



# Mitigation of Problems of Overusing Water For Domestic And Irrigation Purposes: A case study at village level

<sup>1</sup>Shripad P Tohare,<sup>2</sup>Ketki A Jadhav

<sup>1</sup>Junior Geologist,<sup>2</sup>Assistant Geologist,  
<sup>1&2</sup>Groundwater Surveys and Development Agency,  
Amravati, State- Maharashtra, India.

## ABSTRACT

Water is a physical basis for life. Without sufficient water on the planet earth, the existence of biodiversity is highly impossible. Sustainability in water supply can be achieved by understanding the hydrologic cycle. Recent studies on water budget simply state that “A water budget is a basic tool that can be used to evaluate the occurrence and movement of water through the natural environment” The water plan provides information about current water uses and charts a course for water efficiency improvements, conservation activities, and water-reduction goals. A strategic plan establishes the priorities and helps a site or agency allocate funding for water-efficiency projects that provides the biggest impact.

Hence an attempt has been made to calculate water balance in village level using various information gathered from village and measures are being suggested to reduce water demand and increase groundwater recharge.

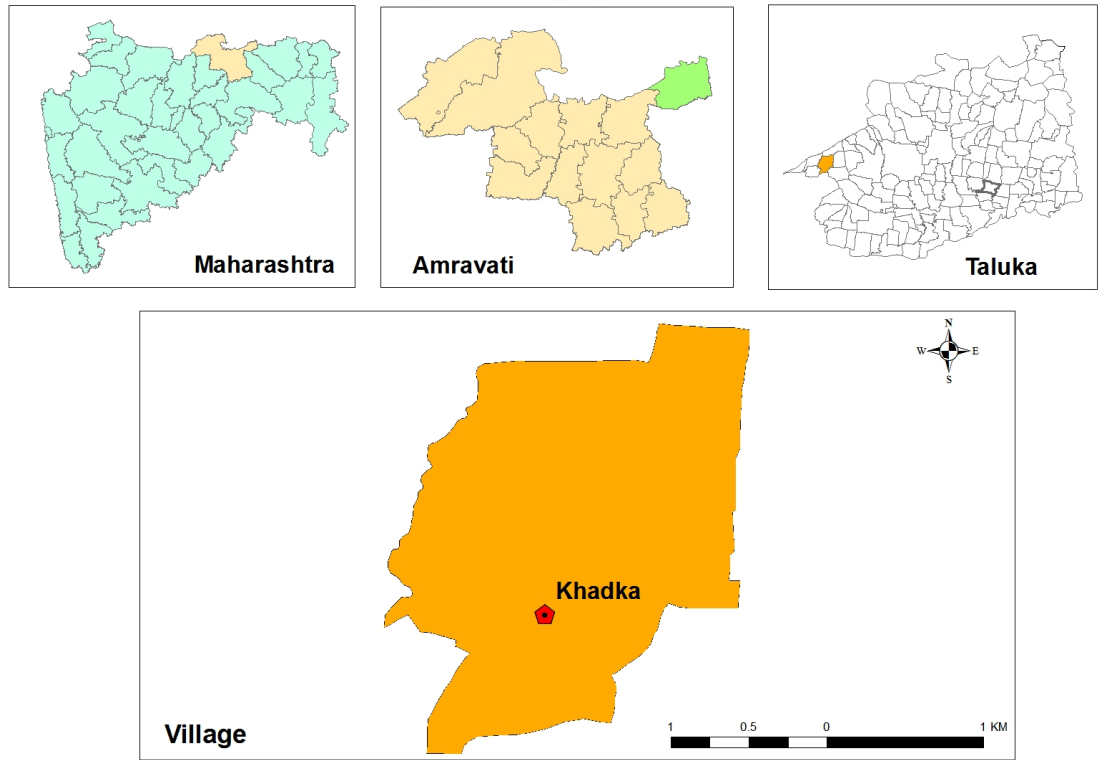
## INTRODUCTION

Increased competition for the limited ground water resource has resulted into the rapid depletion of sources. Which in turn creates unmanageable water scarcity problem during the summer almost in all the agro-climatic zones of India. Keeping village as model watershed, a comprehensive methodology has been adopted to study water balance and suggesting water conservation structures for mitigation of water requirements problems for drinking and irrigation purposes.

