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Status and Conservation of Water Bodies in Gwalior City

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ABSTRACT
PURPOSE :*Water is one of the major ingredient of human life. To survive and to make our self-healthy it is necessary to save the water resource. The prime objective of present research is to identify the fresh water resources in Gwalior city and locate their position on map.*
DESIGN/METHODOLOGY/APPROACH: *To fulfil the prime object of this empirical research Global Positioning System (GPS) is used to locate the exact position of the water bodies. AutoCAD designing software is used to draw the map of all water bodies.*
FINDINGS : *The water bodies surveyed in this study needs immediate attention at the government as well as public level. These water bodies must be conserved properly by clearing their premises, plantation in their banks and motivating the general public for sustainable use of the water resources.*
ORIGINALITY/VALUE*: This paper is first of its kind which focused on identification of living water resource inside the Gwalior city and generation of AutoCAD map through the GPS data.*
KEYWORDS
AutoCAD, Water bodies, Global positioning system, Gwalior, India.

1. INTRODUCTION:

Water plays an important role in sustenance of life. It is vital for almost all activities viz. economic, social, culture and environmental. Lakes, ponds, rivers are important surface water sources (Beck et al 1994). In the past few decades there is progressive degradation of water bodies all over the world due to population growth, industrialization and urbanization leading to increased anthropogenic impacts including discharge of sewage, industrial solid and liquid waste and chemical rich agriculture runoff. Impacts of degradation of water bodies are visible in the form of degraded water quality, alterations and less of biodiversity and change in eutrophic status from meso to hyper eutrophic state after exceeding their carrying capacity (G. Sime et al 2015).

Urbanization results in rapid extinction of water bodies and improper arrangement of drainage system leads to decline of the available water resource. These affect the hydrological cycle and consequently the quality and quantity of water bodies. The development plans generated by the government being implemented now are restricted to physical planning, whereas environmental consideration are on low priority. In the past three decades the water resources in India are under immense pressure and as a result many of them have either lost their identity while other are struggling for their existence (Rao et al 2014). The urban water bodies in the Gwalior are in same condition. The consequences are becoming critical in certain areas of city (Rao et al 2014). Thus an urgent need was felt for identification of problem and evolve remedial measures for recovery at the local level. In order to address the problems strategies needs to be prepared for conserving and sustaining the health of our ecosystem. To ensure long-term sustainability of water resources the focus of water management needs to shift from a traditional supply side management to demand side management, which has traditionally been neglected. Though augmentation of supplies would be required to meet the growing demand in urban centers, the future however lies in effectively controlling our demand for water resources and efficiently managing and using the available resources. The approach calls for the development

of an integrated water demand management strategy, which would aim at reducing the losses in the system, improving operational efficiencies, promoting rationale use of water resources, equitable distribution of the resource and exploring alternative sources such as recycling of wastewater for non-potable uses (Singh and Singh, 2009). Aim of the study is to ensure long-term sustainability of water resources through interventions targeted at improving efficiencies in water distribution and use in urban water supply systems. On the basis of the study the objectives are stated as follows

1. Rapid assessment of current situation of the urban catchment pertaining to availability of water sectorial demand identification of major point and non-point sources of pollution.
2. Identification of Global Positioning System of water bodies.
3. Study of drainage pattern, flow gauging and develop a GPS map based run of model.
4. Develop city specific strategies at improving the water quality.

2. STUDY AREA :

Gwalior is the fourth largest city and situated in the north of the state of Madhya Pradesh, at 26.12° N latitude and 78.18° E longitudes in the Indo-Gangetic plains with the per capita water availability of 190 lpcd (Singh and Singh, 2009). As of 2011's India's census Gwalior had population of 2,032,036 of which male and female were 1,090,327 and 941,709 respectively. There was a change of 24.50% population growth rate compared to population as per 2001 census of India. As per the census of India 2011, density of Gwalior district is 446 people per sq. km. Gwalior district administers 4,560 square kilo meters of areas. Out of the total Gwalior population for 2011 census, 62.69 percent lives in urban regions of district and 37.31 % population of Gwalior districts lives in rural areas (Census, 2011).The city islocated on plains sloping from south-west to north and north-east. The plains extend from Chambal river in the extreme north, where it joins a number of rivers flowing from the south west to finally join the gangetic river system (Mohapatra el al, 2014). Gwalior receives 970 mm (39 in) of rain every year, most of which is concentrated in the monsoon months from late June to early October. August is the wettest month with about 310 mm (12 in) of rain (Rao et al, 2014).

