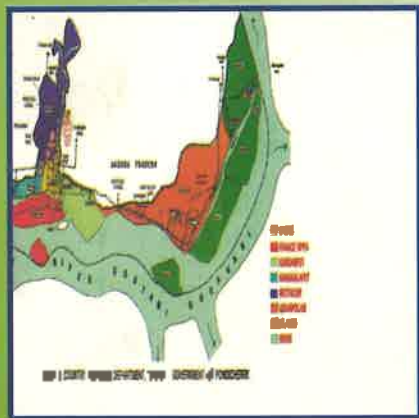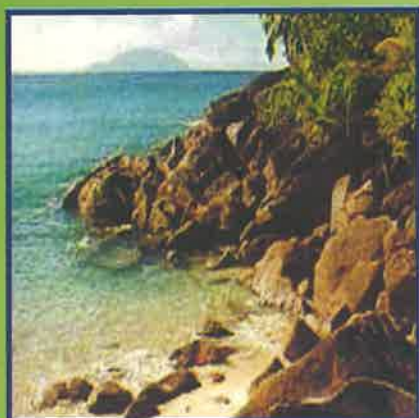# Government of Pondicherry
PONDICHERRY POLLUTION CONTROL COMMITTEE
STATE OF ENVIRONMENT REPORT - 2005

STATE OF ENVIRONMENT REPORT
2005
FOR THE UNION TERRITORY OF PONDICHERRY

PPCC

PONDICHERRY POLLUTION CONTROL COMMITTEE
GOVERNMENT OF PONDICHERRY
PONDICHERRY.

MUKUT MITHI
LIEUTENANT - GOVERNOR
PONDICHERRY

RAJ NIVAS
PONDICHERRY - 605 001

Off : 0413 - 2334051
Res: 0413 - 2334050

Date : September 5, 2006

MESSAGE

I am happy to note that the Pondicherry Pollution Control Committee in co-ordination with Administrative Staff College of India (ASCI), Hyderabad has prepared the State of Environment Report (2005) for the Union Territory of Pondicherry.

Concern for environmental pollution is rather a recent phenomenon emerged from the ill effects of industrial growth overlooking the role of natural resources in sustainable development. Environmental Management has now become the key word and major guiding factor in all the economic decision making process for sustainable development. It is a term that encompasses environmental planning, protection, monitoring, assessment, research, education, conservation and sustainable use of resources.

The PPCC has carved out the report based on the templates of States of Uttar Pradesh and Andhra Pradesh. Despite adopting predetermined templates, the preparation of an environmental report has its own inherent difficulties in quantifying the effects, which are often intangible, complex and imperceptible in nature. The PPCC have to be congratulated for having published a report that gives a fair output of the data pertaining to the various environmental facets of the coastal city. This report, consisting of the basic data, will form the source for in-depth study and analysis in the years to come and will be a useful tool for Environmental Managers & Planners.

(MUKUT MITHI)

N. RANGASAMY
CHIFF MINISTER

MESSAGE

The State of Environment Report (SOER) prepared for the Union Territory of Pondicherry covers the priority issues pertaining to the Environment. The study on SOER for Pondicherry is intended to provide a benchmark for future environmental reporting and also to serve as the database for policy making and preparation of environmental management plans. This report is intended to bring all the data available to one place from which the required data can be accessed and collected.

Pondicherry Pollution Control Committee (PPCC) as the State Host Institution (SHI) as the nodal agency concerned with Environmental policy of the Government of Pondicherry has realized the necessity for building a strong database and has brought out this study to facilitate the formulation of an environmental management plan for the U.T.

It give immense pleasure to note that the Pondicherry Pollution Control Committee is bringing out a State of Environment Report for Union Territory of Pondicherry. I am sure that the report will help in policy formulation decision making & review of development plans for this Unron Territory. I also wish this type of reports has to be updated periodically.
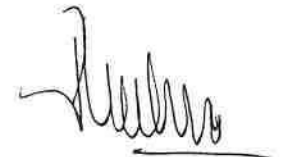
(N. RANGASAMY)
CHIEF MINISTER

PRADIP MEHRA, I.A.S.

M E S S A G E

I am happy to learn that the Pondicherry Pollution Control Committee, in collaboration with the Administrative Staff College of India, Hyderabad is brining out a report on the State of the Environment in Puducherry. The report encompasses the status of different sectors of Puducherry, which have a bearing on our enviornment.

Government of Puducherry is committed to environmental conservation with balanced growth of all sectors. I hope, the report would be useful to ascertain the magnitude of the problem and remedial measures required to be taken in the process of development.

(PRADIP MEHRA)

GOVERNMENT OF PONDICHERRY
CHIEF SECRETARIAT

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FOREWORD

Protection of environment in Pondicherry assume significance in light of the rapid strides made in socio-economic sector. If the surge in socio-economic sector is not kept in tune with the concerns of environment, it may lead to lopsided development and degradation of ecology & environment of Pondicherry, thereby affecting the quality of sustainable life of citizens. It is, therefore, imperative to take stock of the current status of environmental issues, concerning Pondicherry and to suggest a road map for future development.

Keeping the relevant factors in mind, the Pondicherry Pollution Control Committee (PPCC) has taken the initiative and arranged to compile a 'State of Environment Report' (SoER) of Pondicherry. This informative report will also act as ready reckoner for those who seek information on the status of environment of Pondicherry.

I place on record the efforts of officials of Pondicherry Pollution Control Committee (PPCC), Department of Science, Technology & Environment, Government of Pondicherry and Administrative Staff College of India (ASCI), Hyderabad and various line Departments in the preparation of State of Environment Report (SoER) in a comprehensive manner.

Comments and suggestions for improving the content of the report are most welcome. I am optimistic that this report would facilitate making appropriate interventions, wherever required, so as to preserve the quality of environment in the Union Territory of Pondicherry for sustainable development.

(A. ANBARASU)

PREFACE

The Pondicherry Pollution Control Committee (PPCC) under a project sponsored by the Ministry of Environment and Forests, Government of India has prepared the State of Environment Report (2005) for the Union Territory of Pondicherry with the assistance from Administrative Staff College of India (ASCI), Hyderabad.

PPCC was selected as State Host Institution (SHI), which wrote the report. Conscious effort has been made to maintain objectivity, as the PPCC is one of the main stakeholders. Views of the other Departments and the public have been incorporated based on the feedback obtained during the public hearings.

The templates provided by ASCI in the form of 'State of the Environment Report and Action Plan for Uttar Pradesh' and that for the State of Andhra Pradesh have been made use of to a greater extent to save time and effort. The DPSIR methodology developed by the OECD and other agencies, and made use of in the Reports cited above has been adopted in this report as well. The summary of the process and proceedings used for the preparation of SoER is also annexed at the end of the report.

The feedback on the Report is most welcome. The feedback may please be sent to dste@pon.nic.in

Sd/-
(M.ARUNACHALAM)
Director (S&T)
Member Secretary (PPCC)

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CHAPTER – 8 NATURAL RESOURCES
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ACKNOWLEDGEMENT

Pondicherry Pollution Control Committee, Pondicherry gratefully acknowledges the support rendered by the following organizations in the preparation of State of Environment Report - 2005:

1)   Agriculture Department, Pondicherry
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3)   District Industries Centre, Pondicherry
4)   Economics and Statistics Department, Pondicherry
5)   Education Department, Pondicherry
6)   Department of Fisheries and Fishermen Welfare
7)   Department of Forests and Wild Life. Pondicherry
8)   Department of Health and Family Welfare, Pondicherry
9)   Directorate of Industries and Commerce, Pondicherry
10)   Labour Department, Pondicherry
11)   Department of Local Administration, Pondicherry
12)   Department of Planning and Research, Pondicherry
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14)   Revenue Department, Pondicherry
15)   Dept. of Science, Technology and Environment, Pondicherry
16)   Department of Tourism, Pondicherry
17)   Department of Town and Country Planning, Pondicherry
18)   Transport Department, Pondicherry
19)   District Rural Development Agency, Pondicherry

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1)   Mr.C.S.Ramanathan, Sutru Soozal Kalvi Kazhagam, Pondicherry.
2)   Mr.K.G Raj Mohan, Scientist, M.S. Swaminathan Research Foundation, Pondicherry
3)   Mr. T. Srikanth, Empowerment Foundation, Pondicherry

CHAPTER – 1

METHODOLOGY

1.1 Introduction

The Report aims to bring together relevant data and information from various sources so as to get a broad overview of the environment in the U.T. of Pondicherry.

The main objectives of the Report are as follows:
1. Review the state of the environment in the U.T.
2. Identify the principal causes for the deterioration of environment.
3. Prioritize the environmental problems in terms of severity.
4. Create awareness among the stakeholders on environmental concerns.
5. Use this as a tool for planning and regulating development by developing an action plan.

Details of the Chapters in the Report are given below.
The methodology used has been discussed in this Chapter (Chapter 1).

Chapter 2 gives brief introduction about the U.T. of Pondicherry

Chapter 3 gives a brief overview of environmental issues, the contributory factors of environmental degradation, the existing institutional framework.

Chapters 4 to 8 provide an analysis of the important aspects of environment. Chapter 4 deals with water related issues, Chapter 5 with air quality and related issues.

Chapter 6 deals with various kinds of wastes that are being generated and the issues connected therewith. Chapter 7 deals with land related issues; Chapter 8 deals with forests and other natural resources.

Chapter 9 provides a summary of the report-sector-wise and geographical area-wise.

Chapter 10 contains brief recommendations of the report.

1.2 Methodology of the Report

The Report uses Driving Force-Pressure-State-Impacts – Response Framework (DPSIR) framework. This was developed in work on environmental indicators by the Organization for Economic Cooperation and Development (OECD), the European Commission and the World Resources Institute (WRI) and has subsequently been widely applied world wide in environmental reporting.

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1.2.1 Driving Forces

Environment has never been static. It undergoes changes due to natural as well as human factors. Driving forces here mean basically the underlying human activities that lead to environmental changes. These are general in nature. These have been discussed in Chapter 3.

1.2.2 Pressures

These are more specific factors as distinguished from driving forces, which are general in nature. These may be economic, social, institutional or other pressures on the environment that may contribute to or cause particular environmental states and impacts of concern. These have been detailed in Chapter 4 to 8.

1.2.3 State

This refers to the existing state or condition of the environment and the trends in that state or condition brought about by human or other pressures.

1.2.4 Impacts

These are the consequences of pressures and states, in particular those on human health and well being of the economy etc.

1.2.5 Responses

These include actions already taken or proposed to be taken by various stakeholders to address the environmental issues.

1.3 Stakeholders

Participative governance is gaining importance. In fact ultimately it is the public who are going to be affected by various impacts. As such, bringing awareness among them and enlisting their co-operation are essential.

1.4 Data sources and constraints

The existing data both primary and secondary has been used in preparation of this report. The primary data refers to first hand information generated by the PPCC by regular monitoring. It also refers to the data provided by various Government Departments. The secondary data refers to the data obtained from the reports, studies etc. Important Reports / Studies / References are given in Annexure – 1.

Some of the limitations in preparation of the Report are as below:

- Lack of data on some specific aspects.
- Indifference on part of some of the Departments in providing the data.
- Lack of systematic documentation of data by some departments.

CHAPTER - 2

INTRODUCTION

2.1.Introduction

The Union Territory of Pondicherry (U.T.) comprises of four discontiguous regions enclaved in three southern States of India, namely Pondicherry and Karaikal regions enclaved in Tamilnadu, Yanam region enclaved in Andhra Pradesh and Mahe region enclaved in Kerala (Maps 2.1 to 2.5). Pondicherry is the capital. The U. T. being an erstwhile French territory represents a unique blend of Indian and French cultures.

The Union Territory consists of two districts namely, Pondicherry and Karaikal, consisting of 264 census villages, 129 revenue villages, 6 taluks (4 in Pondicherry, 2 in Karaikal) and 2 sub-taluks (Mahe & Yanam). For the purpose of development administration the territory is divided into six blocks namely (i) Ariankuppam block (ii) Oulgaret block (iii) Villianur block (iv) Kariakal block (v) Mahe block and (vi) Yanam block. The Municipal administration comprises of 5 municipalities namely Pondicherry, Oulgaret, Karaikal, Mahe and Yanam and 10 Commune Panchayats, namely (i) Villianur (ii) Mannadipet (iii) Ariankuppam (iv) Bahour (v) Nettapakkam (vi) Thirunallar (vii) Neravy (viii) Nedungadu (ix) Kottucherry and (x) T.R. Pattinam.

As per 2001 census, the population of the U.T. is 9,74,345 which is about 0.09% of India's total population.

With a geographical area of just 480 sq. km., the U.T. accounts for 0.00015 % of that of India. The population density is 2029, one of the highest in India. The sex ratio is 1001.

Geographically, Pondicherry, Karaikal and Yanam regions are more or less flat. The terrain of Mahe is little undulating.

Two small rivers namely, Sankarabarani and Penniar pass through Pondicherry region. In Karaikal Arasalar and Thirumalairayan rivers are the main ones. Distributaries of Cauvery River also pass through Karaikal. In Yanam Gouthami (a tributary of Godavari) is the main river. In Mahe a small river by name Mahe passes through.

Though the U.T. is very small, it has made rapid strides in industrial development in view of the industrial friendly policies of the successive Governments.

The U.T. could achieve a fairly decent industrial growth despite the lack of natural resource base. Tax sops, easy availability of power, good infrastructure and connectivity and ready availability of skilled manpower contributed for this.

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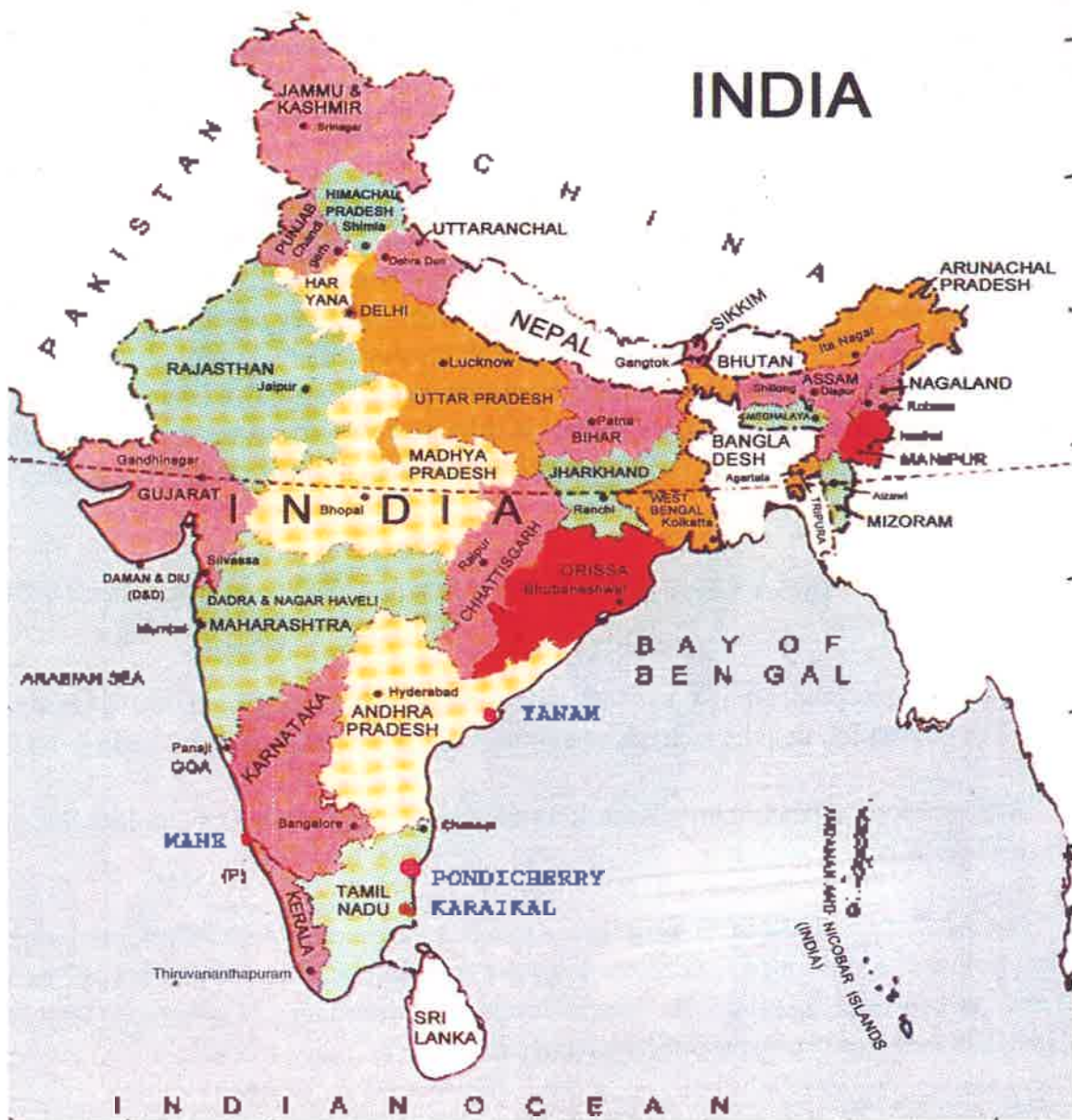
Map:2.1 Pondicherry Union Territory-Location

TAMIL NADU

TAMIL NADU

Ozhukarai

BAY OF
BENGAL

Villianur

Pondicherry

Ariankuppam

Nettapakkam

TAMIL NADU

Bahour

Pondicherry Region Communes
- Ariankuppam
- Bahour
- Mannadipet
- Nettapakkam
- Ozhukarai
- Pondicherry
- Villianur

NIC-PDY
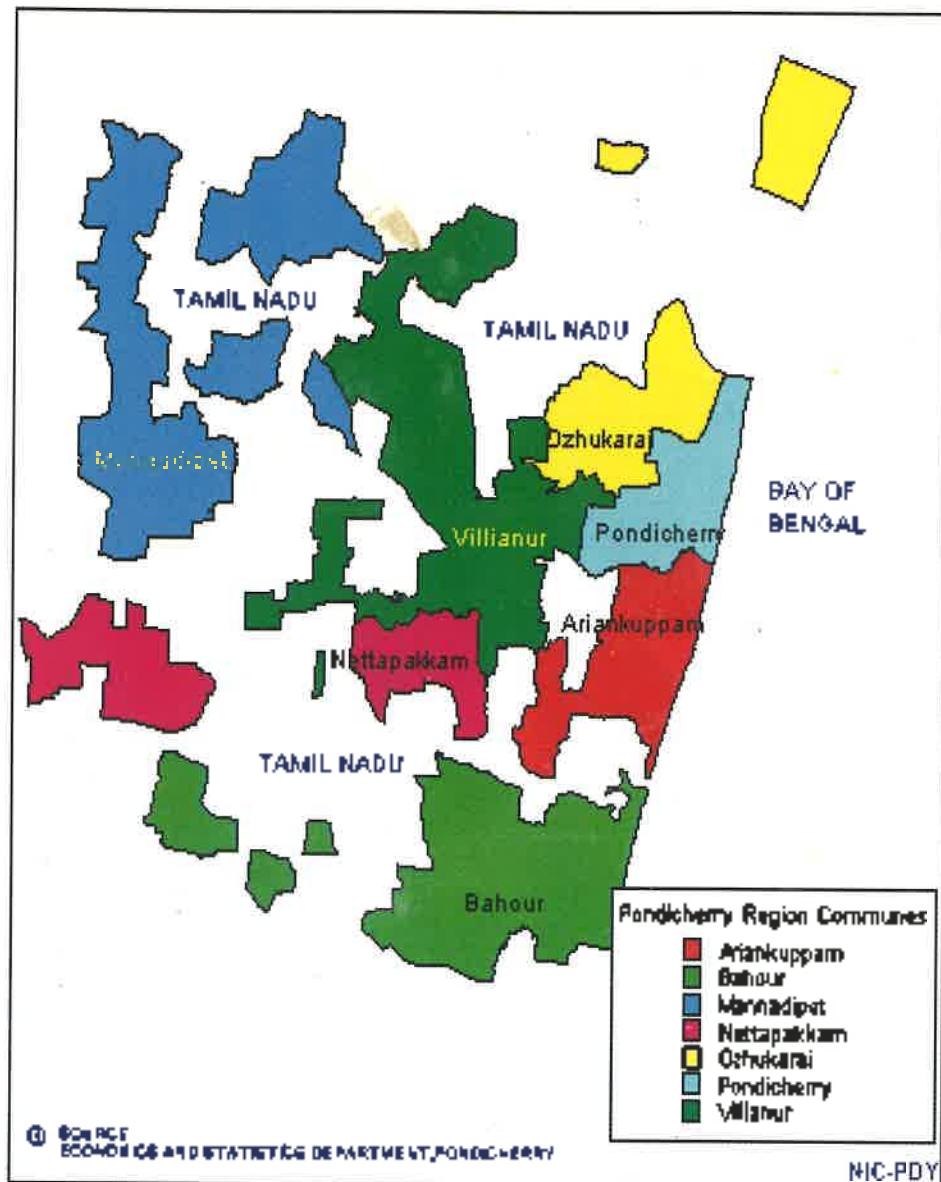
Map 2.2 Pondicherry region Commune wise
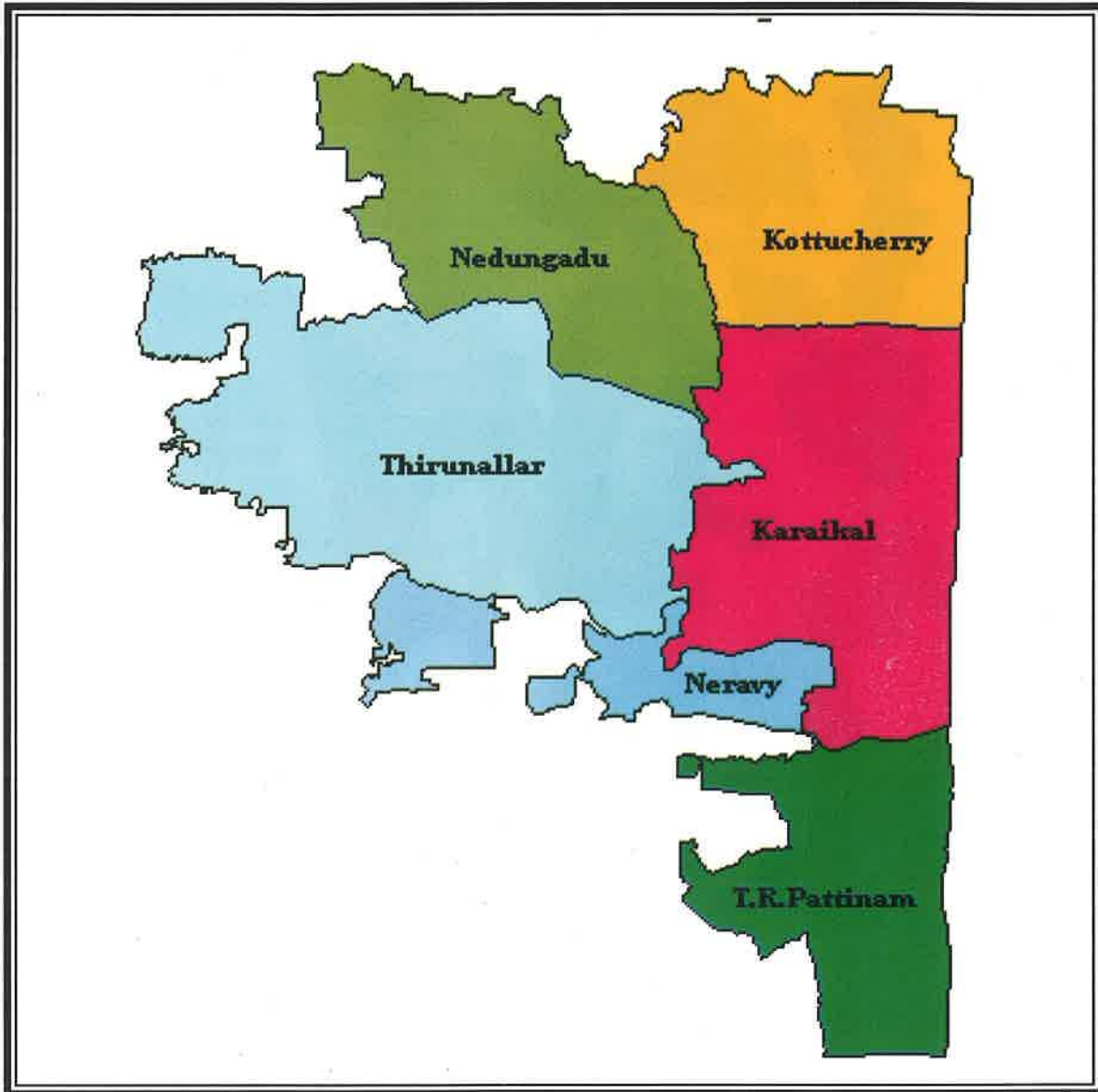
Map: 2.3 Karaikal region Commune wise

