CHAPTER 3
STUDY AREA AND SAMPLING DETAILS

3.1 Introduction

The earth is known as the “Blue Planet” or “Water planet”. The presence of water makes it unique and is the sole basis for the sustenance of life on the earth. About 70.7% of the earth is covered by water and the remaining is land. However, out of this vast coverage of water only 1% is available for human consumption. The remaining 97% of water is in the ocean and 2% in the Polar Regions in the form of glaciers. The 1% consumable quality of water is available on the surface of the earth as well as underground. [118]

Kota is located along eastern bank of Chambal River in Rajasthan, India. The cartographic coordinates are 25°11′N 75°50′E/ 25.18°N 75.83°E. It covers an area of 318 km² (3.63 per cent of the Rajasthan State) with an average elevation of 271 meters (889 ft). The district is surrounded on the North and North West by Sawai Madhopur, west by Bundi Districts, west east by Chittaurgarh and Baran district, south by Mandsore district of M.P. and south east by Jhalawar District. The Chambal River separates these districts from Kota district, forming the natural boundary. In particular, DCM industrial area and its adjoining areas have been chosen as area of study having approximately 10 square Kilometres. (Figure 3.1) [121]

3.2 Administrative setup

Kota district, extending over an area of 5098 sq. km. and comprises Tehsil namely Pipalda, Digod, Ladpura, Sangod and Ramganj Mandi Kota, the district head quarter is situated on the eastern bank of Chambal river. The district is also divided into 5 Panchayat Samiti namely Itawa, Sultanpur, Ladpura, Sangod and Chechat. The district is served by Mathura-Baroda and Kota-Bina broad-gauge section of Western Railways and a net work of all whether roads. Owing to good transport facilities, enough water from dams on river Chambal and availability of electricity has lead to the fast industrialization of the district. [120]
A major part of the district is a flat plain called Kota-Haravati-Plain which has its average elevation of 250 m. above MSL. The Mukundara-Hill range with flat tops trending NW-SE and rising-up to 492M. Above MSL in the South-Eastern and Eastern parts of the district, is the prominent geomorphic feature of the district. The area is drained by the perennial river Chambal and its north flowing tributaries.

![Location Map of Study area](image)

*Figure 3.1 Location Map of Study areas*
3.3 Physiography

The land slopes gently from south to north and is drained by the Chambal and its tributaries. Hills run from south to north. Mukundara range of Vidhyan hills which is 145 km long is located in the district. At many places, it has a curious double formation of two separate ridges, running parallel to each other at distance of more than 2 km. The portion lying between these ridges is covered with dense forest. The Chambal is the principal perennial river of the district. Its tributaries include Kalisindh, Parwati, and Parwan. The river Chambal enters this district from the west. It is deep and wide near Kota city. [122]

3.4 Climate

The Kota has a semi arid climate with high temperatures throughout the year. Summers are long, hot and dry, starting in late March and lasting till the end of June. The monsoon season follows with comparatively lower temperatures, but higher humidity and frequent, torrential downpours. The monsoons subside in October and temperatures rise again. The brief, mild winter starts in late November and lasts until the last week of February. Temperatures hover between 26.7°C (max) to 12°C (min). This can be considered the best time to visit Kota because of intense heat in the summer. The average annual rainfall in the Kota district is 660.6 mm. Most of the rainfall can be attributed to the southwest monsoon which has its beginning around the last week of June and may last till mid-September. Pre-monsoon showers begin towards the middle of June with post-monsoon rains occasionally occurring in October. The winter is largely dry, although some rainfall does occur as a result of the Western Disturbance passing over the region.

3.5 Geology Mineral Resources

Most of the part of Kota district is occupied by rocks of Vindhyan Supergroup which forms the part of Great-Vindhyan-basin, extending from Rohtas in Bihar to the Chittorgarh area of Rajasthan. On the basis of different rock-units the Vindhyan of the area have been divided in to Semari, Kaimur, Rewa and Bhandar Groups comprising Sandstones, Shales and Limestone. The Semri Group is seperated from Kaimur by conglomerate horizon which marks the break in sedimentation before the deposition of Kaimur-group.
The limestone of Sirbu-shale horizon, at places shows the evidence of algal life in the form of arch shaped structures known as "stromatolites". Occurrence of Sandstone at different stratigraphic horizons indicates fluctuation of the sea-level due to transgression and regression of the sea several times during the Vindhyan period.

The general stratigraphic succession of rock types exposed in Kota district is as under:

- **Bhandar Group**: Sandstone and Limestone.
- **Rewa Group**: Shales and Sandstone.
- **Kaimur Group**: Sandstone, Shale and Conglomerate.
- **Semari Group**: Sandstone, Shale and Limestone.

Owing to the total absence of metamorphic rocks (to which mostly metallic minerals are associated) no important ore deposits are occurring in the district. However, it is compensated by dimensional stone of economic importance, such as limestone and sandstone. Structurally, Vindhyan Group of rocks is less distributed over a greater part of the area, the beds i.e. of sandstone are nearly horizontal but at places they show steep dip. Sandstone is general hard, compact and metamorphic in nature. The district is not rich in minerals. The only metallic mineral found in the district is, Bauxite.

