Discussion Paper No. 14

January 1994

URBAN ENVIRONMENTAL ISSUES : A STUDY OF CALCUTTA

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A B S T R A C T

This paper discusses various environmental issues in the context of the city of Calcutta. The environmental aspects of land use, water resources, air quality, noise pollution, wetland and open spaces are considered.

The views expressed in the paper are individual opinion of the author. (The paper is based on data and materials available in 1988).

URBAN ENVIRONMENTAL ISSUES : A STUDY OF CALCUTTA

A.K. Ghosh

I. INTRODUCTION

The environmental conditions of any urban area depend on both biotic and edaphic factors. However, human activities contribute to a great extent to the changing ecology. As such the land use and demographic data in the developmental history of urban Calcutta are essential indices of the present environmental scenerio.

With the annexation of three adjacent regions viz. Garden Reach, South Suburban and Jadavpur, the area of CMC has increased from 104.00 sq. km. to 171.24 sq. km. as also its population, from 3,288,000 to 4,110,000 (1981 census); the figure for population density also has undergone a consequent change; while in the erstwhile CMC area, it was 31,615 per sq. km. (in 1981), the figure has come down to a little over 24,000 per sq. km. with annexation of these lower-density adjacent areas.

II. LAND USE

The city's land use pattern is yet to emerge in a clear, understandable map. Even BDP was drawn without a detailed land use plan, but the gross figures projected in the plan document can indicate a basic pattern prevailing in the 1960's. The survey report of Calcutta Metropolitan Planning Organisation (CMPO) of 1961 reveals that of the total land under its jurisdiction, Calcutta Municipal Area had only 16 per cent which could be classified as ''vacant, or agricultural land''. In contrast, the community residential area had 52.45 per cent of land. Major industrial and commercial sector had 11.42 per cent of land, while major institutional land holding stood at 13.3 per cent; that under transportation sector showed an abysmal figure of 1.58 per cent, while recreational sector accounted for a figure of 8.35 per cent.

While no recent land use report (in 80's) for the same area is available, it can be calculated from independently published figures for parks and gardens that the recreational area of the city has decreased from 8.35 per cent to a meagre 2.8 per cent by the 1980's, while an appropriate figure for a city with 2,50,000 population or more should be around 10-20 per cent. While the transportation sector now claims a fleet of 24,000 private buses, 845 state buses, 950 mini buses, more than 1000,000 private cars, 10,000 taxis, 33,000 two wheelers and 3,000 lorries, available land for the roads is said to be only 6 per cent; while the comparative figure for a city of 250,000 and above is around 20-25 per cent in any advanced country. In otherwords, hardly 10 per cent of the total land in the Calcutta Municipal Area is available for two of the most vital sectors in urban life - parks and roads.

One can recall the report of E.P. Richards (1914) the first chief Engineer of Calcutta Improvement Trust, who stated that ''very few Europeans who lived in Calcutta possessed little or no knowledge of dense blocks that comprise three quarters of the City's urban built up. Calcutta has no street system, it would require creation of 110 miles of ordinary 30-40 feet streets to bring Calcutta into like with even old built up sections of other European cities'' and observed that in a third of Calcutta he found nothing but a slum of 25,000 people living in condition unfit for human habitation. Over the last 75 years wants have further accumulated, neglect have been more pervasive.

The first ever step to proper land use pattern in the state was taken with the enactment of Town and Country Planning Act (T and CP) in 1979. It calls for some vital steps to be taken viz. preparation of existing land use map and land register

(within one year), an outline development plan (within two years) and detailed development plan which may include, interalia, zoning regulation (within three years after ODP). The most useful teeth were provided to any implementing authority by the provision that in any area covered by the Act, no development or change of use of any land shall be carried out without written permission of appropriate authorities. It also states that 'No permission of subdivision of land will be granted where they are necessary for (a) public open space/park/playground or waterbody, (b) drainage facility, (c) environmental and ecological reasons, (d) agricultural use'. Another clause of this Act states that 'No permission for filling of tanks/ponds/waterbody/ marshy land etc. will be given if it is considered necessary for being used as (a) public waterbody, (b) maintenance of drainage facility, (c) fire fighting purpose, (d) environmental and ecological reasons, (e) piscicultural purposes.'

