Draft Report

केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga Rejuvenation

Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Athani Taluk, Belgaum District,Karnataka

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region,Bengaluru

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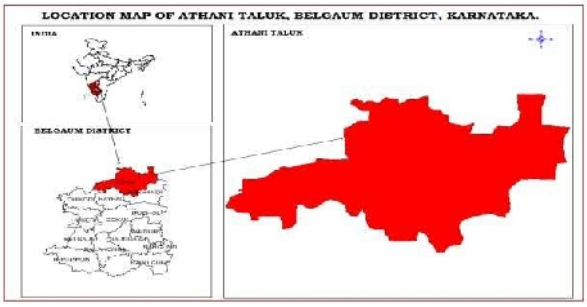
Government of India
Ministry of Water Resources, River Development & Ganga Rejuvenation
Central Ground Water Board

ATHANI TALUK AQUIFER MAPS AND MANAGEMENT PLANS,

BELGAUM DISTRICT, KARNATAKA STATE



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March 2017

ATHANI TALUK AQUIFER MAPS AND MANAGEMENT PLANS, BELGAUM DISTRICT, KARNATAKA STATE

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ATHANI TALUK AQUIFER MAPS AND MANAGEMENT PLANS,
BELAGAVI DISTRICT, KARNATAKA STATE

1. SALIENT INFORMATION

Name of the taluk	**: ATHANI**
District	: Athani
State	: Karnataka
Area	: 1,984 sq. km.
Population	: 5,25,832 (2011)
Annual Normal Rainfall	: 541 mm

1.1 Aquifer management study area

Aquifer mapping studies was carried out in **Athani taluk**, Athani district of Karnataka, covering an area of 1984 sq.kms under National Aquifer Mapping Project. Athani taluk of Athani district is located between north latitude $16^0$30'28.8" and $16^0$57'003" & east longitude $74^0$39'18" and $75^0$23'42", and is covered in parts of Survey of India Toposheet Nos. 47l/13, 47l/14, 47P/1, 47P/2, 47P/5, 47P/6, 47P/9 and 47P/10. Athani taluk is bounded by Maharastra state on north and northwest, Raibhag and Mudhol s on south and Bijapur taluk on east. Location map of Athani taluk of Athani district is presented in Figure-1**.**

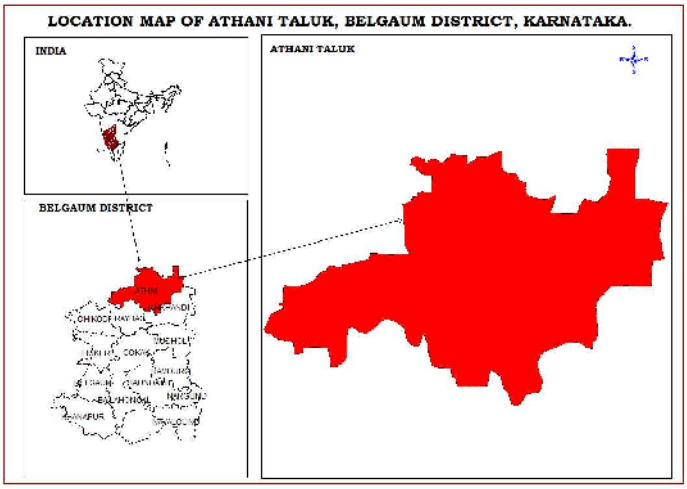

Fig 1: Location Map of Athani taluk, Belagavi district

Taluk administration of Athani taluk is divided into 3 Hoblies and Athani is only one town, which is also the taluk head quarter. There are 108 inhabited villages in Athani taluk.

1.2 Population

According to 2011 census, the population in Athani taluk is 525832, in which 247008 constitute the rural population and 477990 is the urban population, which works out to 90% (rural) and 10% (urban)

of the total population of taluk. The study area has an overall population density of 264 persons per sq.km. The decadal variation in population from 2001-2011 is 13.85 % in Athani taluk.

