Managing Our Urban Ecosystems for Survival

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ABSTRACT

An urban ecosystem is man-made. It is not natural in the way that mountains, forests and oceans are. Nonetheless, its four elements -- land, air, waters and people -- maintain a dynamic balance the poor management of which results in pollution, environmental deterioration and social problems.

Metro Manila is confronted with the environmental and social problems that accompany rapid industrialization and increase in population density. A 1990 study commissioned by the Asian Development Bank identified eight leading environmental problems. These are:

1. *solid waste;*
2. *slum areas;*
3. *flooding;*
4. *water pollution;*
5. *air pollution;*
6. *hazardous/toxic waste;*
7. *destruction of natural resources; and*
8. *noise pollution.*

These environmental problems occur for a variety of reasons; but oftentimes, these reasons include underlying social problems that extend beyond the city. For example, the increase in the number of squatters and slum areas is not only associated with inadequate housing facilities or the high cost of urban real estate but it is also a consequence of rural poverty, rural unemployment and the migration of the rural poor into the cities to seek their livelihood. Once established, slum areas in turn spin an ever-evolving web of social consequences.

To solve the environmental problems of Metro Manila, we must address both the physical and social determinants which give rise to these problems. Resources need to be found to finance the infrastructure improvements for solid waste disposal, sewage, transport, social services and many others. Without doubt, long- term solutions must take into account the larger issues of poverty, social equity and good government.

INTRODUCTION

In 1962, Loren Eisely wrote in **The Epic of Man** (Time-Life International 1962):

> *"Man is paradoxically the supreme generalized animal by reason of a supremely specialized brain. It is his cities that are now his true specializations, his cities that lie vulnerable to extinction under the silent winging of the satellites."*

In the years after Eisely's words were published, man successfully built his spaceships, landed them on the moon and sent them circling around the earth. It is intriguing to think that beneath their quiet orbits, another of man's creations -- the city -- was tracing its own life cycle of growth, development and decay.

This article takes an ecological view of the city. It surveys its problems and suggests certain approaches to solve them. It focuses on Metro Manila, the premier city of the Philippines, whose growth and development may provide lessons for other growing cities within this country.[1]

Speaking figuratively, the ecological view is like a satellite view of things below. It involves the "study of living things, their interrelationships and their relationships with the environment" (Basic Facts: Geography 1983). The environment refers to man's physical surroundings: the soil, vegetation, wildlife and atmosphere. Man's impact on it is of growing concern worldwide: soil erosion, global warming, pollution, the extinction of species, the spread of urban areas (Sadik, Brown and Jacobson 1987). But in

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[1] Metro Manila, also called the National Capital Region, is composed of the cities of Manila, Quezon City, Pasay and Caloocan, and the 13 municipalities of Las Piñas, Makati, Malabon, Mandaluyong, Marikina, Muntinlupa, Navotas, Parañaque, Pasig, Pateros, San Juan, Taguig and Valenzuela.

a broader sense, the environment can include the social surroundings: culture, traditions, language, the economic and political life. Physical and social events influence each other. The world is witnessto situations where social turmoil has spawned environmental disaster: in the recent Mideast war, Iraqi soldiers discharged more than 6 million barrels of crude oil into the sea (Newsweek Feb. 4, 1991) and set fire to hundreds of oil wells in Kuwait (Horgan 1991).[2] But the reverse is also true. Here in Luzon last year we saw how an earthquake destroyed the lives and livelihood of hundreds of our countrymen (The Manila Chronicle July 22, 1990).

To look at the city ecologically then, is to look at it as an ecosystem, to examine its parts and how they interrelate, to study the balance within the whole.

URBAN ECOSYSTEM -- A DEFINITION

An ecosystem is defined as a natural system composed of living organisms and their environment. All elements of the ecosystem are intricately linked by flows of energy and nutrients. A change in one element has repercussions throughout the system (Collins 1983).

For the urban ecosystem to be healthy, its four elements -- land, water, air, people -- must enhance one another; the products and byproducts of one become nutrients or inputs for the others. For example, the atmosphere produces rain; rain replenishes groundwater and surface waters; it revitalizes land and stimulates plant growth; through evaporation water returns to the atmosphere. Here is another example. Man produces excrement which is collected in the sewage systems of the city. Sewage can be treated and piped out to sea where it becomes nutrient for marine life. Part of it can be used as fertilizer for land. Man benefits when land and sea provide him with food for his nourishment.

There are many such cycles in nature and it should be obvious that disruption of any of these causes ecological imbalance. Byproducts which cannot be recycled accumulate and pollute the

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[2] John Horgan writes: " . . . Six million barrels of oil weighing a million tons are going up in smoke daily. If the figure is accurate, 50,000 tons of sulfur oxide – the chief constituent of acid rain – and 100,000 tons of carbon as soot and more than 800,000 tons of carbon in the form of carbon dioxide go into the atmosphere everyday." (Scientific American May 1991)

environment. Such is the case with plastics, styrofoam and toxic chemicals commonly used by urban man (Hayes 1979). Plastics pile up in garbage dumps or clog sewers impairing the drainage of city streets and causing floods. Pesticides are frankly hazardous to people. Conversely substances necessary for the maintenance of a cycle might be excessively depleted. Water shortages in the city are common. Long rainless summers reduce the city's water supply and dry out the wells leaving city people thirsty, hot and miserable (Manila Bulletin, March 21, 1991).

The city, strictly speaking, is a man-made system. In this respect, it is not "natural" as mountains, forests, seas and rivers are. However, as a city draws from the terrestrial and aquatic ecosystems within and around it, and incorporates these unto itself, it will have an impact on these natural ecosystems. Similarly, the city will affect people's lifestyle and health.

The city has its own dynamism: population growth and movements within and across its boundaries, the rise of factories and workplaces, the trading of real estate, the insatiable demand for energy, food and water, the inexhaustible capacity to produce waste. These dynamics often determine whether or not people have decent homes, whether or not there are jobs for jobseekers, whether or not there is enough water in the tap, whether or not commuting on city streets is pleasant.

SOME BASIC QUESTIONS

Man has lived in cities since the earliest of times. The first cities arose from the agricultural villages and towns of Mesopotamia around 3500 B.C. Later they flourished in the fertile valleys of Egypt and India. By 1500 B.C., the Yellow River nourished a thriving urban civilization in China. These early cities had centralized governments controlled by powerful elites. They had systems of law, commerce and taxation. They were fed by large cultivated areas. They maintained armies for protection and conquest (Stuart 1988). The Athens of Socrates in 450 B.C. had a population of 50,000, about the size of a large municipality here in the Philippines. Cities, whether ancient or modern, have had to cope with the same problems inherent in human settlements. For example, this description of the sanitary conditions in a medieval city in Europe around the 1400s, with a population of about 100,000, fits contemporary life in some of our urban districts (Bishop 1970).

"The medieval streets were unquestionably foul. Butchers slaughtered animals at their shop fronts and let the blood run into the gutters. Poulterers flung chicken heads and feathers into the streets. Dyers released noisome waters from their vats. City officials in Italy would throw the fishmongers' unsold fish into the street for the poor, to make sure it would not sicken honest purchasers.

"Sewage disposal was an impossible problem. Only the big cities had sewers, which emptied into rivers below the laundry area. At Strasbourg malefactors were ducked where the sewer joined the river. Pollution of the streams became a serious concern; everyone agreed that something should be done about it. Street cleaning and removal of wastes to rural dumps were usually left to individual householders, who were apt to toss their refuse over the city walls or abandon it just outside the

Today there are about 270 cities with over half a million people and 17 with populations over 10 million people (Ward 1979). By the turn of the century, at its present rate of growth, Metro Manila would move into the second category. According to the statistics of the United Nations Population Fund, Metro Manila ranks 23rd in the world in population size (See Table I).

We might ask ourselves two sets of questions. First, can Metro Manila sustain its present rate of growth? Is it ecologically sound for Manila to continue to expand its size, its population, its industrial and commercial activities? If so, how might we manage this growth? Second, what cost, to ourselves and to our environment, will such growth exact? Is there an alternative to the development road we are taking?

Perhaps, we can already arrive at provisional answers to these questions by surveying our current situation.

MANILA'S ENVIRONMENTAL PROBLEMS -- AN OVERVIEW

A recent report of the Asian Development Bank enumerated eight environmental problems of Metro Manila. ADB ranked them according to how severely (degree of importance) and extensively (geographical spread) they damaged socio-economic activity and physical surroundings. The higher the score the more serious the

problem. Each item could rate a maximum of 100 points (ADB 1990).