## Study Area

Khadka is a Village in Warud Taluka in Amravati District of Maharashtra State, India. It belongs to Vidarbha region . It belongs to Amravati Division . It is located 80 KM towards North from District head quarters Amravati. 18 KM from Warud. 715 KM from State capital Mumbai Khadka Pin code is 444906 and postal head office is Warud .

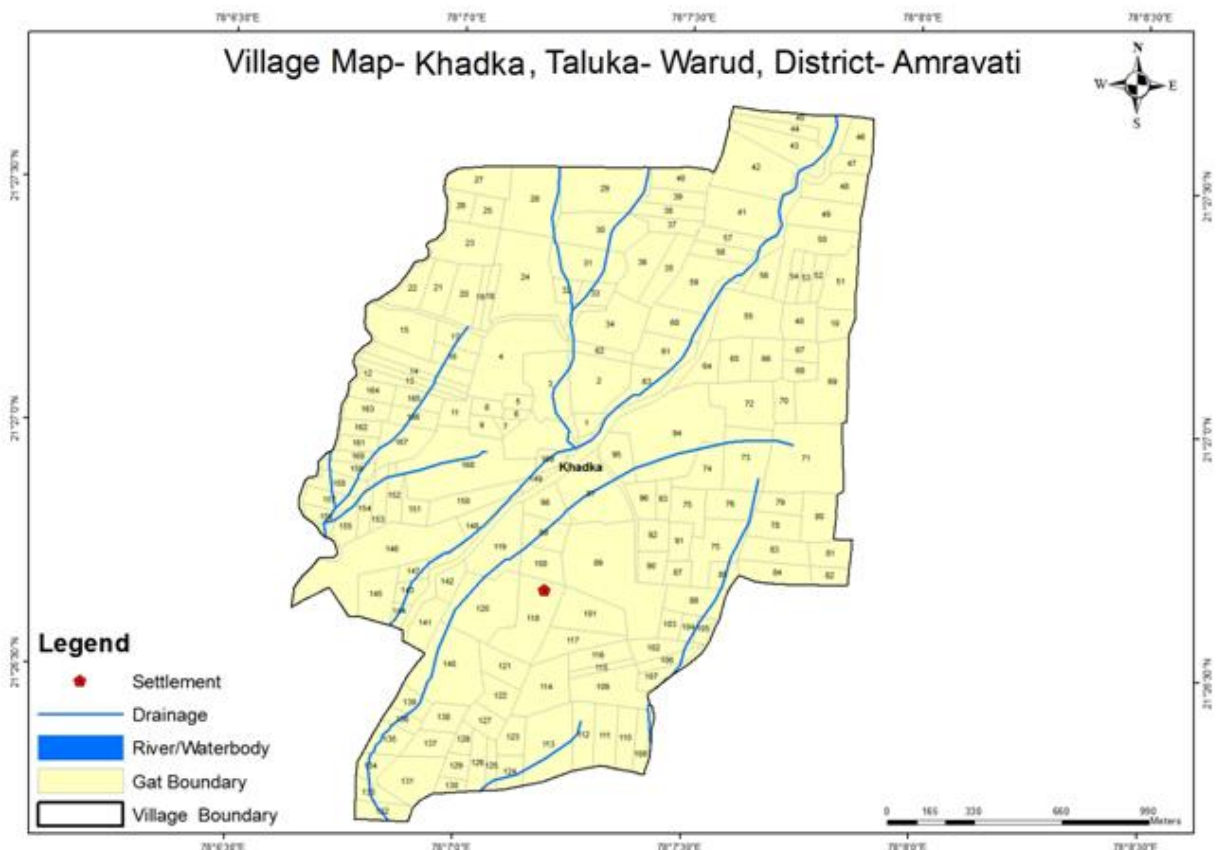
**Khadka Location map of Village, Taluka and District- Amravati**



**Fig. 1- Location Map of village Khadaka**

**AIMS AND OBJECTIVE:**

- I. Detail morphometric analysis is done for the preparation of Drainage map.
- II. Hydrogeological survey is carried out for tracing the aquifer present in the village
- III. Water budget for the same is prepared for estimating the volume of water is being used for various purposes.
- IV. Finally, various water conservation structures are being suggested for fulfill the demand of water for village.