1.3 Rainfall

Athani taluk enjoys semi-arid climate. Dry and hot weather prevails in major part of the year. The area falls under nortern Dry agro-climatic zone of Karnataka state and is categorized as drought prone. The normal annual rainfall in Athani taluk for the period 1981 to 2010 is 541 mm.

The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons: summer from March to May; rainy season or south-west monsoon season from June to September; post-monsoon season covering the months of October and November and dry or winter Season from December to February.

There is one rain gauge station located in Athani taluk (Table-1). The data in respect of this station from the year 1981 to 2010 is analysed and presented in table-2. The data pertaining to these gauges is of long term nature and are well maintained. It is presumed that they are representative of the taluks and the same is used for analysis. Normal annual rainfall in Athni taluk for the period 1981 to 2010 is 519 mm.

Table 1. Raingauges and its location in Athani taluk

Sl.No.	Station	Latitude	Longitude	Altitude
1	Athni	16° 43'	75° 03'	573

Statistical analysis

Computations were carried out for the 30 year blocks of 1981- 2010 on Mean, Standard deviation and coefficient of variation of each month premonsoon, monsoon, post monsoon and annual and are shown in Table-3.

The mean monthly rainfall at Athni taluk is ranging between 0mm during February to 132mm during September. The CV percent for premonsoon, monsoon and post monsoon season is 66, 39 & 55 percent respectively. Annual CV at this station works out to be 27percent.

Table 2. Statistical Analysis of Rainfall Data of Athni Taluk, for the Period 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
Athani	NRM	2	0	5	15	46	94	44	57	132	98	23	3	519
	ST.DEV	5	1	12	19	42	60	26	41	96	61	36	8	141
	CV%	258	300	249	125	91	64	59	71	73	63	158	250	27

Assessment of Drought: Rainfall data of Athani taluk has been analysed for 101 years using IMD method to assess the drought condition in Athani taluk. The results of the classification are listed in the

Table-3. It is observed that the Athani taluk has experienced alternating no drought to severe drought conditions over the years.

Table 3. Classification of drought and its periodicity (IMD, 1971)

% Deviation (Di)		>0	0 to -25	-25 to -50	50 to 75	<-75	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	Severe	Acute	
		Years					
Taluk	Athani	48	28	21	4	0	Once in 4 years

The details of the drought assessment are discussed as herein under. Out of 101 years of analysis in Athani taluk, “No Drought” condition is experienced in 48 years, “Mild Drought” condition is experienced in 28 years and “Moderate Drought” condition experienced in 21 years. Further it is observed that “Severe Drought” condition is experienced in 4years ie, during 1905, 1970, 1994 and 2003 in Athani taluk. Based on occurrence and frequency of past drought events, the probability of occurrence of various intensities of drought at each station has been studied. It has been observed that the frequency of occurrence of drought is once in 4 years at Athani taluk.

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Athani taluk. Major Kharif crops are Jowar, maize, cotton and vegetables. Main crops of Rabi season are maize, Jowar, groundnut, and sunflower (Table-4). Sugarcane is perennial crop grown and sugarcane accounts 37% of total crop area. Maize grown in 19% of total crop area of taluk.

Table 4: Cropping pattern in Athani taluk 2014-2015

Year	Jowar	Bajra	Maiz	Ragi	Wheet	Other Cereals & millets	Pulses	Sugar - cane	Oil seeds	Total fruits	Vegetables	Cotton
	Area under cultivation (Ha)											
2014-2015	27716	3899	34998	0	8474	0	43043	68811	8394	4316	2400	210

Source: District at a glance 2014-15, Govt. of Karnataka

It is observed that net sown area accounts 55% and area sown more than once is 43% of total geographical area in Athani taluk (Table-5). 3% of net area irrigated is from canals, 17% of net area irrigated is from dug wells and 18% from bore wells (Table-6).