Map: 2.4 Mahe Region

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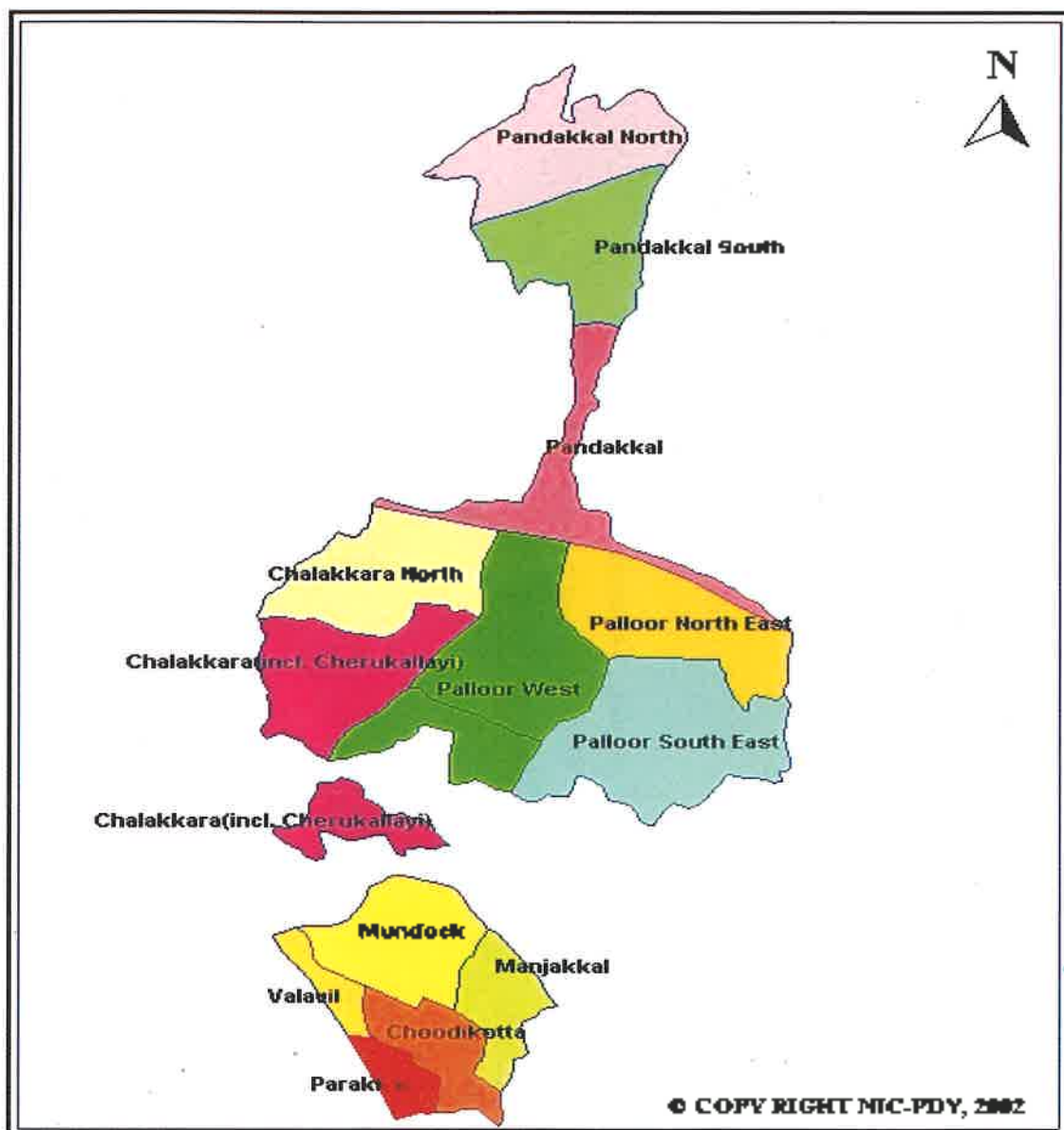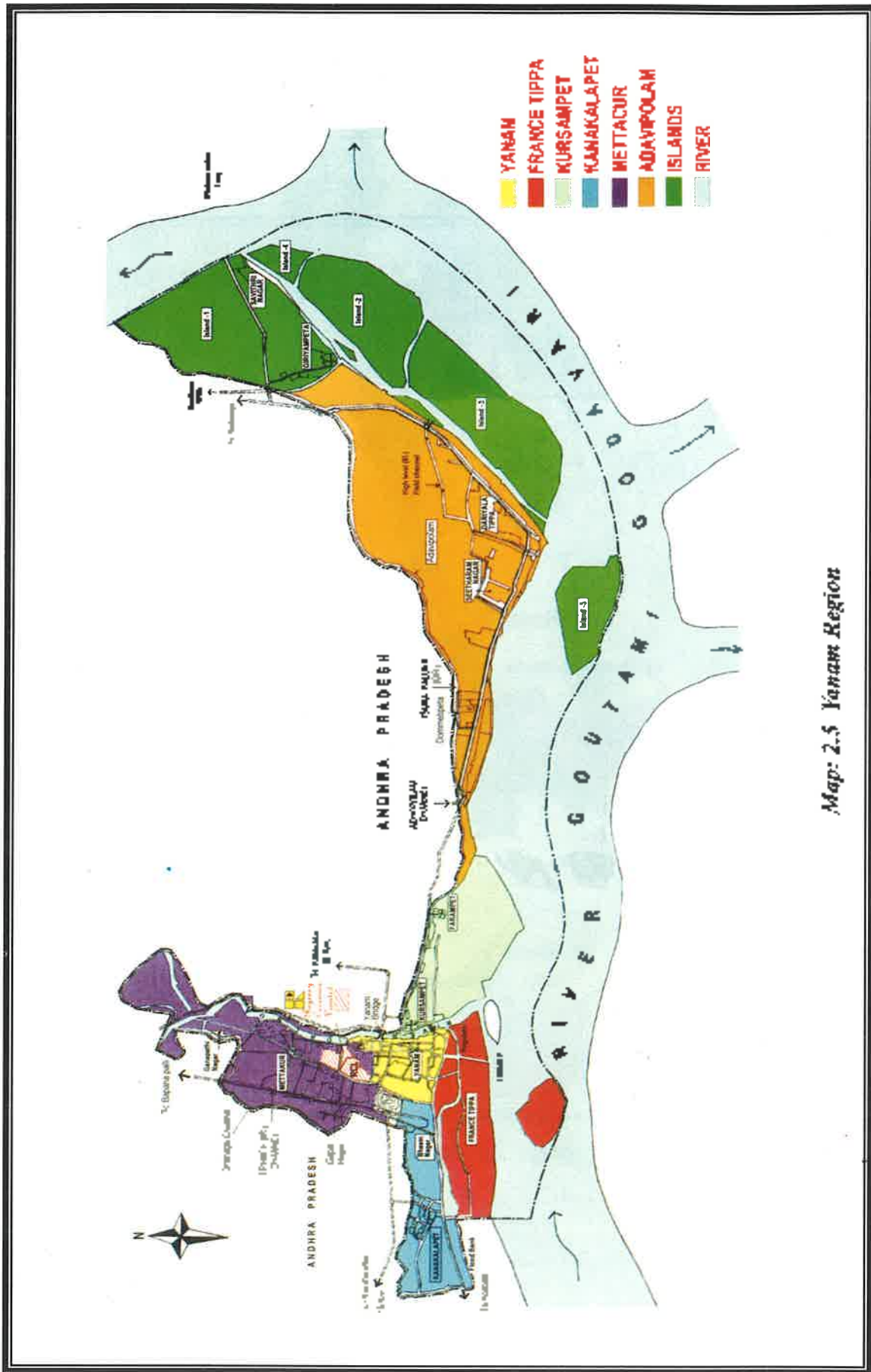
Map: 2.5 *Yanam Region*

The details of area, location, populations are given in the Tables below:

Table 2.1 Area and Location

Region	Latitude	Longitude	Area (sq. kms)	Location	Borders
Pondicherry	11°45' and 12°0' N	79°37' and 79°50' E	290	East Coast. 160 kms south of Chennai	**East:** Bay of Bengal. **West and North:** Villupuram Dist. of Tamil Nadu. **South:** Cuddalore Dist. of Tamil Nadu.
Karaikal	10°49' and 11°01' N	79°43' and 79°52' E	161	East Coast. 160 kms south of Pondicherry	**East:** Bay of Bengal. **West, North and South:** Nagapattinam Dist. of Tamil Nadu.
Yanam	16°42' and 16°46' N	82°11' and 82°19' E	20	East Coast. 840 kms from Pondicherry	**East:** Godavari district of Andhra Pradesh on all sides.
Mahe	11°42' and 11°43' N	75°31' and 75°33' E	9	West Coast 650 kms from Pondicherry	**West:** Arabian Sea.
Total			480		

Table 2.2 Demographic details

Region	Males	Females	Total Population	Population density	Sex ratio
Pondicherry	369428	365904	735332	2535	990
Karaikal	84487	86304	170791	1060	1021
Yanam	15893	15501	31394	1569	975
Mahe	17153	19675	36828	4092	1147
Total	486961	487384	974345	2029	1001

Note: The demographic figures are as per 2001 Census.
Source: Directorate of Census Operations.

The U.T. has a coastline of 43 kms. stretching along the Bay of Bengal and to some extent along the Arabian Sea. Pondicherry region alone has 32 kms of coastline. The U.T. also has 675 sq. kms. of inshore waters.

2.2 Meteorological features
2.2.1 Rainfall

The average rainfall is 1200 mm in Pondicherry, Karaikal and Yanam regions. In Mahe region it is around 3300 mm. Sometimes Karaikal experiences drought conditions with the annual rainfall less than 75% of the normal. Pondicherry and Karaikal regions get most of the rainfall (nearly 70 %) from the North-East monsoon during October to December. Yanam gets rainfall from both the North-East and South-West monsoons. Mahe region gets most of the rainfall (80%) from the South-West monsoon.(June to August)

Table 2.3 Monthly total Rainfall (mm) in Pondicherry region

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Ave
1999	6.5	0.6	0.0	53.0	13.7	61.3	72.6	78.4	24.9	439.5	284 5	297.4	110
2000	41.4	236.7	0.0	34.1	12.9	29.0	20.9	82.6	202.1	157.9	171 6	177.0	97.2
2001	7.4	0.0	0.0	43 1	52.2	27.9	124.1	136.9	107.3	227.1	121.3	101.1	79
2002	38.7	80.3	0.0	1.3	24.6	42.7	57.8	69.5	59.8	242.4	212.6	121.9	79.3
2003	TR	0.0	2.9	1.2	49.3	11.6	76.9	167.3	76.2	206.8	514.7	28.1	94.6

Source: Indian Meteorological Department (IMD)

Table 2.4 Monthly total Rainfall (mm) in Karaikal region

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Ave
1999	8.0	52.8	0.0	50.5	51.7	4.3	0.9	44.8	12.4	216.5	404.1	174.6	85.1
2000	220.9	145.8	0.8	5.4	3.5	52.6	35.0	72.6	112.0	221.1	234.8	157.8	103.5
2001	1.2	TR	0.0	24.7	70.3	35.6	86.1	33.6	135.5	289.7	330.7	389.6	116.4
2002	45.1	295.5	0.2	0.0	12.2	68.5	89.5	22.0	31.0	272.4	368.0	99.1	108.6
2003	11.9	0.7	0.3	6.4	46.7	153.7	90.2	126.2	91.2	80.4	491.4	49.9	95.8

Source: Indian Meteorological Department (IMD)

2.2.2 Temperature & Humidity

The average temperature ranges from 24°C to 38°C during normal days in Pondicherry and Karaikal regions. In Yanam also similar temperature profile prevails. During summer, it may reach to a maximum of 41°C.

Table 2.5 Average Temperature

Item / Division	Unit	2001-2002	2002-2003
(A) TEMPERATURE Pondicherry Region			
(a) Mean Maximum	C°	33.7	33.6
(b) Mean minimum	C°	24.1	24.1
Karaikal Region			
(a) Mean Maximum	C°	33.4	33.1
(b) Mean minimum	C°	24.4	24.6
Yanam Region			
(a) Mean Maximum	C°	-	37.0
(b) Mean minimum	C°	-	28.0
Mahe Region			
(a) Mean Maximum	C°	-	32.0
(b) Mean minimum	C°	-	14.0

In view of the coastal location the relative humidity (R.H.) is generally high. It ranges from 50% to 75%.

2.2.3 Winds

Winds are generally light to moderate in velocity during the summer and early southwest monsoon season. During southwest monsoon, winds are mostly from south to west. During the summer season, winds are Southwesterly or Westerly in the morning and Southerly or Southwesterly in the afternoons. In October and January winds are varied in direction.

2.2.4 Cyclones and Depressions

Being coastal in location, the U.T. is prone to cyclones and depressions. In Pondicherry and Karaikal regions, cyclones occur mostly during November and December.

CHAPTER - 3

OVERVIEW OF ENVIRONMENTAL ISSUES

3.1 Driving forces of environmental change

Broadly these are external and internal factors. External factors mean factors originating outside the U.T., but having impact on it. Internal factors mean those driving forces, pressures etc. that have origin within the U.T. and having an impact on it. Here the focus will be mainly on the latter. Obviously the internal factors can't be viewed in total isolation from the external factors. As such at appropriate places reference is made to the external factors as well. For instance higher rate of power tariffs and taxes in the neighbouring states can be a significant driving force for the setting up of industries in the U.T., where the power tariff and taxation are industrial friendly.

From the environment point of view, the major driving forces and their consequences on the U.T. are listed below:

Table 3.1 Driving Forces

Driving Force	Resulting Pressure
Government's industrial policies such as subsidized power, tax benefits.	Rapid industrialization and urbanization, changing land use pattern, increased pollution load on air, water and land.
Good socio economic infrastructure – social welfare measures.	Migration from the neighbouring States. Migration to urban areas. Stress on the scarce land resources.

3.1.1. Industrial policy as a driving force

Some of the major objectives of the Industrial policy announced in 1997 by the Government of Pondicherry are as follows:

- Promotion of sustainable industrialization.
- Maximum utilization of the human resources.
- Improvement of the quality of life of the people.
- Conservation of local environment and heritage and
- Balanced regional development.

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The following Tables and charts gives the details of industrial growth from 1990-91 onwards.

Table 3.2 Number of industries

Cumulative No.	1990-91	1997-98	1998-99	1999-00	2002-03	2003-04	2004-05
No. of SSIs	3883	5726	6014	6199	6876	7126	7308
No. of MSIs	53	93	111	115	139	149	159
No. of LSIs	17	28	38	42	55	65	70
Total	3953	5847	6163	6356	7070	7340	7537

Table 3.3 Different types of industries

Sl.No.	Categories	LSI	MSI	SSI	Total
1	Food Products	6	12	870	888
2	Cotton Products	7	7	829	843
3	Wood Products	Nil	Nil	465	465
4	Paper Products	4	7	419	430
5	Leather,Rubber,Plastic Products	9	36	729	775
6	Chemicals	20	29	1571	1620
7	Non Metallic Mineral Products	8	5	299	312
8	Metal Products	3	20	853	876
9	Machinery Products	11	31	629	672
10	Miscellaneous Products	Nil	Nil	196	196
11	Personal Services	2	10	200	212
12	Repairing/Servicing	Nil	Nil	248	248
	Total	70	159	7308	7537

Source: Industries Department. Govt. of Pondicherry.

As in 2005, there were approximately 7537 industrial units (7308 SSIs, 159 MSIs and 70 LSIs) or nearly two times the number of industrial units registered in 1990-91. However, all these units are not under the purview of pollution control laws. Approximately 2079 units were under the purview of pollution control laws in 2003-04. The reason for this difference is that certain service based (tertiary sector) units, which are not involved in any manufacture, are registered with the Industries Department, but are not under the purview of pollution control laws.

The Industrial policy document, 1997 identified agro processing including marine products, Electronics & Software Development, Leather products & Footwear, Light engineering including auto components and Textiles including garments as thrust area-sectors. There are nine industrial estates as listed below:

Table 3.4 Industrial estates

Sl. No.	Name of the industrial estate	Place
Pondicherry region		
1.	Industrial Estate	Thattanchavady
2.	Rural Industrial Estate	Kattukuppam (Manapet)
3.	PIPDIC Industrial Estate	Mettupalyam
4.	PIPDIC Industrial Estate	Sedarapet
5.	PIPDIC Industrial Estate	Kirumampakkam
6.	Electronic Park	Thirubuvanai
7.	Software Technology Park	Pillaichavady
Karaikal region		
8.	Rural Industrial Estate	Kottucherry
9.	Growth Centre	Polagam.

PONDICHERRY REGION
IDENTIFIED INDUSTRIAL AREAS

▲ Existing Industrial Estate
1. Sedarapet
2. Mettupalayam
3. Thattanchavady
4. Kirumampakkam
5. Kattukuppam

● Identified Industrial Areas
I. Mannadipet Commune
6. Thiruboranai
7. Thiruvandarkovil
8. Kalitheerthalkuppam
9. Kottery-Lingareddipalayam

II. Villianur Commune
10. Sedarapet
11. Karasur
12. Thuttipet & Thondamanathan
13. Kurumbapet
14. Odianpet

III. Oulgaret Muncipality
15. Alankuppam & Soorjanarayanpet

IV. Bahour Commune
16. Karayampathar

V. Nettapakkam Commune
17. Etripakkam

0 1.5 3   6   9   12
              Kilometers

PONDICHERRY REGION

N

COMMUNES
ARIANKUPPAM
BAHOUR
MANNADIPET
NETTAPAKKAM
OZHUKARAI
PONDICHERRY
VILLIANUR

Map 3.1 Identified industrial estates in Pondicherry region

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KARAIKAL REGION

BAY OF BENGAL

Tamil Nadu

Tamil Nadu

KARAIKAL REGION

IDENTIFIED INDUSTRIAL AREA

IDENTIFIED INDUSTRIAL AREA

1. VANJOOR
2. KEEZHAIYUR
3. POLAGAM
4. THENNANKUDY
5. ELETHUR
6. VARUTCHIKKUDI
7. KOTTUCHERRY

0 1 2 4 8 Kilometers
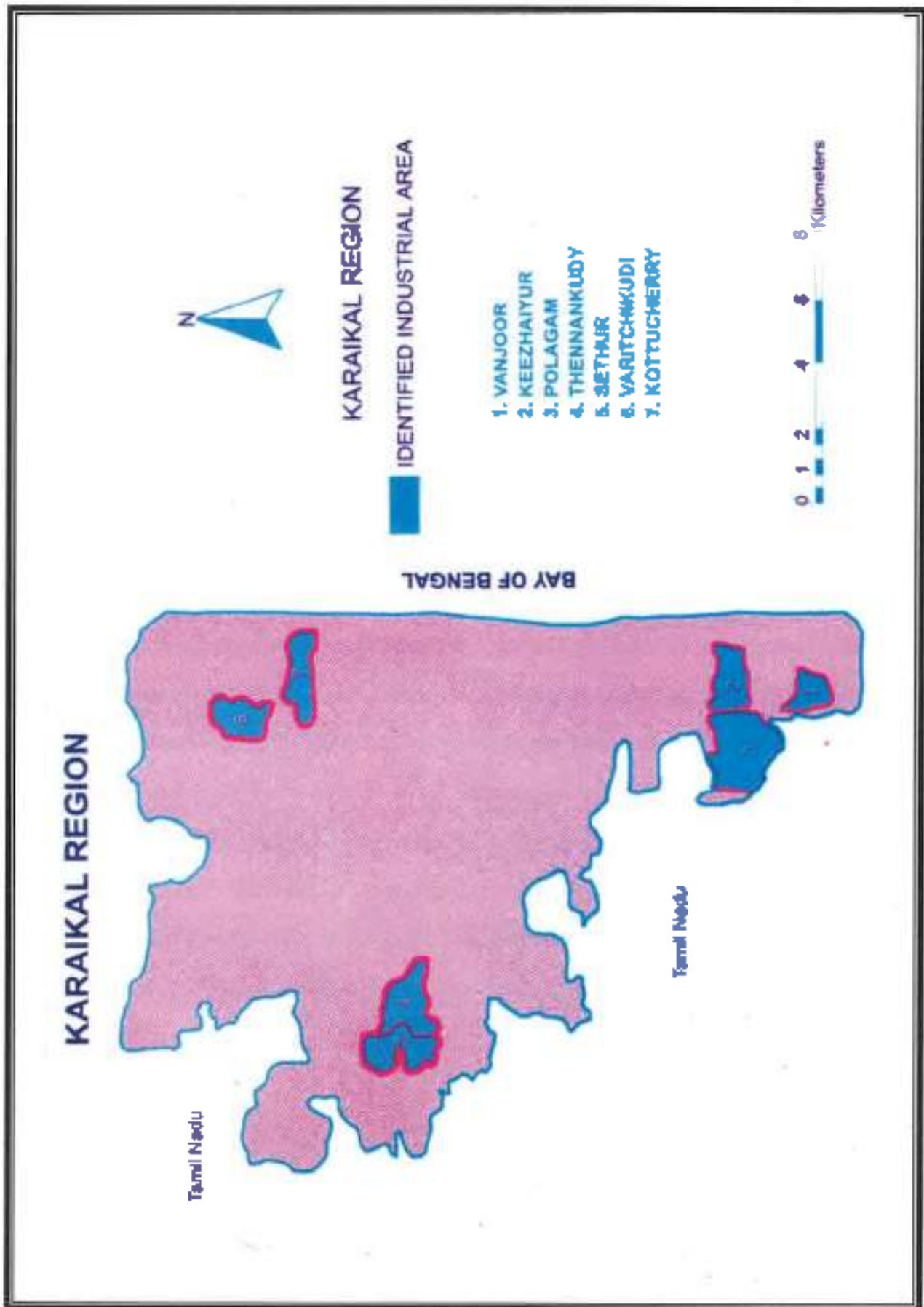
Map 3.2 Identified industrial estates in Karaikal region

17

A Special Economic Zone (SEZ) is also coming up near Pondicherry.

