CHAPTER-I

INTRODUCTION
resource on the earth. Unlike other mineral resources, it gets replenished every year from the precipitation through natural recharge. Water is one of the most essential requirements for the survival of mankind providing him the luxuries and comforts in addition to fulfilling his basic necessities of life and also for industrial and agricultural development. Agriculture is the major user of water accounting for about 80% of all the consumptions. At present, nearly one fifth of the entire water used in the world is obtained from groundwater sources.

In areas where surface sources like canals, tanks etc are absent, the agriculturists are forced to depend mainly on the groundwater resources. During last two decades, the utilization of groundwater for industrial and agricultural purposes has increased manifolds; consequently water levels were lowered alarmingly in certain area, which forms the subject matter of this thesis.

WATER RESOURCES OF INDIA

Water is a very important constituent of our ecosystem. Due to its multiple benefits, and the problems caused by its excesses and shortages and quality deterioration, water as a resource requires special attention. On a global scale total quantity of water available is about 1600 M cubic km., out of which only about 0.26% flows in rivers, lakes, and in the soils and shallow aquifers, which can be readily used.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical area</td>
<td>329 m-ha</td>
</tr>
<tr>
<td>Flood prone area</td>
<td>34 m-ha</td>
</tr>
<tr>
<td>Ultimate Irrigation Potential</td>
<td>140 m-ha</td>
</tr>
<tr>
<td>Resource</td>
<td>Value</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Total cultivable land area</td>
<td>184 m-ha</td>
</tr>
<tr>
<td>Net irrigated area</td>
<td>48 m-ha</td>
</tr>
<tr>
<td>Natural run off</td>
<td>1869 cubic km</td>
</tr>
<tr>
<td>Estimated utilizable surface water potential</td>
<td>690 cubic km</td>
</tr>
<tr>
<td>Ground water resources</td>
<td>433 cubic km</td>
</tr>
<tr>
<td>Available Ground water resources for irrigation</td>
<td>398 cubic km</td>
</tr>
<tr>
<td>Net utilizable ground water resources for irrigation</td>
<td>245 cubic km</td>
</tr>
</tbody>
</table>

(NSS, 2011)
The utilizable surface water potential of the country has been estimated to be 1869 cubic km. But the amount of water that can be actually put to beneficial use is much less due to severe limitations imposed by physiography, inter-state issues and the present state of technology to harness water resources economically. The recent estimates made by central water commission indicate that the water resources utilizable through surface structures are about 690 cubic km (about 36% of the total runoff). An estimate made by central groundwater board indicates that the utilizable ground water is about 432 cubic km. Thus the total utilizable water resource is estimated to be 1122 cubic km.

More than 50% of domestic water supply and 40% of Irrigation water supply is obtained from groundwater in India, and therefore it is very important to preserve and improve the quality and quantity of ground water.

Proper development of water resources involves economic and best utilization of available water. This will have to include forward planning and action, which can specifically address both the existing and emerging human and environment problems.

Over exploitation of ground water not only affects sustainability of the resource but also affects the quality as manifested through Arsenic problem in parts of West Bengal, Coastal salinity in parts of Tamilnadu and Gujarat, and Fluoride problem in parts of number of states in India.

Therefore Assessment of groundwater on a basin scale at least to a rough estimate is of some use to administrators. In this thesis an attempt is made to estimate ground water volume changes in the upper parts of musi basin through water table fluctuation studies.

**GROUND WATER HYDROLOGY OF HARD ROCK TERRAINS IN INDIA**

India is a tropical country within a vast diversity of climate, topography and vegetation. India though blessed with a fairly high annual rainfall at an average of about 1100mm; it is not uniformly distributed in time and space resulting in bulk of the rainfall escaping as runoff. Nearly 65% of the total area of the country and 80% of peninsular India is occupied by hard rocks such as granitic gneisses, khondalites,
basalts, hard sandstones, charnockites, schists, phyllites, lime stones and some volcanic rocks mostly rhylotites (Pathak, 1984). Very limited knowledge exists on the occurrence, movement and distribution of ground water in these areas. Hardly anywhere on the earth is ground water more difficult to detect and assess than in arid and semi-arid regions of hard rock areas. It is also in these areas that water is most needed and in the process is over-exploited. Ground water in hard rocks areas of India is an important source of water supply not because it is capable of giving large yields but because it is in most cases, the only source of water supply and can yield sufficient water for domestic and agricultural needs.

