MASTER PLAN

OF

MUTHURAJAWELA AND NEGOMBO LAGOON

Greater Colombo Economic Commission

euroconsult, The Netherlands

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EXECUTIVE SUMMARY

1. The Master Plan for Muthurajawela and Negombo Lagoon was prepared by the Greater Colombo Economic Commission (GCEC) with assistance from national experts and consultants from Euroconsult, Netherlands at the request of the Government of Sri Lanka.

2. The general objective of the Master Plan is the development of Muthurajawela marshes on an environmentally sound and sustainable basis.

3. The preparation of the Master Plan was preceded by ecological, technical and socio-economic surveys of the study area covering all aspects of the environment: geophysical, biological and human. On the basis of these studies an Environmental Profile was prepared

4. A few centuries ago Muthurajawela was an alluvial flood plain growing paddy. Human intervention with canals and irrigation structures interfered with the eco-system and over the years the fertile land became a large mass of marsh.

5. The rapid environmental degradation, spontaneous settlements, demand for land for development and the potential threat to natural values of a wetland prompted the Government to get the area studied properly before deciding on its course of development.

6. It is recognized that the marsh and the lagoon, covering an area of 3068 ha and 3164 ha, respectively, and their surrounding areas covering 4462 ha are interdependent ecological systems forming one contiguous wetland. Hence the development plan must necessarily cover this entire area.

7. The Environmental Profile revealed that:

   a. Centuries of human interference have left their marks on the wetland but significant natural values are still being found.

   b. There is continuous deterioration of the drainage system resulting in more water logging and intrusion of salt water.

   c. Soils are marginally suitable or not suitable for cultivation of traditional crops such as paddy and vegetables.

   d. Marsh is a habitat for many species of birds, both indigenous and migratory, mammals, reptiles and amphibians.

   e. Sea-grasses in the lagoon are highly productive and provide habitat for a variety of aquatic organisms, including many commercially important species.

f. Sea-grass beds play an important role in shore protection and stabilization.

g. Mangroves in the marsh and the lagoon are the breeding and nursery grounds of the coastal fisheries. Mangrove forests have been severely reduced by cut.

h. The most important economic resource available in the wetland is the fish and crustacean stocks.

i. About 3000 fishermn depend entirely on fishing in the lagoon for their livelihood. The productivity of fish is quite high giving an average of 150 kg/ha. The value of annual catch is about Rs. 100 million.

j. Coconut yield is high and cultivation of coconut and leafy vegetables is a profitable business in certain areas.

k. The marsh is the breeding grounds for many disease agents and vectors. As a result many inhabitants of the marsh suffer from several endemic diseases.

8. Nine development options emerged from the Environmental Profile and suggestions made by various interest groups.

9. They were conservation, urban development, tourism and recreation, infrastructure, agriculture, fisheries, aquaculture, forestry and peat extraction.

10. Conservation of the entire marsh is neither desirable nor economical. It is possible to sustain the natural values and functions of the marsh by conservation of those parts which are closely linked to the eco-system of the lagoon.

11. Similarly, the reclamation of the entire marsh is not feasible on geophysical and economic grounds.

12. Reclamation of land in some form is required for all options other than fisheries, aquaculture, forestry and peat extraction.

13. Reclamation of land depends on current and future demand for land in Muthurajawela area, land prices and cost of reclamation.

14. The development trends in the study area show that over the next ten years the demand for new land for settlement will be around 1000 ha.

15. Land prices have been rising due to increasing demand for development as well as due to speculative buying.

16. Cost of land fill is considerably less if done on a small scale for non-construction purposes such as agriculture.

INTRODUCTION

1 THE EVOLUTION OF THE MASTER PLAN

On 25 January 1989, the Government decided "to freeze all development proposals of both the public and private sectors, until such time an environmentally sound and sustainable master plan is evolved for the development of the Muthurajawela Marshes" and entrusted the preparation of the Master Plan to the Greater Colombo Economic Commission (GCEC).

While conveying the decision, the Government acknowledged that numerous ecological values could be ascribed to Muthurajawela marshes, that it serves as an important detention area for surface storm water run-off, and that it supports economic activities of a large population of the area. Although the Planning Area was confined to the Muthurajawela marsh in terms of the Government decision, the Study Area had to be extended to a wider region covering the tract of land north of Kelani Ganga, west of the Colombo-Negombo main highway and south of the road alongside the northern border of the Negombo lagoon in view of the close physical, ecological and socioeconomic linkages between the marsh, the lagoon and the periphery (see Figure 1).

The GCEC, with the assistance of a Steering Committee to guide and co-ordinate the process of planning and a Working Group to commission and monitor the surveys and studies, compiled an Environmental Profile of the Muthurajawela Marsh and Negombo Lagoon on the basis of the survey reports.

Simultaneously the views and recommendations of all interested parties including public and private sector agencies, non-governmental agencies, specially in the field of wildlife and nature protection, and people's organizations in the area, for the development of Muthurajawela were solicited. The development options emanating from the Environmental Profile were analyzed and discussed at a Workshop and the Master Plan is the result of this joint effort.

2 OBJECTIVES OF THE MASTER PLAN

As indicated in the Government decision of 25.1.1989, the general objective of the Master plan is the "development of Muthurajawela marshes" on an environmentally sound and sustainable basis.

The development of an area means and includes not only the creation of new facilities such as housing, infrastructure, industry and recreation but also conservation of existing facilities. As stated earlier in the directive sent to GCEC, special mention was made of the ecological values of the Muthurajawela marshes, its ecological linkages with contiguous areas, eg. Negombo lagoon, and the economic activities of the people living in the area. Hence in the case of Muthurajawela any plans for development need

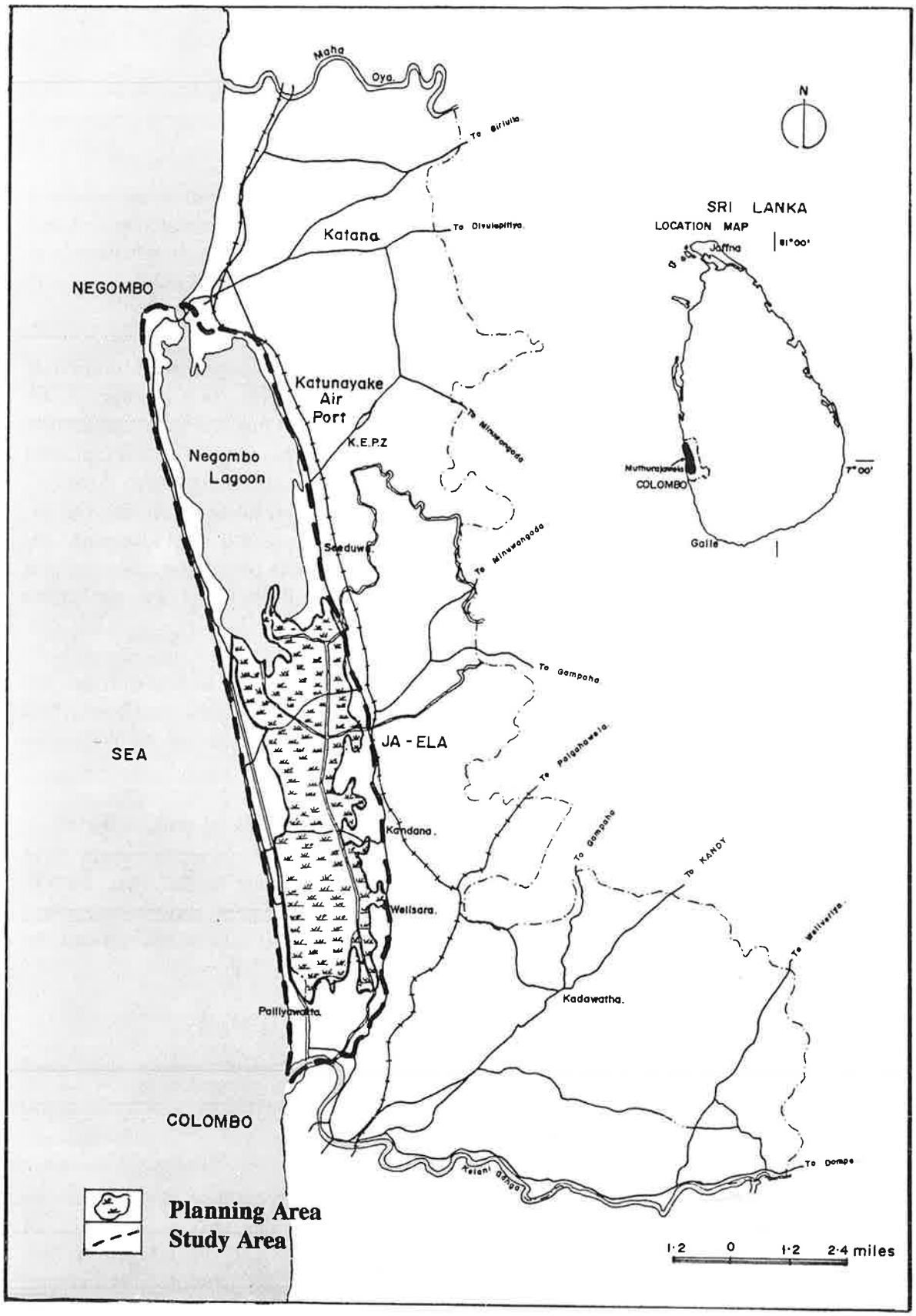

Figure 1 LOCATION MAP

to give equal, if not more, weightage to aspects of conservation particularly in view of its wildlife diversity and its close ecological linkage with the lagoon. Conservation of at least a good part of Muthurajawela, therefore, can be construed as a decision to conserve resources for the future, either to meet the development needs of future generations or as investments in improving the quality of life of the present and future generations.

Viewed in these perspectives the specific objectives of the development plan could be identified as follows:-

1. Conservation of an area sufficient to sustain the natural values and functions of the marsh.
2. Reclamation of land to provide housing, industry, infrastructure and recreational facilities.
3. Re-location of people who are living in the area to be demarcated for reclamation and conservation.
4. Ensure sustained fishery productivity of the lagoon
5. Improvement of productivity in agriculture, eg. coconut, leafy vegetables etc.
6. Improvement of standard of health of the inhabitants of the area.

The development proposals have been prepared to give effect to the above objectives keeping in mind that ultimately there will be sustainability of yield, sustainability of function and sustainability of investments, and also that they will be environmentally sound.

3 HISTORICAL BACKGROUND

The Kotte Period and beyond

The name Muthurajawela is of recent vintage. It is a marsh situated in the Gampaha District in the Western Province. It is surrounded by highlands in the south and the east, the Negombo lagoon in the north and the Hamilton Canal in the west. However, it is believed that the present Muthurajawela is only a part of a larger area called Muthurajawela that existed some centuries ago. The area has been named Muthurajawela after Muttu Rajah or Mootoo Rasa, as the Dutch preferred to call him. He was one of the Royal Commissioners, himself a Princeling, who was entrusted with the supervision of paddy cultivation in the area by Wira Parakrama Bahu VIII (1477-1497), the King of Sri Jayawardenapura Kotte. It was the 'rice bowl' of the kingdom at the time.

The Portuguese period

The earliest known historical reference to Muthurajawela is by the Jesuit historian de Queyroz. It is an historically proven fact that the cutting of the canal to Negombo, now referred to as the Dutch Canal, caused the impregnation of the soil of the area with salt. This canal was originally cut by King Vira Parakrama Bahu VIII of Kotte (1477-1497) in order to connect Kotte with the Port of Negombo. Queyroz goes on record:..." because he ordered to be dug by man strength a broad and deep canal of

six leagues navigable by boat from Cota to Negombo, making the lands bordering this strait salty, because of the tides which enter by the bar at Negombo, with damage to himself and his vassels. There arose against him the inhabitants of Ali Cur (Alut Kuru Korale) and of the Seven Korales, laying siege to Kotte for three months, but his other lieges coming to his aid, drove them away with many deaths" .

Paul E. Pieris agrees with Queyroz. In his "Ceylon - Portuguese Era", Sir Paul states that after the death of Sapumal Kumaraya, King of Kotte, his brother Ambulugala Kumaraya succeeded to the throne as Vira Parakrama Bahu. It was during his reign that the canal was cut. He goes on : "The effect of the opening of this channel was disastrous to the rich stretch of Muthurajawela fields, which now became subject to submersion by salt water from the Negombo Lake; indeed, the loss inflicted on the inhabitants of Alut Kuru Korale was so great that they rose in revolt and besieged the king in his capital". Considering the numbers necessary for keeping such a large tract under cultivation, the region was thickly populated and undoubtedly had been in production for quite a long time before Vira Parakrama Bahu VIII.

The Dutch period

Coming to the Dutch times, the following reference is made in a Resolution adopted in the Council of Ceylon of June 1767 during the time of Governor Falck: "...even from the earliest period till shortly before the arrival of the Portuguese, the area had consisted of fertile fields the best calculated for the culture of grain ... the Portuguese have commenced a channel through this province from the lake of Negombo to the river Kelani for inland navigation.

We became possessed of the same together with various works commenced but not finished by the Portuguese, and we brought principally the channel to perfection to the greatest detriment of the inhabitants .... salt water introduced itself from both sides and spread over the greatest part of the low countries was the reason for the inhabitants being compelled at last to migrate there from .... ever since that time the province became waste and desert".

Governor Falck gave orders to Dissave Costa to undertake the work of restoration, "to cultivate and plant this extensive land of about four thousand morgen Lands, about two acres of ground each morgen", that is about eight thousand acres in all. Paul Pieris in his "Ceylon and the Hollanders" records : "At Colombo, de Costa took up the improvement of Muthurajawela which was expected to ensure a sufficiency of rice for Colombo .... he was so far successful that in 1767 he announced the completion of the task. The Governor ordered the area to be divided into allotments, and appointed a special Head of Cultivation under whom were twelve Govi Vidanes with silver headed canes as their badge of office".

The success was short lived and the expenditure incurred was so vast that Dutch government faced bankruptcy as a result. Costa "caused ditches to be cut through the land of Mootoo Rajawel Elli in the first instance to permit the husbandmen with means for carrying off the corn with more convenience which on account of the lands being extensive cannot be effected without a great deal of trouble, and by which it becomes at present with convenience practicable to navigate through the whole land with small craft". They also served to drain the stagnant water and to divide the land into wards or "wyken" to prevent land disputes. Costa also laid down the policy of land alienation that "to no person ought a piece of high ground be given for planting coconut trees unless he received therewith a spot of arable land".

Towards the end of Dutch rule, except for isolated patches, the land reverted to marsh.

The British period

Next came the British phase. They realized the importance of reclaiming Muthurajawela as a source of food supply and, as early as 1802, Garvin Hamilton, the Agent of Revenue and Commerce, cut the Hamilton Canal to the west of the tract and cross channels to connect it with the Dutch Canal with the intention of getting fresh water floods to wash off the salt. The result was disastrous. At high tide, salt water from both the Kelani river and the Negombo lagoon now entered the entire area; the fresh water floods during the rainy season did not do as much good as he anticipated as they remained stagnant in the low lying areas and failed to neutralize the salinity which kept building up during the dry months. This became so pronounced that the government had to prosecute the villagers who had taken to manufacturing salt illicitly. Governor North was strongly advised to abandon the attempt. Later, local land developers who obtained large tracts from the government made individual efforts. A foreign company also obtained a large extent and made an attempt to exploit the peat deposits in certain areas; the attempt was unsuccessful and the company went bankrupt. So ended the early British attempts at reclamation.

Nearly a hundred years went by, when in 1919, the Director of Agriculture, F.N. Stockdale, for the first time, made a scientific study which resulted in a chemical analysis of the soil in different areas and at various depths. Next came, in 1925, the Harward investigation and report. This was mainly a scheme for the protection of Colombo North from floods from the Kelani river and had not much impact on Muthurajawela.

For two decades Muthurajawela remained in a state of stagnant expectation when the imperatives of producing food during and immediately after World War II projected the need for the development of Muthurajawela as a source of food supply.

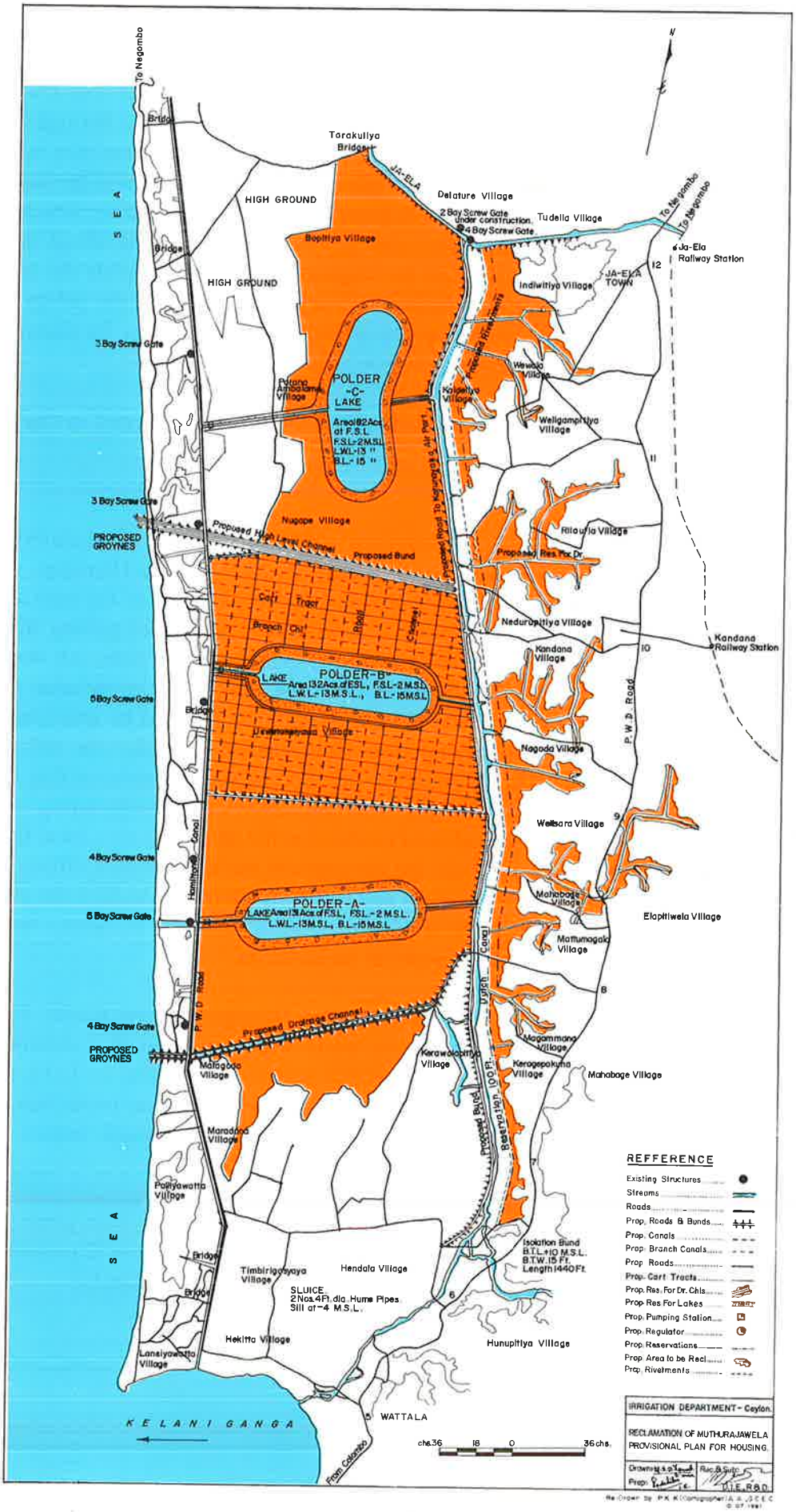

Figure 2 **MUTHURAJAWELA RECLAMATION FOR HOUSING, 1966 - PROVISIONAL PLAN**

The period 1947 - 1989.

Since Independence (1947), successive national governments planned to develop Muthurajawela, in an effort to transform this "Waste Land" into an agriculturally more productive area, or to utilize it for expansion of Colombo and its suburbs.

The first attempt was in 1948, when the Minister of Agriculture and Lands, Mr. Dudley Senanayake, appointed a Committee under the Chairmanship of Mr. M.D. Banda, Parliamentary Secretary to the Minister of Labour and Social Services, "to report on the possibilities of developing the Muthurajawela as Paddy production and an unemployment relief measure". This Committee had two meetings on 26th and 27th August, 1948 and submitted its report on 27th August, 1948.

As a result of this report a land Kachcheri for the selection of settlers for scheme A was held on 8th November, 1948 and the allottees were given 2 1/2 acres each.

Another Committee under the Chairmanship of Mr. C. Kumarasuriyar, Minister of Posts and Telecommunication was appointed by the Minister of Agriculture and Lands, Mr. H.S.R.B Kobbekaduwa, in February, 1971. The terms of reference of this Committee were "to propose a plan for the development of the Muthurajawela area consisting of 7,800 acres of marsh and paddy lands." In the preparation of the plan, the Committee was required to pay special attention to the following possibilities:

1. Utilizing for the development of Muthurajawela varieties of paddy cultivable in areas where the water becomes saline;
2. Popularizing inland fisheries;
3. Establishment of industrial units and other fields of development, and
4. Provision of housing schemes and facilities.

This Committee recognized that "preoccupation with the desire to provide facilities for paddy cultivation to the exclusion of all else had resulted in the area remaining almost undeveloped for centuries" and concluded that "the development of Muthurajawela as an agricultural scheme for cultivation of paddy will be a waste of scarce resources which could be more profitably used for paddy production elsewhere in this country".

In between these 2 Committees there were a few reports, plans and memoranda submitted by various agencies and foreign missions for the reclamation of Muthurajawela marsh. These include:

- the report of the Divisional Irrigation Engineer of the Irrigation Department in 1953,
- the report of the Senior Designs and Research Engineer of the Irrigation Department in 1954,
- the report of Mr. G. Soulet, a French Expert in 1958,
- the report of the Sub-Committee of the Colombo District Agricultural Committee in 1963,
- the Sessional Paper XXI in 1966 (see Figure 2).

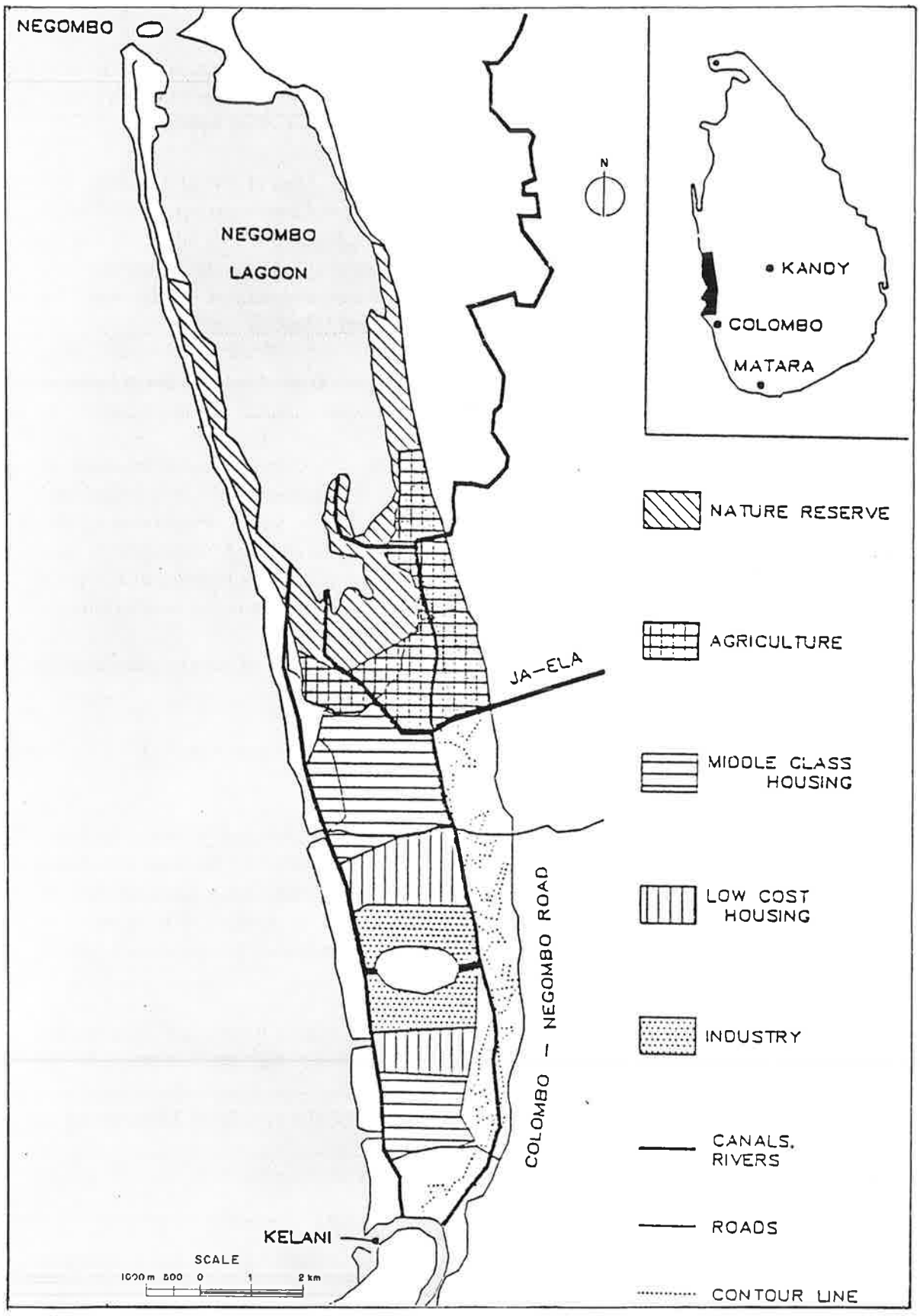

Figure 3 MASTER PLAN FOR MUTHURAJAWELA, SLLRDC, 1985

Subsequently, there were the following reports and development proposals:-

- the report of the Netherlands Government Mission in 1976,
- the Master Plan of the SLLRDC in 1985 (see Figure 3),
- the Investigation Report on the Reclamation for Muthurajawela of the Peoples Republic of China in 1985,
- the Development of Muthurajawela Marsh Area (Phase I) of SLLRDC 1988,
- the Muthurajawela Development Prospects of the CEA in 1988.

The plans and reports submitted earlier, in the fifties and early sixties, concentrated, mostly on the repair and upgrading of the drainage and irrigation infrastructure with a view to revive the agricultural production potential in the area. In the mid-sixties with the issue of the Sessional Paper XXI of 1966, the emphasis shifted to other areas of development specially housing, and the Kumarasuriyar Committee and the Dutch Government Mission categorically advised against the use of the area for agriculture. Although, these reports were not accepted in toto for implementation some of the recommendations in them were implementated in piecemeal fashion without much success. One of the main reasons for not implementing the proposals fully was the cost of reclamation.

In the meantime the demand for land in and around Colombo was increasing, particularly after 1977, for housing, warehousing, industrial, and commercial purposes. This situation intensified when the GCEC was established in 1978 with Muthurajawela coming under its jurisdiction, and the adjoining area with an Export Processing Zone (EPZ) started booming with new industrial and commercial ventures with employment opportunities.

Muthurajawela, with about 3000 ha of unused land and its close proximity to Colombo, continues to attract the attention of land developers, house builders and industrialists. Private lands on the periphery of the marsh are increasingly being sold to developers and various larger and smaller housing projects are planned and under construction at present. In particular areas closest to the Colombo-Negombo Highway are popular and new houses sell here for prices between one and one and a half million rupees.

Wildlife enthusiasts and researchers have become alarmed and fear that progressive reclamation and development efforts in the marsh will deteriorate and eventually destroy the wetland. While the question of reclamation against conservation was being debated during the last decade, encroachers continued to move into the marsh and increased its number of inhabitants. Presently, the number of squatter families living in the marsh is about 750.

Both, the interests and concern shown by the various groups and also in view of the harmful effects that could be caused by unplanned development and encroachments, the Government decided in January 1989 to identify the most appropriate actions to take and directed the GCEC to prepare a Master Plan as a guide for decision making about the marsh.

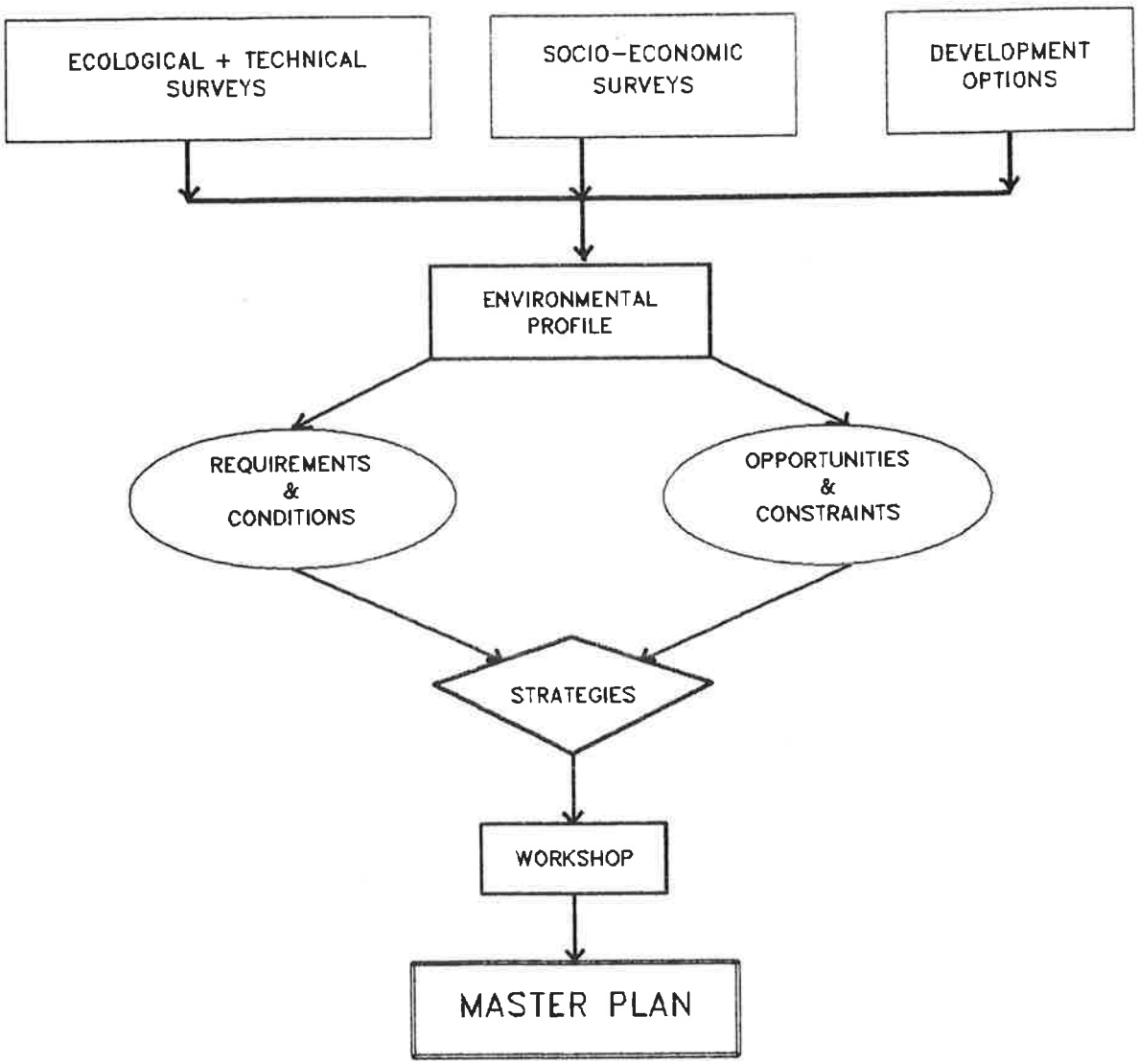

Figure 4 THE MASTER PLANNING PROCESS

4 The Present Study

The Present Study consists of more than 25 research papers covering all ecological and socioeconomic aspects of the Study Area. The survey was carried out in the period between June 1990 and April 1991 and has been documented in the report "Environmental Profile of Muturajawela Marsh and Negombo Lagoon". The Muthurajawela Master Plan was prepared, largely on the basis of the data and conclusions of the Environmental Profile and the recommendations of a Workshop held on 25 April 1991. The Master Planning process is visualized in Figure 4.