The top 8 environmental problems were identified to be:

Problem	Score
1. Solid Waste	53.4
2. Slum Areas	51.7
3. Flooding	51.7
4. Water Pollution	51.0
5. Air Pollution	39.9
6. Hazardous/Toxic Waste	36.5
7. Destruction of Natural Resources	34.4
8. Noise Pollution	28.1

There is no doubt that the above list reflects problems that Metro Manilans are familiar with. Already there are government plans to address some of them, like the opening of new landfill areas for solid waste (Manila Times February 26, 1991) and the building of a new sewage outfall in Manila Bay (ADB I-36). But these problems are only by-products of the pervasive and relentless processes of urbanization and industrialization going on around us. Let us take a closer look at them.

"METRO MANILA ON THE GO" -- A LOOK AT TRENDS

The pressures forcing Manila to go and to grow are staggering. They are driven by the imperatives to modernize, to make the Philippines an NIC (newly industrialized country) by the turn of the century.

Today, Metro Manila has an estimated eight million people. This count excludes transient workers and students. The average growth rate of Manila's population over the last five years is 2.8% per year (See Tables II and III). This means that the city grows by approximately two million people every 10 years. In 1980, there were six million people in Manila; by the year 2000, there will be 10 million. Sixty percent (60%) of the growth is attributed to natural increase and the remaining 40% to in-migration.

Metro Manila's economy dramatically expanded by 35% from 1985 to 1987 after overcoming negative growth rates in the early 1980s (See Figure 1). At the end of 1988, Metro Manila

registered a gross domestic regional output of ₱31 billion measured at 1972 prices. This was about 30% of the total gross national product. Hand in hand with the growth of the economy, the labor force of Metro Manila has steadily grown. In 1989, it was estimated at three million people (See Figure 2).

PATTERNS OF LAND USE

The surge of the economy is reflected in the way land is used and traded. Metro Manila is like an insatiable amoeba stretching its boundaries ever outwards. With the building of the north and south exspressways in the 1970s and '80s, new factories have risen along these main transportation routes. Old factories remain cramped in their original locations along the Pasig River and its tibutaries in places like Pandacan, Punta, Mandaluyong, Pasong Tamo, Pasig and Marikina and the Port Area fronting Manila Bay. It is estimated that of the 636 square kilometers which is the total land area of Metro Manila, 5% is given to industrial use (ADB C-16).

On the other hand, commercial centers have sprouted in several locations. While business has been revitalized by the Light Rail in the old business district on the north bank of the Pasig River (Escolta, Binondo, Quiapo, Sta. Cruz and Divisoria), new commercial centers have flourished elsewhere: Sta. Mesa, Cubao, Balintawak-Monumento, Makati, Greenhills, Las Piñas, Pasig and many others. Business establishments have also invaded residential areas adjacent to growing commercial districts. Along main thoroughfares of residential areas, we find offices, restaurants, dress shops, beauty parlors, video rental counters. We see this in San Lorenzo Village in Makati, Wilson Street in Greenhills, Tomas Morato Street in Quezon City, BF Homes in Parañaque and even the once genteel Malate area. Commercial establishments occupy 8% of Metro Manila's land area (ADB C-15).

The lion's share, 37% of the land in Metro Manila, is used for residential housing (ADB C-14). There are several types. One type is the low-density-low-rise, single detached dwelling units found in well-to-do neighborhoods and residential villages. Another is the high density, generally poorer housing found near the old central commercial district and poorer areas throughout the city. A third type, which is of fairly recent origin, consists of the high-density-high-rise condominiums and the high-density-low-rise town houses in Makati, Sta. Mesa, Greenhills and other

areas. On the intersection of EDSA and Ayala Avenue, for example, stand several high rise condominiums which epitomize the shape of buildings to come. They speak eloquently of how real estate values have risen in Makati as in other parts of Manila.

The trends in residential housing show rising land values and for those who can afford it, the rush towards suburban subdivisions which are a short drive from a bustling commercial center. For the poor who must seek their niches where they can easily find work or some marginal means of livelihood like selling newspapers or sampaguitas, to stay in the city means to live in slums or squat on somebody else's property. Slum and squatter colonies are increasing and most everywhere in the city -- along the reclamation area in Roxas boulevard, beside railroad tracks, under bridges and along riverbanks, on government-owned land -- they take root.

In 1987, the National Statistics Office estimated there were about 415,000 squatter families in the whole of Metro Manila living in 591 different slum and squatter settlements. Squatter population is 2.5 million or 34% of the total population of Metro Manila (See Table IV). By 1992, there will be about 3.0 million squatters in Metro Manila.

As the city grows, population pressure on the land will increase; so will competition for its different uses (ADB C-17) [3] Metro Manila with its many autonomous local governments and its Metro Manila Authority does not appear headed into the future with clear policies and plans for further urban development (ADB E- 2).[4] Without a comprehensive ecological plan for the city, industries and commercial areas will mushroom where they may and so will slums and squatter areas. Inappropriate development has occurred and will continue to occur. As has happened along

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[3] There are three other general categories of land use. One is land occupied by institutions including military installations, educational institutions, health and hospital facilities and government institutions. These constitute about 5% of the total urban area. Another is agricultural land covering roughly 10%. Finally, there is the 35% classified as open area consisting of undeveloped areas, golf courses, parks, playgrounds, and even cemeteries (ADB 1990).

[4] The Metro Manila Authority or MMA serves as the link between the local government units (LGUs) and the national agencies like the National Economic Development Authority (NEDA) and the Department of Finance. MMA's mandate is to act as the central coordinating body of development planning for Metro Manila. The MMA has the power to tax through passage of various revenue-raising ordinances. Local government units contribute 15% of their gross income as contribution to MMA but the national government accounts for 90% of MMA revenues (MMR Environmental Improvement Study Volume 1 1990).

the coastal areas or in the lowland margins of Laguna lake, industries will be set up on land inappropriate for industrial use (ADB C-16).

Metro Manila's growth is an interplay of order and disorder. We have clashing images: well planned and engineered residential subdivisions versus make-shift, congested squatter colonies; food terminals and shopping malls versus muddy, fishy street-markets (talipapa). In a situation of disordered growth, basic services to people are bound to be patchy.

WATER AND SANITATION SERVICES

Only 15% of the city is properly sewered: 12% by the MWSS (Manila Waterworks and Sewerege System) and 3% by other small independent sewerage systems (Fig. 3). This translates to about 1.2 million people served. As 1.2 million was Manila's population count in the mid-1940s, we might say that the city's sewerage infrastructure is at least 45 years behind schedule. The MWSS says that at the planned rate of completion of present projects to expand sewerage services, it will take 25 years to cover 50% of Metro Manila (ADB I-22). At present, 85% of Metro Manila residents rely on inadequately maintained septic tanks; in very poor areas, no waste disposal system exists (Environmental Management Bureau 1990).

Without a pipe sewerage system, the sewage and sullage[5] from households flow into storm drains, then into the esteros and rivers and out to Manila Bay; all watercourses and shoreline waters become polluted as a result. With a sewage outfall 5 to 6 kilometers from shore, shoreline pollution is lessened. There is at present one outfall which serves the existing sewerage system. There are plans to build another (Feachem 1983).

City water services have not been able to serve the whole of Metro Manila either. MWSS provides water to 70% of the population. The areas that do not have city water have resorted to deep wells for their water supply. This for example is the case in the south of Manila in Parañaque and Las Piñas. Experts say

[5] Sullage, also known as graywater, is domestic wastewater not containing excreta -- the water discarded from baths, sinks, basins and the like that may be expected to contain considerably fewer pathogenic microorganisms than sewage.

that the water level of the aquifer has been declining due to overextraction of ground water. This decline has actually been estimated to be about 4 to 10 meters per year in some parts of the city. Near the coastline, it was found that groundwater extraction has exceeded the rate of groundwater recharge. The consequent depletion of the aquifer has caused seepage of sea water into the aquifer. Significant increases in the salinity of wells have been detected within 1.5 km of the shoreline in most coastal areas (ADB I-12, I-13).

Improvement of the water distribution system in Metro Manila is hampered by poor revenue collection. In 1989, 55% of city water was lost in leaks and unbilled water consumption. While MWSS aims to reduce these losses to 32% by 1995, progress to remedy the situation has been slow (ADB I-40).

