SUMMER INTERNSIP REPORT

Under the E- MICROBIOME Project

Under Supervision

Dr. Pankaj Gupta

Centre for Rural Development and Technology

Indian Institute of Technology, Delhi, New Delhi

Submitted To:

Department of Remote Sensing

Birla Institute of Technology, Mesra Ranchi

Jharkhand-835215

Submitted By:

Baby Sonal

Enrollment No

ACKNOWLEDGEMENT

I express my sincere gratitude to **Dr. Pankaj K. Gupta** at Centre for Rural Development and Technology, Indian Institute of Technology Delhi with whom I have enrolled as Intern under the project of E-Microbiome funded by the SERB-DST. He has always there to guide me and constantly encourage me during my project.

I would also express my special thanks to IITD for allowing me to Pursue my internships and also the access to labs and necessary facilities.

I am gratefully to my Parents and Friends for constant motivation and support.

Baby Sonal

CONTENT

CHAPTER ONE

Landuse/Landcover Change Detection using Remote Sensing and GIS In and Around Rania Cr Polluted Site, Kanpur, India

Presented at

GLOBAL INDIAN

YOUNG SCIENTIST RESEARCH AND INNOVATION

CONFERENCE 2023

At National Agricultural Science Complex- ICAR

New Delhi-110012

Date: 31May-2 June

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Presenting Author: Baby Sonal

ABSTRACT:

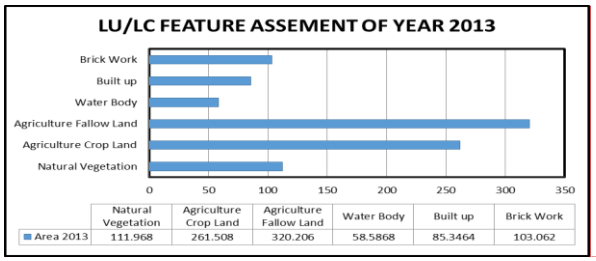

Fig 1: Assement of 2013 LU/LC feature

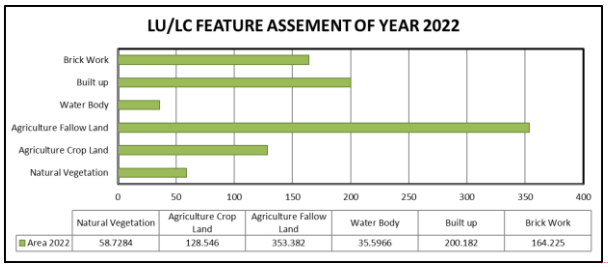

Fig2: Assement of 2022 LU/LC feature

Landuse / Landcover change assessment is most important perspective for change detection around the places. The aim of this study is to analyses the observed changes in land cover between 2013 and 2022 in the Rania-Khan Chandpur, Akbarpur region of Kanpur Dehat in India. Two satellite images of April 2013 and April 2022 from Landsat 8 OLI were used to extract the land cover maps. A cross-tabulation detection method in the geographic information system (GIS) module was used to detect land cover changes. The change has been detected using Google Earth Engine and the supervised classification method, training sample were created for processing. The study emphasis on how contaminated site impact the Landuse pattern of the region as with compared with 2013 in 2022 the Natural vegetation and crop land both decreases as increased in pollution level. The water bodies in the studied area also decrease sharply in the studied years. LULC change is shown to have had a series of negative impacts on the environment of the Akbarpur region. In response, technological, economic, policy, or legislation measures are needed to restore degraded ecosystem services in the district as well as other areas where similar impacts are experienced.

Commented [PKG1]: No visible to me

Commented [PKG2]: Same here

Commented [PKG3]: Of what?

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Commented [PKG5]: What type of negative impact?

INTRODUCTION:

Image classification is process of categorizing Landuse/landcover feature into different classes. Digital image classification helps in thematic information extraction.

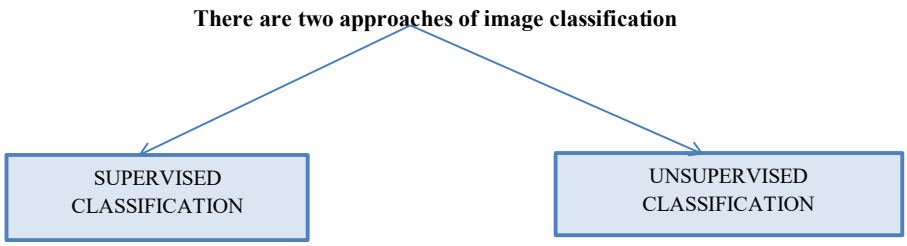

Image Classification Are of Two Type-

- SUPERVISED CLASSIFICATION: It is the process of identification of classes within a remote sensing data with inputs from user in a form of training data.
- UNSUPERVISED CLASSIFICATION: It is process of automatic identification of natural groups or structures within a remote sensing data. In this classification process there is no interpretative guidance from user. An algorithm automatically organizes similar pixels value into groups that become the basis for different classes. It is suitable to image of area where there is no ground base knowledge.

❖

Figure: Stages in process of Image Classification

OBJECTIVE:

i. To identify the LU/LC feature of the selected study area.

ii. To analyses the LU/LC variation in study area over a decade (2013 to 2022).

iii. Raster Converted into thematic Maps.

iv. Use of Google Earth Engine In the classification of Image.