**Fig.2-Village Map Khadka**

The study area os of 397.68 Ha. Out of which total cultivable area in village is 338 Ha. Total population of village is 1465 and number of households are 405. Total 173 dug wells and 06 Bore wells are in use in village. The total cattle population in the village is 417. The village has three dug wells and two handpumps and one public water supply well for drinking purpose.

**Table No. 1**

| Total Domestic water requirement for Human and cattle |                  |                 |
|---|------------------|-----------------|
| Water requirement in Ham                              | Per Day (in TCM) | Annual (in TCM) |
| Human (1465× 365×60 lpcd) as per GEC 2015             | 0.0879           | 32.08           |
| Cattle (417× 365 × 30 lpcd)                           | 0.01251          | 4.56615         |
| <b>Total Domestic water requirement</b>               | <b>0.10041</b>   | <b>36.64965</b> |

**Table No. 2**

| Total Agriculture water requirement for village |            |                            |                   |
|---|------------|----------------------------|-------------------|
| Type of crop                                    | Area       | Water requirement in (Ham) | Water requirement |
| Wheat, Jowar, bajari                            | 217        | 0.25                       | 54.25             |
| Vegetables                                      | 10         | 0.20                       | 2                 |
| Orange  | 220        | 1.20                       | 264               |
| Cotton  | 35         | 0.12                       | 4.2               |
| <b>Total</b>                                    | <b>377</b> | <b>-</b>                   | <b>324.45</b>     |

For the purpose of water budgeting the information of existing water conservation structures and agriculture information is also worked out as follows:

**Table No.3 Existing Water conservation structures information**

| Sr. No | Name of structure | No.      | Total storage capacity in TCM | No. of Filling | Total annual run off arrested (annual storage) in TCM |
|--------|-------------------|----------|-------------------------------|----------------|---|
| 1      | Cement Nala Bandh | 6        | 30                            | 2              | 60  |
|        | <b>Total</b>      | <b>6</b> | <b>30</b>                     | <b>2.0</b>     | <b>60</b>   |

**Table No.4****Information of Existing Farm Ponds**

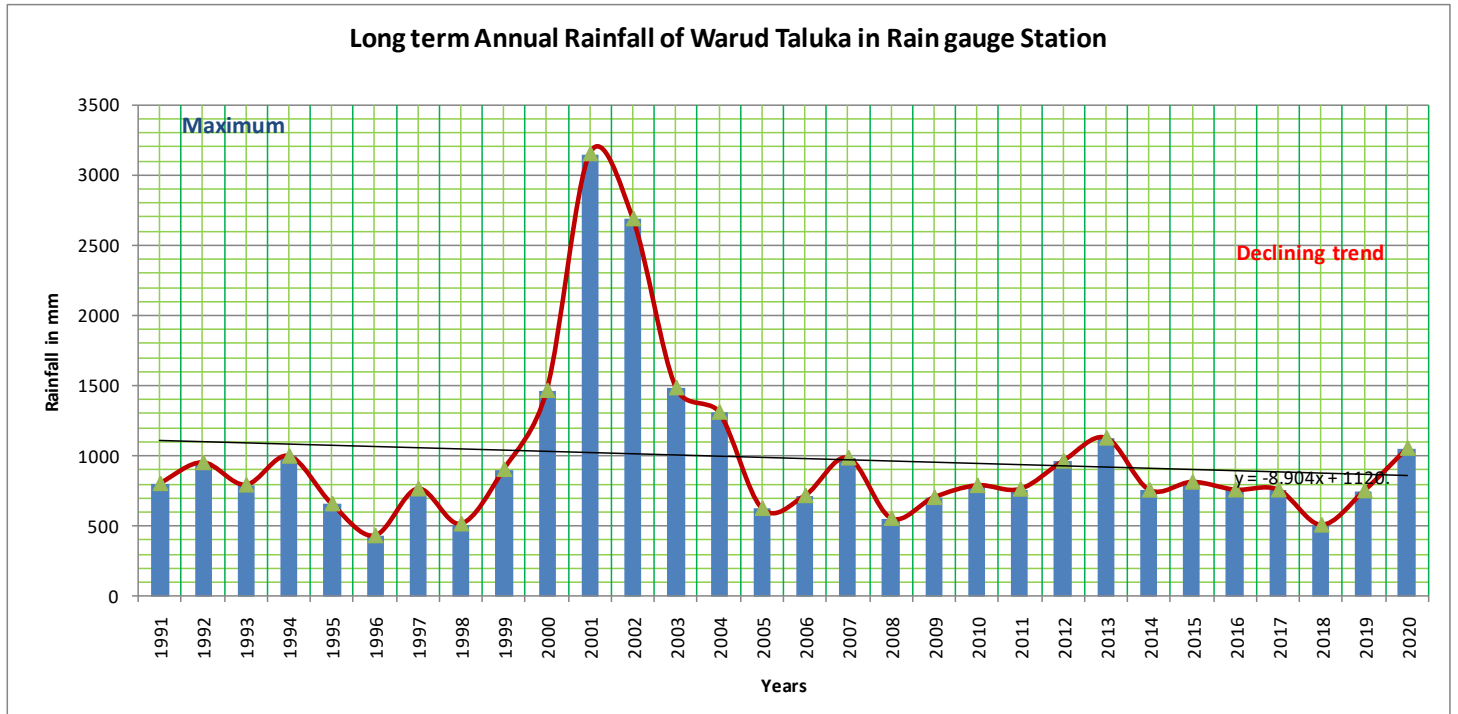
| Sr. No. | Type of Farm Ponds | Average dimensions (m) | Unit storage capacity in TCM | No. of fillings | Total Storage in TCM | Source of Filling |
|---------|--------------------|------------------------|------------------------------|-----------------|----------------------|-------------------|
| 1       | unlined            | 30*30*3(1 no)          | 2.7                          | 2               | 5.4                  | Runoff            |
|         | <b>Total</b>       |                        | <b>2.7</b>                   |                 | <b>5.4</b>           |                   |

