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Study of Open Drainage System With The Help of Remote Sensing Technique : Gomti River Case Study

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ABSTRACT

This paper presents the remote sensing technique for the study of open drainage system and its effect on Gomti river in Lucknow area.Gomti river originates from MadhoganjTanda village in Pilibhit district, U.P. It passes through the district of Shahjahanpur, Kheri, Hardoi, Sitapur, Lucknow, Barabanki, Sultanpur, Jaunpur and ultimately merges in the Ganga. The world is facing problems with a wide variety of pollutants both inorganic and organic in nature. Healthy soil, clean water and air are the soul of life. Often soil, water and air are no longer clean and pure, but pose human health risks. Gomti receives huge quantities of untreated sewage, agricultural runoff, brings lot of pesticides, fertilizer, street washouts bringing oil, asphalt, sediment and many types of heavy metals. From industrial effluents to domestic discharge, the river becomes more of a flowing dumping yard. The physicochemical parameters in water of river Gomti were assessed to know about the water quality in its catchment area. Parameters like Temperature, Total suspended solids (TSS), Total dissolved solid (TDS), pH, Hardness, Dissolved oxygen (DO), Nitrate, Nitrite, Chlorine, Total Coliforms and some Heavy metals were determined. Changes in water quality of River Gomti due to variations in quantity of parameters were found. Heavy metals mainly Iron, Cadmium, Copper and Arsenic were noticed.

1. INTRODUCTION

The Gomti originates from GomatTaal which was formally known as FulhaarJheel near MadhoTanda, Pilibhit, India. It extends to 900 km through Uttar Pradesh and meets the Ganges River near SaidpurKaithi in Gazipur. Its water coverage is about 22,735 square km. After travelling about 240 km Gomti enters Lucknow, where it travels for 16 km. The cities of Lucknow, LakhimpurKheri, Sultanpur and Jaunpur are located on the banks of the Gomti and are the most prominent of the 15 towns located in its catchment area. Its flow mainly depends upon occurrence of rain and therefore the flow in river is very lenient during monsoon. The river collects large amounts of human and industrial pollutants as it flows through the highly populous areas (18 million approx) of Uttar Pradesh. High pollution levels in the river have negative effects on the ecosystem of the Gomti threatening its aquatic life. Before reaching in Lucknow, Gomti receives waste from sugar and distillery industries of Sitapur. All industries of distillery, milk industry, vegetable oil, pouring effluent directly into Gomti and besides this domestic waste water are also discharge into the river Gomti.

Drains are the main source of water pollution especially for rivers flowing within the city carry industrial effluent,domestic waste, sewage and

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medicinal waste results in pooring the water quality. The extent to which these drains pollute the water quality of river Gomti in Lucknow city. The water pollutants include sewage, variety of both organic and inorganic pollutants including oils, greases, plastics plasticizers, metallic wastes, suspended solids, phenols, acids, greases, salts, dyes, cyanides, DDT and some heavy metals like Cu, Cr, Cd, Hg, Pb are also discharged from industries. Gomti is under assault at various points of its journey as it meanders through the 900 km stretch of rich alluvial plains of Uttar Pradesh. According to study carried out by several researchers on some of the important rivers, it has been observed that in recent years, the water of most of rivers is polluted. Many sources of heavy metals including tannery, sugar, beverages, paints, chemicals, fertilizers, batteries, automobiles, factories, food processing units, cement thermal power plants, petroleum refineries and sewage disposal water. Heavy metals reveals a huge amount of problems having high density but physical properties are quit meaningless (Appenroth, 2007). Heavy metals causes environmental pollution and are phytotoxic in nature (Prasad, 2004). Heavy metals have specific gravity 5. The contamination of the environment with toxic metals has become a worldwide problem, affecting crop yields, soil biomass and fertility, contributing for the bioaccumulation and biomagnifications in the chain (Prasad, 2011). High concentration of all metals like Cr, Cu, Ni, Pd and Zn were noticed in River Gomti from 2006-2008. Drinking water containing traces of heavy metals and is dangerous for health. Fresh water fishes also get affected due to bioaccumulation ofheavy metals (Vinodhini and Narayanan, 2008). Heavy metals are carcinogenic to humans. Higher concentration of metal in water and sediment during rainy season could be due to the industrial, agricultural or domestic runoff coming into the river (Gaur *et al*., 2005). River Water quality monitoring is necessary especially where the water serves as drinking water sources, are threatened by pollution resulting from various human activities along the river course. Water quality assessment based on biomonitoring of rivers in Uttaranchal, in view of their religious importance and ecological sustainability was carried out by Semwal and Akolkar (2006). Some algae can be used as bioindicators of water pollution (Dwivedi, 2010). Study carried out indicated that surface water and land resources management plan should be carried out for conservation of precious water. Investigations, monitoring of seasonal variations in the concentrations of heavy metals Pb, Fe, Zn, Mn, Cd,.A survey presented a report on monitoring and assessment of the Gomti river quality in Lucknow. Screening of micro organisms in river Gomti water was made by (Pathak, 1991) under various environmental conditions. Overall aim of the study was to check the water quality parameters and their role in causing water pollution.

