The Samoda nala basin occupies the western part of the Chhattisgarh basin in Durg district of Madhya Pradesh. The area lies between 21°10' and 21°20' East longitudes and 81°17' and 81°25' North latitudes encompassing an area of about 120 sq. km. The study area falls in the Survey of India toposheet number 64 G/7, and 64 G/8 (scale 1:50,000). Durg and Bhilai, are the principal towns in the study area.

The drainage pattern is dendritic in the entire region of the basin. The Samoda nala and its tributaries follow Horton's first and second drainage laws of stream number and stream length, respectively. The bifurcation ratio ranging between 2 and 5 has revealed that there is no effect of lithology on the development of drainage network of the basin. The basin has coarse drainage density with three distinct slope categories. The pattern of annual precipitation (1030.09 mm) and the temperature variation (from 13.2° to 42.5°C) suggests that the study area falls in tropical morphogenetic region. Samoda nala, forms the principal drainage of the study area. Two major geomorphic units viz. sedimentary pediplain and lateritic uplands have been identified with the help of remote sensing technique.

Geologically, the study area forms a part of the Chhattisgarh basin of Central India, consisting of Raipur limestone and shale of Chandi Formation of Raipur Group belonging to the Chhattisgarh Supergroup. In the study area, the limestone is stromatolitic and is purple in colour but variation in colour from gray to pink is also observed at some places. Intercalations and pockets of yellowish and purple silty shale are common in the study area.

On the basis of systematic monitoring of 116 dugwells, covering the entire basin, for pre and postmonsoon seasons, the groundwater level contour maps indicate that the general groundwater flow direction is towards the Samoda nala i.e. the axis of the basin, and which further
moves westwards to the Shconath river. The groundwater fluctuation maps have revealed that the variations in groundwater levels are from 0-3m, 3-6m and greater than 6m. While comparing the groundwater fluctuation in different geological formations, it is found that the limestone forms the major hydroolithounit of the study area. It was possible to demarcate the recharge, discharge and areas of effluent nature of groundwater on plotting the premonsoon, postmonsoon and fluctuation of groundwater levels and comparing them with the topography. The areas around Maroda Tank and Bhubn Township form active groundwater recharge zones in the basin.

The pump test results revealed that dugwells in limestone have higher specific capacities. It is also found that the relation between specific capacity values and the area of cross-section of the dugwell has a direct relation. But at places, due to presence of clay patches or shale in limestone, this relation is found to be reversed. A positive correlation is observed between the specific capacity and water level of dugwells. This is an indirect evidence of the weathering on permeability. The permeability increases with the thickness of weathering. The transmissivity values, determined by Jacob time-drawdown method at five boreholes in the study area, show a large variation, from 6.87 gpm/m to 13.00 gpm/m, which indicates the anisotropic nature of the aquifer due to karstification. The correlation of yield and depth of borewells has shown that the borewells pierced upto 55-65 m depth range in sedimentary pediplain are more productive. The yield data analysis of 142 borewells has brought out that maximum yield is more in the depth range of 55-65 m in sedimentary pediplain.

The electrical resistivity soundings have led to infer that three geoelectric layers are present in the limestone region, namely, top soil, weathered zone in middle, and limestone at the bottom with an average thickness of 3.06 m, 10.88 m and >60 m respectively. The groundwater exploration studies of the investigated area reveal that the groundwater potential of sedimentary pediplain varies from moderate to good, whereas the lateritic upland is suitable to cater, through dugwells, the domestic needs only.

The concentration of major and trace elements in groundwater samples shows that these are well within the prescribed safe limits of drinking water standards of World Health Organisation and Public Health Engineering of Government of India. The groundwater, on the basis of total dissolved solids and hardness, has been classified as freshwater and hard to very
hard water respectively. The Pipers Trilinear Diagram plots show the predominance of calcium as cation and carbonate and bicarbonate as anion in the groundwater. Thus, the groundwater in general, has been designated as calcium-bicarbonate-carbonate water. The sodium adsorption ratio (SAR) and conductance values have clearly revealed that the groundwater of the basin under study is suitable for agricultural purposes without any treatment.

To study the groundwater contamination of the study area, the analytical results were further processed to calculate the various ratios such as, Ca/Mg, Collin's ratio, TA/TH, Base Exchange Index and Mg/Ca versus Cl. Ca/Mg ratio of the study area is within the safe limit except in the localities at Jhenjhri, Khamaria, Keranja, Supela, and Sector 6 where the values are marginally above the cut-off grade (i.e. >0.18). Collin’s ratio plot shows that at Keranja-Bhilai, Bhatgaon, Kurud, Jamul, Nawatarai, Joratari, Newai, Maroda, Kachandur, Supela, Sector 6, Sector 1, Sector 5 the groundwater of these localities can be classified as fresh (< 0.05), groundwater from rest of the localities can be categorised in the slightly to injuriously contaminated range. TA/TH ratio contour of the study area clearly demarcates the groundwater contaminated zones around Junvani, Kurud, Industrial Estate, Supela, Dundera, Slag dumping station and Maroda localities. As per Base Exchange Index contour plot, the groundwater samples from 16 localities of the investigated basin are fresh while rest of the samples fall under the contaminated range. Mg/Ca verses Cl ratio plot reveals that the groundwater samples from Jora-Sirsa, Kohka and Supela are contaminated. Nitrate contamination contours were also plotted to demarcate the nitrate contaminated zones of the study area. High concentration of nitrate above 10 mg/l are found in 59 % of the groundwater samples of the study area. The assessment of pollution due to industrial and domestic waste disposal has been made and finally, the management of pollution has been discussed to facilitate safe groundwater to people of the study area for future use.