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STUDY AREA:

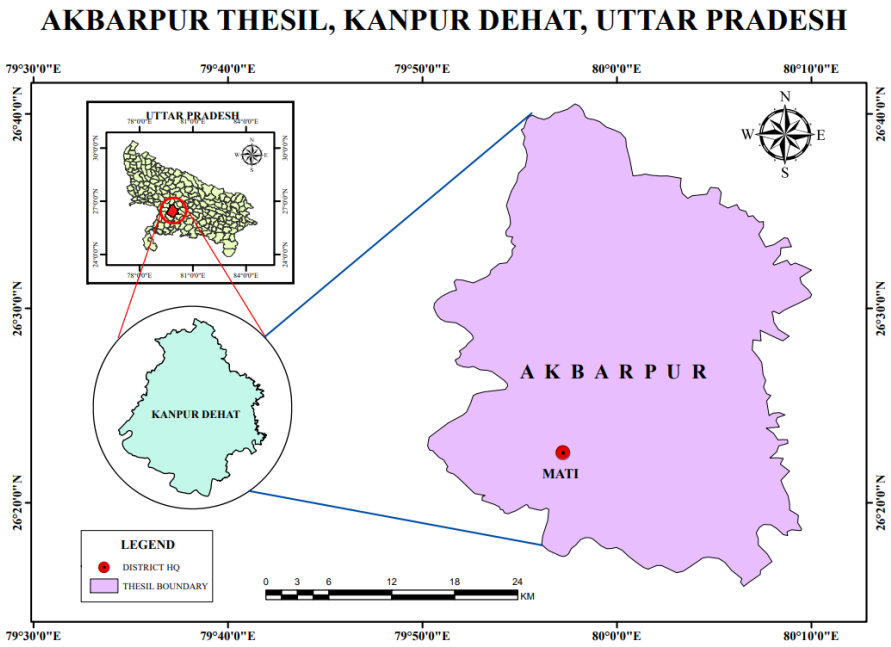

Fig 4 Study Area Map

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The study area comprises the Area of Rania-Khanchandpur of Akbarpur under Kanpur Dehat, Uttar Pradesh.

The area is suffering from Chromium waste deposition pollution.

Data Source: Satellite Imageries, Landsat 8 OLI TIRS, from Earth Explorer USGS, NASA.

Image information:

- Date of acquisition of selected images: 29/04/2013 & 30/04/2022
- Sensors: OLI TIRS
- Used Band: B4 (Red band), B5 (NIR band), B10 (Thermal band).
- Wavelength Range (in micrometres): 0.64 – 0.67 (Red), 0.85 – 0.88 (NIR), 10.6 – 11.19 (Thermal Band 10).
- WRS Path no.: 144
- WRS Row no.: 42
- Resolution: 30 meters (Red & NIR), &100 meters (Thermal bands).

METHODOLOGY:

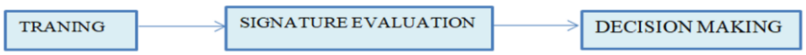

Figure: Stages in process of Image Classification

GEE (Google Earth Engine), cloud based Geospatial Analysis platform is used for the image classification. Then ARCGIS software was used for Map layout and Analysis.

STEPS INVOLVED IN GEE BASED PLATFORM

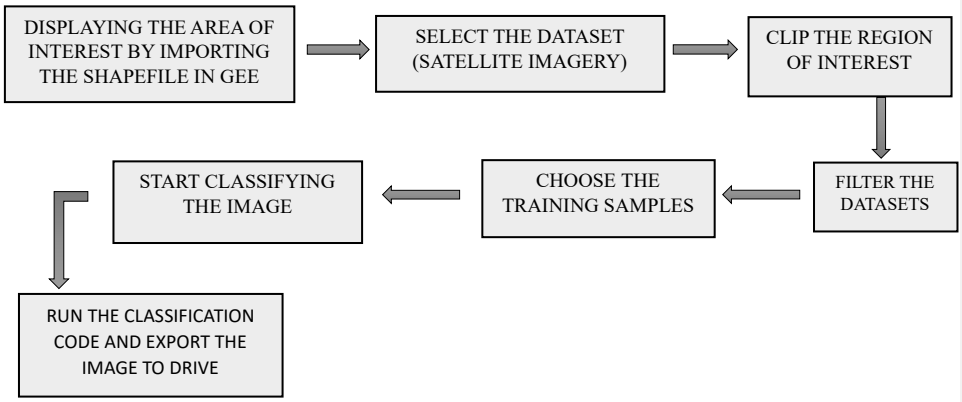

Fig 6: Steps Involve In GEE based platform

RESULTS:

S.No.	LU/LC Features	Area 2013	Area 2022	Area 2013 (in %)	Area 2022 (in %)
1	Natural Vegetation	111.968	58.7284	11.9029142	6.243318521
2	Agriculture Crop Land	261.508	128.546	27.79997219	13.66551145
3	Agriculture Fallow Land	320.206	353.382	34.03994484	37.56745264
4	Water Body	58.5868	35.5966	6.228151379	3.784215338
5	Built up	85.3464	200.182	9.07286793	21.28101546
6	Brick Work	103.062	164.225	10.95614946	17.45848659
7	SUM	940.6772	940.66	100	100

Table 1: Total Area of LU/LC features

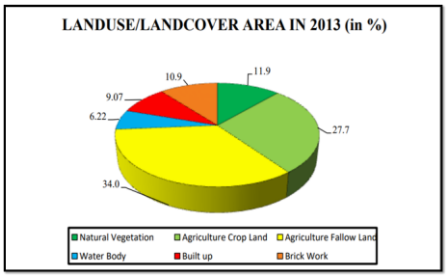

Fig 7: Percentage of total area (2013)

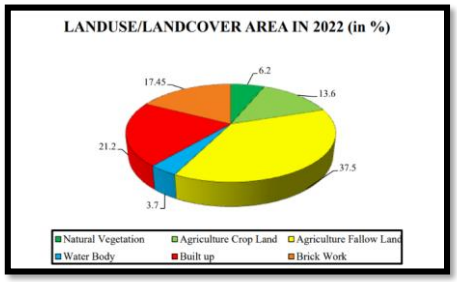

Fig 8: Percentage of total area (2022)

