

# Rejuvenation and Utilization of Surface Water Sources in Gwalior City

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**Abstract** - Due to massive demand of land for various developments such as commercial, residential etc. this leads to large dependency on ground water level through which over exploitation is done. Rainfall is the main source of recharge of groundwater and water table normally rises in response to rainfall in a specific period. This type of system keeps on changing which leads to reduction in number of water bodies which causes reduction of ground water level that has a high impact in drying of various kunds, taal etc. that are situated in many parts of urban and rural areas. So, purpose of this research paper is to promote recharging of surface water sources through rain water and storm water. According to National Water Mission, we have identified unutilized sources of water in Gwalior city and by upgrading, identified source of water to collect and store storm water or rain water by promoting rejuvenation through impressiveness of water bodies in urban landscape, rain water harvesting etc. Apart from these, surface water bodies help in maintaining micro climate at comfort level in their surrounding areas. Hence, at times when climate changes and urbanization leads, value of these surface water bodies and their maintenance at healthy levels, becomes extremely important.

**Key Words:** Surface water sources, Water body rejuvenation, Taal, Storm water, Water quality

## 1. INTRODUCTION

Water plays an essential role in the functioning of existing human life. It is important for laying activities such as economic, social, culture and environmental. Lakes, ponds, rivers, kunds, Taals are essential components of surface water resources. Due to heavy growth in industrialization and urbanization, there is a heavy deterioration of water bodies that includes discharge of sewage, industrial solid and liquid waste and chemically rich agriculture runoff. As a result of which the deterioration are visible in form of loss of biodiversity and low grade water quality. Urban Indian cities are facing water crisis due to:-

- Loss of Water shed
- Increasing pollution Levels
- Encroachment
- Deteriorating water levels
- Illegal constructions
- Lowering of water table
- Dire lack of ground water recharge

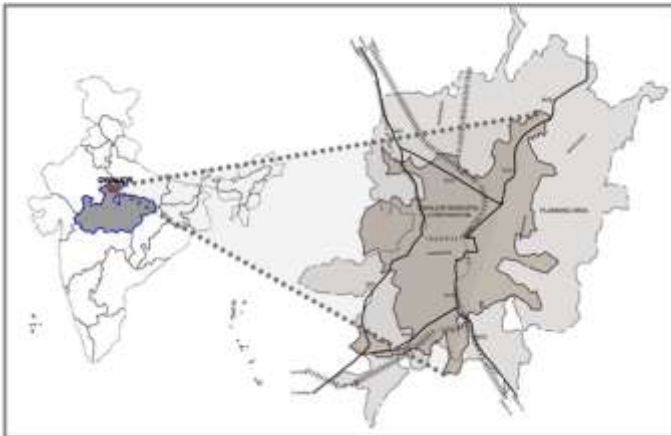
Urbanization results in heavy growth of urban areas and causes lower down of agriculture areas, debarment of water bodies, and irregular laying of drainage system that causes rapid decline in availability of water resources. Due to lowering down of environmental consideration in development plans and large amount of area and importance is given to physical planning, this leads to the decaying of water resources available in India causes the loss of identity of other resources for existence. Rejuvenation of water resources is inclusive of many policies, strategies for commanding the protection of hydrosphere to meet the demands of upcoming generations. The usability of water depends upon population, size of household growth etc.

Due to rapid change in climatic conditions have increase burden on natural resources in manufacturing also in agricultural growth. The basic aim of rejuvenation of water resources are as follows:

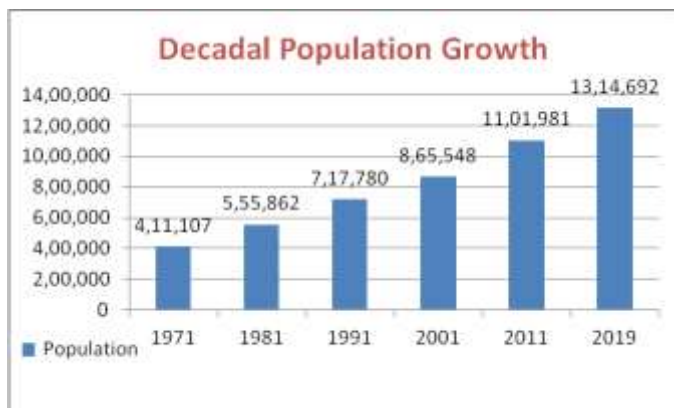
- For future generations, safeguard the accessibility of water
- Conservation of energy due to pumping of water, treatment of polluted water constitutes a essential role in collecting energy in a specific amount
- Due to minimizing the water consumed by human beings and also conserving their habitats, It helps to save fresh water habitats for animals and migrating humans including its quality of water