The Master Plan is providing the answers that were urgently needed: "does Muthurajawela needs to be protected or developed and if development is permissable, to what extent, where and what". It has been prepared as a strategic document in the sense that it does not present a complete "blueprint" for development, nor contains a detailed conservation management programme. Its main purpose is to present a comprehensive development and conservation strategy, including guidelines for area planning, in addition to recommendations for priorities in development, short-term actions and organisational arrangements.

Long-term planning for a highly complex wetland like Muthurajawela demands continuous research and study; hence more detailed work needs to be carried out before action in the field should take place.

5 Contents and layout of the report

The layout of the report closely follows the process of the study as it evolved and starts in Part A with a summary of the major findings and recommendations of the Environmental Profile. Part B presents a listing and evaluation of the most relevant land uses to be considered for the area. The land development and conservation strategy is discussed in Part C. Alternative options are considered and evaluated on the basis of a set of criteria, resulting in the recommended strategy elaborated in Part D. This latter part further presents zoning principles and cost indications for selected development areas and includes recommendations for short-term actions and institutional arrangements.

PART A: MUTHURAJAWELA IN EVOLUTION, CURRENT TRENDS AND IMPLICATIONS FOR THE FUTURE

1 GENERAL

The Muthurajawela Marsh and the Negombo Lagoon, situated about 10-30 km North of Colombo, are interdependent ecological systems forming one contiguous wetland. The total area covers about 10,000 ha of which an area of about 3,000 ha consists of undeveloped marshland. The lagoon measures around 3100 ha and the balance is made up by rivers, canals and other water bodies, a dune belt along the coast, the shore areas of the lagoon and some higher lands along the eastern and southern periphery of the marsh. In these latter areas most of the population is settled.

The wetland represents a large area of brackish marshes, mangrove-swamps and fresh water marshes merging into an estuarine lagoon to the north-west. The lagoon opens to the sea at its northern end, and receives fresh riverwater input from the Ja-Ela and the Dandugam Oya. The town of Negombo is situated at the northern end of the lagoon, near its mouth.

Drainage structures, i.e. canals, drains, bunds, sluices and culverts, many in a state of disrepair, are found all over the marsh as evidence of various attempts made to combat flooding and to prevent salt water intrusion.

Some areas of the marsh still hold reminders of the paddy fields that existed previously. The abandoned paddy fields now provide habitat for wildlife. Flora and fauna values are reported to be high, but severely threatened by ongoing planned or unplanned (often illicit) developments.

The total population in the marsh according to a survey done in 1989 was 3366 most of whom had migrated to the area after 1960. While a few of them are engaged in fishing and cultivation of leafy vegetables in the marsh, the majority are employed as labourers in the nearby townships.

Due to inherent poverty, lack of pure drinking water and sanitary facilities, the living and health conditions of the inhabitants of the marsh are poor and need early attention.

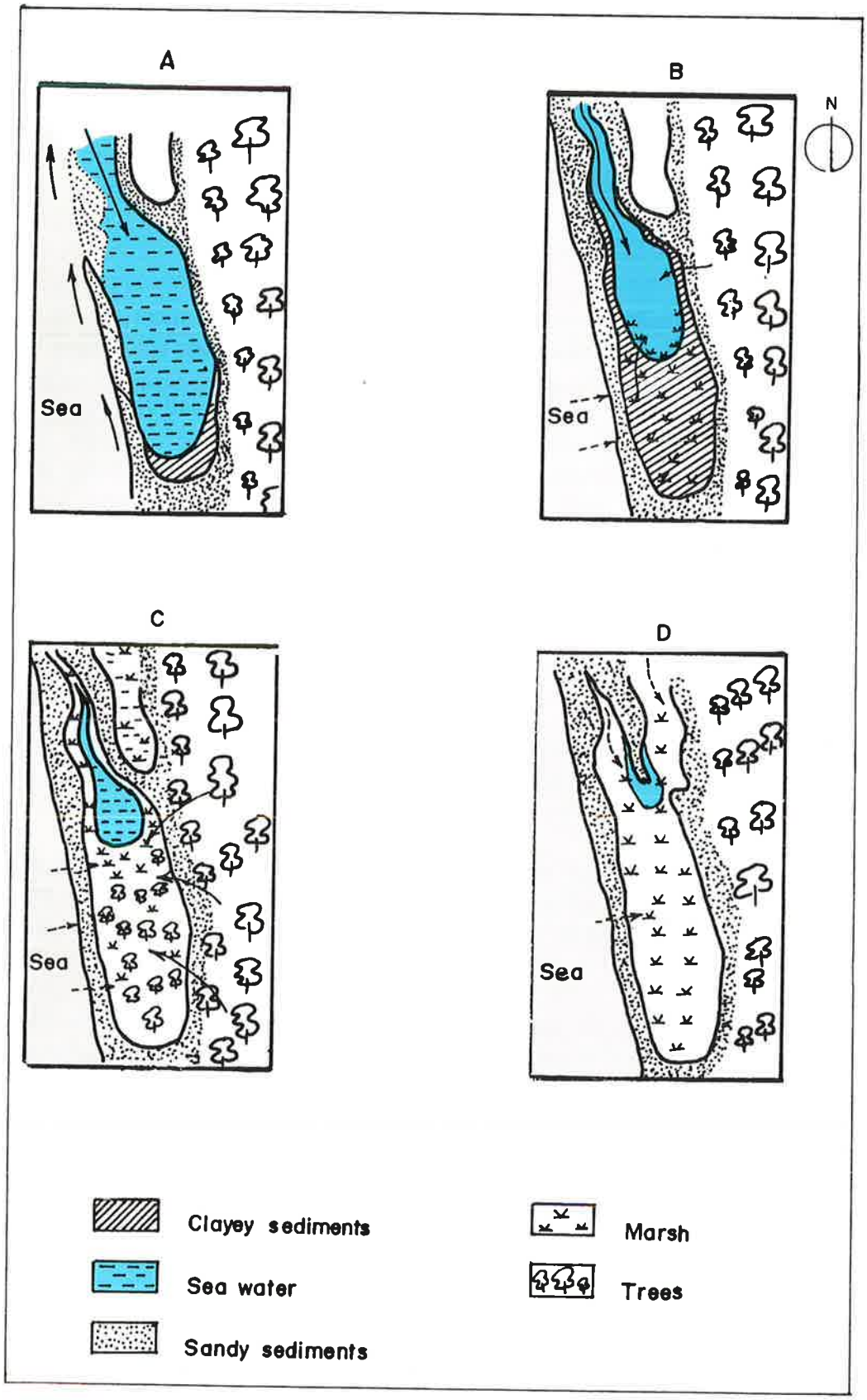

Figure A.1 **GEOLOGICAL EVOLUTION OF MUTHURAJAWELA MARSH**

2 THE GEOPHYSICAL ENVIRONMENT

2.1 Geological trends

The Muthurajawela marsh and the Negombo Lagoon developed during the recent (6000 yrs) Holocene period on the Pleistocene landscape that existed after the last glacial. During the last century the sea level rose at a rate of about 1.2 mm per year. The rise of the sea level caused the coast to transgress over the continental shelf leaving reefs consisting of beach rock at depths varying from 10m to 25m.

Peat started forming in the southern part of the lagoon during a period of low sea level, filling the entire southern part of the wetland (see Figure A.1). Three strata of peat are identified: reed and sedge-type peat on the top, shrub and tree-type peat in the middle and humus-type peat in the bottom. The geological history of the area can be read from the stratification of peat layers.

As long as there is poor drainage the marsh will survive but the present trends show a considerable reduction or even ceasing of the accumulation of peat in the marsh which may lead to its vertical growth lagging behind the rise of the sea level.

2.2 Climate

The climate of Muthurajawela is influenced by the South West Monsoons. It lies in a part of the wet zone which received 2000-2500 mm of rainfall per year. There are two periods of heavy rainfall immediately preceding and following the monsoon period lasting from mid-May to September.

Evaporation exceeds rainfall in January, February and March. In all other months there is an excess of rainfall.

The highest mean daily maximum temperature of 31.5^0 C occurs in April and the lowest mean daily minimum of 22.3^0 C in January.

The main wind directions at 8.30 hours are N to NW from November through February, and mainly SW in the rest of the year. At 17.30 hours the winds are NE from November through February, E in April and March, and mainly SW in the rest of the year.

Along the west coast cyclonic storms are rare. However, from the past experience, the frequency of cyclonic storms can be set at one in eight years, with a severe one, once every 25 years.

2.3 Hydrology of the coastal wetland

The marsh receives water from rainfall, from run-off of surrounding higher grounds and flood water from Dandugam Oya, Kalu Oya and Kelani Ganga. Before the construction of the canals the drainage was very poor.

In the dry season, the marsh acted as a source of fresh water to its surroundings, to the tidal delta and the lagoon. In the wet season, the sediments of the Dandugam Oya were added not only to its delta but also entered the marsh.

The water level in the marsh, and probably also the marsh itself, was slightly higher in the middle than along its fringes. The level raised with the seasons but the retention time was long enough to leave the area inundated, or at least very wet, during the entire year.

The lagoon between the swampy delta in the south, the high ground in the east, the dune ridge in the west and the flood delta of its inlet in the north, was fringed by a narrow strip of low land. The tides and saline water entered the lagoon through its inlet, the salinity being in balance by the inflow of fresh water frm Dandugam Oya, the marsh and precipitation and evaporation.

Salinity is quite low in the lagoon and the estuary of the Kelani Ganga during the wet seasons. There is a surplus of water in the marsh and no salt can penetrate into it. However, during the dry season, an inward flow of saline water occurs due to dilapidated conditions of the sluice gates along the Hamilton Canal. The drainage canals in the whole area are filled with plants. The salt water mixes with the fresh water to create a seasonally variable brackish environment in the lagoon and delta and in the south-western part of the marsh.

Little is known about the quality of the ground water in and under the marsh and the lagoon. Layers of fresh water, fed by rain, are supposed to exist in the dunes and in the sandy area around Bopitiya. Acid water emerges from the marsh and spreads into other waters. The same water probably carries useful nutrients as well.

Pollutants enter the waters from a great number of sources such as squatters, villages, touristic facilities, agriculture, industry etc.

The main trend that can be observed in the hydrological system of the Muthurajawela area is the deterioration of the drainage works leading to even more water logging in certain areas and increased intrusion of salt.

During the last thousand years, the southern marsh area has been free of salt water influences. Moreover, adequate soils and ample supply of water by the Dandugam Oya and the marsh created conditions suitable for cultivation, especially of rice. The later construction of irrigation and drainage systems in the marsh have done little to improve the conditions for agriculture and have largely resulted in the increase of salt intrusion to the extent that practically all paddy fields now have been abandoned.

2.4 Soil characteristics

Several soil types occur in the marsh ranging from very poorly drained organic soils to poorly drained mineral alluvial soils. Most of the soils contain sulphur at levels that could become toxic to most agricultural crops. A large portion of the marsh is subject to tidal influence which raises soluble salt content to levels that adversely affect crops.

The predominant soil of Muthurajawela consists of peat (bog soil) that is very poorly drained, dark brown to black in colour and which is overlying waterlogged mineral subsoils. All soils contain pyrites to the extent that they classify as potential acid sulphate soils.

The bog soils bordering the lagoon and those on the western segment of the main marsh belong to this category. The humic alluvial gley soils have been deposited mainly by river flow and floods. The soils of Muthurajawela are classified as only marginally suitable or not suitable for most conventional uses such as cultivation of rice and leafy vegetables. Some non-conventional uses such as cultivation of sedges and medicinal plants holds out more promise. Coconut grows on well drained soils with jarosite mottles.

3 THE BIOLOGICAL SYSTEM

3.1 The importance of Muthurajawela as a wetland ecosystem

The marsh and the lagoon form a large wetland system covering about 6000 ha. Centuries of human interference have left their marks on these wetlands but up till the present day the ecosystem continues and significant natural values have still been found.

About 7000 years ago, a lagoonal environment prevailed in the area and as the Muthurajawela sand barrier along the coast was formed towards the North, an intertidal ecosystem developed from the southern end. In more recent times the intertidal environment moved northwards paving the way for the present ecological system.

In the Muthurajawela ecosystem the major non-living components are the tidal inflow, river discharge, rainfall, evaporation, nutrients, sediment and decayed material from living organisms. The living components are the micro-organisms, plants, animals and the human beings.

Both the freshwater and the sea water influences are essential to maintain the brackish condition that prevails in the wetland. It enables its characteristic plants and animals to exist as abundant populations that can be harvested for consumption and sale.

With the exception of larger mammalian species bio-diversity is high. Animal species have perfectly adapted to the variety of food types available.

3.2 Flora and fauna in past and present and the causes of change

Three main types of vegetation are discernible in the marsh and the lagoon: the vegetation of the marsh proper [1] in the southern half of Muthurajawela, the brackish water swamp-mangrove vegetation in the central part and along the shores of the Negombo lagoon, and the lagoon vegetation.

In the marsh proper a variety of aquatic plants are found, their occurrence being related to the level of eutrophication, the salinity and the depth of water. The natural vegetation in most of the marsh has been subject to change but over large areas the vegetation survives in varying stages of naturalness. Extensive areas are uniformly covered with a combination of sedges and grasses. A recently introduced shrub-like tree, Annona Glabra, is found on bank gradients everywhere. Shallow pools and canals with more stagnating water, rich in nutrients, are covered with salvinia or with duckweed. The open canal waters are usually very rich in phytoplankton and algae, which are essential elements in the food chain of many higher organisms.

Many marsh plants provide food for animals. The aquatic fauna maintained by the marsh vegetation, in turn, provides food for a variety of fish-eating birds and carnivorous fishes.

The delta zone of the marsh forms the transition between the marsh proper and the lagoon. It is characterized by a brackish water flora and some mangrove forests. This zone, which is ecologically as well as economically important maintains a high productivity, acts as a silt trap, provides spawning, nursing and feeding grounds for a variety of economically important fish, shrimp and other species, supplies coastal water with nutrients and provides a wildlife habitat.

Mangrove forests have been severely reduced by cut and still only extend over a very narrow intertidal area on the edges of the lagoon.

The most luxuriant and least disturbed mangals are found at the mouth of the Dandugam Oya where they grow up to a height of about 15m. More than ten islands of different sizes, mostly covered with mangrove vegetation, are situated in the lagoon outlet to the sea.

Twenty two percent of the lagoon bed is estimated to be covered with sea-grass. These grasses are highly productive and provide habitat for a variety of aquatic organisms, including many commercially important species. The blades of certain sea-grass species provide substrate for plankton growth and many fish and prawn species depend on this plankton for food, making this sea-grass play a major role in the food web of the lagoon.

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[1] "Marsh proper" is the term used in this report for that area of Muthurajawela Marsh having been defined by field survey as to have real marsh conditions and the limits of which have been adopted as boundaries of the Planning Area.

Sea grass beds play an important role in shore protection and stabilization. The sea grass beds are ideal sites for traditional brush pile fishing which does not necessarily have detrimental effects on sea grass beds.

Muthurajawela marsh is a rich biotope. A large number of resident bird species have been recorded from the Muthurajawela-Negombo lagoon wetlands indicating that both the marshes and the lagoon are important areas for a wide variety of water birds, including resident and migratory species.

There is high incidence of reptilian and amphibian species in Muthurajawela. The high incidence of amphibians is due to the presence of a large variety of water related micro-habitats of sufficient extent.

Many canals and waterways in the area provide suitable habitat for numerous species of small to medium sized fish which are used as food by a variety of piscivorous bird species. The extensive undisturbed marshes are also the habitat of a wide range of insects, the feed of a broad spectrum of insectivorous and omnivorous birds.

Muthurajawela, in its present state, is an important fish habitat not only because of its extent, but especially because of its series of interconnected different biotopes: pools, canals, rivers, and the estuary.

Zooplankton species are important in the Muthurajawela-Negombo laoon area, since they are a source of food for fish crustaceans and some birds and also because the larvae of commercially important fish and shrimp species are part of the plankton.

The marsh, in its present condition and harbouring squatter populations with inadequate sanitation facilities, provides a breeding ground for a wide range of disease agents and vectors the most important of them being rats and mosquitoes.

3.3 Ecological trends and their likely impact

The age-long human occupation of Muthurajawela area has brought about many changes in the natural plant and animal communities. Most of the largest mammal species have disappeared and of the larger reptilian fauna, the fate of the surviving estuarine crocodile is in the balance.

The area has retained its value as an important foraging station for a large number of migratory birds.

The marine species of great significance for fisher folk of Muthurajawela and Negombo Lagoon are the penaeid shrimps, mud-crabs, seabass, grouper, angels, scats and grey mullet.

The maintenance of lagoonal stocks of these organisms depend critically on the connection with the sea as well as fresh water discharge which dilutes seawater

adequately. Where the connection between the sea and a brackish water body became blocked or where freshwater discharge was altered, fishery collapses such as in the Kalametiya lagoon and Lunama Kalapuwa.

In the area of flora, exotic aquatic weeds cover many former paddy fields and drainage ditches, whereas water hyacinth is a noxious weed in larger canals.

Most of the mangrove forests along the edge of the lagoon have been cut for brushwood. On the larger islands, mangroves have been removed for human settlement and coconut cultivation and this process is continuing. Mangrove exploitation and tree-cutting generally has reached a point where there are no important tree resources left.

Tall sedges and reeds are available in abundance but difficult access into the marsh leave many parts unharvested.

4 HUMAN SETTLEMENTS, LAND USE AND POPULATION TRENDS

4.1 The economic resources

Muthurajawela area does not have much known resources for exploitation by man. The most important resource available is the fish and crustacean stocks in the lagoon and the marsh.

Fishing is done in a small scale using traditional methods and it is estimated that about 3000 fisherman depend almost entirely on fishing for their livelihood. Fishery productivity of the marsh and the lagoon are quite high, yielding over 150 kg/ha. The trend in fisheries during the past two decades has been definitely over exploitation of both fish and crustacean stocks.

In the marsh proper the significant agricultural activities are the cultivation of coconut and leafy vegetables. Paddy is cultivated only as a marginal activity. Coconut cultivation in the marsh is very labour intensive and the annual production is about 30,000 nuts/ha. Tapping of trees for toddy is done in a small scale.

Small plots of raised beds are used for the cultivation of a variety of crops but marsh inhabitants make use of various natural products of the marsh eg. reeds and sedges for making mats, baskets, hats etc, tree branches for brush-pile fishing, wood for house building and boat making. Small scale livestock rearing is practiced at the edges of the marsh, the main species being pigs, cattle and poultry. Small scale poultry farming is widely practiced even by squatter families. Bee-keeping is also practiced in some areas.

Acquaculture is practiced in the lagoon area only at a very small scale.

In the Planning Area and the Study Area around 40% and 60% respectively of the labourforce is engaged in informal sector activities which focus on preparation and vending of food, personal services and petty trading

An industrial sector survey carried out in the Muthurajawela in 1990 revealed that there are no industries located in the Planning Area. Of the 100 industrial units located in the Study Area and sampled for study, 18 were engaged in repair of vehicles and electrical goods and 14 in garment making. Over 80 percent of the industries were privately owned small units employing not more than 5 persons.

The majority of the population in the Planning Area is engaged in casual labour and only about one percent is engaged in agriculture as a full time occupation. Many of them find employment in the industrial or informal sector in the nearby townships.

Peat mining is done on a very small scale. Peat is a resource that is available in abundance but its applicable uses are very limited. Hence not much income can be generated from peat at present.

4.2 History of human settlements and land use

As mentioned earlier, Muthurajawela area was inhabited by people for centuries. However, due to natural and economic reasons the population moved out of the area during the last century and over two-third of the present population has in-migrated to the area within the last 3 decades. In 1948, when some lands were alienated for the cultivation of paddy the allottees happened to be the unemployed labour from nearby urban areas.

Gampaha district had a population of 1.39 million in 1981 (Census of Population) of which 28 percent were categorised as urban. The total population in the study area was 169,669 in 1981. During the Socio-economic Survey (1989) it was estimated to be about 209,000 and the number of people living in the Planning Area was counted at 3366.

The land use budget of the Study Area is presented in Table A.1. It shows that one quarter of the area consists of marsh proper. The area covered by homegardens is about 5 %. In the marsh proper, 60 ha are cultivated with coconut and 30 ha with paddy. The distribution of the land uses is shown in Figure A.2.

Cultivation of leafy vegetables is a significant agricultural activity in the marsh. Raised beds, about 25cm above water level, of variable dimensions, 10 sq.m. and more, are formed from excavated marsh soil, fertilized with heavy applications of organic manure, and planted with several types of leafy plants.

Built-up area in the Study Area is about 3800 ha with residential, industrial and infrastructure facilities.

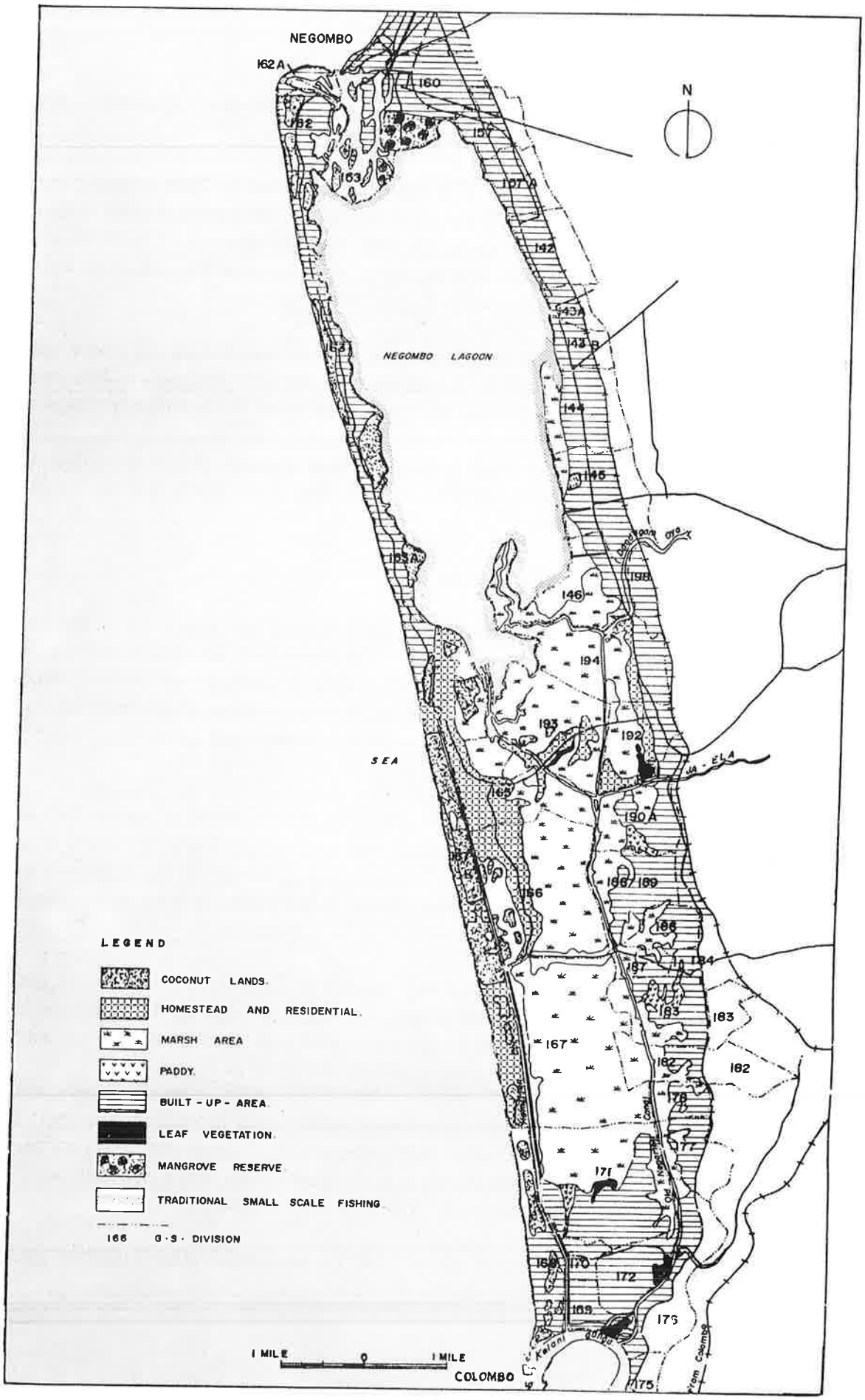

Figure A.2 PRESENT LAND USE

Table A.1 Existing land uses in the Study Area

Land use	area in ha	%
Natural condition		
- Marsh vegetation	2,688	25.1
- Negombo Lagoon	3,164	29.6
sub-total	5,852	54.7
Agriculture		
- Homestead gardens	543	5.1
- Coconut	430	4.1
- Paddy	30	0.3
- Horticulture	30	0.3
- Pastures	6	0.2
sub-total	1,039	9.7
Built-up area		
- residential, industry, infrastructure, etc.	3,803	35.6
Total	10,694	100.0

Source: Socio-economic Survey, 1990

4.3 Current trends

There is no reason to believe that current trends in agricultural land use, ie. reduction in rice area, planting of coconut as a method of land reclamation and cultivation of vegetables and fruits for cash income and home consumption will be reversed under present conditions.

Since the establishment of industrial zones, the rate of population growth in the Gampaha district has increased, due to induced in-migration. It is assumed that by 2001, the population of this district will reach the level of 2.7 million as a result of an annual growth rate of 2.5%. Within this broad perspective, it is anticipated that the increase in population in development centers such as Wattala-Mabole, Hendala, Kandana and Ja Ela, which are bordering Muthurajawela, will be as much as 5% per year by 2001.

However, the present trend is towards increased urbanization at locations more towards the hinterland, away from the Muthurajawela. But a change in the pattern of developments in Muthurajawela could alter this trend.

5 EVALUATION OF THE PRESENT SITUATION AND TRENDS

5.1 The endangered coast and need for protective measures

The entire coast between the mouth of the Kelani Ganga and Pitipana is receding and will do so even more in the future because of extra sea level rise. Incidental breaches of the coast occur already for some years and will become more serious in a few decades if no durable protective measures are taken.

Observations of the recession along the southern part of the coast lead to an average rate of 2.3 m/year, measured over a distance of 1,100 m between 1956 and 1981. No observed rates of recession are available from the rest of the coast, but the impression is that it is much less.

The most vulnerable parts of the coast are its southern one third and some narrow parts of the dune between the lagoon and the sea. A breach will lead to intrusion of salt water and sand into the low lying land behind the dune ridge.

5.2 The natural and economic values of Negombo Lagoon and the need for conservation and management

The recognition of Muthurajawela as a wetland with immense natural values is of recent vintage. None of the earlier reports which examined the possibility of reclaiming the marsh for development purposes touched on the conservation of even a part of the marsh as a national asset. However. it has now been accepted that Muthurajawela is a habitat for many species of birds, including migratory birds, mammals, reptiles and amphibians. Some of these animals are classified as threatened. Similarly, Muthurajawela is well known for its mangroves which are the breeding and nursery grounds of the coastal fisheries. They are also threatened.

Muthurajawela marsh and Negombo lagoon wetland is an economically important ecosystem as it is a highly productive habitat for fish and shrimp. The value of the annual catch of fish and shrimp in the lagoon is estimated to be about Rs. 100 million.

The number of jobs created by the fishing industry in and around Negombo Lagoon is estimated to be about 3000.

The lagoon is threatened at the moment by several activities. The people, specially the encroachers, are responsible for choking the lagoon by filling in of the channel segments of the lagoon. There is polluting of the lagoon due to lack of proper sewage facilities for both the residents and the industries in the area.

The trend in fisheries during the past two decades has been distinctly overexploitation of both fish and crustacean stocks. The increased number of fisherfolk, the progressive decrease in mesh size of nets used, the multiplication

of fishing gear types and the addition of gear types which are known to be destructive to early stages of fish and shrimp, are mainly responsible for creating this situation.

The wetland has further potential for becoming an important educational and research area for students in biology, ecology and geography and is frequently being visited already.

5.3 The "costs and benefits" of the Muthurajawela marsh proper

The estimation of costs and benefits of maintaining a natural resource like the Muthurajawela marsh, either in financial terms or in socio-economic terms, is no mean task. They include many intangible costs and benefits which cannot be measured in terms of a 'market' value. Therefore, an economic analysis can only be made in qualitative terms.

The natural functions of the marsh of production, purification and buffering are important for the sustainability of the ecological integrity and productivity of the wetland as a whole. Not only the lagoon, but also the marsh produces commercially important species of fish and shrimp, although no estimates are available on the value of fish cought in the marsh proper.

There are no financial costs to maintain the marsh now, except the amount paid to the 12 guards to prevent encroachments and unauthorised activities. Most of the irrigation and drainage structures in the area are no longer in operation and are not being maintained. Very little is done in terms of cleaning, dredging and removing of plant growth in the canals such as the Dutch Canal.

On the benefit side, there are some financial gains to those who are engaged in fishing and cultivation of paddy, coconut and vegetables. There are also some inhabitants engaged in toddy-tapping, distilling, cattle rearing, hunting, and in timber, reed and peat extraction. Although these activities bring marginal financial benefits to the people, they also have social costs as some of them are illegal and some of the hunted animals are protected species.

Availability of free housing for the inhabitants could also be called a financial benefit to them although squatting on public land is an illegal activity.

One of the most important social costs of the marsh is its threat to the health of, not only the inhabitants, but also of those living in the vicinity.

Among the social benefits is the availability of opportunities for research, education and recreation. There is a financial benefit also in this as these facilities are available to foreigners as well.