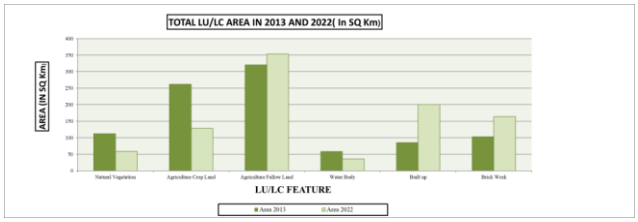

Fig 9: Comparative Analysis of Both Consecutive year

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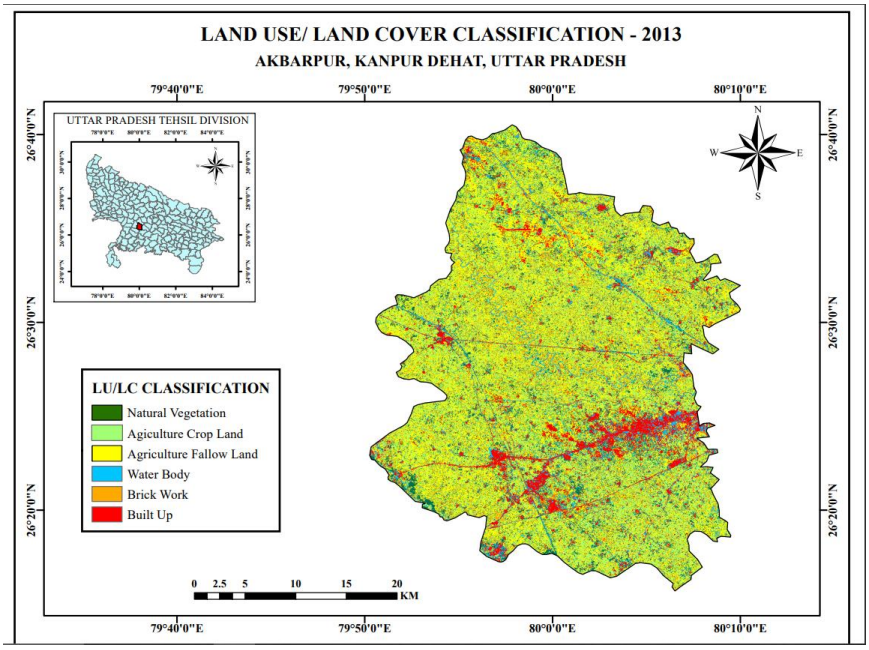

Fig 10: Classification of Year (2013)

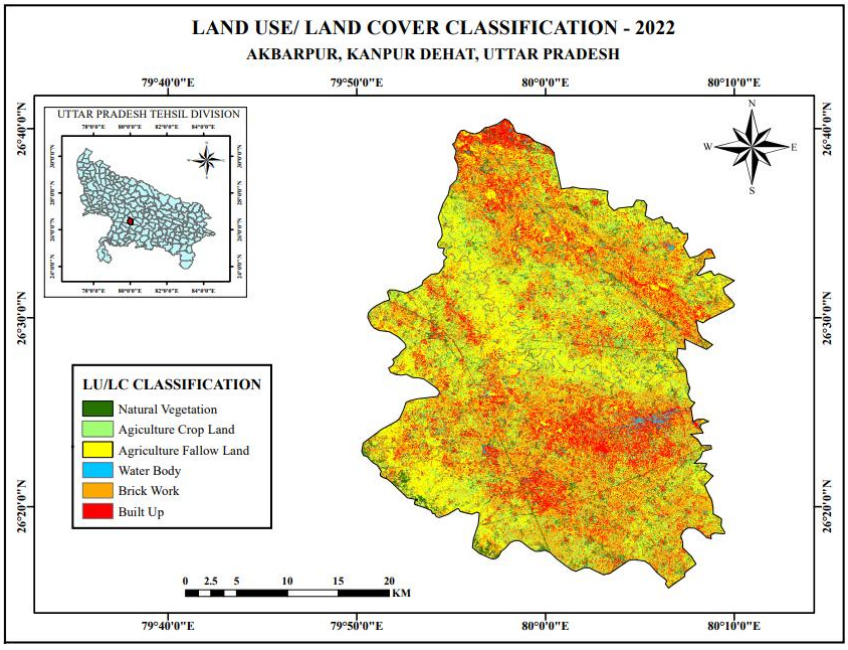

Fig 11: Classification of Year (2022)

DISCUSSION/OBSERVATION:

- **NATURAL VEGETATION:** Natural Vegetation includes the trees and bushes in the region along with some dense planted trees. The region is sparsely vegetated with trees, some spot show stretch of natural vegetation which are mainly located along the river and canal (e.g., Rind River).**The percentage of natural vegetation cover are decreases over time.**

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- **AGRICULTURAL CROP LAND:** The region is intensively cultivated region, Bilwahar, Umarpur, Katehari, Jalapur, Bitih are cultivated Region.
  Year 2013 have more cropped land as compared to 2022.
- **AGRICULTURAL FALLOW LAND:** The North region of study area (Akbarpur) Udaipur shioli have increased fallow land region in following decade.
  The region which are not well irrigated with canal facilities or ponds mainly fallow in month of April (study area time).
- **WATERBODY:** Here, Water body are classified into single class which includes ponds, ponds with algal bloom and waste, canal and river.
  Analysis concludes that in the time period of over 2013 to 2033 the level of polluted water body is increased in a region.
- **BRICK WORK:** Study area comprises mainly brick producing region. Rampur Shivali, Makrandpur Bantha, Gazaffarpur region. Crop Land is Ultimately Converted to Brick work region.
- **BUILT-UP:** The Settlement is mainly located as linear pattern along the roads and rivers, some clusters patterns are also observed near industrial region. While the growth in built up are easily observed from the year 2013 to 2022.
  The settlement regions are rapidly increased in this decade in comparison to other Landuse and landcover features.

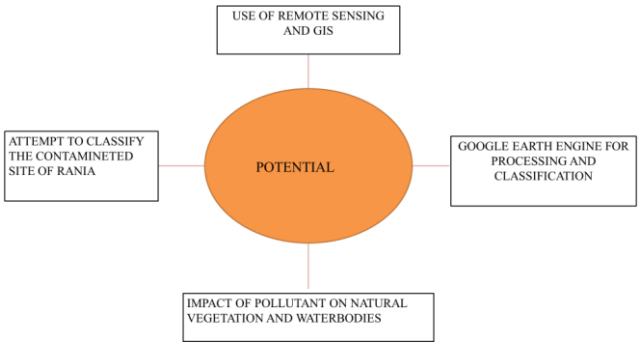

Fig 12: Potential region of the study

CONCLUSION:

Agricultural land has been increased in and around Cr polluted area, based on this study it is highly recommended to increases to natural vegetation to improve phytoremediation in and around Rania Khanchandpur.

To avoid metal uptake by crop it is recommended to minimize agricultural practice near the contamination site.

