International Journal of Research in Social Sciences
Vol. 9 Issue 2, February 2019,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

IMPORTANCE OF WATER RESOURCE CONSERVATION AND ITS IMPLICATION ON FUTURE GENERATION OF LIVING BEINGS IN ABHANPUR BLOCK, RAIPUR, C.G.

Dipak Kumar Maity,
Department of Geography,
PinglaThana Mahavidyalaya, Paschim Medinipur, W.B.

Dipankar Maity,
Department of Physical Education(B.P.Ed.),
Garhbeta College, Paschim Medinipur, W.B.

N.K.Baghmar,
SOS in Geography, Pt. R.S.University, Raipur, C.G.

ABSTRACT
Water is a fundamental natural resource and it is elixir of life. About 75% of the earth surface is covered by vast ocean with saline water but its 97 % water is salty. Only 1% sweet water is available for drinking. There is a continuous increase of scarcity of drinking water all most all countries of the world. In the Abhanpur area 290 tanks are present and these were made mainly to supply the water for irrigation purposes. Now due to irregular rainfall this block is facing water scarcity problems. People have started using ground water. Water conservation is must. According to IPCC reports principal basis for human livelihood and wellbeing including supply of food, fresh water and multiple other ecosystem services as well as biodiversity. Number of tanks should not be decreased.Abhanpur block is an agriculture dominated area.If available water is not managed properly then in the coming years there will be a severe water problem.

INTRODUCTION: Water, whom are you made for? This question has variegated answer. According to Bushman community of South Africa replies that the water belongs to those who lives beside the water bodies. But this water does not belong to them permanently as they have to migrate some other place. According to farmer community of India, the ponds and wells situated in the village belongs to all but these pond and wells are situated inside the own boundary that will be possessed by the head of the family. It is asked to any Govt. officer of any country; he will answer that water bodies made by the Govt. belongs to common people but any time the right of the people can be restricted by the Government. If this question is asked to officers of Coca Cola Company, they will answer that they can use the ground water and underground water occurring in their leased area, according to their needs and in their ownway. Actually, by asking this question from Bushman (South Africa) to Coca Cola Company, it is discovered that how men uses as it is their own property.

In study area two hundred ninety ponds are present in survey area. Which includes 255 (Single), 24(Double), and 11(Series). These tanks are irregularly distributed in the study area. Tanks are made in various types of rocks and soils. The soil type includes four groups namely Entisol,

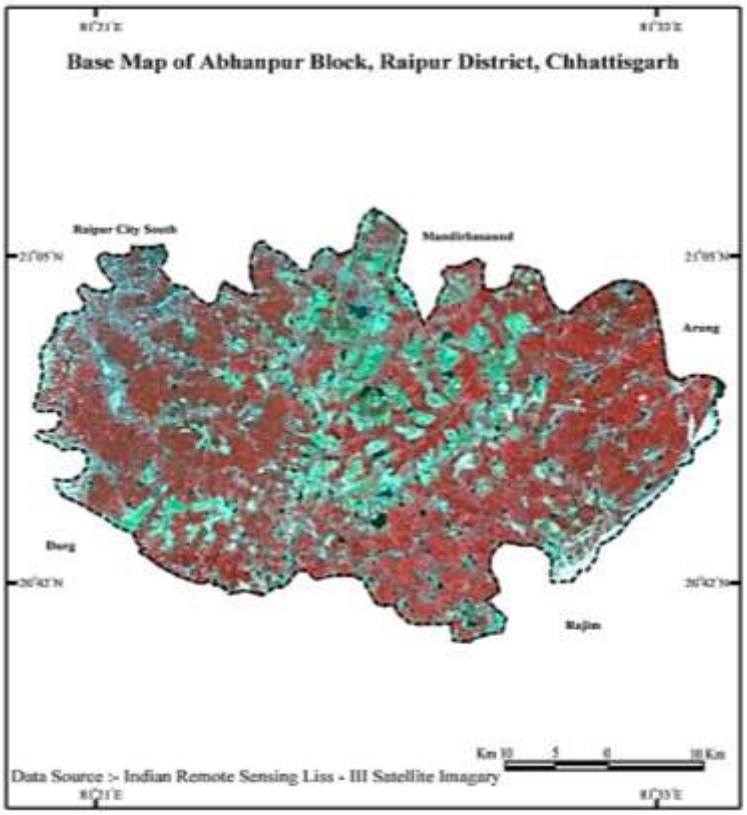
Vol. 9 Issue 2, February 2019,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

Alfisol, Vertisol and Alluvial. Which are locally named as Bhata, Kanhar, Matasi, Dorsa. In Jamidari Pratha these tanks were under the control of the Jamidar but later on these were under the control by the Government. Still today some tanks are also under the private sector. Now a days on the basis of ownership the tanks are classified as (1) Government (2) Gram panchyat (3) Private. Water of the private tanks is also used by the local people like the tanks of Government and Gram Panchyat.