2.1. MATERIAL AND METHOD :

The natural drainage of the Gwalior urban area is dominated by Swarnrekha and Morarriver, Swarnrekha is flowing south to north through the urban area for about 13.65 km storm water and a considerable amount of untreated sewage drains naturally through this stream. Apart from Swarnrekha and Morarriver there are mainly two water tanks Janaktal and Sagartal which are used mainly for recreation and governed by gwaliourmuncipal corporation. The Kaketo and Tighra reservoirs situated in the outskirts of the city (Rao et al, 2014). The water supply of Gwalior urban area mainly depends on Tighra-Kaketo reservoir and groundwater. The observations suggest that more than 35 MLD (7.7 MGD) of water is supplied from the groundwater reserves (Singh et al, 2011). These are the main source of domestic water supply for the city and are also used for irrigation and pisiculture. This was constructed on the river Sank in the year 1914. The average storage capacity of the reservoir is 2,237 mcft and the total catchment area of the reservoir is 260 sq.mt (Singh et al, 2011). It is linked with two reservoirs named Kaketo and Pesari on the upstream by a 55 km. long fedder canal. The total water availabe from Tighra and Kaketo system is 190 MLD. Water is taken into (old&new) water treatment plants located in Motijheel. The old water treatment plant's capacity.is 68.19MLD. The survey has been carried out during April, May and June, 2012. The data were colected every two days in a week from 10:00 am to 5:00 pm. GPS (global position system) was used in survey and longitude and latitude values of the water bodies were identified. The map of water bodies was made with the help of AutoCAD.

3. RESEARCH METHODOLOGY :

The prime objective of study is to identify the exact location of existing water bodies in the Gwalior city. To fulfil this objective global positioning system (GPS) is used. On the basis of identified latitude and longitude

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(2 D position) of existing water bodies in the Gwalior city AutoCAD Classic software is used to draw the map of existing water bodies inside the Gwalior city.

4. OBSERVATION :

The daily total water demand of Gwalior for various sectors is estimated to be 155.52 MLD while the total daily water supply is 130 MLD (54 MLD from motijheel old WTP 54 MLD and the daily total water demand of gwalior city for various sectors is 25.52 MLD (GMC, 2015). There is a gap between demand and supply of water in Gwalior city. To full fil this gap analysis of the existing water body along with the drainage water availability is necessary The drainage of the city can be divided into four major catchments for the purpose of the development of catchment management strategy. Five additional catchments of monitoring points have been identified. Two of these catchments lie with in the Morar river catchment while three in the Swarnarekha River catchment. There are 88 drains (9 large, 20 medium, 59 small drains) drains flowing through the city to join the river. Table -2 explain the 9 large drains of Swarnarekhariver with and their GPS locations.

Table-2: Drains in Swarnarekha River

S.no	Name of Drain	Origin point	Area covered	End Point	GPS location
1.	Bajranggadh drain	Sindhi colony	Tilak Nagar	Swarnarekha River	N 26011.311 E 78008.116
2.	Jinsi Drain	Lakadkhana	Sindhi colony jinsi road no.3	Swarnarekha River	N 26012.330 E 78009.819
3.	Light house Drain	Jai roy hospital	Bazaremahal gate bridge salaughter house behind Hanuman takies	Swarnarekha River	N 26012.335 E 78009.828
4.	Naugoja	nirdhan	Naugoja road shindeychawni area, Bijasenmohalla slum area, Medical college	Swarnarekha River	N 26012.327 E 78009.833
5.	Kalasairnala	BajariaGospura	Harijanbasti, Mahavirchowk, Fish market ,Subhasnagar	Swarnarekha River	N 26011.987 E 78008.528
6.	Dholibua pool na			Swarnarekha River	N 26011.987 E 78008.528
7	Gandhi Nagar Nala	Gandhi Nagar		Swarnarekha River	N 26012989 E 78010.532
8.	DhanmeelNala			SwarnarekhaRiver	N 26011.311 E 78008.117
9.	Hanuman bandh			Swarnarekha River	N 26011.266 E 78008.022

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Table-3: Drains in the Morar River

S.No	Gwalior Drains	Origin Point	Area Covered	End Point	GPS Location
1.	Nadikarapta bridge	Nadikarapta	Riverview colony	Morar River	N 26013.349’ E 78013.220’
2.	Harnampura Drainage	Harnampura	Shiv Nagar	Morarariver	N 26012.627’ E 78012.727’
3.	Gandhi nager Drainage	Gandhi Nagar	Bathammoh alla	Morar River	N 26012.627’ E 78011.573’
4.	Near SVM School	Ganesh colony	SuryaBihar Colony	Morar River	N 26014.879’ E 78013.038’

Figure -1 represent the route map and figure -2 represent point map of different water bodies in Gwalior city.