From the pollution point of view the industrial units have been categorized as **Red, Orange and Green** with high, medium and low pollution potentials respectively.

The major polluting industries have been Mild Steel (M.S.) Ingot, Calcium Carbide, Ferro alloys, Chlorates and Bulk Drug.

Of late in view of the smallness of the area and environmental concerns, units with high pollution potential (like M.S.Ingots, Calcium carbide, Chlorates etc.) are not being encouraged in the U.T.

3.1.2. Energy consumption growth as a driving force

Increasing energy consumption also acts as a driving force. Growth in population and change in lifestyle are the main factors responsible for increased power consumption. With the increasing consumption, more power has to be generated. This requires installation of more power generation facilities. Since most of the power is generated from fossil fuels (more particularly coal) it increases the pollution load. However, since the U.T. doesn't have coal based power-generating facilities it will not add much pollution load. The per capita consumption of power in the U.T. has increased from 1589 kWh in 2002-03 to 1727 kWh in 2003-04. The annual increase in the energy consumption is estimated to grow by 4.62% to 5%.

3.1.3. Population growth as a driving force

The population has grown in the U.T. from 471707 in 1971 to 974345 in 2001. The population density has increased from 958 per sq.km in 1971 to 2,029 in 2001. (Amongst the 4 regions Mahe (4092) and Pondicherry (2535) have relatively high population density whereas Karaikal (1060) and Yanam (1569) have relatively less population density (2001 Census)).

Table 3.5 Population growth trends

Region	1971	1981	1991	2001	Decadal growth (%)		
					1971-81	1981-91	1991-2001
Pondicherry	340240	444417	608338	735332	30.62	36.88	20.87
Karaikal	100042	120010	145703	170791	19.96	21.41	17.21
Yanam	8291	11631	20297	31394	40.28	74.51	54.67
Mahe	23134	28413	33447	36828	22.81	17.72	10.1
Total	471707	604471	804471	974345	28.15	33.64	20.62

Source: Statistical Handbook 2001-2002, Directorate of Economics & Statistics,

The growth rate of population in the past three decades has almost been an average of 27 % per decade.

Though the decadal growth rate during 1991 – 2001 is low (i.e., 20.56%), because of comparatively high population base in absolute terms it may not be much significant.

Migration from the neighbouring states has been one of the major contributory factors for the growth of population in the U.T. The density of population has doubled in the past three decades from 958 per sq.km in 1971 to 2029 in 2001.

3.1.4. Urbanization as a driving force

Urbanization has got its own advantages and disadvantages. The main advantage is that it provides scope for provision of common infrastructure facilities. The main disadvantage is that it creates more strain on the resources (including land and water). The environmental consequences of urban growth are considerable. Cities are prolific users of natural resources and generators of wastes. The urban ways of living contribute to relatively more pressure on resources. Migration of people to cities puts enormous pressure on the infrastructure in terms of available land, water etc. Some of the issues will be water scarcity and water pollution, air pollution, climate and Heat Island Effect, poor management of solid wastes, urban congestion etc. The U.T. is predominantly urban in character (66.57%).

Table 3.6 Population in Rural & Urban areas

Area	Rural	Urban	Total
Pondicherry	229373 (31.20%)	505959 (68.80%)	735332 (100%)
Karaikal	96353 (56.44%)	74438 (43.56%)	170791 (100%)
Mahe	0 (0%)	36828(100%)	36828 (100%)
Yanam	0 (0%)	31394 (100%)	31394(100%)
Total	325726 (33.43%)	648619 (66.57%)	974345 (100%)

Source: Directorate of Census Operations. (2001)

There are no metropolitan cities in the U.T. Pondicherry, Karaikal, Mahe, & Yanam are the main towns.

Migration of people from the rural areas may lead to the formation of slums. Lack of awareness and adequate facilities lead to unhygienic conditions. Solid waste and sanitation management is another problem. Pondicherry Slum Clearance Board is implementing a housing scheme to phase out the slums.

Slum Population

The details are given in the table below

Table 3.7 Slum Population (in lakhs)

Year	1981			1991			2001		
Category	A	B	%	A	B	%	A	B	%
Pondicherry	3.160	0.942	29.8	5.170	1.531	29.6	7.106	2.128	29.6

Source: A Compendium on Indian Slums.

Town and Country Planning Department

Note: A   -   Urban Population

   B   -   Identified slum Population

Slum population estimates are based on the information received from the concerned U.T. Government for the year 2001.

3.1.5. Economic activities as driving force

Economic activities also constitute an indirect pressure in the sense they increase the movement of men and material. This leads to increased fuel consumption, waste generation etc. Good educational, health and tourism infrastructure has increased the floating population in the U.T. The details of educational and health institutions are given below:

Table 3.8 Education institutions in Pondicherry

Sl. No	Type of Institutions	1997-98	1998-99	1999-2000
I.	GENERAL EDUCATION			
1.	Central University	--	--	1
2.	Arts, Science & Commerce Colleges	7	8	8
3.	Junior College	--	--	1
4.	Higher Secondary Schools	58	60	63
5.	Secondary Schools	105	114	120
6.	Middle Schools	116	107	105
7.	Primary Schools	340	356	346
8.	Pre-Primary Schools	179	192	222
	Total	805	837	866
II.	PROFESSIONAL / TECHNICAL AND SPECIAL EDUCATION			
A)	Degree Levels and above	3	3	3
1.	Medical College	2	2	4
2.	Engineering & Technology College	1	1	1
3.	Law College	1	1	1
4.	Agricultural College	1	1	1
5.	Veterinary College	1	1	1
6.	Teacher Training college	--	--	1
7.	Vector Control Research Centre	1	1	1

8.	Institute of Public Health Sciences	1	1	1
9.	Music and Fine Arts College			
B.	**Below Degree Level**			
1.	Polytechnic Institutes	4	4	4
2.	Teacher Training Institutes	1	1	2
3.	School of Nursing	1	1	1
4.	Catering Institute	--	--	1
5.	Craft School	1	1	1
6.	Special School	7	7	5
	Total	**25**	**26**	**30**
	Grand Total (I +II)	**830**	**863**	**896**

Table 3.9 Number of medical institutions and beds

Sl.No	Item	2000	2001	2002
1.	Hospitals	8	8	8
2.	Chest Clinic	3	3	3
3.	Community Health Centre	4	4	4
4.	Primary Health Centre	39	39	39
5.	Sub Centre (Urban)	23	23	24
6.	Sub Centre (Rural)	52	52	51
7.	ESI Dispensaries (Urban)	10	10	10
8.	ESI Dispensaries (Rural)	2	2	3
9.	Hospital Beds (Incl. Chest Clinic)	1759	1759	1925
10.	Primary Health Centre Beds	192	192	196
11.	Community Health Centre Beds	120	120	120

Note: Medical institutions run by Central government are not included.
Source: Directorate of Health and Family Welfare Services, Pondicherry.

3.1.5.1. Tourism as a driving force

The most popular tourist destinations have been Aurobindo Ashram in Pondicherry and Thirunallar Temple in Karaikal. In 2004, 590498 tourists visited the U.T. Even though in absolute terms the number is not significant, given the smallness of area and a population of around 10 lakhs (2001 Census), the number of tourists as a proportion to the population is very high.

Table 3.10 Number of Tourists arrival in the U.T.

	Tourists		
	Domestic (No.)	Foreign (No.)	Total (No.)
2000	572274	23878	596152
2001	476804	22115	498919
2002	480519	20094	500613
2003	500139	25559	500613
2004	558445	32053	590498

Source: Directorate of Tourism, Govt. of Pondicherry

CHAPTER – 4

WATER RELATED ISSUES

4.1. Introduction

In this chapter, an attempt is made to take stock of the water resources in the U.T. and the problem of pollution due to human activities.

4.2. Pressure

4.2.1. Increasing population

With the increasing population the requirements of water also increases. Even though water is available at shallow depths in the coastal areas, provision of potable water becomes a major issue because of high salinity. Excessive drawal of groundwater in coastal areas also creates pressure in the form of salt water intrusion.

Increasing population also increases wastewater generation and the need for more infrastructure facilities like water supply and sewerage system.

4.2.2. Increased urbanization

Though most of the issues are discussed above, urbanization needs special emphasis in the sense that more number of water resources are required for supply to urban areas as the population density will be high.

4.2.3. Inadequate sanitation facilities

Lack of sanitation facilities and improper disposal of human and animal wastes contribute to poor surface water quality and thus lead to the spread of water borne diseases.

In urban areas, the pressures are lack of adequate sewage collection, treatment and disposal facilities. This often leads to high levels of biological pollution load leading to eutrophication.

Slum growth is another problem. In Pondicherry City, out of the total sewage generation of around 60 MLD only 13 MLD is treated presently using the treatment facilities available. Rest 47 MLD is discharged into sea untreated.

3.3.4. Industrialization:

The industries apart from consuming water generate waste water/effluent, which if not treated properly before discharge, can pollute water resources. Liquid effluents, generated from certain industries may contain toxic pollutants. The Ministry of Environment and Forests (MoEF) has identified 17 categories of highly polluting industries for the purpose of close monitoring and regulating pollution from them. They are listed below.

1. Aluminum Smelter
2. Caustic Soda
3. Cement
4. Copper Smelter
5. Distilleries
6. Dyes & Dye Intermediates
7. Fertilizer
8. Integrated Iron & Steel
9. Tanneries
10. Pesticides
11. Petrochemicals
12. Drugs & Pharmaceuticals (Bulk)
13. Pulp & Paper
14. Oil Refineries
15. Sugar
16. Thermal Power Plants
17. Zinc Smelter

Summary Status of the Pollution Control in the units of 17 categories in the U. T. is given below:

Table 4.1 Status of 17 Categories of Units

Total Number of Units	Status of the Number of Units		
	Closed	C#	Defaulters
8	1	7	0

Note: C# - Having adequate facilities to comply with the Standards.
Source: Annual Report 2003-04, MoEF, and PPCC.

The Ministry has, over the last two decades, developed standards for regulating emissions from various industries and emission standards for all the polluting industries including iron and steel plants, cement plants, fertilizer plants, oil refineries, pulp and paper, petrochemicals, sugar, distilleries and tanneries have been prescribed under the Environment Protection Act 1986

Many industrial units in the U.T. have installed onsite ETPs (Effluent Treatment Plants) to treat the industrial effluents. There are no common ETPs (CETPs) in the U.T.

4.2.5. Increasing application of pesticides and fertilizers

The consumption of pesticides and inorganic fertilizers has been on the rise in case of irrigated lands. The trends of consumption of fertilizers and pesticides in the U.T are given below. The main problem is that of excessive application leading to soil and water pollution.

Plate 4.1 ETP Tank

Plate 4.2 Solar evaporation pond

Table 4.2 Consumption of Fertilizers and Pesticides in the U.T.

Year---->	1985-86	1990-91	1995-96	2000-01	2002-03
Chemical Fertilisers (in thousand tons)	14.8	21.9	2064	23.7	33.36
Pesticides (Kgs / Ha)	N.A.	N.A.	2.68	1.37	1.18

Table 4.3 Consumption of Pesticides.

Year---->	1994-95	1995-96	1996-97	1997-98	1998-99
Pesticides (Technical Grade) in Metric Tons	130	118	115	81	71

Source: Ministry of Chemicals and Fertilizers

4.2.6. Land degradation

Land degradation, unregulated sand and red earth mining etc. affect the recharge of water in the riverbeds. This may also cause floods during excessive rains.

4.2.7. Increasing irrigation

In view of better returns as a general trend, people are moving towards irrigating their lands from whatever source available – tanks, canals, borewells (ground water). This will add pressure on the demand side. The application of pesticides / fertilizers is also more in case of irrigated land.

4.2.8. Pressure due to aquaculture

The main environmental issues related to brackish water aquaculture are as below:

Brackish water aquaculture involves storage of large volumes of saline water on land. This may cause dispersion of salts into land area in and around the farms, making them saline, and unfit for any other agricultural purpose. This may also contaminate the ground water as well. Huge quantities of freshwater are required for commercial aquaculture farms in order to dilute the seawater (salinity around 25,000 mg/l). This will exert pressure on freshwater. Further uncontrolled abstraction of groundwater for aquaculture farming may result in:

- Lowering of the water table.
- Salinisation of groundwater due to seawater intrusion.

Unconsumed feed, shrimp excreta, other chemicals / antibiotics used during the farming operations cause the pollution of pond water. When discharged, such pond water may cause eutrophication in natural water bodies and also deplete dissolved oxygen due to the presence of biodegradable organic pollutants.

Considering the environmental damages of intensive commercial aquaculture practices, the Supreme Court of India has banned intensive aquaculture within CRZ (W.P.No.561/94) and entrusted the job of issuing clearances to the farms existing / proposed outside the CRZ, to the Central Aquaculture Authority constituted as per the directions of the Supreme Court with headquarters at Chennai.

Of the total area of 1592 Ha of brackish waters in the Union Territory of Pondicherry, 121 Ha in Pondicherry, 745 Ha in Karaikal and 339 Ha in Yanam region are found suitable for aquaculture.

The ideal soil salinity for brackish water aquaculture is around 25 ppt and more. Aquaculture is being practiced in an area of around 5.74 Ha in Pondicherry region, 82.61 Ha in Karaikal region and 40.00 Ha in Yanam region. The land where aquaculture is carried out is nearer to the sea and is not fit for agriculture in view of high salinity.

The Environment Impact Assessment (EIA) done by the Central Marine Fisheries Research Institute (Madras Research Centre) in and around the aquaculture farms in Karaikal (Vanjore) has revealed that the waste water discharged from the aquaculture farms is meeting the permissible standards as shown below:

Table 4.4 Discharge water quality.

Sl.No.	Parameter	Observed range at Vanjore (Karaikal)
1	PH	7.7 to 8.3
2	DO (mg/l)	3.3 to 5.5
3	BOD (mg/l)	3.29 to 45.60
4	COD (mg/l)	100.1 to 100.6
5	TSS (mg/l)	0 to 82
6	Ammonia (mg/l)	0.0 to 0.5
7	Phosphate (mg/l)	0.25 to 0.50
8	Copper (g/ml)	0.021 to 0.251
9	Chromium (g/ml)	0.187 to 0.251
10	Zinc (g/ml)	0.437 to 0.520
11	Cadmium (g/ml)	0.043 to 0.117

Only biodegradable organic materials like Mahua Oil Cake, tea seed cake are used instead of chemicals as per the guidelines of the Aquaculture authority. Only traditional and improved traditional methods as opposed to intensive methods are adopted.

4.3. State

Water requirement for various sectors (as estiminated in 1998) is as follows: domestic-35.35 MCM, (16%), Agriculture-174.4 MCM (81%), Industries and others- 7.02 MCM (3%). The U.T. is mainly dependent upon groundwater for agriculture. The groundwater potential in the Pondicherry region is shown in the map 4.1. In some places (in Pondicherry region) tank irrigation (Ousteri & Bahour tanks) is in vogue. These tanks are in turn fed by Gingee and Pennaiyar rivers.

In Karaikal region during favourable monsoon years Cauvery water is available for irrigation. For industrial use the main source of water supply is ground water. Of late PPCC is insisting upon desalinization in case of new large-scale industries to minimize or phase out groundwater usage. Similar is the encouragement for adopting zero discharge technology to minimize wastewater discharge and promote recycling/ reuse of the treated wastewater.

4.3.1. Surface water

The main sources of surface water are the tanks and ponds and small rivers like Sankaraparani, Pambayar, Malattar, Penniar (in Pondicherry region), Arasalar and distributaries of Cauvery (in Karaikal region), Gouthami (in Yanam) and Mahe (in Mahe). Map 4.2 gives the surface water drainage pattern in the Pondicherry region.
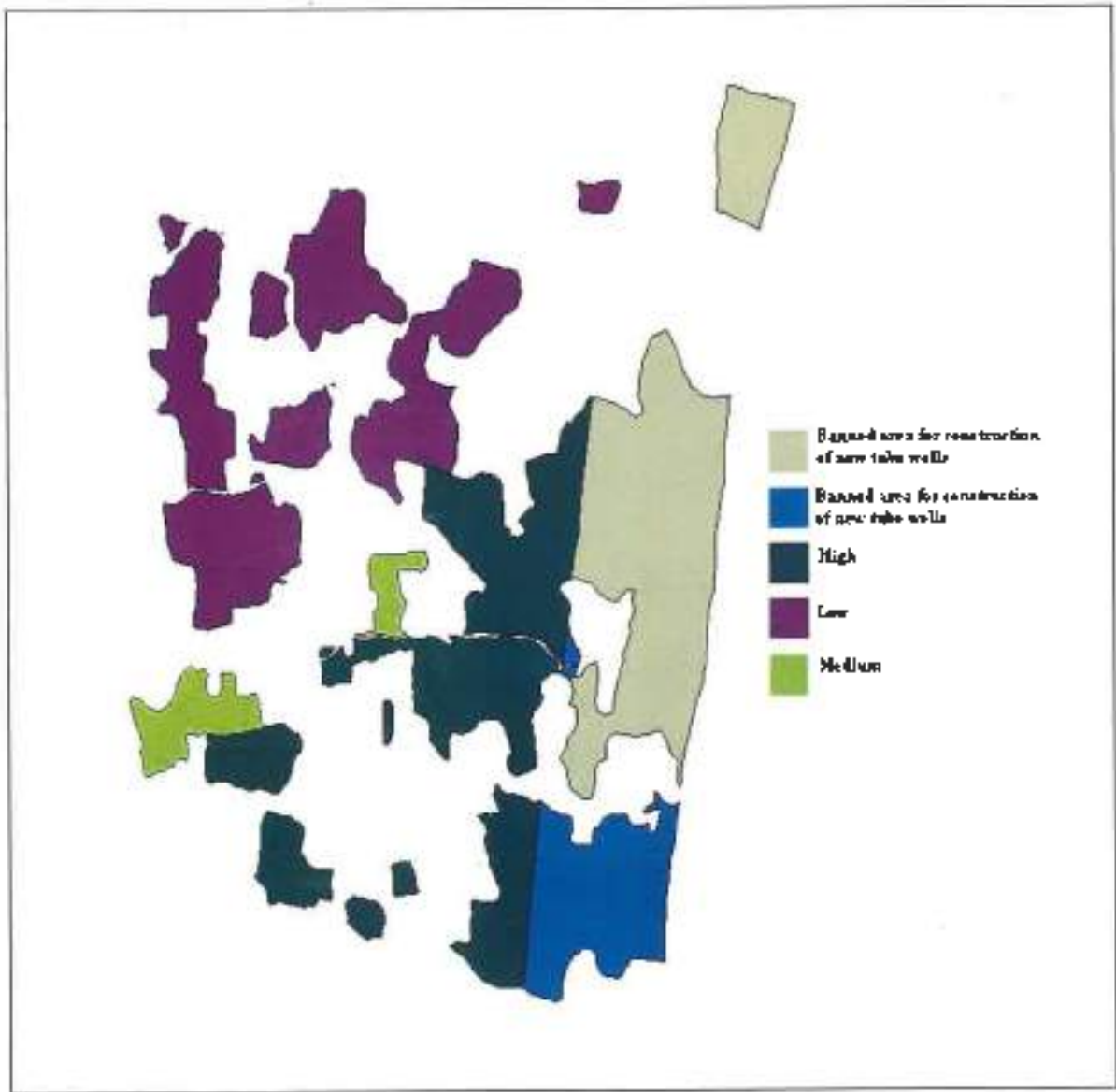
Map 4.1: Ground water potential

The legend reads:
- Banned area for reconstruction of new tube wells
- Banned area for construction of new tube wells
- High
- Low
- Medium

There are 86 small and medium tanks in Pondicherry region of total capacity 46.36 MCM, which are serving about ,6764.6 Ha. The storage capacity of Ousteri and Bahour tank is 15.29 MCM and 5.60 MCM which are serving about 1568.0 Ha and 388.7 Ha of Agriculture land respectively.