LOCATION AND EXTENT OF THE STUDY AREA:

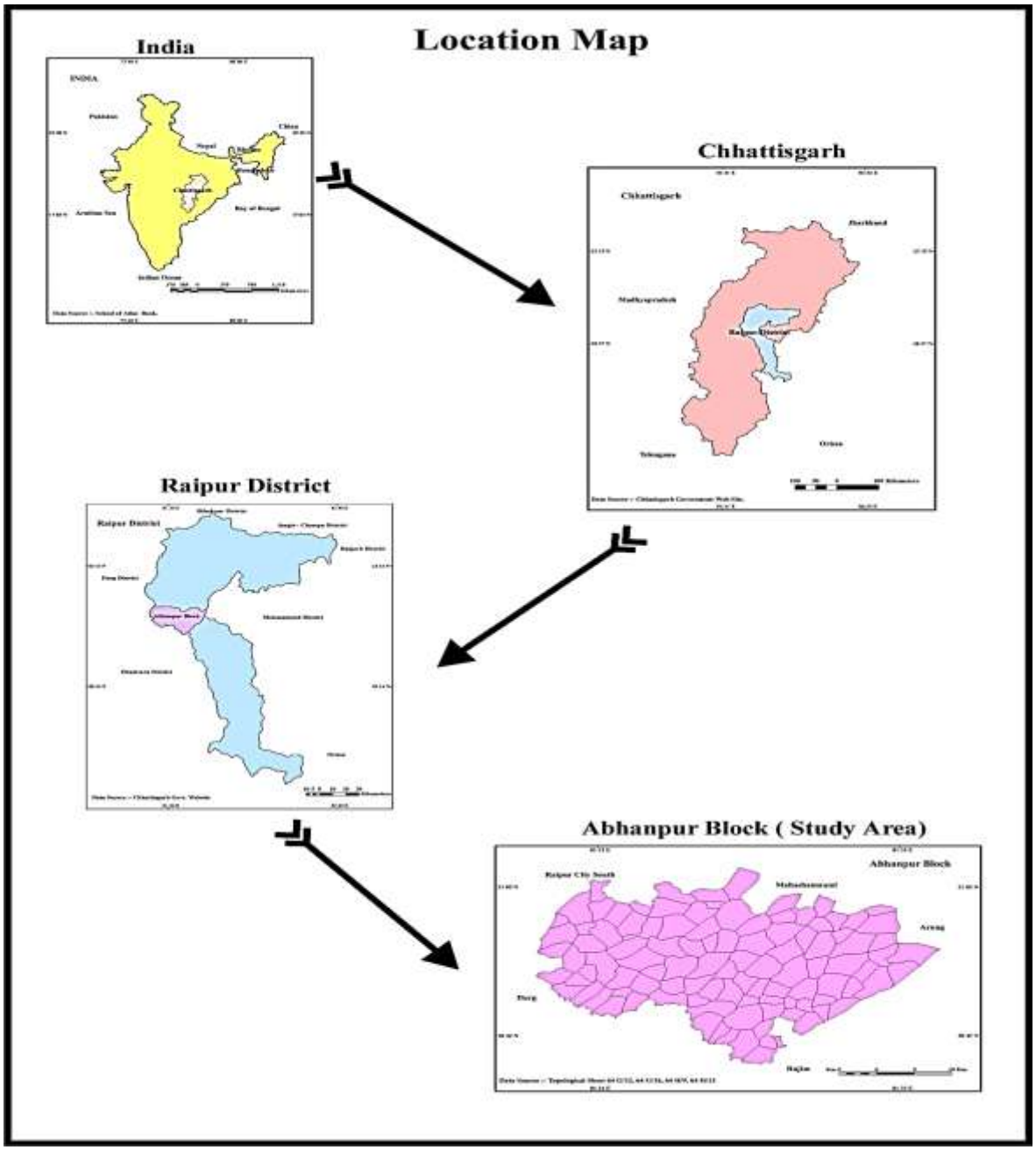
The study area Abhanpur Block, Raipur Dist., C.G., is well connected by road (state high way-43) with the Raipur, capital of Chhattisgarh state. This block is bounded by the 20°10'11''North latitude to 20°56'24'' North latitude and 81°34'36'' E longitude to 81°58'42'' E longitude. This block extends in East to West 41.75 Km. and in North to South 22Km. The river Mahanadi flows SW to NE and demarcated the east boundary of the Abhanpur block. The Kharun River flows south to north and makes a welt to this area. The study area enveloped by Dharshwa, Arang, Kurud, Patan and Fingeswer blocks. This block has 89-gram Panchyat. Total population is 1, 75,840 (2001 census) and 242089 (2011 census). The study area is douab of Kharun River and Mahanadi River. It is included in survey of India topographical sheets 64 G/12, 64 G/16, 64 H/9, 64 H/13. (Fig. No.1, Map No.1).