So, this is observed that the water bodies are getting more polluted over the time and this is also analysed that built up region are rapidly increasing leads to decrease in vegetation and agricultural land cover features.

This problem needs to be addressed through proper planning and management of growing population.

CHAPTER SECOND

QUANTIFICATION OF SURFACE LECHATE DEPOSITION OF CROMIUM AND HEAVY METAL FOM LEACHATE SITE OF RANIA - KHANCHANDPUR, KANPUR DEHAT

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Indian Institute of Technology, Delhi, Center for Rural Development

QUANTIFICATION OF SURFACE LECHATE DEPOSITION OF CROMIUM AND HEAVY METAL AND GREEN HOUSE GAS EMISSION FOM LEACHATE SITE OF RANIA -KHANCHANDPUR, KANPUR DEHAT

INTRODUCTION

Climate change is one of the major issues facing by mankind which defined as long term shift in temporary and weather pattern regionally as well as locally. Write one or two paragraph here on soil-water quality, watch my talk here to write this para--

Commented [PKG10]: (3) Listening to Learn: Soil-Water Quality Management - YouTube

This study comprises the villages of Kanpur Dehat, Rania- Khan Chandpur COPR water dump site. Aim of this study to identified the surface water chromium and heavy metal deposits through water sampling test and Green House Gas emission from the leachate site and classifying.

The surface area land of the village Khanchandpur on both side of the highway was more or less similar to the surface area of the dump of the Chromium.

The underground water which is used and which lies collected in small puddle is used for drinking by animals.

The surface water was contaminated due to leachate from the chromium dump.

The sample were collected pre-monsoon and post-monsoon. The study assess the level of heavy metals near the dumpsite.

The study comprises the use of GIS for classification, Analyzation and Plotting of data showing their spatial variation. Further it deals with the deriving methods to cut the source of this water source and source of Green House Gas which are affecting the environment locally as well as globally.

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OBJECTIVE

- To detect the emitted Green House Gas from waste dump site through Remote Sensing and UAV Survey.
- To test the water sample on various parameters.
- Analyze the temporal effects of these concentration with the help of GIS.
- Plotting and Monitoring the Potential Emission site.
- Spatial Variation of Surface water Cr concentration and Green House Gas from Landfill site.

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SCOPE OF THE STUDY

PHASE I

The first scope of the study is to plot the previous quantify sample of surface water and greenhouse gas with the method of interpolation in GIS platform. Further making the layouts and drawing the analyzation potential sites.

PHASE II

Then the study deals with the testing of surface water sample of recent collected samples from COPR polluted sites of Rania-Khanchandpur.

PHASE III

Plotting the second stage sample collection from the site and drawing analyzation from the prepared map layouts.

LITERATURE REVIEW

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The paper composes of surface and ground water rich chromium hazard waste in Rania- Khan Chandpur, monitoring compressive groundwater and surface water pollution site, assessment of its affect.

One of the major problems identified in this area is lack of proper drainage of industrial waste water.

The area has huge stockpile of chromium deposits in ground as well as surface.

Water samples were monitored phase wise.

ESTIMATION AND COMPARING NET GHG_s MONITORING AND ESTIMATION:

Net GHG emissions = Gross manufacturing GHG emissions - (Increase in carbon stocks + Avoided utility GHG emissions)

This equation should only be considered in the context of comparing two alternative materials management scenarios in order to identify the lowest net GHG emissions.

FACTORS	SUB-FACTORS
Gas Production Rate	Organic matter content of waste and its biodegradability
Gas Migration Properties	moisture and the temperature inside the landfill
Collection Efficiency of the Gas Extraction System	pressure and concentration gradients of the gas inside the landfill
Factor Affecting The transfer of the gas from the exposed area to the Atmosphere	wind speed , barometric pressure fluctuation , air temperature

Table 2: Factors affecting the GHG_s Emission in the atmosphere

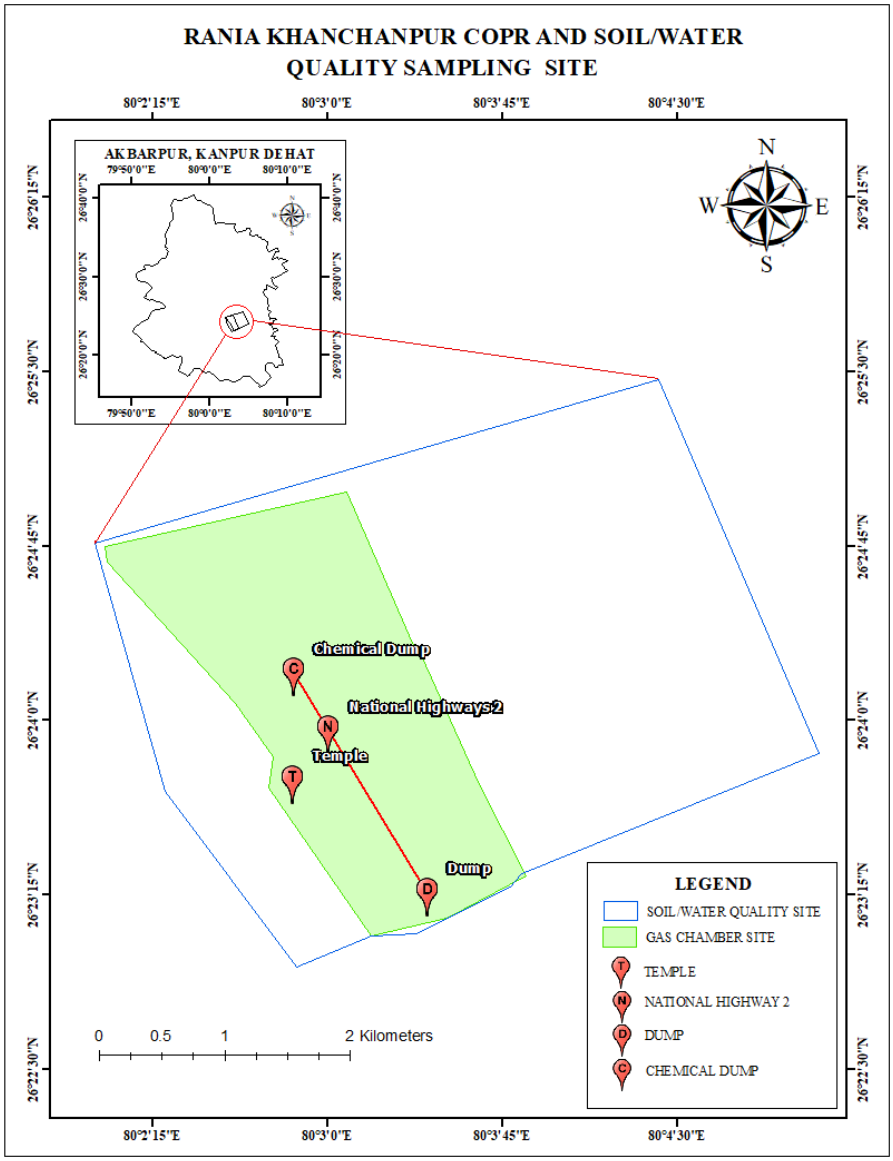
CLASS	REQUIRED DATA/ KNOWLEDGE	CHARACTERISTICS
Statistical analysis	a large number of data which are collected for different purposes	no assumption of cause-effect relation
stochastic model	time series of experimental data	simply generated output based on specific input with no explanation
simplified deterministic model	knowledge of the mechanism,biodegradability of the different components of waste	deals with the ecosystem on which the process is based
Complex deterministic model		