Total storage from existing water conservation structures is 65.4 TCM.

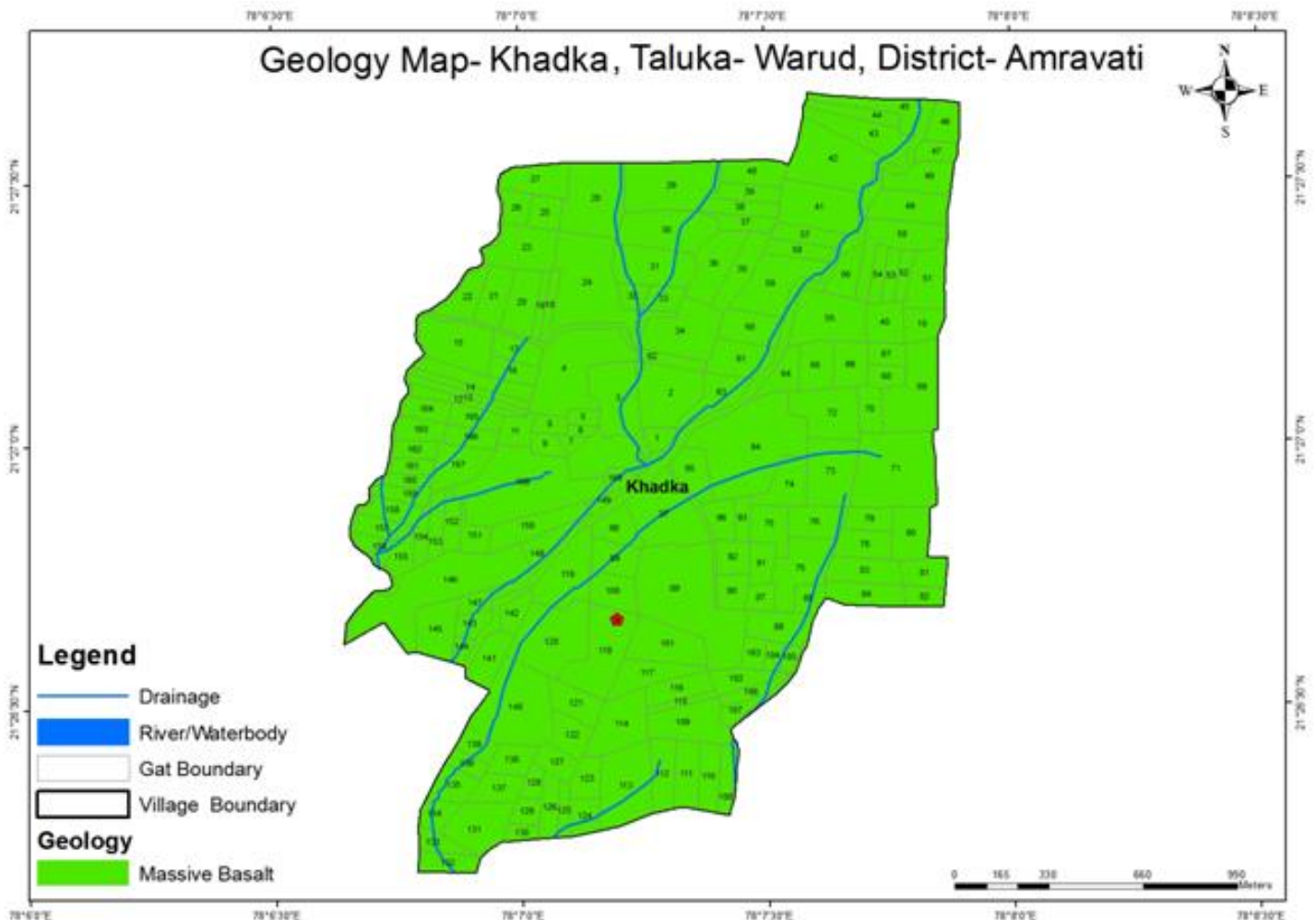
**HYDROGEOLOGICAL DATA ANALYSIS**

**Rainfall analysis**

Area receives rainfall from South-West monsoon during June to sepetember. Normal rainfall at Warud rain gauge station is 782.5 mm. In year 2020 a total of 1052.3 mm rainfall was recorded at Warud rain gauge station. Long term (Yr. 1991 – 2020) analysis of rainfall data collected at Warud rain gauge station shows slightly decreasing trend.