The above two clauses of the T and CP Act, if followed properly, could have saved many unwanted conversion of both public open space/parks and also wetlands. The reports of such conversion on diverse pleas during last 7 years (since inclusion of Calcutta under T and CP Act in 1982) abound. The net result, however, is continued chaos and lack of management of precious land and water bodies leading to further deterioration of quality of life. The author had the experience of interacting with the authorities of Railways and Calcutta Port Trust in an attempt to conserve two of the vital wetlands in Santragachi and Brace Bridge area; while SE Railway authorities agreed to preserve the habitat of hundreds of migratory birds species in Santragachi (The Amrita Bazar Patrika, Calcutta); the Calcutta Port Trust continues to fill up the Brace Bridge Wetland with solid waste; this is inspite of submission of a

lengthy scientific report prepared by scientists of BSI and ZSI (both under Department of Environment, Govt. of India) to CPT authorities. The role of CMC authorities or of the concerned State Department of Environment remains obscure.

The latest onslaught on the existing natural scenario can be traced to the proposal of yet another satellite township by filling up low lying marshes in salt lake area. (The Telegraph, Calcutta, 31st August, 1988). East Calcutta wetlands have been serving multipurpose functions viz. (i) as drainage outfall/basin for the entire city of Calcutta, (ii) for pisciculture, (iii) for waste recycling including sewage-fed fisheries and garbage-based vegetable cultivation, and (iv) as dumping ground of animal caracasses which in itself has generated a vast potential for economic sustenance of poor and backward communities. The same area has already witnessed, specially during last three decades, the construction of a major by-pass, Salt Lake City and several small township like East Calcutta and Baisnabghata Patuli township. It is noteworthy that the same region had 20,000 acres of wetlands of which 11,570 acres were used for sewage-fed fisheries in 1945 (DEC 1945). By now sewage-fed fisheries have diminished to 7500-8000 acres; in the same region, by recycling solid waste, about 800 acres of garbage firms have come up (IWMED, 1986). The sewage fed fisheries contribute 10 quintals of fish/per acre while the vegetable firms produce an yield of 1500 quintals/per acre, both of which feed the Calcutta market. The total acreage covered by these two economic activities has decreased considerably; the deluge of 1978, 1985 and 1986 in Calcutta City have been ascribed to a great extent to the largely man made conversion of the spill basin available until recently for these. While any further development in the east and south will not only affect the

spill basin but also will expose the population in the centre to the critical water crisis; alternate areas can be located for human habitation beyond north of Dum Dum towards Kalyani-Haringhata, with vast potable ground water supplies and without endangering the spill basin.

III. WATER RESOURCE

The major sources of water in Calcutta city for more than 100 years is the Hooghly River. Palta Water Works was established in 1865 to draw water from the river, filter the same and supply it through Talla Water Works; the average daily supply of potable water increased substantially between 1931 and 1965 from 59.0 mgd million gallon daily to 84 mgd, but, due to exploding population pressure, per capita availability of water declined from 52.3 gallons per day to 28 gallons per day. After the formulation of the Basic Development Plan (BDP) in 1966, the capacity of Palta Plant has been augmented from 80 mgd to 160 mgd and CMDA now claims that a Calcuttan receives 40 gallon of water per day (as against international standard of 60 gpcd). The future major water supply grid in Calcutta Metropolitan Area envisages withdrawal and supply of 310 million gallons of water from Hooghly system at a cost of Rs. 1025.3 million.

