Hydrogeological Reconnaissance Survey- Collection & Testing of 100 Raw water & 3 Wastewater samples around 10km Radius of Plant

Hydrogeological Reconnaissance Survey of Project Site

"The Coca Cola Export Corporation (TCCEC)" awarded the assignment of collection of 100 samples including raw water & wastewater around a 10 Km radius of TCCEC Plant to GeoScience Associates (GSA).

Reason to Conduct Survey

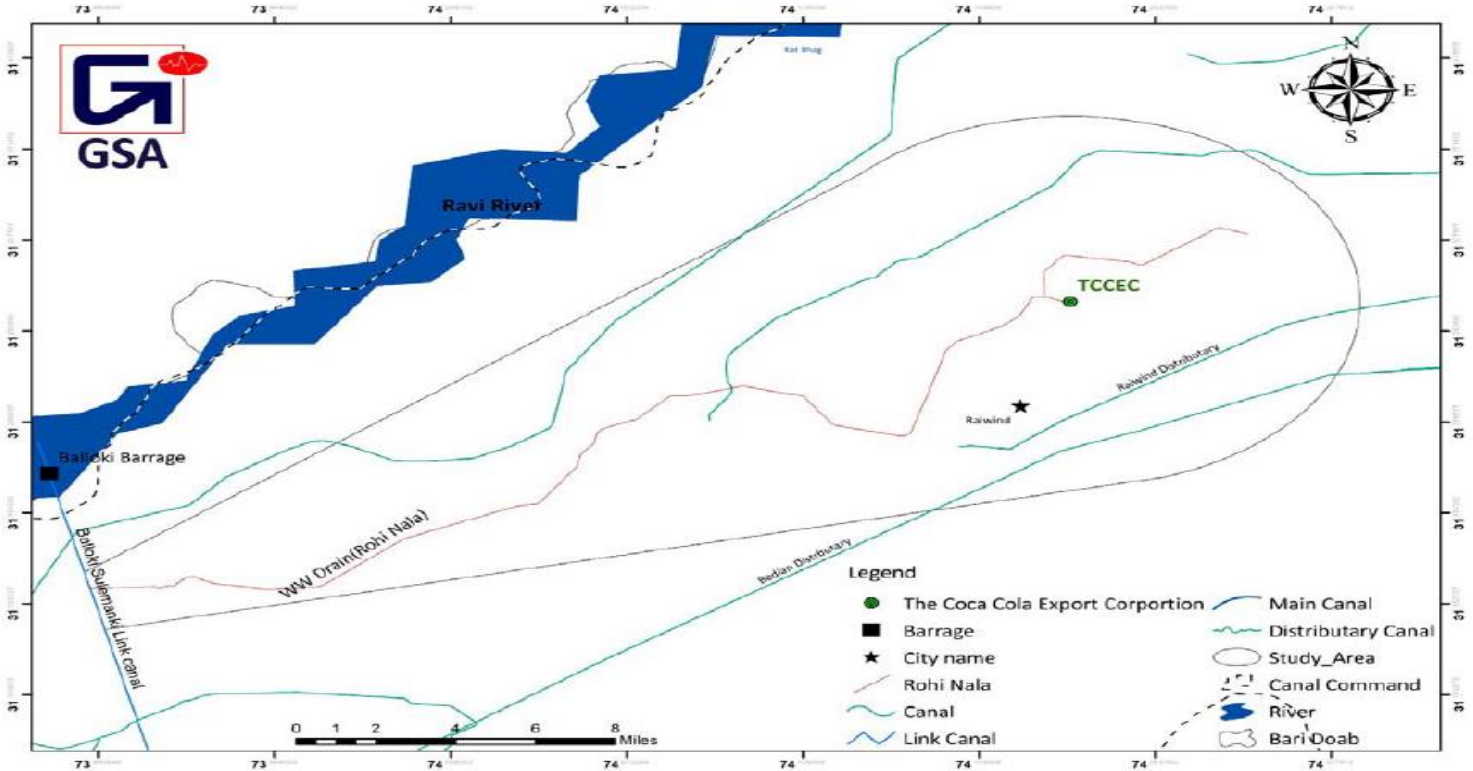
- The reason to conduct comprehensive study in first phase in the project area is to identify the functioning level of pollution in the ground water at different depths & the main factors contributing to the deterioration of water quality as microbial and chemical pollutants are the main factors responsible exclusively or in combination for various public health problems.
- Access to sustainable, clean & good quality water is of fundamental importance and business survival issue for TCCEC.
- It has also become a local community problem around the project area henceforth an extensive investigation of the proposed area was conducted to help & understand the ground water quality in the catchment and the relationship between groundwater and the surrounding area.