## 2. STUDY AREA

Gwalior declare to be the fourth largest city that is situated in northern side of Madhya Pradesh, at 26.22° N latitude and 78.18° E longitudes. The average elevation of Gwalior is 211 m. According to the data of 2011 census, Gwalior had an amount of population of 10,69,276 with decadal growth rate of 27.32 percent. According to the data as per census of 2011, density of city is 5478 people/ sq. km. Gwalior district supervisors declares that it consist area of 604 square kilo meters of areas. At present the population of the city is estimated to be 13,14,692. The availability of water as per capita is 190 lpcd (Gwalior Municipal Corp. Gwalior). Water demand for domestic purpose is 86.34 percent, for non domestic uses is 1.42 percent, for industrial uses is 0.24 percent as well as for other uses is 12 percent.



**Fig -1:** Location of Study Area (Gwalior)  
(Source: Gwalior Municipal Corp.)



**Chart -1:** Decadal Population Growth  
(Source: Gwalior Development Plan and Census)

### 3. NEED OF REJUVENATION OF WATER BODIES

The amount of natural resources is limited so because of industrialization and global warming it is duty of every citizen to preserve the natural sources natural resources and also to find out ways to employ various resources in appropriate manner. Now, it's time to focus on the restoration of our natural resources. Saving of water and its resources helps to preserve our environment. It decreases an amount of energy that is required to proceduring and delivering of water that helps in reduction of pollution and in preserving resources. If we save water, we are helping the future generations through ensuring an adequate water supply. An urgency for detection of problem and providing measures for recovery at local level.

- Preparation for preservation and sustainability to acquire health of ecosystem
- To provide surety for long-term sustainability of resources i.e., water
- A paradigm shift of management for water should be from traditional supply to demand side

- Reduction of losses in the system
- Improvement in operational efficiencies
- Promoting reasonable usage of water resources
- Distribution of resources should be done equally

### 4. PRESENT SCENARIO OF WATER SUPPLY SYSTEM IN CITY

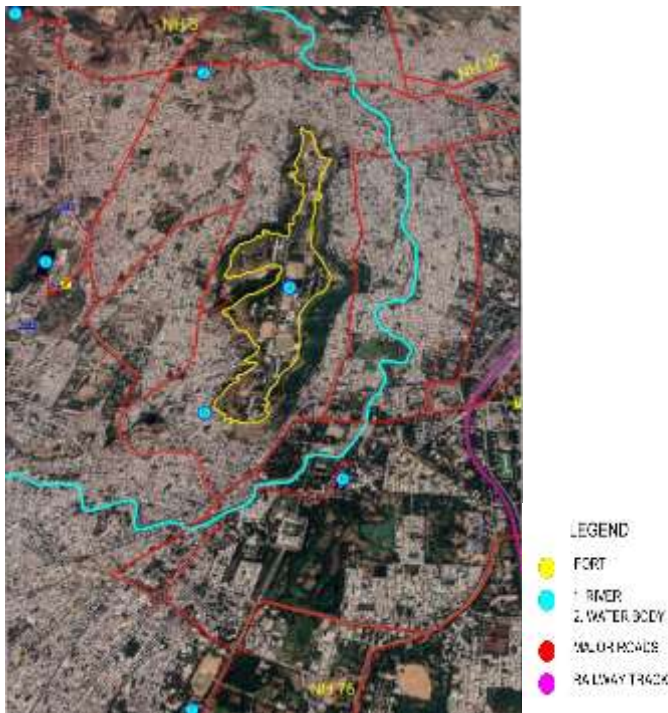
The supply of water in city essentially depends on *Tighra*, *Kaketo* reservoirs and also groundwater. These are considered to be the source of water supply in city and also used in irrigation and other activities. *Tighra* dam was built on river *Sank* in 1916. Supplies from *Tighra* dam are augmented from another reservoir of *Kaketo* dam on *Narver* River. The live storage available at *Tighra* dam is 4382 MFT<sup>3</sup> (340.82 MLD). The average monsoon yield for *Tighra* catchment is 2044 MFT<sup>3</sup>. The catchment area of reservoir is 265 sq.mt. Availability of water from *Tighra and Kaketo* dams is 190 MLD. Water is supplied into old and new water treatment plants located in *Motijheel*. Water is supplied by gravity from *Tighra* reservoir through twin 1200 mm pipelines. The water is taken to two treatment plants situated at *Motijheel*. Old water treatment was commissioned in the year 1930 and expanded a number of times and has installed capacity of 15 MGD (68MLD). The new water treatment plant at *Motijheel* was commissioned in the year 1986 and having capacity 15 MGD (68MLD). The ground water is also used as supplementary source and supplies about 6 MGD (27MLD) through nearly 1000 tube wells within the city limit. (Source: Gwalior Municipal Corp.)