The other sources of potable water are the ground water aquifers. About 20 mgd of ground water is being fed into the Calcutta Water System through a grid of deep tubewells. Chakrabarti, Ghosh and Hore (1981) of GSI, in their report on environmental Geoscientific Studies of CMA, stated that chemical quality of ground water in the region is varied and complex; earlier data indicate an increase in salinity level, down to a depth of 150 m, from north to south and water from deeper aquifers contains more iron and might be brackish in nature. The ground

water source in Salt Lake City area in the east and Jodhpur Park area in the south amply testifies the above hypothesis (Ghosh, A.K., in press). Data are, however, not available on the total quantum of groundwater being withdrawn independently by the clustare of housing complexes and multi-storied high-rise buildings. One can only make a guess about the ever increasing demand in such booming activities.

Exploitation of ground water without any planning may lead to a drop in the piesometric level. The data on ground water level collected during 1956-84 clearly reveal that both at upper aquifer (20.0-40.0 m depth), and lower aquifer ((116.0-160.0 m) levels the decline has been evidenced from 0-3 m in the rural areas to 3.0-7.0 m in urban areas; in some urban areas (eg. Taratolla and Ballygunge) decline upto 9.5 m has also been recorded (Ghosh, A.K. in press). This, in the long run, can lead to a gradual subsidence of land in a deltaic area as has been evidenced in Texas, USA (Daniel, P. Sheer, Water Resource Management Inc., Pers Comm.).

The water quality and quartity are considered vital components in the environmental profile of any urban settlement. In Calcutta Municipal Area, as has already been evidenced, the quantity of water available per capita per day remains inadequate. The quality of water can be assessed from a report of K.J. Nath of the All India Institute of Public Health and Hygiene wherein he stated that a high percentage of coliform organism (35 per cent) and foecal coliform organisms were noted in most of the 266 water samples collected from diffdrent parts of the city; it is well known that foecal coliform organisms carry pathogens for such diseases as infective hepatitis and amoebic dysentry. The report further adds that it clearly demonstrates, in the absence of residual chlorine, in 81 per cent of samples tested, that drinking water in the distribution system in many areas of the city

are foecally contaminated. Even when tubewell water is charged into the city system, it is often done without any treatment of adequate chlorination. The report of chemical analysis of the potable water ever in the high-valued Jodhpur Park area states that, chemically, the water supplied is ''unfit for human consumption due to high total solids, very high chloride and salinity'' etc. (Ghosh, A.K. in press). An ecological reconnaissance survey of Palta Water Works, carried out by the present author in 1984-85, reveals, the archaic system of water quality testing (Ghosh, A.K. 1987). The system of tap-end sampling for water quality appear to be non existent. Out of 8 recommended points of chlorination (besides at Palta) only 4 operate.

The effect of drinking of such ''potable water'' can be evidenced from the fact that as many as 67 per cent of citizens of Calcutta visiting health clinic suffer from water borne diseases. Repeated out-break of enteric diseases and hepatitis, even in hospitals, in the 1980s is another evidence of such contamination. The risk of health hazard due to the unsuitability of water can further be substantiated by the data available from Health and Socio-Economic Survey in CMA (1982) which pointed to a high percentage of non-immunised population (in 1976-77) against such diseases as cholera (96.8 per cent), typhoid (97.5 per cent), diptheria (94.7 per cent), whooping cough (93.9 per cent), tetanus (55.c) and tuberculosis (96.3 per cent).

III. AIR QUALITY

The living condition and quality of life in any urban center depends on such vital factors as quality of water, greenery, habitat condition, disposal of solid waste and liquid effluent etc. The ambient air quality of the City of Calcutta has been monitored since 1970's by National Environmental Engineering Research Institute (NEERI). In 1971, the CMD had 6000

large and medium industries, 54,000 small scale industries, 27,000 furnaces and other factories. The up-to-date figures are not available, but one is tempted to believe that while some of large and medium units might have shifted elsewhere a host of other small units have grown, like mushrooms, all over the area during last two decades. The number of vehicles have undoubtedly been increasing every year. The CMA has at least two thermal power plants operating within its orbit. A large percentage of urban poor and middle class continue to depend on fossil fuel for essential energy.