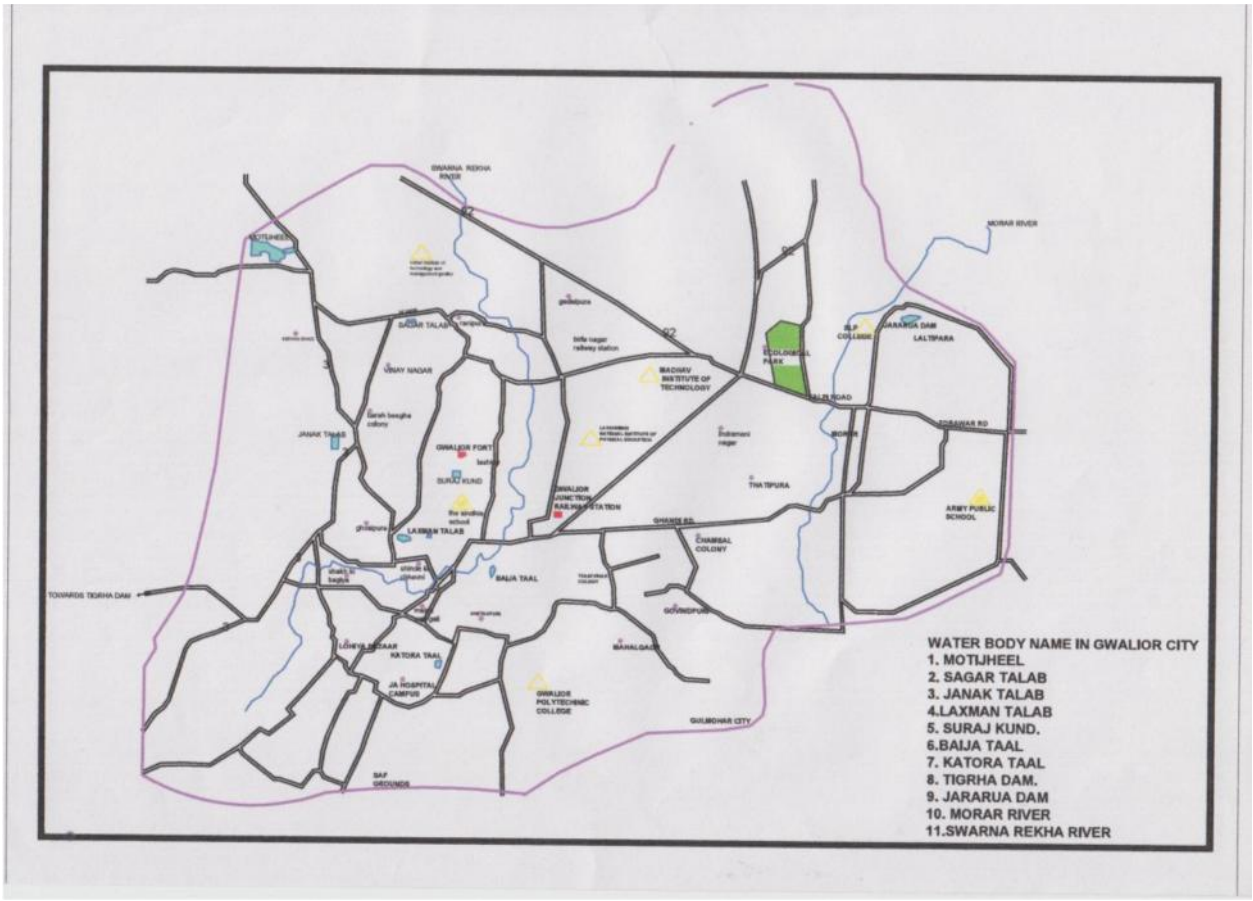

Fig-1: Route map of water bodies

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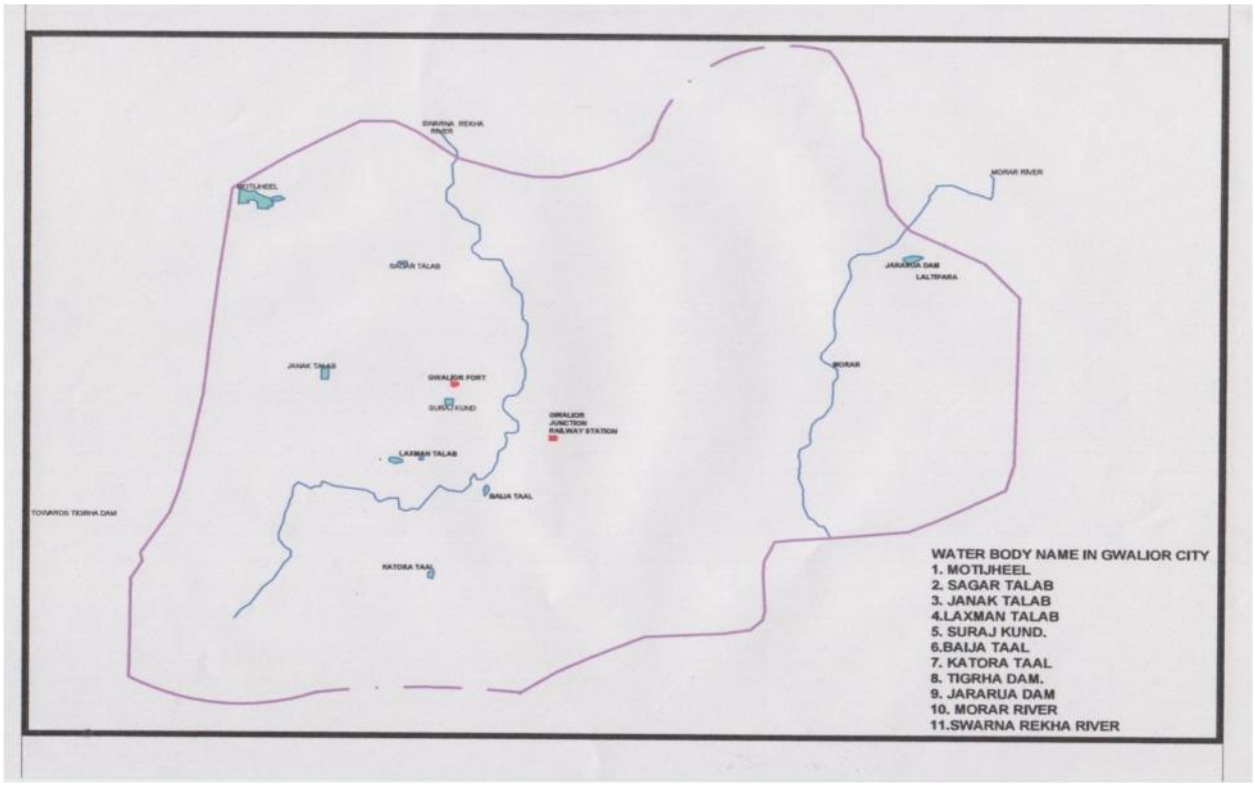

Fig-2: Point map of water bodies

Figure 3, 4, 5 and 6 shows the exact location of all the water bodies which are considered for the study with their exact GPS location. Figures are as follows:

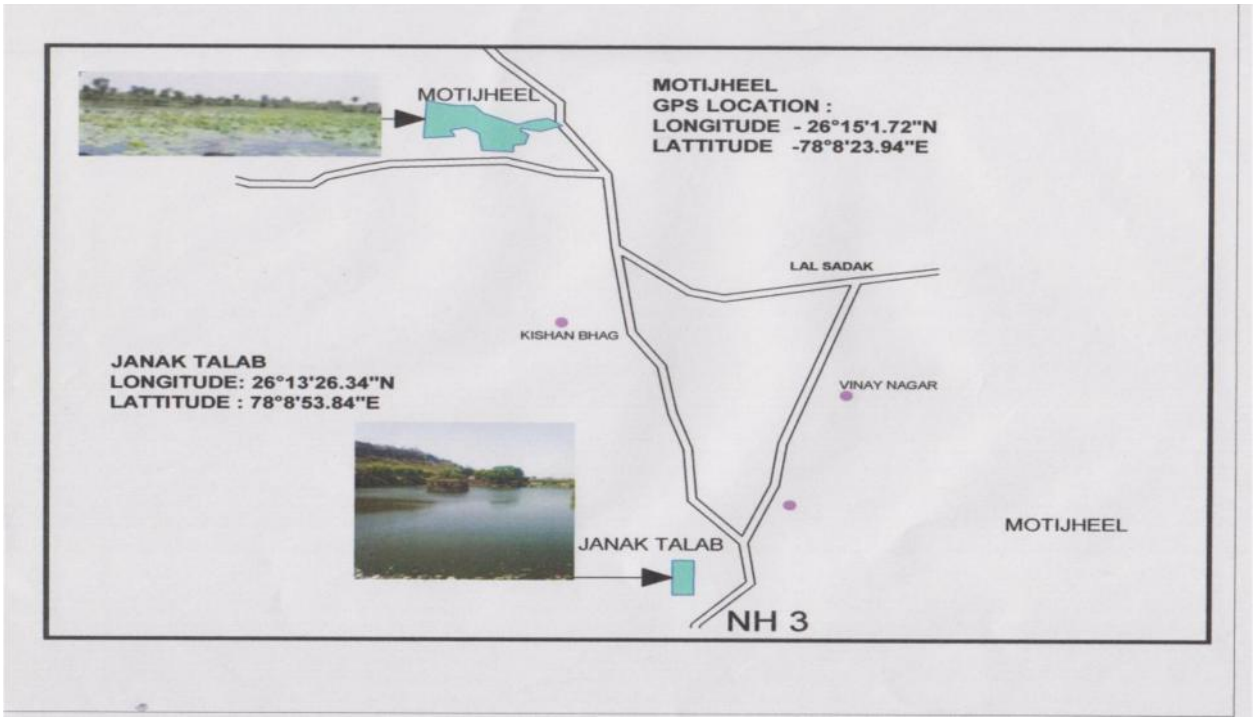

Fig-3: GPS location of Motijheel and Janaktal water body

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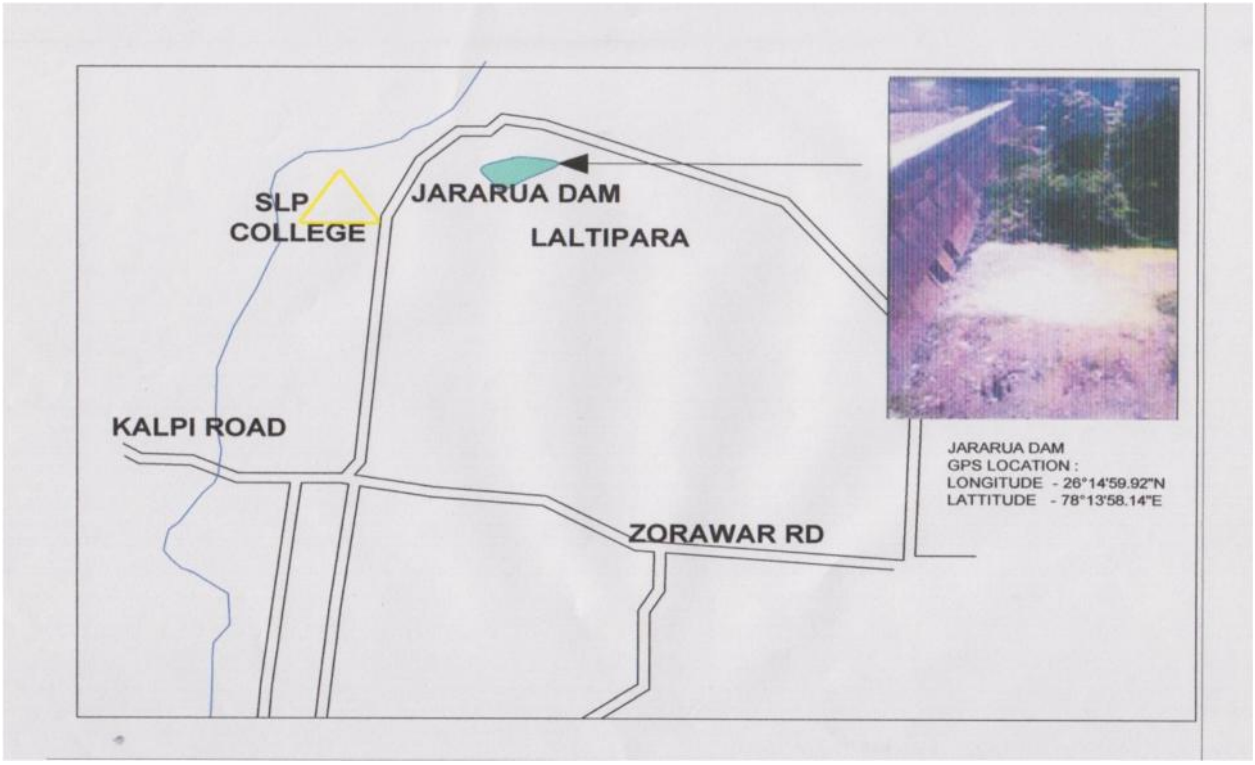