**Fig. 3- Geological Map Khadka**



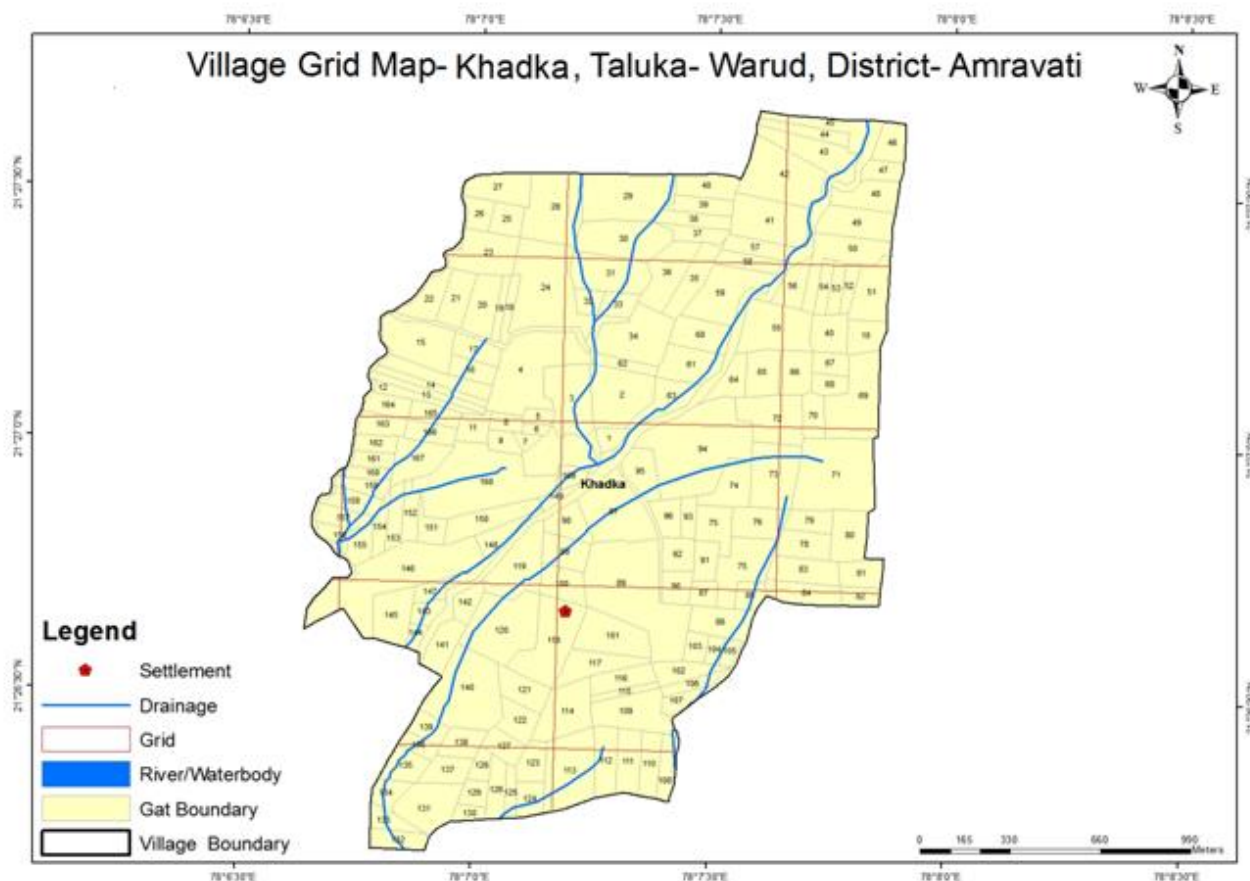


Fig. 4- Drainage Map Khadka

#### WATER CHEMISTRY

Water chemistry analysis of last 3 years shows that groundwater in village is contaminated mainly due to Nitrate .

Table No. 5 Water quality Analysis

| Sr No | Name of Village | Location            | Source | Turbidity in NTU | PH  | EC   | TDS (mg/L) | Alk (mg/L) | Cl (mg/L) | Flu (mg/L) | NO3 (mg/L) | Sulphate (mg/L) | TH (mg/L) | Fe (mg/L) |
|-------|-----------------|---------------------|--------|------------------|-----|------|------------|------------|-----------|------------|------------|-----------------|-----------|-----------|
| 1     | KHADKA          | PARU PROJECT        | DW     | BDL              | 7.1 | 923  | 600        | 300        | 150       | 0.8        | 56         | 70              | 450       | 0.01      |
| 2     | KHADKA          | KUND RIVER BANK     | DW     | BDL              | 7.3 | 1077 | 700        | 250        | 50        | 0.5        | 56         | 75              | 400       | 0.02      |
| 3     | KHADKA          | NEAR KUND RIVER     | DW     | 0                | 7.5 | 1200 | 780        | 320        | 50        | 0.0        | 270        | 35              | 350       | 0.0       |
| 4     | KHADKA          | PAK PROJECT         | DW     | 1                | 7.4 | 1215 | 790        | 280        | 50        | 0.0        | 91         | 42              | 400       | 0.0       |
| 5     | KHADKA          | Z.P. SCHOOL         | DW     | 1                | 7.5 | 1231 | 800        | 260        | 150       | 1.0        | 5          | 3               | 540       | 0.0       |
| 6     | KHADKA          | BAUDHA VIHAR        | HP     | 0                | 6.9 | 1662 | 1080       | 180        | 200       | 1.0        | 189        | 42              | 150       | 0.0       |