Opportunity cost of keeping the marsh in its present status is very high with regard to the increasing demand for housing, industry and recreation facilities in an

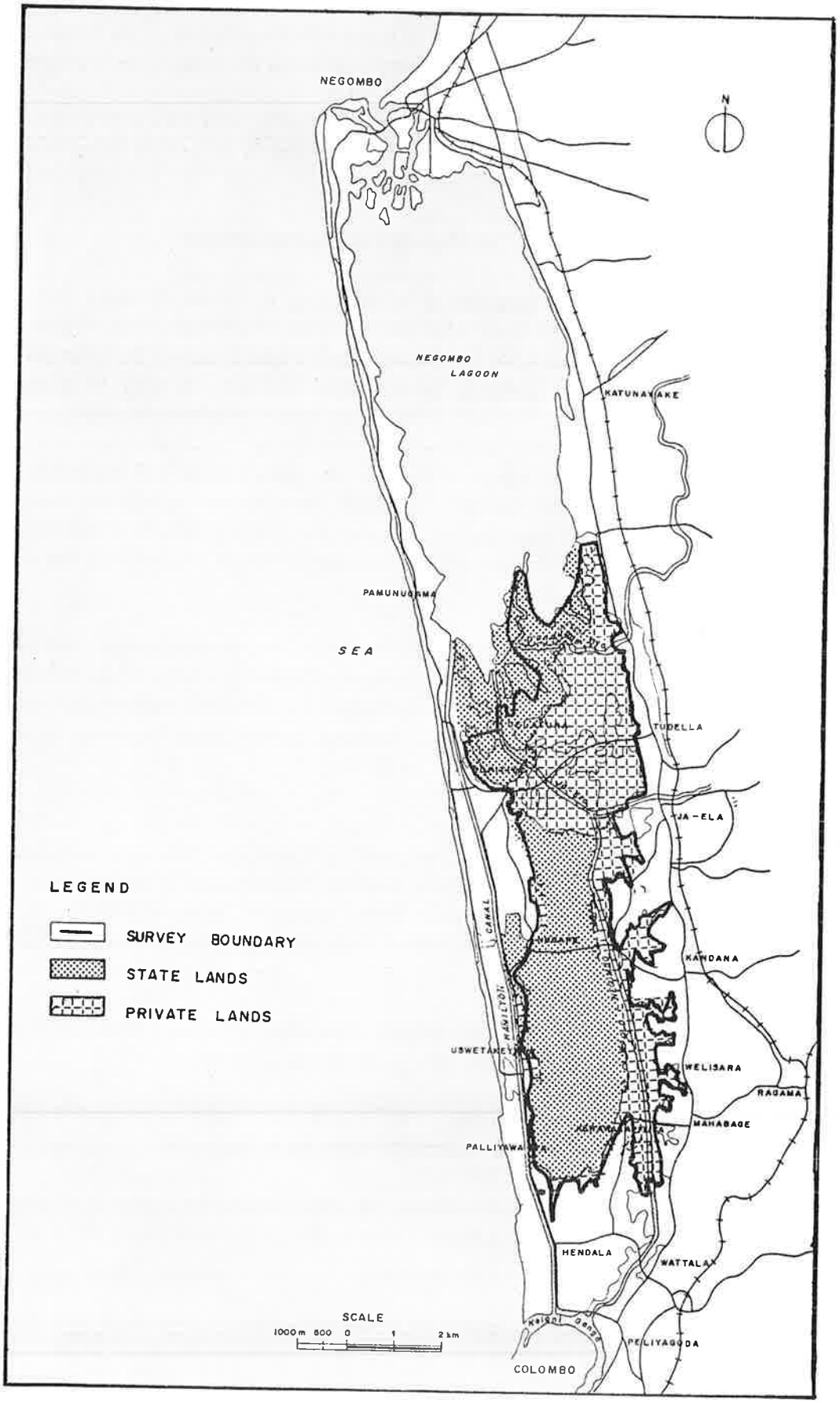

Figure A.3 LAND OWNERSHIP IN THE MARSH

expanding economy. The marsh is situated close to the capital city of Sri Lanka, the International Airport and Katunayake EPZ. These activity centres require area for expansion and for the accommodation of growing numbers of workers. The opportunity cost of the marsh will be equal to the cost of providing land and services elsewhere. As most of the marsh is government owned land the financial cost of development will be much less than when private land needs to be purchased. Land ownership in the marsh is shown in Figure A.3.

5.4 Socio-economic conditions of the marsh population

The total population of the study area was 169.669 in 1981 (Census of Population). The estimated population in 1990 was 208,615 giving a rate of increase of 2.3% per annum during the decade. This was more than the rate of increase in the District which was 1.7% during the same period.

The total population of the marsh proper in 1989 was 3366 (GCEC). Their age-sex distribution is as follows:-

Age	Male	Female	Total
0-5	194	185	379
8-14	490	393	883
15-65	1056	1019	2075
over 65	18	11	29
	1758	1608	3366

A comparison of the age-sex distribution of the people in the study area with that of the people in the marsh proper shows that there is no significant difference in the age distribution of males (X^2 = 3.826, d.f. 4) but there is a difference for females (X^2 = 6.549, d.f. 4) at 10% level.

The unemployment rate[2)] in the marsh is quite high giving a percentage of 61.9 of the labour force[3)]. The majority of the unemployed are below 30 years of age with primary or secondary level of education. Those employed are mostly engaged in manual labour in the nearby townships or in coconut estates. Of the population in the Study Area 8% are engaged in lagoon fishing. Of the inhabitants living in the marsh proper 14% are engaged in fishing.

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2) An "unemployed" person is a male or female in the age group of 15-65 who is not engaged in any kind of work for wages or profit and is not attending school.

3) Labour force consists of males and females in the age group of 15-65 who are employed or unemployed but seeking employment.

In the marsh 80% of the household income is spent on food. There is no expenditure on house rent. There are some households owning bicycles and radios and a negligible number owns T.V. sets as well.

Ninety percent of the houses in the marsh are temporary structures with cadjan roofs, timber plank walls and peaty clay floors. No drinking water is available on site and majority of the marsh inhabitants use open spaces for toilet purposes.
The health conditions of the people in the marsh are very poor and they suffer from several infectious and endemic diseases. Leptospirosis is the most common public health problem.

The nutrition study revealed that there are four major nutritional disorders, namely, protein energy malnutrition, nutritional anaemia, iodine deficiency and vitamin A deficiency. The prevailing poor health conditions of marsh people stems mainly from poverty and unsatisfactory sanitary and environmental situation.

PART B: DEVELOPMENT RESOURCES, LIMITATIONS AND REQUIREMENTS

1 INTRODUCTION

In this part of the report opportunities will be explored to improve the use of resources of the wetland, including the natural, economic and land resources intrinsic to the area. To facilitate reference to particular locations, the Study Area has been divided into planning units, shown in Figure B.1.

Strictly speaking, the marsh offers only two alternatives: conservation or reclamation. Although to varying extent and cost, land reclamation is required for all active land uses. Economic activities and land uses most fitting for the area were already identified in the Environmental Profile. In part their identification resulted from suggestions made by various government agencies when asked for which uses they considered Muthurajawela an appropriate location. These suggestions are shown in Figure B.2. The various uses and activities identified are analysed and discussed below in terms of their hydrological, environmental, economic and regional aspects to assess their validity as building blocks for integrated planning.

2 CONSERVATION

2.1 General

Conservation implies more than just leaving the area untouched. It presupposes deliberate action, aiming at protection of the area against all possible causes that may negatively effect the ecological integrity of the wetland and requires wildlife management, environmental monitoring and user control. Conservation has social values, and may generate economic benefits, but has also economic cost attached. Conservation has therefore also been included in the list of development options to facilitate comparison with other uses and to assist balanced decision making.

2.2 Hydrological considerations

It is of critical importance that, disregarding seasonal variations, the balance between fresh and salt water in the lagoon be maintained to sustain fish and shrimp productivity. For the same reason the depth and volume of this water body should not be changed to any major extent. This requires the following:

River discharge flow of the Dandugam Oya and the Ja Ela should not be reduced any further, for instance, by water extraction for irrigation and urban water supply in upstream reaches of these rivers.

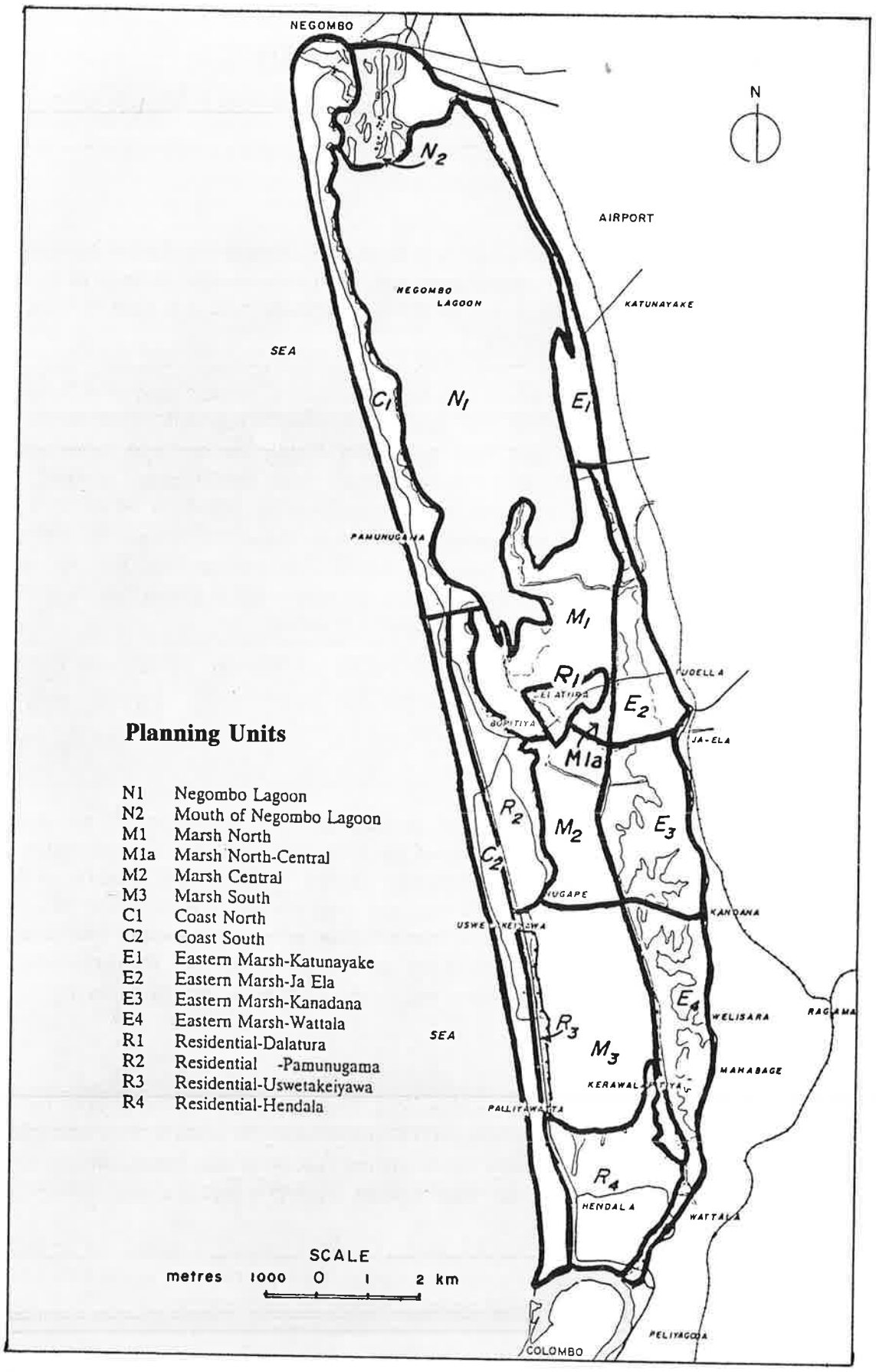

Figure B.1 DIVISION OF THE AREA IN PLANNING UNITS

- The sea inlet of the lagoon at Negombo **[N2]** should be kept open to permit tidal in- and outflow of sea water. It may be necessary from time to time to remove sand in the main outlet channel by dredging, also to maintain sufficient water depth for the marine fishing fleet having its anchor ground mainly in the lagoon.

- Current small-scale land reclamation by local fishermen communities on the islands in the mouth of the lagoon should be stopped to avoid further restriction of water flow between the sea and the lagoon.

- Dredging in the lagoon should not be permitted: the water depth, particularly in the shore regions, should not be increased and dredging may cause turbidity, detrimental to the sea grass beds.

- Although there have been reports that the existence of the lagoon is endangered by accelerated silting up, new information suggests that the rate of sedimentation is compensated by the present rate of sea water rise.

- It is recommended to establish a sedimentation and river load monitoring system for the lagoon and its tributaries. The system should also include water quality control to monitor pollution levels.

- The northernmost part of the marsh, surrounding the delta of the Dandugam Oya and Ja Ela **[M1]** is strongly linked hydrologically to the lagoon and hence contributes substantially to its productivity. The hydrological system in this area should therefore not be disturbed or altered.

For parts of the marsh to be conserved, it is essential that water levels and water quality continue to meet the requirements of the marsh flora and fauna. Therefore, the incidence and risk of drying out of the marsh in the dry season should be minimized. Also the need should be investigated for, and the feasibility assessed of (a) increasing the inflow of fresh water and/or (b) decreasing the drainage of the area, while considering the following:

- Increasing the inflow of fresh water eliminates the risk of water stagnation, inherent to drainage restriction.
- Run-off water from the areas east of the Dutch Canal, now being intercepted and conveyed by this watercourse, could be considered as one source of water supply in the dry season and be diverted to the marsh. The Ja Ela could be considered as another source, provided it carries sufficient water. A third source could be urban waste water (see Section B.5).
- The water retention time of the marsh could be increased by operation (after their repair) of the sluice gates in the marsh drains along the Hamilton Canal.
- Note: Maintaining continuously high water levels in the marsh would also reduce salt intrusion. However, this may not meet the approval of the many families living in houses located on land at, or close at marsh level as it would cause the incidence and duration of flooding to increase.

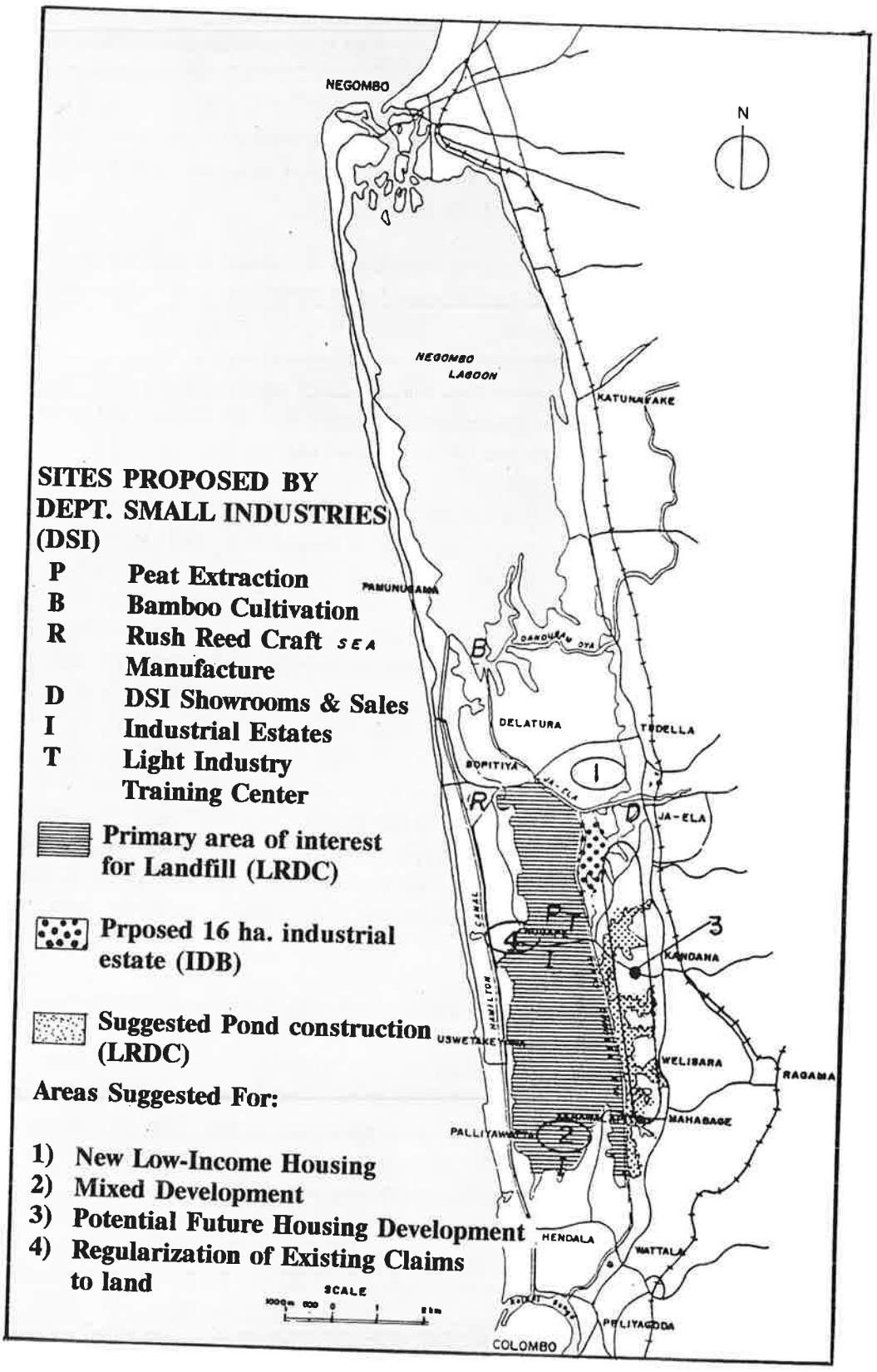

Figure B.2 LAND USES SUGGESTED BY GOVERNMENT AGENCIES, 1990

2.3 Environmental guidelines

- Although there are endangered animal species in the area, including some endemic (unique to Sri Lanka) in the marsh, there are none for which Muthurajawela is the only remaining habitat. Nonetheless, Muthurajawela marsh should be seen as one of the few remaining large wetlands in Sri Lanka.

- The connection between the marsh and the lagoon is important for ecological reasons, even though the original hydrological connection has been largely broken by the construction of the Ja Ela enbankments, the Tudella road and various bunds in the area, obstructing surface and ground water flows in northerly direction. A north-south connecting corridor between the sections M1 and M2 should be maintained for the movement of wildlife.

- To increase its isolation and to minimize the potential negative impact of development in its vicinity, buffer or transition zones with strict use control should be created between conservation areas and development areas. These will also help to prevent future encroachment on the marsh.

- Muthurajawela functions as a "green lung" for the metropolitan area, and should, at least in part, be preserved as an important landscape amenity for the present and future urban populations of Colombo. The marsh and lagoon are also important for wetland study and research.

2.4 Economic aspects

The conservation of ecosystems has economic relevance, i.e. by

- sustaining existing productivity (fish, shrimp, etc.)
- sustaining existing, freely provided environmental services such as air and water purification, landscape attraction, etc. These generally influence investment values in positive terms.
- preserving development resources for future needs.

The Environmental Profile study has now provided a basis for selection of resources to develop now and those to be kept in reserve for future decision.

The Negombo Lagoon - Muthurajawela Marsh wetland is economically important because it has a high fish and shrimp production. "The sharp decline in prawn and crab harvests in lagoon and estuaries which appeared temporary and was brushed aside as such by some people, is now being taken more seriously. Scientists have identified underlying causes as reduction in size of lagoons and estuaries due to land-filling, pollution from industrial effluents (as in Negombo and Valaichchenai) and the servicing of fishing craft in relatively still lagoons."[1)]

[1)] Sri Lanka National Conservation Strategy, Central Environmental Authority, December 1988, p. 54.

NARA[2] estimates that in the Study Area 3000 fishermen obtain their sole or major income from fishing in the wetland. Of the 3366 inhabitants of the marsh proper registered in the survey carried out by GCEC in 1989, only about 15% relied primarily on the resources of the marsh for their subsistence and income. Eighty-five percent of these families depend primarily on income earned outside the marsh.

The more successful farmers with coconut production are largely located on higher ground in areas around the marsh.

2.5 Planning recommendations [3]

- Protect Negombo Lagoon's wildlife resources: ensure the continued inflow of pollution-free sea and river water in appropriate balance, protect remaining mangrove cover and regulate fishing catch, techniques and equipment.

- Although a maximum area for conservation is preferred, no strict limits can be given for the minimum area of marsh required to secure survival of the wetland's ecosystem.

- Generally, the northern areas of the marsh are more important ecologically than the southern areas; the transition zone between Negombo lagoon and the marsh (**M1**) is most important and should be designated as minimum conservation area in any strategy considered.

- Leave undeveloped areas as biological corridors between section of the marsh to be preserved, notably between the planning units (**M1**) and (**M2**).

- Include a buffer zone between areas to be designated for development and conservation.

- Investigate the need for, and feasibility of, retaining more water in areas to be conserved with the aim to improve bio-productivity and diversity in the marsh.

- Include facilities for wetland research in the environmental management programme to be prepared for the area.

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[2] National Aquatic Resources Agency

[3] The recommended development strategy should take into account statements of national policy relative to conservation. For instance, the Action Plan to Implement the UNP Manifesto of 1989 (p.8&9) includes the following points, among others:

(13) Subject all development projects to Environmental Impact Assessment

(15) Take urgent action on priority areas such as deforestation, soil erosion, coast erosion and water pollution.

(19) Adopt appropriate and stable environmental policies which are supportive of development and based on the principles of sustainability of resources and carrying capacity of the environment.

3 URBAN DEVELOPMENT

3.1 General

Given the location of Muthurajawela in the Colombo Metropolitan Region (CMR), there is considerable pressure for urban development in the area. Rapidly growing population and job opportunities in the area contribute to this. For this reason urban development is discussed here as the second most relevant option. Moreover, urban development has an inherent potential to be in conflict with wetland conservation. Therefore, the permissible extent, location and contents of future urban development need critical judgement.

The most limiting factors of Muthurajawela for urban development are the poor soils and the high water levels, necessitating land reclamation for almost any type of development. The average land level of the marsh is about 30 cm above M.S.L.

3.2 Land reclamation

The entire marsh is virtually covered with a layer of peat with an average depth of about three meters. The strata below are believed to contain predominantly well-bearing clayey and loam-sandy soils. The peat profile is highly irregular and borings have found depths of six meters and more. The layer generally inclines to deeper peat from south to north with minimum depths in the south of the marsh and along the eastern periphery.

Although various programmes were carried out over the years, they were either inaccurately recorded or different soil classification systems were used. Information on depth and physical properties of the peat is inadequate for reclamation planning and design and it is important that, at least for the areas to be approved for development, an intensive soil survey be carried out with sufficient number of borings.

Of all common soil types, peat has the lowest bearing capacity and is, in combination with high ground water levels, unsuitable for construction of buildings, roads and the like. To permit their construction, either the water level needs to be lowered drastically (possible only by pumping), or by raising the land level by filling with coarse material, or by a combination of the two. However, the best, but most expensive solution is removing the peat altogether and refill with coarse material till well above flood level.

Given the many low-lying areas in Colombo and elsewhere in the country that have been reclaimed for building and other purposes, substantial experience has been gained with landfill and associated drainage works. Most of these projects are of a relatively small scale and use gravel, sand or laterite from nearby pits being brought in by carts and trucks. Most recently, in Colombo solid waste is being used as alternative fill material, a common practice in industrialized countries.

In Muthurajawela small-scale land fill is a common activity. It is carried out by individual landowners to increase cultivable land, but it is also increasingly done by land developers on a commercial basis, mainly for residential and industrial developments. The most commonly practiced landfill in the marsh is the raising by homesteaders of portions of land with peat excavated from the marsh itself. This results in soil depletion and the creation of water ponding. The raised land is generally covered with a thin layer of mineral soil when it is to be used for building construction, pathways and similar uses, requiring a minimum of seal and bearing capacity.

This system could also be considered for future open air uses such as parks, playgrounds and golf courses, for which heavy landfill is not required and would be too costly. However, this fill method requires larger than normal sites since parts of the area is used for peat excavation and remains permanently inundated.

Another method of land reclamation is hydraulic landfill. In view of the heavy and costly equipment required, this type of fill is only suitable for large scale projects. It has been used in Sri Lanka so far only for a few landfill projects, e.g. for the Parliament site in Kotte.

The SLLRDC [4] has proposed to use hydraulic landfill for land reclamation in Muthurajawela. A number of technical and environmental studies have already been carried out for this project which demonstrate that, if such a large project were feasible and acceptable, Muthurajawela would be a most suitable area for this method. Sea sand would be used as fill material. A sand-water mix would be conveyed by pipe over a relatively short distance from the coast. The minimum area to be reclaimed by this technique would be 400 acres(162 ha) in order to achieve the economies of scale required to attain minimum unit costs (cubic meters deposited).

While the existing peat layer requires landfill to improve the bearing capacity of the soil, the high water table in the marsh requires additional fill to attain a flood free level for development. When no peat is removed before the land is reclaimed, an extra amount of fill is required to compensate for compaction of the peat. It has been estimated by various authorities [5] that a depth of three meter peat must be covered

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[4] Sri Lanka Land Reclamation and Development Corporation

[5] The first recommendations on hydraulic landfill for Muthurajawela were made in 1976 by Prof. A. Volker, who led a Dutch Government Mission to advise on reclamation opportunities in the area. From the Report of a Mission on the Reclamation of the Muthurajawela Marsh Lands, Colombo, July 1976, the following is quoted:

- "In order to arrive at a sufficient bearing capacity, a sandfill should be applied ....of say 4 feet, and even more in case of heavy traffic." page 15;
- "If at regular distances open water, e.g. canals is available, a distance of about 4 feet between (ground) water level and surface level, which is taken to be 1' +M.S.L., is necessary." page 16;
- "Considering that during the rainy season the maximum level in the Hamilton Canal does not exceed 2' +M.S.L., a (minimum) surface level after filling up and subsoil compaction of 5' +M.S.L. is necessary." page 18.

(continued next page)

with a sand layer of at least three meters in order to attain, after settlement of the soil, a recommended level of minimum 1.50 - 1.80 m above M.S.L. (the average marsh level is about 30 cm above sea level). After settlement of the soil, which may take 2 - 3 years depending on the method of fill, the bearing capacity of a three meter sand layer is more than sufficient for general urban development including for industries, ware housing and heavy duty roads. Only high rise buildings would require slab foundations or piling.

The most difficult question to answer without extensive hydrological modelling is the effect of large-scale land reclamation on the flood levels in the marsh and adjoining residential areas. Although the buffer capacity of the basin will not be substantially reduced by landfill, urban areas have a larger and much faster water run-off than undeveloped areas.

Before any large-scale landfill will be undertaken, it is essential that detailed investigations be carried out as to the drainage capacity of the Hamilton Canal, being the major end-conveyor of marsh drain water, and to identify ways and means of enlarging its discharge capacity if needed. For instance, it may be needed to widen the canal or to construct an additional sea outfall[6]. Constructing a new sea outfall would be a major project in technical and financial terms and may have an impact on the feasibility of large-scale landfilling schemes since most of its construction cost should be borne by these schemes.

3.3 Potential land uses

Given the expanse of available land and the location of Muthurajawela in a metropolitan region, the areas to be zoned for reclamation could be considered for development of

- housing,
- light industry, warehousing, transport and industrial services,
- (large) institutions such as hospital, college, university, convention center, trade promotion center, exhibition ground, etc.

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5) contin.
- "...it is estimated that after about 3 - 5 years the soft (peat) layers will be compressed to at least 50% of their original thickness.
- "A sandfill of 9 - 10 feet meets the other goal, improvement of the bearing capacity amply, as only a thickness of 4 feet (1.2 m) is required." page 19.

Also the SLLRDC in its report Development of Muthurajawela Marsh Area (Phase 1), 1988, has arrived at the same conclusion: "Adopting the design groundwater table equal to the annual average flood level of +0.61 m M.S.L., the reclamation level should be +1.80 m M.S.L."

6) Ecological Survey of Muthurajawela - Estimation of Flood Buffer Capacity, Hydrology Division, Irrigation Department,1991. "Capacity of Hamilton Canal is 440 cusecs, but outflow from 50 year design storm is 679 cusecs. This shows the inadequacy of Hamilton Canal to mitigate a major flood. Therefore, any development programme for Muthurajawela necessitates the opening of new sea outlets at appropriate locations as existed during the past." page 5.

- regional or city park, sports fields, stadium, country club, golf course, campings, etc.

- public utilities such as treatment plants and electricity sub-stations,

Muthurajawela could offer sites for institutions and industries now occupying large tracts of valuable land in the city of Colombo and which should desirably be relocated, either for economic and environmental reasons, or to decentralize employment opportunities to the urban periphery.

However, the first group for which land in the area must be made available is the resident population of Muthurajawela. In the first place about 750 squatter families living in the marsh need to be re-settled while also land should be made available to the families who will loose their land or means of livelihood as a result of the restrictions imposed by nature conservation.

A second target group to be provided with residential accommodation in Muthurajawela would be the immigrant workers employed in the nearby industrial zones at Katunayake, Ekala and Peliyagoda. Many of these are landless and live in sub-standard accommodation at present.

3.4 Development considerations

From public health point of view Muthurajawela is at present not the most ideal location for settlement and employment of large numbers of people. The area harbours various disease agents, among them malaria vectors and the potential for epidemics exists. Poor sanitary conditions, particularly in squatter settlements contribute to a relatively high incidence of water-borne diseases in the area.

However, urban development will induce improvement in environmental conditions, advancing the introduction of sanitary systems into the area.

On the other hand, due to the prevailing winds from the sea, the area has clean air and is located close to the amenity of sea and beaches. The narrow but forested dune strip between the Hamilton Canal and the coast provides a windbreak that substantially reduces the inflow of salt-loaden air, reputed to have a strong erosive impact on buildings and equipment in coastal areas and requiring high cost of maintenance.

For land to be designated for urban development good access, infrastructure and transport linkages with other parts of the metropolitan area are a prerequisite. At present, these facilities and services in Muthurajawela are inadequate to support large-scale urban development. However, road and utility hook-ups with district level facilities and supply systems require only short distance connections.

Land in the area is flat, regarded as highly desirable for industries, warehousing and transport and distribution services. In flat areas the construction of roads and other infrastructure works is technically more simple while investment,operating and maintenance cost substantially lower than in hilly terrain.

3.5 Environmental guidelines

- Filling in some of the southern part of the marsh (**M3**) would not necessarily threaten the ecological functioning of the marsh and lagoon bio-system. The major environmental concern is to avoid pollution of the marsh and disturbances of wildlife.

- Buffer zones between areas for development and conservation should only be designated and developed for non-intensive open air uses which may include areas and facilities for recreation, sport and tourism.

- Surface and ground water quality requirements of the marsh and the lagoon dictate the need for central waste water collection systems in all future urban development areas.

- Industrial effluent and emissions, i.e. solid and fluid wastes, gases, smoke, noise and vibrations, can pose particularly important environment risks and human health problems; GCEC's pollution control standards should be applied and enforced in all areas.

- Controls will be needed regarding water quality deterioration in the marsh as potential result of landfill operations such as seepage of acids from compressed peat layers and salt water intrusion caused by hydraulic landfill using sea sand.