These sources could be identified to understand the trend of air pollution in Calcutta. NEERI reports basically deal with essential parameters for air quality viz. suspended particulate matter (SPM), sulpher dioxide (SO_2) and oxides of nitrogen (NO_2), and data were collected from residential, commercial and industrial zones for this purpose. The latest NEERI report (1988) on air quality status (1982-85) of Calcutta indicates that the level of SPM in all three categories of area exceeded the standards set up by Central Pollution Control Board (CPCB). The ambient SO_2 levels were also higher as also NO_2 level. A comparision of seasonal variation projected a considerable build up of SPM levels during the winter, probably due to the inversion phenomenon prevalent during that season. While downwash effect of monsoon were clearly evident in case of SPM and SO_2, the same could not be noted in case of NO_2.

The standards for the basic quality parameters are as follows :

Suspended Particulate Matter	- 150/$\mu g/m^3$ for 24 hr.
Sulpher Dioxide	- 80 $\mu g/m^3$ annual, arithmatic mean (AM)
Sulphation Rate	- 0.5 $\mu g/SO_3/100$ cm day
Dust fall	- 10 MT/km^2/ month
Nitrogen dioxide	- 20 g-90 g/m^3/24 hr.

Any increase towards an increase in pollution levels above the reference values indicates the urgency for control and abatement. In Calcutta, the SPM level varied between 297 and 404 $\mu g/M^3$, on an average, the highest level recorded being in the residential area during 1982-1985. The Sulpher dioxide level shows an annual level of between 36 and 57 $\mu g/M^3$ during the same period. The sulpharation rate in terms of mg SO_3/100 Cum^2/day stand at between 0.26 and 0.31 g and dust fall at 35/MT/km^2/month. The SO_2 level and sulpharation rate as such show a decreasing trend and well within permissible limit but SPM and Dust Fall appear alarmingly high. While the permissible NO_2 limit in residential areas stands as 60 $\mu g/m^3$, the actual figure moved steadily upward from 21 $\mu g/m^3$ in 1982 to 127 $\mu g/m^3$ in 1985 in residential areas; for industrial and commercial areas also the same upward trend is noted. (29 μg - 162 μg and 35 μg-131 μg against permissible limits of 90 μg and 20 μg, respectively).

Beside the NEERI group's study, researchers from Jadavpur University have noted the presence of large number of polynuclear aromatic hydrocarbons (PHA's) and certain amount of toxic metals and non-metals, mostly in aerosol form, capable of long distance dispersal; of the 26 PHA's recorded by Prof. Dipankar Chakrabarti and his team from Jadavpur, at least 10 are recognised as carcinogenic. The data amply verify the observation in the NEERI reports that Calcutta experiences the highest level of pollution compared to nine other major cities covered under the National Air Quality Monitoring Network.

IV. GREENERY AND OPEN SPACE

A recent study undertaken by the State Government reveals that Calcutta Municipal Corporation area has only 6.60 sq.km. of parks and open space. This represents about 4 percent of the total area under CMC. The single largest

open space is offered by Maidan, encompassing half the open space in the city, while the North Calcutta and Central Calcutta contain 1 per cent to 2 per cent of open space. The old and historical buildings with adequate open space and greenery are changing hands and being transferred into housing clustars; on the other hand the existing parks and gardens have been encroached upon both by the civic authorities who are supposed to maintain them and the development agencies (like Metro Railways). The City, which was once described as a ''City of Palaces'' and ''City of Gardens'', is witnessing a fast decline of greenery and open space. During the preparation of BDP (1966), Calcutta had 0.5 acres open space for 1000 people, which has now come down to 0.1 acres for 1000 persons, against an internationally accepted norm of 4 acres. CMC authorities admit that out of 124 Parks and Gardens under CMC and CIT only 18 are properly maintained. The budgetery provision for such activities is dismal, with CMC providing only Rs. 30.00 lakhs, a major share of which is again accounted for by salary components.