| 7     | KHADKA          | BAUDHA VIHAR        | DW     | 0                | 7.2 | 923  | 600        | 330        | 150       | 0.0        | 26         | 35              | 500       | 0.0       |
| 8     | KHADKA          | NEAR KUND RIVER BED | DW     | 1                | 7.8 | 1615 | 1050       | 480        | 125       | 0.3        | 67         | 20              | 300       | 0.1       |
| 9     | KHADKA          | PAK PROJECT         | DW     | 1                | 7.8 | 1231 | 800        | 400        | 75        | 0.5        | 8          | 7               | 250       | 0.0       |
| 10    | KHADKA          | IN HANUMAN MANDIR   | DW     | 0                | 7.3 | 1092 | 710        | 250        | 100       | 0.4        | 74         | 60              | 300       | 0.0       |
| 11    | KHADKA          | BAUDDH VIHAR        | HP     | 0                | 7.3 | 923  | 600        | 200        | 170       | 0.5        | 5          | 10              | 150       | 0.0       |
| 14    | KHADKA          | Near Kund River     | DW     | 0.66             | 7.3 | 1462 | 950        | 250        | 80        | 0.4        | 270        | 91              | 310       | 0.01      |
| 15    | KHADKA          | Pakk Project        | DW     | 0.52             | 7.3 | 1000 | 650        | 250        | 60        | 0.3        | 91         | 25              | 210       | 0.02      |
| 16    | KHADKA          | In Z.P. School      | DW     | 0.36             | 7   | 1000 | 650        | 190        | 60        | 0.5        | 20         | 18              | 360       | 0.1       |
| 17    | KHADKA          | Bauddh pura         | HP     | 0.48             | 7   | 692  | 450        | 190        | 120       | 0.4        | 12         | 30              | 120       | 0.11      |