- It is recommended to carry out vaccination campaigns and other necessary preventive health actions among the local residents as soon as possible to combat the most common endemic diseases.

3.6 Planning recommendations

- Urban development should exclusively be zoned in the southern part of the marsh and its growth should be staged from south to north. Located in southernmost part, early development can best be monitored and would benefit from:

  - proximity to the Kelani end of the Hamilton Canal, likely reducing costs for increasing the Canal's drainage capacity.
  - shortest distance from Colombo city, saving on travel, transport and utility hook-up cost
  - shortest distance on average to employment centers in the CMR.

- Reclamation by hydraulic landfill with sea sand should, for economic reasons, not be considered for areas less than 400 acres (162 ha).

- Areas with a depth of peat layer of more than three meters should not be considered for landfill for reasons of high cost of reclamation and high maintenance requirements due to likely continued soil subsidence.

- Public health considerations dictate that squatter settlement without sanitation facilities should be stopped.

- Low income housing should be part of the ultimate development programme for social reasons and provisions should be made for the resettlement of the present occupants of the marsh.

4 TOURISM AND RECREATION

4.1 General

Muthurajawela marsh alone has little to offer for recreation and tourism but in a wider geographical context it may contribute to development of this sector for its scenery and ecological significance. In addition, recreation and tourism are, compared with other potential land uses, highly compatible with marsh conservation. Further being one of the most important growth sectors of the country, tourism and recreation have for these reasons been singled out for discussion as a separate development option.

4.2 Present situation

The Muthurajawela, Negombo Lagoon and the town of Negombo are regarded as attractive places to visit. The areas are mentioned in various tourist guide books which in particular recommend travelling along the coastal road for its sightseeing attractions, beaches and wetland scenery. Despite the scenic attractiveness of the area it has failed so far to attract tourists in any appreciable numbers. What could have been the prime attraction, the extensive sea coast, lacks sufficient beach width and is suffering from increasing erosion and pollution. In addition, due to the reefs and bars the sea is dangerous for bathing and unsuitable for any water sports. Despite these deficiencies, there exist three modest hotels along the Muthurajawela coast: Pegasus Reef, Palm Village and the Blue Lagoon hotel. They host both, domestic and international visitors but are largely used by tourist for a one-night transit stop after arrival or before leaving Sri Lanka by air. Their close proximity to Katunayake airport is the more important reason of their existence than the beach location. They can not compete with the nearby beach hotels in Negombo in terms of standards, facilities and beach quality.

The Negombo Lagoon has attractiveness for water sports and is used for sailing, wind surfing and water skiing. Although a few small boat yards and renting facilities exist along its shores, the number of users of the lagoon is very small.

The marsh and lagoon scenery is attractive and the good accessibility provided by the network of rivers, canals and lakes has recently prompted a local travel agent to organize boat trips to the area for tourists. No reports are available about the success rate of this venture.

4.3 Scope for development

The increase in recreational demand is an accepted collateral of socio-economic development. Population growth in the CMR and most notable in the northern corridors of this region will increase the pressure for recreational areas and facilities. It is important to demarcate areas for recreational use by future generations and to ensure that these be kept in reserve for this purpose. Conservation of important parts of the wetland is also for this reason a welcome decision. Suggestions for tourism and recreation projects in the area were made by the Sri Lanka Tourist Board which are shown in Figure B.3.

The type of domestic recreation facilities to be considered for location in Muthurajawela to serve both local and metropolitan needs are local and city parks, swimming pools, sport fields (for recreation and competition sports), a sport stadium, a zoo, etc. The area does not lend itself to sports that are disturbing for the wildlife such as motor sport, car and speedboat racing. It is even recommended to disallow the use of motorised leisure craft on Negombo Lagoon. Suggestions have been made to establish a folk art center near Ja Ela and even the idea has been launched to develop an international theme park along the lines of the "Disney" parks in the USA to take advantage of the large amount of available land and the proximity to Colombo and the international airport.

In view of the tourism market of Sri Lanka and the type of tourists visiting the country, the scenic and biological attractions of the wetland are not sufficiently unique and competitive to warrant promotion and development. Also for amateur biologists and other special-interest visitors, whose joint numbers are very small anyway, there exist other wetlands and national parks in Sri Lanka in a more pristine state and with more appeal for these groups. Given further the relatively short stay of the average tourist in Colombo, the market for day trips in the vicinity of the city is small. The best prospect for the area is the development of a golf course, being discussed under sport tourism below.

4.4 Opportunities for sport tourism

There is considerable interest for the construction of new golf courses in Sri Lanka. This sport becoming increasingly popular worldwide, the feasibility of developing more courses in the country should certainly be investigated. Developing golf facilities would also support convention tourism now being developed and promoted by the Sri Lanka Tourist Board.

Two development companies, with foreign financial backing, have shown interest in Muthurajawela as a location for a golf course. In view of its landscape character and low-intensity use, it would be an appropriate utilization of the buffer zones and highly compatible with marsh conservation.

Construction of a golf course in the marsh is considered only economically feasible if a cheap method of landfill can be used. This would imply that as much

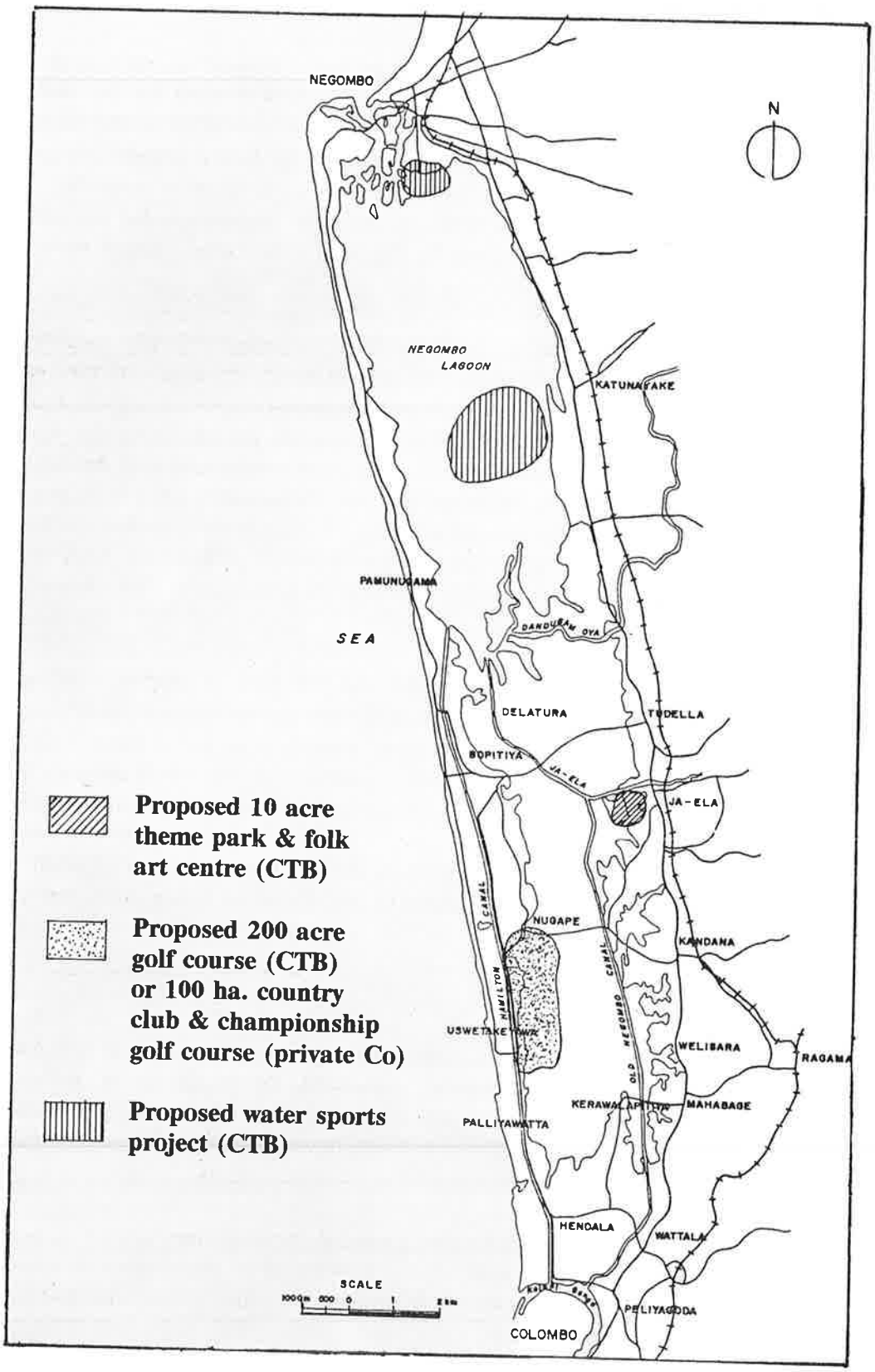

Figure B.3 **RECREATION AND TOURISM PROJECTS PROPOSED BY THE SRI LANKA TOURIST BOARD, 1990**

as possible the peat of the marsh be used as basic fill material and be covered with only a thin layer of stable and fertile top soil to permit grass growth. Although the fairways need to be well above common floodlevel, fill can be reduced by accepting occasional inundation of the course for short periods.

Although compacted and stabilized peat would offer sufficient bearing capacity for human load, in order to meet present-day tourist requirements, the fill should also be able to sustain use by motorised caddies and would permit landscaping of the course with trees. In view of the tropical climate, trees are a prerequisite for a golf course in Sri Lanka. The most commonly found tree in the area is the coconut palm which should be considered for predominant use in landscaping of the course. This palm is probably one of the few tree species that would grow on the fill material, it provides excellent shade cover and, due to its long-stemmed trunk, permits passage of wind and sea breeze. In addition, when properly managed, the coconuts of the palms could be harvested and would bring in handsome revenues to help recover the cost of the landfill.

Since as much as 50% of the actual area may need to be used for peat extraction, half of the golf course would consist of reed-lined ponds, lakes, creeks and islands, and the remainder of palm shaded fairways. This could create a unique environment. It would be a challenge for an experienced international course designer to prepare its layout and landscaping proposals. Given the strongly reduced amount of land remaining after reclamation, the gross area required for an 18-hole course would likely be in excess of 250 acres (101 ha).

Before any realistic cost estimates can be made for construction of a golf course in such a peculiar environment it is necessary to investigate in detail alternative systems of low-cost landfill and to carry out pilot tests for assessing soil subsidence, soil bearing capacity and tree growth. Also tree stability in organic soil should be verified in view of the coastal location and the incidence of cyclones.

4.5 Environmental guidelines

- With the exception of motorized sports and facilities drawing large crowds, tourism and recreation activities are relatively benign environmentally and in principle do not conflict with nature conservation.

- If parts of the marsh are made accessible for nature observation and study, care should be taken that areas be isolated and kept as an undisturbed nesting area and wilderness.

- The use of herbicides and pesticides should be controlled in the Study Area as well in its water catchment areas to minimize contamination of the marsh.

- Motor boats, jet-skis etc should not be allowed in the lagoon, and pleasure boats and wind-surfers should be kept away from the critical areas of sea-grass beds.

4.6 Economic considerations

Sports tourism can be interesting economically, but it is essential to achieve high quality of design and construction of facilities to meet international standards required by the tourist groups aimed at.

Servicing tourist and recreation areas with utilities such as water, electricity, sewerage and telephone, is essential but may be costly when these have to be provided for isolated projects at long distance from existing trunk lines. All developments should have high standard sanitation facilities to safeguard the marsh from pollution.

The economic value of recreational areas such as parkland and sports fields in a a capital city to its residents can not be quantified, but there is a clear value in terms of the added quality of living.

4.7 Planning recommendations

- Recreation and tourism facilities should, by preference, be located in the buffer zones. In view of their open space and landscape use they are more agreeable with marsh conservation than most other land uses, while location in the buffer zones would allow land in areas to be zoned for reclamation to be used for higher value and more intensive real estate development.

- Develop in the area, by preference, those recreation and tourist attractions and facilities for which their target groups require optimum access and therefore should benefit from being at very short distance to:

  - Katanayake international airport, (e.g. international golf course)
  - Negombo beach hotels (international "sun & beach" motivated tourists)
  - Colombo business/expatriate communities (e.g. country and sporting clubs)
  - the Colombo recreation, sports and day-trip market.

5 REGIONAL INFRASTRUCTURE

5.1 General

A few centuries ago settlement along the coast did not extend much beyond the Colombo-Negombo road land inward. Muthurajawela was well populated compared with its hinterland. For many years it had an extensive network of roads and its canals were also constructed and used for shipping. This situation is now reversed: while suitably dry land for settlement in Muthurajawela was limited, the higher lands to the east offered better opportunity for residential and industrial development, even at the cost of loosing valuable coconut and rubber plantations (See Figure B.4). As development in Muthurajawela stagnated growth extended to other areas. In the Colombo-Negombo urban corridor, many more people now are living east of the road than to the west of it.

Considering further growth in this corridor as planned[7], Muthurajawela could, considering its geographic location, topography and available land, be a more desirable location for those regional infrastructure facilities which would be more difficult and costly to establish elsewhere in the corridor. Regional infrastructure requirements and those with particular relevance for the Study Area are discussed below. Existing infrastructure facilities and services in the corridor are shown in Figure B.5

5.2 Land drainage

The marsh and lagoon receive river and surface run-off water from sizable catchment areas to the east. Land use in these catchments is rapidly being converted and intensified, due to urbanization as well as intensified cropping through improved water management and irrigation. Urbanization increases the volume of surface run-off with more intense peak flows, while both activities cause deterioration of surface water and groundwater quality. Nature conservation of the marsh and lagoon will only be successful if water entering the marsh and lagoon can be kept free of damaging types and amounts of pollutants.

Most of the water from the catchments flows into the area and through the marsh via rivers and canals: the Dandugam Oya, the Kalu Oya and the Ja Ela. The remainder is surface run-off water from the areas located between the Dutch Canal and the Negombo Road.

By far the largest river inflow is from the Dandugam Oya and Ja Ela, jointly carrying 1325 million cubic metre water per year to the Negombo Lagoon. The water contribution of the Kalu Oya is small and accounts only for 75 million cubic metre, most of which flows along the southeastern periphery of the marsh directly into the Kelani Ganga. At peak flows in the rainy seasons these rivers overflow and cause substantial flooding near their vicinity. It is believed that high water levels in these rivers also cause water to percolate into the marsh through the permeable peat layers underneath the river banks. However, the total amount of flood water and surface run-off water entering the marsh is small compared to water received by annual precipitation. Moreover, the amount of water entering the marsh by river flooding has been reduced over the years by construction in the area of flood protection banks. Nevertheless, it is important for the marsh that the quality of river and of run-off water be maintained at acceptable levels. To reduce the risk that polluted surface water would enter the marsh the following actions should be considered:

- repair and raise river and flood protection banks in the marsh, e.g. Ja Ela bund

- construct a proper bank on the west side of the Dutch Canal and improve the drainage capacity of this canal in order to restrict surface water to enter the marsh.

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7) Regional Structure Plan for the Colombo Metropolitan Region, 1978

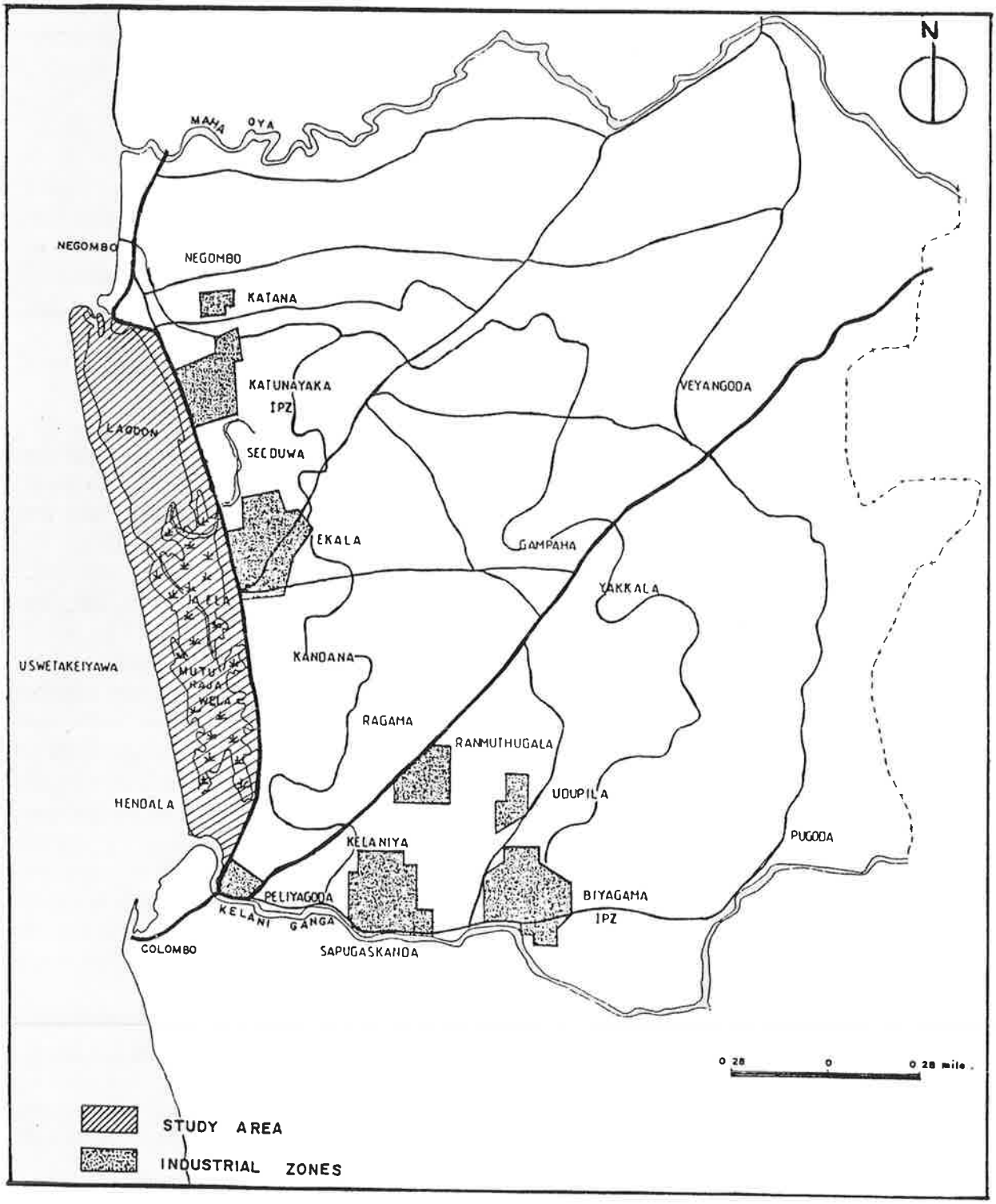

Figure B.4 INDUSTRIAL ZONES IN GAMPAHA DISTRICT

5.3 Water supply and sanitation

With the increase of urbanization in the corridor groundwater becomes scarce and programmes are now underway to install pipe-borne water system in the Colombo - Negombo urban corridor. With installation of this new supply system water use will greatly increase and consequently so does the amount of waste water discharged. To avoid drastic deterioration of surface and ground water, it is recommended to construct also a waste water collection system more or less simultaneously, at least in the more intensively developed urban communities.

The water supply of Colombo and the Greater Colombo area is currently about 80 million gallons per day (MGD), and current requirements are estimated at 100 MGD. The Ambatale Treatment Facilities -- Extension Project, scheduled to commence in 1991 and to be completed in 1994, will treat an additional 40 MGD. Approximately 28 MGD will be supplied to areas that are already equipped with pipe borne water and 12 MGD to feed a proposed new water supply scheme to towns East of Colombo City: Maharagama, Pannipitiya, Battaramulla and Kaduwela.

About 6 MGD is currently supplied to towns north of Colombo. The plan is that new areas will be hooked up to the existing transmission lines, to fully utilize their capacity of 12 MGD. The new areas mentioned are Ragama, Kandana and Ja-Ela, areas somewhat to the east and the south-east of the Muthurajawela Marsh. These are listed as "Stage 2" areas. Plans to equip land-fill areas in the South of Muthurajawela might fit into this Stage 2 development. The relatively near location is in Muthurajawela's favour. Total availability of water and priorities would need to be discussed.

A waste water collection system could be constructed as open drains but a closed sewerage system is preferred. Whatever system is chosen it should be designed on gravity flow to reduce expensive pumping. Given the general slope of the land down to the west, the lowest land levels in the corridor are found in Muthurajawela. It is self evident that, taking also into account the ultimate sewering of the residential areas west of the Negombo area, all waste water should desirably be intercepted near the marsh for subsequent conveyance to a selected disposal point.

For disposal of the waste water various options could be considered:

- a sewage treatment plant

- disposal at sea,

- sedimentation and oxydation ponds in the marsh, e.g. in a buffer zone.

The most desirable method would be purification in a sewerage treatment plant but this is prohibitively expensive. Discharge into the sea requires pumping and a pipe system with its outfall at sufficient distance from the coast. Sedimentation of solids and oxidation treatment in ponds and ditches is the cheapest technique and commonly used in areas where land is in sufficient supply. Recently, highly successful

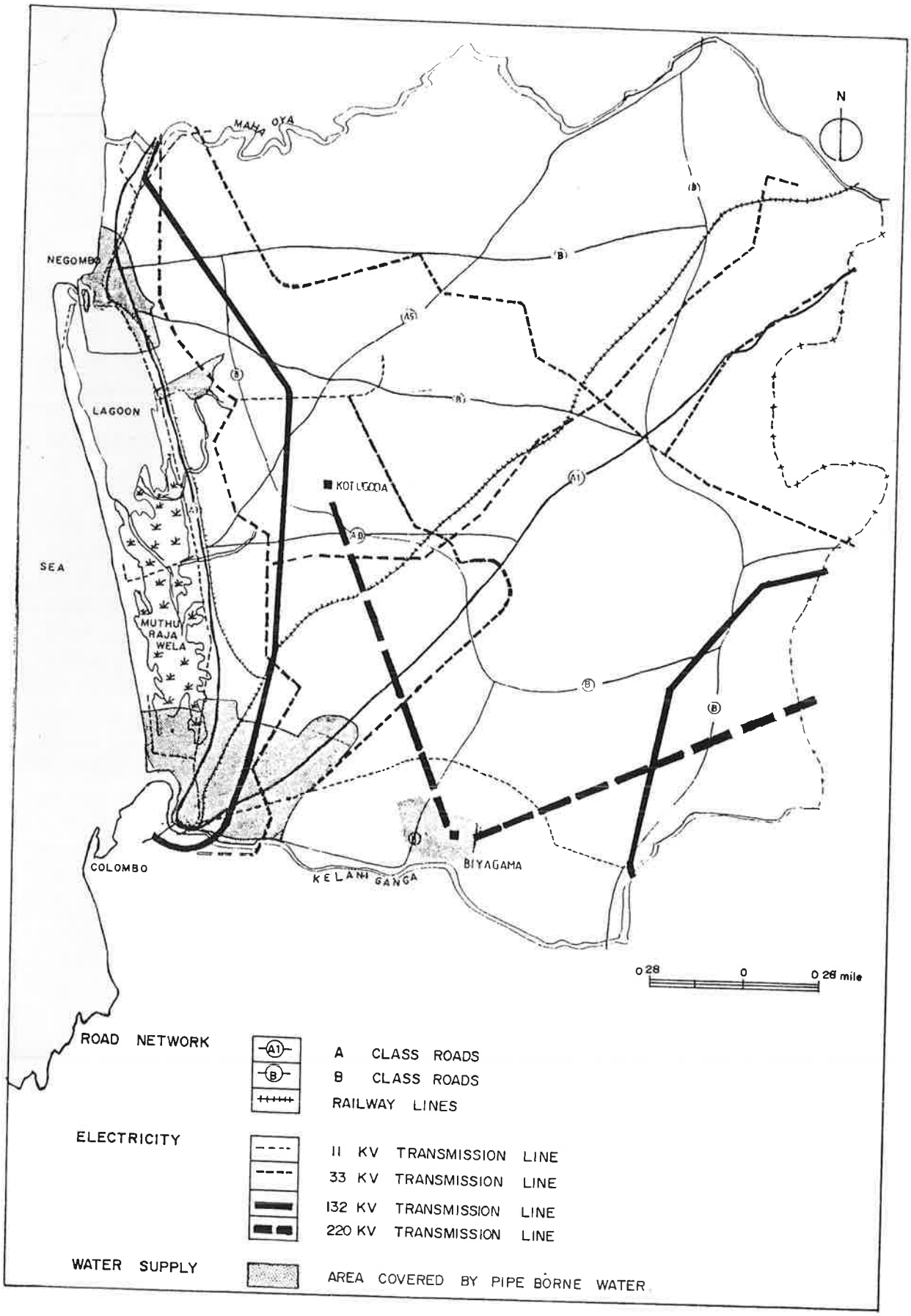

Figure B.5 MAIN INFRASTRUCTURE FACILITIES IN GAMPAHA DISTRICT

experiments have been reported with waste water treatment in shallow circulation ponds lanted with reeds which were found to have a very high purification capacity. However, like any open sanitation system, particularly in tropical conditions, treatment ponds may cause nuisance of stench and mosquito's and may become a health hazard if not properly managed. The prevailing wind directions (NW and SW) would also not favour open air treatment.

5.4 Roads

Despite substantial urban growth in the Gampaha district and increasing volumes of traffic on its roads, the road network in the area has not kept pace with development. Muthurajawela should be considered as an area where roads can be constructed to serve a wider region, i.e. for:

- improving South-North access, e.g. between Colombo and Negombo and beyond,
- improving East - West access, in particular to connect the hinterland with Muthurajawela and the coast and vice versa.

The present South-North running Colombo-Negombo road does hardly meet any more the requirements of an inter-regional highway. Development along its sides and the growth of the urban centres along its route are severely reducing traffic flow and capacity. Apart from economic losses incurred by increasing volumes of cargo traffic, for safety and environmental reasons it is urgently required to relieve this road by the construction of a bypass facility. The present road can not further be widened and improved and should only be retained as a district collector road with local access function. All longer destination traffic should be removed from this road as soon as possible.

JICO-sponsored experts carried out a feasibility study for a new highway between Colombo and the Katunayake airport[8]. A recommended alignment of this Expressway to the east of the present road has now been accepted by the Government. However, it is unlikely that funds be obtained for its construction in the short term. The Expressway has been designed as a dual carriageway facility and includes expensive marsh and river crossings. Most of the required land must be purchased from private owners. Present and near future traffic volumes do not warrant the construction of such high capacity facility and it would be appropriate to investigate more modest alternative solutions for, say the next 10 to 15 years.

Muthurajawela offers flat unoccupied land, efficient for road construction, and most of the marsh is Government owned land. A bypass road, developed alongside the Dutch Canal, or constructed on its bed, would provide a new link between Wattala and Seeduwa (see Figure B.6). At Wattala this bypass road could be made to cross the existing Negombo Road and be aligned to coincide with the southern section of the Expressway at Peliyagoda.

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8) The Feasibility Study on Colombo - Katanayake Expressway and New Port Access Road Construction Project, Japan International Cooperation Agency, 1984.

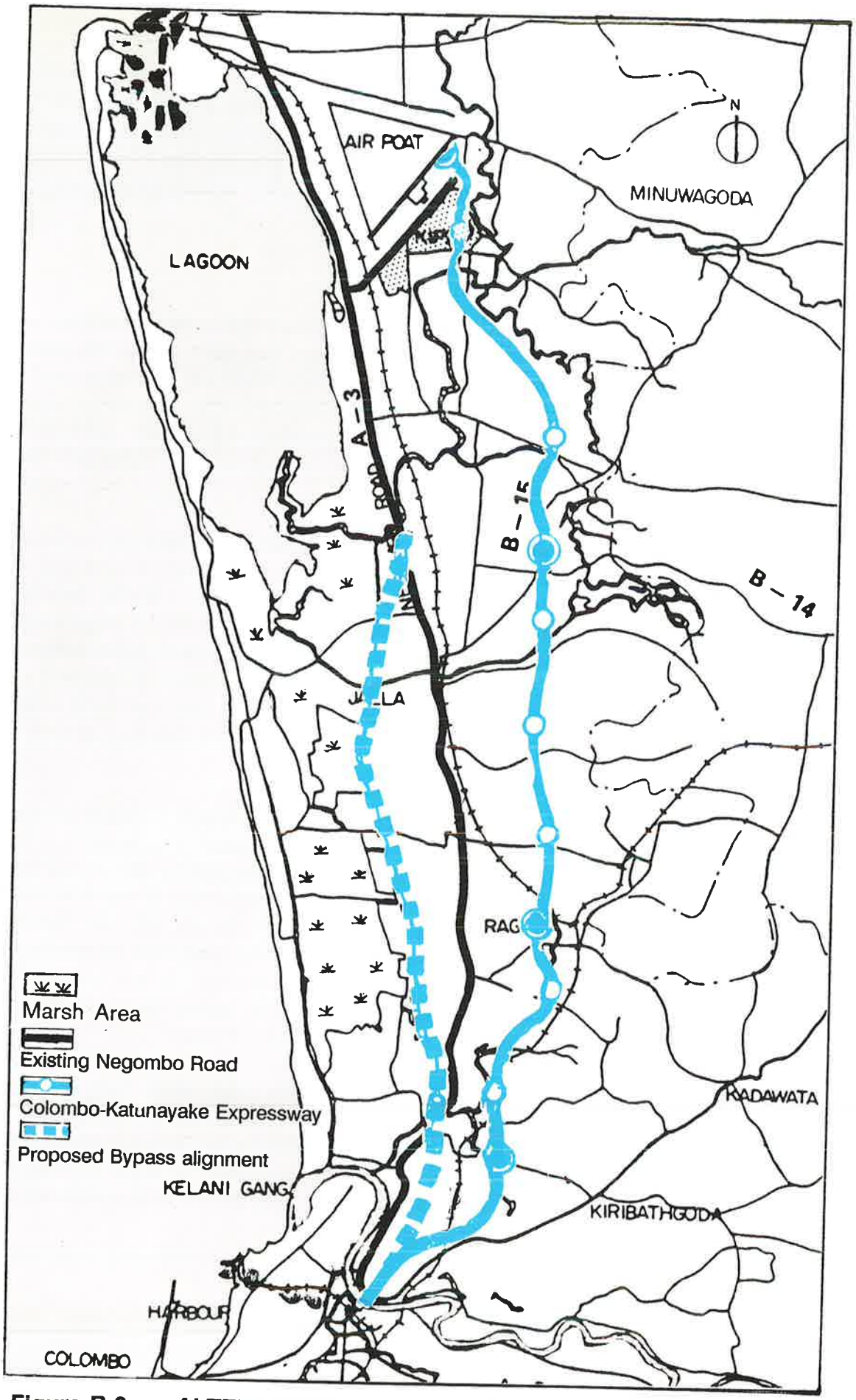

Figure B.6 **ALTERNATIVE COLOMBO-KATUNAYAKE BYPASS ROAD**

Of the existing Negombo Road the section between Seeduwa and the airport junction can continue to serve its present function. It is straight and much wider than all other parts of the road and carries less traffic than the other sections. Only the road section between Wattala and the Kelani river crossings will remain a bottleneck and needs further consideration to improve its traffic capacity.