Main Objective & Scope of Study

The main objective of study is to identify and quantify groundwater conditions of the proposed area. Following steps were followed:

- Archived data analysis, desk study map/literature review.
- Hydro-geological Reconnaissance of the project area
  - ❖ Planning for water sampling
  - ❖ Collection of water samples for microbiological and physiochemical analysis
  - ❖ On site water sample testing of basic parameters.
  - ❖ Wastewater samples collection from different locations of the main drain flowing in the area
  - ❖ Identification of important water related areas.
  - ❖ Information on the sewerage system, drainage system, water supply system and WASH situation of the project area.
  - ❖ Public consultation to identify water related problem of the study area.

Map of Project Site



Sources of Contamination of Groundwater Quality

GeoScience Associates (GSA) accomplished the job of 100 nos. raw ground water samples taken from the sources installed at different depths from the selected locations/zones to ascertain the general hydro-geological conditions with special emphasis to the quality of ground water in the project area.

Potential Sources of Contamination

- Land disposal of solid wastes
- Sewage disposal on land
- Agricultural activities
- Urban runoff
- Polluted surface water

Step # 1 Review of Archived data analysis, desk study map/literature review.

- In the beginning of this study, the relevant data of testing conducted for ground water investigations cum development during the last decade in the project area was collected from the database of GeoScience Associates and compiled for review & analysis to develop a thorough picture of the prevailing field conditions with regards to ground water.

- Summary of previous testing reports of project area are attached as Annexure- 1 of Hydrogeological Survey Report

Step# 02 Planning for Collection of Water & Wastewater Samples

- Total of 100 no. samples were collected from different locations of the project area that are being extensively used for drinking, industrial and other domestic purposes.
- The **water samples** were taken from the following sources installed at different depth ranging from (depth 50-750 feet).
    - ❖ Submersible Pump (SP)
    - ❖ Ejector Pump (EP)
    - ❖ Hand Pump (HP)
    - ❖ Tube wells (TW)
- **Few wastewater samples** from different locations of the main drain (Hudiara drain) flowing in the area were also collected.
- The detailed **physico-chemical and microbiological analyses** were performed on the samples of ground water.
- The lab results are reproduced along with graphs of each parameters, **shown in Annexure 4 of Hydrogeological Survey Report.**

Analysis of Raw water & Wastewater Samples in the Catchment

- **Physico-Chemical Analysis**
  - ❖ Major Chemical parameters (Alkalinity as CaCo3, Bicarbonate, Calcium, Carbonate, Chloride, Hardness, Magnesium, Potassium, Sodium, Sulfate, Nitrate-N, Nitrite, TDS),
  - ❖ Physical- Aesthetic Parameters (i.e, Color, EC, PH, Turbidity),
  - ❖ Trace-Ultra Trace Elements (i.e, Arsenic, Flouride, Iron, Total Suspended Solids-TSS)

Locations are mentioned in Table 1 & Raw Water Laboratory Test Reports are in Annexure 3 of Hydrogeological Survey Report.

- **Microbiological Analysis**

Micro biological analysis parameters (Total Coliforms, Fecal Coliforms and E. Coli) were tested and analyzed in 100 samples and compared the results with WHO guidelines for drinking water.

Test Results are shown in in Annexure 3 of Hydrogeological Survey Report.