Forty years ago, A.P. Benthal (1946) provided an account of 276 species of trees of Calcutta and its neighbourhood these included 69 naturalised species and at least 21 fruit trees grown in orchards. The recent surveys conducted by NGO's on tree cover of Calcutta clearly indicate a sizeable loss of species diversity and density. The city planners are yet to design an arbour-horticultural plan for the city, keeping in view of the role of plants in pollution control, as sound-brakers, in oxygen generation, in providing shades and controlling micro-climate and above all in aesthetics. The plantation programmes always make arbitrary selection of species, without consideration of suitability and long term effects; many of the xspecies introduced to the city have created newer problems, of aerobiology.

The loss of green perhaps concerns environmental scientist more than any one else. It is an established fact that considerable quantities of air pollutants are absorbed by the green cover of plants. Pollutants enter the leaf surface through air passages called stomatas. The number of stomatas varies between herbaceous plants and woody plants; while herbaceous plants can possess as many as 2000 per sq. cm. of leaf surface, the woody plants have fewer. One square kilometer of herbaceous plant (including grasses) can remove 250-300 kg. of pollutants per day, and thus can play a vital role in keeping urban environment cleaner. The greenery also plays a significant role in absorbing smog during the inversion phenomenon in the winter. The dense green belt along highways and around identified industrial belts can reduce the noise level to a significant extent.

Hard scientific data provide a strong argument for conserving the existing open space, parks and gardens in this city for the absorbtion of oxides of sulphides and nitrogen, heavy metals, photo-chemicals, carbon monoxides and hydro carbon, for the reduction of noise level and for meeting the aesthetic and recreational needs. While civic authorities put forward strange arguments for conversion (as in the case of Rowdon square, which has 3 acres of prime land and a large sized tank located south of Park Street) citizens have a right to claim a total ban on such conversion.

V. WETLANDS

The Calcutta Metropolitan Area has three municipal corporations, thirty-one municipalities, three notified area authorities, 165 gram panchayets, 72 non-municipal urban units (NMU) and 400 rural mouzas. In this vast urban, semi-urban and peri-urban set up wetlands play an important environmental role. The general slope of land follows north to south gradient, the maximum height dropping away from 9 m in the north to 3 m in the south. The major drainage line is river Hooghly and entire CMA is criss-crossed by numerous channels of the river. A

number of paleo-channels have been identified by a GSI team (Chakrabarti et al. 1985). In the same area a large number of wetlands have originated, naturally and also due to anthropogeni causes, along with interdistributory marshes. Numerous tanks have been noted (of less than one acre to more than 40,000 acre area) with shallow to approximately 3 m depth. An IWMED report (1988) has given a list of 16 larger wetlands (more than 100 acres) in CMA covering a total of 64,263 acres. The wetlands offer an unique component of urban ecosystem in nutrient recovery and cycling, releasing excess nitrogen, inactivating phosphates, removing heavy metals, chemicals, toxins, suspended solid matter and silt. Wetlands also play a positive role as a storage reservoir in various drainage basins recharging aquifers and helping in mitigating flood during monsoon. The silt in the wetland system, called ''Detritus'', offers an ideal niche for a complex chain of microorganisms to act as decomposer,thereby providing habitat for primary consumers and secondary consumers, as shows below :

1. Food Source	- Organic Debris
2. Producers	- Bacteria and Microorganism
3. Primary Consumers	- Detritus feeding invertebrates
4. Secondary Consumers	- Birds and Fishes

The marshy Salt Lake area, according to an unpublished report of ZSI team headed by Biswamoy Biswas, showed an impressive list of as many as 248 species of birds (45 migrant) and 22 species of mammals, including a new species of marsh mongoose. Recent survey reports (De et al. 1989) indicate the components of food-chain and energy cycle in wetlands of east Calcutta, with as many as 15 species of reptiles, six species of amphibians, 32 species of fishes, 18 species of molluscs, 48 species of insects and arachnids, 11 species of crustaceans and 4 species of annelids. The survey report of one single wetland in south Calcutta (Brace Bridge area) reveals as many as 143 species of plant.