Fig. No.1



International Journal of Research in Social Sciences
Vol. 9 Issue 2, February 2019,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

Map No.1



Vol. 9 Issue 2, February 2019,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

SOURCES OF DATA & METHODOLOGY:

Primary Data: Primary data collected from:

1. **Field Survey:**Primary data collected from observation method and consultation with village people.

   The lack of published literature of Abhanpur Block especially about the tanks is one of the important handicaps. So, to overcome this problem available literature were consulted and certain important point noted and caped for the discussion with the people who are residing near the tanks during the field work. Several questions have been asked to the local people relevant to the tank, to know detailed about the tanks. Field photographs have been taken also sketches were made for few tanks. Local people gave several information related to tanks.

   Viable discussion with the local people was made to know various aspects about the tanks, especially about the creator of the tanks, age of the tanks, utility (past and present) of the tanks and also the water problems.
2. **Technical Data:**Technical data collected from with the help of Global Positioning System (GPS), Geographical Information System (GIS) and Remote Sensing.

   Technical data has been collected with the help of GIS and Imagery. To do this work more smoothly the author has gone intensive training course of 90 days held at NRSC, Hyderabad, Dept. of Space, Govt. of India. For analysis of the work following soft ware used – 21st Century. Provides image analysis, GIS deciphering the layer.Water tank point map, water tank polygon map, water tank buffer zone, vegetation map of the study area etc.

   A land cover map has been generated using IRS, P6, and LISS –III imagery with the help of 21st Century software. Imagery has been procured from ISRO, NRSC, and Hyderabad. In this study satellite P6, Sensor LISS-III, dated 2009 have been used. Because imagery information about water body, settlement and land use pattern gives with more clarity.

   Some vital aspect and limitations choosing P6, LISS-III imagery for the research work. My research purpose P6 LISS –IV imagery is better fruitful than LISS-III imagery. Because one LISS –III imagery covers more area than LISS IV imagery. So it was a financial matter choosing LISS –III imagery.

3. **Seasonal Data:**Seasonal data collected from different seasons such as summer, winter and rainy season observation of the several tanks.

   Secondary data: The study will be also based on secondary data. Data will be collected from the following sources.

a. **Thematic Data**: Thematic data were collected from the S.O.I. topographical sheets and satellite imageries.

Topographical sheets were scanned and Georectification was done for the preparation of base map and from this base map various types of maps were prepared with the help of 21st Century software.

The water bodies and geomorphological features have been delineated from visual interpretation of false colour composite paper print of 1:250,000 and 1: 50,000 scale data of IRS and PAN with limited ground truth. Output created through Geographical Information System.

b. **Climatic Data:**Climatic data like temperature, rainfall and humidity were collected from Meteorological Department.

c. **Geological Data:**Geological data from Geological Survey Report and District Gazetteer and other information.

OBJECTIVE OF THE STUDY:

1) Present status of Tank Morphology.
2) Conservation of Ground Water.
3) To review the government schemes of the water resources development and suggest other development project.

GEOLOGY OF THE REGION:

The Raipur basin of Chhittishgarh region occupies about 37,000 sq. km. and this basin spread in the Raipur, Durg, Bilaspur and Raigarh district of Chhittishgarh state. This saucer shaped basin elongated about 200 km. in east –west and its extinction is about 180 km in north south direction. Hear rocks are divided in 4 stages namely chandrapur stage (old stone), Charmuria Stage, Gunderdehi Stage and Raipur Stage (Youngest one), Chandipur Stage basalt conglomerates grits and quartisitssandstones, Charmuria stage includes flaggy limestones. In Gunderdehi Stage shales and sandstones are common and occurs as bands. Raipur stage comprises of shales, sandstones and limestones with stromatolites structures. Generally, Chandrapur Stage has about 300 m thickness but limestones with intercalated bands its thickness increases much and has reached at places up to about 1- 800 meters. The strike of the basin is variable and beds are almost horizontal (Map No. 2).