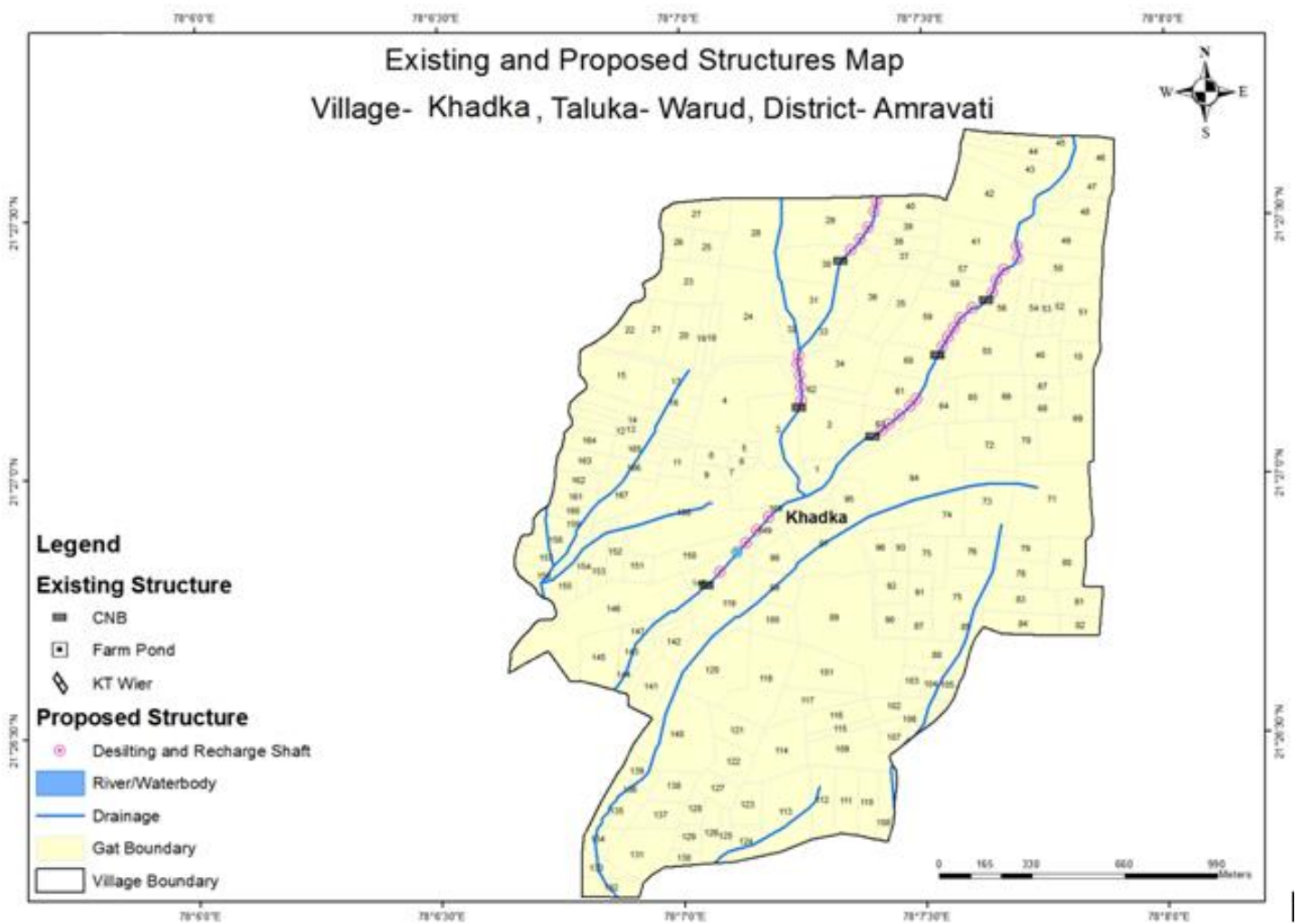


**Water budgeting of study area**

|          |  |                 |
|----------|--|-----------------|
| 1.       | Recharge due to rainfall (area * rainfall in (mm))(397.58*749.7) | 298.06 Ham.     |
| 2        | Total requirement of Drinking water                              | 0.036Ham        |
| 3        | Total requirement for agriculture purpose                        | 324.45          |
| 4        | Total water requirement of village (2+3)                         | 324.486         |
| <b>5</b> | <b>Water Surplus/deficit</b>                                     | <b>- 26.426</b> |

From above table it is clear that the village requires 26.426 Ham water to be recharge in village area so that the water requirement of the study would be fulfilled.

Following recharge measures are suggested to implement in the study area and map for the same is prepared.



**Fig. 5- Existing And Proposed structures Map Khadka**

Table-6 Proposed measures to be taken for GW recharge

| Name of proposed structures | No.       | Total storage capacity in Ham | No. of Fillings | Annual storage in Ham | Anticipated GW recharge in Ham |
|-----------------------------|-----------|-------------------------------|-----------------|-----------------------|--------------------------------|
| CNB Desilting               | 6         | 30                            | 2.00            | 60                    | 24                             |
| New CNB                     | 1         | 15                            | 2.00            | 30                    | 12                             |
| Gabion Bandhara             | 10        | 60                            | 1.5             | 90                    | 36                             |
| Recharge Shaft              | 25        | 5                             | 2.00            | 10                    | 4                              |
| Farm Pond (Unlined 30*30*3) | 12        | 3.0                           | 2.0             | 72                    | 28.8                           |