In a recent report (IWMED, op. cit) on wetland resource development by CMDA, the researchers of Institute of Wetland Management and Ecological Design (IWMED), have clearly traced the unique role of Calcutta Wetlands, in sewage fed fishery development. The inter-distributory marshes changed their characteristics over the years; with the lowering of salinity level and stagnancy, they have become sewage receptacle for the city. This has led to the development of 'waste water fisheries' producing 10 quintals of fish per acre per year for the city . Wetlands also store runoff water from adjacent areas and are traversed by sewage outfall channels draining eastwards. Calcutta's backyard thus witnesses an unique panorama of wetlands, sewage channels and solid waste dumps which together play an active role in the process of natural recycling of city waste and production of fish and vegetable for the city dwellers.

What is most galling is the wanton destruction of these wetlands by both land speculators and by the authorities. Large scale filling up of wetlands and low lying areas have created a critical situation in this fragile ecosystem, which is also a vast utilisable natural resource base with multipurpose functions. An increasingly massive and often unplanned process of changes in the name of 'development', has decreased considerably the total acreage of wetlands (Ghosh, D.J. and Susmita Sen, 1987). It is in this context that the recent Rs. 49.00 crore proposal by the State Government for the recovery of another 800 acres of wetlands should be judged. In a recent communication, a group of four experts on urban ecology attached to the Institute of Local Government and Urban Studies (ILGUS), have pointed out that enough land is available in the north (area located to the north of Dum Dum

towards Kalyani-Haringhata) for human settlements.

VI. DRAINAGE AND SEWERAGE

Urban environment is primarily dependent on the natural resource system (eg. air, water, land, biota etc.) and the resultant output of such resources. The drainage and sewerage system get their outputs from the use of water and natural rain.

The canal system, excavated for the purpose of drainage on the eastern side, and which over the years, carries both the rain water of the spill basin area and city effluents and provided a free waterways for transporting from South Bengal (only 20 years back 7500 boats used to carry vegetables timbers, hay and thatch to Baghbazar) has by now become heavily silted and suffers from continuous encroachment on the embankment. The WHO masterplan for water supply, sewerage and drainage for Greater Calcutta envisaged desilting of drainage basin and of canals (in 1960s); CMPO even recommended a canal park-way system along the circular canal in the north and east and Tolly's Nullah in the south with greenery, to be connected with river front promonade. All these plans now survive only on the drawing broad.

Beside the canal system mentioned above, one ''Dry Weather flow'' (DWF) and one Storm Water Flow'' (SWF) channel were constructed to assist quick disposal of water and effluent. DWF originates at Topsia and SWF originates at Ballygunge Pumping Station, the former with a width of 6-10 m and a depth of 2 m, while the latter has a width of 50 m and a depth of 4-6 m. Both pass through Bantolla sedimentation tank (which remains non-functional). The open-cut canals and channels, we have already noted, contribute towards the sustenance of Pisciculture through sewage -fed bheris (ponds) covering 7500-8000 acres, and

irrigating agriculture in about 10,000 acres of paddy field.

But the drainage and sewerage system remains geriatric and can not cope with about 700 million liters of municipal effluents and untreated industrial effluent from 12,000 licensed unit which continue to pour into the system which was built for one million people inhabiting 40 sq. km. It is interesting to note that CMDA considered the renovation of system only under JCUDP III (1983-84 onward). It is reported that the city's 53 km. of underground drain get about 2 million cubic feet of silt every year of which not more than half a million can be removed. This silt in underground system, as noted earlier, ultimately joins the open-cut canal system of Calcutta (Ghosh, A.K. et al. 1986; Ghosh, A.K. 1987).

Further, in CMC, a large tract of area in Beliaghata, Narkeldanga, Kidderpore, Watgunj etc. remain unsewered for long; while much of the area outside CMC but within CMA, remain without a sewerage and drainage system.