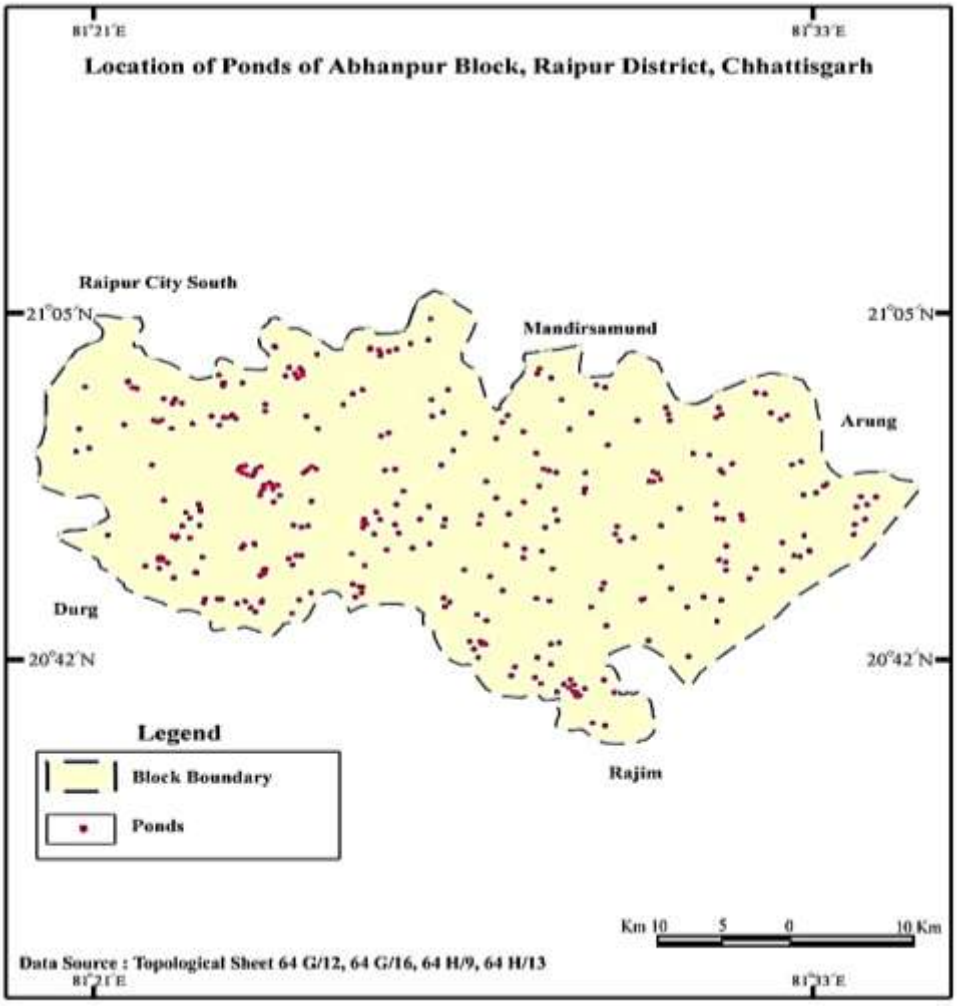
(Map No. 2)

LOCATION OF TANKS OF ABHANPUR BLOCK:

The topographical sheet (1971) shows the presence of 292 tanks in the Abhanpur Block, in which 257 single units, 24 twins and 11 series of tanks. The study of the imagery of 2009 shows the