4.3.2. Ground water

The evaluation of ground water quality is as important as quantity, since the usability of water is determined by its chemical and biological characteristics. The quality of ground water depends upon the nature of rock formation, physiography, soils, environment, recharge and discharge conditions in the area. Artificial pollution sources like sewerage, organic and other waste dumps, and chemical dumps too cause considerable ground water pollution particularly in the urban areas.
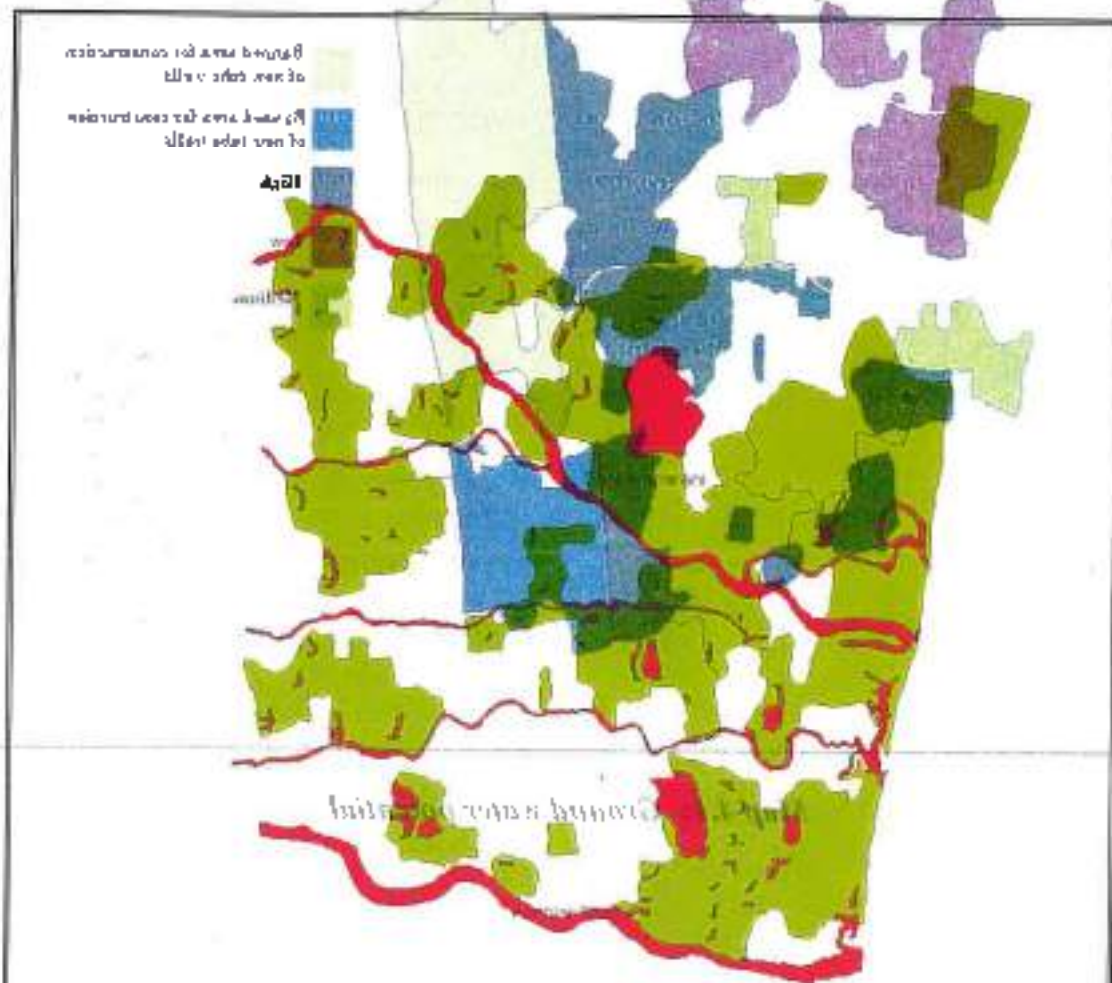
Map 4.2 Drainage - Pondicherry region

The prescribed water quality parameters and water quality criteria for various uses are shown in Table 4.5 and Table 4.6

Table 4.5 Drinking water quality standard – IS:10500-1991

Sl. No	Substance or Characteristics	Requirement (Desirable limit)	Permissible limit in the absence of alternate source
	External characteristics		
1.	Colour, Hazen units, Max	5	25
2.	Odour	Unobjectionable	--
3.	Taste	Agreeable	--
4.	Turbidity NTU, Max.	5	10
5.	pH value	6.5 to 8.5	No relaxation
6.	Total hardness (as $CaCo_3$)	300	600
7.	Iron (Fe) mg/l	0.3	1.0
8.	Chlorides (as Cl) mg/l, Max.	250	1000
9.	Residual, Free chlorine, mg/l, min	0.2	--
	Desirable characteristics		
10.	Dissolved Solids mg/l, Max.	500	2000
11.	Calcium (as Ca)	75	200
12.	Magnesium (Mg^{2+})	30	100
13.	Copper (Cu)	0.05	1.5
14.	Manganese (as Mn) mg/l, Max.	0.1	0.3
15.	Sulphate (as SO_4) mg/l, Max	200	400
16.	Nitrate (as NO_3) mg/l, Max.	45	100
17.	Flouride (as F) mg/l, Max.	1.0	1.5
18.	Phenolic compounds (as C_6H_5OH)	0.001	0.002
19.	Mercury (as Hg) mg/l, Max.	0.001	No relaxation
20.	Cadmium (as Cd) mg/l. Max.	0.01	No relaxation
21.	Selenium (as Se) mg/l, Max.	0.01	No relaxation
22.	Arsenic (as As) mg/l, Max.	0.05	No relaxation
23.	Cyanide (as CN) mg/l, Max.	0.05	No relaxation

24.	Lead (as Pb) mg/l, Max.	0.05	No relaxation
25.	Zinc (as Zn) mg/l, Max.	5	15
26.	Anionic detergents (as MBAS)	0.2	1.0
27.	Chromium (as Cr^{6+}) mg/l, Max.	0.05	No relaxation
28.	Mineral off mg/l, Max.	0.01	0.03
29.	Pesticides mg/l, Max.	Absent	0.001
30.	Radioactive materials • Alpha emitters Bq/l • Beta emitters pci/l, max.	---	0.1
31.	Alkalinity mg/l, Max.	200	600
32.	Aluminium (as Al) mg/l, Max.	0.03	0.2
33.	Boron mg/l, Max.	1	5

Table 4.6　Water quality criteria for different uses (according to CPCB)

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN / 100ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand 5 days 20oC 2mg/l or less
Outdoor bathing (Organised)	B	1. Total Coliforms Organism MPN /100ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN / 100ml shall be 5000 or less • pH between 6 to 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less

Propagation of Wild life and Fisheries	D	• pH between 6.5 to 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	❖ pH between 6.0 to 8.5 ❖ Electrical Conductivity at 25°C micro mhos/cm Max.2250 ❖ Sodium absorption Ratio Max. 26 ❖ Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

Degradation in the quality of groundwater is mainly because of -

i. excessive exploitation leading to salt water intrusion,

ii. indiscriminate disposal of solid wastes and the consequent contamination by leachate,

iii. discharge of untreated or partially treated sewage

iv. discharge of untreated or partially treated industrial effluents.

A study (2004-05) was done by PPCC on the impact of acid slurry units on ground water and soil in the areas surrounding the concerned units. It points out that because of improper handling of raw materials (Sulphuric acid and Linear Alkyl Benzene) and storage and indiscriminate discharge of effluents, the soil as well as groundwater were found polluted in and around some of the units. Acidity and high sulphate content are the major contributing factors.

PPCC is regularly monitoring the water quality in 10 sampling points (9 in Pondicherry region and 1 in Karaikal region) (maps 4.3 & 4.4) under the NWMP (National Water quality Monitoring Programme) project to assess the water quality. The details are as below:

Table 4.7 NWMP locations

Sl.No.	Location	Type	Sampling Frequency
1	Pondicherry University	Bore Well	Half Yearly
2	V.O.C. Nagar	Bore Well	Half Yearly
3	Thengaithittu	Bore Well	Half Yearly
4	Muthirapalyam	Bore Well	Half Yearly
5	Nehru Statue	Bore Well	Half Yearly
6	Katterikuppam	Bore Well	Half Yearly
7	Ousteri Lake	Lake	Quarterly
8	Bahour Lake	Lake	Quarterly
9	Chunambar	River	Quarterly
10	Arasalar (Karaikal)	River	Quarterly

Note: (1) Half Yearly-→April-May and October-November Quarterly-→January, April, July and October.

(2) pH, Conductivity, BOD, Nitrate-Nitrogen and Nitrite-Nitrogen are monitored regularly. Whereas the parameters of turbidity, Phenolphthalein alkalinity, total alkalinity, Chloride, COD, total Kjeldahl-N, Ammonical –N, hardness, Calcium, Sulphate, Sodium, TDS, Total Fixed Solids, TSS, Phosphate, Boron, Magnesium, Potassium and Flouride are measured once in a year.
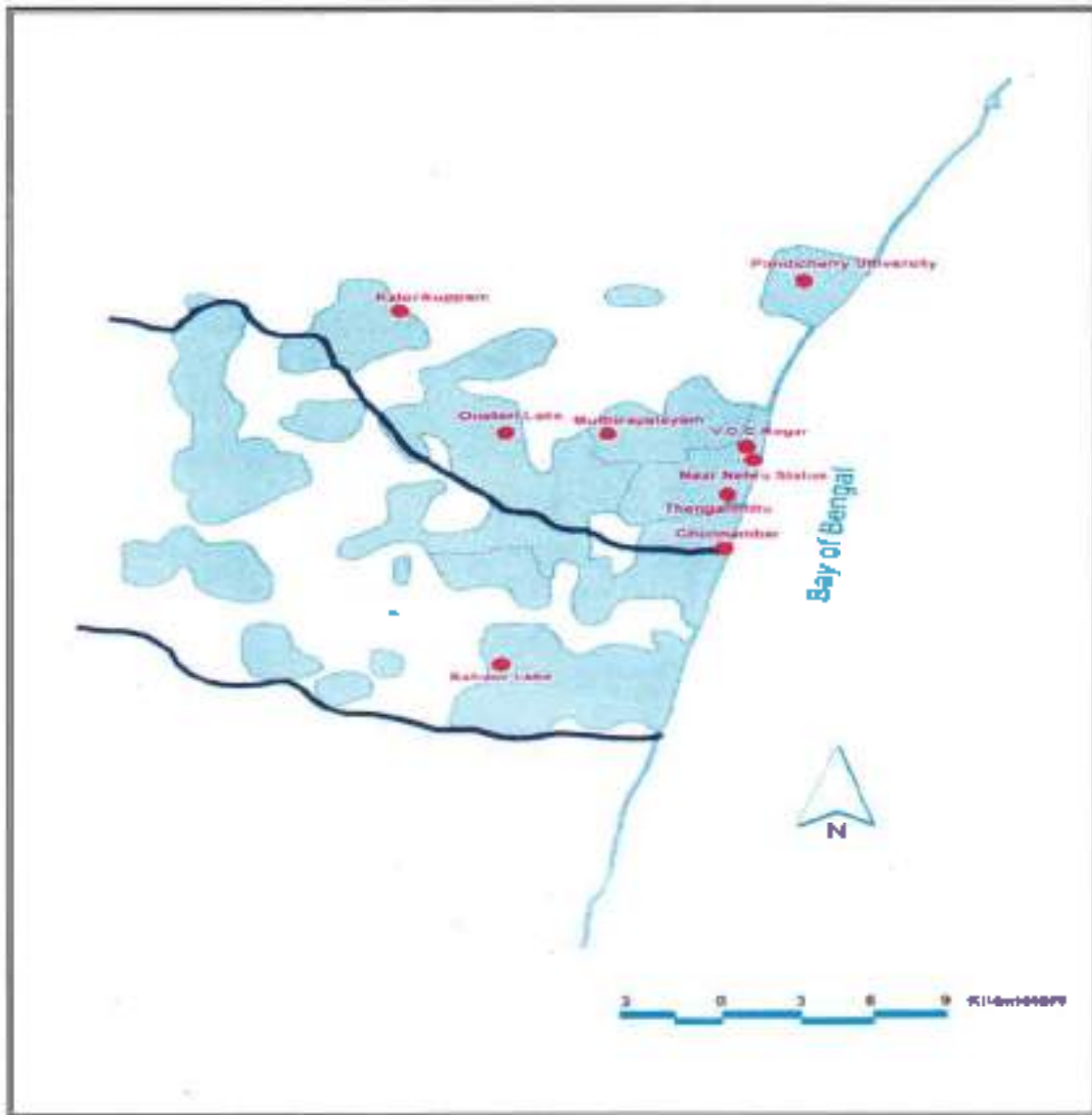
Map 4.3 Location of NWMP stations in Pondicherry

Arasalar River

Bay of Bengal
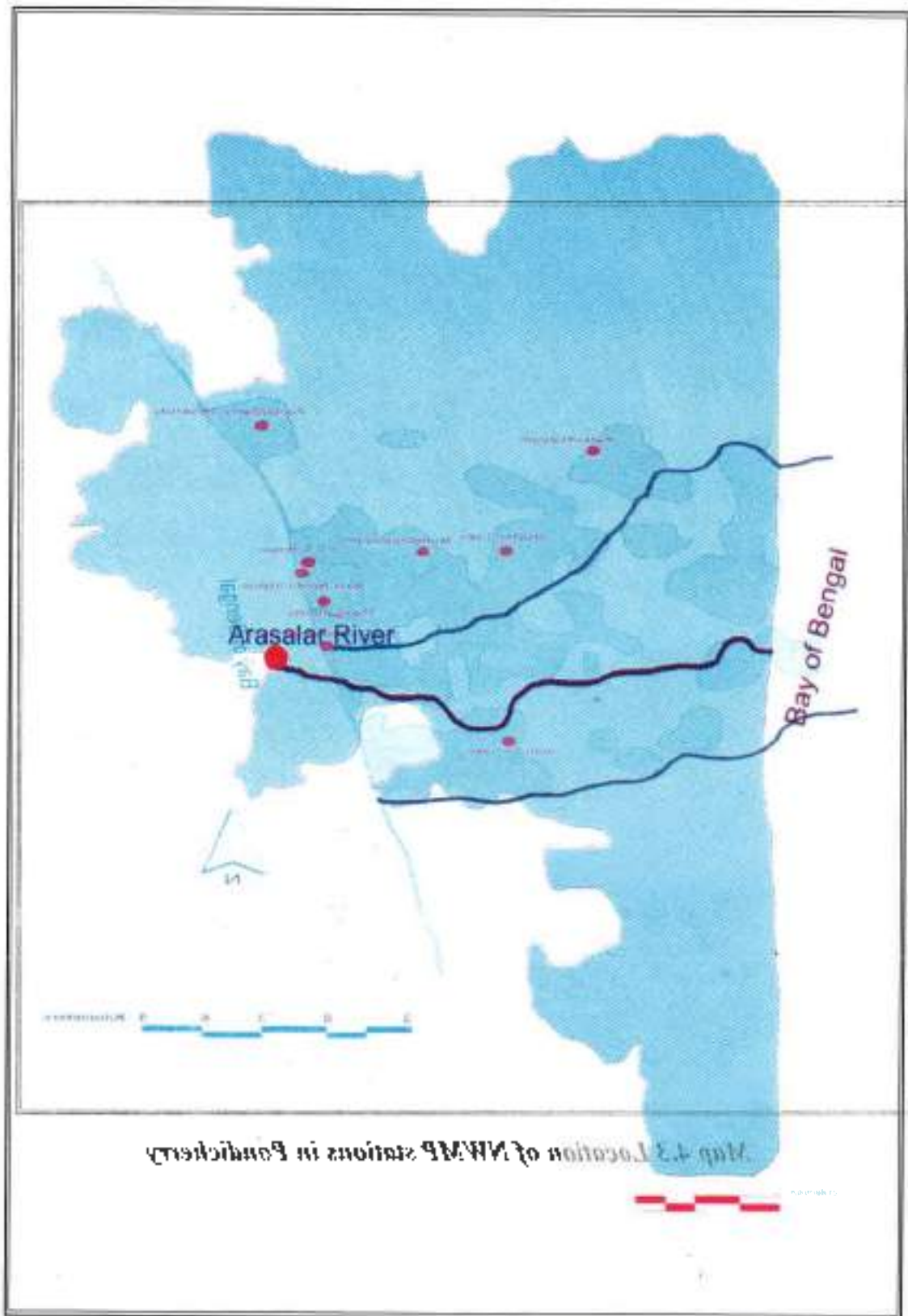
Map 4.4 Location of NWMP station in Karaikal

The observed quality parameters of surface water and groundwater in various sampling locations in Pondicherry, Karaikal and Yanam regions are given in Tables 4.8, 4.9, 4.10 and 4.11.

Table 4.8 Water quality in Pondicherry region

Parameters	Muthirapalyam Borewell		Std. value	Chunambar River		Bahour Lake		Std. value
Period	Jun2k	Apr04	--	May.02	Apr. 04	May.02	Apr.04	--
Temp. in °C	32	29	-	30	32	37	33	--
PH	6.91	6.95	6.5-8.5	8.88	8.8	9.23	8.0	6.0-8.5
Chloride	59	56.3	250	15653	21400	139.5	77.7	--
TDS	339	430	500	29312	27800	483	540	--
NO_3-N+NO_2-N	0.43	BDL	45	BDL	0.12	0.784	40.6	--
NO_3-N+NO_2-N	BDL	BDL	--	0.04	BDL	0.02	0.11	--
Total Hardness	128	149.5	300	4368.6	11650	95	104.8	--
Ca Hardness	102	97.0	75	815	1165	42.7	42.7	--
Mg Hardness	26	52.5	30	3553.6	10485	52.3	62.1	--
Sulphate	22.7	34.1	200	355.7	295	43.5	75	--
Phospate	0.007	0.04	--	0.024	0.007	0.25	0.182	--
DO	4.9	6.6	--	13.4	11	4.1	2	--
BOD	BDL	BDL	--	15.8	12	45.3	21	--
COD	NIL	NIL	--	61.2	46.7	97.9	87	--
Alkalinity	125.4	163.5	500	155.2	180	184.3	260.8	--
Conductivity	509	670	--	37500	35400	795	830	--
Sodium	-	47.4	--	486	6450	117	99	--
Potassium	-	3.1	--	-	227	-	8.7	--

Note:- All the parameters are expressed in mg/l except pH, Temperature and Conductivity.
Source: Department of Science, Technology and Environment, Pondicherry

The higher values of TDS, Chloride, Sodium, Magnesium etc. in the case of Chunamber river are due to the estuarine environment of the river.

Table 4.9 Water quality in Karaikal region

Parameters	Arasalar River		Standard values
	May 02	Apr.04	
Temp.in °C	50	28	--
PH	8.7	8.44	6.0-8.5
Chloride	4340	378.8	--
TDS	6732	1220	--
NO_3-N+ NO_2-N	0.24	0.14	--
NH_3-N	0.03	0.068	--
Total Hardness	1146	101	--
Ca Hardness	271.8	349	--
Mg Hardness	873.7	66.1	--
Sulphate	235.3	72.9	--
Phospate	0.075	0.307	--
DO	6.6	1.7	--
BOD	14.5	9	--
COD	36.7	31.6	--
Alkalinity	261.9	211.1	--
Conductivity	11240	1890	--
Sodium	1470	6895	--
Potassium	-	256	--

Note:- All the parameters are expressed in mg/l except pH, Temperature and Conductivity.

Source: Pondicherry Pollution Control Committee

Table 4.10 Surface water quality in Yanam region

Parameters	French Canal	French Canal (Gopal Nagar)	River Godawari	River Godawari (Darialdippa)	River Goringa	Adavipolam Canal	Std. values
pH	6.95	7.16	8.17	8.12	8.22	7.53	6.0-8.5
Conductivity in Micro Mhos/cm	203	281	39700	39800	38000	166	--
SO_4	8.8	12.6	352.7	411.02	407.5	3 5	--
TDS	132	204	33828	34832	32368	116	--
Alkalinity	89.9	110.9	147	137.02	183.7	3045	--
NO_3 N+NO_2-N	BDL	BDL	0.031	0.209	BDL	0.0059	--
Total Hardness	77.2	91.08	5940	9306	63.36	67.2	--
Ca Hardness	65.34	61.38	2970	6732	45.54	43.56	--
Mg Hardness	11.86	29.7	29.70	2571	1782	23.64	--
COD	NIL	NIL	56	16	NIL	NIL	--
BOD	BDL	BDL	22	18	BDL	BDL	--
Chloride	24.9	36.99	157.0	18494	17400	21.99	--

Note: All parameters are expressed in mg/l except pH and conductivity

BDL - Below detection level.

Source: Pondicherry Pollution Control Committee

Date of Sampling: 12.04.2002.

The higher values for TDS, Chloride, Sodium etc. in the case of Godavari river are due to the estuarine environment of the river.

Table 4.11 Ground water quality in Yanam

Parameters	PWD Ground well	Darialdippa Well	Mettacur well water	Standard values
PH	8.03	7.94	7.69	6.5-8.5
Conductivity in Micro Mhos/cm	218	1596	1489	--
SO₄	13.09	85.40	144.10	200
TDS	132	1032	1072	500
Alkalinity	95.70	639.45	470.40	200
NO₃+NO₂-N	0.48	0.031	0.011	45
Total Hardness	79.20	209.80	273.24	300
Ca Hardness	63.36	194.05	227.70	75
Mg Hardness	15.84	15.76	45.54	30
COD	NIL.	NIL	NIL	–
BOD	BDL	BDL	BDL	--
Chloride	26.99	177.90	31.99	250

Note: All parameters are expressed in mg/l except pH and conductivity
BDL - Below detection level.
Source: Pondicherry Pollution Control Committee
Date of Sampling: 12.04.2002

The water samples taken in Kalapet area (from the borewells in the premises of Jawahar Navodaya Vidyala) in Pondicherry had indicated contamination of ground water due to improper discharge of effluents from a nearby pharmaceutical industry (2003). After stoppage of discharge of effluents and after rains in the consecutive period the quality of groundwater has improved.

4.3.2.1. Fluorides

Earlier (1993-94) high fluoride and low pH content have been noticed in the Mettupalayam industrial estate and a study conducted by National Geophysical Research Institute, Hyderabad and mitigative measures have been taken. Now there is no Fluoride problem in the Union Territory of Pondicherry.

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4.3.2.2 Nitrates

There is no much nitrate problem in the U.T.

4.3.2.3. Total Dissolved solids (TDS)

The TDS is high in coastal areas mainly because of salt water ingression. Along the coastal area in the Pondicherry region the shallow aquifer is brackish in nature because of ingression of seawater and excessive drawal of groundwater on the western side. In karaikal region even though water table is very shallow the same has not been fully utilised because of high TDS. In most of the areas in Karaikal region have high TDS (in some places ranging from 800 to 2000 mg/litre).

4.3.2.4. Sulphates

High sulphate content of 900 mg/l has been noticed in the ground water in Sedarapet area (in situ) and 200mg/L in Mettupalayam (because of industrial pollution) in Pondicherry region. In Ramanthapuram sandstone formation in the North-West part of Pondicherry region sulphate content is high.

Usage of ground water

The usage of groundwater is more in the U.T. is given below:

The following Tables gives details of Groundwater Resources (in MCM/Year) in the U.T.

Table 4.12 Usage of ground water

Total Replenishable Ground water resources	Provision for Domestic, industrial & other uses	Available For irrigation	Projected Net Draft	Balance For future use	Level of Ground water Development
174.6	26.2	148.4	115.5	32.9	77.85%

Source: Central Groundwater Board, (CGWB)

Around 70 MLD is drawn through bore wells maintained by the Public Works Department in Pondicherry town for public water supply.

The following Tables give the details of observed fall in water Table in some of the selected locations in Pondicherry and Karaikal regions:

Table 4.13 Extent of fall in water Table in Pondicherry region
(in meters below the ground)

Sl. No	Village Name	Well Type	Year									
			1985		1990		1995		2000		2004	
			Feb	Sep	Feb	Oct	Feb	Oct	Feb	Sep	Feb	Sep
1	Ariyur	A	12.92	15.89	26.50	28.30	30.19	30.48	21.70	28.00	38.30	N.A
2	Kodathur	A	14.42	17.15	25.34	26.97	32.49	29.15	22.60	27.10	35.00	36.10
3	Marunadipet	A	19.00	22.00	29.72	31.86	35.89	36.90	22.80	26.80	36.10	36.50
4	Lingaredipulayam	C	13.04	16.44	29.30	30.15	38.87	35.00	27.15	32.15	13.60	40.80
5	Puransingupalayam	C	17.04	20.68	31.44	28.25	36.99	33.60	24.30	27.20	37.00	N.A
6	Thondamanatham	C	8.45	9.65	25.87	25.12	34.78	21.60	N.A	N.A	N.A	N.A
7	Karaiampathur	T	7.50	14.21	21.56	23.28	27.84	25.25	N.A	22.10	32.10	33.25
8	Manakuppam	T	8.15	13.45	21.40	22.64	24.88	24.05	N.A	N.A	30.40	31.00
9	Mangalam	T	5.49	8.17	15.70	19.73	18.06	18.10	11.15	20.15	14.15	11.30
10	Thirukanchi	T	4.61	N.A	12.43	14.87	17.86	15.60	10.00	13.00	N.A	19.00

Note: A- Alluvial, C- Cretaceous; T- Tertiary

The data clearly shows that the water Table has fallen steeply in the past two decades.