At present MWSS is expanding water services to unserved areas of Metro Manila. There are also plans to tap Laguna de Bay as a source of drinking water by the year 2000 (ADB J-24). Expansion of water services must be coupled with parallel growth of the sewerage system. Otherwise the amount of wastewater pollution increases. Because of the 65% increase in water supply without the concomitant increase in sewerage facilities in 1980-85, there was a 53%-net increase in domestic wastewater discharge into rivers and the coastal shorelines of Manila Bay (ADB I-24).[6]

For Laguna de Bay to be converted into a source of potable water for Parañaque, Muntinlupa and Cavite, its present water quality must be upgraded from a fishery (Class C) to a public water supply (Class AA) (See Table V) (ADB I-4). This requires the construction of sewage systems and treatment plants for both domestic and industrial wastes. This is necessary because the Laguna lake basin particularly its western portion is densely populated and highly industrialized.[7] Open fishing and fishpen

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[6] Volumes of domestic sewage depend on quantities of water used in the home. Houses connected to sewers must also be connected to water systems; they usually have comprehensive plumbing fittings. Such houses may, rarely, use as little as 30 liters per capita daily. If daily use falls below 50 liters per capita, however, the sewers lose their self-cleansing flow and become blocked. At the other extreme, households with many water-using appliances (such as washing machines) may use 300 or more liters per capita daily (Feachem 1983).

aquaculture would also be phased out. The conflict of interests makes this plan highly controversial (ADB J-16).[8]

PUBLIC TRANSPORTATION SERVICES

These last few years have seen a worsening of the public transportation situation in Metro Manila. It has been more and more difficult for a commuter to get around the city.[9] In recent years the number of public transport utilities has not kept pace with the growth in population. Government has tried to ease the transport crisis by importing new buses to travel city and provincial routes. In 1989, some 1,000 buses were procured by the Department of Transportation and Communication (DOTC). The DOTC has also activated rail transport into the city as well as ferry boats on the Pasig River. The trains service 20,000 passengers per day while the ferry boat, 5,000 (Ibon Facts and Figures, March 1990). The long queues and waiting times, especially during rush hours, depict a system under severe strain.

The number of motor vehicles in Metro Manila has more than doubled from 231,000 in 1975 to 500,000 today (Nierras 1979; EMB 1990). As in most cities, the trend has been for the urban dweller to buy a car if he can afford it. In the third quarter of 1989, for example, 39,685 new motor vehicles were registered, 87% of which were private cars (Ibon, March 1990). As early as 1974, studies showed that 41% of the estimated 1.7 million

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[7] The Laguna lake basin covers an area of 382,000 ha; the lake itself covers 90,000 ha. Eighty percent of industries are located on the western part of the lake. In the early 1980s, the Laguna lake region had a population of 6.2 million and a growth rate of 3.7%. This population would include the towns and municipalities south of Metro Manila. Only a portion of Metro Manila, mainly its southern municipalities including Taguig, Pateros, Muntinlupa, are considered part of the Laguna watershed (Environmental Management Bureau 1991.).

[8] In her book **Blanco** where she presents the painting of a family of artists from Angono, Alice G. Guillermo writes: "In years past, the early morning air resounded with the voices of fishermen hauling in their nets and vendors haggling for the piles of leaping silvery freshwater fish, the *kanduli* which thrives in the waters of Laguna de Bay. Of late, although the village is yet unaffected by urban taint, the fisherfolk of Angono are menaced by the pollution of the waters from the new factories. The other more immediate threat to the livelihood is the powerful fishermen who have come to exploit the lake with launches and larger nets and who have set up rows of fishpens which effectively crowd out the small fishermen from their traditional ground." (Guillermo 1987).

9 Travel times by public transport have been one of the slowest in the world. In 1975, it took an hour to travel 10-20 kilometers within Metro Manila in a jeepney or a bus (Nierras 1979).

vehicle- trips per day were made by private vehicles (Nierras 1979). With the increasing number of private cars on the road, this percentage is now probably larger. This increase translates into more traffic on the road, actual longer travel times on the average, more gasoline consumption and more motorcar exhaust pollution.

Of the urban transport problem, an expert wrote in 1979:

> *Supplying mobility to Metro Manila's - 7 million residents has become a dilemma. On one hand, the combined capacity of all public vehicles -- about 431,000 seats – is not enough to meet the 8.5 million person-trips per day, especially during the rush hours. On the other hand, there are not enough vehicles to meet the travel demand, the roads are too few and too narrow to accommodate the increasing number of vehicles. Solutions lie somewhere between providing more roads and transport infrastructure, providing more and better public vehicles, and reducing the population and travel demand (Nierras 1979).*

ENERGY

There were frequent power shortages in Metro Manila during summertime over the last couple of years. Ironically, the shortfall of energy has slowed down economic growth. A 1989 survey of 60 firms by a metropolitan daily showed production losses amounting to ₱27 billion (Ibon, March 1990). The shortage of power has been attributed to a number of factors. One is the decreased capability to generate hydroelectric power during summer when the water levels in the dams fall. Another is the increased demand for electric power as a result of expanded economic activity.

The country is dependent mainly on imported petroleum for energy. In 1975, the energy use patterns of the various sectors were: transportation, 35.8%; industry, 34.2%; residential commercial, 6.6% and others 23.4% (See Fig. 4). The high consumption of energy in the transportation sector has much to do with use of motor vehicles in Metro Manila where half of all motor vehicles in the country are found. The increasing urban sprawl and increased travel times as a result of longer distances to and from work, the increasing number of private cars which consume more

energy per capita compared to buses and other forms of mass transport, the worsening traffic situation and the poor maintenance of vehicles all contribute to a higher energy bill.

With increasing industrialization and commercialization, construction of more residential subdivisions, more demand for transport services, the energy requirements of Metro Manila will continue to rise.

HEALTH SERVICES

Services for personal health care are widely available in the city for those who can pay. For those who cannot, there are the government hospitals and clinics.[10]

Government provides the bulk of public health services, which include programs and health interventions with broad community focus. Some examples of these are: Dengue fever control by fogging against the mosquito vector; regulation of sanitary practices in restaurants; prevention and control of infectious disease epidemics like typhoid and cholera. Some public health services, like immunization and tuberculosis treatment, seek community impact (eg. prevention of measles, polio, or TB) by servicing as many eligible clients as possible. In so protecting large segments of the population, the spread of illness is either slowed down or stopped.

The increase in the number of slum and squatter dwellings has made it difficult to cover large portions of urban populations susceptible to disease. Measles epidemics have often erupted in urban poor areas where measles immunization coverage is low. The very recent measles outbreak in Novaliches in May 1991 where eight children died is a case in point (The Manila Bulletin, May 30, 1991). In places like these, immunization coverage of children is only 30-60% (Unpublished data of Maternal and Child Health Service, Department of Health, 1990). In Barrio Magdaragat, better known as "Smokey Mountain", which is the site of the biggest dumping area (15 ha) in Tondo, only 39% of the 216 children surveyed had measles vaccination. Furthermore, 96% of

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[10] Personal health care refers to direct medical service to an individual for a specific ailment. In the country as a whole, public hospitals, and clinics account for 26-36% of personal services provided. In Metro Manila, where private services are concentrated, this percentage is much less (Intercare: Health Care Financing in the Philippine: A Country Studio).

these children harbored intestinal parasites and remained untreated (Auer 1990).

Crowding and the lack of water and sanitation facilities are known to be associated with the spread of cholera (Velimirovic, Subramanian, Sadek 1975). Studies by the Department of Health have associated cholera with water hoses used to collect water from public faucets in urban poor areas along the coastline (Benabaye unpublished). Seepage of sewage into water lines through illegal pipe connections is common. A recent epidemic in Barangay Escopa, Quezon City illustrated this (Lopez et al. unpublished).

The above situations amply confirm what is widely known: that many urban health problems stem from the squalor of the environment compounded by the lack of basic services.

TYPES OF URBAN POLLUTION

One of the consequences of industrialization and urbanization -- particularly when rapid -- is pollution. This is common in many parts of the world. Mexico and China, two countries that have rapidly industrialized in the last 25 years, have seen their industrial centers suffer from smog, acid rain and toxic sludge (National Geographic, May 1973 and Time Magazine, April 29, 1991). A city poisons itself in many ways. Let us examine the pollution picture of Metro Manila.

POLLUTION OF THE URBAN AQUATIC ECOSYSTEM

Pasig River. Like many ancient cities whose civilizations sprung from a magnificent river like the Nile in Egypt or the Tigris-Euphrates in what is now Iraq, Manila had its beginnings at the mouth of a river: the Pasig. A Filipina writer-historian wrote: "The first street of Manila was the Pasig, if by street is meant a passage or thoroughfare. From the waters of the South China Sea up through the Pasig -- an old Malayan word pertaining to the coast or strand -- rowed the early Manilans." (Luning 1977).

The Pasig River flows through Manila from east to west for 25 km from its origins at the Laguna de Bay to its mouth at Manila Bay. It is estimated that 60% of Metro Manila comprise the watershed of the river involving some 5 million residents in the cities of Manila and Quezon City and the municipalities of San

Juan, Mandaluyong, Makati, Pasig, Taguig, Marikina, San Mateo and Montalban (ADB J-2).

The Pasig has suffered the accumulated abuses of garbage dumping, discharge of industrial effluents, mismanagement of domestic waste, siltation due to deforestation and bank erosion and proliferation of squatters along its banks (See Fig. 5). It is estimated that 60-70% of pollution of the Pasig River is due to domestic waste. The Pasig is so badly polluted that some parts of it are biologically dead. The most polluted portion is the Navotas-Malabon-Tullahan-Tenejeros tributary which is a 26-km water-course that runs from the La Mesa reservoir in Novaliches towards Manila Bay. It is polluted by over 1,000 industries and wastes from 11,000 squatter homes on its watershed (ADB I-10).