Contrary to common belief, a highway does not necessarily conflict with nature conservation and could instead help to control access and encroachment. Provided such a road is built on an embankment with drains alongside and grade separated road crossings and intersections, it acts as a strong and effective barrier, while wildlife has in similar situations been observed to become rapidly accustomed to traffic, without undue disturbance of habitat and behaviour.

Improvement of East - West road connections would help (1) to make the coast more accessible for recreation for population in the hinterland, (2) to facilitate transport of local produce such as sea fish to the Colombo market, and (3) to make the areas to be reclaimed in Muthurajawela better accessible and hence more attractive for investment and development.

5.5 Solid waste disposal

At present Muthurajawela marsh is considered by many people as waste land evidenced by frequent dumping of household and industrial waste in the area. It is evident that in the interest of nature conservation this practice has to be stopped immediately. However, it could be considered to use solid waste as a fill for land reclamation. Provided such a disposal area is adequately isolated from the rest of the marsh and the composition of the solid waste is strictly controlled to exclude toxic substances, waste disposal may offer a slow but cheap method of land filling. Settling of the soil would take a long time and the ultimate bearing capacity would be low and, unless the waste would be finally be covered with a sufficiently thick top layer of coarse material, such a disposal site could eventually only be used for agriculture, landscaping and similar uses (e.g. parks, sport fields, golf courses).

For other regional utilities such as electricity and telephone Muthurajawela will benefit from close access to existing trunk facilities in Gampaha District while the large amount of available State land in the marsh could offer sites for future plant such as telephone exchanges and electricity sub-stations.

6 AGRICULTURE

6.1 General

Due to salinity, acidity and low natural fertility of the predominant peat soils, the marsh is unsuitable for cultivation of all but a very few crops such as some leafy vegetables as gotukola. Although there is evidence that rice has been cultivated in the marsh proper in the past, there are no records of yield and quality. It is possible that lower salinity levels and thin top layers of silt may have made the conditions for rice growing somewhat more agreeable. The later construction of drainage facilities have

likely accelerated soil erosion and has certainly caused soil subsidence and the rise of salinity levels in the marsh.

The most successful agricultural activity reported is coconut growing on reclaimed and raised plots. Also bananas and some vegetables are cultivated on reclaimed land on a small scale. On the naturally higher ground around the marsh, coconut plantations are extensive. Coconuts growing is in a few instances also undertaken by investors who pay for the excavation of peat soil and sand and for the coconut seedlings. The latest plantations now use the more expensive hybrid varieties of coconut, implying a significant investment and anticipation of substantial yields.

Small-scale livestock raising is widespread on the edges of the marsh, including pigs, some cattle, and a lot of fowl. There is limited pasturing of water buffalo in the marsh. (Fishing is treated separately in Section 7, below.)

Marsh inhabitants make use of various natural products of the marsh ecosystem, including reeds and sedges for making mats and baskets, tree branches for brush-pile fishing, wood for houses and boats, grasses for feeding livestock, etc. These are generally traditional sorts of activities.

6.2 Environmental guidelines

- Environmental considerations for agricultural production have mostly to do with the use of agricultural chemicals, which appears to be very limited in the area now. However, care should be taken with the increased application of fertilizers in the future, particularly in the areas east of the marsh which higher lands naturally drain towards the marsh.

- Landfill and reclamation for cultivation or homesteading purposes should discontinue and no longer be allowed in areas to be set aside for strict marsh conservation.

6.3 Economic aspects

The exploitation of natural vegetation of the marsh, primarily reeds and sedges for mat making, baskets etc. as well as for indigenous fish traps is a source of income for some marsh dwellers. In some places, green grass is cut and carried to confined livestock, primarily cattle, around the edge of the marsh. This sort of economic activity based on harvesting of the indigenous resources is generally a part of the survival strategy of the marsh inhabitants, but the activities in themselves give very low returns and cannot be considered an economic basis for any kind of development.

Paddy cultivation is uneconomical in the marsh area except in a few small areas that have suitable soils and elevations and secure water supply. Even in these areas, the land could probably be used more profitably, because paddy yields are low here compared to other areas of the country.

Coconut production is profitable under certain circumstances. The Coconut Development Board has stated that yields from coconut trees in the marsh area are higher than national average yields for plantations, despite the fact that coconuts are known to require good drainage. It may be that statistics reflect the higher yields associated with coconut planted in homesteads on high ground rather than those grown in the marsh proper.

There is demand for land for cultivation of coconuts and recently 75 local landowners have requested the Commissioner of Agrarian Services to withdraw their land from the list of lands officially designated as paddy land and to permit them to grow coconuts.

Production of vegetables, particularly leafy greens, is a source of cash income.

Raising waterfowl, particularly ducks, for the export market, has been suggested by Taiwanese experts, but both technical and economic feasibility are yet unknown.

Specialty products, including lotus roots, can easily be marketed, but production (as opposed to the gathering of wild roots) possibilities have not been investigated

The proximity of Colombo means that there is a clear demand for food products and for locally preferred specialty crops such as gotukola. Coconuts are currently brought into Colombo from further inland. Presumably any surplus production from the marsh area could be easily absorbed by the urban market.

The sea port and airport are also at close distance that if any export crops were identified (e.g. pot plants and flowers), intermediate transport costs would be low.

6.4 Planning considerations

- In view of marginal social and economic returns, the marsh, with or without drainage improvement, should no longer be considered for investment for the cultivation of paddy or any other crops.

- Instruct the Commissioner of Agrarian Services to allow any land in the Planning Area that is still designated as paddy land to be used for cultivation of other crops, consistent with the zoning regulations of the Master Plan.

- Encourage higher-value productions (e.g. leafy vegetables, honey, cut flowers, ducks) if they can be shown to be profitable and provide the necessary technical and financial support.

7 FISHERIES

7.1 General

The findings of the Environmental Profile studies make it very clear that the natural productivity of the Negombo Lagoon is exceptionally high. This productivity is dependent upon the continued functioning of the rather complex hydrological system resulting from the interaction of the rivers, the marsh, the lagoon itself and the ocean. The brackish mixture of salt and fresh water provides the proper environment for various organisms that make up the food chain and provide the habitat for commercially important fish and shrimp species.

An important part of the ocean catch (fish and shrimp) is also dependent upon the productivity of the lagoon, because many species spend a portion of their life-cycle in the lagoon. (eg: shrimp breed outside the lagoon, but the tiny hatched shrimp are carried into the lagoon by water currents. They grow to a certain size in the lagoon, but migrate out again as maturing individuals and complete the breeding cycle in the ocean). Both for reasons of maintaining proper salinity within the lagoon and for actual movement of fish and shrimp, the hydrological link between the ocean and the lagoon must not be disrupted.

In comparison with the catch from the lagoon, the commercial fish yield of the waterways in the marsh is negligible and has no potential for development.

The CEA suggests that deep sea fisheries, so far an undeveloped national resource, should be developed in Sri Lanka[9]. Considering the available fisheries expertise, manpower and facilities in Muthurajawela and Negombo, as well as the proximity of Colombo and the harbour (for export), the area may offer, somewhere along its coast, a good location for a deep sea fishing port.

7.2 Environmental guidelines

The lagoon and (at least) the northernmost part of the marsh should be protected from pollution and from over-exploitation of the natural resources on which the productivity depends. This includes protection of seagrass beds from destructive fishing practices (push-nets) and limits on cutting of mangroves. Mangroves are easily encouraged to grow (as shown by the land-reclamation activities at the mouth of the lagoon) and if mangrove brush is needed for the construction of brush-pile fisheries, then small groves should be planted for that purpose, and the wild growth left undisturbed.

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9) National Conservation Strategy - Draft Action Plan, Central Environmental Authority, 1990. The report states (page 2-3): "Fish stocks on the floor of the continental shelf and in deep waters are not being adequately exploited at the present time. Exploitation of these stocks will contribute to conservation of coastal stocks by reducing pressure on them." And further recommends, among other actions: "Develop gear and craft suitable for exploitation of identified stocks."

At least 133 different fish species inhabit Negombo Lagoon, more than half of which are marine species that move from the sea to feed or spawn. Some of these move into the canals and the marsh, including a number with economic importance (mullets, sea bream, snappers and groupers). Twenty one species of fish were found in Muthurajawela Marsh in a relatively short survey period.

7.3 Economic apects

The value of the annual catch of fish and shrimp from the Negombo Lagoon is estimated at roughly Rs 100 million. Off-take levels of fish and shrimp in the lagoon have been high, and the catch of larger individuals has dropped severely. Fishermen are now catching smaller fish (largely sold for export as tropical fish for aquaria and for aquaculture) and smaller shrimp (reducing the catch of larger, older shrimp in the sea). Current catch levels are economically still very interesting. They appear to be sustainable provided that (1) the habitat is not destroyed further by the use of push nets and (2) larger mesh size nets are used to avoid the offtake of undersize fish and shrimp.

The value of the sea catch that is directly related to the Negombo Lagoon is very difficult to estimate. An estimated 40% of the shrimp caught offshore in the region spends part of its life-cycle in the lagoon.

The possibilities for improving upon the commercially important productivity of the lagoon are most closely related to long term management to keep the production sustainable. It is possible to improve upon traditional brush-pile fishery techniques slightly, and it will be necessary to limit the catch overall.

Fish is an important source of animal protein for Sri Lankan people and the urban centers offer strong demand for fish and shrimp.

7.4 Planning considerations

- Preserve the productivity of the lagoon-marsh by:
  - protection of the sea-grass beds,
  - protection of the remaining mangroves,
  - control of water pollution
  - keeping the mouth of the lagoon open.

- Limit the size of fish and shrimp caught.

- Allow the brush-pile fishing but prohibit the use of push-nets.

- Develop a fisheries management plan.

- Investigate opportunities for development of deep sea fishing in the area.

8 AQUACULTURE

8.1 General

Aquaculture seems like an ideal activity for the marsh inhabitants, but unfortunately, the technical limitations are so severe, that with present technologies aquaculture is barely feasible, and not economically viable. The major constraint is the acid peat bog soils of the marsh. These soils influence the water, making it too acid to support fish. Although the soil directly under an aquaculture pond can be de-acidified, the risk is that rainfall and high water conditions will bring excess runoff water into the aquaculture ponds, and this water is often acid enough to kill the fish. This has been the experience in a number of aquaculture enterprises so far.

Under the currently available technologies, aquaculture is not economically viable in the marsh. Consideration would also necessarily be given to Buddhist religious sentiments on raising animals in captivity for food.

9 FORESTRY

9.1 General

The marsh itself is not a likely site for forestry activities of any important scale. The Forestry Department has suggested plantings along the sea coast as part of dune stabilisation programmes and social forestry programmes inland (on the higher ground). Both are potentially good ideas and could be investigated.

The exception is the mangroves. Mangroves are not generally planted, but if brush-pile material is in short supply and wild mangroves are threatened, the fishing communities could be encouraged to plant mangrove seedlings. It would be a small-scale activity, and part of the fishing management programme of the lagoon and marsh.

9.2 Planning considerations

Dune stabilisation plantings could be part of a coast protection effort. The coastal protection plan should be developed in any case, by the appropriate authorities.

Social forestry programmes could be promoted in areas of rural settlement in the marsh area on higher ground. These activities are not large enough in scale to be a significant part of land-use planning overall, but could be recommended as part of an agricultural extension programme for any areas to be zoned as agricultural or rural housing areas.

10 PEAT EXTRACTION

10.1 General

Several studies have been done as to the possibilities of extracting the peat in the marsh to use either as fuel or as soil ammendments of various kinds. The fuel potential is seriously constrained by the quality of the peat which is too low in energy value and too high in sulfur to be a good quality fuel.

Peat as a soil conditioner (for instance mixed with coconut coir dust and fertilisers) and sold as a potting material is technically feasible.

10.2 Environmental guidelines

Excavating large quantities of peat risks acidifying surrounding waters and generally disrupting the ecosystem functioning of the marsh. It should only be attempted in areas where the marsh is to be filled or otherwise developed, not in areas preserved as natural ecosystem.

10.3 Economic aspects

There is clearly an international market for soil ammendments and potting soil for horticultural production and for home gardening. One Sri Lankan company has successfully marketed to the Middle East and to Japan in the past. It is not clear how much such an enterprise can afford to pay for peat. It appears that the profitability of peat extraction for such purposes is a function of the purchase price of land from which the peat was extracted.

If it is determined that an area is destined for landfill, a study could be made as to whether a peat-using enterprise would find it profitable to extract the peat first, given that extracting peat would increase the amount of sand or other fill required.

10.4 Planning considerations

Peat extraction should only be allowed in areas that are zoned for purposes other than environmentally protected zones.

Bidding for peat extraction could be encouraged in combination with bidding for land fill. Enterprises operating within a free market should be able to determine whether the extracted peat is worth paying for.

PART C: INTEGRATED DEVELOPMENT PLANNING

1 INTRODUCTION

In Part B the various options for development were discussed and evaluated. They constitute, as it were, the "building blocks" for integrated planning, the subject of this part of the report. It aims at finding the answers to the following questions:

a. land supply and demand in Muthurajawela and Gampaha District,
b. the cost of land reclamation and development in Muthurajawela,
c. the amount of marshland to be designated for conservation and development.

2 LAND RESOURCES AND LAND DEMAND

2.1 Land availability and present use in the Study Area

The area defined as continuous wetland consists of the centrally located marsh and the lagoon, covering a total area of 6,737 ha or 63% of the Study Area (see Table C.1). The remainder of the Study Area consists of:

- The narrow coastal sand dune strip to the west **[C1 and C2]** and north **[N2]** is largely occupied by marine fisherfolk and homesteaders, mainly growing coconuts, and harbouring three beach hotels. The total strip measures 1,818 ha (17% of total area) and consists entirely of private land, some carrying very old land rights. The area is under pressure from coastal erosion, causing land loss and hinterland flooding. Already some fishing communities had to be relocated. Also seafront land is under pressure from demand for development of holiday homes by citizens of Colombo. Land for absorbing local population growth is in short supply.

  Hendala/Kerawalapitiya area **[R4]**, located between Kelani Ganga and the marsh is located on higher ground and is the largest populated part of the Study Area. It measures almost 641 ha and is mainly developed by homesteaders and for housing. The area is well provided with community facilities and services and includes a number of industries. Due to its proximity and good access to Colombo it is a popular residential area. It has some capacity for accomodating further growth by reclaiming yet undeveloped low-lying parts but intensification is restricted by planning regulations requiring plots in subdivisions to be no less than 13.5 perch in size.

  The eastern part of the Study Area, to the east of the Dutch Canal **[E1 to E4]**, consists of about 75% of higher land, most of which is
  occupied by homestead and residences. Along the border fronting onto the Negombo Road mixed development is found, including commercial and industrial activities. The lower sections of the area, measuring a total of over 600 ha, were defined as part of the marsh proper. In some small sections paddy is still being

Table C.1 – Planning units by area and broad land use characteristics

					Conversion factors:		2.47 acres = 1 ha 640 acres = 1 sq.mi.
STUDY AREA		sq.mi.	acres	hectares	percent of whole	hectares	percent of whole description
N1	Negombo Lagoon	12.80	8,192	3,317	31%		
N2	Mouth of Negombo Lagoon	1.25	800	324	3%	3,640	34% lagoon
M1	Northern Marsh	3.70	2,368	959	9%		
M2	Central Marsh	1.81	1,158	469	4%		
M3	Southern Marsh	3.99	2,554	1,034	10%	2,462	23% marsh west of Dutch canal
C1	North Coast	3.18	2,035	824	8%		
C2	South Coast	2.50	1,600	648	6%	1,472	14% sea coast and barrier dunes
E1	Lagoon East Shore (Katunayake)	1.15	736	298	3%		
E2a	Eastern Side (Ja-Ela) marshland	0.50	321	130	1%		
E2b	Eastern Side (Ja-Ela) highland	1.01	645	261	2%		
E3a	Eastern Side (Kandana) marshland	1.03	657	266	3%		
E3b	Eastern Side (Kandana) highland	1.27	815	330	3%		
E4a	Eastern Side (Wattala) marshland	0.84	538	218	2%		
E4b	Eastern Side (Wattala) highland	1.46	934	378	4%	1,881	18% marsh and highlands east of Dutch canal
R1	Residential – Delatura	0.30	192	78	1%		
R2	Residential – Pamunugama	1.67	1,069	433	4%		
R3	Residential – Uswetakeiyawa	0.30	192	78	1%		
R4	Residential – Hendala	2.30	1,472	596	6%	1,184	11% built up areas, mostly residential
	TOTAL	41.06	26,278	10,639	100%	10,639	100%
PLANNING AREA (marsh proper)							
R1	Residential – Delatura	0.30	192	78	1%	78	1% built up areas, mostly residential
M1	Northern Marsh	3.70	2,368	959	9%		
M2	Central Marsh	1.81	1,158	469	4%		
M3	Southern Marsh	3.99	2,554	1,034	10%	2,462	23% marsh west of Dutch canal
E2a	Eastern Side (Ja-Ela) marshland	0.50	321	130	1%		
E3a	Eastern Side (Kandana) marshland	1.03	657	266	3%		
E4a	Eastern Side (Wattala) marshland	0.84	538	218	2%	614	6% marsh east of Dutch canal
	TOTAL	12.17	7,789	3,153	30%	3,153	30%

grown. Given the recent population growth rates in areas such as Wattala, Kanadana and Ja Ela of about 5% per year, these lowlands are much under pressure for reclamation and residential development. All land in the area is privately owned and the current trade in land in the area is brisk.

The marsh proper measures 3,068 ha of which 2,608 ha or 85% is under marsh vegetation cover. The remaining area includes the somewhat higher ground in Dalatura and on the fringes of the marsh, being occupied by settlers since long. Other smaller pockets of the marsh have been converted into paddyfields and small plantations while others are occupied by illegal settlers. Almost the entire central part of the marsh **[M1, M2 and M3]** is government owned land.

2.2 The demand for land

A. General

Given the present conditions in Sri Lanka under which economic and financial systems operate the demand for land must be distinguished into two components: the demand for land for development purposes and the demand for investment in land as a hatch against inflation. The latter demand is pushing land values up considerably at present. Although there is no indication that this demand will diminish in the foreseeable future, care should be taken not to designate marsh areas and release government land for land uses which are not likely to prompt early development as this may upset programmes of regional development, notably of social and technical infrastructure.

Secondly, there is a **formal** and **informal** demand for land. Formal demand is reflected in land values, while informal demand is manifested by illegal occupation of public and private lands by squatters. The present occupation of the marsh by about 750 squatter families is a token of the informal demand for land by low income people. Similarly, many people have migrated in recent years from rural areas to the Colombo-Negombo corridor, attracted by new employment oppotunities, but these workers are reported to be poorly accommodated in sub-leased units, having no access to land or other housing in the area.

Furthermore, there is the **potential demand** for land, of which the value is likely to rise in view of its prospective conditions and location such as dry land level, good soil properties and access to utilities and services, as well as the future proximity to employment and service centres, transport facilities and recreational amenities. The intrinsic value of low-lying land, requiring expensive reclamation, is obviously much lower than land in similar context but on higher and firm land.

B. Current land prices

In Table C.2 current prices for urban land in and around the Study Area and in some Colombo suburbs are shown. Urban centres nearest to Colombo and the Negombo

Table C.2 – Prices for land in and around study area and suburbs of Colombo (Rupees per perch)

	COMMERCIAL				INDUSTRIAL		RESIDENTIAL				AVERAGE			
	primary		secondary				primary		secondary					
	high	low	high	low	high	low	high	low	high	low	commercial	industrial	resident.	all
study area														
Paliyagoda	150,000	150,000	100,000	75,000	100,000	75,000	35,000	25,000	20,000	15,000	118,750	87,500	23,750	74,500
Wattala-Mabole	200,000	150,000	100,000	75,000	50,000	40,000	40,000	30,000	30,000	20,000	131,250	45,000	30,000	73,500
Welisara	75,000	50,000	40,000	30,000	30,000	20,000	25,000	20,000	20,000	10,000	48,750	25,000	18,750	32,000
Kandana	175,000	125,000	60,000	50,000	25,000	20,000	40,000	25,000	20,000	10,000	102,500	22,500	23,750	55,000
Ja-Ela	175,000	125,000	60,000	50,000	30,000	20,000	40,000	30,000	15,000	10,000	102,500	25,000	23,750	55,500
Seeduwa	75,000	50,000	50,000	40,000	30,000	20,000	25,000	20,000	15,000	10,000	53,750	25,000	17,500	33,500
Negombo	250,000	200,000	100,000	75,000	40,000	30,000	60,000	50,000	35,000	25,000	156,250	35,000	42,500	86,500
Mattumagala	-	-	40,000	30,000	30,000	20,000	25,000	20,000	15,000	10,000	17,500	25,000	17,500	19,000
Nugape	30,000	25,000	25,000	20,000	15,000	10,000	15,000	10,000	10,000	5,000	25,000	12,500	10,000	16,500
Bopitiya	40,000	30,000	25,000	20,000	15,000	10,000	25,000	15,000	10,000	5,000	28,750	12,500	13,750	19,500
Ekala	55,000	40,000	50,000	30,000	30,000	20,000	25,000	20,000	15,000	7,500	43,750	25,000	16,875	29,250
Horape	17,500	15,000	15,000	10,000	10,000	8,000	10,000	8,000	7,500	5,000	14,375	9,000	7,625	10,600
Ragama	125,000	100,000	80,000	60,000	25,000	15,000	30,000	25,000	20,000	15,000	91,250	20,000	22,500	49,500
Walpola	15,000	12,000	12,000	10,000	7,500	5,000	10,000	7,500	7,500	5,000	12,250	6,250	7,500	9,150
Gampaha	225,000	175,000	100,000	75,000	25,000	17,500	50,000	30,000	20,000	15,000	143,750	21,250	28,750	73,250
Minuwangoda	100,000	50,000	30,000	25,000	12,000	8,000	30,000	20,000	12,500	7,500	51,250	10,000	17,500	29,500
Kelaniya	75,000	60,000	50,000	40,000	25,000	20,000	30,000	25,000	20,000	15,000	56,250	22,500	22,500	36,000
Dalugama	100,000	75,000	50,000	40,000	20,000	15,000	30,000	25,000	20,000	15,000	66,250	17,500	22,500	39,000
Hendala	75,000	50,000	40,000	30,000	25,000	20,000	50,000	40,000	25,000	15,000	48,750	22,500	32,500	37,000
high	250,000	200,000	100,000	75,000	100,000	75,000	60,000	50,000	35,000	25,000	156,250	87,500	42,500	86,500
average	103,026	78,000	54,053	41,316	28,658	20,711	31,316	23,447	17,763	11,579	69,099	24,684	21,026	40,987
low	15,000	12,000	12,000	10,000	7,500	5,000	10,000	7,500	7,500	5,000	12,250	6,250	7,500	9,150
Colombo suburbs														
Kotte	200,000	150,000	125,000	100,000	75,000	50,000	100,000	75,000	60,000	50,000	143,750	62,500	71,250	98,500
Battaramulla	150,000	100,000	100,000	80,000	30,000	20,000	50,000	40,000	35,000	25,000	107,500	25,000	37,500	63,000
Kolonnawa	100,000	75,000	50,000	40,000	15,000	12,000	25,000	20,000	12,000	7,500	66,250	13,500	16,125	35,650
Kaduwela	75,000	60,000	40,000	30,000	15,000	10,000	20,000	15,000	10,000	7,500	51,250	12,500	13,125	28,250
Maharagama	225,000	175,000	80,000	60,000	30,000	20,000	40,000	30,000	30,000	20,000	135,000	25,000	30,000	71,000
Mt.Lavinia	250,000	225,000	100,000	75,000	50,000	40,000	60,000	40,000	35,000	25,000	162,500	45,000	40,000	90,000
high	250,000	225,000	125,000	100,000	75,000	50,000	100,000	75,000	60,000	50,000	162,500	62,500	71,250	98,500
average	166,667	130,833	82,500	64,167	35,833	25,333	49,167	36,667	30,333	22,500	111,042	30,583	34,667	64,400
low	75,000	60,000	40,000	30,000	15,000	10,000	20,000	15,000	10,000	7,500	51,250	12,500	13,125	28,250

source: Land Valuation Department and Urban Development Authority, April 1991

Road reflect their attractive location in the higher land prices such asWattala-Mabole, Hendala, Welisara, Kandana, Ja Ela and Seeduwa, as compared to localities in the marsh such as Bopitiya and Nugape, being only 50% to 25% of these values.

The Negombo Road is clearly attractive for commercial activities with prices ranging from Rs 100,000 - 200,000 per perch. Industrial land prices seem to reflect the attractiveness of proximity to Colombo and its harbour: Rs 40,000 - 100,000 in Wattala - Mabole and Paliyagoda respectively. Average land prices for primary and secondary residential land in Gampaha District range from Rs 12.000 - 60,000.

Local information suggests that in Muthurajawela the price for wetland and for drained land suitable for coconut cultivation range from Rs 600 - 900 per perch. The UDA estimates the current value of undeveloped land in the marsh at about Rs 2000 per perch and coconut lands in Gampaha hinterland at Rs 6,500 per perch.

C. Regional development aspects

Disregarding later minor modifications, the basis for regional development planning in the Western Province is contained in the CMR Regional Structure Plan of 1978 (see Figure C.1). The recommendations of the Plan with regard to the region's growth strategy, which have formally been adopted, call for the "development of suburban clusters outside the city's core area". These clusters were proposed in the north around Ragama, in the east at Homagama, and in the south at Panadura. In the north-east also growth centres are foreseen at Gampaha and Veyangoda. The choosen settlement pattern is closely related to the location of job opportunities.

New industrial areas are to be expanded at Ja Ela (Ekala) in the north and Ratmalana in the south. A distinction is made between suburban clusters (now called inner regions) and outer subregions. "The north-eastern inner region is at a strategic position on the railroad junction of the Puttalam line (northern) and the Main line (north-eastern). It is proposed to be the largest regional concentration outside the Colombo Urban Area proper with about 300,000 urban inhabitants by 2001. The north-eastern suburban cluster includes Ragama T.C., Kanadana T.C., Ja Ela U.C. and perhaps also Gampaha U.C., which will keep a rather autonomous position" (Technical Report, Vol. 1, page 133).

D. Land demand in Gamapaha District

According to the latest projections of UDA[1)], the population of the Gampaha Inner Region will grow in the next ten years from 684,000 in 1991 to 867,000 in 2001, an increase of 183,000 people. The Outer Region of the district will increase by 102,000 over the same period. The total district will reach the 2 million mark by about the year 2000.

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1) Urbanisation and Industrialisation - Planning guidelines for the development and conservation of Muthurajawela within a regional framework, UDA, 31 March 1991

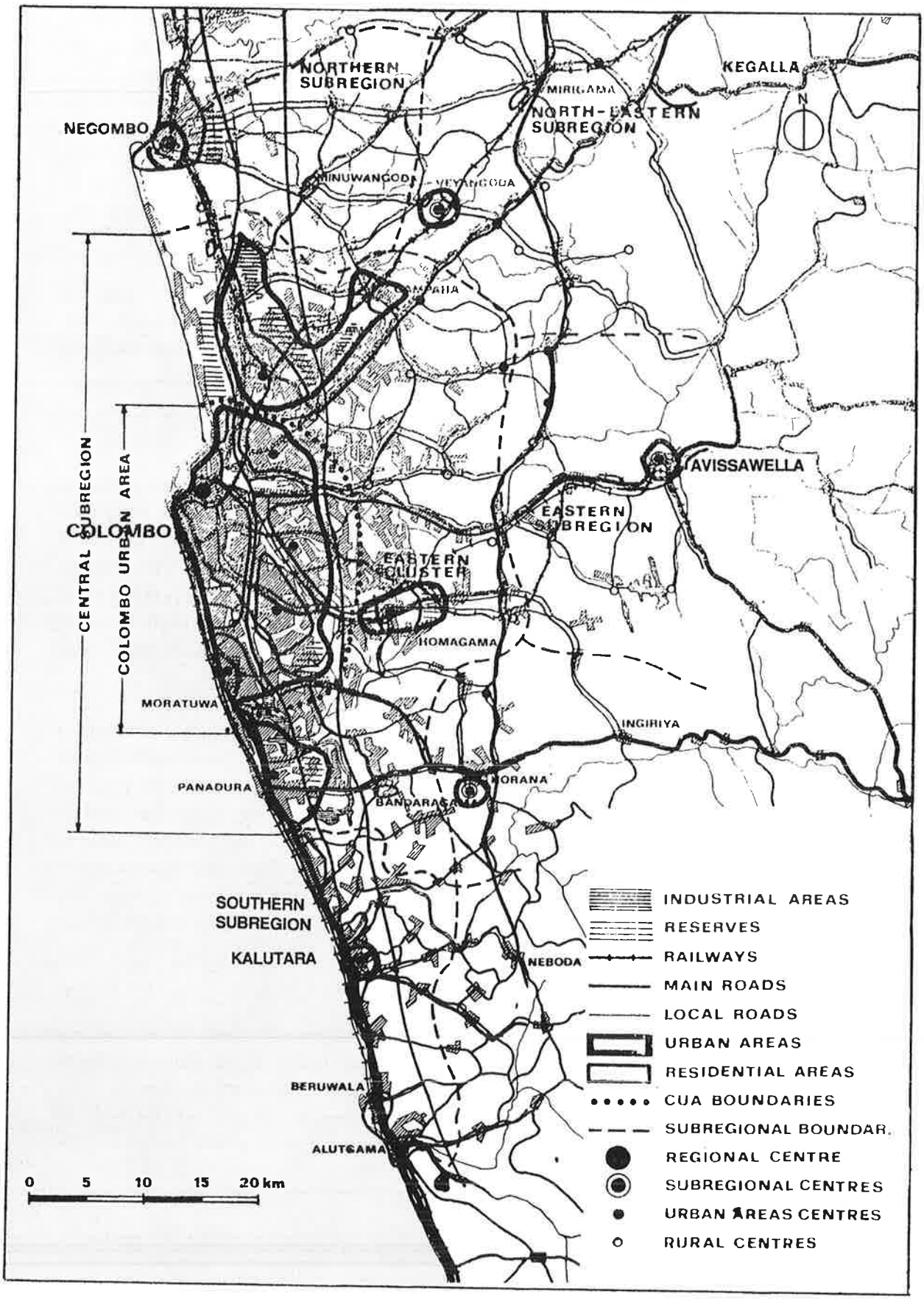

Figure C.1 COLOMBO M.R. - REGIONAL STRUCTURE PLAN

To assess the amount of land needed to absorb population growth, UDA has set desirable population densities which the authority can control to some extent by applying plot size standards in subdivisions. The gross densities set for the inner and outer region of Gampaha are 60 and 40 residents per hectare respectively. The resulting demand for land for settlement (both urban and rural) in the inner region by 2001 is about 1,350 ha, as shown below.

