CHAPTER 1

INTRODUCTION

1.1 GENERAL

Water is an integral part of the ecosystem. Water, for which there is no substitute, has always been mankind’s most precious resource. It is a natural resource as well as a social and economic good. Freshwater resources form an intrinsic part of the earth’s hydrological cycle and are an indispensable part of all ecosystems. Water is not distributed equally across the globe. Only 2.5% of the world’s water is fresh, and two-thirds of that is locked up in ice caps and glaciers. Of the remaining amount, about 20% is in areas too remote for human access and a further 60% comes at the wrong time and place-in monsoons and floods-and is not captured for use by people. Only 0.08% of the total water on the planet is accessible for human consumption.

The general objective of mankind is to make certain that adequate supplies of water of good quality are to be maintained for the entire population of this planet, while preserving the hydrological, biological and chemical functions of ecosystem. Innovative technologies, including the improvement of indigenous technologies, are needed to fully utilize the limited water resources and to safeguard those resources against pollution.

Many parts of the world is coming under increasing pressure as a result of degradation of the fresh water resources and growth in population. Worldwide, freshwater consumption rises six times between 1900 and 1995,
more than twice the rate of population growth. At present, approximately one-third of the world’s people live in countries with moderate to high water stress, and more than 5 million people die every year as a result of poor water quality. At present water is moving into the realm of economic goods. There is a growing dependency of economy of a country as a whole on the availability of water. Conservation and utilization of water resources are inextricably bound up with the exploitation of the entire resources heritage of the region and the water resources have some influence on every aspect of national economy.

Even advanced countries possessing plentiful water resources have started realizing the need for careful planning in the conservation, utilization and management of water. Efficient planning and management of water resources, for drinking and other uses, is an important aspect for the development of any system. Recognition of the fact that groundwater and surface water are not separate entities but are two forms of the same total water source, leads to recognition of the importance of conjunctive water use in the management of groundwater-surface water system, for the coordinated and harmonious development and for increased efficiency of the system.

The water withdrawals for domestic and industrial sectors, as shares of the total water withdrawals in India, are quite small compared to those in other developing countries. However, with increasing urbanization and per capita demand the water demands of the domestic, industrial and other sectors are expected to increase rapidly. The spatial variation of water availability is a crucial factor for proper water demand management.

Water management decision can have environmental, physical, social and economic impacts that are widespread and pervasive. It is therefore, necessary to have most relevant information for arriving at rational decisions that will result in the maximum amount of benefit to most people.
Accurate and reliable information on the water resource system can, therefore, be a vital aid to strategic management of the resource.

1.2 USES OF WATER

Water resources occupy a special place among other natural resources. Water use, in the broadest sense, pertains to the interaction of human activity with and their influence on the hydrologic cycle. It includes elements such as self-supplied withdrawal, public supply delivery, consumptive use, reclaimed wastewater etc. Water consumption is divided into two categories as consumptive use and non-consumptive use. Mostly all uses are partially consumptive and partially non-consumptive, which includes domestic, commercial, industrial, irrigation, livestock and electricity generation.

The domestic (municipal) water use consists of water used for household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, car washing, watering lawns and gardens. Commercial water use consists of water used by commercial facilities such as hotels, restaurants, office buildings, government and military facilities, hospitals, educational institutions and retail sales stores. Industrial water use consists of water used to manufacture products such as steel, chemical, paper as well as water used in petroleum and metals refining. Industrial water use includes water used for boilers, air conditioning, cooling, sanitation, washing, transport of materials and steam generation for internal use.

Irrigation water use consists of all water artificially applied to farm, orchard, pasture and horticultural crops. In addition to normal plant growth, irrigation water may be used for land preparation, germination, frost and freeze protection, chemical application, crop cooling and harvesting. Livestock water use consists of water used to raise cattle, sheep, goats and
poultry. Other livestock water uses consist of evaporation from stock ponds, dairy sanitation, cleaning and waste-disposal systems, processing animal products and incidental water losses. Water is also used in large scale for hydroelectric - power generation.

The management of supply of water to these uses is under the control of government agencies. In recent times, as economic activities increase and diversify, as population size increases, and as the balance between rural and urban people and activities changes, there arises a need to integrate these water services.