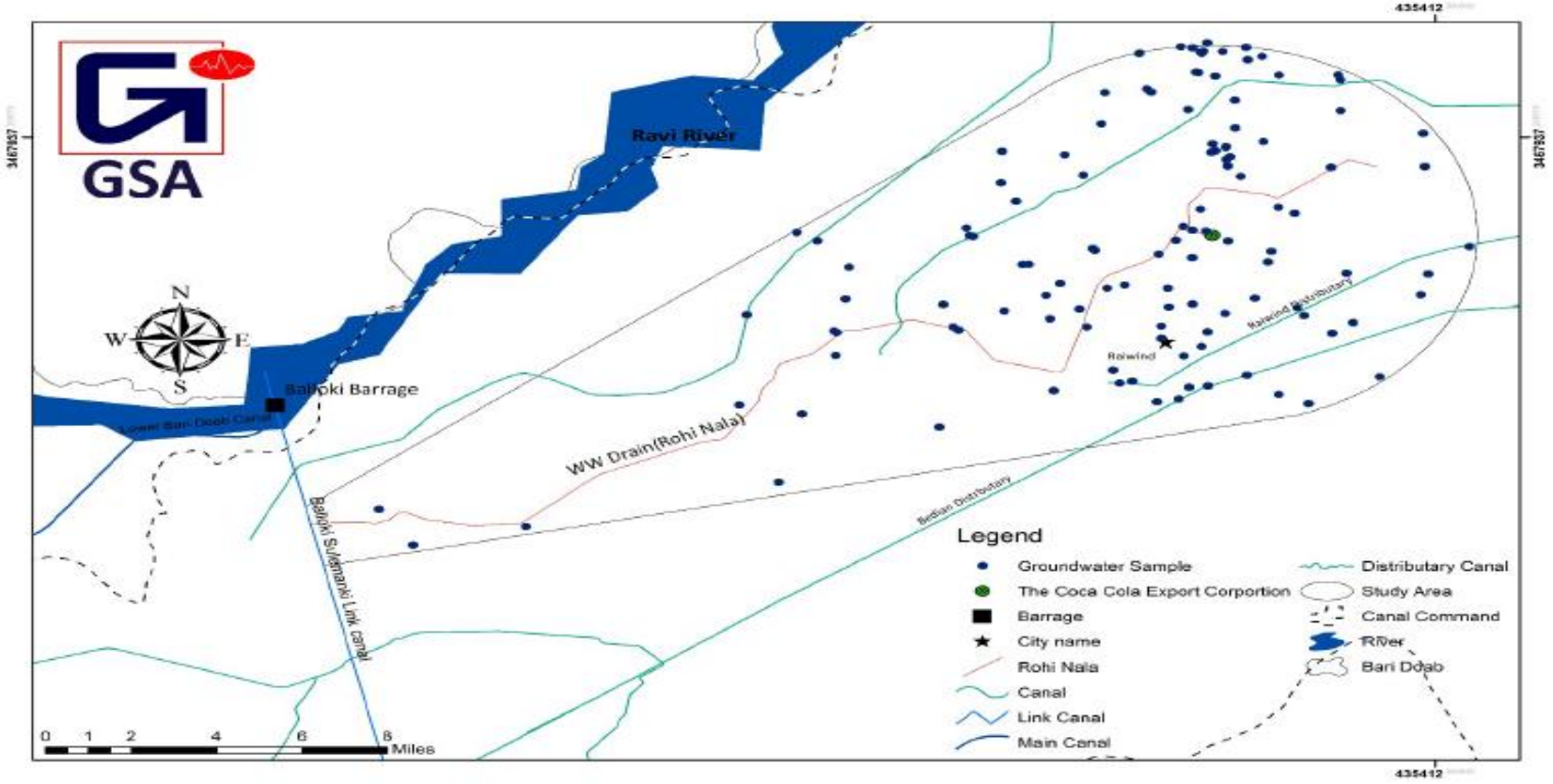
- **Wastewater Quality Analysis**

Wastewater quality Parameters that is Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) & Biological Oxygen Demand (BOD) were examined of 3 no. samples collected from different locations of the Hudiara drain.

Locations are mentioned in Table 1A & Wastewater quality Laboratory Test Reports are in Annexure 2 of Hydrogeological Survey Report.