Gampaha Inner Region	Yr. 1991	2001
Population estimates	683,800	866,800
Population density (inh/ha)	52	60
Gross settlement area (ha)	13,100	14,450
Additional land required for settlement (ha)		1,350

The increase in gross settlement density will largely be effected by the increase in net residential densities. Plots are divided or houses added onto them to accommodate children and family, while also cultivated plots within residential areas are converted into urban land. An overall increase in settlement density by 15% requires roughly an increase of population density in the residential areas of around 25-30%. This may, given the relative short period of time of 10 year, be too optimistic. An overall increase of 10%, instead of 15%, would result in a demand for new additional settlement land of 2,450 ha, instead of 1,350 ha.

So, as demographic growth will largely be absorbed by intensification of residential areas, the need for land will mainly arise for the establishment of larger industries, community services (e.g. schools), the housing of in-migrants and for infrastructure such as new roads.

The above projection has no validity for areas already densely populated, for areas where strict density controls apply, and for areas which should not have been inhabited and from where population should be removed, i.c. the encroachments in the Muthurajawela marsh. Settlements along the coast and villages in the marsh such as Bopitiya and Delatura should preferably, for environmental reasons, not further be expanded. Other locations in the district should be made available for such resettlement and accommodation of local growth in these areas.

E. Land demand in the Study Area

The Study Area had in the period 1981-1989 a higher population growth rate (2.3%) than the estimated average of Gampaha District (1.7%). If this growth rate were to continue over the next ten years the Study Area's population would increase by around 79,000, as shown in the table below. The areas now used for habitation (excluding lagoon and undeveloped marsh) amount to 4842 ha. Average population density in these areas is 45 inh./ha, a little below the Gampaha average of 52 inhabitants/ha.

Table C.4 – Cost estimates of land reclamation

Conversion factors:	*40 Rupees = 1 $US*		*2.47 acres = 1 hectare*			*640 acres = 1 sq.mile*				
	160 perches = 1 acre		*10,000 sq.meter= 1 hectare*			*272.77 sq.feet = 1 perch*				
Source of estimate	depth of fill, in feet	area basis	UNIT COSTS			PROJECT COSTS			foreign exchange	
			$US/acre	$US/ha	Rs./perch	acres	$US million	Rs.million	%	$US million
Estimates of land–fill costs										
SLLRDC: hydraulic fill, commercial estimate	10	200 ac.	75,000	185,250	18,750	200	15.0	600.0	80%	12.0
for Muthurajawela; includes sandfill	10	300 ac.	67,000	165,490	16,750	414	27.7	1,109.5	80%	22.2
up to +2.0m. msl, drainage system &	10	500 ac.	62,000	153,140	15,500	319	21.4	854.9	80%	17.1
main access to filled area (culvert across	10	1000 ac.	60,000	148,200	15,000	542	33.6	1,344.2	80%	26.9
primary drain) estimate dated 15 Feb. 1991	10	1500 ac.	60,000	148,200	15,000	1,275	76.5	3,060.0	80%	61.2
SLLRDC, estimate: small–scale landfill with locally available gravel, fill only, 1991	10	10 ac.	56,000	138,320	14,000	10	0.6	22.4	0%	
SLLRDC, revised cost: Bloemendhal North Colombo, Sri Lanka Ports Authority, 1991	10–15	16 ac.	68,672	169,620	17,168	16	1.1	44.0	0%	
NHDA contract to private firm, outside of Colombo at Kadol Kale, loose earth, 1988	3	8 ac.	41,359	102,157	10,340	8	0.3	13.2	0%	
ACE landfill, private contractor, 1990	8–10	68 ac.	19,639	48,509	4,910	68	1.3	53.4	0%	
UDA, private contractors, Peliyagoda	5	250 ac.	18,000	44,460	4,500	105	1.9	75.6	0%	

Attempts were made to obtain prices and unit cost for various infrastructure works in order to make an estimate of the cost of land servicing for urban development of an area of around 400 acre, required for feasible hydraulic landfill. The estimate obtained varied widely and range from Rs 7,500 - 12,000 per perch not including a sewerage system, provisions for external headworks and utility hook-ups, landscaping and works required to increase primary drainage capacity. It is estimated that the real cost of urban infrastructure for an area of 400 acre (162 ha) will not be less than Rs 15,000 - 20,000 per perch.

4 THE EXTENT OF CONSERVATION AND DEVELOPMENT

4.1 The minimum conservation option

The Environmental Profile has clearly indicated the important hydrological and ecological relationship between Negombo Lagoon and the northernmost part of the marsh **[M2]**. This part includes the delta's of the Dandugam Oya and Ja Ela. This part is severly subject to flooding and is hardly suitable for any type of land use, including agriculture. Although there is no proof that the lagoon and this delta area would not survive on their own if the remainder of the marsh were developed, the general opinion of all experts involved in this study was that the central section **[M2]** also should be included for conservation. It is believed to contain fairly deep peat layers making it unattractive for development anyhow. Therefore, the minimum area set aside for conservation covers the entire Negombo Lagoon and the planning units **[M1 and M2]**, shown on Figure C.2. This proposed minimum area for conservation would amount to around 5070 ha.

4.2 Maximum development option

Maximum development of Muthurajawela would allow development of the eastern fringes of the marsh **[E2a, E3a and E4a]** as well as the southern section **[M3]**. This option would provide an area for development of 1650 ha as well as 5070 ha for conservation.

4.3 The results of the "Muthurajawela Workshop"

To ensure a balanced decision making about the ultimate designation of the area it was considered an important part of the planning process to involve in the deliberation as many of the groups in society with an interest in the wetland. For this reason a planning workshop was held on 25 April 1991. A report on the proceedings and results of this workshop have been appendixed to this document.

The participants of the workshop were provided with background information on the ecological significance of the wetland and about development opportunities and constraints of the marsh as documented in the Environmental Profile and elaborated by the project team. Furthermore, two principle development options were presented, a maximum and a minimum development model, to be used by the participants as a reference for the formulation of the most desired option.

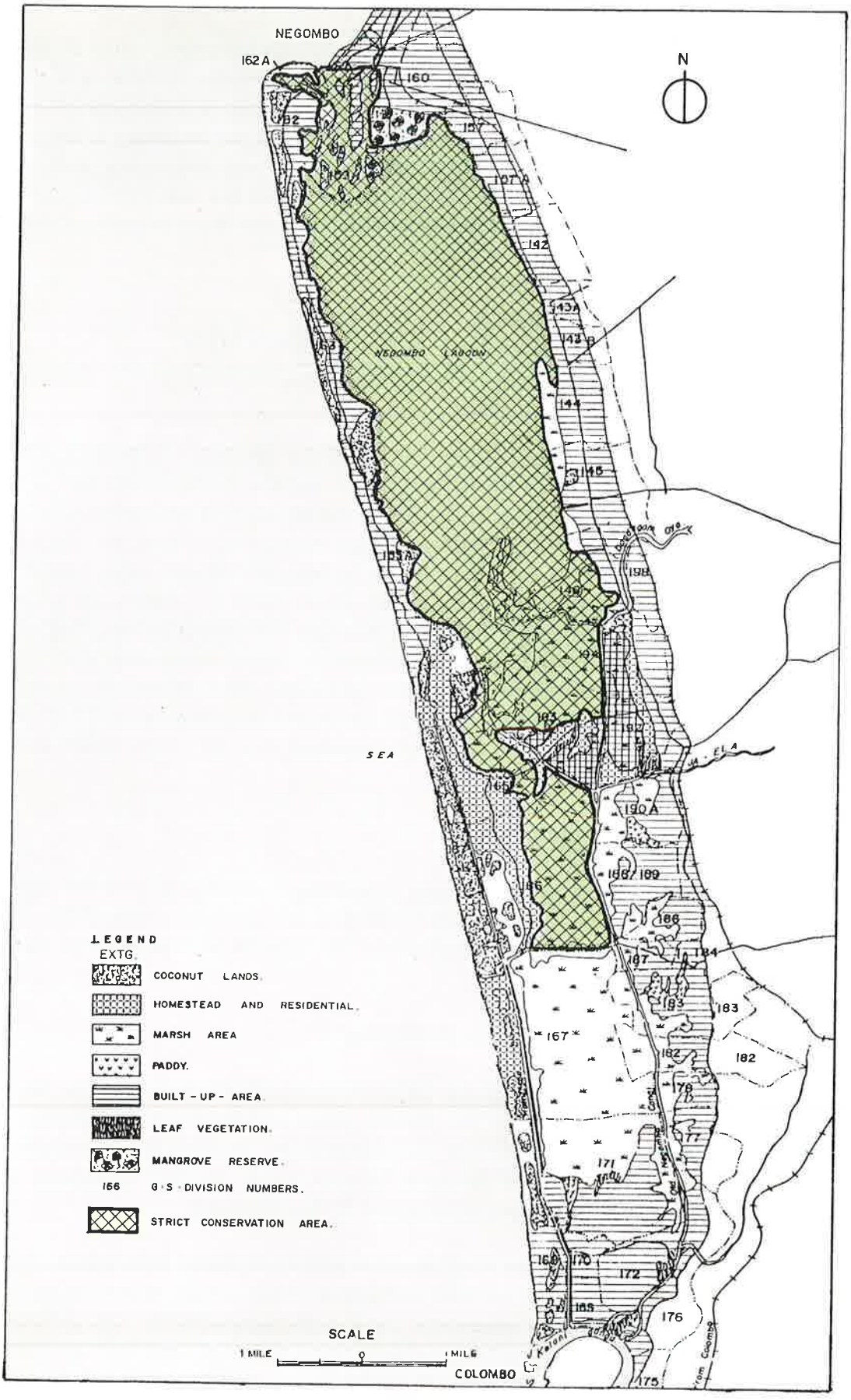

Figure C.2 MINIMUM CONSERVATION OPTION

The participants were divided in three groups and each group was requested to formulate its preferred development concept, clearly demarcating areas to be designated for conservation and other land uses.

The workshop was considered very successful, not in the least for the fact that the three groups showed a remarkable consensus in their recommended conservation and development strategy. The development model ultimately adopted and accepted in the concluding plenary session of the workshop is shown in Figure C.3.

It is worth noting that the agreement on the location and extent of areas designated for development in this model does not imply, in the opinion of most of the workshop participants, that these areas should be developed per se. Concern was expressed about the required scale of reclamation, as well as doubt about its technical and economic feasibility. Therefore, in the next and last part strategies are proposed for the management of conservation and development in the area.

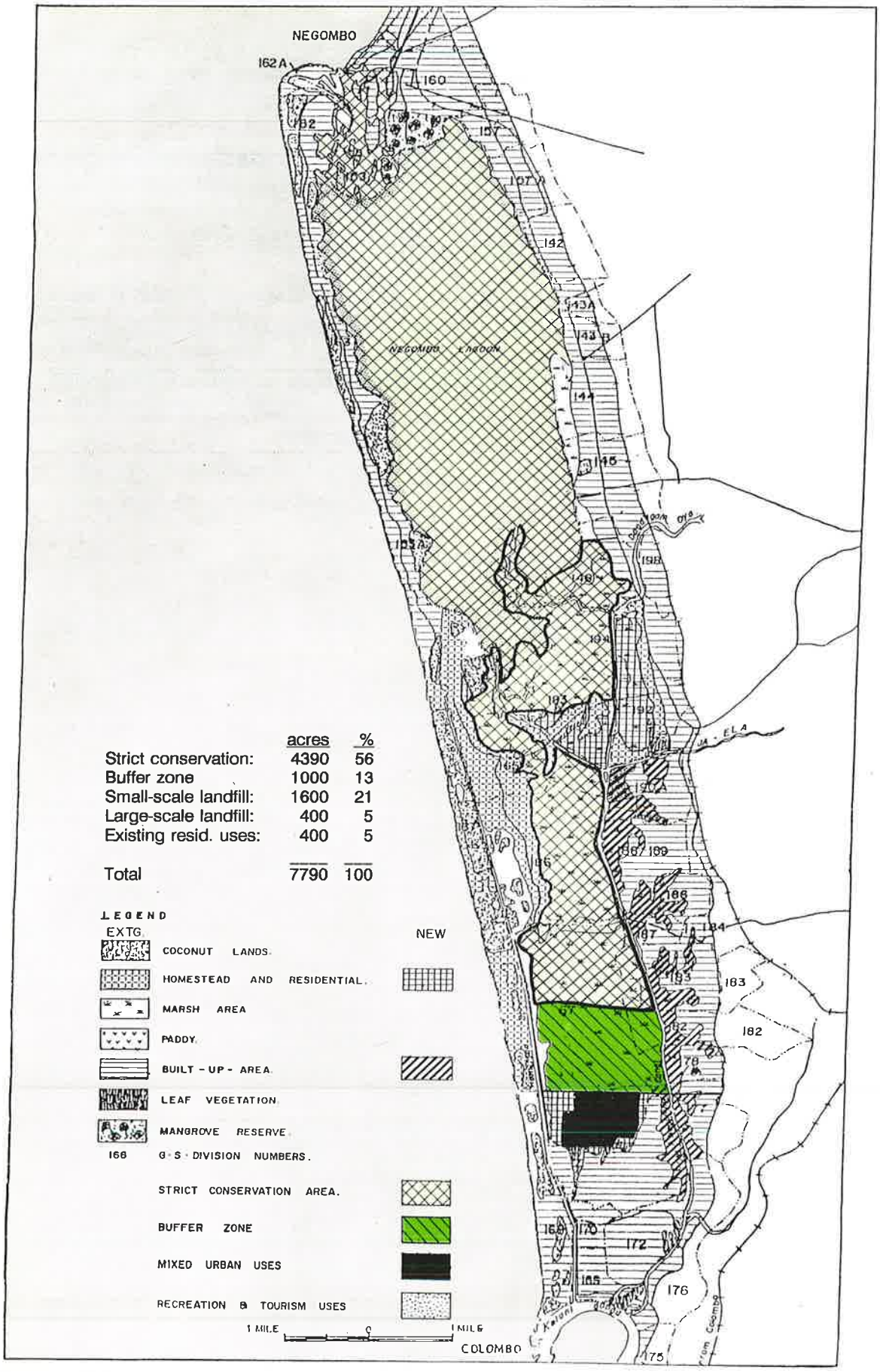

Figure C.3 PROPOSED CONSERVATION AND DEVELOPMENT MODEL

PART D: RECOMMENDED DEVELOPMENT AND MANAGEMENT STRATEGY

1 INTRODUCTION

In this final part of the report strategies are outlined to facilitate implementation of the Plan's recommendations regarding the actions required for active conservation and controlled development. With regard to land management it is important to adopt a land development strategy on the basis of which detailed development plans, programmes and controls can be made, as well as projects can be identified and formulated. This strategy, presented in Section 2, will form the basis on which local interests, the private sector and the government can cooperate together and support each other in the timely execution of the most desired development. To streamline the implementation process even further and to ensure that conservation and development interest are properly weighed in decision making, implementation management is proposed to be brought under single-handed control as discussed in Section 3. Finally, to ensure immediate action on the highest priority issues, a short-term action programme has been formulated as a terms of reference for the governing body to be instituted. This programme is presented in Section 4.

2 LAND DEVELOPMENT STRATEGY

2.1 The Muthurajawela Structure Plan

The recommended land conservation and development model for Muthurajawela, presented in Part C, meets already with the approval of representatives of the most important interest groups in society. Its status should further be formalized by its elaboration into a sub-regional structure plan, to be submitted for Government approval and gazetting as a statutory plan. The concept for this plan is presented in Figure D.1.

The Structure Plan is proposed to include the entire wetland, including Negombo Lagoon, and to be bounded by the sea in the west, by the Kelani River in the south and by the Colombo-Negombo road in the east. In the north, the boundary would follow the lagoon up to the mouth in such a way that sufficient shore land would be included in the Plan to allow inclusion of the mangrove forests for protection.

The area covered by the Plan includes several local administrative areas for which zoning plans already exist. Unless this study recommends different land uses in these areas, the provisions of these zoning plans are concurred and will continue to apply as indicated. For all other administrative areas detailed zoning plans should also be made in the future based on the designated, broadly defined land uses as shown on

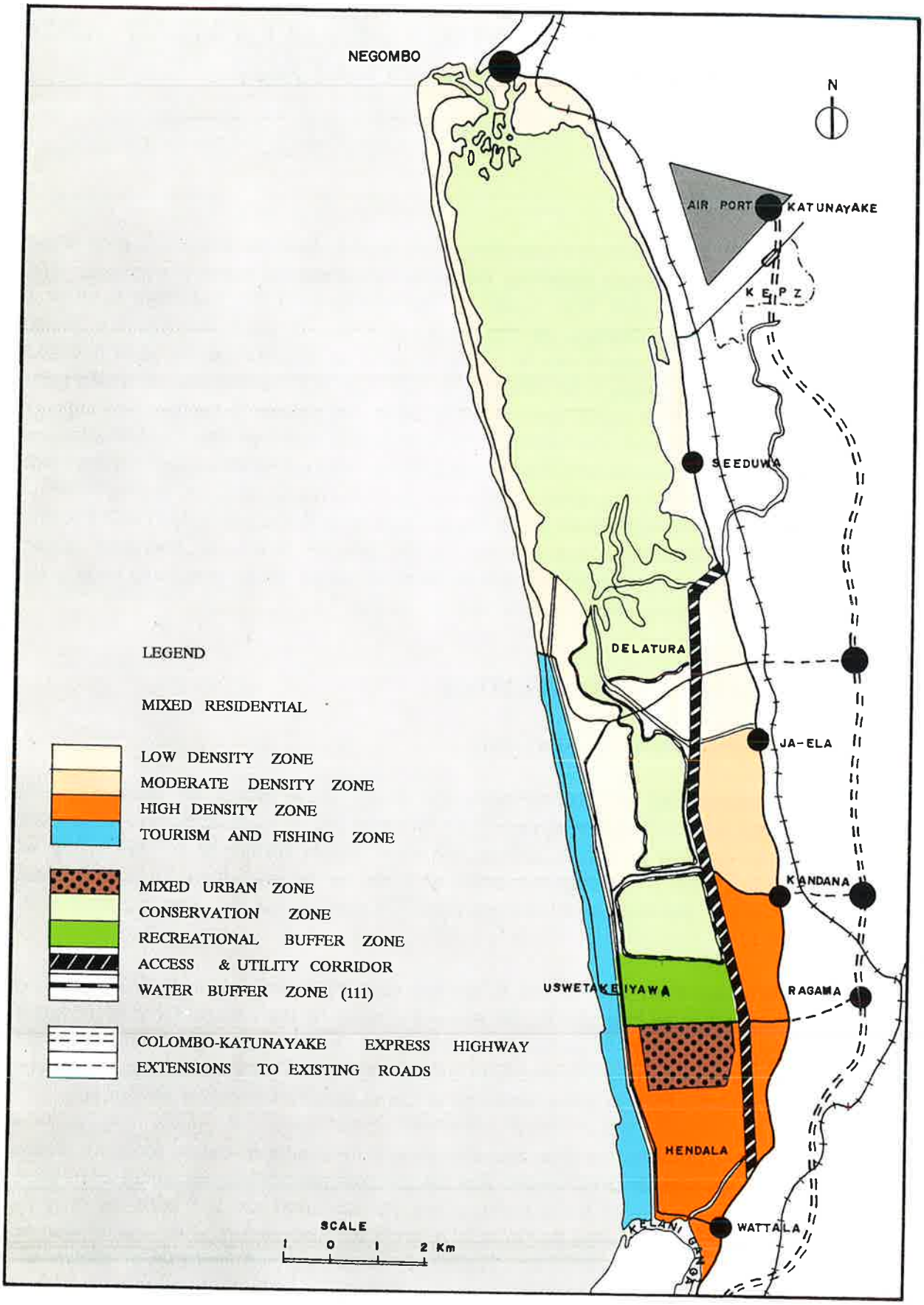

Figure D.1 MUTHURAJAWELA STRUCTURE PLAN CONCEPT

the Structure Plan. Under the provisions of available town and country planning legislation, it would also be possible, and sometimes desirable, to prepare detailed development plans or action plans for special project areas.

The main elements of the Plan which, if forthcoming and properly implemented, are determinants of the role the wetland could play in the future are the following:

- an area to be designated for conservation, preferably with sanctuary status, including the entire Negombo Lagoon **[N1 and N2]** and of Muthurajawela marsh the planning units **[M1, M2** and part of **M3]**,
- the units along the perihery of the marsh **[E1-E4, R1-R4, C1-C2]** zoned for mixed residential development with permissable uses of homesteading, fisheries, and tourism and recreation,
- an area of about 500 acres (202 ha) in **[M3]** of which 400 acre (162 ha) is permitted to be developed as for mixed urban purposes, including housing, industry and warehousing, and
- 3 types of buffer zones as follows:
  a. a buffer zone in **[M3]** in between the urban zone and the conservation area, permitted to be developed exclusively for low intensity and low environmental impact uses such as recreation, tourism and education,
  b. a reservation of 50 m on either side, and over the full length of, the Dutch Canal as a public utility and landscape corridor for the future possible siting of trunk facilities (water mains, trunk sewer, power lines, etc.) and of a road to serve access to the existing and future residential areas to the east of this corridor and with the possible additional function to relieve the existing Negombo Road.
  c. a protective water buffer along the boundary of the marsh to limit its accessibility and future encroachment.

2.2 Special development areas

The concept Structure Plan contains a number of areas with a special development focus. These include:

- mixed residential development in the areas east of the Dutch Canal,
- recreation and tourism development in the urban buffer zone, and
- a possible new fishing port near Dikowita.
- large scale (400 acre= 162 ha) urban development in Kerawalapitiya,

The areas east of the Dutch Canal are progressively being developed from the Negombo Road westward. All higher lands have largely been developed for homesteading and residential purposes and are relatively densily populated. At present, many of the low-lying parts are now being reclaimed and occupied both, by landowners and property developers.

Most of the small-scale development takes place unplanned and consequently the provision of infrastructure is deficient. However, the central location in the Colombo-Negombo corridor and the short access to transport and services provided on and along the Negombo Road makes these areas highly popular, reflected in rapidly

increasing land prices. Given the demand, in particular for housing in this corridor, development of the remaining low-lying parts of these areas for mixed residential development is considered appropriate.

The areas are zoned for mixed urban development with the exclusion of larger complexes of industry and warehousing. For these latter activities it is proposed to make land available in Kerawalapitiya (see Section 2.3 below). The present proliferation of container yards and warehousing all over the district should be stopped, for economic as well as environmental reasons.

As the demand for land increases in the direction of Colombo city, development density ratios for the different sections of these areas have been increased accordingly. Using plot size as the commonly used method of density control, in subdivisions the following ratios are proposed (minimum permissable plot size in perch):

Planning Unit:	Residential	Commercial	Industrial
[E1]	20 perch	10 perch	10 perch
[E2]	15	8	15
[E3]	15	8	15
[E4]	10	10	20

Except for public facilities such as schools, plot sizes for all other uses should not exceed 20 perch in size. Furthermore, "mixed residential" refers to the category of land use being use by the UDA in its zoning plans and the controls pertaining to this category are recommended to apply in the Structure Plan.

In Table D.1 land use budgets are shown for an area of 25 ha to be developed for mixed for high, medium and low density which could be used for planning of small-scale land reclamation projects. In Table D.2 an investment analysis is shown for the low density alternative, based on a number of price assumptions.

2.3 Kerawalapitiya Urban Development

Present land uses of the area are shown in Figure C.2. Given its southern location in the marsh at closest distance to Colombo and having developable land of considerable size, makes this area highly suitable for intensive mixed urban development. Moreover, the high cost of reclamation of this land necessitates concentrated and high value development.

As all of the land is State-owned the Government will play an important role in defining type and content of development and its ultimate realisation. For instance, the Government could sell the land to long-term investors who would probably hold on to the land until its value has raised to a level that provides a handsome return without actually realising any real estate.

Table D.1 – Suggested land use budget for a small-scale landfill area

LAND USE		DENSITY LOW	DENSITY MEDIUM	DENSITY HIGH
Gross area	ha	25	25	25
Roads & open space	%	15%	25%	35%
	ha	4	6	9
Community services	%	5%	8%	15%
(saleable)	ha	1	2	4
Net saleable res. area	%	80%	67%	50%
	ha	20	17	13
Size of plots	# perches	20	10	5
Number of plots	/acre	8	16	32
	/ha	20	40	79
	total	395	662	988
Size of household	res/house	5	5	5
Inhabitants	#	1,976	3,310	4,940
Population density	res/ha	79	132	198
Community services	%	5%	8%	15%
(saleable)	ha	1	2	4
Size of plots	# perches	15	15	15
Number of plots	/acre	11	11	11
	/ha	26	26	26
	total	33	53	99

BREAK-EVEN PRICES		DENSITY LOW	DENSITY MEDIUM	DENSITY HIGH
Development price I	Rs/perch	8,000	8,000	8,000
net area price	Rs/perch	10,000	11,940	16,000
lot price	Rs	200,000	119,403	80,000
Development price II	Rs/perch	12,000	12,000	12,000
net area price	Rs/perch	15,000	17,910	24,000
lot price	Rs	300,000	179,104	120,000
Development price III	Rs/perch	16,000	16,000	16,000
net area price	Rs/perch	20,000	23,881	32,000
lot price	Rs	400,000	238,806	160,000
Development price IV	Rs/perch	20,000	20,000	20,000
net area price	Rs/perch	25,000	29,851	40,000
lot price	Rs	500,000	298,507	200,000

Table D.2 – INVESTMENT ANALYSIS OF A SMALL–SCALE LANDFILL AREA (in 1,000,000 Rs.)

ASSUMPTIONS:			development time:			sales prices perch:	20,000	Rs/perch
area:	25	ha	landfill:	1	year		25,000	Rs/perch
landfill costs:	8,000	Rs/perch	settling &				30,000	Rs/perch
infrastructure costs:	10,000	Rs/perch	construct.	3	years	houses:	200,000	Rs/perch
			sales:	3	years	net benefit/house:	30,000	Rs/perch

		years								
COSTS	rates	1	2	3	4	5	6	7	8	9
landfill		79								
infrastructure			33	33	33					
TOTAL:		79	33	33	33	0	0	0	0	0
BENEFITS (land sales)										
low–density residences	80.0%									
sales price/perch	30,000	0	0	0	83	83	83	0	0	0
commercial services lots	5.0%									
lots	30,000	0	0	0	5	5	5	0	0	0
TOTAL:		0	0	0	88	88	88	0	0	0
NET BENEFIT (3 years development)		-79	-33	-33	55	88	88	0	0	0
IRR =		14.39%								
NET BENEFIT (2 years development)		-112	-33	55	88	88	0	0	0	0
IRR =		17.55%								
houses (net revenue)		0	0	0	12	12	12	0	0	0
NET BENEFIT (no houses, 3 yrs)		-79	-33	-33	43	76	76	0	0	0
IRR =		8.93%								

Figure D.2 EXISTING LAND USES IN THE SOUTHERN MARSH

A better alternative would be for the Government to enter into a joint venture with a consortium of investors, property developers and contractors. The Government would retain shares in the project, the revenues of which could be used for the provision of infrastructure and, for instance, subsidizing land for low income residential development. In any case, the land should not be sold off by the Government unless evidence is provided that the land is required for the purpose of short-term development.

The problem of the project is the large size of area that needs to be reclaimed at once in one contract. As stated before, the only practical method to reclaim land in the marsh is by hydraulic landfill with sea sand but this requires a large area to achieve the required economies of scale. A sudden additional supply of 400 acres of land could have an impact on the land market in the region and average land values may drop considerably.

Therefore, the justification of this project hinges to a large extent on its objectives. An important reason would be to create an urban district at close distance to the city as well as other nearby employment and service centres with good opportunities for planned, proper standard development, decent housing and direct access to employment opportunities in the same urban area, reducing travel distance. However, implementing such a project is a major management task and would require a highly professional and streamlined organisation.

The content of development will to a large extent be dependent on demand of land for the various urban land uses, notably for housing and industry. In Figure D.5 a suggestion is given of an urban development structure showing a network of canals and roads and three alternative land use patterns based on different proportions of residential and industrial development. The purpose of this excercise is to show that in the approach taken, land use allocation is flexible and could change according to future demand. After reclamation and construction of basic infrastructure, as shown in Figure D.3, the first stage development would contain the mixture of housing, industry and services, in proportions as the market would indicate (see Figure D.4). Once the area has demonstrated to become popular, either more for housing or industry, or both, indicated by the market in the appreciation of land values, development will follow suit. In Figure D.5 three alternative land use patterns are shown into which the area could develop depending on market demand.

In Table D.3 alternative land budgets are shown in which the following variables were used:

- different proportions of housing and industry
- different proportions between high and middle income residents
- different plot sizes.

For calculation of the areas required for roads, public services and open space uses, UDA standards for urban planning were used.