Table 3 :Classification of landfill gas Generation Models

Parameters	**Method Adopted**	**Instrument used**
pH	Electronic Method	Electronic pH meter
Total Dissolve Solid (TDS)	Gravimetric	_
Chloride	Argenotometric	_
Iron, Cadmium	Graphite Furnance Atomic Absorption	Graphite furnance
Chromium	Spectrometric method	Atomic Absorption Spectrophotometer
Manganese		
Nickel		

Table 4: Details of parameteters monitored, Method of Analysis and Instruments

STUDY AREA



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GEOGRAPHY

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Kanpur Dehat is the district of Indian state of Uttar Pradesh, Lying between Latitude of $26^0$06'30''-$26^0$50'15''N and Longitude $79^0$30'00''-$81^0$10'15 E. Total area is 3021sq/km.

Akbarpur is District Headquarter, Rania- Khanchandpur are two villages where sample collection survey is performed and they are closest to COPR dump site.

DEMOGRAPHY

Kanpur Dehat population according to 2011(census) is 17,96,184 of which 9,63,255 are male and 8,32,929 are female.

The literacy rate of Kanpur Dehat district is 65.15% out of which 71.94% males are literate and 57.3% female. The population density 595 per sq.km

RAINFALL AND CLIMATE

The average annual rainfall of the district is 782.8mm the climate is sub- humid with hot summer.

PEDOLOGY

Yellowish to reddish brown sandy loam soil, mildly to highly alkaline and non-calcareous, are found in Akbarpur region, the region are fully comprises older Alluvial plain.

DRAINAGE

The drainage system of the district is controlled by Ganga- Yamuna tributaries Pandu, Rind and Sengar.

AGRICULTURAL STATISTICS

(Agricultural statistics of Kanpur Dehat district, UP year 2019-2021 area in hectare)

This statistic is about the Akbarpur region, Total reported area is equal to 26,174

Net shown area is around 16496, gross shown area under Rabi Crops 15096, Gross shown area under Kharif crops 13958. Net Irrigated area is equal to 12033

Gross irrigated area is 19476.

MATERIAL AND METHODOLOGY

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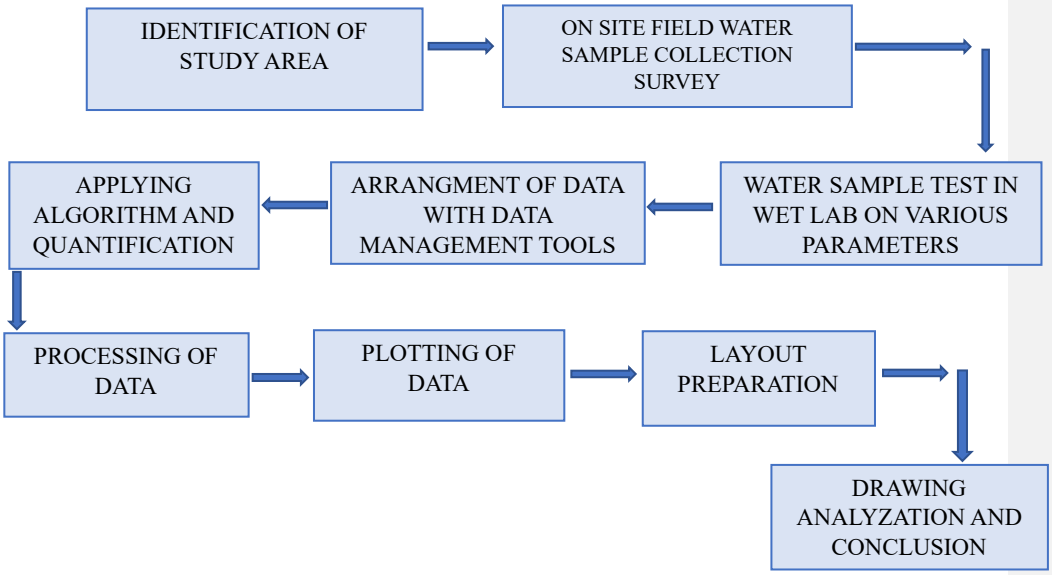

FIG 13: Representing the whole report methodology used for studying the surface water sample

THE FOLLOWING DISCUSS BELOW IS STEP WISE METHODOLGY FOR TESTING THE VARIOUS PARAMETERS OF SAMPLE TEST

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Ph (POTENTIAL HYDROGEN)

PH refers to a scale of intensity of acidity or alkalinity. This is regarded as measure of concentration of H^+ Ions in water. If H^+ ions are more than OH^- ions, the water will be alkaline. pH 7 indicates neutral water, pH above 7 is alkaline and below 7 is acidic.