The Department of Environment and Natural Resources regularly monitors the Pasig River for certain parameters which include: color, temperature, turbidity, pH, dissolved oxygen, biochemical oxygen demand, suspended solids, total and fecal coliforms, nitrate, phosphorus, oil and grease. Dissolved oxygen levels, which give an indication of the capacity of the aquatic environment to sustain living things, have consistently been measured at less than 2 mg/l in many monitoring sites (ADB I-9) This is below the standard for surface water classified only for navigational use (Class E) (See Table V). Biochemical oxygen demand, which is a measure of the amount of organic matter in wastewater, has occasionally been recorded as high as 500 mg/l (ADB I-10); this is much like the BOD level of wastewater which contains heavy amounts of human excreta. For a river where fish and aquatic resources are propagated, the recommended level is 20 mg/l. Industrial pollution, as measured by mercury levels above acceptable limits, has also been documented.

Laguna de Bay. Laguna de Bay, a 90,000-ha freshwater lake, which contributes to the waters of the Pasig, traditionally provided the livelihood of thousands of fishermen in lakeside towns. Today, it has also become shallow from siltation as a result of deforestation of the land around it. To prevent lakeshore flooding, the Napindan hydraulic control structure permits discharge of lake water into Manila Bay via the Pasig River. The channel can be opened or closed to control the flow of water coming into or leaving the lake. Fishermen want the channel open for saline water from Manila Bay to enter the lake and provide nutrients for fish. However, when this happens, it is polluted saline water from the Pasig and Manila Bay which enters the lake. Coupled with the

industrial effluents from about 1,000 industries in its watershed, pollution now threatens the lake. Dissolved oxygen levels measured in 1986-87 showed levels ranging from 6.1 - 9.3 mg/l which is above the standard set for Class A waters (ADB I-12). This is encouraging as the lake is being considered a source of drinking water. However, quite recently, disease in fish associated with *Aeromonas hydrophila* has been attributed to pollution; these occurrences herald a worsening of the lake's degradation (Environmental Management Bureau 1990).

Manila Bay. Like Laguna de Bay and the Pasig River, Manila Bay has also become shallow and heavily polluted. Fourteen sampling stations in different parts of the bay detect signs of eutrophy which means the depletion of oxygen because of excessive algae and bacteria. Dissolved oxygen levels ranged from 3mg/l to 8.5 mg/l in various parts of the bay indicating some variation in the extent of pollution within the bay area. In the Navotas area, for example, pollution is such that the geometric mean of fecal coliforms averaged 0.6 million per 100 ml for 1982-89; this is 100 times less than the number found in raw sewage but nowhere near the acceptable level for bathing or recreation. In the Luneta area, coliforms were measured at 77,000 per 100 ml and near Corregidor Island (P. Grande sampling station), fecal coliforms had fallen to 500 per 100 ml (ADB I-17). A Hong Kong study showed that at the levels of pollution like that measured near Corregidor, swimmers were still more likely than non- swimmers to develop infections of the eyes, ears, gastrointestinal and respiratory systems (Cheung, Chang and Hung 1990).

Data collected at the sampling stations indicate that the level of pollution in Manila Bay as indicated by the numbers of coliforms has gradually worsened over the last decade. At Luneta and P. Grande near Corregidor, fecal coliform counts went up over a hundredfold from 1982 to 1989 (See Table VI). At Bacoor, where shellfish (oysters, mussels) are farmed, levels have fluctuated probably because of the proximity of the sampling point to the outlet of the Imus River.

The pollution in Manila Bay has great public health implications for the shellfish industry in Cavite as oysters and mussels are known to be associated with infections, like cholera, hepatitis A and paralytic shellfish poisoning. The eventual confidence of the public in these sources of shellfish could erode what is now a ₱100-million industry. This already happened in 1988 when the

public stopped buying mussels because of the Red Tide phenomenon.[11]

To control the spread of illnesses, like cholera and typhoid that result from sewage poisoning, sanitation -- more than any other intervention (eg. vaccines or drugs) --- is most effective (See Fig. 6).

THE GARBAGE SITUATION

The rise of the garbage pile has accompanied the growth of the city. Metro Manila is said to produce close to 4,000 tons of solid waste everyday, only an estimated 70% of which is collected and transported to dumpsites (Environmental Management Bureau 1990). The uncollected waste is scattered on city streets, thrown or washed down drainage pipes, esteros and rivers, and contribute to the flooding problem. A recent television advertisement declared, "Basurang itinapon mo, babalik rin sa iyo" while cinematically portraying the rush of flood waters and accompanying debris into the family living room.

Several reasons have been identified for the garbage problem. One is indiscriminate and unmindful disposal of refuse in streets and empty lots by people. Another is the poor system of collection. A third is the inability of garbage trucks to collect garbage in squatter and slum areas where streets are narrow and inaccessible. A fourth is the inability of city authorities to adequately plan and provide resources for the proper collection and disposal of waste (ADB F-2). Recently the mayors of Metro Manila have made garbage collection one of their main priorities but the permanent solution to the problem will require a far-ranging and comprehensive approach that goes beyond improvement of garbage collection.

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[11] In the Philippines, Red Tide is cause by a marine dinoflagellate, *Pyrodinium bahanense* which, because of unpredictable blooms, causes sea water to turn red. Filter feeders, like mussels, accumulate high concentrations of the toxin produced by the dinoflagellate. When contaminated mussels are ingested by man, an illness called paralytic shellfish poisoning results. Symptoms include numbness and respiratory paralysis. These might lead to death. Outbreaks of Red Tide occurred in various parts of the Philippines, including Manila Bay, in 1988-89 (Department of Health 1989).

The exact causes of the dinoflagellate blooms have not been fully determined. Some factors thought to contribute to their occurrence include enrichment of marine waters from land run-off, upuvelling of colder nutrient-rich oceanic water and temperature rises (Environmental Management Bureau 1990).

For example, Metro Manila's garbage is transported to open dumpsites which do not fulfill the standards for an environmentally acceptable refuse disposal system (See Fig. 7). The areas are not fenced. They breed rodents, flies and other vectors of disease. The lack of earth cover for the daily pile of refuse allows rainwater to seep through the heap causing anaerobic decomposition, gas production and bad odors. The result is a "smokey mountain": on top of it, poor people scavenge; under it, contaminants threaten to leak into nearby aquifers (ADB F-2).

A recommendation has been made for Metro Manila's dumpsites to be closed and for two new landfill areas to be opened, one to serve the north, and the other the southern part of the city. On Feb. 26, 1991, The Manila Times carried a photo of the San Mateo landfill starting its operation.

AIR POLLUTION

There are two major sources of air pollution in the city. Motor vehicles account mostly for carbon monoxide and nitrogen dioxide emissions; industries are the main source of sulfur dioxide. All these gases are hazardous to good health.

Although monitoring of air quality in Metro Manila has been erratic due to breakdown of instruments and changes in technique, data show that air quality in the city deteriorated in the last decade. High readings for total suspended particulates, which include dust, smoke, fumes, and metallic and mineral particles, have been found in several areas like Valenzuela, Malate, Ermita, and Pasay. Carbon monoxide levels have been rising with the increase in motor vehicles and the generally poor vehicle maintenance. Although sulfur dioxide and other heavy metal pollutants (lead, cadmium, copper, zinc) still do not show dangerously high levels, the increasing industrialization of the Metro Manila area and the inadequate compliance with and enforcement of pollution control laws do not provide optimism that air quality will improve (Environmental Management Bureau 1990).

Local air pollution will have effects on the environment beyond the boundaries of Metro Manila. Air pollutants anywhere and everywhere cumulate and lead to global warming, ozone layer depletion and acid rain.

MANAGING THE URBAN ECOSYSTEM: WHERE TO BEGIN?

As described above, the problems of the urban ecosystem are complex and intractable to quick fixes. Solutions need to be applied at individual, community and societal levels, by government and private sectors working together, with local and international support.

First, we must begin to develop, cultivate and propagate among Filipinos, an attitude of respect, maybe even reverence, for our environment.

Richard F. Townsend of the Art Institute of Chicago said: "Harnessing ecological resources and expanding the economy are primary forces in the development of societies and their increasing complexities, but parallel with that is the idea of sacred places." The ancient Aztecs understood the unity of the land and the cosmos and of the gods which protected it. Because of this, they built beautiful temples and did not pollute their surroundings. The Spaniards under Hernan Cortes, accustomed to the dirt and grime of the Old World cities, marvelled at the cleanliness of the Aztec capital of Tenochtitlan in 1519 (Stuart 1988). There is much we can learn from this ancient civilization.