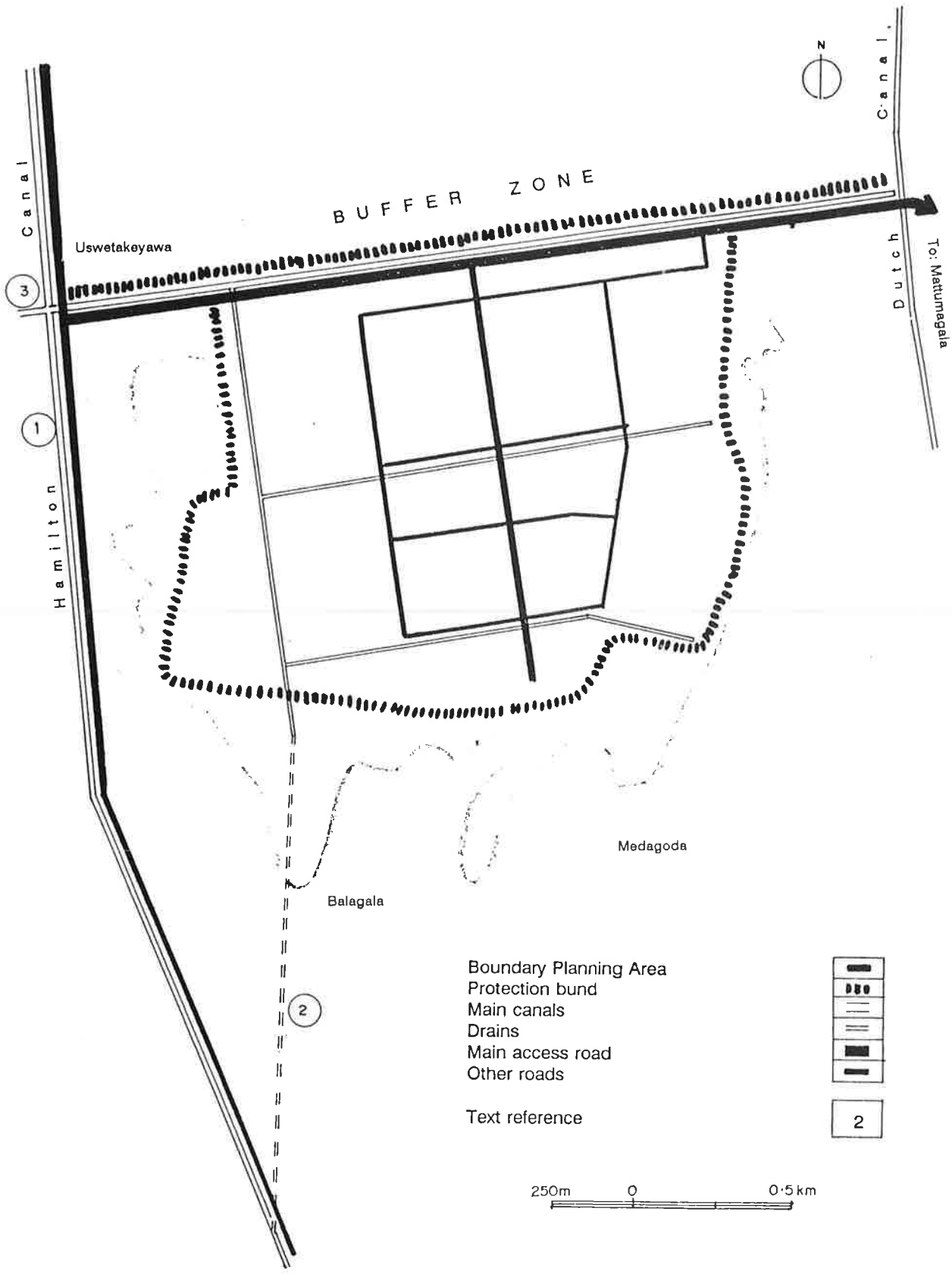

Figure D.3 KERAWALAPITIYA: PROPOSED BASIC INFRASTRUCTURE

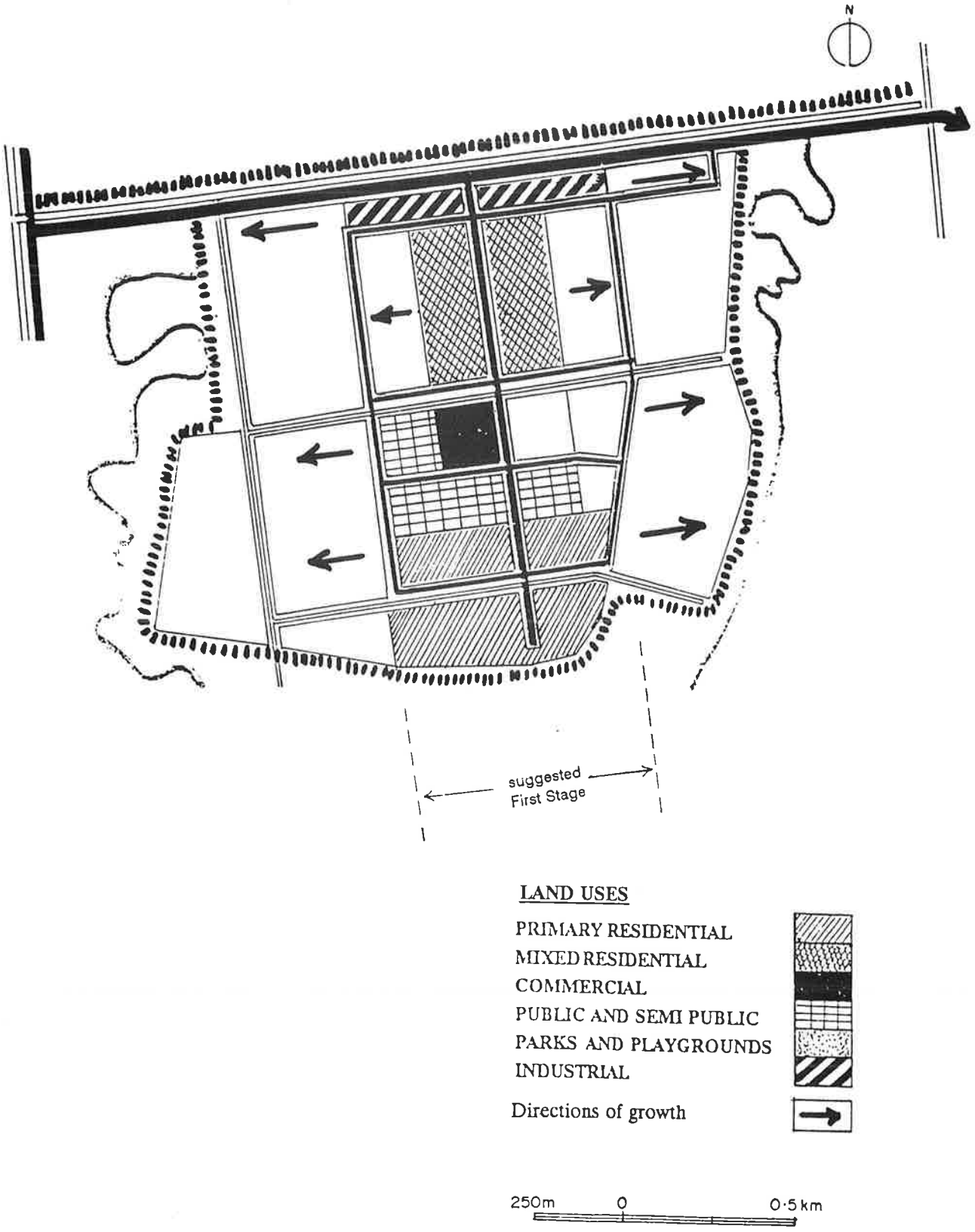

Figure D.4 KERAWALAPITIYA: STAGE 1 DEVELOPMENT

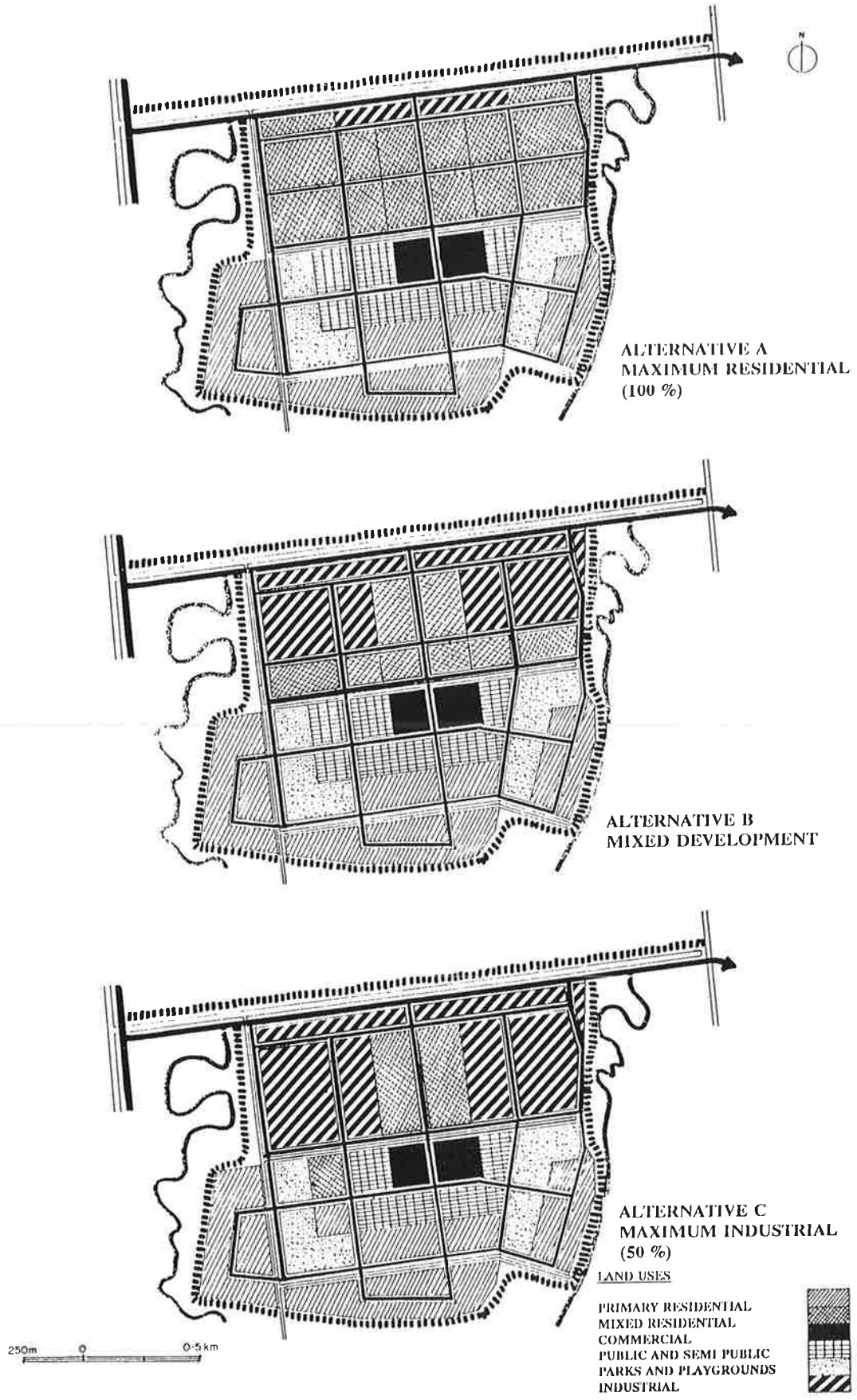

Figure D.5 KERAWALAPITIYA: ALTERNATIVE LAND USE MODELS

In Tables D.4A, D.4B and D.4C investment analyses of the Keralawapitiya development are shown for the three alternative land use budgets. As industries pay higher cost for land and require less, non-saleable land for roads and services, urban development with a high proportion of industry is economically more feasible. As no realistic cost figures could be obtained on the provision of infrastructure, the rates of return shown should be treated as indicative only.

3 MANAGEMENT AND ORGANISATION STRATEGY

3.1 Introduction

The Master Plan largely recommends a threefold strategy:

a. strict conservation of the northerly marshlands and Negombo Lagoon, jointly to be enacted as a "sanctuary",
b. socio-economic support and improvement of health conditions for the benefit of the local residents of Muthurajawela with particular attention for the (illegal) occupants of the marsh proper,
c. reclamation and development exclusively in the southern and eastern parts of the marsh.

In order to implement these objectives successfully, a new organisational structure is deemed necessary. At present, three levels of authority dealing with development planning and implementation can be identified:

- Central Government Agencies, including GCEC,
- District and local government agencies,
- Non-governmental organisations (e.g. MUPO, Church)

The Environmental Profile observed that there are insufficient coordination and conflicting targets pursued by the various agencies, which are not conducive to sound environmental management and to the sustained use of the natural resources in the area.

In this section basic organisational requirements are identified and recommendations made for a new organisation with sufficient power and expertise to ensure integrated planning, balanced decision making and sound environmental management.

3.2 Procedure and time frame

Organisation needs to be tailored to the tasks and requirements of each stage of the development process. Given the course of action set out for Muthurajawela so far, the following stages can be discerned:

- Development identification and strategy formulation (Master Plan),
- Project programming and feasibility assessment (Commitment Plan)
- Execution and monitoring (Implementation Plan).

Table D.3 Kerawalapitya: alternative land use budgets

Land use	lot size in perch	%	%	%	acre	inhab's	saleable acres	density inh./ac.
Alternative A:	**Max. residential – medium income 100% – small plots**							
residential		100			215			
– high income			0	0	0	0		
– medium income	6		100	54	215	20,048	150	93
industry		0		0	0		0	
services				19	75		60	
open space				13	50		10	
main roads				15	60		0	
Total		100	100	100	400	20,048	220	50
Alternative B:	**Mixed development – high–medium income: 75/25% – larger plots**							
residential		75			214			
– high income	13		75	40	160	7,704	125	48
– medium income	8		25	13	53	3,905	39	73
industry		25		13	53		43	
services				11	43		35	
open space				7	29		6	
main roads				15	60		0	
Total		100	100	100	400	11,609	248	29
Alternative C:	**Max. industry (50%) – medium income 100% – larger plot size**							
residential		50			174			
– high income	–		0	0	0	0	0	
– medium income	10		100	45	181	10,882	132	60
industry		50		22	87		70	
services				12	50		40	
open space				8	33		7	
main roads				15	60		0	
Total		100	100	103	400	10,882	248	27

1 acre = 0.4 ha

160 perch = 1 acre

Table D.4A – Kerawalapitya: Investment analysis (in million Rs.)

Alternative A.1

ASSUMPTIONS:			development time:		sales price	high-income resident.:	60,000	Rs/perch
area:	160	ha	landfill:	1 year		medium-income res.:	40,000	Rs/perch
hydraul. landfill costs:	16,000	Rs/perch	settling & infra-structure:	5 years		low-income resid.:	15,000	Rs/perch
infrastructure costs:	10,000	Rs/perch	sales:	5 years		local commercial:	150,000	Rs/perch
						public services:	40,000	Rs/perch
						industrial:	100,000	Rs/perch

COSTS	% of land	years 1	2	3	4	5	6	7	8	9
landfill		1,011								
infrastructure			126	126	126	126	126			
TOTAL:		1,011	126	126	126	126	126	0	0	0
BENEFITS (land sales)										
high-income residential	0.0%	0	0	0	0	0				
medium-income residential	37.5%	190	190	190	190	190				
low-income residential	0.0%				0	0	0			
local commercial	1.8%			35	35	35	35	35		
public services	15.5%				78	78	78	78	78	
industrial	0.0%		0	0	0	0	0			
TOTAL:	54.8%	190	190	224	302	302	113	113	78	0
NET BENEFIT (3 years development)		-822	63	98	176	176	-14	113	78	0
IRR =	-4.34%									

Table D.4B – Kerawalapitya: Investment analysis (in million Rs.) **Alternative B.1**

ASSUMPTIONS:			development time:		sales price			
area:	160	ha	landfill:	1 year		high-income resident.:	60,000	Rs/perch
hydraul. landfill costs:	16,000	Rs/perch	settling & infra-			medium-income res.:	35,000	Rs/perch
infrastructure costs:	15,000	Rs/perch	structure:	5 years		low-income resid.:	15,000	Rs/perch
			sales:	5 years		local commercial:	150,000	Rs/perch
						public services:	30,000	Rs/perch
						industrial:	100,000	Rs/perch

	% of	years								
COSTS	land	1	2	3	4	5	6	7	8	9
landfill		1,011								
infrastructure			190	190	190	190	190			
TOTAL:		1,011	190	190	190	190	190	0	0	0
BENEFITS (land sales)										
high-income residential	10.0%	76	76	76	76	76				
medium-income residential	28.0%		124	124	124	124	124			
low-income residential	0.0%				0	0	0			
local commercial	1.8%		35	35	35	35	35			
public services	10.3%				39	39	39	39	39	
industrial	10.3%		130	130	130	130	130			
TOTAL:	60.4%	76	364	364	403	403	328	39	39	0
NET BENEFIT (6 years development)		-935	175	175	214	214	138	39	39	0
IRR =	1.89%									

Table D.4C – Kerawalapitya: Investment analysis (in million Rs.)

Alternative C.1

ASSUMPTIONS:			development time:		sales price			
area:	160	ha	landfill:	1 year		high–income resident.:	60,000	Rs/perch
hydraul. landfill costs:	16,000	Rs/perch	settling & infra–structure:	5 years		medium–income res.:	30,000	Rs/perch
infrastructure costs:	15,000	Rs/perch	sales:	5 years		low–income resid.:	15,000	Rs/perch
						local commercial:	150,000	Rs/perch
						public services:	30,000	Rs/perch
						industrial:	120,000	Rs/perch

COSTS	% of land	years 1	2	3	4	5	6	7	8	9
landfill		1,011								
infrastructure			190	190	190	190	190			
TOTAL:		1,011	190	190	190	190	190	0	0	0
BENEFITS (land sales)										
high–income residential	0.0%	0	0	0	0	0				
medium–income residential	31.0%		118	118	118	118	118			
low–income residential	0.0%				0	0	0			
local commercial	1.8%		35	35	35	35	35			
public services	9.2%				35	35	35	35	35	
industrial	18.0%		273	273	273	273	273			
TOTAL:	60.0%	0	425	425	460	460	460	35	35	0
NET BENEFIT (6 years development)		−1,011	235	235	270	270	270	35	35	0
IRR =	9.67%									

This Muthurajawela Master Plan is a strategic plan, providing answers to the question "what part of the marsh to preserve and which part to develop".The Plan includes broad land use zoning but does not contain detailed development programmes. For construction projects these detailed programmes can only be formulated when market requirements become known over time. The environmental management programmes can only be executed when the conservation area has been legally instituted and responsible authorities nominated and properly equiped with budgets and staff. Consequently, feasibility analyses have to be prepared in Stage 2 after programmes and detailed designs have been prepared for specified construction and conservation project components.

The Muthurajawela Project design brief stipulated the future need for the preparation of Environmental Impact Assessments (EIAs) for major development projects. EIAs can only be prepared when suitable projects have been identified and designed in detail.

The three stages are anticipated to cover the following periods:

- Stage 1 - Master Planning : ending 1 June 1991
- Stage 2 - Programming and Feasibility Analysis : June 1991-1993
- Stage 3 - Implementation and Monitoring : 1994-onwards

3.3 Organisation strategy

It is of foremost importance for any future organisational structure to recognize the integrity of the wetland as a unified ecosystem. This should be reflected in the setup of a single governing body with full executive and controlling power and with responsibility for both management tasks: conservation and development. This body could have the following alternative modalities:

- form: a committee or a board,
- level: responsible to the President or a Minister, in which latter case the Minister of Policy Planning and Implementation is recommended,
- composition: government agencies, with possible addition of NGO's and representatives of the private sector,
- duration: temporary or permanent,
- tasks: policy setting and decision making,
  idem, including budget allocation and management
  idem, including executive powers and instruments.

When conservation management and development management are under single control, the ensuing executive and operational tasks could best be delegated to the existing, competent agencies as follows:

- conservation management: e.g. Wildlife Conservation Department
- socio-economic development: e.g. GA. Gampaha and AGA's with sectoral support from central government agencies
- reclamation & development: e.g. Urban Development Authority or a Muthurajawela Development Authority.

The Wildlife Conservation Department would be responsible for conservation management of the wetland sanctuary to be gazetted under the provisions of the Fauna and Flora Protection Ordinance (1937). It would carry out all required preparations, including consultations with other agencies such as the Ministry of Fisheries and Aquatic Resources and the Central Environment·Authority. The Department would prepare a long term, as well as annual programmes and budgets for approval by the governing body. The sanctuary would include Negombo Lagoon and the northern and central sections of the marsh.

The UDA or, alternatively, a specially instituted authority for Muthurajawela development would be mandated to manage all land development tasks in the areas of the marsh designated and approved for urban and recreational uses (See figure 1). It is recommended that any selected authority would enter into partnership with the private sector, at least for the purpose of investment support for large-scale landfill projects.

The development authority would also be entrusted the task of allocating and preparing land for local housing demand and in particular for the resettlement of the illegal occupants of the marsh. In this and other fields concerning the socio-economic support programme for the resident population of Muthurajawela the authority may be given additional tasks to assist local authorities, for instance, in executing drainage, watersupply, sanitation and public housing projects. It is recommended that this authority would effectively be established as a corporation and be permitted to handle its own budgets and to acquire and sell land.

In terms of staging, it is most important that a governing body would be established immediately after completion and approval of the Master Plan. Its most urgent tasks would be:

- the handling of development applications after the "building freeze" in Muthurajawela has terminated,
- to coordinate the preparation of enactment of the Muthurajawela-Negombo Lagoon Sanctuary and of a conservation management plan for the area,
- to establish mechanisms for the immediate stopping of further encroachment of the marsh,
- to prepare detailed development plans and cost estimates for priority land reclamation and development.
- to appraise Environmental Impact Assessments to be prepared for major projects proposed in the area.

In order to execute these tasks it is recommended that the governing body be provided with a small secretariat of technical and administrative staff.

The governing body has to remain in function as long as new development is in progress and development interests need to be weighed against conservation interests. But as the development potential of Muthurajawela has been restricted in the Master Plan to around 2300 acres (931 ha) of developable land, excluding possible development in the buffer zone of M3, the role of the governing body has a temporary nature and could eventually be taken over by the district and local authorities.

Nonetheless, its task is expected to last a minimum of 10 years. For such a mandate, a board would be a more appropriate organisational form than a committee.

With the completion of the Master Plan, the Steering Committee has finished its task and will cease to exist. A period of at least one year will be required to obtain formal government acceptance of the Master Plan and Parliamentary approval for the institution of the recommended governing body. In the meantime the GCEC will have to continue its present task of planning and exercising development control in the area. To avoid delay of desired action and development it may be considered that the GCEC delegates some of the most urgent actions to be undertaken to other agencies, such as

- the preparation of a detailed development plan for the 1st stage to the UDA,
- detailed hydrological studies to the Irrigation Department,
- detailed technical and financial feasibility studies to the Land Reclamation and Development Corporation, and
- the monitoring of development and the appraisal of EIAs to the recently established National Wetland Steering Committee under the aegis of the CEA.

3.4 Recommendations

In conclusion, it is recommended that:

a. As soon as possible, a **Muthurajawela Environment Management and Development Board** be appointed, consisting of representatives of government agencies with a key role and/or competence in:
   - wetland conservation
   - local socio-economic development
   - urban land development.

   Suggested agencies to be represented in the Board are shown in Table D.5.

b. A small **Muthurajawela Executive Board (MEB)** be appointed, consisting of representatives of those government agencies, holding a key position in the development and managemnt of the area. The suggested agencies on this Executive Board are shown in Table D.5. The legislative enactments which will have bearing on the management and development of Muthurajawela and Negombo Lagoon are shown in Table D.6.

c. The MEB be immediately appointed so that its functioning could be effected as per 1 June 1991, the date of the completion of the Master Plan and the formal cessation of the functioning of the Muthurajawela Steering Committee.

d. The Secretary of the Ministry of Policy Planning and Implementation be nominated as Chairman of the MEMDB.

TABLE D.5 GOVERNMENT AND NON-GOVERNMENT AGENCIES PROPOSED TO BE REPRESENTED IN THE MUTHURAJAWELA ENVIRONMENT MANAGEMENT AND DEVELOPMENT BOARD

	Executive Board(MEB)	MEMDB
A. Government organisations		
Min. of Policy Planning and Implementation		X
* Greater Colombo Economic Commission (GCEC)	X	X
* Urban Development Authority (UDA)	X	X
* Land Reform Commission		
Ministry of Environment and Parliamentary Affairs		
* Central Environment Authority	X	X
Min. of Public Administration, Provincial Councils and Home Affairs		X
* Provincial Council, Western Province	X	
* Goverment Agent Gampaha		
Min. of Lands, Irrigation and Mahaweli Development		
* Wildlife Protection Department	X	X
* Forestry Department		
* Irrigation Department		
* Land Commissioner's Department		
Min. of Ports and Shipping,		
* Coast Conservation Dept.		X
Min. Fisheries and Aquatic Resources,		X
* Dept. of Fisheries	X	
Min. of Industries, Science and Technology		
* Natural Resources, Energy and Science Authority of S.L. (NARESA)		X
Min. of Health and Women Affairs		
Min. of Housing and Construction		X
* Nat. Housing Development Authority (NHDA)		
* Nat. Water Supply and Drainage Board		
* S.L. Land Reclamation and Development Corporation	X	X
Min. of Transport and Highways		
* Road Development Authority (RDA)		
Min. of Power and Energy		
* S.L. Electicity Board (S.L. Electricity Company)		
Min. of Tourism and Rural Industries		
* S.L. Tourist Board		X
B. NON-GOVERNMENT ORGANISATIONS		
Wildlife and Nature Protection Society		X
Muthurajawela United People's Organisation		X
C. PRIVATE SECTOR ORGANISATIONS (to be selected)		

TABLE D.6 ACTS AND ORDINANCES APPLICABLE TO MUTHURAJAWELA AND NEGOMBO LAGOON

- Forest Ordinance No. 16 of 1907
- Plant Protection Ordinance No. 10 of 1924
- Flood Protection Ordinance No. 4 of 1924
- Coconut Research Ordinance No. 29 of 1928
- Lands Development Ordinance No. 19 of 1935
- Fauna and Flora Protection Ordinance No. 2 of 1937
- Irrigation Ordinance No. 32 of 1946
- Land Acquisition Act No. 9 of 1950
- Requisitioning of Lands Act No. 39 of 1950
- Soil Conservation Act No. 25 of 1951
- Sri Lanka Land Reclamation and Development Corporation Act No. 13 of 1968
- Land Reform Law No. 1 of 1972
- Urban Development Authority Law No. 41 of 1978
- State Lands (Recovering Possession) Act No. 9 of 1977
- Land Grants (Special Procession) Act No. 43 of 1979
- Agrarian Services Act No. 58 of 1979
- National Housing Development Authority Act No. 17 of 1979
- Mahaweli Authority Act No. 23 of 1979
- Coast Conservation Act No. 57 of 1981
- National Water Supply and Drainage Board Act No. 2 of 1974
- Control of Pesticides Act No. 33 of 1980
- Water Resource Board Act No. 29 of 1964
- Tourist Development Act No. 14 of 1968
- National Aquatic Resources Research and Development Agency Act No. 54 of 1981
- Fisheries Ordinance No. 24 of 1940
- National Environmental Act No. 47 of 1980
- Greater Colombo Economic Commission Law No. 4 of 1978
- Pradeshiya Sabhas Act No. 15 of 1987
- Thirteenth Amendment to the Constitution 1987
- Housing and Town Improvement Ordinance No. 19 of 1915
- Town and Country Planning Ordinance No. 13 of 1946
- Marine Pollution Prevention Act No. 59 of 1981
- Provincial Council Act No. 15 of 1987
- Coconut Development Authority Law No. 46 of 1971
- Mines and Minerals Law No. 4 of 1973
- Natural Resources Energy and Science Authority Act No. 78 of 1981

e. A General Manager be appointed by the Ministry of Policy Planning and Implementation as a full-time staff member of the Board. This General Manager to be the Chairman of the MEB and Secretary of the MEMDB.

f. Representatives of relevant NGO's and private sector organizations be appointed to the MEMDB.

g. The MEB be made directly responsible to the MEMDB and the MEMDB to the President or the Minister of Policy Planning and Implementation.

h. The MEMDB be given the exclusive statutory powers to acquire, sell, develop land, and to regulate and control the use of land, within the confines of its area of authority, recommended to coincide with the boundaries of the Muthurajawela Structure Plan conecpt (see Figure D.1).

i. The MEMDB be provided with a required budget and professional staff for the establishment and operation of a secretariat, to be temporarily located in the premises of the GCEC.

j. The MEB be given, next to its executive tasks as outlined in Section 4, the specific assignments of:

- preparing a work plan and budget for the Stage 2 period (1991-1993) and this to be completed within one year of the MEB's establishment.

- to advise and report on the organization and management requirements of Stage 3 (1994-2000).

k. Following the institution of the MEMDB, consider the employment of an existing authority (e.g. UDA), or the establishment of a new authority as implementing agency for all reclamation and land development activities as recommended in the Master Plan. This authority to report directly and exclusively to the MEMDB. This Board and development authority could progressively expand their area of authority to assume the same tasks for other wetlands.

3.5 Financial Implications

As indicated earlier Master Plan is a strategic document and not a 'blueprint' for development with detailed conservation management programmes. These details will have to be worked out by the MEB and the MEMDB when decisions are taken on the model of development and the extent of private sector participation is determined.

Hence no large scale financial commitments at this stage are envisaged. Immediate requirement is to set up the MEB office and the appointment of staff.

The present Muthurajawela Project office is provided with all the infrastructure facilities by GCEC with Dutch aid. This office can at once be given over to MEB as its office. There is also a vehicle available.

The appointment of a General manager for MEMDB will have to be done immediately. The supporting staff working in the Muthurajawela Project office could be seconded for service with the MEB.

The budget for the fisrt year will be as follows:

General Manager	Rs. 120,000.00
Regional Planner/Admin. Officer	Rs. 39,600.00
Secretary	Rs. 26,400.00
Office aid	Rs. 31,320.00
MEB meetings (Honoraria)	Rs. 36,000.00
Vehicle running & maintenance	Rs. 120,000.00
Stationery	Rs. 30,000.00
Miscellaneous	Rs. 28,000.00
Contingencies	Rs. 100,000.00
	Rs. 531,320.00

4 SHORT-TERM ACTION PROGRAMME

4.1 Protection of the natural resources

A. Stop further reduction of valuable marshland

* Demarcate valuable marshland and enact this as a sanctuary under the Fauna & Flora Ordinance (1937),
* Secure support for conservation from the local population,
* Institute control mechanisms to stop future encroachment and other illegal use of the marsh

B. Facilitate regeneration of the wetland

* As early as possible, relocate all illegal settlers living within the designated conservation area,
* Create natural barriers between the (occupied) higher lands and the marsh, e.g. by the dredging of a peripheral water course to obstruct access to the marsh and to discourage encroachment,
* Remove, where feasible, obsolete man-made structures from the marsh (e.g. vacated dwellings, drains, drainage structures, etc.),
* Register those inhabitants who are at present entirely dependent on the wetlands for their livelyhood and issue a limited number of access and user permits (e.g. for fishing, reeds, sedges and wood collection, etc.),

* Establish a code of conduct for all permit holders and in particular for the fishermen of the Negombo Lagoon with particular regard to:
  - fishing techniques and the use of equipment,
  - permissable type and size of catch,
  - collection and use of natural vegetation such as mangrove wood,
  - all other activities detrimental to the production, yield, diversity and/or the sustained use of the natural resources,
* Institute authorities and mechanisms and employ trained staff for inspection, monitoring and contol of the sanctuary.

4.2 Coastal protection and hydrological management

A. Protect coast against erosion

* Take all necessary measures to stop further erosion of the coast and carry out permanent beach protection works at critical points (e.g. Dickowita),
* Excercise controls to stop the removal and use of beach sand for landfill, construction and other purposes.

B. Re-instate hydrological management

* Investigate the feasibility of rehabilitating the drainage structures of the marsh along the Hamilton Canal with a view to limit excessive drainage of the marsh and to prolong water retention into the dry season. This may:
  - reduce the subterranean inflow of saline water into the marsh,
  - support the marsh flora and fauna to survive in periods of severe drought, and
  - reduce subsidence of the soil by limiting oxidation of air-exposed peat layers.

* Investigate in detail:
  - the technical and economic feasibility of creating a third connection of the Hamilton Canal with the sea by a new outfall, possibly near Dickowita, with the objective to improve the drainage capacity of the Canal, thereby reducing the incidence and duration of flooding in the area;
  - the closure and infill of the Dutch Canal with the objective to reduce salt penetration in the marsh and to improve drainage of the areas to the east, now being obstructed by the banks of the Canal; it is observed that the present drainage function of the Canal is very limited and a redirection of the general gravity drainage flow to the west (via the marsh) is considered more appropriate than the present lateral drainage towards the Kelani Ganga.

- Institute a continuous monitoring programme for water quality control of the Lagoon and of the rivers that feed it (Dandugam Oya and Ja Ela); the programme should concentrate on salinity levels, water pollution (both organic and heavy metal contents) and sediment loads and distribution.