VII. SOLID WASTE DISPOSAL

The City of Calcutta produces about 2,000 tonnes of solid waste per day. The civic budget shows that a major allocation (33 per cent) has made for an effective clearence of solid waste and transportation to the central dumping ground in the east. While an examination of the system of solid waste dump in CMC area will reveal a horrifying exposure of the human population to the stinking waste, pests and other hazards. Further the conservancy service disposes of 1300 tons a day or 65 per cent of the total daily solid waste produced in the city, while the rest of the solid waste remains in dumps scattered unhygenically over the city.

CMDA proclaims that, gaining from experience over 20 years, plans have been formulated with a mix of short term tactics and long term strategy. Large road sides vats would be replaced by demountable containers and box carts by a larger wheeled carts. In 1986, CMDA reports claimed that to raise the efficiency level of garbage disposal, a master plan is being implemented at a cost of Rs. 18.95 crores, and 'there has been all round improvement in garbage collection transportation and disposal system'.

However, the survey made by the author and his team from the Environment Monitoring Wing, reveals a completely different picture. Garbage continues to accumulate in the open dump in almost all human habitation areas (irrespective of location e.g. Camac Street, Ballygunge, Free School Street, College Street, Southern Avenue) and so called employment of 200 tipper trucks, Dumpers, Dozers, Tractors and Wreckers appears to have made little improvement. Situation in the rest of CMA region appears to be even worse.

The solid waste from the city was dumped in Salt Lake area, first by acquiring one square mile area (2.59 sq. km. in 1865, Subsequently, during 1868-72, a railway line was constructed to facilitate local transportation of garbage. The reclamation process, however, continued with the dumping of garbage over the years and reclaimed lands were being leased out for short-term periods for cultivation and pisciculture in the water bodies, which were left in between dumping areas. Settlements gradually sprang up and IWMED report (1986) shows that at present 800 acres of garbage firms in nine village settlements of Dhapa and adjoining area, are used for growing as many as 11 crops a year. Dumping of garbage has raised the land level up to 1.5 meter; but the landfill has produced 'an economically viable natural biological system to recycle the waste which is inseperably

linked with the waterbodies of the area' (Ghosh, D.J., and Sen, 1987). The rate of productivity is calculated to be 1,500 quintals of vegetables per acre per year. Ghosh and Sen, 1987). opined that, given proper management and necessary technological upgrading Dhapa garbage farms could produce a low cost technique of solid waste recycling in agriculture but did not explain about the possible impact of continuous landfilling in the same area or how long the Dhapa area could sustain the accumulation of solid waste from the city. Even if arrangement is made to clear all 2000 tons of solidwaste per day, how and where the same is going to be deposited and recycled? The alternatives of land filling process exist but the composition of city's garbage (after having been screened by rag pickers) (Table 1) may hardly leave scope for generation of bio-gas and electricity in view of low calorific value.

IX. NOISE POLLUTION

While the major resources e.g. land, water, vegetation and air and the impact of development on those have been dealt with in the foregoing sections. We have not so far discussed pollution created by noise. The ever increasing number of vehicular traffic, din of small sector industrial units, indiscriminate use of public address systems, all these contribute to the noise level in the city. The medical experts in ENT diseases have expressed a great concern regarding the high noise level of city and its impact on audibility and other physio-neurological functions. The results of a survey of noise level in Calcutta are shown in Table 2.

Since Calcutta has no strict zoning pattern and no restrictive practices of residential settlements are followed, it will be difficult to compare the noise level in the city with the standard recommended by internationally acclaimed body, e.g. Environmental Protection Agency (EPA) of U.S.A. However

EPA standards, which classify residential areas into five different categories - very noisy (58 db), noisy (53 db), urban (48 db), suburban (43 db) and quiet suburban (38 db) - specify average noise level between 38 db to a maximum of 58 db. In none of the Calcutta city areas, the noise level is less than even the highest permitted standard of EPA. It is however interesting to note that the high-valued areas of Alipore residential sector have the lowest noise level but even that is above the permitted maximum. Exposure to 85-90 db for eight hours daily can make a person deaf in 30 years according to wellknown ENT experts in the city. The other effects of noise pollution include stress, fatigue, peptic ulcer, colitis, headache, heart-ailment and psychic deficiency which are, incidentally, not so uncommon amongst the citizens of this metropolis.

