CHAPTER 1

INTRODUCTION

1.1 GENERAL

Water is the prime natural resources, a basic human need and a precious national asset. It is indeed required in all aspects of life and health for producing food, industrial activities, energy generation and maintenance of environment and sustain of life and development. Not only do we humans use it, but every living being needs it to live. It has helped to form the Earth as we know it, and it covers over 70% of the Earth. Even where there is land, much of it is covered with ice, which is obviously just solid water. The importance of water is clear to us in many ways, and we can’t overlook it. Water has played a role not only in the history of countries, but also in religion, mythology, and art.

Water in many religions cleanses the soul through holy water. For example, the water at Lourdes, France is thought by many religions to be sacred water with healing powers. In Egyptian mythology, the Nu was the beginning of everything and represented water. It brought life to their people, but in drought, produced chaos. Water has always been perceived as a gift from the Gods as it rained from the heaven. Water is a remarkable solvent, when water is combined with atmospheric carbon dioxide it forms into a very weak carbonic acid, while it moves through soil and rock in the form of groundwater, it is likely to be contaminated as it dissolves very small quantities of minerals and holds them in solution. Water is the only substance that occurs in all three states of matter such as solid, liquid and gas.
India is the largest user of groundwater in the world, with an estimated use of 230 cubic km of groundwater every year, more than a quarter of the global level. Now, groundwater supports around 60 percent of irrigated agriculture and more than 80 percent of rural and urban water supplies. Yet, our society continues to contaminate this precious resource. Before it reaches the consumer's tap, it comes into contact with many different substances, including organic and inorganic matter, chemicals, and other contaminants. The rapid growth of urban areas has further affected the groundwater quality due to over exploitation of resources and improper waste disposal practices. Due to increasing industrialization on one hand and exploding population on the other, the demands of water supply have been increasing tremendously. Moreover considerable part of this limited quality of water is polluted by sewage, industrial waste and a wide range of synthetic chemicals. The quality and quantity of water supply is of vital significance.

Many research works were carried out in India in the analysis of water quality by physico-chemical analysis, statistical analysis, water quality index and identification of groundwater prospective zones by GIS and electrical resistivity methods.

Tamilnadu lies in the southernmost part of the Indian Peninsula and is bordered by the union territory of Pondicherry, and the states of Kerala, Karnataka, and Andhra Pradesh. It is bound by the Eastern Ghats in the north, by the Nilgiri, the Anamalai Hills, and Palakkad on the west, by the Bay of Bengal in the east, the Gulf of Mannar, the Palk Strait in the south east, and by the Indian Ocean in the south. Tamilnadu is the eleventh largest state in India by area and the seventh most populous state. Tamilnadu is heavily dependent on monsoon rains. The normal annual rainfall of the state is about 945 mm of which 48% is through the Northeast monsoon, and 32% through the Southwest monsoon. Since the state is entirely dependent on rains for
recharging its water resources, monsoon failures lead to acute water scarcity and severe drought.

Agriculture is one of the main occupations of the people of the district of Erode. Bhavani, Cauvery, Amaravathy and Noyyal are the main rivers of the district. Other significant rivers are Palar in the North, Vatamalaikarai odai and Uppar rivers in the south. Palar constitutes the boundary between Erode district and Karnataka State in the North. The sub-soil in most parts of the district being sandy and surface soil thin and of poor quality, the farmers have to depend heavily on irrigation facilities. Erode district is one among the industrially developing districts. Industry and trade occupy a place of prominence in the economy of the district. Consequently, declining trend in water table condition is noticed in almost all places and this creates concern among the water users especially the farmers. This is true in the case of Erode district also. In this context, it is to be noted that geologically, the entire Erode district is underlain by hard rocks. Generally the hard rock does not contain potential aquifers to store large quantity of water and to transmit to other areas. Due to non-homogeneous nature of the hard rock formation, it is really difficult to identify the potential areas of groundwater and to adopt suitable strategy for its development.