Fig.1: Showing the actual pollution in the gomti river, lucknow area

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2.0 MATERIALS AND METHODS

2.1 Site Selection

The Gomtiriver is tributary of Ganga river. About 240 km the Gomti enters Lucknow, through which it meanders for about 12 km. the Nishatganj area of the Gomti river is selected for the study of different parameters .As few small drains and more contamination is observed due to various religious activities also, so this area is studied for the parameters.

2.2 Collection and laboratory analysis of water quality samples

Water samples from the site is collected ,study area contains single site for the the analysis .The water quality parameters included Total Solids (TS), Dissolved Solids (DS), Suspended Solids (SS), pH, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Dissolved Oxygen (DO), Chloride and Total Hardness (TH) in this study. These water quality parameters of each sample were analysed in laboratory.

Table-1: Levels of Parameters Found in Lab Testing of Water Sample

S. No.	Parameters	Unit	Gomti River	Minimum Detection Limit
1	Sodium (Na)	Mg/l	14	0.003
2	Potassium (K)	Mg/l	10.3	0.005
3	Nickel (N)	Mg/l	0.05	0.02
4	Manganese (Mn)	Mg/l	<0.01	0.01
5	Copper (Cu)	Mg/l	0.03	0.02
6	Cadmium (Cd)	Mg/l	<.007	0.007
7	Lead (Pb)	Mg/l	<.01	0.01
8	Zinc (Zn)	Mg/l	<.006	0.006
9	BOD	Mg/l	7.7	0.1
10	COD	Mg/l	20.1	1
11	DO	Mg/l	3.8	0.05
12	Ammonical Nitrogen	Mg/l	<0.5	0.5
13	Total suspended solid	Mg/l	52.1	0.5

Table-2: Levels of parameters found in Lab testing of water sample

S. No.	Parameters	Unit	Gomti river	Minimum detection limit
1	Turbidity	NTU	<0.5	0.5
2	pH value	-----	8.1	0.1
3	Total dissolved solids	Mg/l	350	0.01
4	Chloride (cl)	Mg/l	31	1
5	Fluoride (F)	Mg/l	1.3	0.01
6	Total Hardness	Mg/l	141.6	1
7	Calcium (Ca)	Mg/l	3.01	1
8	Iron	Mg/l	0.1	0.04
9	sulphate	Mg/l	11.5	0.3
10	Nitrate oxygen	Mg/l	5.1	0.1
11	Alkalinity	Mg/l	230	3
12	Aluminium	Mg/l	<0.003	0.003
13	Phosphate	Mg/l	4.8	0.02

2.3 Analysis by the Satellite Images

Analysis of the satellite data and google images is done, from which the number of drain falling in the study area have been recorded and identified the impact of the major drains on pollution and contamination of river water is found more. it can be clearly analyzed by the use of pre monsoon and post monsoon testing. Various chemical levels, color, odor are found to be disturbed in the amount more than its minimum limit these chemical can give harmful effect to the mankind as well as the aquatic life. As the dependency of people for drinking water is becoming more day by day on river in Lucknow. So from satellite data we can easily identify these drain points on large scales. More over the hand held GPS can give the accurate coordinate of the sampling points for the further analysis. In this paper hand held GPS is not used for the sampling point coordinates. Just the analysis of the satellite data is done for the identification of major drains falling in the Gomti river.

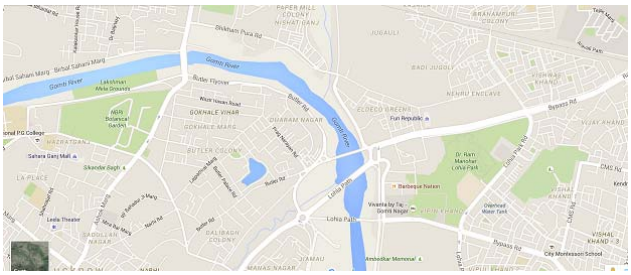

Fig.2: Satellite image showing two major open drainage systems in Lucknow

3. RESULTS AND DISCUSSION

Samples were taken near Nishatganj for the analysis.and lab testing report is given in Table 1 and Table 2. The DO, TSS, TDS, nitrate, nitrite and other parameters at some of the sites were beyond permissible limit, water was polluted and is not suitable for beneficial uses without conventional treatments. The river is highly polluted due to discharge of domestic and industrial waste through several drains. The increase in value of chloride, nitrate and total hardness were also due domestic discharges. Increased concentration of heavy metal in water at Parag, Daligaj, Mohan Meakin and Monkey Bridge area could be due to high discharge of water from catchment area, industries and various drains.

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