Respect for the environment can be taught through innovative programs at all levels of schools and colleges. Futhermore, well- crafted communication campaigns designed for home, work and public places should set a climate so that people are encouraged to behave in non-wasteful, non-pollutive ways. Simple anti- littering and proper garbage disposal practices are of immense importance when millions of people are involved. There is no underestimating the role of each individual in contributing to the total effort of conserving or rehabilitating the physical surroundings. Educational materials are needed. A book entitled "50 simple things you can do to save the earth" published by the Earthworks Group of Berkeley, California, advises on a host of things, like pesticide use, recycling of motor oil and composting. Ideas in such a publication, if widely circulated and discussed, could change people's views and behavior for the better.

Second, as a society, we must solve the problem of rural poverty from which stems the complex web of in-migration, squatting and slum areas.

History has shown that any success in fighting rural poverty will depend on a successful land reform program. Japan and the

tiger economies of Asia put land in the hands of the tiller and supported him with cooperative structures for marketing and purchasing, extension services and sustained research and innovation As the rural population prospered, they became both a market and a source of savings for industrial investment. Japan completed its land reform program in the late 1940s and early '50s, Korea, in the 1970s (Ward 1979).

Furthermore, Sixto K. Roxas has made a case against economic policies that generate mass poverty by marginalizing people in the rural areas. Such policies include the conversion of scarce prime agricultural land into non-agricultural uses (eg. export processing zones) thereby wasting the inherent productive capacity of land as soil. Roxas believes that this approach makes no sense because it increases the amount of capital necessary to generate livelihood (Roxas 1990).

Third, we must find ways to upgrade the urban infrastructure for basic services without which city living becomes unpleasant and hazardous.

The investment requirements for this upgrading have been estimated as follows (ADB p. 7-1):

Integrated Solid Waste Management		139.0
Integrated Flood Control Program		297.0
Integrated Water Quality Management		163.0
Industrial Pollution Control Program		100.0
Environmental Management and Monitoring	US$	11.3 M
Total		710.3 M
	(P	16,640.0 M)

Where will the money come from? Environment Secretary Fulgencio Factoran, in a speech at a conference convened by the Philippine Futuristics Society on May 30, 1991, lamented the cuts in the budget of the Department of Environment and Natural Resources which will jeopardize the implementation of ongoing projects (Futuristics Society, Proceedings of the Conference, unpublished). There were no clear answers to this question but alternative modes of financing were proposed.

One, cleaning up the environment raised opportunities that businesses could invest in and profit from. For example waste recycling technologies for sewage and for solid waste are being undertaken in other countries. Two, a scheme called the debt-for-nature swap could allow a non-governmental organization to

undertake an environmental rehabilitation program using local funds generated by the exchange of a foreign debt obligation with a new obligation to undertake a conservation program. Three, taxes could be raised from polluters. An emissions tax could be charged from motor vehicles discharging unacceptable levels of carbon monoxide or carbon dioxide. Factories could also be made to pay for pollution attributable to their operations.

Fourth, institutional roles and responsibilities must be straightened out. The Metro Manila Authority, the different local government units and various national agencies need to get their act together so to speak, to effectively undertake Environmental improvement projects and enforce laws and ordinances on land use, squatting, pollution controls and many other issues.

Figure 8 (ADB 6-6a) shows us how complex the organizational set- up is. This chart includes the national agencies involved in the environmental improvement projects of Metro Manila. Local government units are not indicated.

On the matter of law enforcement, a foreign consultant observed:

> *Among the phases of urban and environmental management process, the enforcement of rules, regulations, legislations and ordinances is weakest. This is primarily due to: lack of financial support to properly implement the rules and regulations; lack of specific provisions in policies or regulations which make implementation or enforcement difficult; and lack of sincere commitment on the part of implementors and enforcers. Enforcement in Metro Manila is characterized with partialities, is seasonal and is vulnerable to graft and corruption. (ADB 1990).*

There are a multitude of weaknesses that need to be addressed here. We could start by strengthening the powers of the Metro Manila Authority and perhaps making governorship of Metro Manila an elective position so that it could carry more clout. And of course, we would need to elect better public officials.

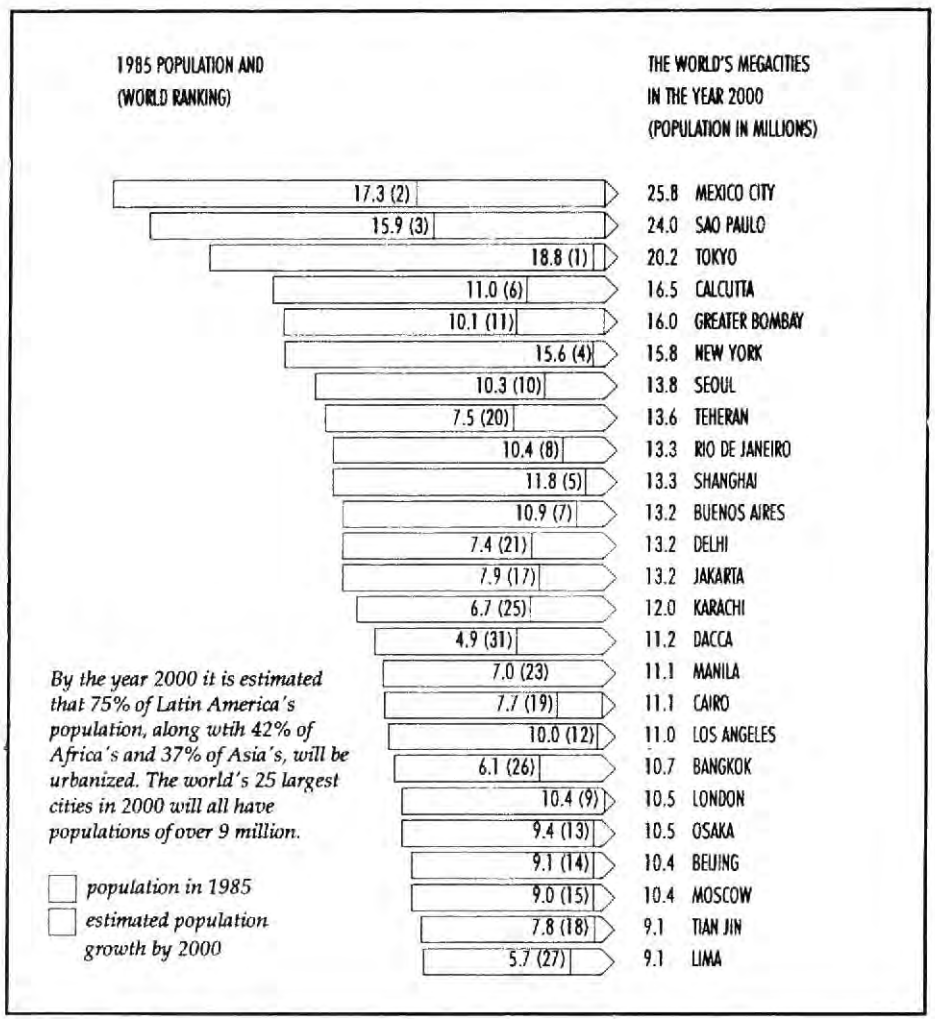
Finally, we should use the lessons of Metro Manila's development in order to plan and build better cities in other parts of the country.

The problems of Metro Manila are already happening in the cities of Cebu, Iloilo and Davao. The list is the same: poor sewage

and sanitation services, poor water supply, squatter colonies, and others.

Let me end by relating a recent conversation with the Assistant Provincial Health Officer of Guimaras Island in Iloilo. In speaking about the development of that small island, he envisioned the education of its poor people who could provide the labor for a boat building industry that might be set up there. Development, when it uplifts people, is also a vehicle for environemental conservation. It is this people-oriented development that we must continue to strive for.