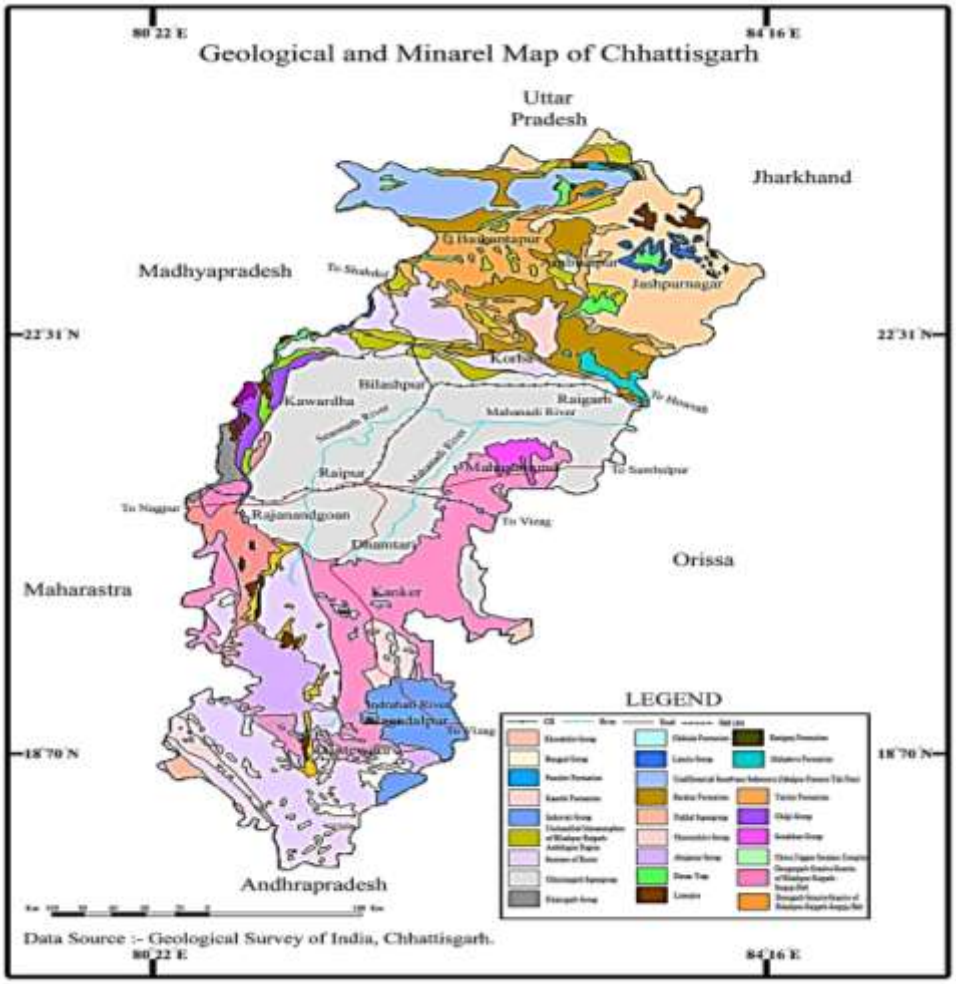
Vol. 9 Issue 2, February 2019,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

presence of 290 tanks in the study area. It is quite possible that the difference of only two tanks may be due to the enhancement or the error in the visual interpretation. (Map No. 3)



(Map No. 3)

International Journal of Research in Social Sciences
Vol. 9 Issue 2, February 2019,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A



NEEDS OF WATER CONSERVATION:

In India the development of water resource, was started in the second half of the 20th century. Possibly India is the 1st country where the development of water resources took place with vigorously. As always India gives priority to the agricultural sector, during the period 1947 to 2000 about 65 million hectares of land were brought under irrigation scheme. As it is known that there are several rivers flows on the land and causes floods and damages to the life and property to control this thousands of small, medium and large structures/dams were constructed. These reservoirs were the main sources of water for irrigation and later on also used for power generation and fisheries. Even in few decades back ground water was not trapped for large scale irrigation. Increase of demand of water and decreasing quality of surface water in surface bodies have demanded the management of present water resources. Water resource management is in the process of development and it needs to be much developed. Success of any project depends on its proper management of implementation and formulation. Still India is behind than many other Asian countries like China, Japan and others in crop yields/hector. Only water resources management is

blamed for this. If one example is taken just to compare-China's annual agricultural production from 45 million hector of irrigated land is higher than India's 65 million hector (Sengupta, 2002).

Table No – 1 Scenario of Wastage of Precious Working days:

Work	Surplus amount (Rs)
Wages for the collection of drinking water (15 crore working days)	1000 Crore
Wages for collection of fire wood and preparation of cow dung cake.	600 Crore

Source: Amandabazer Patrika, dated. 26/04/2015

41 lakhs households have their own drinking water source out of 01 crore 37 lakhs rural households in West Bengal. 43 lakhs households have to cover a distance not less than ½ K.M. for collections of drinking water. Data shows that Indian village women waste 15 crore working days for the purpose of collection of drinking water. Similar thinghappens all over India and Abhanpur is not an exception.

Development of water resources has given prime importance because of the expansion of irrigation. Water is required for the success of green revolution and to make available the require food and nutritional security to the people. India is 4-5 times less as compared to World average water supply and future development. World Summit on Sustainable Development (2002) declared water, education, agriculture, health and biodiversity as the five main significance points that provides respectable livelihood including environmental securities. About 83 % of India's water resources are now utilized for irrigation. This does not include agriculture in wetlands and required water of domestic and industrial effluents. Government of India assigned high priority to the development of water resources during the post-independence period.