4.3 Socioeconomic support for the local population

A. Improve health situation in Muthurajawela

* Initiate as soon as possible a vaccination campaign, particularly among the occupants of the marsh, to reduce the incidence of various water-borne and vector-borne diseases common in the area.
* Improve the sanitary conditions in the area, among others, by:
  - relocating settlers from the marsh, notably those in the most squaller conditions,
  - accelerate the construction of pipe-borne water supply and provide support for the improvement or installation of on-site waste water disposal facilities (e.g. proper standard sceptic tanks),
  - investigate opportunities for installing rain water collection system (from house roofs) as a source of household water for remotely located families,
  - investigate the absorbtion capacity, purification potential and sustainability of the marsh for polluted surface water and sewage; highly successful experiments have been recorded with sewage treatment in reed cultivation ponds,
  - improve drainage conditions in flood prone areas.

B. Regulate use and ownership of land

* Resettle illegal occupants on dry land that should be offered to them with the prospect of title upon the construction of a new house by the owner, possibly with credit support from the NHDC.
* Accelerate the settlement of land ownership by the Land Reform Commission, notably in the planning units M1, M2 and M2a, and compensate the loss through public acquisition of private land in the marsh conservation area, either financially, or by offering other land in the vicinity.
* Land borderering onto marsh conservation area will be strictly controlled with regard to permissable land use and activities. These lands have been zoned for homesteading and low density residential use. Existing building intensity should nort be increased and no industrial use will be allowed.
* Land will be made available by reclamation in the southern and eastern fringes of the marsh. This land should by priority be made available to residents of the study area in general and to the residents and their offspring in the Planning Area in particular.

C. Provide economic support

* Increase agricultural extention services to improve productivity of the homesteading activities, notably coconut and livestock production
* Assist the marine fishermen in the area with marketing, conservation and transport of their production and investigate opportunities to establish a new fishing port in the area for deep-sea fishing as recommended in the National Environmental Action Programme.
* Stimulate and support the growth of small-scale industries based on local resources in the area and on area-specific demand.

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The Steering Committee which met on May 9, 1991 endorsed the Workshop Evaluation Report and recommendations of the Working Group and decided on the proposals to be included in the Master Plan on the basis of the following broad principles:

1. Strict conservation of the northerly marshlands and the Negombo lagoon which will be declared a 'sanctuary'.

2. Reclamation and development only in the southern and eastern parts of the marsh (E2, E3, E4 and M3).

3. Socio-economic support and improvement of living conditions of the people in the area with special attention being paid to encroaches who are to be re-settled.

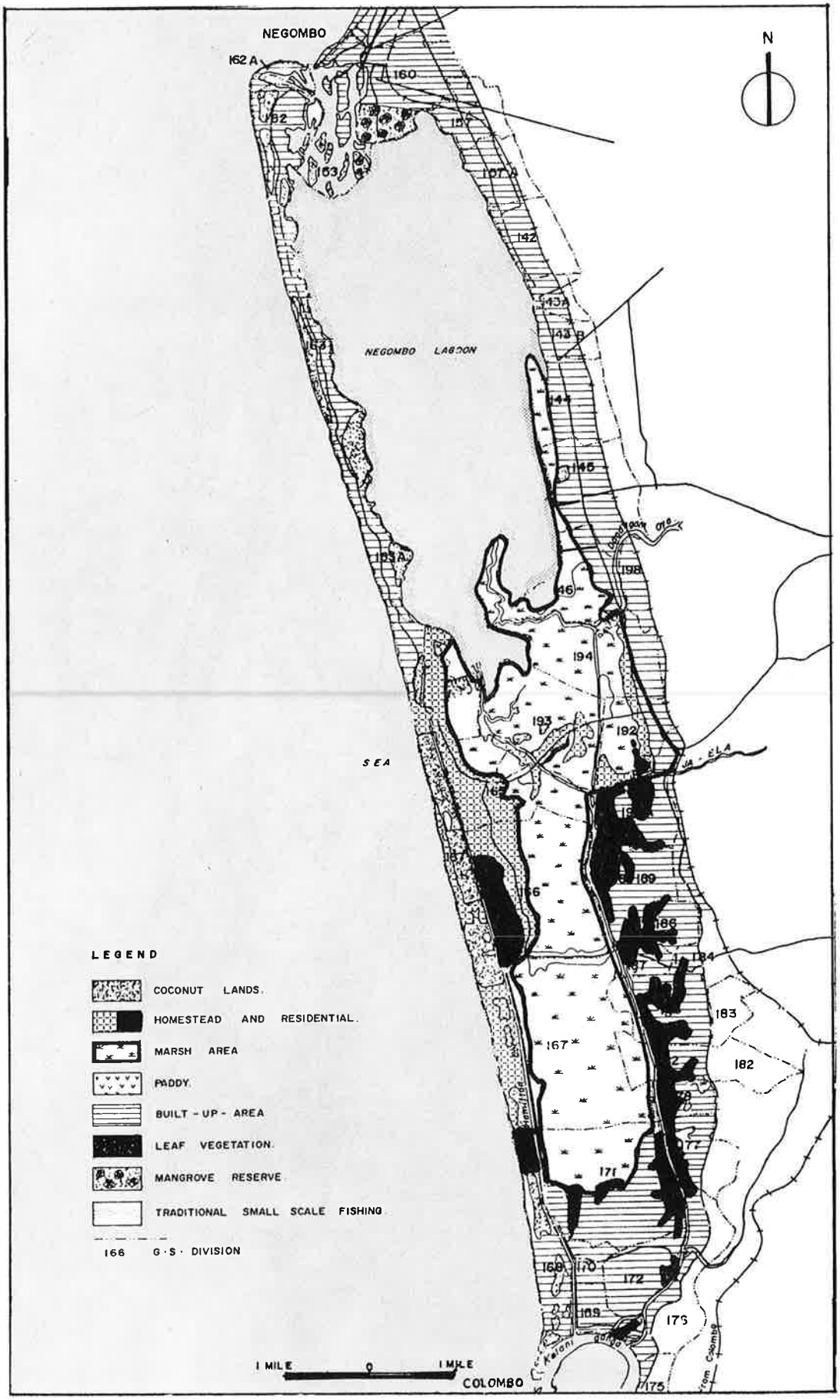

Figure APP A-1 MINIMUM DEVELOPMENT

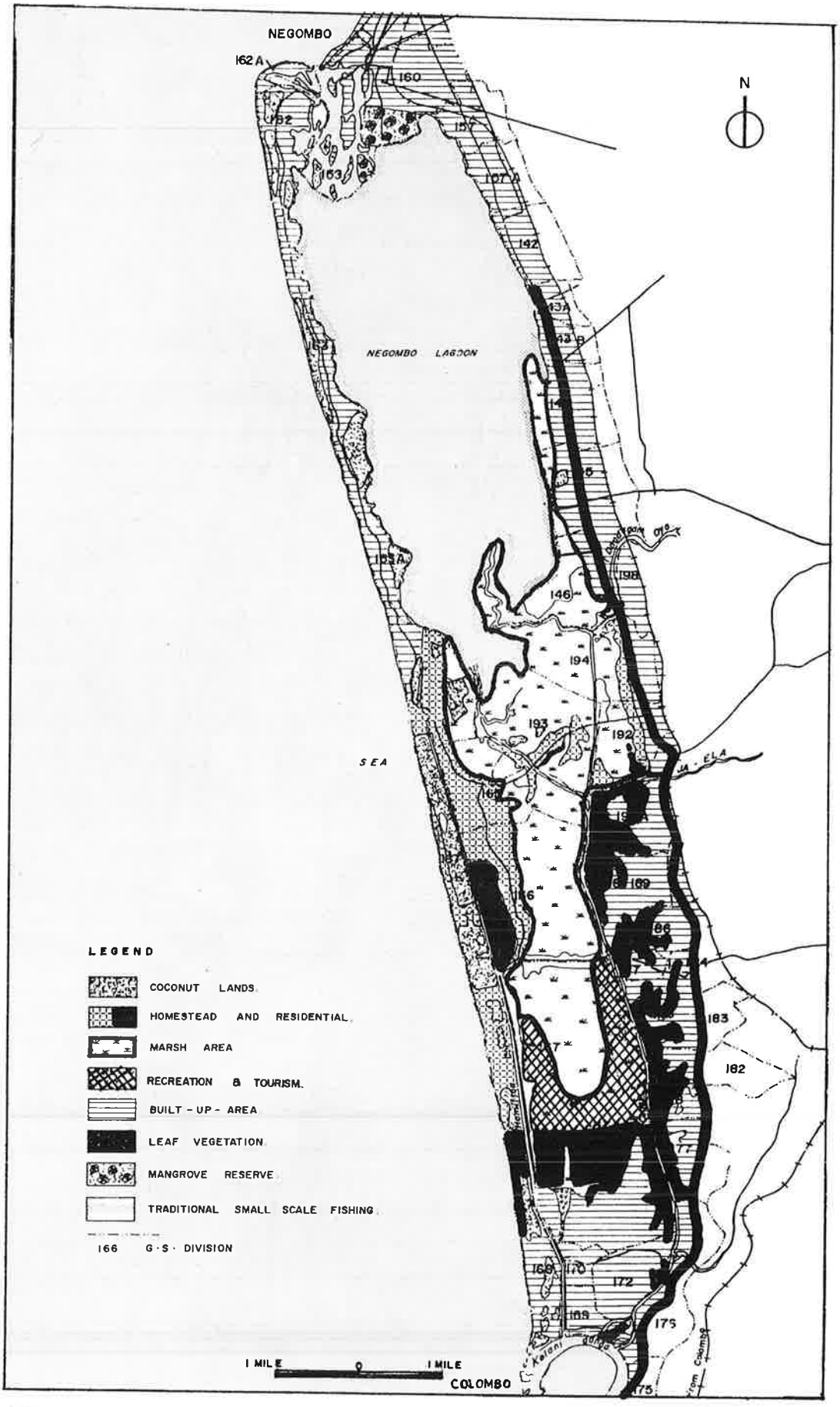

Figure APP A-2 MODERATE DEVELOPMENT

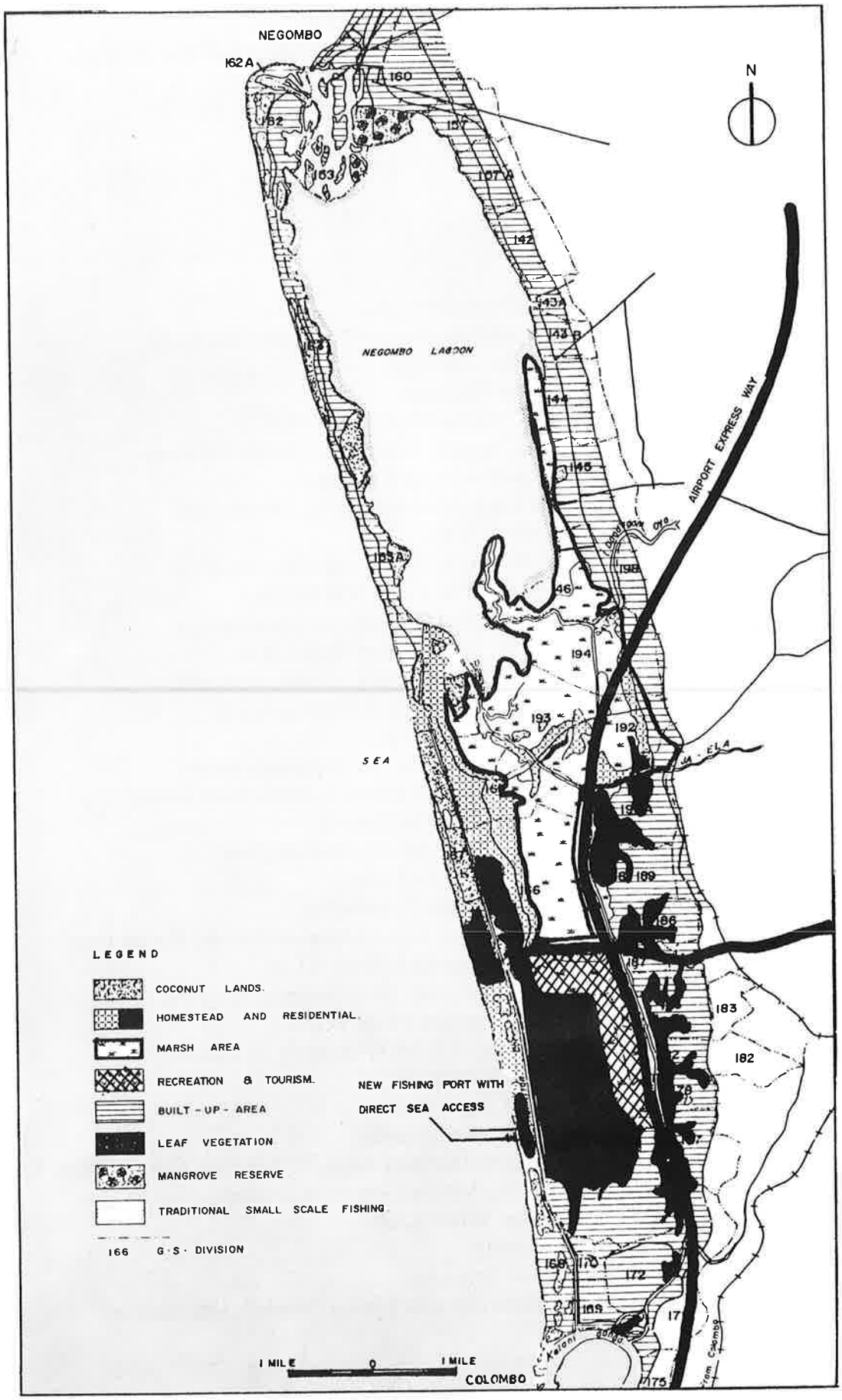

Figure APP A-3 MAXIMUM DEVELOPMENT

GREATER COLOMBO ECONOMIC COMMISSION
WORKSHOP ON
MUTHURAJAWELA MASTER PLAN

DATE: 25.4.1991.
VENUE: A.R.T.I, Colombo.

PARTICIPANTS

1. Mr. W.A. Siriwardane, Director/Planning, UDA
2. Mr. P.De S. Malalgoda, Deputy General Manager, SLLRDC
3. Dr. Shanthi Wickremeratne, Director, NARA
4. Mr. H.N.R. Perera, Senior Engineer, CCD
5. Mr. Anura Dassanayake, Senior Manager, NHDA
6. Mr. P.K. Nagodavithane, Deputy Director, Fisheries (Marine)
7. Dr. Jayanthi de Silva, University of Colombo
8. Mr. A.A.T. Adikari, Ja Ela Pradeshiya Sabha, Dandugama
9. Mr. P.L. Gunasinghe, AGA Wattala
10. Mrs. Soma Gunasena, Municipal Commissioner, Negombo
11. Mr. S.K.H. Perera, A.G.M. (Planning), NWS&DB
12. Mr.T.K. Fernando, Deputy Director, Dept. of Meteorology
13. Prof. C. Maddumabandara, University of Peradeniya
14. Ms. Mallika Fernando, Ja Ela, Pradeshiya Sabha, Kandana
15. Mr. G.S. Hattotuwegama, Director, Engineering, RDA
16. Mr. R.M. Munasinghe, Director, CTB
17. Mr. M.D.C. Abeyratne, University of Sri Jayawardenapura
18. Mr. D.A. Kaththriarachchi, Deputy Director, Geological Survey Dept.
19. Mr. K.D. Fernando, University of Moratuwa
20. Mr. P.K.Y. Perera, University of Sri Jayawardenapura
21. Mr. M. Watson, Asst. Director, NARESA
22. Mrs. K. Vitharana, Environmental Foundation
23. Mr. H. M. Bandaratilake, Deputy Conservator of Forests, Forest Dept.
24. Mr. H.L. Susiripala, Environmental Officer, CEA
25. Mr. K.G.D. Bandaratilake, Director, Environmental Projects, CEA
26. Mr. V. Parameswaran, Ceylon Electricity Board
27. Mr. M.A.G.D. Hemachandra, A.G.M. (Planning), SLLRDC
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29. Dr. J. Handawela, Dept. of Agriculture
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32. Dr. R.S.B. Wickremesinghe, Medical Research Institute
33. Mr. Rex I de Silva, Ceylon Birds' Club
34. Dr. L. Pinto, Open University
35. Mr. S. Dimantha, Dept. of Irrigation
36. Mr. Peiris, Secretary, Muthurajawela United People's Organization

37. Mr. S.H.C. de Silva, Irrigation Consultant
38. Mr. W. Wattala, Asst. Director, Dept. of WildLife Conservation
39. Mr. C. Jayawardena, WildLife Ranger, Dept. of WildLife Conservation
40. Dr. R. Fernando, President, W.N.P.S.
41. Mr. N.D. Dickson, Director General, UDA
42. Mr. T. Bulankulame, Director, Town & Country Planning
43. Dr. S. Epitawatte, University of Sri Jayawardenapura
44. Prof. A.L.S. Perera, University of Moratuwa
45. Mr. N.V. Gooneratne, AGM (R&D), SLLRDC
46. Mrs. S.E. Yasaratne, Acting Director, CEA
47. Mr. A.L.M. Ismail, Irrigation Dept.

MUTHURAJAWELA MASTER PLAN

WORKSHOP - 25TH APRIL, 1991

GROUP REPORTS - GROUP 1

MODERATOR: Mr. N.D. Dickson

MEMBERS:
1. Mrs. K. Vitharana
2. Mr. M. Watson
3. Mr. G.S. Hattotuwegama
4. Mr. A.A.T. Adhikari
5. Mr. P.K. Nagodavithane
6. Mr. C.P. Attanayake
7. Mr. H.L. Susiripala
8. Mr. A.L.M. Ismail
9. Prof. C. Maddumabandara
10. Dr. Shanthi Wickremeratne
11. Mr. T.T. Ranasinghe
12. Dr. R.S.B. Wickremesinghe
13. Mr. M.A.G.D. Hemachandra

The Members of the Group were of the opinion that the Conservation Area proposed in the minimum "Development Option" should be further extended to Mudianselage Ela to the South. This Area is ecologically very sensitive and there should be no development activity in this area what so ever.

A Buffer Zone to be defined to the South of the Conservation Area where no building development is to be permitted. Recreational and tourism based activities be developed in harmony with the environment and eco-system. Any activity which involves even a limited reclamation of land in this area has to be very carefully examined from the point of view of hydrology and detention capacity. Detail planning of this area, in full recognition of its environmental conditions and limitation should be a pre-requisite condition of any development in this area. The existing birds and animal habitats have to be preserved and maintained. Recreational and tourism based activities should be given the secondary place to environmental conservation if conflicting situations arise.

Recreational water areas may be created within the Buffer Zone to improve the landscape and promote tourism based activities.

Agricultural activities which are in conformity with the ecological and environmental conditions of the area may be permitted in the Conservation Area.
However, such areas have to be carefully identified in the land use zoning plan. The type of agriculture and the agricultural practices have to be specified in detail in the Development Plan in order to preserve the environmental character of the areas concerned.

The developable area to be restricted to approximately 500 hectares to the South of the road proposed in the "Minimum Development Option" to accommodate Urban Development Activities preferably housing and related uses. Due to the high underground water table of the area septic tanks may not function satisfactorily and it may be necessary to implement a Central Sewerage System. The possibility of high density development may be considered on the basis of development costs on foundation of building and land value increases.

The infilling of estuary areas on the Eastern Boundary of the Conservation Areas may be permitted to accommodate low income housing. Presently, there are a substantial number of squatters in the Conservation Area who have to be resettled in this area.

The reclamation of the developable area may be undertaken on the basis of a pilot project to ascertain the actual technical and economic problems involved and make adjustments according to the experience gained.

Infrastructure facilities such as internal roads, water and sewerage facilities should be provided to the proposed development area, particularly a good road connection to the new development area has to be provided. Tourist facilities including hotel accommodation may be provided to the West of the Conservation Area.

The guidelines provided in the plan be further defined in detail and embodied in the Master Plan with implementation guidelines.

The land use zoning plan be prepared as part of the Master Plan for implementation under the UDA Law or Town & Country Planning Ordinance.

The implementation of the Master Plan be carried out by the involvement of private sector developers with the State providing the incentives and guidelines.

The enforcement and implementation of the Master Plan be carried out by a State Agency created for the purpose.

MUTHURAJAWELA MASTER PLAN

WORKSHOP 25TH APRIL, 1991

GROUP REPORTS - GROUP 2

MODERATOR: Prof. A.L.S. Perera

MEMBERS:

1. Mr. H.M. Bandaratilake
2. Mr. M.D.C. Abeyratne
3. Mr. T.K. Fernando
4. Mr. P.L. Gunasinghe
5. Mr. W.A. Siriwardena
6. Mr. Rex I De Silva
7. Dr. L. Pinto
8. Mr.W. Wattala
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10. Ms. Mallika Fernando
11. Mr. S.K.H. Perera
12. Mr. H.N.R. Perera
13. Mr. N.V. Gooneratne
14. Mr. S. Dimantha
15. Mr. K.D.G. Bandaratilake
16. Dr. J. Handawala

The participants of this group generally endorsed the view that the environmental profile was a useful guide for the development of the Negombo lagoon and the Muthurajawela marsh. The group also agreed that the conclusions reached in this report were sound and most of the recommendations made and limitations shown, therein, in terms of development were valid.

The group also agreed that the Negombo lagoon and the Muthurajawela marsh have not only to be viewed as one eco-system but also the master plan proposals and the implementation methods and procedures should embrace this entire system. While agreeing that the entire lagoon and a substantial part of the marsh need to be conserved the necessity for a balance between conservation and development was widely discussed before a general consensus was reached. It was argued by some that the strategic location of the southern part of the marsh and the relative scarcity of land in the region and the relatively high rate of urbanization in the Gampaha District increased the demand for developed land for an array of economic and social activities. On the other hand some of the participants held that there is no conclusive proof of the non-availability of suitable land for development elsewhere in the region. In the absence of a comprehensive spatial strategy for the development of land or a composite inventory of land resources, there is no doubt of the existence of an element of uncertainty. However, it was agreed that the trends in terms of spatial distribution of urban activities, pattern of development and the availability of agglomeration economics all favour reclamation of at least some part of the marsh. On the basis of the above discussion general consensus was finally reached that the minimum development option of reclaiming about 415 acres of land in the extreme south of the marsh should be recommended.

The possibility of Kelani floods consequent to land reclamation was also discussed, and it was finally agreed that land reclamation was technically feasible and will not result in the inundation of the surrounding areas. However, the group observes that the cost estimates for land filling were sketchy and current prices of land values in the area were no indicator or guidance for determining future demand for land. However, from a regional perspective the group felt that the demand for land will increase, and will receive a further boost due to higher urbanization trends observed in the Gampaha district in particular. On the whole it was

providing infrastructure for reclaimed land was also considered. In terms of past experience it was estimated that the cost of infrastructure will roughly be in the region of Rs. 10,000 per perch. It was observed that even with no development a source of safe drinking water and sewage facilities are critical and the non-availability of them are potential sources of health hazards in the area.

The group also recommended a buffer zone between the conservation area and the demarcated area for development. The location was to be about 200 meters from behind the irrigation office premises. The exact location needs to be checked.

It was also observed that such a buffer could accommodate recreation and such other compatible land uses such as education, research, eco-tourism etc which may attract both foreign and local tourists interested in such activities.

The need for protection of the Negombo lagoon from pollution and harmful exploitation were stressed. The conservation and maintenance of the Negombo lagoon and the Muthurajawela marsh as an important eco-system was also mentioned.

The group proposed that the Master Plan should detail ways and means of effectively protecting the mangrove areas and propose schemes for growing of mangroves for exploitation.

The need for social forestry programmes with the involment of the public in keeping with the forestry policy and principle of public participation in development afforestation along the sea coast and measures for coastal protection against erosion were some of the important suggestions of the group.

The process of development of the lagoon and the marsh entailed the appropriate relocation of the residential population living within the marsh and in the periphery. The group agreed with the proposal to maintain the existing settlements and the one towards the north of the marsh as a low density residential area. The master plan should however, propose adequate measures for the protection of the environmentally sensitive areas from encroaches. It should also make provision for the supply of safe drinking water to the residents and a central sewage system for the area as mentioned earlier.

The planting of bamboo, reed etc along with keera and other types of vegetable cultivation can be advocated within homesteads to supplement the income of the settlers without adversely affecting environmental quality. Although the marsh on its own cannot economically support its residential population some of the above activities can supplement their incomes.

The proposal for an express-way through the region did not receive the approval of the group. The general consensus was that an express-way will have little or nothing to offer to the development of the area. It was however, felt that a road which will improve accessibility in the area will considerably help the economic development of the area and will also help to boost land values. It was also proposed that the existing roads within the area should be improved.

A proposal was also made by a member of the group as regards the provision of some central functions in probably a newly established township in the project area. The group however, felt that there were already several towns servicing the area which could be better equipped to serve the people rather than a new town.

A Master Plan is generally a comprehensive document setting out policies, goals and objectives of development. It will contain detailed proposals for the development of the area comprising of several projects and programmes. One of the most important instruments of the Master Plan is the detailed land use zoning proposals for the entire area which have to be strictly implemented. It is therefore important to establish an institutional mechanism for implementation of the Master Plan proposals, monitoring and feed back. Such an organizational set up should also make provision for a coordinated effort with the Central Environmental Authority in effecting managing the wetland.

MUTHURAJAWELA MASTER PLAN

WORKSHOP 25TH APRIL, 1991

GROUP REPORTS - GROUP 3

MODERATOR: Dr. R. Fernando

MEMBERS:
1. Mr. P.K.Y. Perera
2. Ms. Soma Gunasena
3. Mr. P. De S. Malalgoda
4. Mr. T. Bulankulame
5. Mr. Peiris
6. Dr. S. Epitawatte
7. Mr. C. Jayawardena
8. Mr. K.D. Fernando
9. Mr. R.M. Munasinghe
10. Dr. Jayanthi de Silva
11. Mr. Anura Dassanayake
12. Ms. S.E. Yasaratne
13. Mr. S.H.C. de Silva
14. Mr. K.G. Dayananda
15. Mr. V. Parameswaram

Members of the group made careful note of the introductory address of Director Regional Development. Mr. Amaratunga, and the explanatory addresses by Consultants, Caroline Hoisington and Franz Ziegler.

It was noted that information regarding the load-bearing capacity of the different areas of the marsh had not been assessed and the data used was therefore NOT SITE SPECIFIC. Consequently the cost estimates of land reclamation and development as indicated in Table 3 may or may not reflect realistic values.

It was also clarified that the costing was on the basis of 1 square meter surface area and not on the basis of cubic meters of filling: the latter estimation was consequently based on the assumption that the total height of filling required would be only 3 meters (10" ft) under any circumstances. There was no indication of allowance having been made for the very real possibility of filled areas sinking with time and therefore, requiring more than 9 cu. meters of filling material to fill an area of 1 square meter (this has happened at Peliyagoda and Attidiya).

The issues discussed were:-

a) The very real problem of unauthorized occupation and private land in the marsh and recognition of those factors that prompted individuals to seek a living in this area inspite of substandard living and employment opportunities and unhygienic conditions.

b) Ecological and environmental sensitiveness of the marsh; its importance in maintaining a hydrological balance in relation to areas such as Negombo, Ja-Ela, Wattala and the higher elevation areas surrounding the marsh.

c) The limited extent to which the ecosystems in the marsh could be altered without seriously jeopardizing hydrology and bio-diversity and the associated natural resources (sea beds, faunal and avian life etc) in the marsh.

d) The importance that any development plan recognizes the socio-economics of the marsh and the lagoon and its current occupants and will not leave room for social discriminization and cause resentment among the people of the locality.

e) The necessity to link any type of development in the area with the necessity to offer enhanced employment, housing and similar socio-economic benefits to the occupants in the area as high priority.

The broad-outline of recommendations which evolved were that:-

1. The multiplicity of factors that necessitated imposition of ecological and environmental safeguards warranted the declaration of those areas identified for protection to be declared a sanctuary as prescribed in the Fauna and Flora Protection Ordinance.

   The entire length and breath of marsh between Dandugam Oya in the North to the East West boundary from Mattumagala to the Hamilton Canal be thus declared a Sanctuary with provision for about 200 acres of a buffer zone interposed between the southern sector of the proposed sanctuary and the area recommended to be filled (Para 8).

2. The buffer zone of about 200 acres may be used for translocating the Dehiwela zoo (which has no additional room for the currently desired extensions) while releasing this prime land in Dehiwela for housing, industry etc.

   The buffer zone may also be used for the planting of medicinal plants and similar environmentally safe exercises.

3. Low degree land filling be permitted along the length of marshland to the east of the Old Dutch Canal, leaving a green belt (of about 100 yards) between the boundary of the Old Dutch Canal and the land to be filled. This filled area be reserved for low-cost housing mainly to accommodate the present inhabitants of the area.

4. The opening of the lagoon to the sea in and around Kadolkalle and Munnakkara be strictly managed such that there would be no obstruction to the free-flow of water through this communication. Presently, unauthorized activities and land filling tends to cause obstruction, which should be removed.

5. All man-made structures within the proposed sanctuary and not essential for the functioning of the sanctuary be removed and the sanctuary permitted to revert to its natural form. All persons (legal owners or unauthorized) be provided land in the area to be filled under recommendation 3 so that the recent (last 10 years) encroachments into the marsh be demolished and these persons relocated along the eastern sector of the Old Dutch Canal (Para 3).

6. The coastal belt on the western boundary to be well protected from disturbance of any sort and the currently existing canals opening from the marsh (via the Hamilton canal to sea be retained patent, ensuring free flow of water in these canals.

7. Land filling to total extent of 417 acres be permitted at the southern end with clear instructions that no extension of this area be permitted under any circumstances.

8. The recommendations of "sea-sand' filling if it is to be adopted, will have to be reviewed in the light of changes to the environment of the sea, the sea beds and possible impact on the marine fisheries in the area. Oceanic currents and other aquatic aspects of excavating vast quantities of sea-land be revised and the impact of sea-water impregnated (5:1) sand on the ecology of the proposed sanctuary (marsh) be assessed with an EIA.

9. Alternative methods of filling will also have to be evaluated against the proposal for "sand filling".

10. The recreational areas be located preferably along the South East quadrant of the lagoon i.e. north of Dandugam Oya, as this would facilitate watersports (skiing, wind surfing) in addition to the suggestion for a golf course. Any recreational promotion activities be required to recognize the pressing land-hunger among the low income groups in and around the area so that social disparities will not be highlighted.

11. The proposed sanctuary itself could offer recreational areas in association with the low-grade filling recommended in Para 3.

12. In zoning the 417 acres of land filling area for different uses the employment benefits and housing benefits to the local inhabitants be given priority as these 417 acres would be required to provide all amenities for the expanding population that would move into this area consequent to the land filling.

13. The suggested highway was considered unwarranted while improvement of the conditions of the existing network of roads from Mahabage and Kandana would be a necessity.

14. Concomitant infrastructure development such as, electricity, sewerage, water supply, schools, hospitals, market places, administrative offices etc; to be identified in the 417 acres land filled area and also the areas to filled in accordance with Para 3.