Population of World's Megacities
Table I



SOURCE: UN POPULATION FUND

Table 2. Population by city and municipality (NCR, 1948-1980)

Jurisdiction	1948	1960	1970	1975	1980
NCR	1,569,128	2,462,481	3,966,695	4,970,006	5,970,310
Manila	983,906	1,138,611	1,330,788	1,479,116	1,642,708
Caloocan	58,208	145,523	274,453	397,201	471,323
Pasay City	88,728	132,673	206,283	254,999	289,927
Quezon City	107,977	397,990	754,452	956,864	1,174,605
Las Piñas	9,280	16,093	45,732	81,610	137,537
Makati	41,335	114,540	264,918	334,448	375,424
Malabon	46,455	76,438	141,514	174,878	192,432
Mandaluyong	26,309	71,619	149,407	182,267	206,905
Marikina	23,353	40,445	113,400	168,453	213,199
Muntinlupa	18,444	21,893	65,057	94,563	137,703
Navotas	28,889	49,262	83,245	97,098	127,091
Parañaque	28,884	61,898	97,214	158,974	210,115
Pateros	8,380	13,173	25,468	32,821	40,590
San Juan	31,993	56,861	104,559	122,492	131,063
Taguig	15,340	21,856	55,257	73,702	135,0142
Valenzuela	16,740	41,473	98,456	150,605	213,955
Pasig	35,407	62,130	4,156,492	209,915	270,583

Source: For 1948-1990: 1980 Census of Population by Province Municipality and Barangay, NCR, Final Report

Table 3. Population projection of cities and municipalities: .1980-2030. (Medium assumption: Moderate fertility decline and moderate mortality decline)

Province/ Municipality	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030
Metro Manila	5970310	6942204	7974002	8970970	9894837	10737419	11481317	12152388	12765312	13265262	13607025
Caloocan City	471323	543302	615726	680769	735657	780438	814885	842105	864376	879294	885288
Manila	1642708	1765907	1876194	1954926	2001338	2021942	2021067	2009880	1995673	1995673	1974072
Pasay City	289927	331860	373657	410663	441357	465919	484343	498582	510053	517387	519713
Quezon City	1174605	1377926	1587140	1781159	1951129	2095504	2212170	2308301	2389270	2447735	2478649
Las Piñas	137537	207770	302560	421420	562420	722333	894996	1075709	1258577	1430111	1575997
Makati	375424	421367	465896	503560	533019	554994	569895	580334	588156	591923	590775
Malabon	192432	220197	247860	272336	292621	308839	320990	330370	337921	342738	344244
Mandaluyong	206905	233843	260221	282922	301090	315031	324897	332116	337707	340819	340931
Marikina	213199	259806	309986	359340	405449	447256	483584	515347	543241	565168	579534
Muntinlupa	137703	183696	238337	298449	361343	424867	486372	545099	600230	647908	684665
Navotas	127091	147364	167919	186588	202554	215772	226127	234440	241317	246063	248219
Parañaque	210115	266740	330552	396779	462181	524743	582181	634686	682338	721779	750229
Pasig	270583	334770	405075	475673	543075	605498	660955	710318	754238	789522	813660
Pateros	40590	48346	56478	64209	71174	77262	82348	86653	90349	93131	94784
San Juan	131063	142444	152880	160783	166001	168998	170082	170160	169837	168735	166649
Taguig	135142	166308	200239	234066	266122	295595	321583	344574	363939	381182	392140
Valenzuela	213955	290551	383274	487318	598298	712421	824833	933707	1037081	1127686	1198808

Source: Philippine Population Projections, NEDA

Table 4. Metro Manila Distribution of Squatter Population, 1987

District	LGU	Total Population	Squatter Population		Squatter Families
1	Manila	1,813,064	545,496	(30.1)	90,916
2	Caloocan	572,763	223,848	(39.1)	37,308
	Malabon	231,492	73,374	(31.7)	12,229
	Navotas	155,702	102,714	(66.0)	17,119
	Valenzuela	325,958	52,682	(16.2)	8,781
3	Quezon City	1,462,327	516,000	(35.3)	86,000
	Makati,	439,747	81,612	(18.6)	13,602
	Mandaluyong	244,687	108,380	(44.3)	19,300
	Pasig	362,519	100,668	(27.8)	16,278
	Pateros	,51,605	25,530	(49.5)	4,255
	San Juan	146,856	21,972	(15.0)	3,662
	Marikina	279,729	61,692	(22.1)	10,282
4	Pasay	348,923	266,220	(76.3)	44,370
	Parañaque	291,687	76,776	(26.3)	12,796
	Las Piñas	242,716	37,578	(15.5)	6,263
	TOTAL	7,354,190	2,485,696	(33.6)	415,020

Source: NSO/LGUs

Note: Figures in parenthesis represent percentage of total population.
Figures for squatter families are based on average assumed family size of 6 persons.

Table 5. Water Usage and Classification

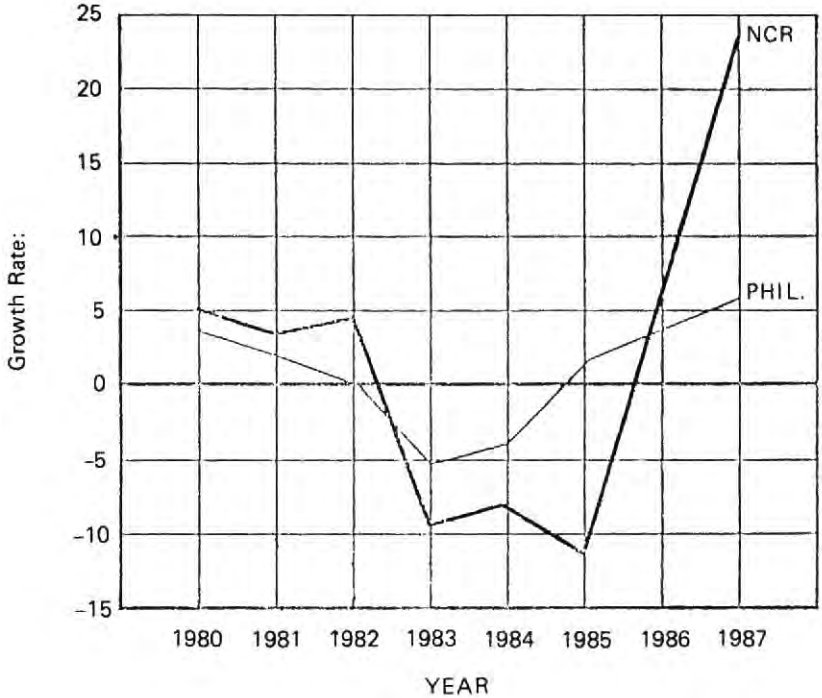
		Dissolved Oxygen (mg/l)	BOD (mg/l)
Class AA	Public water supply needing only disinfection to meet standards for drinking quality	—	—
Class A	Public water supply needing complete treatment (coagulation, sedimentation, filtration and disinfection) to meet standards for drinking quality	5	10
Class B	For primary contact recreation	5	15
Class C	For propagation and growth of fish and other aquatic resources	5	20
Class D	For agriculture, irrigation, livestock watering and industrial cooling and processing	3	–
Class E	For navigational use	2	–

Source: (ADB, I-4)

Table 6. Geometric Means for Fecal Coliforms (1982-89)

Station	1982	1983	1984	1985	1989	1982-1989
Luneta	17,833	25,246	31,007	91,435	2,223,123	611,280
Bacoor	45,605	10,987	21,982	17,086	66,169	26,240
P. Grande	137	168	384	976	16,771	670

Source: (ADB, I-17)