India carries a long history of tanks, canals, and wells irrigation. Here very high priority was accorded for investments in the multi-purpose hydroelectric projects like Bhakhra dam for power generation, irrigation, domestic and industrial utilities, presently about 4,000 large dams in the country.

In many places it is reported that water table is declining 1 to 3 meter per annum and 30% of centrifugal pumps have been replaced with more expensive submersible pumps. In India 5723 unitspresent in which 89 (13%) where water had been over exploited i.e., extraction of water is more than the recharge of water (Samra, 2008).

It is very important to note that the present population is more than 700 crore and in the last century out of these 500 crores has been added.

So, population is increasing and the demand of water and quantity of requirement of water will also increase use of fresh water is increasing day by day. It is noted that the use of fresh water has increased three times, more than earlier and this is because of fast urbanization and industrialization. Due to excessive pumping of ground water level is going down at different intensity. Record shows that in some places water level decreased up to 30 meters. There is a forecast that if population increases at this rate, then in 2025 manylivings being have to face an acute crisis of fresh water. Both the quality of water required for public use and for irrigation will be significantly increased. In the present situation about 12 million people are deprived of fresh water. Although medical science has developed with life saving medicine and machines' even then due to lack of fresh water and sanitary system about 50 lack's causalities in a year and 6 thousand children in a day.

To overcome this problem many seminar/conferences have been organized at national and international levels. A proposal has come up in "Earth Submit" and Millennium Development 75 billion dollar will be spent for fresh water and healthy sanitary system in 2015 (Pandit, 2013).

TYPES OF WATER CONSERVATION:

Artificial recharge is very important in present context. There are number of methods are present in our practical field. But to solve the water crises problem only recharge of ground water cannot solve the problem completely.

Conservation of water is very important because huge amount of water is wasted in every process of work and manufacturing goods. Recycling of used water can be reused for certain purposes even can be use for drinking purpose if properly treated. A huge amount of water is lost as a result of washing, cleaning, gardening etc. A miserable quantity of water is loss during transportation by tanker or through leakage of pipes etc. Due to pollution and to get potable water good number of people is using Aqua guard/RO/UV for the health. But in this process huge amount of water goes waste.Water conservation can be made directly or indirectly.

Rainfall can be collected and after filtering one can drink it except industrial areas where there can be acid rain, in other area,it may be possible.Rain water can be collected if the roof is very vast than the amount of water will be collected more, and the same may be used for different purpose such as car washing, garden, lawn, toilet and even for agriculture.

Water conservation can be done indirectly by allowing rain water to flow below the ground to increase ground water level.

CONTROL ON EVAPORATION LOSS:

It is a natural process. The amount of evaporation increases with the Temperature i.e, in summer, it is more than other times. Where there is vegetation the evaporation loss is relatively lower than the evaporation in the concrete jungles.

Engineers' and Scientist have made several models and experiments to reduce evaporation losses from surface of water bodies. Evaporation is controlled by meteorological factors and which cannot be controlled under normal conditions.
By physical and chemical menace attempts have been made to suppress evaporation from water surfaces. The methods generally used are-Wind breakers, Water surface is covered, water surface is less expose, water is stored under ground, integrated operation of reservoirs and treatment with chemical water Evapo-Retardants.

There are certain chemicals namely- Cetyl Alcohol (Hexadeconol), Stearyl Alcohol (Octadecanoyl) , Ethoxylated Alcohals and Liner Alcohols, Linoxyd CS-40, Acilol TA 1618 (Cetyl Stearyl Alcohol), Capable of forming a thin nono-mole color film, which reduces evaporation loss. Cost of these chemical is high so generally is not used. The film from by chemicals allows air through it, so aquatic life not effective.

Although use of chemicals to reduced evaporation need to be studied in detailed because the aquatic animals and plants may it these chemicals. Through these animals and plant these chemicals may reach human food chain which may caused damage to the human body.

MINIMIZING AND CONTROL IN THE USE OF WATER:
Water is used in residential sector, industry and agricultural purposes. When the required water is not available then available water is managed to do the necessary work. To overcome the shortage of water if it's used in minimize and controlled in different sector than the problem may be solve.

So many developments are taking place with the help of new innovations by science and technology still nature remains a mystery for us. Although we have so much water but even than there is paucity of drinking water. We have been able to manage to process the saline water to drinking water but it is not possible for all the areas due to many problems. Hydrological cycle is a continuous never-ending process. Water from the atmosphere fall as rain earth Surface (Land and Ocean) and again goes back to atmosphere by evaporation. Charapunji (Assam) receives about 11000 mm rain fall annually, where as India receives annual rain fall about 1,170 mm and the global average is 800 mm only. Water problems can be solved by Rain Water Harvesting and Conservation. Rain water which falls on the earth its surface flow must be checked so that the water can percolate the soil/rock and also may be stored as surface water bodies for direct use. Various methods have available to recharge the ground water such as pits, trenches, dug wells, hand pumps, recharge wells, recharge shafts with bore wells and spreading techniques.