**SIGNIFICANCE OF THE PRESENT PROBLEM**

There is a progressive lowering of ground water levels at various places throughout the basin due to over exploitation of ground water through indiscriminate drilling of bore wells in the basin owing to increased population. The study area that Musi river basin is one of the severe drought prone areas in the North Telangana region of Andhra Pradesh. The average annual rainfall in this region is around 740mm. The surface water sources are very limited with only few localized tanks and ephemeral streams acting as the sources of recharge. The population of the existing habitations invariably suffers from severe water shortage for drinking and agricultural needs due to constant failure of monsoons. Keeping this in view, the present study has been taken up to assess the ground water on a basin scale at least to a rough estimate of ground water volume changes in the upper parts of musi basin through water table fluctuation studies.

**DESCRIPTION OF THE STUDY AREA**

*Location and Extent of the Study area*

The study area is the Musi, basin a tributary of river Krishna. The area falls in the survey of India toposheet numbers 56k/7 to 56k/11. The area is bounded by longitudes 77°49’15” to 78°56’09” and latitude 16°58’12” to 17°42’70”. The Study area, has an average altitude of 640m in western part, this gradually decreases towards the east till
450m. The location map of the area is shown in the map Musi river basin covers the districts of Medak, Mahaboob Nagar, Rangareddy, Nalgonda and Warangal.

Musi tributary of Krishna River in the Deccan plateau following through Telangana state in India. Hyderabad stands on the bank of Musi river which divides the historic old city with new city. Himayath sagar and Osman sagar are dams built on river Musi which are used act as major source of drinking water of Hyderabad. It was known as Muchukunda river in olden days. The river originates in Anantagiri hills near Vikarabad in Ranga Reddy district, 90 km to west of Hyderabad and flows due east for almost all of its course and joins Krishna river at Vadapalli in Nalagonda district after covering a distance of about 240 km.

FIGURE 1.1: LOCATION MAP OF THE MUSI RIVER BASIN

Accessibility of the Study Area

The study area comprises of in and around Hyderabad, which is the state capital of united Andhra Pradesh as well as headquarters of Ranga Reddy district. The road network is well developed in the Musi sub-basin with metalled (bitumen) and
non-metalled roads. The state highways to Chennai, Mumbai and Bangalore pass through Hyderabad.

**Topography of the Study Area**

Topographically, the area is generally undulating and shows gentle slope, characterized with isolated hills with intervening streams. Dolerite dykes and quartz reefs have developed their own prominence in the study area. The Musi sub basin can broadly be divided into two distinct physiographic units namely, western and eastern low lands and central plateau. Both the units are characterized by gently moderate undulating topography. The area of higher elevation is the area being usually underlying by Deccan traps and Laterite, give rise typical flat topped profiles. In the remaining area the topography is undulating with basement of Granites of Archean age.

**Drainage Pattern of the Study Area**

Drainage pattern refers to the particular plan or design, which the individual stream courses collectively form. It is generally recognized that drainage pattern reflects the influence of some factors like initial slopes, inequalities in rock hardness, structural controls etc (Thornbury, 1954).

Generally, the drainage pattern in the study area is dendritic (i.e., irregular branching of tributary streams in many directions and at almost any angle usually at less than a right angle) to sub-dendritic and trellis. The drainage density in this study area varies from 0.4 to 4.0 km/sq.km.

**Hydrometeorology of the Study Area**

The climate of the area is tropical during summer season from March to June with maximum and minimum temperatures are between 44°C and 21 °C respectively. The winter is from November to February with maximum and minimum temperatures between 21 °C and 10°C respectively. The sunshine hours range from 3.77 to 10.71 hours with an average of 7.6 hours and rate of evaporation ranges from a minimum of 36 cm to maximum of 75 cm with a mean of 55 cm. The humidity
ranges from 21 to 90% with a mean of 60%. Humidity is generally high from October to February. The predominant wind direction is due east during south-west monsoons and due west during north-east monsoons. The wind velocities at 3m height range from 5.14 kmph to 18.15 kmph with an average of 9.72 kmph.