Table 5: Details of land use in Athani taluk 2014-2015 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once	Total sown area
Athani	199513	581	10911	72942	109645	85706	484732

Source: District at a glance 2014-15, Govt. of Karnataka

Table 6: Irrigation details in Athani taluk (Ha)

Source of Irrigation	Length(km) / No.	Net area irrigated	Gross Area	% of Gross Area
Canals	9	3015	3350	3.3
Tanks	28	0	0	0
Wells	11750	15395	17105	16.7
Bore wells	1815	17001	18890	18.5
Lift Irrigation	4634	15800	16950	16.6
Other Sources	0	40708	45837	45
Total		91919	102132	

Source: District at a glance 2014-15, Govt. of Karnataka

1.5 Geomorphology, Physiography & Drainage

The geomorphology of the district is characterized by vast stretches of undulated plains interspersed with sporadic ranges or isolated clusters of low ranges of rocky hills. Athani taluk falls in the plain region. The Athani taluk, Belagavi district falls under Krishna River basin. The important rivers of the district are Krishna and its tributaries. The drainage network is influenced by South West monsoon (Fig.-3).

1.6 Soil

Major part of the taluk is covered by mixed sandy soil and followed by black soil. The mixed Sandy soil comprises of brown loams, brown sandy, sandy loams and medium black soils.

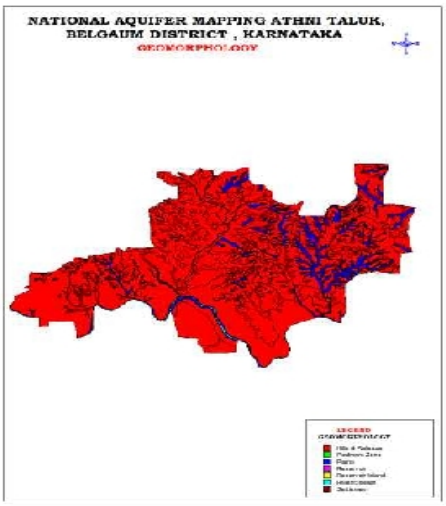

Fig 2: Geomorphology Map

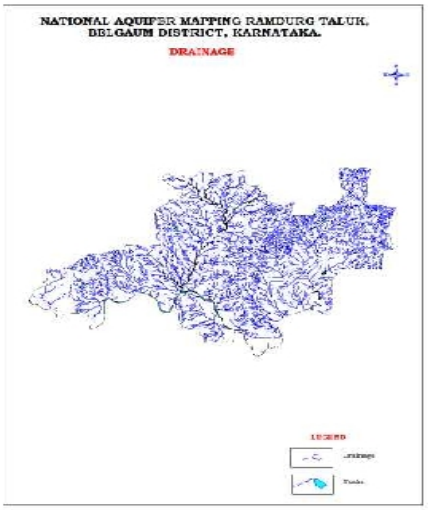

Fig 3: Drainage Map

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth are given in Table-7 below.

Table 7: Total GW Resources (2013) (Ham)

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
Athani	8757	907	2740	12404

1.8 Existing and future water demands (as per GEC-2013)

- Net ground water availability for future irrigation development : 105 MCM
- Domestic (Industrial sector) demand for next 25 years : 814 MCM

1.9 Water level behavior

(a) Depth to water level

Aquifer - I

A. Pre-monsoon: 3.85 – 14.12mbgl (Fig.-4)
B. Post-monsoon: 0.9 – 11.57 mbgl (Fig.-5)

Aquifer - II

C. Pre-monsoon: map is based on water level from adjacent monitoring station (Fig.-6)
D. Post-monsoon map is based on water level from adjacent monitoring station (Fig.-7)

(b) Water level fluctuation

Aquifer-I (Fig.-8)

E. Seasonal Fluctuation: Rise ranges between 1.11 to 9.99 m;

Aquifer-II (Fig.-9)

