on enforcement

Various studies have identified several issues concerning institutional arrangements and performance of respective government agencies in line with their functions, responsibilities, and authorities on management of water resources, most especially on water quality management.

A related assessment report prepared by EMB concerning its Enforcement and Compliance Program mentions that while implementation mechanisms are slightly different under each law, enforcement remains a significant challenge.

In addition, the report further states that each new law enacted adopts different regulatory strategies, giving varied powers and responsibilities to regular agencies (EMB, etc.), LGUs, and specially-constituted multi-sectoral management bodies. One example for this is the Clean Air and Clean Water Acts. Both create specialized management areas with local governing boards, while solid waste management remains primarily a local government concern (EMB, 2004).

In terms of enforcement of existing regulations, this report identifies the following key challenges:

- Transition problems in the transformation of EMB towards becoming a “line” agency;
- Overlapping authorities as a result of the creation of multi-sectoral environmental bodies; and
- Devolution of responsibility for waste management to local governments that lack capacity.

With regard to compliance monitoring, EMB has full legal authority and a complete array of regulatory instruments for a comprehensive enforcement strategy. However, excerpts from the Philippine Country Assessment: Enforcement and Compliance Program by EMB presents the following findings:

“…A recent study assessing environmental enforcement and compliance reported that the EMB is able to monitor and inspect only about one-quarter of the regulated establishments in its database. This number is estimated to be less than five percent of total registered industrial establishments nationwide.

The study found that “the proportion of the regulated community under the inspection-monitoring system is small. The universe of regulated establishments has not been established. And there is no prioritization of facilities to be inspected.

Various factors have contributed to delay of the enforcement process. These factors include the uneven implementation of inspection, the involvement of regional enforcers in other tasks, the ambiguous guidelines on the duration of the *permit to operate (PTO), the practice of unannounced visits, and the resistance of firms to inspection and other regulatory processes."*

This report also presents insights regarding indicators used by DENR to evaluate program success.

According to the report, each year, DENR sets targets to be achieved within the year, and are assessed at the end of each year. Oftentimes, unit reports would show that achievements are either close to or even exceed the targets. However, scientific studies continue to show the worsening pollution problem in the country, which, according to the report, suggests that the data the agency is gathering are not the appropriate indicators for efficiency and success.

The report then compares DENR's practice with program evaluation conducted by the LLDA. The report observes that the experience of LLDA where studies before and after the imposition of the regulation clearly indicate that there were quantitative (amount of wastewater discharged by companies) and qualitative (changes in processing technology initiated) impacts of the regulation that lead to a decrease in effluent discharges.

While there is a need to address limitations on existing standards for water quality and effluents to ensure that all types of pollutants are taken into consideration, enforcement issues seem to be another big issue that is greatly influenced by institutional concerns rather than the absence or limitation of existing policies. It seems clear that what is called for are pollution prevention-oriented policies rather than mere regulations which, although present and, on paper, presumably adequate, prove to be very difficult for involved government agencies to enforce.

V. Status of clean production in the Philippines

Clean Production is a whole new way of looking at how products are produced and consumed. More than just good housekeeping and pollution prevention in factories, it is about redesigning products and product systems so that they are more attuned to natural processes throughout the product's entire life cycle. Clean Production is based on the Precautionary Principle (when an activity has the potential to harm human health or the environment, a cautious approach should be taken in advance—even if the full extent of harm has not yet been fully established scientifically) and follows product life cycles rooted in circular concepts, not linear as is the conventional production system. It also promotes the use of renewable energy, minimal resource inputs that are non-toxic in a closed loop and sustainable system, and generates wastes that are benign and returnable into the production process. Furthermore, it promotes the protection of biological and cultural diversity. Finally Clean Production must encourage democratic processes especially among affected sectors.

Global companies with operations in the Philippines have started to set targets and timelines for phase out of some of the most toxic chemicals in their products and product systems. Nokia, for example, has already eliminated Polyvinyl

Chloride (PVC) from their new mobile phone models and Brominated Flame Retardants (BFRs) from remaining applications.

And to close the loop for the custody of their end-of-life products, these companies have established take back systems under an Extended Producer Responsibility (EPR) regime. In the Philippines, take back systems are still in their infancy as they are all voluntary in nature. As far as EPR policy is concerned, the Philippines is lagging far behind some its neighbors including Japan, Taiwan and South Korea. (An attempt was made by the EcoWaste Coalition and Greenpeace to kick start the discussion with the National Solid Waste Management Commission and the Environmental Management Bureau of the DENR. The draft Administrative Order that would have set into motion the EPR policy discussions never left the Commission or the EMB's offices.)

VI. List of major reports on water in the Philippines

International Reports

- World Bank
  - Philippine Environment Monitor 2001, 2003, 2004, 2006
  - World Development Report 2004, Making Services Work for Poor People
  - World Bank Country Water Resources Assistance Strategy 2003
- World Health Organization
  - Philippines (2002)
  - Philippines Environmental Health Country Profile
- United Nations Industrial Development Organizations - Industrial Policies and the Environment in the Philippines
- United Nations Development Program - Human Development Report (2006)
- Joint Monitoring Report by WHO-UNICEF (2002)
- FAO
  - AQUASTAT
  - Water Reports: Review of World Water Resources by Country
- State of Water Resources Management in the ASEAN (2005)
- United Nation: Freshwater Country Profile 2004
- WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation (2006)
- Water Environment Partnership in Asia
- JICA: Country Profile on Environment
- Regulating Public and Private Partnerships for the Poor: Urban Water Supply, Manila

- Status of Institutional Reforms for IWRM in Asia (by Bandaragoda, D.J.)

National Reports:

- National Water Regulatory Board
  - NWRB Strategic Planning and Management of Integrated Water Resources Management in the Philippines (2003)
  - Philippines Country Paper
  - Formulation of a Water Vision (by Hector Dayrit)
  - Challenges in Water Resource Management in the Philippines (by Pacita Barba)

- Environmental Management Bureau
  - Philippine Country Assessment: Enforcement and Compliance Program
  - National Water Quality Status Report (2001 - 2005)

- Country Study on Customary Water Laws and Practices (by James Kho and Eunice Agsaoay-Sano)

- Impact of Agrochemical to Soil and Water (by Leonila Varca)

- PIDS Discussion Series: Metro Manila and Metro Cebu Groundwater Assessment report (2001)

- WG3: An Inquiry of the Water Supply Situation in the Philippines

- (Dissertation) Assessing the Water Management Practices in Philippine Economic Zones (by Brenda Ortigoza Bateman)

- Rationalizing Water Tariff for Private Water Utilities (under the NWRB)

- LWUA Profiles of Water Districts

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