Source: MMC - OCP

Figure 1. Growth trends of NCR economy

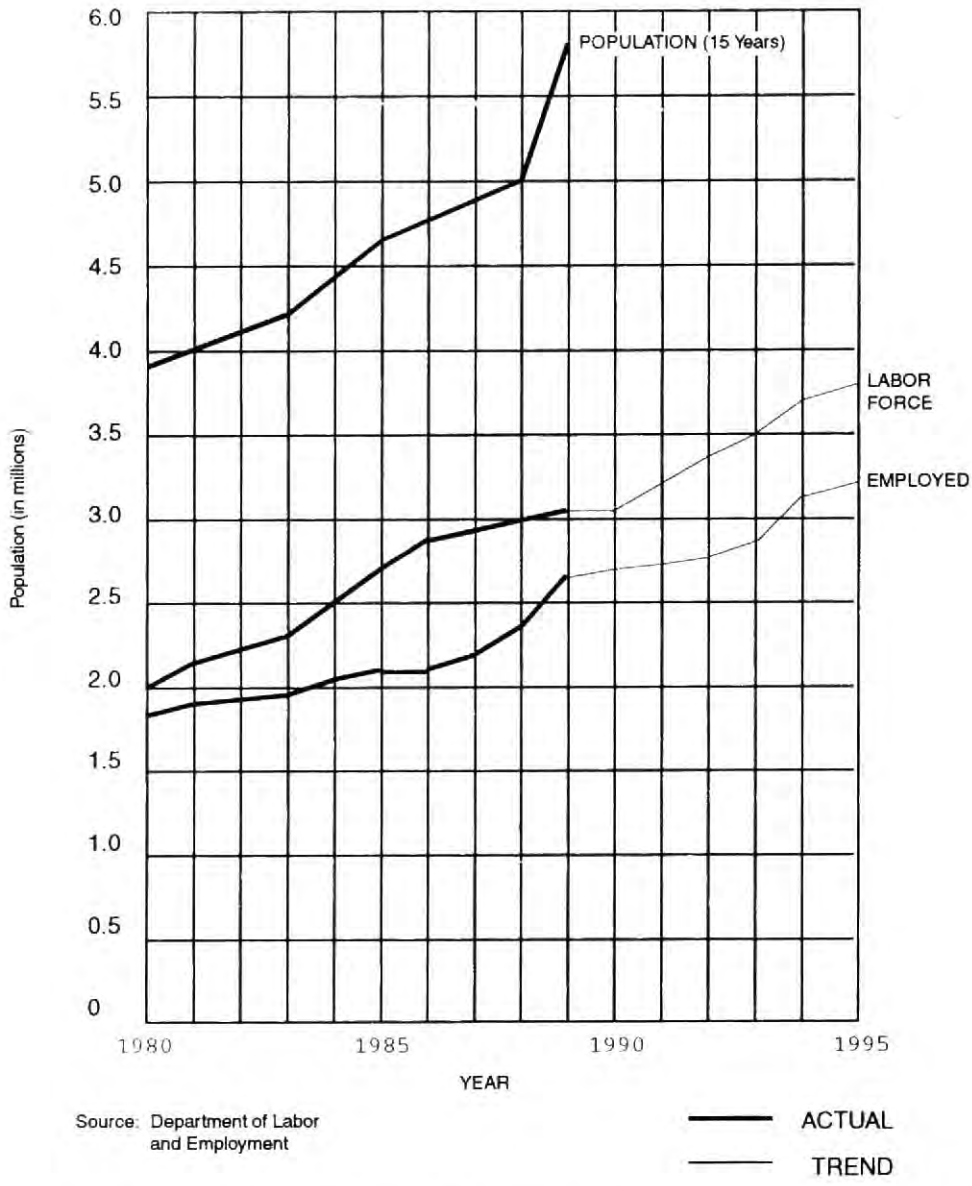


Figure 2. Employment Situation, 1980-1995

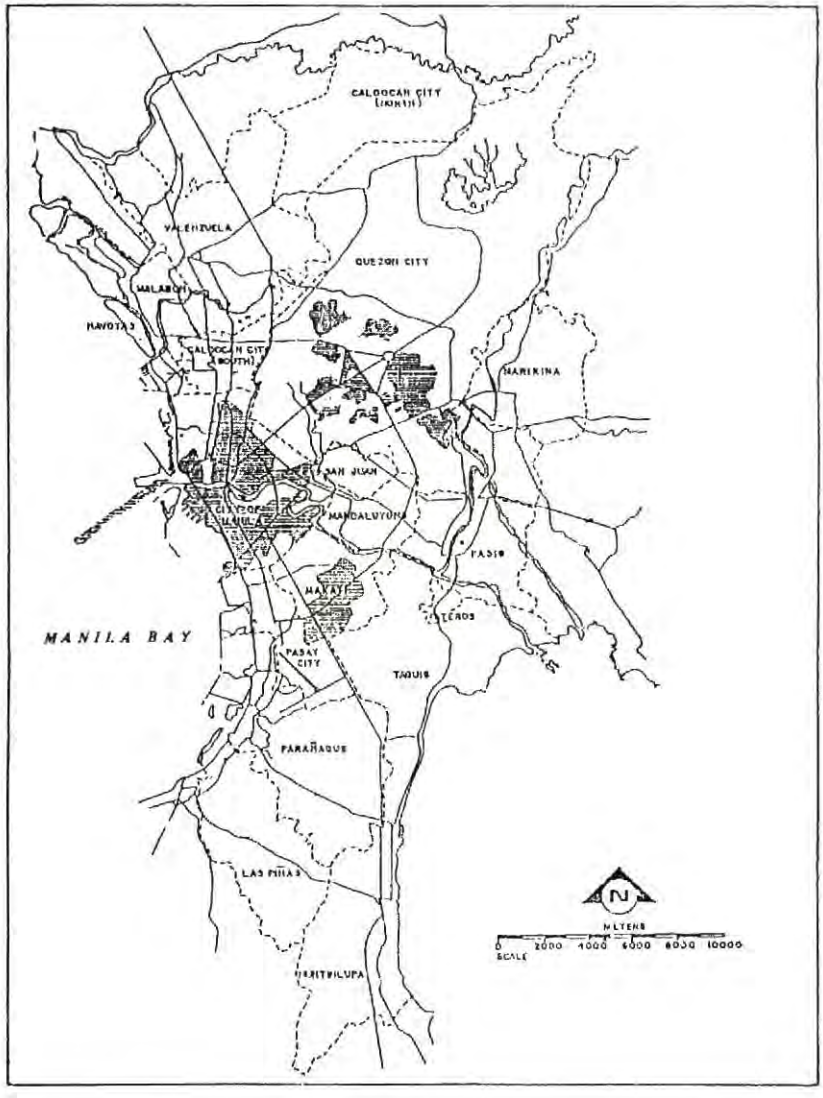


Figure 3. Areas with existing pipe sewer system

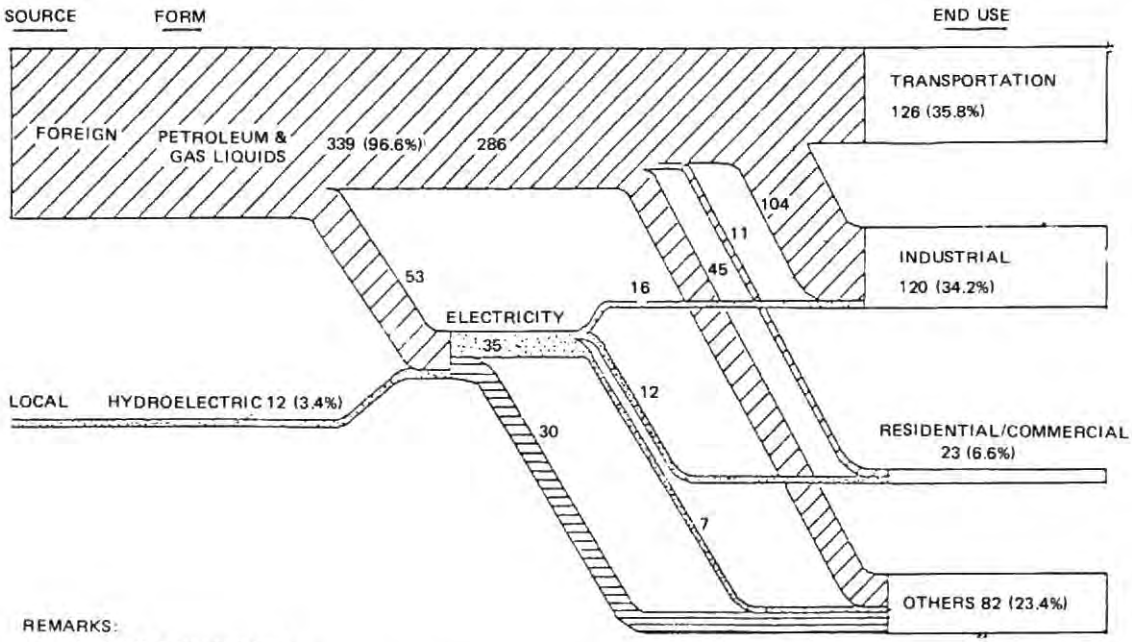


Figure 4. Energy flow patterns in the country

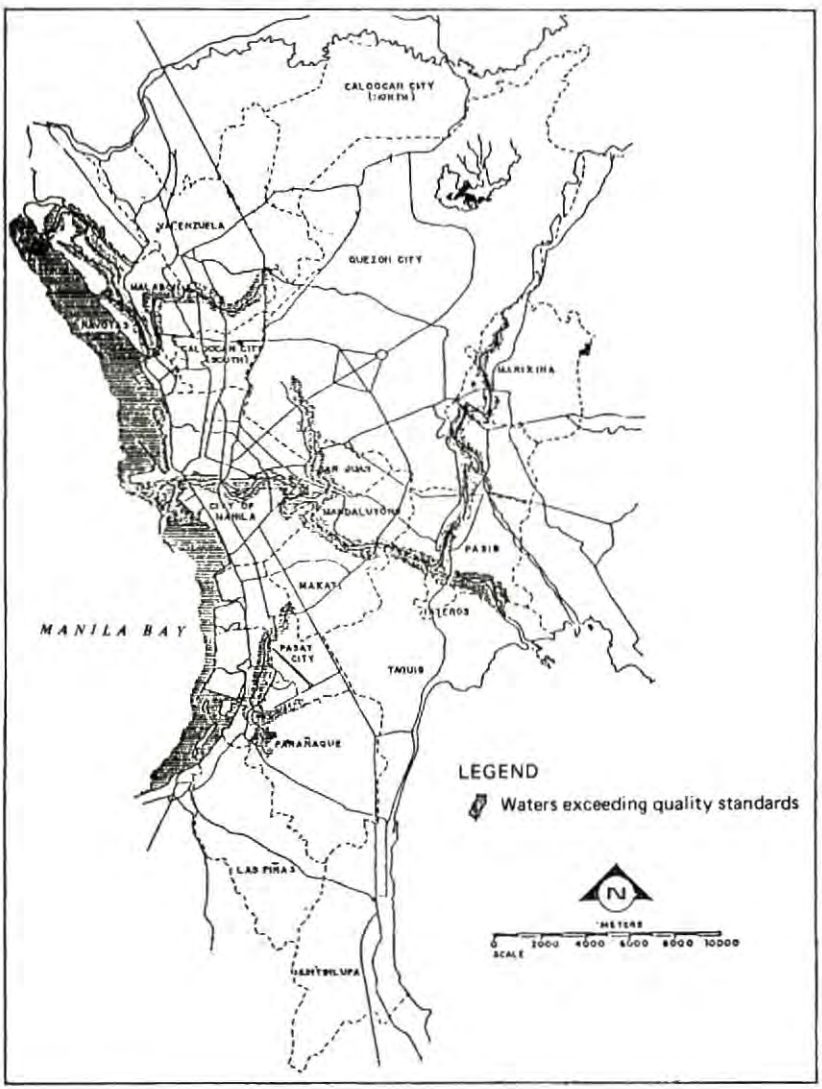
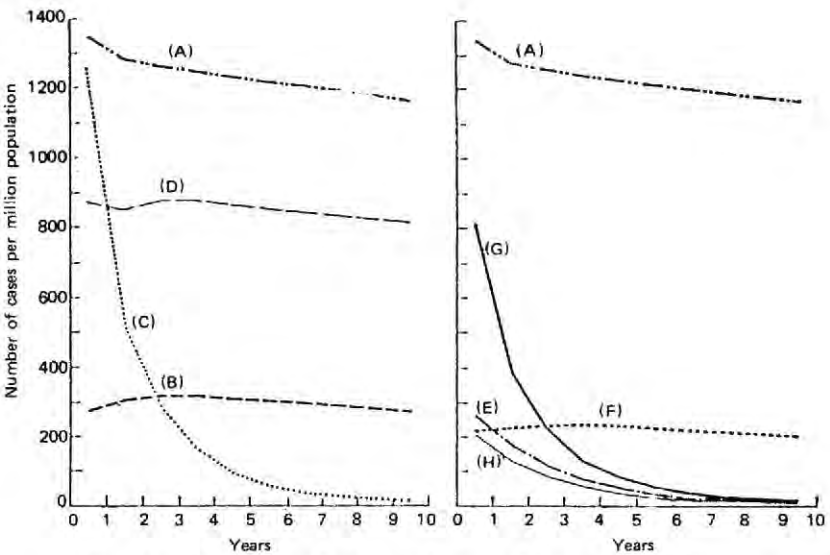


Figure 5. Surface waters exceeding quality standards