### 3.6 Industries

Kota has 3 types of power stations – thermal, hydro and gas. The major industries include Kota Celiments, Subhigiri Group, DCM Sriram Consolidated Limited (DSCL), Instrumentation Limited, Multimetals Limited, Samtel Glass Limited, Birla Cement, CFCL Chambal Fertilizers and Chemicals Limited. Sriram Fertilizers, Metal India, Rajendra Engineering Works, and Sohal Engg. Rajendra Engineering Works claimed to make India's first machine to produce mustard pungent oil without Kachhi Ghani. Kota is also emerging as a Dairy center with 3 major private players in Dairy farming. [93]
3.7 Impact of Industries in the Study Area

Most of the industries in the study are medium or small scale industries. Kota is very famous for ‘Kota stone’. The raw materials used in various industries are Lime stone, Alumina, silica, seeds for oil, cotton, and latex, wood, sand, coal and polymers etc., the source of water for most of the industries is only groundwater through bore wells. Due to over extraction of ground water, the water table is considerably lowered. Large number of Kota mining industries causes geomorphologic changes which also may be a reason for runoff. There are no direct entry points of pollution from the industries to the rivers, channels and tanks. It has been observed that no hazardous chemicals or effluents are discharged in rivers or channels or tanks. The only possible pollution is the dust pollution due to many crusher mills, lime stone and Multi metal industries. This leads to bronchial diseases. Women and children are involved in many industries which pose the major problem of health of the people. In the study area, we are finding effects of pollutions.

3.8 Disease / Health hazards

Seasonal fever and diarrhea are reported in many areas. Kidney disorder is also found in slum area of Bombay yogena. The reason for kidney disorder is due to the salinity of ground water in this area. This is also because of lack of rainfall, scarcity of water and industrial polluted water intrusion. Skin related diseases are often reported because of the poor quality of water, water logging, poor drainage and sanitary facilities.

3.9 Sample locations

A total of 15 samples of groundwater used for drinking purpose were collected from different sources like hand pumps, tube well, pizometer and dug wells at different spots spread over DCM Industrial area during pre-monsoon, monsoon and Post-monsoon season in 2014. (Figure 3.3 (a) and (b)) These spots were specifically identified on the basis of frequent use and probability of contamination and were mapped. (Table 3.1, Figure 3.2) The season was selected because contamination often increases or decreases depends upon low dilution and tends to the accumulation of ions in all season. Before sampling, all the necessary precautions were taken. The water was left to run from the source for five minutes in case of hand pumps while water was taken out from a depth of 03 meters of available water in case of wells. The water samples were collected in pre cleaned,
sterilized polyethylene bottles of 1 L capacity. All water samples were analyzed within 12 to 24 hrs after collection.

**Figure 3.2** Location map of sampling points

**Figure 3.3(a): Source of ground water (tube well)**
Table 3.1 Description of spots

<table>
<thead>
<tr>
<th>Spot No.</th>
<th>Name of the spot</th>
<th>Source type</th>
<th>Distance between spots [In ms.]</th>
<th>Area [-1 sq. km.]</th>
<th>Spot population</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Near Govt. Girls Senior Secondary School, Bombay Yogen, Kansua</td>
<td>Tube Well</td>
<td>500 m</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>Near Bombay Yogena Colony, Kansua</td>
<td>Hand Pump</td>
<td>550 m</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>Near Samudayik Bhawan, Near Maszid, Kansua</td>
<td>Hand Pump</td>
<td>500 m</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>Near Shiv Mandir, Kansua</td>
<td>Hand Pump</td>
<td>750 m</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>Near Govt. Senior Secondary , Ram Nagar</td>
<td>Hand Pump</td>
<td>1000 m</td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>S6</td>
<td>Near Govt. Senior Secondary School, Indra Colony , DCM</td>
<td>Hand Pump</td>
<td>750 m</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>S7</td>
<td>Shri Ram Fertilizer Gate , Near Fly Over, Prem Nagar</td>
<td>Hand Pump</td>
<td>500 m</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>S8</td>
<td>Samudayik Bhawan Ke Paas Prem Nagar III</td>
<td>Tube Well</td>
<td>450 m</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>S9</td>
<td>Papaji Ke Bhatte Ke Paas, Rayans Industry Boundary.Prem Nagar III</td>
<td>Tube Well</td>
<td>500 m</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>S10</td>
<td>Industrial Area, Near Dakaniya Station, Sanjay Nagar</td>
<td>Hand Pump</td>
<td>1000 m</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>Raipur</td>
<td>Dug Well</td>
<td>1000 m</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Daddevi</td>
<td>Dug Well</td>
<td>1000 m</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>Soorsagar</td>
<td>Pizometer</td>
<td>1000 m</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>Dhakerkhari</td>
<td>Dug Well</td>
<td>850 m</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>Dakniya talav</td>
<td>Hand pump</td>
<td>1000 m</td>
<td>2000</td>
<td></td>
</tr>
</tbody>
</table>

3.10 Sampling Method

Manual sampling method is used for collect ground water samples. Manual sampling involves minimal equipment but may be unduly costly and time-consuming for routine or large-scale sampling programs.

3.11 Sample Containers

The type of sample containers used is of utmost importance. Containers which are used in collecting sample are made up of plastic compound. Especially for bacteriological analysis, sterilized plastic bottle is used that’s why protecting contamination. [215]
3.12 Sample Volume

We collect a 1-L sample for most physical and chemical analyses. It is important that some necessary precautions were taken during collect sample volume i.e. do not use samples from the same container for multiple testing requirements (e.g., organic, inorganic, radiological, bacteriological, and microscopic examinations) because methods of collecting and handling are different for each type of test. Always collect enough sample volume in the appropriate container in order to comply with sample handling, storage, and preservation requirements. [215]

3.13 Preservation Technique

To minimize the potential for volatilization or biodegradation between sampling and analysis, we keep samples as cool as possible without freezing. Avoid using dry ice because it will freeze samples and may cause glass containers to break. Keep composite samples cool with ice or a refrigeration system set at 4°C during compositing. Analyze samples as quickly as possible on arrival at the laboratory. If immediate analysis is not possible, preferably store at 4°C. [215]