X. CONCLUSION

The strategy for management of urban resource and ensuring a healthy growth pattern has been discussed, more seriously since 1960s . However, of the 31 schemes identified for implementation during 1966-86 under BDP, the author's analysis shows that only 2 have been completed, 6 partially completed and 23 items have not been touched. While the expenditure during last 13 years of BDP on sewerage and drainage alone was as high as 50 crores, it is clear that provision of fund alone will not lead to any miracle. The situation is however still retrievable. We will suggest the following measures :

1. Urban development must be restricted in the line of land-use map, currently being published under W.B.T. and CP Act, 1979.
2. Sub-surface water resource should be mapped regionally and only controlled withdrawal should be permitted based on recharging-withdrawal ratio.

3. Any further development of the city by reclaiming marshland, wetlands and lowland in south and the east must be banned.

4. Major Paleo courses, as suggested by the GSI report should be re-excavated to facilitate better drainage and saving the city from becoming marooned for ever.

5. All potable water supply must be properly treated and regularly checked at tap-ends for corrective measures.

6. Since, it is impossible to find additional road space, encroachment on the foot-paths should be stopped and all existing set ups along major trunk and arterial routes, on the pedestrian way should be cleared off. This will prevent millions of pedestrians from transgressing road space, and thereby making the traffic slower, which in turn leads to a higher rate of toxic emission.

7. The public transport system must conform to ''Pollution Under Control (PUC)''certification rules and abatement of noise rules.

8. The existing open space, parks, gardens and public pools should not be allowed to be converted but must be taken up for restoration and maintanance as a top priority item. Additional open space and recreational areas must be earmarked in the next perspective plan to raise the ratio of open space to 1.5 acres/1000 persons.

9. The conservancy services must be monitored with strictest vigilance, if necessary under contractual obligation, and a master plan be drawn up to identify future dumping sites and recyclying methodologies.

10. An arbore-horticultural design for the CMC and broadly for CMA (in phases) should be drawn up with clear perception of species, density, appropriate location etc., and implemented by 1995.

11. Monitoring of air, water, land pollution and post-monitoring action for rectifying the ills must be centralised and co-ordinated by the State Departments of Local Government and Urban Development, Environment and Waterways as well as major agencies such as CMDA, CIT and CMC.

A hazard control cell with proper equipment and authority should be put under the Department of Environment.

12. Restriction should be imposed against issuance of trade license and permits for the setting up of small/medium/large sector units in predominantly residential areas.

TABLE - 1

CHARACTERISTICS OF SOLID WASTE OF CALCUTTA AREA

A		B	
Components	Percentage wt.	Chemical Analysis	
Leaves	13.05	pH	7.31
Garbage	16.05	N2	0.55
Hays-straw	6.3	K_2O	0.40
Coconut shell	4.95	Carbon	19.50
Paper	3.17	Org. matter	35.24
Ash and Earth	33.58	C/N	37.40
Ignited Coal	8.08		
Earth	6.64		
Stone	1.33		
Iron emetal	0.66		
Bone	0.40		
Leather	0.86		
Polythene/Plastic	0.65		
Glass	0.87		

C	
Calorific value	
BTU/lb	2707.70
Moisture	41.10
Organic matter	37.29

Source : Ghosh, A.K. (in press)

TABLE - 2

NOISE LEVEL IN CALCUTTA

Crossing	Area	Mean noise level(db)
B.B.D. Bag	Central	80-85
Esplanade	Central	75-84
Park Street	Central	78-81
Gariahat	South	80-82
Alipore	South	65
Shyambazar	North	80-82

Source : Ghosh, A.K. (in press)

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