STEPS OF ELECTROMETRIC METHOD OF Ph MESUREMENT:

- Calibrate the pH electrode using 4, 7 and 9.2/10 pH buffer solution. Clean the electrode after each step using distil water and by wiping the electrode through tissue paper. After calibration dip the electrode in storing solution of 0.01 M HCL solution of KCL solution until further analysis of sample.
- Then analyze the sample using calibrated electrode.
- Temperature should also be monitored at each step.

TOTAL HARDNESS

Total hardness of water refers to the sum of concentration of alkaline earth metal cations present in it. Calcium and Magnesium have been the main cation which are imparting hardness.

STEPS FOR TH MESUREMENT

Take 50ml sample in Erlenmeyer flask. Add 1ml of ammonium buffer solution (reagent A) and 4-5 drops of erichrome black T indicator (reagent B).

Titrate it against EDTA solution (reagent C) until the wine red colour of solution changed into blue (end point) (figure 16).

Calculation

TOTAL HARDNESS (mg/l, as CaCo3) = T*1000/V;

Where, T=volume of titrant(ml), and V=volume of sample (ml)

CALCIUM HARDNESS

Calcium occurs in abundance in all-natural water. Its source has been in the rocks from which it gets leached its concentration depends upon natural water depends upon the nature of the basin. Calcium is important micronutrient which is required in large quantity by mollusks and the vertebrates. It is an important part of total harness of water so can affect the quality required for domestic purposes. But its higher concentration in water is not good for health as well as domestic purposes.

STEPS FOR MEASUREMENT OF CALCIUM HARDNESS

- Take 50ml sample in conical flask.
- Add 1 ml of reagent A (Sodium Hydroxide solution) and pinch of reagent B (Murexide indicator).
- Titrate it with reagent B i.e., EDTA solution until pink colour changed to purple (end point).

ALAKLINITY

- Alkalinity of water may be define as its capacity to neutralize a strong acid. It has been characterized by the presence of hydroxyl ion capable of combining with hydrogen (H^+) ions. In natural water carbonates, bicarbonates and hydroxides have been considered as important bases. Natural water with high alkalinity have been generally rich phytoplankton, blue green algae.

STEPS FOR MEASUREMENT OF ALKALINITY

Take 100ml of sample and add 3 drops of Methyl Orange indicator and determine the total alkalinity (TA) by continuing the titration to second equivalence point.

CHLORIDE

Chloride constitutes approx. 0.05% of the earth crust. Chloride concentration of between 1 and 100 ppm (parts per million) is normal in fresh water.

STEPS FOR MEASUREMENT FOR THE CHLORIDE

- Wash the burette with distilled water and rinse with standardized solution of silver nitrate and then fill the burette with same.
- Carefully pipette out the 10ml of given solution of chloride ions and transfer into 100ml conical flask.
- Add 1ml of the potassium chromate indicator solution in (it advisable to use a 1m pipette for this purpose).
- Titrate the solution with silver nitrate solution and ensure that the flak is constantly swirled.
- With the progress of titration, we observed that the red colour formed by the addition of each drop of silver nitrate begin to disappear more slowly, slow down the rate of addition of silver nitrate the end point is indicated by sudden development of a faint but distinct change in colour to reddish-brown. This does not disappear on swirling the titration flask.
- Repeat the procedure for at least three times and record the observation.

MATERIALS:

PARAMETERS	TEST METHODS	MATERIALS/INSTRUMENT
PH	Electrometric	pH meter along with electrode, Thermometer
ELECTICAL CONDUCTIVITY	Conductivity	EC Meter
TOTAL HARDNESS	Titration	Burette, Conical Flask, Erichrome black T-indicator, EDTA solution
CALCIUM HARDNESS	Titration	Burette, Conical Flask, Sodium Hydroxide Solution, Murexide Indicator, EDTA solution
TOTAL DISSOLVE SOLIDS	Conductivity	Electronic pen or electrode
ALKALINITY	Titration	HCL, Phenolphthalein Indicator, Methy Orange
CHLORIDE	Titration	Burette, Potassium chromate Indicator, Fluorescein Indicator, Silver Nitrate

Table 5: Various Parameters and their methods and material of Testing.

STEPS INVOLVED IN GIS PROCESSING

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Interpolation is spatial analyst tool to predict values for cells in a raster from limited number of sample data points. It can be used to predict unknown values for any geographic point data, such elevation, Rainfall, Chemical Concentration, so on. IDW, Kriging, Natural Neighbor, Spline, Trend.

IDW: (Inverse distance weighted) tool uses a method of interpolation that estimates cell values by averaging the values of sample data points in the neighborhood of each processing cell. The closer a point is to the center of the cell being estimated, the more influence or weight it has in the averaging process.

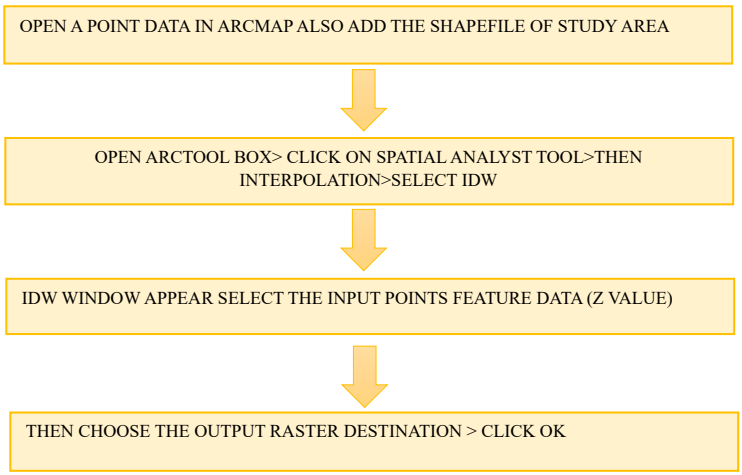


FIG14: Summary of GIS steps involve in processing of data

STEP1: Open ArcMap software > Go to "ADD DATA" option from the main menu bar > Edit the .csv file with having a coordinate > Provide the desire coordinates system i.e., Geographic coordinate system or Projected Coordinate system> with the help of add data option add the Shapefile of the study area.

