6.0 DISCUSSION AND RECOMMENDATIONS

All organisms are exposed to fluoride released from natural sources and/or by human activities. Fluoride can help prevent cavities, but at high intakes it can harm teeth development (dental fluorosis) and at higher intakes still, weaken and deform bones (skeletal fluorosis). There is a narrow range between intakes which are beneficial and those which begin to be detrimental. When drinking water is artificially fluoridated, the "optimum" level of fluoride, associated with the maximum level of dental caries protection and minimum level of dental fluorosis, is considered to be approximately 1 mg/litre. Although there has been an increase in the prevalence of dental fluorosis over the past 30 to 40 years, it has generally been attributed to the widespread increased intake of fluoride from sources other than drinking water, such as toothpastes, mouth rinses, fluoride supplements, fluoridated salt or milk, as well as locally applied dental gels, solutions and varnishes.

Traces of fluorides are present in many waters; higher concentrations are often associated with underground sources. In seawater, a total fluoride concentration of 1.3 mg/litre has been reported (Slooff et al., 1988). In areas rich in fluoride-containing minerals, well water may contain up to about 10 mg of fluoride per litre. The highest natural level reported is 2800 mg/litre. In groundwater, fluoride concentrations vary with the type of rock the water flows through but do not usually exceed 10mg/litre (US EPA, 1985).

Effects on the bone, such as skeletal fluorosis and fracture, are considered to be the most relevant outcomes in assessing the adverse effects of long-term exposure of humans to fluoride. In areas of the world with high levels of fluoride naturally is present in minerals and water, and intake of fluoride from drinking water and foodstuffs is the primary cause for endemic skeletal fluorosis, a crippling disability that affects millions of people in various parts of Africa, China and India. In some regions, the indoor burning of fluoride-rich coal also serves as an important source of fluoride.
Fluoride may be an essential element for humans. For humans, however, the essentiality has not been demonstrated unequivocally, and no data indicating the minimum nutritional requirement are available. To produce signs of acute fluoride intoxication, minimum oral doses of at least 1 mg of fluoride per kg of body weight were required (Janssen et al., 1988).

Many epidemiological studies of possible adverse effects of the long-term ingestion of fluoride via drinking-water have been carried out. These studies clearly establish that fluoride primarily produces effects on skeletal tissues (bones and teeth). Low concentrations provide protection against dental caries, especially in children. However, fluoride can also have an adverse effect on tooth enamel and may give rise to mild dental fluorosis (prevalence: 12–33%) at drinking-water concentrations between 0.9 and 1.2 mg/litre (Dean, 1942); the period of greatest susceptibility is at the time of mineralization of the secondary upper central incisor teeth at about 22–26 months of age. This has been confirmed in numerous subsequent studies, including a recent large-scale survey carried out in China (Chen et al., 1988), which showed that, with drinking-water containing 1 mg of fluoride per litre, dental fluorosis was detectable in 46% of the population examined.

At total fluoride intakes of 14 mg/day, there is clear evidence of skeletal fluorosis and an increased risk of bone fractures; at total intake levels above about 6 mg fluoride/day the evidence is suggestive of an increased risk of effects on bone. There is inadequate information for estimating total exposure to fluoride and the uptake into the body from different sources which limits the conclusions on dose response that can be drawn from studies on adverse effects. Excess exposure to fluoride in a form that can be absorbed by organisms poses a risk to aquatic and terrestrial environments. There is a need to improve the knowledge available on the accumulation of fluoride in organisms and how this can be monitored and controlled. The biological effects associated with different levels of fluoride exposure should be better characterized.
The hydrogeological assessment of the Dharmapuri district giving attention to its hydrochemical variation and aquifer characterization is conducted using hydrometeorological, geological, hydro geological and geophysical data. The study area is a part of Tamil Nadu just to the west of the India. The district covers a surface area of 9581.26sq.km and is characterized by flat to gently sloping for most of its parts and at parts with hilly landforms. The area has a mean annual rainfall of 791mm to about 920mm with actual and potential evapotranspiration of respectively. A major amount of rainwater leaves the basin as surface runoff annually. The annual groundwater recharge is 52.3 mm, which is about 9 % of the annual precipitation.

Geological map at a scale of 1:50,000 shows the existence of major units of soil types ranging from black to mixed loam Red sandy soils are seen gradually in Dharmapuri district especially in Harur taluks. Black and loam soil are found in Dharmapuri Taluks. Generally, the soil is low in Nitrogen and Phosphate content with no marked variations between taluks. The climate is generally warm and dry whereas the places bordering Karnataka State are cool. The temperature ranges from 17° c to 37° c.

Geological structures, which are the most important and influencing parameters in controlling the groundwater movement and occurrence in the study area has been studied. From the geophysical data and well data of Dharmapuri district is characterized with the region comes under granite gneiss bed with the intrusion of basic dykes in its southern part. Quartz and black granite are the minerals found in the district. Crystalline rock formations of Achaean metamorphic complex are exposed in the district. The geological units are Charnockites, Hornblende Gneiss, Granites and Biotite Gneisses, Amphibolites, Syenites, Carbonatites, Pyroxenites and Dunites. Relatively the Dharmapuri district is not disturbed with dolerite sills and dykes that show relatively continuous nature in horizontal and vertical aquifer properties.
The hydrochemical study indicates the presence of one major water types within the Dharmapuri district. The hand-pump wells form the Dharmapuri are Ca and Na type. The up-stream side of the Dharmapuri district is characterized by Ca dominated type water where as the down-stream side is dominated by Na, which is related to the difference in lithology. Except some deviation in Ca, and Na concentration the water sources in the up-stream side of the Dharmapuri fulfills the standard limit set for domestic, industrial and agricultural purpose. The shallow groundwater system of the Dharmapuri district is highly exposed to pollution from surface water interactions. Generally, this has a high concentration of pH, TDS, T.Alk and TH from the Dharmapuri district limit. The following recommendation are forward based on the present work

Groundwater recharge, storage and movement in the study area depends on the magnitude and intensity of fracture and joint openings and the degree and extent of weathering in the dolerite and limestone units. So water well points should be developed in areas where there exists dense concentration of fracturing, well developed and thick weathered unit. From groundwater quality point of view the proper site for additional wells is the extreme up-stream side of the study area where it has low Ca, Na and TDS content. A well site location within the influence of persistent streams or ponds to prevent depletion and dewatering of the fracture system is suggested for the area if contamination is not a potential problem.

The region as the whole is under recurrent draught problem. Proper soil and water conservation in the study area is very important to enhance the groundwater recharge. Therefore, proper watershed management should be implemented in the study area of Dharmapuri district. Additional and systematic isotopic data collection should be conducted in order to refine the conclusion drawn in this thesis and to assess the source of the recharge, the relation between surface and groundwater, the amount of groundwater outflow and inflow and the age of the water systems.
The pumping test data are not reliable, so it is advisable to conduct additional pumping test for the wells in the catchments so as to characterize the aquifer in detail and to estimate the groundwater reserve. Policy makers and strategy planners should give emphasis on environmental policy that takes into consideration the contamination risk level of the well field by agricultural activates industries and domestic waste disposal. In view of the comparatively high level of ground water development in the major part of the district and the quality problems due to lithogenic and anthropogenic factors, it is necessary to exercise caution while planning further development of available ground water resources in the Dharmapuri district.