Fig-4: GPS location of Jararuadam water body

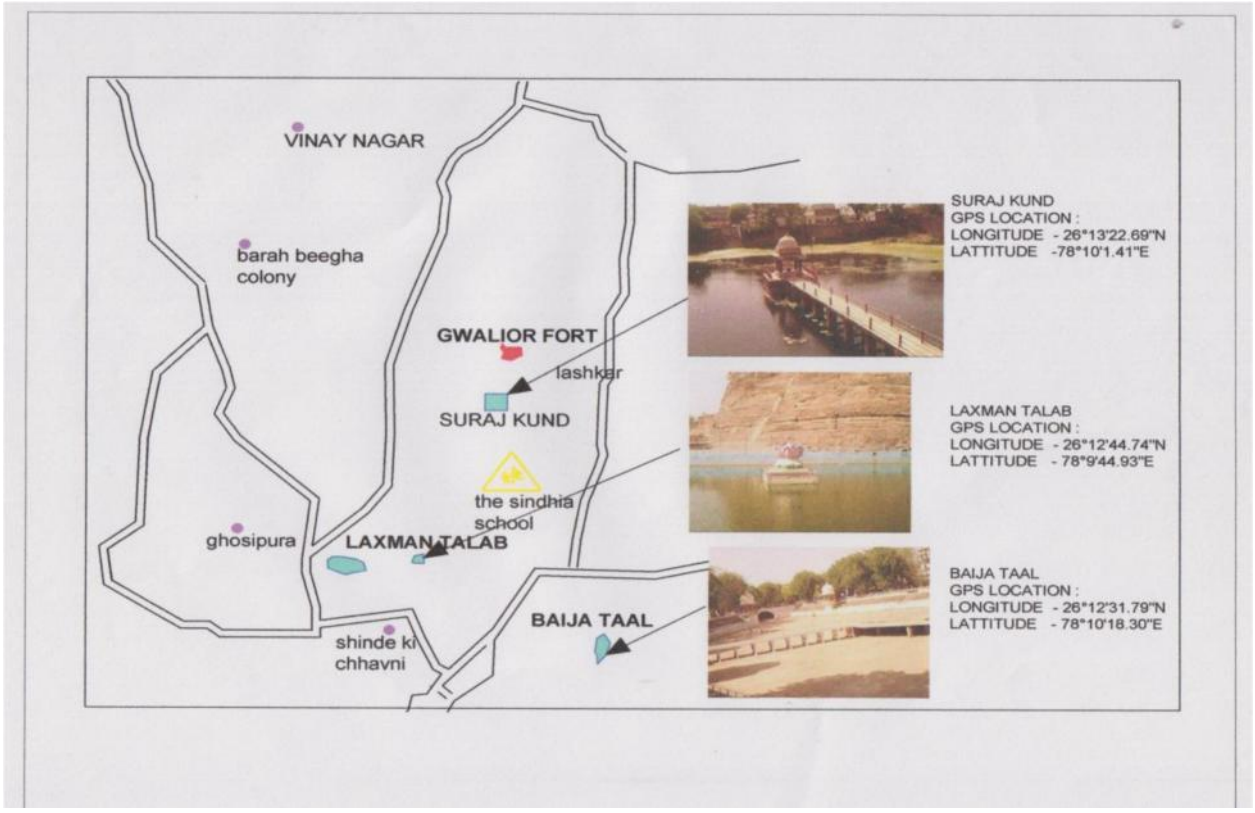

Fig-5: GPS location of SurajKund, Laxmantal and Baijataal water body

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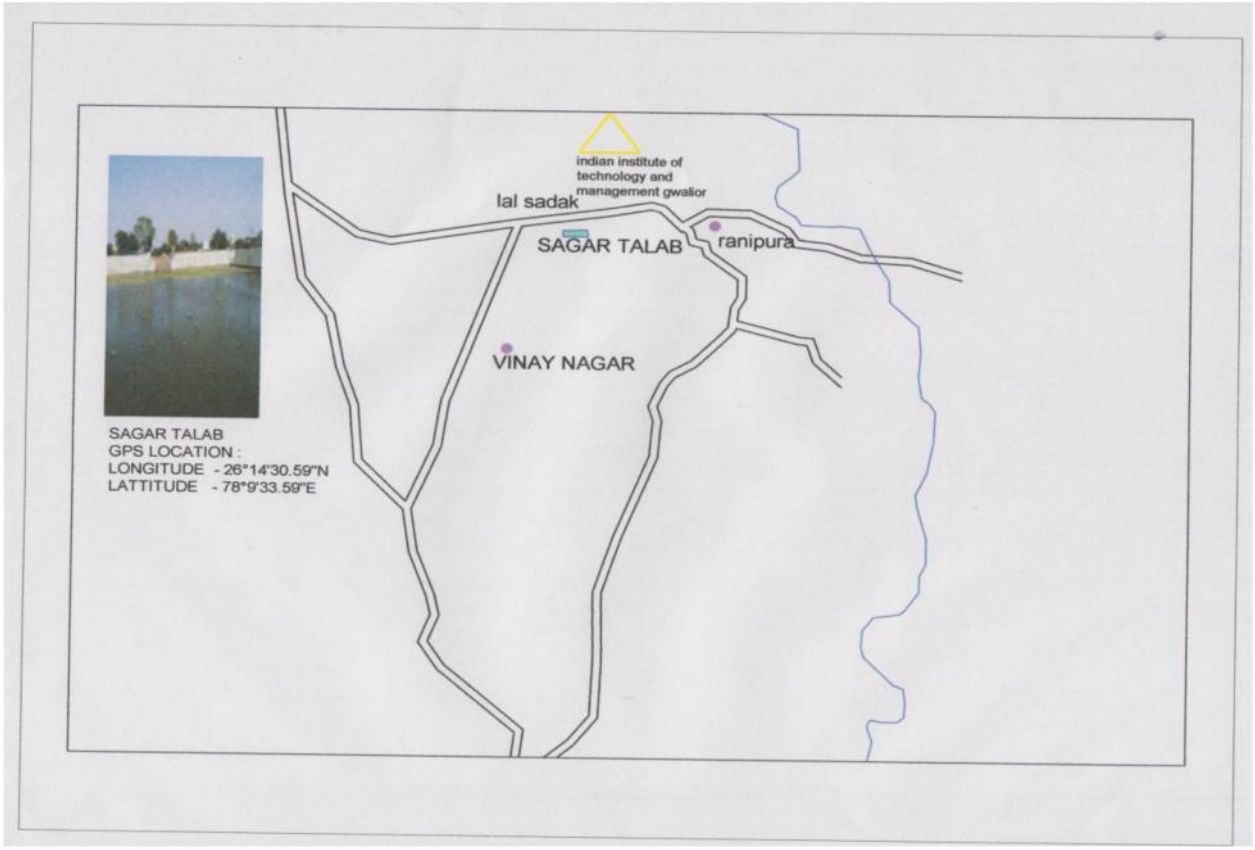

Fig-6: GPS location of Sagartal water body

The detailed observation of the studied water bodies are as follows:

➢**TIGHRA DAM :**Tighra Dam creates a freshwater reservoir on the bank River, about 23 km from Gwalior It plays a crucial role in supplying water to the city. It has full facility to provide peoples for amusement purpose such as Boating, Fishing and all types of food items are available.

➢**SWARNAREKHA RIVER :** The discharge of waste water in these drainage of waste water (sewage) in these drain as overflow from septic tanks or leakages from broken sewerage lines and dumping of solid waste in their catchment cause organic pollution due to anthropogenic activities and direct influencing the water quality of river. Small scale industries along the river add to toxic chemical pollution in it. Solid waste dumping in the open area in the catchment affects the water quality.