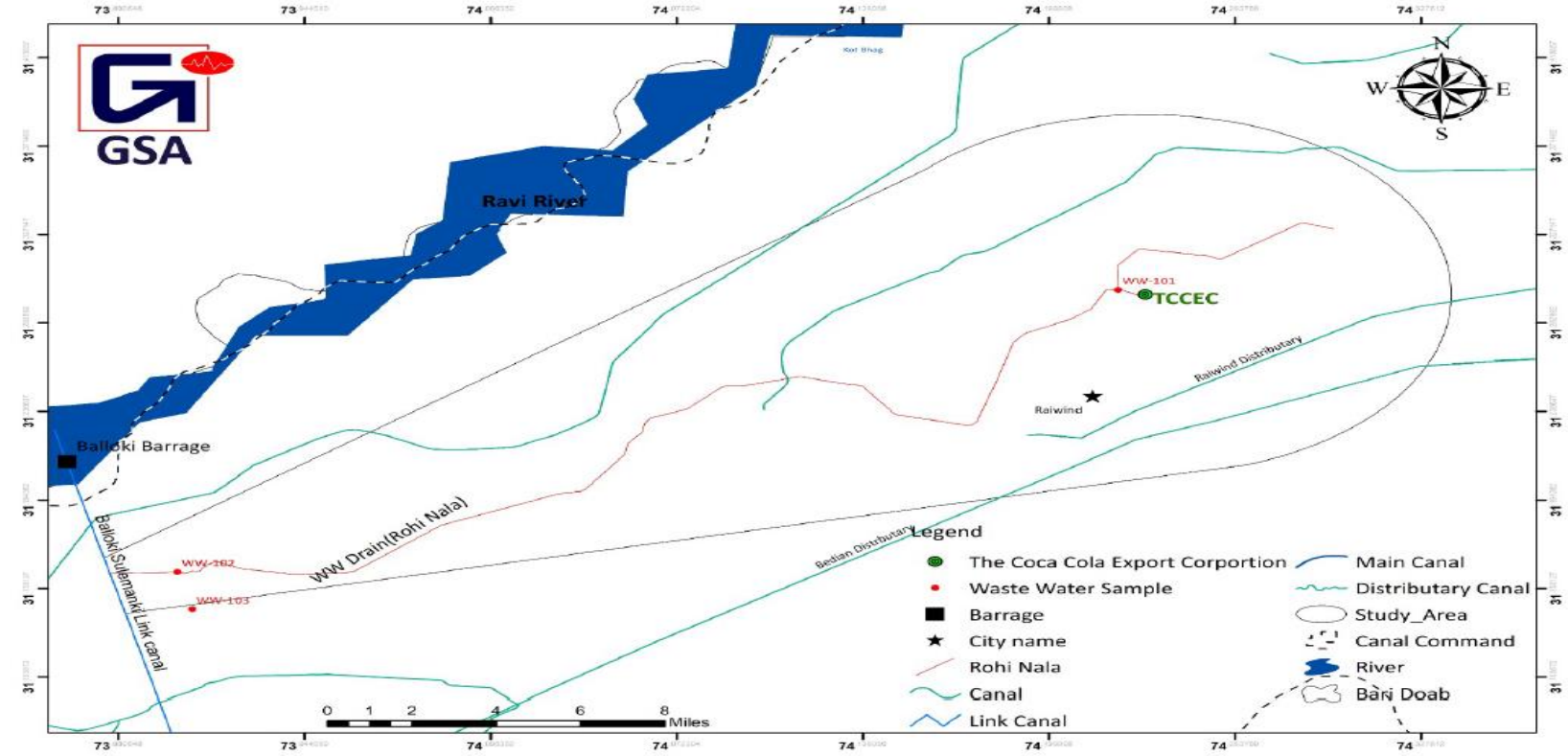
Location Map of Raw Water Testing in Catchment

Figure 1: Map Showing the location of Raw Water Sampling Points



Location Map of Wastewater Collection Points

Figure 1a: Map Showing the location of Waste Water Sampling Points



Findings/Results of Hydrogeological Survey of Catchment

Findings of Catchment Water & Wastewater Quality

Shallow Ground Water	Deep Ground Water	Wastewater Quality
Increase in the concentrations of Major Chemical parameters, Physical- Aesthetic Parameters and trace elements in shallow ground water relative to deep water	Low Concentrations of Major Chemical parameters, Physical- Aesthetic Parameters and trace elements in shallow ground water relative to shallow water	Laboratory results of wastewater revealed that there is an increase in the concentrations of all tested parameters (BOD, COD, DO) as per PEQS permissible limits (2016).
Drinking water situation of shallow sources are found unsatisfactory of study area	Drinking water situation of most of deep sources are found satisfactory of study area	
Shallow aquifers are being more affected by pollution due to the disposal & seepage of untreated industrial and domestic wastewater in Hudiara drain	Deep aquifers are being less affected by pollution due to the seepage of industrial wastes	
Most of the results of microbiological analysis of shallow sources clearly indicates the microbiological contamination relative to deep sources.	-	
47 out of 62 samples are found safe for drinking	**22 out of 38 samples are found safe for drinking**	
At shallow depth total Dissolved Solids (TDS) are in the range from 198-3767 ppm.	**At deeper depth total Dissolved Solids (TDS) are in the range from 236-1645 ppm.**	
The Quality of water in upper horizon is Marginal to Brackish	**The Quality of water in deeper depth is Good to Marginal**	