Table 4.14 Extent of fall in water table in Karaikal region (In meters below the ground)

SL. No	Village Name	Well Type	Year										
			1986		1990		1996		2000		2004	
			Feb	Aug	Feb	Aug	Feb	Oct	Feb	Sep	Feb	Sep
1	Adaikalapuram	A	–	6.5	3.81	11.78	5.8	4.25	2.35	7.60	8.10	15.20
2	Ayyanarkoil Thidal	A	–	5.48	3.19	–	4.15	2.4	2.60	5.90	9.85	11.10
3	Keezha Paruthikudi	A	–	–	5.16	7.83	6.35	3.10	2.50	–	8.35	11.70
4	Melakasakudy	A	1.91	3.3	2.75	–	4.2	3.97	1.65	4.70	5.80	8.10
5	Punbethi	A	–	5.54	1.33	2.82	2.6	2.98	–	–	6.30	–
6	Puthakudi-Vadamattam	A	–	5.0	2.92	6.76	4.6	2.90	2.25	4.90	7.50	8.65
7	Serhur-Pandaravadai	A	–	5.24	3.75	–	4.5	2.50	2.80	7.80	9.70	10.65
8	Senmavilungal	T	–	7.04	2.44	4.32	2.65	7.52	4.65	7.90	14.60	14.10
9	Vadamattam	T	–	3.38	1.55	2.92	–	2.96	3.35	5.05	11.65	11.75

Note: A- Alluvial; T- Tertiary.

The data clearly shows that there is an appreciable fall in the water Table in the past two decades. This is because of poor utilization of ground water resources in Karaikal region.

4.4. Impact

The discharges have not only local but regional and global effects also.

Table 4.15 Local, Regional and Global effects of pollution

Local effects	Regional	Global
Heavy metals in water, soil and plants, e.g. from industrial discharges. Land degradation, Contamination of surface and groundwater, Eutrophication, Bioaccumulation, Health effects on local population.	Runoff may contaminate down stream.	Changes in the marine environment. Leakage of oil etc. can spread over large areas.

Nutrients, mainly nitrogen and phosphorus contribute to the eutrophication of lakes, rivers and marine waters. Approximately half of the nitrogen discharges are estimated to originate from agricultural land. A considerable proportion of the phosphorous discharge is from untreated wastewater. Contaminated water especially with high TDS affects productivity and the type of crops that can be grown.

4.4.1. Water supply & Sanitation

As per the data provided by Public Works Department, public water supply has been provided to 100% households in Pondicherry region, 60.84% in Karaikal region and 22.19% in Yanam region in 2001-02.

The U.T has achieved 100 % coverage in provision of drinking water facilities both in the urban sector (11 towns) and in this rural sector (264 census villages / habitations). Water supply in Pondicherry and Mahe regions is through ground water sources while in Karaikal it is through conjunctive use of ground water and surface water. In Yanam region, the supply is entirely from surface water. Mahe and Yanam regions are urban and therefore have only urban water supply schemes. In Pondicherry and Karaikal both urban and rural water supply schemes are under implementation. The per capita supply at present under urban system is 135 lpcd (litres per capita per day) and under rural system is 70 lpcd.

The annual requirement of water for domestic purposes in the U.T. is projected as below:

Table 4.16 Annual requirement of water

Year	Population (in lakhs)	Water requirement (in MCM)
1991	80.8	30
2001	97.4	40
2004	101.3*	40

*-Estimation.

Norms: Rural Water Requirement = 70 litres per capita per day

Urban Water Requirement = 200 litres per capita per day

Source. Central Water Commission.

The Pondicherry town area has been divided into 9 zones of which 4 zones have been provided with underground sewage disposal facilities. Of the total 60 MLD (Million Litres per Day) of sewage generated in the Pondicherry town area, only 13 MLD is treated before being discharged into sea. The growth of basic civic amenities especially drainage and sewerage system has not kept pace with the rapidly growing population. This has resulted in overburdening of the existing system.

Plate 4.3 Sewage treatment through Oxidation Pond at Karuvadikuppam, Pondicherry

Lack of proper sanitation facilities coupled with improper disposal of human and animal wastes   are   the   main   factors   for   the   spreading   of   water   borne

diseases. Discharge of municipal waste into surface and near shore waters results in health risks from the presence of sewage pathogens, eutrophication/oxygen depletion due to nutrients and organic carbon, and contamination of the aquatic food chain leading to toxification of marine organisms and humans. Water contaminated with chemicals as well as biological organisms like bacteria and other germs causes serious health related problems. The cost of treatment to make the water potable will also increase.

The excess of nitrates in drinking water causes methaemoglobinemia where nitrite (reduced form of nitrate) interferes with oxygen carrying capacity of blood and this affects mostly children.

Excessive use of urea in rice fields promotes the growth and spread of vectors causing Japanese encephalitis.

High fluoride content causes fluorosis affecting bones and spinal cord.

Microbial contamination is known to cause gastrointestinal illness, diarrhea, hepatitis B etc. The data provided by the Health Dept. shows comparatively high incidence of water borne diseases like diarrhea in Pondicherry and Mahe regions. (Table 4.18). The following Table gives details of water borne diseases:

Table 4.17 Water borne diseases and their causative factors

Sl.No	Name of the Disease	Causative Organism
1.	Water-borne diseases Bacterial	
	Typhoid	Salmonella typhi
	Gastroenteritis	Vibrio cholerae
	Paratyphoid	Simnonalla parayphi
	Cholera	Enterotoxigenic- Escherichia coli
	Bacterial dysentery	Variety of Escherichia coli
2.	Viral	
	Infectious hepatitis	Hepatitis-A-virus
	Pilomycetis	Polio-virus
	Diarrhea Diseases	Rota-virus, Norwalk agent
	Other symptoms of enteric diseases	Other virus Echono-virus, Coxsackie-virus
3.	Protozoan	
	Amoebic dysentery	Entamoeba hystolitica
4.	Water-washed diseases	
	Scabies	Various skin fungus species
	Trachoma	Trachoma infecting eyes
	Bacillary dysentery	E. Coli
5.	Water-based diseases	
	Schistosomiasis	Schistosoma sp.
	Guinea worm	Guinea worm
6.	Infecton through water related insect vectors	
	Sleeping sickness	Trapanosoma through testse fly
	Malaria	Plasmodium through Anaphelis
7.	Infection primarily due to defective sanitation	
	Hookworm	Hook worm, Ascaris

Table 4.18 Incidence of Diarrhoea

Region	No. of cases reported		No. of deaths	
	2001-01	2002-03	2000-01	2002-03
Pondicherry	3082	4094	25	14
Karaikal	NA	NA	NA	NA
Yanam	171	23	1	1
Mahe	264	398	NA	NA

Source: Directorate of Health
Note: NA – Not applicable.

4.5 Response

The Government of Pondicherry is implementing a Tank Rehabilitation Programme with the financial assistance of the European Union. The main objective is to desilt and thus rehabilitate the existing tanks to increase their capacity. This apart from providing irrigation will re-charge ground water and minimize / halt salt water intrusion Water Users Associations have been formed for each tank for regulation and better usage of water resources.

Pondicherry Groundwater (Control and Regulation) Act, 2002 has been enacted. Under the Act Pondicherry and Karaikal regions have been declared as notified areas for groundwater usage and as such permission of the Pondicherry Ground Water Authority is necessary. The digging of bore wells within 6 kms from the seacoast is regulated. Beyond 6 kms there is restriction as to the spacing of tubewells as below:

Groundwater source   **Minimum distance between two tube wells**

1. Pondicherry region

      Alluvium   150m

      Cudalore sandstones Formations   250m

      Vanur Ramanathapuram Formations 300m

2. Karaikal Region

                               60m (shallow tubewells)

                               150m (Deep tubewells)

No industry located within 6 kms from the Coast are permitted to draw more than 10 KLD of water.

Biofertilisers / Biopesticides-Initiatives

PASIC (Pondicherry Agro Services Industries Corporation) is involved in the production and distribution of biofertilisers and biopesticides at subsidized rates to the farmers in the Union Territory of Pondicherry. The biofertilisers include different kinds of nitrogen fixing and phosphate solubilising microbes such as Azospirillum lipoferum, Azospirillum brasilense, Rhizobium sp., Bacillus megatherium var phosphaticum etc. PASIC has produced 11.29 Tons of biofertilisers during 1995-96, which has increased to 14.79 tons during 2003-04 and the whole was utilized in the U.T. of Pondicherry. PASIC has distributed 4.42 tons of Pseuodomonas fluorescens biopesticide during 2003-04. The promotion of the use of compost, biofertilisers and biopesticides will reduce the use of chemical fertilisers and pesticides to a greater extent.

Table 4.19 Response matrix

Dept / Agency	Policy	Institution	Programmes / Functions
PPCC	Regulatory agency for issuing consent to establish and consent to operate under the water (Prevention and control of Pollution) Act,1974 and EP Act, 1986.	Gets data on ground water from State Ground Water unit. Clearance from State Ground water unit is needed for using groundwater in large quantity by the industrial units.	- Conducts need based studies on pollution. - Periodical analysis of water samples under NWMP Project. - Issue of directions to industrial units to set up ETPs., minimize discharges by adopting better technologies like RO. - Desalinisation by industries for meeting large scale water requirements. - Recycling of waste water by adopting zero discharge Technology. Remarks:- Need to generate more awareness and disseminate the data collected. Poor in data analysis.

Dept. of Industries	Allocation of land for setting up of industries and providing common infrastructure facilities.	Interfaces with PPCC in getting mandatory clearances. PIPDIC allocates land in industrial estates.	• Gives financial incentives to industries for providing/upgrading pollution control equipments.
Dept. of Local Administration	Provides civic amenities like drinking water collection and disposal of municipal solid waste.	Local bodies like municipalities (in urban areas) and Commune Panchayats (in rural areas) are responsible for provision of civic amenities.	• Segregation of biodegradable and non-biodegradable wastes under the 'Hyderabad model' Remarks:- Lack of proper dump sites and unscientific disposal of wastes.
Dept. of Agriculture	Regulation of usage of groundwater by way of digging borewells, promotion of environment friendly farming practices like INM, IPM, use of bio-fertilisers & bio-pesticides.	State Groundwater Authority regulates usage of groundwater. State Ground Water Unit monitors groundwater levels.	• Programmes of IPM, INM promotion of bio-pesticides, bio-fertilisers. • Subsidised input supply through Former Help Centers (Uzhavar Udaviyagams), • promotion of rain water harvesting by providing incentives.
Public Works Departments	Maintains public sewerage system in Urban areas. Supplies drinking water in urban areas. Implements Tank rehabilitation.		Remarks:- Only 21.66% of sewage is treated in Pondicherry Town Is implementing Tank Rehabilitation Project.

CHAPTER – 5

AIR ENVIRONMENT

5.1. Introduction

Increasing industrialization and urbanization on the one hand and decreasing green cover on the other hand are the main contributing factors for deteriorating air quality in urban areas. In rural areas with predominantly agriculture activity, the air quality is appreciably good. Of course the problem of indoor air pollution in rural areas is more, as the usage of domestic fuels like cow dung, fuel wood is more.

Indoor air quality (IAQ) refers to the physical, chemical, and biological characteristics of air in the indoor environment within a building or an institution or commercial facility. These characteristics can be influenced by many factors, even though these buildings or facilities do not have industrial processes and operations found in factories and plants.

Factors that influence IAQ include the following:-

- Inadequate flow of outside air. In view of the current trend of constructing air conditioned buildings with glass doors, this has to be given due attention.

- Contamination arising from sources within the building (e.g., combustion products including carbon monoxide and environmental tobacco smoke; volatile organic compounds from building materials, fabric furnishings, carpet, adhesives, fresh paint, new paneling, and cleaning products; ozone from office equipment).

- Contamination from outside the building (e.g., ozone, carbon monoxide, and particulate matter) through air intakes, infiltration, open doors, and windows.

- Microbial contamination of ventilation systems or building interiors.

However, it is the developing countries that face the greatest threat from indoor pollution, mostly in rural areas and to some extent in urban areas as they continue to rely on traditional fuels for cooking and heating. Burning of such fuels produces large amount of smoke and other air pollutants in the confined space of the home, resulting in high exposure. In these circumstances, exposure to pollutants is often far higher indoors than outdoors.

Vehicular emissions are of particular concern (especially in urban areas) since these are ground level sources and thus have the maximum impact on the general population.

There is often more focus on ambient air quality with reference to the industrial units. Air quality within the closed premises of the industrial units is also equally important and a holistic approach is needed in this regard.

5.2. Pressure

There are a number of sources like vehicular exhaust, industrial emissions, waste burning, suspended road dust etc. The main sources are as follows:

a. The combustion of fuels to produce energy for heating and power generation both in the domestic sector as well as in the industrial sector.

b. The exhaust emissions from the transport vehicles that use petrol or diesel oil etc.

c. Waste gases, dust and heat from many industrial sites including chemical manufacturers etc.

The diffusion of pollutants in the atmosphere depends upon the prevailing meteorological parameters like wind speed, direction, temperature, humidity and stability. Because of high humidity and frequent precipitation in view of the coastal location, in the U.T. the problem with dust is comparatively less.

5.2.1 Vehicular pressure

As is elsewhere the number of vehicles being used is raising day by day in the U.T. as well. Two-wheelers form the majority of vehicles in usage. Most of the vehicles are found in urban areas. One of the reasons for the rapid increase in the number of vehicles especially two wheelers is that they provide convenient personalized mode of conveyance. The increasing income levels and easy availability of loans are other important factors. Vehicles emit CO (Carbon monoxide), HCs (Hydrocarbons), NO_x, SO_2, and other toxic substances such as lead.

The primary pollutants produced in vehicle emissions may undergo a series of complex interrelated chemical reactions in the troposphere and lower stratosphere to form secondary products (Photochemical reactions).

Between 1996 and 2002-03 the number of vehicles in the U.T. has almost doubled. Personal modes of transport like two-wheelers and cars have increased by 96% during this period. In comparison, the number of buses in the corresponding period has grown by just 35%. The general trend of increasing private (personal) modes of transport is a significant pressure on urban air pollution. An individual bus may emit more pollutants than a two-wheeler or a car, but given the number of passengers it carries, the per capita emissions are less.

No data is available on the quantity of fuel used in the U.T. The data even available may not give a correct picture. This is because in view of the fuel price difference in the U.T. compared to the neighboring states, some quantity of fuel is utilized by vehicles operating in the neighboring states also.

Table 5.1 Number of Motor Vehicles registered in the Pondicherry region.

SI. No.	Type of Vehicles	As on 31.3.96	96-97	97-98	98-99	99-2K	2K-01	2K1-02	2K2-03	2K3-04	Total Reg. Vehicles
A	**Transport Vehicles**										
1	Multiaxled Articulated Vehicle	48	17	24	11	11	13	50	13	13	200
2	Trucks & Lorries	3606	818	395	444	495	571	234	47	93	6703
3	**Light Motor Vehicles (Goods)**										
	a. Four Wheelers	1041	167	134	78	130	105	84	134	309	2182
	b. Three Wheelers	27	5	4	15	9	9	7	15	18	109
	Total (a+b)	1068	172	138	93	139	114	91	149	327	2291
4	**Buses**										
	a. Stage Carriages	1091	37	48	46	38	46	50	103	73	1532
	b. Contract Carriages	119	4	2	3	7	7	2	5	7	156
	c. Private Service Vehicles	81	0	4	5	4	7	2	11	2	116
	d. Other Buses	68	4	4	5	9	6	5	14	5	119
	Total (a+b+c+d)	1359	45	58	59	59	66	59	133	87	1923
5	**Taxis**										
	a. Motor Cabs	2	0	0	0	0	0	0	8	-	10
	b. Maxi Cabs	67	8	4	9	6	4	5	35	-	138
	c. Other Taxis	1068	144	51	52	46	50	58	65	129	1663

5.3 State

5.2.1 Introduction

The major air pollutants arising from various sources are particulate matter, Nitrogen dioxide (NO$_2$), Sulphur dioxide (SO$_2$), lead, carbon monoxide, PAHs (Poly Aromatic Hydrocarbons) etc.

Source apportionment (i.e. relative contribution from different sources) is an important input for improving air quality.

Table 5.2 Some major pollutants and their sources

Pollutant	Source
Carbon monoxide (CO)	Incomplete fuel combustion (e.g. two stroke engine)
Sulphur dioxide(SO$_2$)	Burning of sulphur containing fuels like coal in power plants and oil by vehicles. Sulphur is found naturally in crude oil and unless it is removed during refining, petrol and diesel will contain varying amounts of Sulphur.
Suspended particulate matter(SPM)	Smoke from domestic, industrial and vehicular sources. Natural dust is also a source.
Oxides of nitrogen (NO$_x$)	Fuel combustion of motor vehicles, power stations and furnaces. NOx are formed in high temperature combustion, mainly from air, in the combustion chamber.
Volatile hydrocarbons	Partial combustion of carbonaceous fuels (two stroke engines, industrial processes, disposal of solid wastes).
Oxidants and ozone(O$_3$)	Emissions from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons. Ozone is not emitted directly but is a secondary pollutant formed by photochemical reactions.
Lead(Pb)	Emissions from motor vehicles (mainly because of lead additives like Tetra Ethyl Lead)

5.3.2. Emissions from industry

As regards the U.T. the major air polluting industry types have been M.S.Ingots, calcium carbide Chlorates and Ferro silicon units. They contribute both by lateral and stack emissions. Much of the problem is due to inefficient maintenance and operation of Air pollution control systems (APCS). It is estimated that 5868.78 tons of SPM, 42.7 Tons of SO_2 & 19.65 Tons of NOx are being discharged annually (2002) in region.

Plate 5.1 Ambient air quality in industry

5.3.3. Emissions from vehicles

Two wheelers in view of their large number and high per capita emissions add more loads. Some of the public transport vehicles like diesel driven tempos (Vikram) are causing more pollution. Some battery-operated tempos are also on road.

Plate 5.2 Vehicular Emission Monitoring

Plate 5.3 Cyclone separator

Plate 5.4 Lateral Emissions during tapping in MS Ingots Unit

Plate 5.5 Stack emission after starting Scrubber

Plate 5.6 Stack emission before starting Scrubber

Plate 5.7 Wet scrubber

5.3.4. Emissions from burning solid waste

In some areas the municipal solid waste is being burnt unauthorisedly. It is also common that litter and other debris are burnt after sweeping. This results in release of toxic gases and SPM thereby deteriorating the local air environment.

5.3.5. Emissions from domestic fuel usage

One appreciable thing is that majority of the people use LPG, Kerosene and electricity as the domestic fuel. Only few use fuel wood. This is in view of the easy availability of LPG. The number of LPG consumers in the U.T is 82000 (2004)

Plate 5.8 High Volume Sampler

Plate 5.9 Wind Vane & Anemometer

The entire U.T. has been notified as air pollution control area. PPCC is operating 3 stations.

All these locations were in Pondicherry town area, for measuring air quality under National Air Monitoring Programme (NAMP) (Map 5.1)

The National Ambient Air Quality standards are given in Table 5.3 and Table 5.4 gives details of air quality measured in the 3 NAMP locations.

Table 5.3 National Ambient Air Quality Standards

| Pollutants | Time-weighted average | Concentration in ambient air | | | Method of measurement |
		Industrial Areas $\mu g/m^3$	Residential Rural & other Areas $\mu g/m^3$	Sensitive Areas $\mu g/m^3$	
Sulphur Dioxide (SO₂)	Annual Average*	80	60	15	- Improved West and Gaeke Method - Ultraviolet Fluorescence
	24 hours**	120	80	30	--
Oxides of Nitrogen as (NOx)	Annual Average*	80	60	15	- Jacob & Hochheiser Modified (Na-Arsenite) Method
	24 hours**	120	80	30	- Gas Phase Chemiluminescence
Suspended Particulate Matter (SPM)	Annual Average*	360	140	70	- High Volume Sampling, (Average flow rate not less than 1.1 m3/minute).
	24 hours**	500	200	100	--
Respirable Particulate Matter (RPM) (size less than 10 microns)	Annual Average*	120	60	50	- Respirable particulate matter sampler
	24 hours**	150	100	75	--
Lead (Pb)	Annual Average*	1.0	0.75	0.50	- ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5	1.00	0.75	—

Ammonia	Annual Average*	0.1 mg/ m³	0.1 mg/ m³	0.1 mg/m³	---
	24 hours**	0.4 mg/ m³	0.4 mg/m³	0.4 mg/m³	---
Carbon Monoxide (CO)	8 hours**	5.0 mg/m³	2.0 mg/m³	1.0 mg/ m³	- Non Dispersive Infra Red (NDIR)
	1 hour	10.0 mg/m³	4.0 mg/m³	2.0 mg/m³	Spectroscopy

* Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week   24 hourly at uniform interval.

** 24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of   the time, it may exceed but not on two consecutive days

Table 5.4 Ambient annual average air quality particulars from monitoring stations in Pondicherry region

Year	Station I			Station II			Station III		
Pollutant	SPM	SO$_2$	NO$_x$	SPM	SO$_2$	NO$_x$	SPM	SO$_2$	NO$_x$
Standards	70	15	15	140	60	60	360	80	80
1996	125	19.1	19.4	319	91	49.6	247	45.1	40.9
1997	125	20	25.3	389	118	70	281	42.8	39
1998	133	21	22.7	435	115	84.7	270	41.8	55.9
1999	112	18.2	19	409	97.2	82	188	16.9	30.4
2000	133	12.9	14.5	202	34.9	39.2	161	17.6	22.9
2001	100	11.6	20.4	128	19.3	22.3	133	12.6	21.7
2002	79	14.3	10.9	89.6	15.1	12.4	72	20.1	16.1
2003	58.5	17.2	12.4	80	18.9	14.1	90.9	25.4	21.5
2004	59.2	21.4	15.5	78.2	20.7	15.5	90.4	24.4	21.3

Note : Values of all parameters are in $\mu g/m^3$

All are annual averages.

Due to strenuous action taken by the PPCC, viz. up gradation of scrubber in the Sulphur handling units, replacement of firewood with cleaner fuel like LDO/ Briquettes etc., the pollutants levels are considerably reduced in the recent years.

Map 5.1 Location of NAMP stations in Pondicherry region

Station I:

French Institute till June 2000 *(Sensitive Area)*

Agriculture Department from July 2000 to June 2002 *(Residential Area)* and

Chamber of Commerce from June 2002 to till date *(Sensitive Area)*.

Station II:

Department of Science, Technology & Environment, Anna Nagar

(Residential-Commercial Area).

Station III:

PIPDIC Industrial Estate, Mettupalayam *(Industrial Area)*.

Source :-Pondicherry Pollution Control Committee

The present data indicates that for Station I the values of SO_2 and NO_x are higher than the prescribed standards (in 2004), possibly because of vehicular exhaust. In case of other Stations the values are within the permissible limits.