In today’s world with rapid industrialization, modern agricultural activities and explosive population have imposed series of unpredicted demands on natural resources, which are to be optimally utilized. The Geographical Information System (GIS), which is an effective tool for analysis and presentation of geographic information, is a very valuable asset at this critical juncture where natural resources are depleting fast due to over population. The term geographic information system stands for providing information regarding the spatial objects, to support operation, management, analysis and decision making in any developmental activity.
1.2 AIM OF THE PRESENT WORK

- To study rainfall and groundwater fluctuations in the study area
- To assess groundwater quality in the study area
- To delineate the groundwater potential zones sites by using weighted overlay analysis in GIS for the study area
- To find the groundwater potential zones by using electrical resistivity method for the study area
- To identify the impact zones based on drinking and irrigation water quality
- To evaluate the optimum location for recharging wells to bring down the concentration level of impacted zones by various scenarios
- To study the improvement of groundwater quality and suitability for irrigation and drinking purposes

1.3 REQUIREMENT FOR THE PRESENT WORK

Water resources play a vital role in the growth and development of human civilization on the surface of the earth and holding a key role on the economy of any country. As the requirement for water increases day by day, it is very difficult to meet the needs of growing population and modern development in various sectors. The erratic nature of precipitation cause highly uneven distribution of available water both in the space and time which leads to floods and droughts affecting vast areas of our country. Hence it is essential to manage the available water resources.
Management of water resources includes the management of groundwater resources also. Groundwater is commonly referred to as the water, which lies below the surface of the earth interstices and voids in various formations (Todd 1980). It is the major readily available fresh water in our earth (Ragunath 2007). Now a day groundwater resources are being continuously exploited from the aquifers to meet the demand for industrial, agricultural and domestic needs. Groundwater is always under movement and the flow takes place from the higher potentiometric surface to the lower potentiometric surface.

Groundwater resources in Erode District, Tamilnadu, India is being continuously exploited to meet the demand for water supply and irrigation because the water available in surface water bodies such as tanks and reservoirs are not sufficient. Groundwater quality is also affected in many places due to anthropogenic activities. Hence it is essential to assess the groundwater quality for extraction, identification of potential zones and recharge sites using Remote sensing and GIS, which is emerging as a great public concern in this region.

1.4 OVERVIEW OF THE PRESENT STUDY

In the presently chosen study area viz, Erode district, groundwater is available mainly in the granitic gneiss rocks. The rivers being generally seasonal, its surface flow could be seen during peak monsoon periods alone. The water table has gone down due to over exploitation of it for irrigation through dug wells and bore wells. In view of the over exploitation of groundwater, there is a progressive depletion of its quality and potential with the passage of time. In this context, it is very essential to explore the availability of the natural resources by applying modern techniques. Keeping this view in mind, an attempt has been made to demarcate areas for groundwater potential zones in areas of Erode district using an integrated
approach of Remote Sensing in conjunction with Geographic Information Systems (GIS).

1.5 ORGANISATION OF THE THESIS

Chapter 1 gives a general introduction about the groundwater, significance of groundwater, method of identification of groundwater, aim and outlook of the present work.

Chapter 2 reviews the literature relevant to the objective of the study, i.e., status of water quality as well as information on the development of prospect by GIS & electrical resistivity method and also includes MODFLOW literature.

Chapter 3 presents an overview of the study area, methodology of the present research work and describes the fluctuation of rainfall and water level.

Chapter 4 describes quality of groundwater, statistical analysis and water quality index in premonsoon and postmonsoon with reference to different physico-chemical parameters.

Chapter 5 gives groundwater prospects by weighted overlay of various thematic maps such as geomorphology, geology, soil, land use and land cover, lineament density, drainage density and slope.

Chapter 6 focuses groundwater prospects by electrical resistivity method.

Chapter 7 details on regional groundwater flow model development by primary boundary conditions and evaluation of groundwater
quality by effective location of recharging well around the impacted zones in the study area.

Chapter 8 gives the conclusion of the present work with respect to the suitability of groundwater for drinking and irrigation purpose, delineation of groundwater prospects by weighted overlay method and electrical resistivity method and future scope of the present study.