Geology of the Study Area

The Geology of the study area under investigation is mainly exposed Peninsular Gneissic complex that includes a variety of granites, Migmatites of various phases and enclaves of older Metamorphic rocks (Murthy, 1924, Peer Raju and Nataranjan, 1977) belonging to the Archean age. These are intruded by various acidic (pegmatites, apatite, quartz veins/reefs) and basic intrusives of dolerite and gabbros.

Major dykes of epidiorite and dolerite composition cut across the country rocks in different directions. These dykes mainly occur in the basin in its southern and northwestern parts with significant strike directions along east-west, north-east, south-west and north-south directions and are presented as clusters in the northeastern portions of the area, while they are scattered and discontinuous in other parts. Narrow pegmatite veins are also common and could be seen on the surface cutting across the country rocks. A few outcrops of Deccan Traps are exposed as small narrow patches in the western and southeastern parts of the basin.

Hydrogeology of the Study Area

Ground water in the area occurs under water table to semi-confined conditions restricted to weathered and fractured formation. Ground water occurs under unconfined conditions in the open wells and semi-confined conditions in the bore wells if they tap deeper fracture zones. Ground water in granites occurs under water table conditions. The yield of dug well in weathered granites ranges from 35 to 70 Cu.m/d and that of bore wells to 1000 to 3000 Gph in weathered and fracture zones. Groundwater in basalts occurs unconfined to semi-confined condition in weathered and fractured formations. The yield of dug wells in basalts range from 40 to 60 Cu.m/d and that of bore wells from 600 to 2000 Gph. Ground water in laterite occurs under water table condition and is confined to pore spaces and contact zone of laterite and basalts. The yield of dug well in these formations varies from 40 to 100 Cu.m/d, bore wells from 800 to 3000 Gph.
OBJECTIVES OF THE PRESENT STUDY

The broad goal is to gain a better understanding of the Ground water levels through systematic data collection and analysis. The following are the Specific objectives of the study

(i) To Estimate Rainfall recharge, Rainfall Infiltration, Ground water draft, change in ground water storage and Ground water balance available in upper musi catchment.

(ii) To obtain relationship between rainfall and ground water level raise.

(iii) To construct water table contour maps for pre-monsoon and post- monsoon for last 20 years.

(iv) To observe the long-term ground water level changes for the past 20 years.

(v) To Examine the water quality of Musi river basin.

RESEARCH METHODOLOGY

To meet the set objectives it is proposed to adopt the following. For the study of Water table fluctuations in Musi river basin, the seasonal water level data has been taken for 20 years period that is from 1985-1986 to 2004-2005. Rainfall recharge has been calculated from the analysis of water levels made in observation wells. Draft calculation has been made based on well census data and crop irrigated area statistics data. Change in ground water volumes are calculated from the water levels of observation wells. Long-term ground water level changes are observed from the Composite hydrograph of piezometer wells and well hydrographs of observation wells. Relation between rainfall and water level raise has been obtained from daily digital water level data of piezometer wells. By observing the water levels in open wells or bore wells pre-monsoon and post monsoon contour map are constructed by using “SURFER” package. Ground water samples collected in pre-monsoon and post monsoon during study period were analyzed for major ions in the Water Quality level ll+ lab of the Ground water Department.
FORMAT OF PRESENTATION

This thesis contains a total of six chapters. The first chapter consists of introduction of India's ground water scenario and emphasizes the need for proper development of water resources and to preserve and improve its quality. It also includes significance of the problem, objectives of the present study and proposed research approach to achieve the objectives. Review of the literature on ground water levels Investigation and analysis is carried out in the second chapter. The third chapter, covers theoretical background for the data processing, analysis, techniques adopted in the thesis such as generation of contour maps using software called 'SURFER', and graphical methods of representation in detail. The results of the Rainfall Recharge, Rainfall Infiltration, Ground water draft, Change in ground water storage and Ground water balance studies are carried out in the fourth chapter. Evaluation of ground water quality has been analysed in Fifth chapter. The summary of the entire thesis and the conclusions are listed out in the sixth chapter.