# Chapter 7
# Hydro-Chemical Investigation and Quality Assessment of Groundwater Industries: Softcomputing and Analysis

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## ABSTRACT

*This study assesses groundwater quality for drinking purposes in and around the Peenya Industrial Area using the Water Quality Index (WQI) method, focusing on 11 key physio-chemical parameters. The calculated WQI values range from 39.10 to 224.16, revealing that while 74% of groundwater samples outside the industrial area are drinkable, 83% within the area fall into a poor category, indicating unsuitability for consumption. Hydro-chemical facies analysis during the pre-monsoon season shows a Ca-Mg-HCO3 water type. ArcGIS was used to create geographical distribution maps for clearer spatial analysis. The study highlights the necessity of frequent groundwater monitoring and suggests that integrating soft computing techniques can improve prediction accuracy, facilitate trend analysis, and optimize long-term groundwater quality management in industrial regions.*

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## INTRODUCTION

Water is very necessary for the continuation of life on Earth. There is less than one per cent of the total water resources on Earth are comprised of freshwater resources. Access to non-contaminated freshwater is critical to the existence of the human race. There are more than one billion people throughout the globe who do not have access to appropriate water for consumption. Groundwater is one of nature's most precious resources that meets our rural and urban needs. Water pollution has emerged in the modern era of science and technology due to industrialization and unplanned growing urbanisation (Gautam et al., 2022; Lemessa et al., 2023; Megahed, 2020). Overpopulation, increased urbanisation, and fast industrialization are driving up the demand for groundwater. Industries and their related operations pose the greatest risk to groundwater quality in the study region by polluting it (Lalitha et al., 2021). Various industrial activities produce a large quantity of pollutants and effluents. Groundwater is becoming scarcer as a result of rising urbanization, industry, and population. For this reason, it is critical to evaluate how urbanization and industry have affected groundwater quality to maximize its use while minimizing environmental degradation. Industrial parks have a beneficial economic impact, but they also have negative environmental effects, such as biodiversity loss and water pollution, which can worsen the deterioration of ecosystem services and functions.

The primary aim of the present study is to assess the temporal variations in groundwater quality in and around (5km radius) of the Peenya Industrial Area. To determine whether groundwater is safe for consumption the water quality index (WQI) mathematical indices are used (Brindha et al., 2013; Tiwari et al., 2014). Horton et al., 1965, was the one who first developed the WQI tool. WQI is a single-number value that can be easily understood by decision-makers and the public. (Bansal*, 2018; Chung et al., 2014). A geographical information system (GIS), which is a technology that is based on computers is used to create a visual representation of the features of groundwater and soil (Srinivas et al., 2013). GIS can handle vast amounts of data and facilitate the rendering of choices via graphical representation. In addition, Geographic Information Systems GIS offers the capability to ascertain and give precise values (Ali & Ali, 2018; Rauf et al., 2020).

The primary objective of the current study is to assess the groundwater quality both within and outside the Peenya area utilizing the Water Quality Index (WQI). Additionally, a box-and-whisker plot and piper-trilinear diagram have been utilized to thoroughly investigate the hydro-chemical characteristics of the groundwater in the study area. Spatial distribution maps were prepared to show a graphical representation of the variation in concentrations of the various chemical parameters across the study area.