Ambient Air Quality status for Pondicherry region is given below:

Locality	SO_2	NO_x	SPM
Residential	L	L	M
Industrial	L	L	L

Table 5.5 Pollution level in industrial and residential area

Pollution Level	Annual Mean Concentration Range ($\mu g/m^3$)			
	Industrial		Residential	
	SO_2 & NO_x	SPM	SO_2 & NO_x	SPM
Low (L)	0-40	0-180	0-30	0-70
Moderate (M)	40-80	180-360	30-60	70-140
High (H)	80-120	360-540	60-90	140-210
Critical (C)	>120	>540	>90	>210

The Table 5.6 gives the details of noise levels at different locations in Pondicherry town. The levels of noise in Pondicherry are higher than the standards prescribed by the Central Pollution Control Board (CPCB).

Table 5.6 Noise level survey on a normal day in Pondicherry city
(From 6.00 A.M TO 10.00 A.M)

Sl No	Location	Category	2000 in dB(A)	2001	2002	2003	2004
1	Nellithope	Residential Area	-	65	59.8	65.6	64.0
2.	Mudaliarpet	Residential Area	65	74	70.2	70.3	63.4
3.	Uppalam	Residential Area	-	72	70.1	--	52.5
4.	Raja Theatre	Commercial /Residential Area	75.5	73.3	82.8	--	--
5.	Raj Bhawan	Silence Zone	65.9	64	64.2	70.9	54.7
6.	Muthialpet	Residential Area	52.8	77	66.9	83.4	57.2
7.	JIPMER	Silence Zone	59	74	65.2	--	--
8.	Lawspet	Residential Area	61.3	67	65.1	73.1	552.1
9.	Saram	Commercial / Residential Area	-	74	77.6	--	50.8
10	VVP Nagar	Commercial / Residential Area	-	79	76	--	54.6

5. 4.   Impact

5.4.1 Introduction

The emissions have not only local but also regional and global effects also.

Table 5.7 Regional and global effects of pollution

Local effects	Regional	Global
Heavy metals in air, soil and plants, e.g. from vehicular and industrial emissions Noise. Health effects on local population.	Landscape changes. Acid rains photochemical smog.	Changes of the climate due to ozone depletion and the greenhouse effect.

The high concentration of particulates in the atmosphere over large urban and industrial areas can produce a number of general effects. Smoke and fumes can increase the atmospheric turbidity and reduce the amount of solar radiation reaching the ground. The air pollution may cause the following effects:

  i. Deterioration of buildings and materials due to acid rains.

  ii. The presence of gaseous pollutants in the air and deposition   of particulates on to the soil can affect plants. It can affect the cattle and animals too as they have been found to develop breathing difficulties and suffer from low yield of milk, lameness and joint stiffness in a polluted environment.

  iii. Health impacts: They are detailed in the subsequent paragraphs.

5.4.2. SPM

According to WHO health effects of SPM on humans depend on particle size and concentration, and vary with daily fluctuation in the finer particle size, PM10 and PM 2.5(PM10 and PM2.5 refer to that fraction of the SPM which is less than 10 and 2.5 microns respectively in diameter). Studies have indicated that smaller particles are more dangerous (PM10 and lower).

5.4.3. Emissions of volatile organic substances

Volatile organic substances might have adverse health effects. Many of them are carcinogenic. In combination with nitrogen oxides and in sunlight, some of them might form ozone and other photochemical oxidants. These are harmful to plants.

5.4.4. Emission of Green House Gases

The greenhouse effect plays a crucial role in regulating the heat balance of the earth. It allows the incoming short-wave solar radiation to pass through the atmosphere relatively unimpeded; but the long-wave terrestrial radiation emitted by the earth's surface is partially absorbed and then re-emitted by a number of trace gases in the atmosphere. This natural greenhouse effect warms the lower atmosphere. Gases called GHGs (greenhouse gases) like water vapour, carbon dioxide, methane, nitrous oxide and ozone present in the troposphere and in the stratosphere prevent some of the heat radiation re-emitted from the earth from escaping into space.

The concentration of green house gases is increasing because of increased burning of fossil fuels and this is presumed to raise the temperature of the earth over a period of time.

5.4.5. Health impact

The Health impact of various pollutants is given below:

Table 5.8 Pollutants and their related health hazard

Pollutants	Health Effects	
	Short Term Effects	**Long Term Effects**
Carbon Monoxide	Asphyxiation at 2.5% concentration as it inhibits oxygen carrying capacity of blood.	Fatal in large does; aggravates heart disorders; affects central nervous system.
Sulphur Dioxide(SO_2)	Suffocation, irritation of throat, eyes	Respiratory diseases.
Nitrogen Oxides (NO_x)(NO_2 & NO)	Irritation of respiratory tract	Bronchitis. Oedema of lungs.
Suspended Particulate Matter (SPM)	Asthma	Chronic bronchitis, asthma, premature death due to alveolar fibrosis. Silicosis (in Glass industry), Byssinosis(in Cotton Ginning industry) etc.
Ozone	Eye, nose and throat irritation; risk asthmatics	
Lead (from petrol vehicles)	Extremely toxic; affects kidneys, liver, gastrointestinal tract;	Can impair mental development of children; causes hypertension
Hydrocarbons (mainly from 2-wheelers and 3-wheelers)	Drowsiness ,eye irritation, coughing	Impaired lung functioning.
Benzene		Carcinogenic
Aldehydes	Irritation of eyes, nose and throat, sneezing. coughing, nausea, breathing difficulties;	Carcinogenic in animals
Polycyclic Aromatic Hydrocarbons PAH (from diesel vehicles)	Carcinogenic	

In 2003 around 6 persons working in a glass factory in Pondicherry died of silicosis. Loss of productivity, pain and suffering and increased expenditure on medical care are components of the cost of air pollution.

5.5. Response

PPCC is regularly monitoring air quality in 3 locations in Pondicherry region. Regular industrial monitoring is done and wherever the emissions are beyond the standard limits directions are issued and compliance is ensured.

Most of the vehicles are old ones and generate unburnt hydrocarbons, carbon monoxide because of their decreased efficiency. The engines in the old vehicles need to be replaced with new ones in a phased manner. The Government needs to encourage LPG/CNG run and battery-operated vehicles.

Renewable energy initiatives

District Rural Development Agency (DRDA), Pondicherry, is promoting the use of renewable energy in the Union Territory of Pondicherry by extending suitable subsidy.

During 2002-03, 116 No. of solar streetlights, 10 Nos. of Home Lighting systems have been installed. 3 Nos. of Solar Photo Voltaic (SPV) water pumping systems have been installed (1 in Pondicherry and 2 in Karaikal).

A 25 KW SPV power plant at a cost of Rs.69.3 Lakhs has been installed in the Chief Secretariat to meet part of the power required in the building. Similarly a 5 KW SPV – Wind Hybrid Power system (SPV – 1.8 KW + Wind 3.3KW) power plant has been installed near Chunambar Beach Resort, Pondicherry.

A 100 KW biomass power plant has been installed in Pondicherry Engineering College, Pondicherry.

4 Night soil based biogas plants with the total biogas capacity of 75 cu. Ms. per day have been installed in Pondicherry.

The use of solar energy though very expensive is non-polluting. The use of biomass / biogas energy enables recovery of useful energy which otherwise would have gone waste.

Free availability of subsidized power from the grid and the initial high cost of the non conventional energy equipments are the main reasons for limited use of non-conventional / renewable energy resources.

Battery operated vehicles

Battery operated three wheelers are already on road in Pondicherry city. To promote the use of these, the government has exempted payment of Sales Tax and Road Tax for these vehicles. Battery operated two wheelers are also in use.

The main limitations of these vehicles are lack of adequate number of charging stations (only one is there), longer time for charging (8 to 10 hours), limited battery life (1.5 to 2 years) etc.

With research on for developing efficient batteries with more power, in the near future the use of battery-operated vehicles is expected to increase.

At present there are 17 battery operated three wheelers running in Pondicherry. Out of this for 10 vehicles DRDA has given subsidy.

Plate 5.10 Battery charging station in Pondicherry

Table 5.9 Response matrix

Dept / Agency	Policy	Institution	Programmes / Functions
PPCC	Regulatory agency for issuing consent to establish and consent to operate under the Air(Prevention and control of Pollution) Act,1981 and EP Act, 1986.		• Conducts periodical air and noise pollution monitoring in industrial units and need based studies e.g. during festivals like Deepavali Bhogi & Pongal. • Periodical analysis of air samples under NAMP Project. • Issue of directions to industrial units to install Air pollution control devices to minimize emissions. Remarks:- Needs to generate more awareness and disseminate the data collected.
Dept. of Industries	Allocation of land and infrastructure facilities for setting up of industries.	Interfaces with PPCC in getting mandatory clearances. PIPDIC allocates land in industrial estates.	• Gives financial incentives to industries for providing pollution control equipments.
District Rural Developmen t Agency (DRDA)	Promotion of renewable energy sources such as solar lanterns / solar cookers Promotion of battery operated vehicles by giving subsidy (from MNES, Government of India)		
Dept. of Transport	Regulation of Vehicles		Takes punitive action on Vehicles causing more pollution.
Chief Inspector of Factories	Regulates installation of machinery in the factories. Monitors occupational safety issues.		

CHAPTER – 6

WASTE MANAGEMENT

6.1 Introduction

Waste generation is a natural outcome of many of the human activities. Generation of wastes is inevitable. The management of wastes assumes importance in view of the environmental hazards they pose. The different types of wastes are dealt in detail below:

6.2.1. Municipal solid waste

Municipal Solid Wastes are all those wastes arising from human and animal activities that are normally solid and which are discarded as useless or unwanted. The Municipal bodies are responsible for the collection and proper disposal of municipal solid waste as per the Municipal Solid Waste Management Rules, 2000 notified under Environment Protection Act, 1986. The PPCC is the nodal body overseeing the implementation of the Rules.

There are 5 Municipalities (2 in Pondicherry, 1 each in Karaikal, Mahe and Yanam regions) in the U.T. Apart from these as a French legacy the U.T. has 10 communes (5 each in Pondicherry and Karaikal regions), which are agglomerations of villages.

These civic bodies are entrusted with municipal solid waste management i.e., collection, transport and disposal.

6.2.2. Industrial solid & hazardous wastes

Hazardous wastes are characterized mainly by their properties like ignitability, corrosivity, reactivity, toxicity and persistence. These wastes pose a substantial danger to our health and environment. Due to their distinct properties and by way of ingestion, inhalation, contact etc. they affect human beings adversely. The Hazardous Wastes (Management and Handling) Rules, 1989 (as amended in 2003) envisage a proper mechanism for handling, treatment and disposal of the Hazardous Wastes. Under the Rules it is the responsibility of the individual industries to collect, store, transport & dispose of the industrial solid & hazardous wastes. PPCC is the regulatory body. The hazardous wastes can be categorized under three broad categories- Recyclable, Incinerable and Landfillable. Used oil is recyclable. Waste oils etc. are incinerable. ETP Sludge etc. are landfillable.

6.2.3. Biomedical waste

Wastes being generated by the hospitals/nursing homes can broadly be grouped into three categories i.e. (1) domestic wastes (2) hazardous wastes and (3) infectious wastes.

Domestic wastes generated are similar to the municipal (domestic) solid waste and if properly segregated (without being contaminated) these can be collected, transported and disposed of along with the municipal solid wastes.

Hazardous wastes generated in hospitals primarily comprise of discarded and off-specification chemicals and consumables, the packaging of the medicines, radioactive materials and other such materials which are hazardous.

Infectious wastes being generated in hospitals and nursing homes are a matter of concern as there is a danger of spread of diseases.

Under the Biomedical Wastes (Management & Handling) Rules, 1998 it is the responsibility of the individual generator to safely dispose of the biomedical waste. PPCC is the regulatory agency overseeing the implementation of the Rules.

6.3. Pressures

6.3.1. Municipal solid wastes

❖ Rapid increase in population and urbanization and the consequent increase in the volume of Municipal solid waste making it difficult to manage with the existing infrastructure facilities.

❖ Changing lifestyles and consumption patterns with 'use and throw' products result in increase in the per capita generation of waste. It is estimated that on an average there is generation of 400 gms of waste (garbage) per person per day. Increasing income levels and consumerism has lead to generation of more wastes. Obviously the proportion of non-biodegradable wastes such as plastics is on the rise.

6.3.2. Industrial hazardous wastes

With the increase in number of industries and the consequent rise in the industrial output the industrial waste generation also has increased. The main industrial sectors that are generating hazardous wastes in the U.T. are those manufacturing chemicals, pharmaceuticals, Paints/ Pigments, Electronics. Engineering, Textiles, Tiles, Distilleries and Waste re-processing units. Certain processes like electroplating generate more hazardous wastes.

6.3.3. Biomedical waste

Increase in population and the consequent need for more health facilities, incidence of disease, occupational health disorders, etc., are the main pressures. Lack of adequate health facilities in the surrounding areas of the neighbouring states also creates pressure in the sense that people from those areas come to the U.T. for treatment. Changing lifestyles and consumption patterns coupled with sedentary lifestyle is also an important pressure.

Increased awareness regarding health, hygiene and the fear of spread of infectious diseases has lead to the use of disposable syringes in place of reusable glass syringes. This has significantly increased the waste generation.

6.4. State

6.4.1. Status of municipal solid waste

The approximate quantity of waste generated town-wise is as below:

Table 6.1 Quantity of Municipal solid waste generated

Sl. No	Name of the Town (Municipality)	Population (2001 Census) (in thousands)	Estimated Quantity of waste (Tons per day)
1.	Pondicherry - (Pondicherry Municipality)	221	175
2	Pondicherry - (Oulgaret Municipality)	217	125
3	Karaikal - (Karaikal Municipality)	74.33	15
4	Yanam – (Yanam Municipality)	31.3	05
5	Mahe –(Mahe Municipality)	36.8	15
	Total	190.43	335

Collection & Disposal

The local authorities are collecting the waste in most of the urban areas on a day to day basis. The collection and transport has been privatized in some areas and in some areas the 'Hyderabad model' involving collection of segregated municipal solid waste at doorsteps is being tried. The waste is disposed of in the disposal yards. In view of the inadequate space Pondicherry municipality has acquired a new site for the disposal. The major constraints in this regard are lack of adequate space, objection from the nearby residents for dumping of waste, inefficient or no segregation of biodegradable waste from non-biodegradable waste, at point of collection. Part of the waste is being composted.

The major deficiencies found in the management of municipal wastes are,

- Littering of garbage due to unorganized collection
- Establishment of storage facilities like dustbins or other facilities and their operation is not satisfactory. Insufficient number of dustbins and their small size makes frequent lifting necessary, otherwise there will be spillage.
- Processing of garbage is not practiced. No segregation of waste at source level or at the community level.
- Lack of co-operation from the public.
- No scientific management is seen.

6.4.2. Status of industrial hazardous and solid wastes

In accordance with the Hazardous Waste (Management and Handling) Rules, 1998 notified under the EP Act, 1986 the PPCC is regulating issues relating generation, transportation and disposal of hazardous wastes. At present there are 88 units which are under the purview of the Rules. PPCC has granted authorization under the Rules to nearly 85 units.

Most of the hazardous waste generating industries in the U.T. are located mainly in Pondicherry region. Few are located in Yanam and Karaikal regions. No such units are there in Mahe region.

Table 6.2 Hazardous waste generation details

Total No. of units issued authorization (1)	#Recyclable (TPA) (2)	$Handling as Raw materi l (TPA) (3)	*Land fillable (TPA) (4)	@Incinerable (TPA) (5)	Total (TPA) (2)+(3)+(4)+(5)
85	10631.7	16946.3	92.3	6.8	27667.1

Note:
1. Out of the total Hazardous waste of 27667 TPA, 92.3 TPA is landfillable and 305.423 tones of accumulated landfillable waste has been stored on land (cumulative). It is required to be shifted to TSDF of adjacent State.
2. 4 No of units which got authorization have wound up their operation.

   \#   -   Hazardous waste to be reprocessed by other units (eg. Waste oil, dichromate waste, zinc ashes etc)
   $ -   Hazardous waste handling as raw material by other units (eg. Dichromate waste)
   *   -   Hazardous waste cannot be reused or reprocessed (eg. ETP sludge)
   @   -   Hazardous waste cannot be reused or reprocessed; can be incinerated (eg. Cotton soaked with waste oil)

The total quantity of hazardous waste generated in the U.T. is about 27667.1 tons per annum. Pondicherry region accounts for 87.88 % of the total waste followed by Yanam region accounting for 11.85 % and Karaikal region accounting for 0.25 %.

Out of the total quantity of hazardous wastes, 16946.3 TPA is being re-used as raw material for further production. About 10,631.7 TPA is of recyclable & reusable quality and about 92.3 TPA is landfillable. There is no Treatment, Storage & Disposal facility (TSDF) in the U.T. The High Powered Committee constituted by the Supreme Court on the issue of hazardous wastes as advised that states generating less than 20,000 TPA of hazardous wastes might tie up with the neighbouring states for disposal.

In view of the limited land resources and in view of the comparatively less quantity of waste generated, PPCC is planning to tie up with the neighbouring state of Tamilnadu for disposal of hazardous wastes. Tamilnadu is in the process of setting up a TSDF. Presently, the Hazardous Waste Generators are given authorizations to store the wastes with in their premises. After getting approval from the neighbouring states for using TSDFs established in their States the accumulated wastes will be sent to the concerned TSDFs.

As far as the non-hazardous wastes are concerned some of the recyclable wastes like wastes from plastic units are used as raw materials by small-scale units. In some other cases there is no proper disposal (e.g. slag from M.S. Ingots is often dumped in low-lying areas).

6.4.3. Bio medical waste

Under the Biomedical Waste Management Rules, 1998 notified under the EP Act, 1986, it is the responsibility of the generator to dispose of the biomedical waste in a safe manner. In the U.T., Pondicherry region is the main center for medical services. There are 6 medical Colleges and around 90 hospitals and Clinics.

Bio-medical Wastes have to be treated in accordance with Schedule - I of the Rules. They need to conform to the standards prescribed in Schedule V. Wastes have to be segregated at the source and collected in colour coded bags/ containers as per Schedule II of the Rules and labelled as per Schedule III of the Rules and transported with labeling as per Schedule IV of the Rules.

To comply with the above, the primary option for treatment/ disposal of the wastes is incineration/landfilling (excluding chlorinated plastics). Other major options for treatment/ disposal of the wastes are Autoclaving / Microwaving of the wastes. The residue, ash and chemical wastes used in disinfecting processes can be disposed of in secured landfills. In the U.T. PPPC has been declared as the Prescribed Authority for issuing authorizations for hospitals for treatment/storage/disposal of the wastes.

Most of the hospitals have primary treatment facilities like microwaving / autoclaving. Some hospitals have their own incinerators. There are eight medical institutions / hospitals are having incinerators in the U.T. of Pondicherry. Most of the incinerators are pyrolytic incinerator with dual chamber with light diesel oil, 100 feet chimney and venturi scrubber as air pollution control system.

As per Bureau of Indian Standards, (BIS), the quantity of solid waste generated can be between 1 and 2 kg per bed per day. (The waste generated per head in U.S hospitals is as high as 4 or 5 kg/bed).

Table:6.3 Details of Hospitals

Sl. No	Category	Total No. of Hospitals*	Time limit to get Authorization	Authorization issue status
1	Above 500 Beds	3 (2-G, 1-P)	June 2000	Authorization issued
2	200 to 500 Beds	7 (2-G, 5-P)	Dec. 2000	Authorization issued
3	50 to 200 Beds	7 (5-G, 2-P)	Dec. 2001	Authorization issued
4	Less than 50 Beds	73 (46-G, 27-P)	Dec. 2002	Authorization issued 26
5	All other not covered in above	Animal Dispensary - 8 Vet. College – 1	Dec. 2002	Yet to issue

* Details listed in Annexure-IV.

At present the municipal authorities are collecting and disposing of the biomedical waste. Some hospitals like (1) Government General Hospital, (2) Jawaharlal Institute of Post Graduate Medical Education and Research (JIPMER), (3) Pondicherry Institute of Medical Sciences (PIMS), (4) Mahatma Gandhi Medical College and Research Institute (MGMCRI), (5) Arupadai Veedu Medical College and Hospital (all in Pondicherry region), (6) Vinayaga Missions Medical College and Hospital, Karaikal 8) Government General Hospital, Mahe have their own incinerators for disposing of the biomedical wastes.

6.5. Impact

The possible impact are detailed below:

6.5.1. Municipal solid waste

Unscientific disposal of collected municipal solid waste poses the following problems:

❖ The food and other organic wastes attract insects such as flies, which in turn cause a menace to the nearby residents. This also results in emission of bad odour. The main reason for vehement opposition of the nearby residents for the disposal of municipal solid waste is the problem of bad odour and flies.(In the U.T. land is a scarce resource)

❖ Improper disposal of plastics often leads to blockage of sewer pipes etc. leading to unhygienic conditions.

❖ Inadvertent consumption of plastics among the solid waste by animals, thereby affecting them

❖ Improper disposal attracts pigs, which may lead to incidence of diseases like brain fever etc.

❖ Leachate from the disposal site may contaminate ground water.

Plate 6.1 Indiscriminate disposal of municipal solid waste at Karuvadikuppam, Pondicherry

6.5.2. Industrial waste

The major problem with the industrial waste is that its improper disposal may result in the contamination of ground water. In a study carried out by PPCC on the impact of Acid Slurry Units on ground water it is noted that improper handling of raw materials and indiscriminate disposal of effluents in some of the Acid Slurry manufacturing units has resulted in contamination of ground water (pH and Conductivity are affected).

6.5.3 Biomedical waste

If incinerators are not operated properly to maintain sufficient residence time, residence temperature and turbulence, there is more harm caused in the form of emission of toxic gases including dioxins (in case of chlorinated plastics). Improper disposal of disposable syringes etc. results in illegal recycling. Similarly disposal of sharps without shredding often causes injuries to the persons handling the same. If the biomedical waste is not disinfected there is possibility of spread of infections.

6.6. Response
6.6.1 Proper Management of municipal solid waste
Initiatives
COMPOSTING

PASIC (Pondicherry Agro Services & Industries Corporation Ltd.), a Pondicherry State Unit, is manufacturing compost from biodegradable municipal solid waste generated in the Pondicherry city. Compost is also produced from the press mud generated in the Co-operative Sugar Mills located in Lingareddipalayam, near Pondicherry.

Plate 6.2 Compost yard at Arasur (Pondicherry)

The compost is also enriched by adding additional nutrients. PASIC has 3 units (2 in Pondicherry and 1 in Karaikal) for producing compost of 7000 M.T. per annum.

New dump site

PASIC is developing new facility near Pondicherry for proper disposal of municipal solid waste. PASIC also has plans to generate fuel from waste plastics (particularly Polypropylene and Polyethylene).

Plate 6.3 Solid waste being segregated for Vermi Composting

Plate 6.4 Vermi Compost stored at yard

New dump site

The Table below gives details of concerned Departments and their specific initiatives to tackle the problems associated with different kinds of wastes.