| <b>Total</b>                | <b>54</b> | <b>11.3</b>                   | <b>9.5</b>      | <b>26.2</b>           | <b>10.48</b>                   |

To overcome the above water deficiency in the area following recommendations can be made

- Optimum planning of GW recharge and need to control the irrigation draft less than the recharge.
- Application of Regulatory measures for not drilling bore wells.
- In this area orange cultivation is on large scale with lot of flood irrigation practices. Water saving irrigation practices like Drip and sprinkler must be promoted for Optimum use of water saving practices.
- There should be annual GW budgeting on regular basis.
- Need to plan cropping as per GW availability.

#### Regulatory measures

- Drilling of new bore wells shall be discouraged.
- Encouraging the use of surface water for filling up of farm ponds rather than GW.

#### Water Saving practices

- Use of water saving irrigation methods like drip irrigation etc.

#### REFERENCES

- [1]C.G.W.B., (1997). Groundwater Resources of Maharashtra .Central Groundwater Board, Ministry of Water Resources. Government of India. Nagpur, Maharashtra.
- [2]C.G.W.B., (1998). Artificial recharge project in orange growing area, Amravati and Banana growing area, Jalgaon district, Maharashtra.
- [3]C.G.W.B., (1998), Groundwater Resources of Maharashtra. Central Groundwater Board Ministry of Water Resources. Government of India, Nagpur, Maharashtra.
- [4]CGWB 1998. A report: on Artificial recharge in groundwater in orange growing area's watershed WR-2 Taluka Warud, District Amravati, Maharashtra.
- [5]C.G.W.B., (2000), Ministry of Water Resources Government of India, Guide on Artificial Recharge to Groundwater. pp.1-59.
- [6]Central Ground Water Board, (2002). National Water Policy, Central Ground Water Board, Ministry of Water Resources, Government of India, New Delhi, pp. 8.
- [7]C.G.W.B., (2007). Ministry of Water Resources Government of India, Manual on Artificial Recharge of Groundwater. pp. 1-198.