Roof Top Rain Water Harvesting is very useful and has already implemented in many places. This harvesting process has started yielding fruitful results. In this process one has to calculate and design even thing accordingly,e.g. size of the catchment area or roof surface area from which the rain fall will be collected, distance needed to be transported will involve the size (diameter) and

length of the pipe, size of the screen, size of the storage tank and treatment of collected water.

Recharge of ground water is done through abandoned dug well, through hand pumps, recharge pits, through tranche, and gravity head recharge tube well.

In domestic sector the use of water can be minimized by using Indian toilets, cleaning, and utensils in bucket full of water, less use of washing machine etc. The used water can be collected and reuse for garden. Industry also consumes huge amount of water. Which can be re-cycled to solve the water crisis? In many states in India the industrial waste water is processed and used mainly for agriculture.

In Chhattisgarh verities of rice are produced. It is well known that normal type of rice needs a huge quantity of water. The water used goes completely waste and its re-use is difficult. Because it contains fertilizer and insecticide. Now hybrid and special verities has come up, which required less time and less quantity of water but it gives significant amount of production. Deep irrigation is practiced which needs less quantity of water to minimize and control the use of water for various sectors more researches are needed to be carried out.

BIBLIOGRAPHY

1. Adhikari, R.N., A.K.Singh, S.K.N.Math, P.K.Mishra and K.K.Reddy, "Response of Water Harvesting Structures on Ground Water Recharge Process in Red Soil of semi–Arid Region of Andhra Pradesh." Journal of Indian water Resources Society, Roorkee, Uttarakhand, vol. 28, No. 2, April, 2008, pp-1-5.
2. Adyalkar.P.G and P.N.Phadtare "Karstic Limestones in Part of Raipur District, Madhya Pradesh and Their Ground water possibilities." Golden Jubilee Memoir of the Geological society of India, Vol.67,2008, pp.193-200.
3. Ahlfeld, David. P. and Ann E. Mulligan "Optimal Management of Flow in Ground Water System" Academic Press, San Diego. 1976.
4. Allen.David W. and Jeffery M.Coffey "GIS Tutorial 3 Advanced Workbook" ESRI Press, 380 New York Street, Redlands, California, 2011.
5. Baby,K. " Rain Water Harvesting and Drinking Water Management", Kurukshetra, New Delhi, Vol. 63, No. 7, May. 2015, pp. 20-23.
6. Barry, R.G." The World Hydrological Cycle", R. J. Chorley (Ed.), 1969, pp.11 – 29.
7. Baghmar, N.K. "Water Resource Potential Use and Development in Raipur District: A Geographical Analysis" Ph.D. Thesis, Pt. R.S. University, 1988.
8. Chandraker.A.R.,J. Kumar and N.K.Baghmar "Sustainable Water Conservation and Morphology of Tanks in Mahasamund District, C.G., Resource Conservation and Food security, Vol.I,Raipur.pp.105-113.