STEP 2: Now, right click on Attribute Data > Go to "Join & Relate" >choose the field to join>click ok

STEP 3: For displaying surface water chemical concentration **'INTERPOLATION'**

Go to "Arc Toolbox" >Then choose the "Spatial Analyst" Option from the drop-down Tool> select the interpolation> then choose "IDW" option> IDW dialog box appear in working

window give the required information> Input point feature data set > Give the Z value > Then give the output file location.

STEP 4: Click on 'ENVIRONMENT' option from below > click on 'PROCESSING EXTENT' option > select the study area shapefile> then go below select the 'RASTER ANALYSIS'> choose the study area shapefile in "MASK" option.

STEP 5: Click ok >ok.

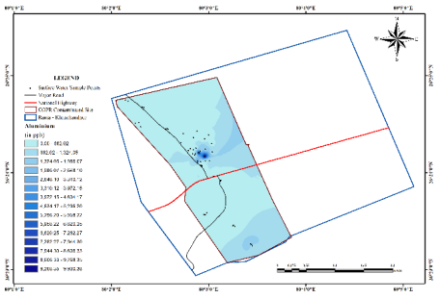
Note: Repeat this process for each Parameters.

STEPS FOR CREATING A MAP LAYOUT

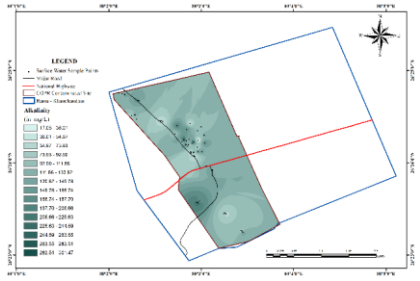
- For creating map click on layout view option > choose the size & orientation of your layout page accordingly.
- With the help of 'PAN' tool adjust the map to fit the layout in the frame.
- Click on 'INSERT' at top of the menu bar> insert the Title, Legend, Scale Bar, Grids, Neat Line.
- Now Click on "File"> Click on Export Map> Export the map in desire location with appropriate file format by setting the Dip.

RESULTS AND DISCUSSION:

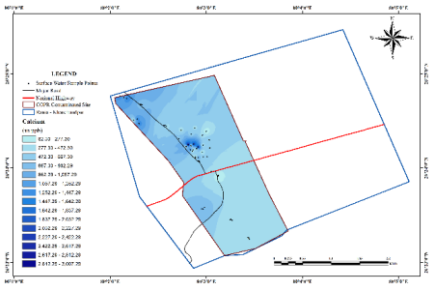
ALUMINIUM IN SURFACE WATER
RANIA - KHANCHANDPUR



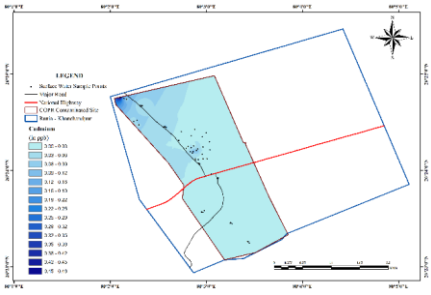
ALKALINITY IN SURFACE WATER
RANIA - KHANCHANDPUR



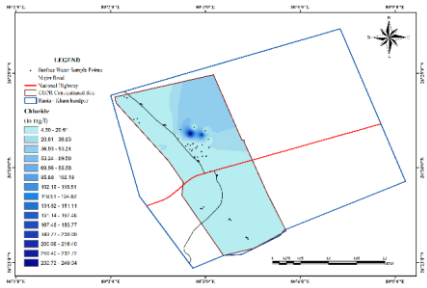
CALCIUM IN SURFACE WATER
RANIA - KHANCHANDPUR



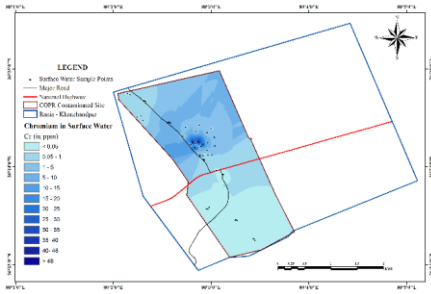
CADMIUM IN SURFACE WATER
RANIA - KHANCHANDPUR



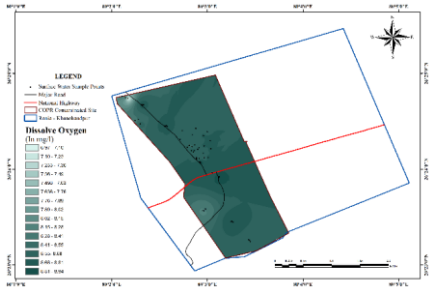
CHLORIDE IN SURFACE WATER
RANIA - KHANCHANDPUR



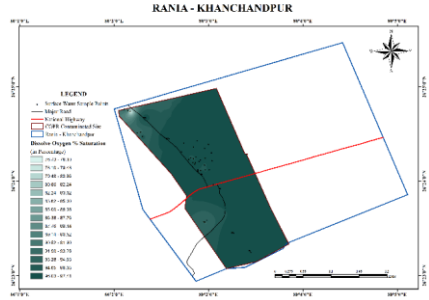
CHROMIUM CONCENTRATION IN SURFACE WATER
RANIA - KHANCHANDPUR



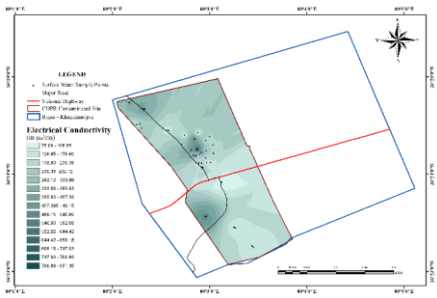
DISSOLVE OXYGEN IN SURFACE WATER
RANIA - KHANCHANDPUR