Table 6.4 Response Matrix

Dept / Agency	Policy	Institution	Programmes / Functions
PPCC	Regulatory agency for issuing authorizations under various Rules dealing with different kinds of wastes such as municipal, hazardous, bio medical wastes etc.	Coordinates with Local administration Department regarding proper disposal of municipal and biomedical waste.	• Conducts regular inspection. • Issue of directions to industrial units not complying with the Rules. Remarks: - Need to increase awareness and disseminate the data collected
Local Admn. Dept.	Implementation of Municipal Solid Waste Management Rules.	Municipalities in Urban areas and Commune Panchayats in Rural areas are the implementing agencies.	Has initiated collection of segregated municipal wastes in some locations based on 'Hyderabad Model'. Acquisition of land for disposal of municipal wastes generated in Pondicherry city.

LAND DEGRADATION

7.1. Introduction

The U.T. has limited land area and as such proper usage of the same and minimization / halting of land degradation is very important. Soil degradation involves a number of physical, chemical and biological processes, which may act singly or jointly. Soil erosion by water due to storms and soils with poor surface structural stability is the most obvious form of land degradation. The other forms of degradation seen in our state are salinisation, alkalisation, laterisation and inundation. Land degradation may be due to natural factors like occurrence of Tsunami, floods etc. and consequent erosion, tidal action leading to erosion in coastal areas. It may be due to human factors like improper disposal of municipal and industrial wastes inadequate treatment of sewage, industrial waste waters, improper agricultural practices in terms of excessive usage of water, fertiliser, pesticides, mono cropping (thereby altering the nutrient balance in the soil), illegal and indiscriminate sand and red earth mining.

7.2. Sectoral linkages

Land is the basic resource and as such its availability is linked to all the sectors either directly or indirectly. Land degradation as such affects mainly agriculture & groundwater recharge (thereby affecting irrigation, water supply etc.)

7.3. Pressures

7.3.1. Water logging

Excessive irrigation in areas with poor drainage causes water logging and salinisation of the soil. It also affects the optimum utilization of water by bringing more area under irrigation.

7.3.2. Improper exploitation of land resources

The unregulated mining of red earth has resulted in the formation of deep ravines and loss of topsoil in Kalapet and Kurumbapet areas in Pondicherry region. Similarly the illegal sand mining on the banks of rivers Sankarabarani, Penniar in Pondicherry region may affect the ground water recharge.

7.3.3.Inappropriate land-use and cropping pattern

Increasing industrialization and urbanization have led to the conversion of agricultural land into non-agricultural one. Often farmers sell out their lands to industrialists, real estate developers as they find it difficult to carry on agriculture and also in view of higher price they get on sale.
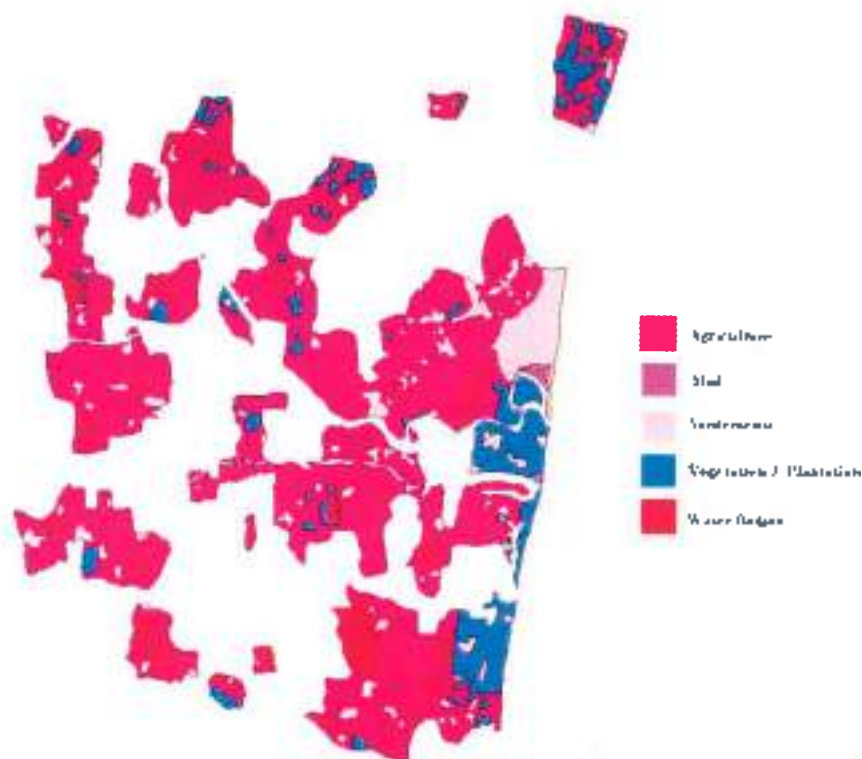
Map 7.1 Land use pattern – Pondicherry Region

Excessive use of agricultural inputs such as fertilisers and pesticides, (refer Table 4.2 and 4.3) may lead to both on-site impacts (reduction of productivity) and off-site impacts (eutrophication in surface water bodies, contamination of groundwater.

The livestock exerts grazing pressure on land for both grazing and fodder production.

The total livestock population has marginally increased during the past four decades in the U.T. One possible reason for not making greater strides in this regard may be lack of adequate grazing lands. The details of livestock are given below:

Table 7.1 Livestock Census (1997)

Sl.No.	Items	Pondicherry	Karaikal	Mahe	Yanam	Total
1	Cattle	53368	18180	831	390	72769
2	Buffaloes	1766	1390	--	886	4042
3	Sheep	1439	382	--	48	1923
4	Goats	22118	17884	277	440	40719
5	Horses	78	6	--	1	85
6	Donkeys	13	5	--	--	18
7	Pigs	889	348	--	19	1256
8	Rabbits	573	77	--	4	654
9	Dogs	10887	1881	362	88	13218
10	Total Livestock	91185	40153	1470	1876	134684
11	Fowls	75750	36131	1858	2640	116379
12	Ducks	3112	485	5	34	3636
13	Other Poultry	583	655	12	11	1261
14	Total Poultry	79445	37271	1875	2685	121276

Table 7.2 Livestock Census(2003)

Sl.No	Items	Pondicherry	Karaikal	Mahe	Yanam	Total
1	Cattle	55831	21065	600	599	78095
2	Buffaloes	1553	895	1	1438	3887
3	Sheep	2214	218	-	157	2589
4	Goats	24207	22690	136	506	47539
5	Horses	51	24	1	4	80
6	Donkeys	17	1	-	-	18
7	Pigs	529	248	-	54	831
8	Rabbits	1324	365	14	-	1703
9	Dogs	19836	3137	429	161	23563
10	Total Livestock	105562	48643	1181	2919	158305
11	Total Poultry	201668	28544	6370	7889	244476

7.4. State

Agriculture accounts for 50.02% of total land area and the area put to non-agricultural use accounts for 31.46% of the total area. The net cultivated area has declined from 32266 hectares in the year 1976-77 to around 21570 hectares in 2002-03. The Table below gives the land use pattern in the U.T.

Table 7.3 Nine fold classification of land

Sl.No	Description	1999-2K	2000-01	2001-02
	Total geographical area according to village papers	48,842	48,842	48,842
1	Forests	--	--	0
2	Land put to non-agricultural use	15,369	15,498	15,861
3	Barren & unculturable land	114	113	108
4	Permanent pastures & other grazing lands	18	18	18
5	Land under miscellaneous tree crops & groves not included in the net area sown	829	821	920
6	Culturable waste	3,323	4,089	4,363
7	Other fallow lands	3,510	3,024	2,513
8	Current fallow	1,247	950	1,373
9	Net area sown	24,432	24,329	23,686
II	Area sown more than once	17,965	18,948	14,906
III	Total cropped area	42,397	43,277	38,592

Source: Directorate of Economics & Statistics, Pondicherry.
Details of extent of land degradation are not available.

7.5. Impacts

7.5.1. Impact of improper disposal of wastes

Improper disposal of municipal and industrial wastes apart from polluting water resources has degraded land as well. Improper handling and storage of raw materials, and final products and discharge of untreated or improperly treated effluents degrade the land. It is very difficult to reclaim lands contaminated with heavy metals. Technologically and economically it is a difficult option. It will have an irreversible impact. Even cultivation in such lands is dangerous as some of the plants tend to accumulate these heavy metals and when they are consumed will have adverse effect on health.

7.5.2. Impact of improper agricultural practices

The main impacts will be decline in agricultural productivity over a period of time, contamination of soil and water resources in cases of excessive fertiliser and pesticides applications, eutrophication, contamination of food products, bio-magnification etc.

7.5.3. Impact of unregulated red earth / sand mining

It will affect groundwater recharge. It will lead to erosion of valuable top soil and may cause floods. It may also cause landslides.

7.5.4. Impact of natural factors

Coastal erosion due to tidal action and some times due to occurrences of natural disasters like tsunami, earthquakes etc. endanger the lives and livelihoods of people living near the coastal areas. In densely populated coastal areas the impact will be more.

Due to Tsunami that occurred in December 2004, around 100 hectares of agricultural land in Pondicherry region and 1000 hectares of agricultural land in Karaikal region have been affected. Reclamation is a difficult task. The TDS in the shallow water Table also has increased.

7.6. Response

The Agriculture Department is promoting adoption of diversified cropping pattern, use of organic manures, adoption of IPM (Integrated Pest Management) etc. It is also promoting use of bio-fertilisers and bio-pesticides.

The Government and the NGOs are trying to reclaim the salinity-affected areas (due to tsunami).

Coastal erosion

Coastal erosion is a serious problem. In some areas in Pondicherry town, the problem is severe. Both natural and human factors contribute to erosion. The coastal sandy soils in Pondicherry and Karaikal regions are subject to wind erosion and are unproductive. The U.T. administration has constructed wall with stone boulders to protect the land area especially habitations from the impact of erosion.

Table 7.4 Response Matrix

Dept./ Agency	Policy/Strategy	Institutions	Current projects
Dept. of Agriculture	Promotion of use of organic manure, bio-fertilisers, bio-pesticides. Thrust on diversified agriculture.	• PASIC is marketing compost • Uzhavar-Udaviya-gams (Farmers Help Centres) have been set up to facilitate information dissemination.	Reclamation of Salinity affected areas.
Forest Dept	Promotion of afforestation programmes		• Restoration and Rehabilitation • Shelter belt development in the coastal areas
State Land use Board	Regulation of conversion of agricultural land for non-agricultural purposes in areas not covered under the Master Plans.		
Town & Country Planning/ Planning Authorities	Regulates the usage of land in areas covered under Master plans, which are reviewed every 5 years.		Master Plan review is in progress.
Revenue Dept	Regulation of sand mining / red earth mining.	Obtains views of PWD regarding the possible impact.	
Local Administration Dept	Collection and disposal of municipal solid waste.	Municipalities in urban areas and commune panchayats in rural areas are the implementing agencies.	Land has been acquired in the outskirts of Pondicherry town for developing a model solid waste management facility
PPCC	Regulates disposal of all types of wastes- municipal, industrial, biomedical etc.	Interacts with Local Administration and Health Departments for implementing municipal solid waste and biomedical waste Rules.	
Pondicherry Coastal Zone Management Authority	Implements CRZ regulations thereby regulating developmental activities in the coastal areas falling within CRZ.	Interacts with regional planning authorities for regulating development in CRZ.	

CHAPTER - 8

NATURAL RESOURCES
(Forests & Biodiversity)

8.1. Introduction

The U.T. doesn't have any major mineral resources. Around 2.6 mi. tones of Cement grade limestone has been proven in Pondicherry region. Ignite deposits have been recorded near Bahour, Aranganur and Kanniakoil. 250 MT of graphite has been estimated in Pondicherry region. Rare mineral resources like Ilmenite are found to occur in the form of alluvial deposits in the coastal area of Karaikal. (Source: Minerals of India, NBT Publication 1994 Edition).

Forests play a vital role in a nation's development. Forests act as carbon cycles, help in nutrient cycles, soil formation, precipitation. Forests provide livelihood to many indigenous people. Forests are reserves of biodiversity.

8.2. Pressures on Forests

❖ Deforestation due to unregulated and unsustainable exploitation of forests.

❖ Diversion of forest lands for non forest usages.

8.2.1. Pressures on Biodiversity

❖ Monoculture cultivation of hybrids disregarding native varieties.

❖ Excessive use of pesticides, fertilizers which have adverse effects on biodiversity.

❖ Introduction of exotic species.

❖ Discharge of untreated sewage and industrial effluents thereby affecting many flora and fauna.

8.3. State

There is no appreciable forest cover in the U.T. The only existing patch of forest in Pondicherry is the vegetation available in Swadeshi Cotton Mills Campus, a sizable portion of which was cleared for the construction of District Court building.

Mangrove vegetation is seen to some extent in the estuaries and along the sides of Ariyankuppam river (in Pondicherry region), Gouthami river near Guirempeta (in Yanam region).

Some of the important mangrove species in Pondicherry are Rhizophora apiculata, Rhizophora mucronata, Avicennia marina, Bruguiera cylindrica, Bruguiera gymnorrhiza (Rhizophoraceae), Acanthus ebracteotus, Acanthus illicifolius (Acanthaceae) etc.

Plate 1. True mangroves of Pondicherry.

Acanthus illcifolius

Acanthus ebracteatus

Avicennia marina

Bruguiera cylindrica

Bruguiera gymnorrhiza

Rhizophora apiculata

Rhizophora mucronata

Two tanks of Ousteri and Bahour are home for a number of migratory birds. Some of the migratory birds visiting the wetlands at Pondicherry are little Grebes, Great Cormorant, Pelican, Grey heron, Egrets, Indian Pond heron, white storks, painted storks, white spoonbills, Black headed Ibises, Tufted Ducks, common coots, Jacanas, Whiskered Terns etc.

Exhaustive data on the floral and faunal diversity in terms of number of species, genera and family is not available. An effort was made by the Pondicherry University to document, the biodiversity in the U.T. in its document entitled 'Biodiversity Strategy & Action Plan' for the U.T. The details of endangered flora and fauna are given below:

8.3.1. Endangered / Threatened Fauna

Wildlife population in Pondicherry comprises of small mammals, birds, reptiles and fishes. A large number of birds are sighted in the botanical garden and the two large water bodies namely, Ossudu and Bahour tanks. Similarly, the backwaters of Karaikal also attract a number of migratory aquatic birds including Ducks, pTeals, Pochards etc. The wild animals recorded in the U.T. are Jackal, Black Napped Hare, Bonnet Macaque, Jungle Cat, Civet Cat, Mongoose, Monitor Lizard, Olive Ridley Turtle and Leather Backed Turtle. Among these, the Olive Ridley Turtle and Leather Backed Turtle have been declared as endangered.

Table 8.1 Endangered and threatened plant species

Sl.No.	Plant Name	Location
1	Derris ovalifolia	Pondicherry
2	Santalum album	Pooranankuppam Sedarapet
3	Mallotus philippensis	Pondicherry
4	Atlantia monophylla	Pondicherry
5	Pamburus missionsis	Pondicherry
6	Glycosmis pentaphylla	Pondicherry
7	Lepisanthus tetraphylla	Pondicherry
8	Diosypyros ebmum	Pondicherry
9	Amorphophalus sylvaticus	Karasur grove
10	Gloriosa superba	Pondicherry
11	Gymnema sylvestre	Pondicherry
12	Crateva religiosa	Kizhur grove
13	Salvadora persica	Kizhur grove
14	Combretum ovalifolium	Pondicherry
15	Derris scandens	Pondicherry
16	Derris ovalifolia	Pondicherry

8.4. Impact

The mangrove ecosystem plays a vital role in coastal economy by way of providing natural spawning and nursing ground for many important fish and shellfish varieties. They also help in reducing the impact of natural disasters in coastal area. It has been reported that mangroves moderated locally the impact of tsunami that occurred on December 26, 2004. Since the U.T. doesn't have much forest cover the question of impact of deforestation may not arise.

The loss of biodiversity in view of industrial pollution etc. may have serious consequences in the long run.

8.5. Response
8.5.1. Sacred groves Role in conservation

Sacred Groves locally known as 'Kovil Kadugal', 'Ayyappan Kavu' represent small patches of forest left untouched by the local communities because of their faith and tradition that the area is sacred and the vegetation and animals inhabiting the same should not be destroyed. They are repositories of medicinal plants and local flora and often they harbour local fauna as well. These sacred groves are often dedicated to local spirits or deities and as such the people attach some sanctity to them. Religious practices and cultural traditions have been spun around them to deter people from exploiting the biodiversity contained within them. This ancient Indian conservation tradition has played a vital role in conserving small pieces of forest cover, which often consists of endangered flora. These groves are often found in forestlands, Community lands, temple lands and sometimes in private lands.

However due to scarcity of land, change in outlook etc. these areas are under pressure of extinction.

Around 123 patches of sacred groves varying in size from 0.2 to 5.0 ha in around the temples have been identified in the U.T. of Pondicherry.

Some of the important sacred groves are at Mangalam, Poomankuppam, Thirukkanur, Madagadipet, Lawspet, Mettupalayam, Abhisekapakkam, Keezhur, Karasur (all in Pondicherry Region) Chembara and Pandakkal (in Mahe Region)

Plate 8.2 Sacred groves species

Canarus monocarpa

Salacia oblonga

Antidesma menaesu

Leea indica

Curcuma

Pandakkal Sacred Groove

95

Table 8.2 Response matrix:

Dept/ Agency	Policy/Programme
Agriculture Department & State Ground Water Authority	Promotion of biofertilisers, IPM, rainwater harvesting. Regulation of exploitation of ground water
Dept. of Forests & Wildlife	Social forestry schemes (shelter belts in the coastal areas) Conservation of mangroves. Prohibition of hunting of birds and other wild animals.
Public Works Department	Tank Rehabilitation Programme
PPCC	Guidelines for rainwater harvesting raising green cover in industries. Insisting desalination in case of large industries.

CHAPTER – 9

SUMMARY OF THE REPORT

9.1. Summarization

In the chapters 4 to 9 different environmental issues have been discussed with relevance to different departments and geographical areas. To have an integrated approach it is necessary to summarize the same from the perspective of the concerned sector / government department.

The development of a particular sector may impact the development of others apart from impacting the environmental issues. Similarly different sectors may impact a particular environmental issue. The relationship is 'one to many' and 'many to many'.

For instances growth of sectors like 'industry', 'urban development', 'energy', 'agriculture, etc. may contribute to the environmental issue of 'water pollution'. They may also contribute to 'air pollution', 'solid waste management' and so on. The relationship is therefore complex.

Table 9.1 Summary of Environmental Pressures, States and Impacts sector-wise

Environmental Issues Sector	Water	Air	Solid Waste Management	Land Degradation
Industry Expansion and Diversification Improper emissions & discharges	Increases consumption of water. Increases waste water generation. Both the pollution loads and health impacts increase	Increases air pollution load as more energy is consumed and more emissions are released from the industrial processes. May increase the incidence of respiratory disorders.	The quantity of industrial wastes increases. The storage and disposal of hazardous will be a problem	Conversion of agricultural land for non-agricultural purposes.
Energy & Power	Since the U.T. is getting part of the power supply from the grid and part of it through gas based power station the pollution load on water is negligible.	The air pollution from gas based power generation is minimal when compared to that of coal based power generation. The consumption of fuels like furnace oil, coal, fuel wood etc. by the industrial sector will increase the air pollution. Similar is the case with increasing domestic fuel consumption in view of increasing population.	As noted under water	As noted under water.
Transport		Growth in Number of vehicles especially two-wheelers results in increase in vehicular air pollution.		Developing additional infrastructure like roads etc. to cater to the increasing demands lead to conversion of agricultural and other land.

Local Administration	Inadequate Sanitation infrastructure results in enhanced levels of biological pollution load. Demand for water increases.	Per capita consumption of fuel and thereby per capita emissions increase with the increasing urbanization due to population increase.	Generation of waste increases. Ineffective infrastructures to handle the same will pose problems.	Adds pressure on agricultural and other lands as more land will be required for residential purposes and also for providing infrastructural facilities.
Agriculture	Increased use of pesticides and fertilisers will contaminate groundwater Need for more output will lead to exploitation of ground water in some areas.			Need for more productivity and the consequent intensive agriculture with pesticide & fertiliser application may degrade the land. Excessive irrigation may lead to water logging.

CHAPTER-10

STATE OF ENVIRONMENT REPORT PROJECT PROCESS AND PROCEEDINGS

First Interaction Meeting with officials of Govt. of Pondicherry took place on 11-03-2003 with a team of 15 officials headed by Mr. Narendra Kumar I.A.S., Secretary to Govt. of Pondicherry, Industries, Commerce, Science, Technology and Environment (attendance sheet is enclosed). During the meeting following were explained by Administrative staff College of India (ASCI) consultants.

1. Background information to Ministry of Environment & Forests (MoEF) initiatives about SoER (State of Environment Report Project) and its objectives.

2. Process of writing SoER Viz.

   - Formation of Steering committee in the Union Territory of Pondicherry,
   - Selection of State Host Institutions (SHIs)
   - Role of SHIs
   - Role of NHI (National Host Institutions).
   - Stake Holder workshop
   - Budget Availability from Ministry of Environment & Forests

The Second meeting for Sensitization workshop under this project was organized on 04-0602003 in conference hall of Pondicherry Secretariat to sensitize and build awareness on roles and responsibilities of various Nodal Officers, Resource Persons etc. as well as for completion of this task of writing SoER efficiently. Various departmental heads, representatives of NGOs attended the workshop (list enclosed). The workshop had good participation across departments, which included Agriculture Department, Animal Husbandry Department, District Rural Development Agency, Local Administration Department, Health Department, Public works Department etc. The workshop was inaugurated by the Member Secretary PPCC (Schedule of the activities enclosed). Given the importance of documenting the environmental profile and the trends in the status of Environment in Pondicherry, PPCC had initiated the task of preparing the State of Environment Report a couple of years ago, which had resulted in bringing out a document in 2002. This reveals the commitment of the Organisation in undertaking an assignment of this importance.

During the meeting, issues like Data collection and Selection of resource persons were discussed. Sectoral and Cross Sectoral problems were also discussed and prioritized. Later on Specific formats for data collection prepared by experts of ASCI were given to Nodal Officers of Pondicherry for collection of relevant data.

A comprehensive four days advanced training programme for resource persons was orgainized at ASCI, Hyderabad from December 11-15-2003. Two persons attended (Dr. R. Sagaya Alfred and Dr. M.M.Sheik Dawood) the programme from Pondicherry. After this ASCI followed-up continuously for completion of the report. but it was delayed inordinately due to change of Member Secretaries (Head of SHI) three times. Finally Mr. P.T. Rudra Goud the present Member Secretary arranged to complete the draft report by the end of June 2005. A stakeholder workshop was organized on July 12. 2004 in Pondicherry where thirty-four participants from various organizations participated very actively (list enclosed). A number of suggestions were made and additional data was also proposed and the same was incorporated in the final draft report. Apart from this a group exercise was carried out (Participants were broken into six groups) and the individuals deliberated to prioritize the Environmental issues of the Union Territory. All the six groups deliberated among themselves and the result of the exercise is also enclosed here-with at the end of the report. The final draft report has been gone through by ASCI and given back to Mr. Rudra Goud with necessary suggestions to be incorporated before printing.