Simulated incidence of cholera during a 10-year period. (A) no control measures undertaken; (B) vaccination programme, 75% coverage; (C) sanitation programme (10 years); (D) drug prophylaxis; (E) vaccination and sanitation (B + C); (F) vaccination and drug prophylaxis (B + D); (G) sanitation and drug prophylaxis (C + D); (H) vaccination + sanitation + drug prophylaxis (B + C + D).

Figure 6. Infectious Disease Dynamics

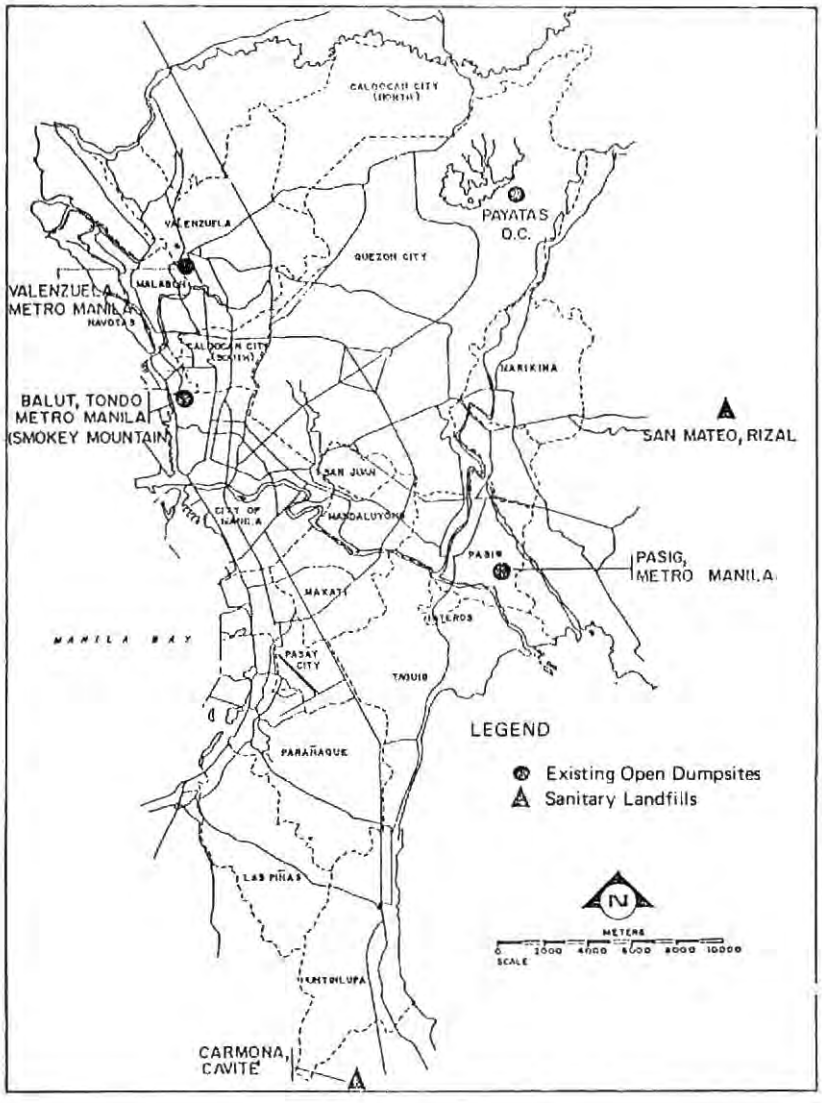


Figure 7. Solid waste disposal sites

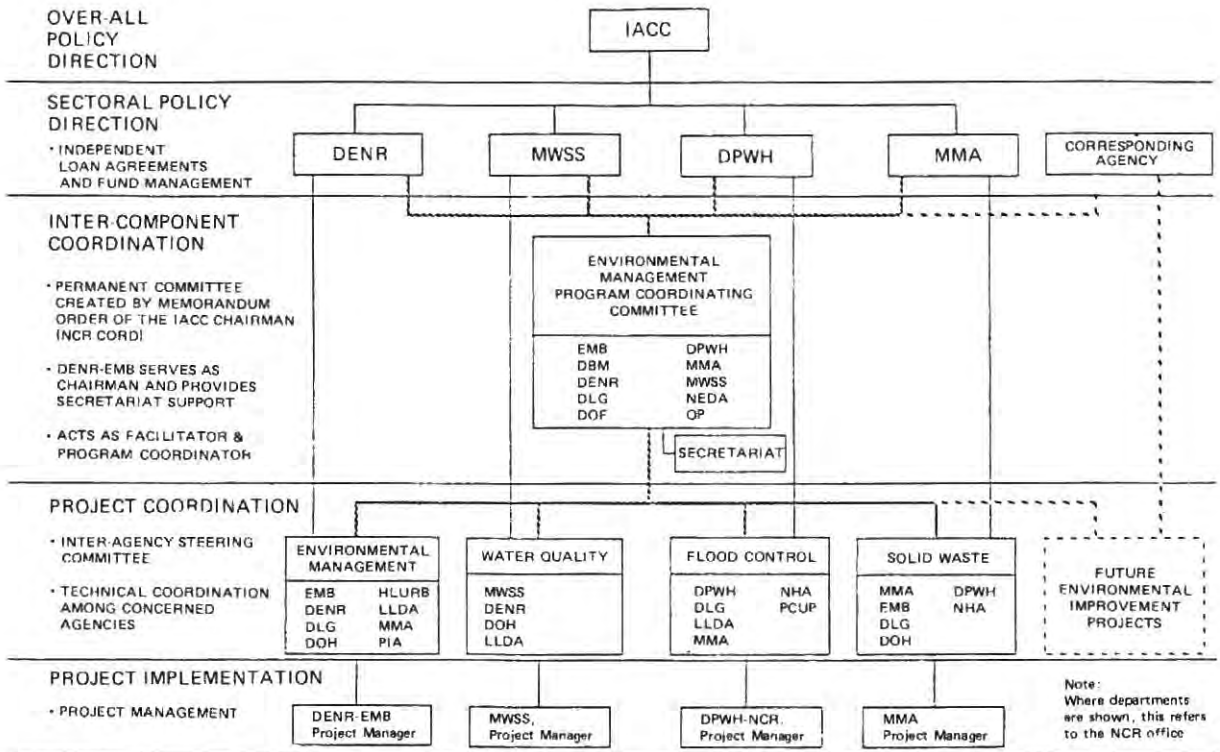


Figure 8. Institutional arrangement for separate loan packages