### 5. MAJOR FINDINGS

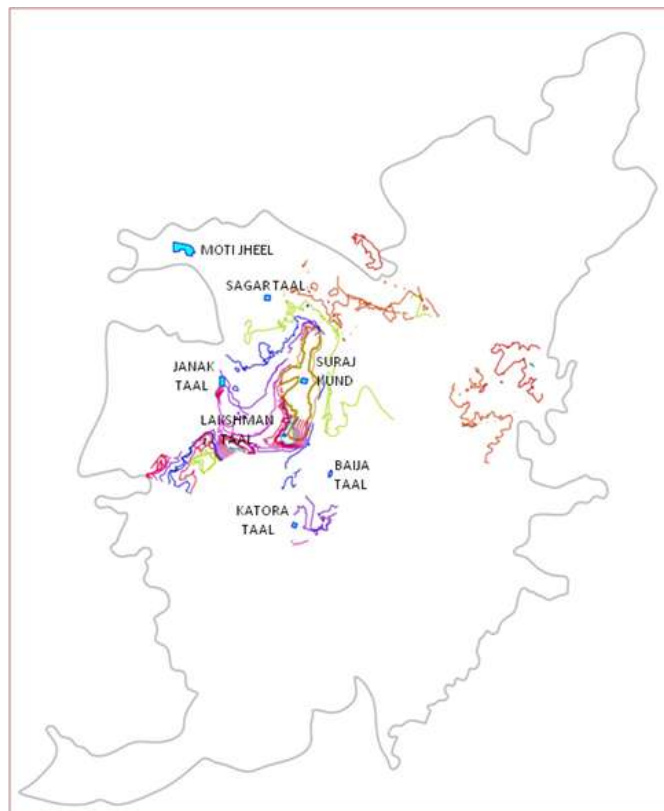
Daily water demand of city for different zones is 155.52 MLD while total supply of water on daily basis is 130 MLD. There is a huge difference in demand and supply of water in city. To fulfill this difference, analysis of the surface water body is necessary. The detailed observation of the surface water bodies of the city are as follows:

**MOTIJHEEL:** *Motijheel* is situated near railway station and has also near *Motijheel* treatment plants. *Motijheel* is heavy polluted due to increase in domestic activities such as bathing, washing clothing etc. and also due to industrial effluents such as algal blooms were found in *jheel* so eutrophication process takes place. Hence, water is contaminated by pathogens. So, it becomes unfit for drinking. *Motijheel* has a capacity of 90ML.

**JANAK TAAL:** *Janak Taal* is located in western part in city. This kind of places are used for recreational activities in town and also has religious values. Major issues with *Janak Taal* are solid waste dumping, washing, bathing etc. The capacity of *Janak Taal* is 275.11 ML.



**Fig -2:** Water bodies Location in Gwalior  
(Source: Wikipedia)



**Fig -3:** Topography map of Water bodies  
(Source: Wikipedia)

**SURAJ KUND:** It is located at central part of Gwalior Fort. The current state of water body is poor. Major issues with water

bodies are solid waste dumping, washing activities, bathing; inflow of household's untreated waste water etc. causes formation of chemically harmful substances.

**LAKSHMAN TAAL:** Water body is situated near Fort hill. The water is less polluted and it is embanked by boundary wall. Major issues with the place that it is under religious aspect for Lord Hanuman. The capacity of Lakshman Taal is 4.80 ML.

**BAIJA TAAL:** It is located near Motimahal and has a stage for cultural events in central part of water body. No environment disturbances are found. At present it is filled with water by the GMC but now a day the Taal area is dried due to non-availability of fresh water. The capacity of Baija Taal is 66.25 ML.

**SAGAR TAAL:** Sagar Taal which is situated in the bank of lake also has religious significance due to high availability of temples. It is controlled under Municipal Corporation. Aquatic weeds are spread all over the area of Taal in partial manner. Due to throwing of various waste materials that reduces its capacity and contaminates water. The capacity of Sagar Taal is 219.10 ML.

**KATORA TAAL:** Katora Taal which is situated near the Maharani Lakshmi Bai College has high religious importance because of availability of Achleshwar Mandir nearby. This water body is also under the control of Municipal Corporation. This water body is used as a recreational place. The capacity of Katora Taal is 12.42 ML.

## 6. PROBLEMS & THREATS

The surface water bodies in Gwalior city become deteriorated due to certain activities. Some of major reasons for deterioration are:

- Dumping of all kind of wastes
- Siltation of water spread area
- Change of land use pattern
- Encroachments (unauthorized construction activities)
- Poor maintenance of lakes
- Absence of awareness regarding water bodies, environment and nature etc.