1.3 NEED FOR THE RESEARCH

India is a large country with regional differences in per capita water supply and demand. Attempts to describe the water situation in India at a national level are often misleading because of tremendous diversity in the water situation across the country. According to the 2001 census, the population of India was 10270 lakhs and is expected to stabilize around 16400 lakhs by the year 2050. Due to rapid rise in population growth gross per capita water availability will decline from 1820 m$^3$/year in 2001 to as low as 1140 m$^3$/year in 2050 (Gupta and Deshpande 2004). In 1995, about 75% of Indian population was rural, but a substantial proportion of the population is expected to live in the urban areas in future. By 2050, 48% to 61% (Sudhirendar Sharma 2002) of India’s population will be living in urban areas.

Tamil Nadu, the south east state of India, has a geographical area of 130058 sq.km against the area of 3287590 sq.km of the country. The population and area of the Tamil Nadu is 7% and 4% respectively of that of the country but the available water resources is only 3% of that of the country. The average rainfall is 925 mm against the average rainfall of 1170 mm of the country. It varies from 1200 mm near coastal area to 550 mm in inland area.
In order to assess the water potential of the state, river basin was considered as a hydrological unit. In Tamil Nadu there are 34 rivers including minor rivers and west flowing rivers.

The four metropolitan cities in India are New Delhi, Bombay, Kolkata and Chennai. Decades of unplanned land use and human settlement practices in metropolitan cities are the prime factors behind the gradual decline of ground and surface water. In 1981, the population of Chennai Metropolitan Area (CMA) was 43 lakhs. In the last 2 decades, its population has doubled to 80 lakhs (Directorate of Census Operation, Chennai). The level of rainfall over Tamil Nadu, Chennai in particular, has not changed significantly in the last few decades. Chennai is blessed every year, except for the rare drought, with annual rainfall of 1200 mm. Meanwhile drinking water continues to be scarce. This mismatch-of paucity and plenty-is because of various factors like population, migration, etc.

Due to urbanization in Chennai, the rainwater is allowed to drain into gutters and thereby allowed to combine with sea water, without trying to retain them in the ground. The reduction in open lands to catch rainwater and the cutting of trees has reduced the groundwater level to a considerable extent. There were no systematic and conscious attempts to rejuvenate the water table. Much of the water supplied to the urban areas is sourced from underground wells or river systems. These run almost completely dry in summer. This brings to today’s condition where Chennai faces a severe water problem.

It is the need of the hour to find out new and sustainable sources and appropriate management of the sources as well as the system. The challenge of meeting the drinking water requirement of such huge population in addition to the other water requirements needs immediate steps to be taken. The need for an integrated approach and planning based on the application of
modern technology to initiate investigations and scientific studies on the various aspects of water resources and utilization are keenly felt. A concerted strategy for management of water resources in the Chennai Metropolitan Area need to be put in place in order to avoid the crisis. A new paradigm, to manage water, can be built both on past traditions and the current practices. The traditional systems should be improved through appropriate adaptation and integration of modern systems.

This study is conducted to find out the present water supply situation of Chennai Metropolitan Area and management measures are suggested to improve the existing water sources and also to provide improved water distribution.

1.4 OBJECTIVES

The objectives of this research are as listed below:

1. To study the domestic water supply and demand scenario of Chennai Metropolitan Area from the year 1981 onwards to the current status and the water demand for the future.

2. To suggest management strategies to reduce the gap between supply and demand and also to provide improved distribution of domestic water for Chennai Metropolitan Area.

1.5 ORGANIZATION OF THE THESIS

The various aspects covered in different chapters of the thesis are given below:
• Chapter 1 gives a general introduction, need for the research, objectives and organization of the thesis.

• Chapter 2 presents a critical review of the literature on General water management, Case studies from abroad and Case studies in India

• Chapter 3 gives a detailed study of the Chennai Metropolitan Area.

• Chapter 4 explains the methodology of the present work

• Chapter 5 presents the analysis and detailed discussion of the water management strategies.

• Chapter 6 furnishes the conclusion, recommendations and scope for future work.