9. Charyulu. D. Kumara, A. V. Ramanjaneyulu and T. L. Neelima, "Integrated Water Management – Hunger free India"., Kurukshetra, Publication Division, Ministry of India, Govt. of India, Soochna Bhawan, New Delhi – 110003, Vol. 55, No- 11, Sep- 2007, PP. 3 –11.
10. Chorely. R. J., "Introduction to Geographical Hydrology", Methuen & Co. Ltd., 11 New fetter Lane, London EC4, 1969, PP. 76 –78.
11. Das, Subhajyoti "Five decades of groundwater Development in India" Gol.Ju.Vol.69, GSI, Bangalore,2008, PP. xiii-xxix.
12. Dasmann,R.F. " Environmental Conservation", Wiley India (p) Ltd., New Delhi, 2011, 486p.
13. Dhruva Narayana, V.V., G.Sastry, V.S.Patnaik, "Watershed Management" Publication and Information Division, Indian Council of Agricultural Research, Krishi Anusandhan Bhaban, Pusa, New Delhi, 1997, pp-56-60.
14. Evaporation Control in Reservoirs", Govt. of India, Central Water Commission, BasinPlanning and Management Organisation, New Delhi.
15. George B Korte, P.E. "The GIS Book Fifth Edition Update and Expanded" Onward Press, Thomson Learning, 2005.
16. Goswami,R. and D.P. Kuity " Changing water scenario due to urbanization in Raipur, C.G", Indian Geography Congress, Bangalore, Dec. 2-4, 2005, p. 25.
17. Ground Water Manual, A Water Resources Technical Publication" Scientific Publishers, Jodhpur, India, 1985.
18. Guide on Artificial Recharge to Groundwater, Central Ground Water Board, Ministry of Water Resources, New Delhi, 2000.
19. Hamill,L. and F.G.Bell "Groundwater Resource Development" Butterworths, London, 1986
20. Jagannathan, V. and D.S.Pandey, "Nature of Aquifers and their inter-relationship in a part of Sutlej basin, Punjab", Jr. GSI, 26 (Feb.) ,1995, pp. 118-124.
21. Jain, Anil k., "Fundamentals of Digital Image Processing" PHI Learning Private Limited., New Delhi -110001, 2010.
22. Kalkoti, G. " Nature's Endowment to Mankind", Kurukshetra, New Delhi, Vol. 61, No. 3, Jan. 2013, pp. 23-27.
23. Kuity,D.P., "Recharge of Ground Water: Need of time" Water Conservation, Recharge and Morphology of Tanks-A Remote Sensing, GIS and GPS Approach, Pingla Thana Mahavidyalaya, Kol. 2013, pp 7 -18.
24. Maiti, M.M.,and R. Maiti "A critical analysis of feasibility of roof-top water harvesting at Primol village, Darjiling, West Bengal" Journal of applied Hyderology, Visakhapatnam, Vol. XXIV, No. 1&2, Jan-April 2011, pp.- 1-8.

25. Mandal,S. and Z.L. Shiftan, "Ground Water Resources Investigation and Development" Academic Press, A Subsidiary of Hartcurt Brace Jovanovian Publishers, New York, 1981.
26. Matthews, Olen. Paul. "Water Resources, Geography and Law" Dept. of Geo., University of Idaho, Scientific Publishers, Jodhpur, 1987.
27. Pandit,P., 'Water Conservation: A New Challenge to Modern Cavitation', Water Conservation Recharge and Morphology of Tanks-ARemotesensing, GIS and GPS Approach, Kolkata, 2013, pp79-86.
28. Paramasivan,G. and J. Sacratees " Water Scarcity to Worsen" Kurukshetra, Publication Division, Ministry of India, Govt. of India, Soochna Bhawan, New Delhi – 110003, Vol. 61, No- 03, Jan- 2013, PP. 31 –34.
29. Radhakrishana, B.P. "Man-made drought and the Looming water crisis", Jr. GSI 63(May) ,2004, pp. 477-481.
30. Radhakrishna, B.P., How much groundwater is escaping in to the sea? Jr.GSI, 48, July,1996, pp. 1-2.
31. Sharma, R. " Innovative Government Initiatives for Rural Drinking Water Supply", Kurukshetra, New Delhi, Vol. 63, No. 7, May. 2015, pp. 12-16.
32. Sudarshan, G., P.N.Rao and A.D.Rao " Change in Ground Water Scenario during the last Five decades in Andhra Pradesh", Changing Geohydrological Scenario, Geological Society of India, Bangalore, Golden Jubilee Volume, 2008, pp. 21-38.
33. Sudhakar S and SVC Kameshwara Rao "Land use and Land cover Analysis" Indian Remote Sensing Centre, Indian Space research Organisation,Dept. of Space, Govt. of India, Balanagar, Hyderabad – 500635, April,2010, pp. 21 - 48.
34. Todd, D. K. "Groundwater Hydrology" Wiley India Pvt. Ltd., New Delhi, 2010, 535p.
35. Venugopal T.N. " Groundwater legislation" Drinking water and food security in Hard Rock areas of India, Geological society of India, Bangalore, 2008, pp. 126-130.
36. Venugopal, K. and N.Ghosh "Rooftop rainwater harvesting at CWPRS, Pune; Maharashtra-A Case study", Jr. Appl. Hydro. XXIII, 1&2,2010, pp.12-16.
37. Vishwanath, S. " Rainwater Harvesting in Urban Areas" Changing Geo-hydrological Scenario, Geological Society of India, Bangalore, Golden Jubilee Volume, 2008, pp. 162-177.
38. Yadav,D.N. and M.R. Joshi " Geo-hydrological study of groundwater recharge using 3H as a trader at NSDF, Trombay" Jr. of Applied Geochemistry, Indian society of applied Geochemists, Hyderabad, vol. 10, No. 2A, July2008. pp. 630-639.