The degradation of the water bodies is further categorized as structural and non-structural destruction. Various structural damages are recited below:

1. Destroying of bunds
2. Encroachments of lakes
3. Growth of water weeds

Non- structural destruction is mentioned with respect to quality of water and its ecosystems:

1. Throwing of solid waste

2. Dischargement of various wastage of water
3. Eutrophication
4. Deposit of silt due to catchment degradation

- Bioremediation
- Habitat Restoration

## 7. DELINEATED WATER BODY

After the consideration of problems & threats for different surface water sources, the *Janak Taal* has been selected for rejuvenation process on the basis of following criteria:

1. **CAPACITY** *Janak Taal* has a sufficient capacity of water which can be used when there is water crisis in the city.
2. **LOCATION** The location of *Janak Taal* is suitable because that ward faces heavy crisis of water. In addition to it, the wards also cover such areas that are also suffering water crisis.
3. **WATER DEFICIT** In case of worst situation, the *Janak Taal* can only be able to supply water in the wards during the crisis period (*May-June*) in summer.
4. **POPULATION** *Janak Taal* is situated in the ward which has high density along with the wards situated nearby.

## 8. PROPOSALS FOR REJUVENATION OF JANAK TAAL

- **DEWATERING**  
It means complete separation of water from soil in which bottom of water body should be exposed to sunlight for minimum fifteen days.
- **DEWEEDING**  
The removal of growth of weeds from water body including peripheral area is essential for cleaning water body.
- **DESILTING & EXCAVATION**  
This process is done in order to achieve better percolation and also increase volume of water body.
- **DIVERSION OF WASTES**  
It includes change the movement of flow of wastes to improve quality of water such as increase in transparency & species diversity and reduction of nutrients.
- **CAPS & COVERS**  
It is used to clean materials such as sand, gravel, rock to keep it in bottom of water body. It helps in achieving a new clean habitat for bottom dwelling habitat.
- **DEVELOPMENT OF CATCHMENT**
  - Fencing
  - Construction of Embankments/Bunding



Fig -4: Proposed Layout of *Janak Taal*  
(Source: Wikipedia)

- **SETTING UP OF TREATMENT PLANT**  
Location of treatment plant is proposed within peripheral area of water body.
- **CONSTRUCTION OF OVERHEAD TANK**  
Construction of overhead tank is proposed within peripheral area of water body.
- **CONNECTION WITH THE SUPPLY OF CITY**  
After process of rejuvenation, treated water from water body can be connected to existing water supply system.

## 9. STRATEGIES & RECOMMENDATIONS FOR REJUVENATION OF WATER BODIES

1. Identification of Water Body/Taal in urban areas. Water Bodies has to be marked as per municipal assets i.e., Water Bodies for common objectives including mentioning of their respective area and location.
2. The border area of Water Bodies should be properly fenced for protection from unwanted encroachments. If any encroachment exists on shore side, it needs to be re-located through consulting with people that are affected.
3. The inlet and outlet of Water Body has to be recognized and need to be observed at regular intervals. Any kind of obstruction in or near inlet and outlet of respective water body should be eliminated.
4. Any outfall of domestic/ industrial sewage into the Water Body should be prevented.
5. Actions such as cleaning of Water Body that involves de-silting, de-weeding, aeration, reduction of nutrient, removal of floating etc. has to be taken up under consideration.

6. Desired treatment for catchment area such as afforestation, drainage of storm water etc., has to be executed.
7. The surrounding area of the Water Body/Taal has to be announced as an eco-sensitive area. Hence, dumping of wastes should be under punishable offence.
8. The preferable quality of water in Water Body has to be observed on weekly as well as monthly basis by ULBs.
9. For providing knowledge among people, various signage boards has to be exhibited in the surrounding areas of Water Body/Taal.
10. Common people along with ULB's has to take into account the characterization and preservation of catchment areas, feeder channels etc.
11. A clear vision plan of Water Body/Taal with respect to level of rejuvenation of Water Bodies that has to be developed by ULB.
12. The participation of Stakeholder and their capacity building should be an important tool for effective controlled management of Water Bodies.
13. Urging ban on utilization of 'potable water' for other purposes and developed effective and illustrated system to use potable water as drinking water.
14. An effective Storm Water Management Plan has to be composed or developed so that storm water can be treated through various techniques such as sedimentation basin etc.

## 10. CONCLUSION

The study focused to figure out present fresh surface water resources in city. Clean water resources comprise of an unique most important class of natural characteristics of water resource empowering its economy and patterns of human settlements. It comprises the river systems, water body/taal, groundwater, and wetlands. All seven surface water resources consist of unfavorable condition and approach towards diminishing. To overcome difference between demand and supply, it is important to provide necessary action that has to be taken for preservation of water body. The long term impact of rejuvenation is to ensure long term supportability of water resource that main focus of management which needs to be shifted from traditional supply to demand side due to their availability in the environment on limited basis.

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