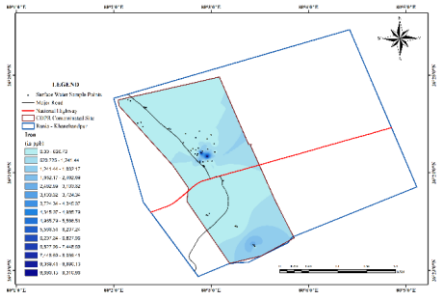
DISSOLVE OXYGEN PERCENT SATURATION IN SURFACE WATER
RANIA - KHANCHANDPUR



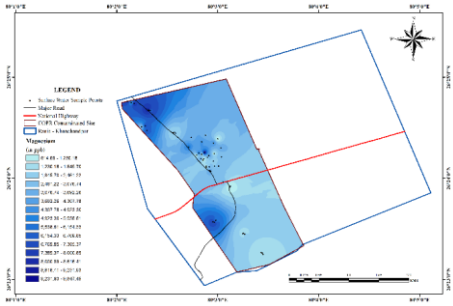
ELECTRICAL CONDUCTIVITY IN SURFACE WATER
RANIA - KHANCHANDPUR



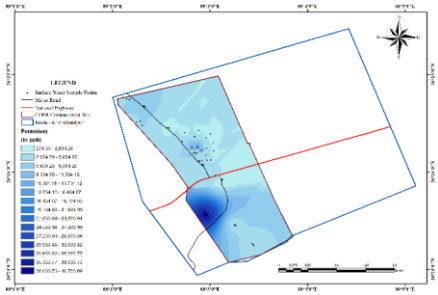
IRON IN SURFACE WATER
RANIA - KHANCHANDPUR

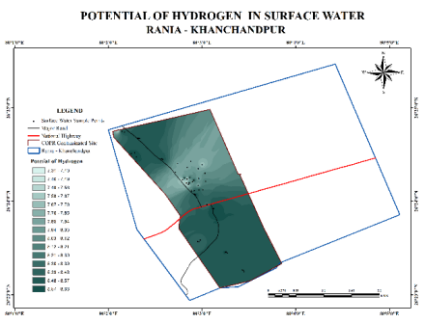


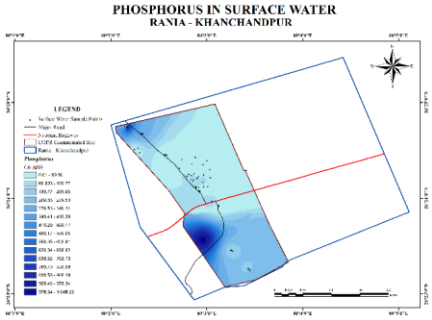
MAGNESIUM IN SURFACE WATER
RANIA - KHANCHANDPUR

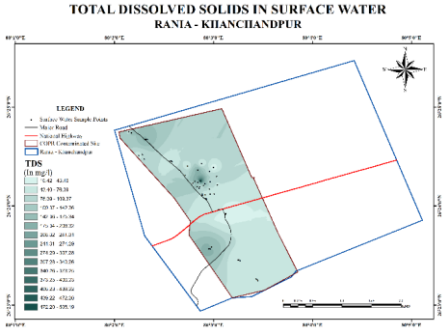


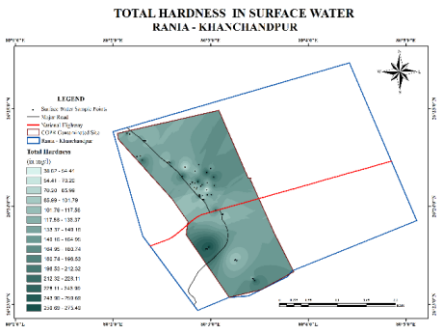
POTASSIUM IN SURFACE WATER
RANIA - KHANCHANDPUR

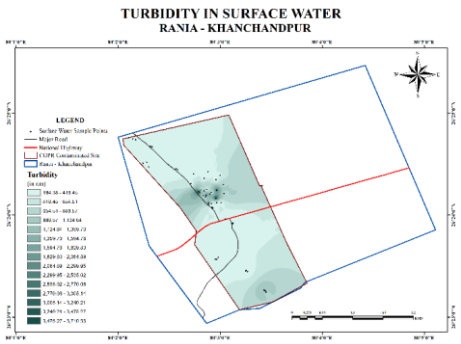












Spatial Variation of Surface Water Quality Parameters;

Chromium deposits in surface water are seen closed to COPR dump site. Concentration in surface water chromium and distance are inversely related proportionate as close to dump there is highest chromium concentration which decreases with distance.

That is close to COPR dump site their highest Cr concentration and away from the site concentration decreases.

Cadmium is soft, malleable, bluish metal found in zinc ore, exposer to cadmium in air, food and water cause damage to kidneys cadmium is considered as cancer causing element.

Cadmium concentration were high on extreme north from COPR contamination site. The value ranges from 0.00 (lowest) to 0.48 (highest) in ppb in the given data.

CONCLUSION:

The chromium dump is noted to be Hazardous waste since 1976 and repeated records were formed. The surface water collected from dump is expressing the green colour i.e., Leachate of chromium. The water comes from the handpump and surface water is unfit for drinking.

In order to study the contamination quantity in water, samples were collected and tested in lab on various parameters. These parameters include the Ph, Electrical conductivity, Total Hardness, Calcium Hardness, Alkalinity, Chloride, chromium and various. There is no source of fresh water in Khanchandpur for drinking purposes so measures should be taken as chromium deposition in borewell are harmful for drinking.

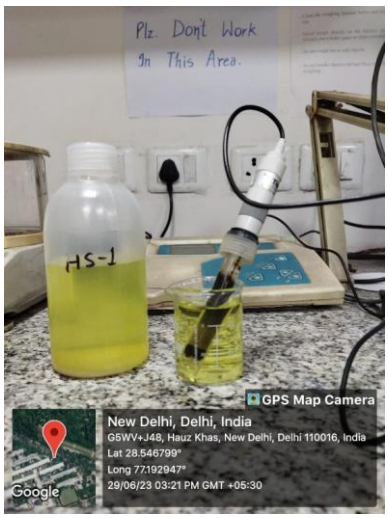
And serious measures should be taken in order to save lives. Government should ensure that all the handpumps should be closed completely in these two villages. State government must provide the regular supply of drinking water.

Under this project an effort has been put to study the contamination of Chromium deposits in groundwater, surface water and soil, so that an estimated quantification of contamination could be done.

Further the role of new technology has been proven in showing its spatial distribution and analysis of potential zone of the contamination.

The basis role of GIS is spatial analyzation and real-world problem solving.

GEOTAGED IMAGE:



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