PROCESS STEPS FOR STATE OF ENVIRONMENT REPORT PROJECT

1. Finalization of State Host Institution & Nodal Persons

2. Small Infrastructure Requirement for SHI – Initial Visit by NHI to each SHI

3. Release of funding by NHI to the tune of rupees seventy five thousands for facilities upgradation in SHI

4. Sensitization workshop in each state headquarters by NHI

5. Selection of resource Persons by SHI for training them In SoE preparation by NHI

6. Release of funding from MOEF of SHIs

7. Arriving at sectoral as well as cross-sectoral environmental priorities for each state-to give the customized and focused attention in SoE.

8. Wetting the priorities by Steering Committee for SoE headed by Chief Secretary.

9. Training of Resource Persons by NHI

10. Data collection by SHI under the guidance of NHI and in the formats provided by NHI

11. Data compilation and preliminary Analysis by SHI.

12. Submission of preliminary Analysis to Steering Committee for Inputs and Suggestions.

13. Preparation of draft SoE Report

14. NHI giving suggestions for improvements in the draft SoE Report

15. Incorporation of the suggestions by resource persons/SHI and finalization of the report

16. Stakeholder Consultation Workshops in different regions of the state

17. Presentation to Steering Committee and its approval as well as incorporation of its suggestions for finalizing the SoE Report.

18. Incorporation of the suggestions by resource persons/SHI, finalization and printing of the report.

CONCLUSIONS AND RECOMMENDATIONS

The state of environment report shows that the environmental profile of the region on air, water, and land resources is relatively better compared to the stress that is being contributed by waste (municipal, industrial and bio-medical) and on the limited forest and bio-diversity resources of the region. Inadequate infrastructure for collection and disposal of sewage in urban and rural areas contributes significantly to the water borne diseases in the state. Most of the environmental issues such as agricultural run off, in door air pollution etc., could not be addressed adequately due to limitations of data availability as well as the gap in the knowledge that exists. Even the existing information from various sectoral departments is difficult to obtain because of lack of appropriate documentation and retrieval methods adopted by these agencies. Formats will be given to the concerned departments for collection of data required for better environmental management and the present data gaps will be plugged in future.

Glossary and Notes

Acid rain

Sulphur dioxide and nitrogen oxides, which are produced from the burning of fossil fuels, such as coal, natural gas, and oil, and from certain kinds of manufacturing, combine with water vapour in the air to form acids (sulphuric and nitric acids), which eventually return to the ground as acid rain.

Carbon dioxide, produced from the burning of fossil fuels including gasoline, is the leading cause of the greenhouse effect, a phenomenon considered to be responsible for rising global temperatures.

Aquifer

The underground layer of water-soaked sand and rock that acts as water source for a well; described as artesian (confined) or water Table (unconfined).

BOD & COD

The concentration of organic matter is measured by the BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) values.

BOD indicates the amount of oxygen used over a particular period (usually 5 days) by microorganisms as they decompose the organic matter in sewage/waste water. Thus it indicates the quantity of biodegradable organic matter present in waste water. Waste water with high BOD if discharged without any treatment would reduce the DO (Dissolved Oxygen) of the recipient water body / soil and there by affects the aquatic life forms / microflora.

COD is the amount of oxygen (mg/l) required to oxidize both organic and oxidisable inorganic matter. The value of COD is always higher than that of BOD because many organic substances can be oxidized chemically but the same cannot be oxidized biologically.

Commonly, BOD is used to test the strength of untreated and treated municipal and biodegradable industrial wastewaters. COD is used to test the strength of wastewater that is either not biodegradable or contains compounds that inhibit activities of microorganisms.

Bio-degradation

Breakdown of synthetic or natural organic substances into simpler substances like CO_2, water etc by way of oxidation by microorganisms (like bacteria and fungi) present in the soil and water.

Biodiversity

It refers to the variety and the variability among living organisms. These include diversity within species, between species, ecosystems etc..

Biofertilizers

Microorganisms like certain bacteria that increase the amount of nutrients available to plants.

Biomagnification

Certain chemicals do not dissolve easily in water, but they dissolve easily in many fats and oils. They are not degraded in living tissues and therefore they tend to accumulate in the living tissues and circulate upwards in the food chains. They enter plant tissues through air, water and soil. Animals eat these plants, and the small amount of these chemicals from each plant adds up to higher concentrations in the tissue of the animals. These animals are in turn eaten by other animals, in which these chemicals concentrate further. The concentrations reach higher levels in organisms higher in the food chain and this process is called biomagnification. E.g. DDT, a pesticide.

Biopesticides

Microorganisms that are naturally antagonistic towards certain pathogens or pests and that can be used to protect crops.

Coliform bacteria - Non-Pathogenic bacteria found in fecal matter

Due to addition of sewage and wastes. BOD values increase. The number of microbes such as Escherchia coli (a coliform bacterium) also increases tremendously and these also consume most of the dissolved oxygen. Therefore a count of Coliform bacteria gives the extent of pollution. The number or count of coliform bacteria is expressed as the Most Probable Number (MPN) / 100 ml. The presence of coliform bacteria in water beyond certain limits indicates that the water is infected with pathogenic organisms.

Dioxins

Dioxins are a group of chemicals that contain chlorine, carbon, oxygen, and hydrogen. Dioxins are undesirable byproducts formed during chemical processes that involve chlorine and compounds composed of hydrogen and carbon. Dioxins form when chlorine gas is used to bleach paper, during the production of chlorine-containing compounds such as pesticides and antiseptics, and when substances that contain chlorine like PVC (Poly Vinyl Chloride) are burnt. Dioxins are very stable and they do not easily break down into other compounds.

Dissolved Oxygen(DO)
It is a measure of the oxygen dissolved in water expressed in milligrams per liter (mg/l).

Dissolved Salts

Chemical substances either organic or inorganic that are dissolved in a waste stream and constitute the residue when a sample is evaporated to dryness.

Effluent

The liquid waste generated during manufacturing process by the industries.

Electric Conductivity

It indicates the availability of free flow cations (zinc, mercury, lead, chromium etc.) in water. In other words it indicates contamination through inorganic chemicals. It is expressed in micro mhos/cm.

Estuary

Regions of interaction between rivers and near shore sea waters, where tidal action and river flow create a mixing of freshwater and saltwater.

Eutrophication

Excessive fertilizers and other nutrients used to promote plant growth may eventually contaminate water. At first, these nutrients encourage the rapid growth of plants and algae in water. However, when the plant matter and algae die and settle underwater, microorganisms decompose them. In the process of decomposition, these microorganisms consume oxygen that is dissolved in the water. Oxygen levels in the water may drop to very low levels so that oxygen-dependent animals in the water, such as fish, die. This is called eutrophication.

Greenhouse effect

In greenhouse (a glass house) where plants are grown under controlled conditions, the glass allows the incoming solar radiations without any restriction, but restricts the outward movement thereby trapping the radiations inside the chamber. This results in rise in temperature.

Similarly in atmosphere certain gases like Carbon dioxide, Nitrous Oxide, Water vapour etc., which exhibit the same property as that of a glass house prevent the reflected / reradiated radiations to escape into space. This results in increase in temperature. This increase in concentration of these gases known as green house gases results in increasing temperature on the surface of the earth which may have serious consequences. This is known as the Green House Effect.

Hazardous wastes

Hazardous wastes are chemical wastes that are toxic (poisonous), reactive (capable of producing explosive or toxic gases), corrosive (capable of corroding steel etc.), or ignitable (flammable). If improperly treated or stored, hazardous wastes can pollute water and soil and can cause damage.

Inorganic and organic materials

Inorganic wastes are chemical substances of mineral origin, which are only slightly affected by the action of microorganisms e.g., sand, salt, iron, calcium, and other mineral materials. Organic wastes are chemical substances usually of animal or plant origin. Organic waste generally can be consumed by bacteria and other small organisms.

IPM

Integrated Pest Management is an eco-friendly approach aimed at minimizing the use of chemical pesticides by employing available alternative methods of pest control like cultural, mechanical and biological methods.

Land – fill

Proper disposal of hazardous sludge or solid wastes in protected trenches in order to minimize or prevent the possible harms from such hazardous sludge or solid wastes. This also enables anaerobic (in the absence of air) treatment.

Leachate

The water (run-off) containing soluble components from solid wastes etc.

Monitoring

To measure quantitatively or qualitatively the level of a substance over a period of time.

Mangroves

Mangroves are woody trees or shrubs that grow in coastal habitats in waterlogged saline soils. Mangrove plants occupy shallow water and inter tidal zones in tropical and subtropical coastal regions.

Organic Nitrogen

Nitrogen combined in organic molecules such as proteins, amines, and amino acids.

Oxidation Pond

Artificial lake or Pond in which wastewater or effluent is stored for a period of time so as to permit oxidation of wastes before discharge.

Ozone layer

A layer in upper atmosphere (about 30-50 Km above earth surface) which contains Ozone (O-tri-atomic form of oxygen i.e O_3) and which filters the harmful Ultra violet (UV) radiations entering the earth's atmosphere.

Particulates

Particulates include substances that may exist as solid or liquid at normal temperature and pressure. They can settle down or remain suspended in air depending upon size/diameter and meterological conditions.

pH

The pH analysis is a measure of the concentration of hydrogen ions of a wastewater sample. It indicates the acidity or alkalinity of the water / soil. pH is expressed as a number in the scale of 1 to 14. Value 7 indicates neutrality and value less than 7 indicates acidity and value higher than 7 indicates alkalinity.

Potable Water

Water that does not contain objectionable pollutants, contaminants, minerals, or infective agents and is considered satisfactory for drinking.

Renewable resources

Resources that can be replaced or replenished, either by the natural processes or by human action. Air, water, and forests are often considered to be example of renewable resources. Minerals and fossil fuels are examples of non-renewable resources.

Reverse Osmosis

Reverse Osmosis is a technique for purification of liquid with high solid like brackish water or seawater by passing water through a semi-permeable membrane under pressure to filter dissolved solids and pollutants from the water. The water diffuses through the membrane and the dissolved salts remain behind on the surface of the membrane.

Runoff

Rain water running down slopes rather than percolating the ground/soil. Deforestation, lack of vegetation cover will increase runoff.

Sewage

The used water and water-carried solids from homes that flow in sewers to a wastewater treatment plant. The preferred term is wastewater.

Shelter belts

They refer to rows of trees planted to act as a wind barrier etc.,

SPM

SPM in air generally is a complex (air borne particles, low vapour pressure liquid droplets) and too small in size. It is usually range from 0.1 micron to 100 micron size, which remains in the atmosphere for significant period of time. SPM caused by processes such as incomplete combustion of solid, liquid and gaseous fuels, waste from metallurgical, chemical refining operation, incineration etc.

Total solids

Total solids are the residue left on evaporation at 130 °C. Total Solids have two fractions, the dissolved solids (TDS) and the suspended solids (TSS). Thus, Total solids= TDS+TSS.

Turbidity

The amount of suspended matter in wastewater, obtained by measuring its light scattering ability.

Water quality

The quality of water varies greatly depending upon the sources. Surface waters generally contain larger quantities of turbidity and bacteria than groundwater, but groundwater contains higher concentrations of dissolved chemicals. Seawater contains high concentrations of dissolved chemicals and some microscopic organisms as well. Water quality standards set the concentration levels of chemical compounds and bacteria that can be safely allowed in the treated water.

Zero discharge

Zero discharge means that no wastes are discharged i.e., Wastewater is recycled and as such no effluent is discharged on to the land. Solid waste is however disposed of.

ABBREVIATIONS

APCS	-	Air Pollution Control System
BGL	-	Below Ground Level
BIS	-	Bureau of Indian Standards
BOD	-	Biological Oxygen Demand
CETP	-	Common Effluent Treatment Plant
CFC	-	Chloro Fluoro Carbons
CGWB	-	Central Ground Water Board
Cl_2	-	Chlorine
CNG	-	Compressed Natural Gas
CO	-	Carbon Monoxide
COD	-	Chemical Oxygen Demand
CPCB	-	Central Pollution Control Board
CRZ	-	Coastal Regulation Zone
DG	-	Diesel Generator
DO	-	Dissolved Oxygen
DPSIR	-	Driving Force – Pressure · State – Impact · Response
DSTE	-	Department of Science, Technology & Environment
EP Act	-	Environment (Protection) Act, 1986.
ETP	-	Effluent Treatment Plant
GHGs	-	Green House Gases
Ha	-	Hectare
HCFC	-	Hydro Chloro Fluoro Carbons
HCs	-	Hydro carbons
IAQ	-	Indoor Air Quality
IMD	-	Indian Meteorological Department
IPM	-	Integrated Pest Management
IS	-	Indian standard
KW	-	Kilo Watt
KWh	-	Kilo watt per hour

L_{max}	-	Linear Maximum
L_{min}	-	Linear Minimum
L_{eq}	-	Linear equivalent
lpcd	-	Litres per capita per day
LSI	-	Large Scale Industries
LTL	-	Low Tide Line
M.S.	-	Mild Steel
MLD	-	Million Liters per Day
MNES	-	Ministry of Non conventional Energy Resources
MoEF	-	Ministry of Environment & Forests
MSI	-	Medium Scale Industries
MW	-	Mega Watt
NAMP	-	National Air Quality Monitoring Programme
NGOs	-	Non Governmental Organisations
NGRI	-	National Geophysical Research Institute
NH_3	-	Ammonia
NIO	-	National Institute of Oceanography
NO	-	Nitrogen Oxide
NO_2	-	Nitrogen Dioxide
NOC	-	No Objection Certificate
NWMP	-	National Water quality Monitoring Programme
OECD	-	Organization for Economic Cooperation and Development
PAH	-	Poly Aromatic Hydrocarbons
PASIC	-	Pondicherry Agro Service & Industries Corporation Ltd
PCZMA	-	Pondicherry Coastal Zone Management Authority
PIPDIC	-	Pondicherry Industrial Promotion Development and Investment Corporation Ltd.
PM 10	-	Particulate Matter with a diameter of less than 10 microns
PM 2.5	-	Particulate Matter with a diameter of less than 2.5 microns

PPCC	-	Pondicherry Pollution Control Committee
ppm	-	Parts per million
ppt	-	Parts per trillion
PWD	-	Public Works Department
RH	-	Relative Humidity
RO	-	Reverse Osmosis
SEZ	-	Special Economic Zone.
SO₂	-	Sulphur di Oxide
SPM	-	Suspended Particulate Matter
SPV	-	Solar Photo Voltaic
SSI	-	Small Scale Industries
TD	-	Transmission Distance
TDS	-	Total Dissolved Solids
TPA	-	Tonnes Per Annum
TSDF	-	Treatment Storage and Disposal Facility
TSS	-	Total Suspended Solids
UT	-	Union Territory
VCRC	-	Vector Control Research Centre
WRI	-	World Resource Institute

ANNEXURE – I
Reports / Studies / References

1. 'Statistical Hand Book' (2003 & 2004) Directorate of Statistics and Economics, Pondicherry -

2. 'Assessment of Pollution in Pondicherry with an Action Plan' (1999), Pondicherry Pollution Control Committee -

3. 'State of Environment Report for Pondicherry' (2000), Pondicherry Pollution Control Committee.

4. 'Compendium of Environment Statistics' (2003), Ministry of Statistics and programme implementation, Government of India.

5. 'Zoning Atlas for Pondicherry and Yanam', (2002), Prepared by the Department of Town and Country Planning, Pondicherry for PPCC.

6. 'Industrial Master Plan' (1997), Department of Industries, Pondicherry.

7. 'Minerals of India' (1994), An NBT Publication.

8. 'Biodiversity Strategy and Action Plan of Pondicherry' (2004), Dept. of Life Sciences, Pondicherry University.

9. 'Flora of Sacred Groves of Pondicherry region – Pictorial Guide', (2005) Dr. P. Devaraj, Deputy Conservator of Forests et al.

10. 'Study on the diversity and management of Pondicherry Mangroves' (2003-2004) K.R.Saravanan, Research Scholar, Salim Ali School of Ecology and Environmental Sciences, Pondicherry University, Pondicherry -

11. 'Rapid carrying capacity Assessment of M.S.Ingots, Ferro alloys, Chlorates & Calcium Carbide units in Pondicherry, Karaikal & Yanam regions', (2002), Prepared by Centre for Environmental studies, Anna University, Chennai for the Industries department, Pondicherry.

12.   'Ambient Air Quality Status & Statistics', (1996 & 1997), Central Pollution Control Board, Delhi -

13.   'Water Quality Status & Statistics' (1996 & 1997), Central Pollution Control Board, Delhi.

14.   'Water Resources and their Management Pondicherry region' (1999), Department of Agriculture.

15.   'Background Note in connection with study visit of the Departments related Parliamentary Standing Committee on Home Affairs to Pondicherry' (2005), Government of Pondicherry.

METHODS OF MEASUREMENT OF AIR POLLUTION

Methods of measurement of air pollution followed by the Central Pollution Control Board are as follows:

A. Sulpur Di-Oxide (SO₂)

The SO_2 is absorbed from air in a solution of potassium tetrachloromercurate (TCM). The resultant complex is made to react with pararosaniline and formaldehyde to form the coloured pararosaniline methylsulphunic acid, the absorbance of this solution is measured by means of a suiTable spectrophotometer at 560 nm.

B. Nitrogen dioxide (NO₂)

The NO_2 in ambient air is collected by bubbling it through a solution of sodium hydroxide and sodium arsenate. The resultant nitrite ion concentration is colorimetrically determined by reacting it with sulfanilamide and N-(1-napthyl) ethylene diamine dihyrochloride, the absorbance is then measured at 540 nm.

C. Suspended Particulate Matter (SPM)

SPM is measured gravimetrically high volume sampling with whatman filter patper is used at average flow rate being not less than 1.1 cubic meter per minute.

METHODS OF DETERMINATIN OF WATER QUALITY PARAMETERS

Sl. No	Parameter	Recommended Method
1.	Temperature	Thermometeric method
2.	pH	Electromatic method
3.	TSS	Nephlometric method
4.	Velocity of Flow	1. Current method 2. Float method 3. Chemical method
5.	Dissolved oxygen	Iodometric method
6.	Bio-chemical Oxygen Demand	Dilution method
7.	Total Kjeldahl Nitrogen	• Digestion • Distillation 1. Titration method (>5mg/l) 2. Nesslerization method (<5mg/l)
8.	Nitrogen . nitrate + nitrite	Amalgamated Cadmium Reduction method for reduction of nitrate to nitrite y diazotisation method
9.	Total Coliform (MPN)	Multiple Tube Dilution technique
10.	Fecal Coliform (MPN)	Multiple Tube Dilution technique
11.	Conductivity	Conductometric method
12.	Chloride*	1. Argentometric method 2. Mercurimetric method
13.	Hardness	EDTA Titrimetric method
14.	Calcium	EDTA Titrimetric method
15.	Magnesium	By difference of 13 & 14
16.	Alkalnity	1. Electrometric method 2. Visual titration method
17.	Sulphate	Turbidimetric method
18.	Sodium	Flame Photometric method
19.	Chemical OxygenDemand	Dichromate reflux method
20.	Total Dissolved Solids	Gravimetric method
21.	Fixed Dissolved Solids	Gravimetric method
22.	Phosphate	Molybdate method (Colorimetry)
23.	Boron	Curcumine method (Coloritmetry)
24.	Free Ammonia	Curcumine method (Colorimetry)

Source: Water Quality –Status & Statistics (1996 & 1997), Central Pollution Control
      Board.

Note: Wherever more than one methods are give, they are in order of preference.

* (Argentometric method has been given first preference but if the colour of the sample interferes with the chromate end point then mercurimetric method should be used. Uasually sulphate concentration is low in surface waters & hence gravimetric method may not be accurate as turbidimetric method, therefore, trubidimetric method is suggested.)

Details of Hospitals in Pondicherry Region

Sl. No.	Name of the Hospital
1.	General Hospital, Pondicherry.
2.	Jawahar Institute of Post-Graduate Education and Research (JIPMER), Gorimedu, Pondicherry
3.	Govt. Maternity Hospital, Pondicherry
4.	St. Joseph of Cluny Nursing Home, Pondicherry
5.	Mahatma Gandhi Medical College and Research Institute, Pillaiyarkuppam
6.	Aarupadai Veedu Medical College & Hospital, Pondicherry
7.	Pondicherry Institute of Medical Sciences, Pondicherry
8.	Chest Clinic, Pondicherry
9.	Mahatma Gandhi Govt. Leprosy hospital, Pondicherry
10.	Nallam Clinic, Pondicherry
11.	Sethu Nursing Home, Pondicherry.
12.	ESI Hospital, Gorimedu, Pondicherry
13.	New Medical Centre, Pondicherry
14.	Mahatma Gandhi Dental College & Hospital, Pondicherry
15.	Sri Mahalakshmi Nursing Home, Pondicherry
16.	Govt. Chest Clinic, Pondicherry
17.	Sri Krishna Nursing Home, Pondicherry
18.	Clinic Nallam, Pondicherry
19.	Arthur Eye Nursing Home, Pondicherry
20.	Rani Hospital, Pondicherry
21.	A.G. Padmavati's Hospital, Pondicherry
22.	Sri Devi Nursing Home, Pondicherry
23.	Care Clinic, Pondicherry
24.	Jagadesh Eye Clinic, Pondicherry
25.	Aurobindo Ashram Nursing Home, Pondicherry
26.	Jothi Eye Care Centre, Pondicherry
27.	VKN Hospital, Pondicherry
28.	Kamala Nursing Home, Pondicherry

Details of Hospitals in Karaikal Region

| Sl. No.	Name of the Hospital
1.	Govt. General Hospital, Karaikal.
2.	Vinayaga Mission's Medical College & Hospital, Karaikal.
3.	St. Rock's Dispensary, Karaikal.

Details of Hospitals in Yanam Region

Sl. No.	Name of the Hospital
1.	Govt. General Hospital, Yanam
2.	Satya Nursing Home, Yanam.
3.	Sri Veeraraju Nursing Home, Yanam.
4.	Renuka Nursing Home, Yanam.

Details of Hospitals in Mahe Region

Sl. No.	Name of the Hospital
1.	Govt. General Hospital, Mahe
2.	Primary Health Centre, Mahe
3.	Community Health Centre, Pallor, Mahe.
4.	ESI Dispensary, Pallor, Mahe

PPCC
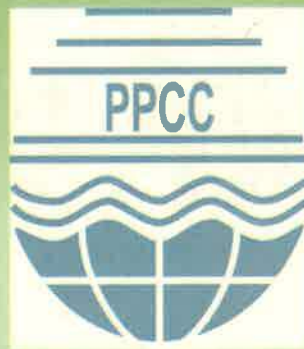
PONDICHERRY POLLUTION CONTROL COMMITTEE
III Floor, Housing Board Building,
Anna Nagar,
Pondicherry - 5.