➢**MORARRIVER (KALPIRIVER):** The Morar River (Kalpi River) originated from Ramaua Dam flowing through Morar sub city of Gwalior region. The pouring of wastes contaminates the river and decreases biodiversity. The Morar river while flowing through the city area receives the discharge of waste water (sewage) through no of drains as over flows from septic tank and leakages from broken sewage lines and dumping of solid waste in their catchments cause organic pollution which directly have adverse impact on the water quality of river. Discharge of hospitals and nursing homes into the river into Toxic pollution. Inflow of Agriculture runoff into the river carrying Fertilizer and Pesticides residues causes nutrient enrichment and pollution. Solid waste dumping in the open area in the catchment affects the water quality. Nutrient enrichment is causing Growth of Aquatic weeds.

➢**MOTIJHEEL:** Motijheel is situated near the railway station and has also a Motijheel treatment plant near the lake .now a days Motijheel is much polluted due to domestic sources such as washing clothing etc. and industrial effluents such as harmful chemicals many algal blooms are found in jheel so excessive algal blooms

carry eutrophication process takes place. So the human intervention, water contaminated by pathogens cause disease like chloral Typhoid etc. hence the water becomes unfit for drinking use.

➢**JANAKTAL:** Janaktal is located in a western part of the city. The Tal is a spot of recreational activities of the town and also has religious due to the presence of Hanuman temple and other temples which are situated on a bank of this lake. The major problems of the waterbodies are

solid waste dumping, washing, bathing activities inflow of household's untreated waste water, cattle wallowing and grazing.

➢**JADERUA DAM :** While flowing through the city areas receives the discharge of waste water (sewage) through no of drains as over flows from septic tanks and leakages from broken sewage lines and dumping of solid waste in their catchments cause organic pollution which directly have adverse impact on the water quality of river. Discharge of hospitals and nursing homes into the river into Toxic pollution.

➢**SURAJKUND :**It is situated in Gwalior fort. The condition of this waterbody is very bad. The major problems of the waterbodies are solid waste dumping, washing, bathing activities inflow of household's untreated waste water as harmful chemicals many algal blooms are found.

➢**LAXMANTALAB :**There are 100 meter on the fort hill but here are many facility provide by municipal corporation Gwalior, Madhya Pradesh vidhyutmandal. The water is not more polluted and it is covered by boundary. The major problems of the waterbodies are like solid waste dumping, washing, bathing activities inflow of household's untreated waste water, are not found there.

➢**BAIJATAAL TALAB :**It is situated near Chetakpuri and it has a stage in water. This is very famous stage for functions in Gwalior. No environment problem are found there, previously it was filled with water but now the Tal is dry due to unavailability of fresh water.

➢**SAGARTALAB:** Sagartal also has religious importance due to presence of temples which are situated in the bank of the lake this waterbody is under control of municipal authority. Lake is partially covered with aquatic weeds. Lack of proper solid waste management system in the fringe area of the lake reduces water storage capacity of the lake and also add contaminants.

5. DISCUSSION: Water is renewable natural resource due to ever increasing industrialization, urbanization this precious resource is continuously under stress. The local Gwalior water resources are not far from these problems. There are nine water resources inside the Gwalior city some of which are natural such as Tighra, Sagartalab, Surajkund, Jaderua dam, Swarnarekha River, Janak Tal and MotiJheel. LaxmanTalaiya and Baijataal are man-made. All these water sources are responsible for water supply to fulfil the demand of Gwalior city. In this research AutoCAD map is generated to show their flow and exact location of all nice water bodies through GPS data. These maps also consumes the current photograph of water bodies. AutoCAD map also represent all the drains of waterbodies which comes under the Gwalior nagarnigam. These water bodies having the pressure of increasing population, loss of forest cover, untreated effluent discharge from industries and municipalities, insecticides etc. are causing water pollution. This study is first of its kind which focused on available water bodies inside the Gwalior city. To support the increasing demand and population growth it is necessary to preserve all these water bodies foe better future.

6. CONCLUSION : This study attempted to identify the existing fresh water resources inside the Gwalior city. Freshwater resources comprise the single most important class of natural endowments enabling its economy and its human settlement patterns. The freshwater resources comprise the river systems, groundwater, and wetlands. Each of these has a unique role and characteristic linkages to other environmental entities (MoEF, 2009: 28). GPS approach has been used for the integration of various geospatial data, which plays major role in this study. GPS data is used to generate the map which occupies all the nine water resources. The overall shows that all nine fresh water resource having very critical status and approaching towards their decline. To fulfil the gap between supply and demand. It is necessary that immediate action has

to be taken to preserve these water bodies because to ensure the long term sustainability of water resource the focus of water management needs to shift from traditional supply side to demand side management due to their limited availability.

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