F. Seasonal Fluctuation: map is based on water level from adjacent monitoring station.

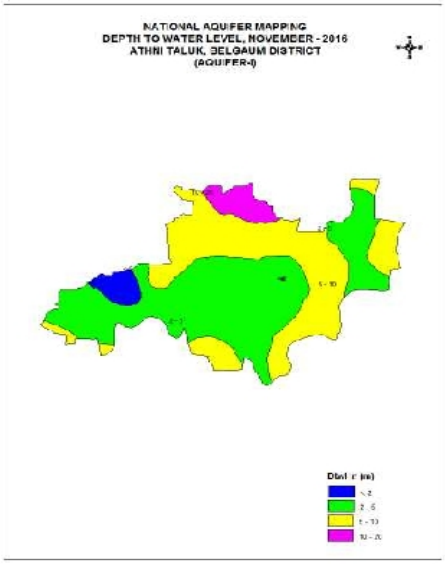

Fig 4: Depth to water level Map-Aq-I (Nov.2016)

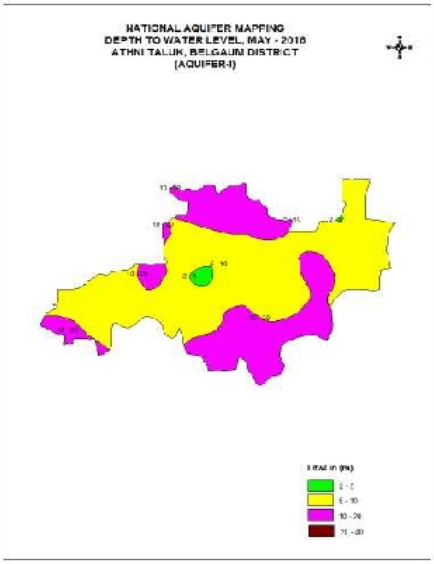

Fig 5: Depth to water level Map-Aq-I (May.2016)

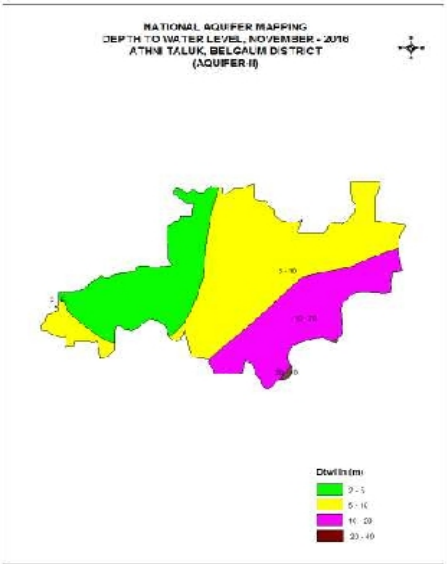

Fig 6: Depth to water level Map-Aq-II (Nov.2016)

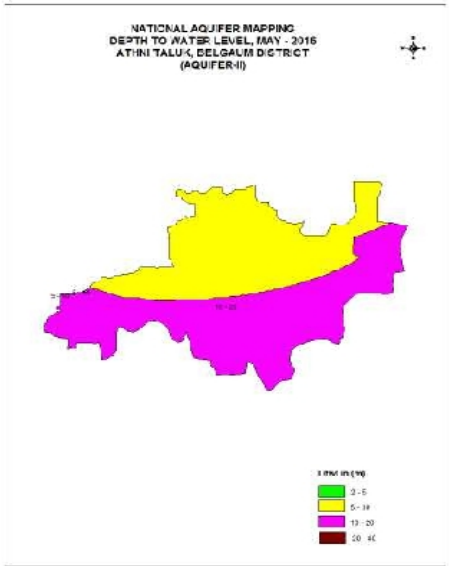

Fig 7: Depth to water level Map-Aq-II (May.2016)

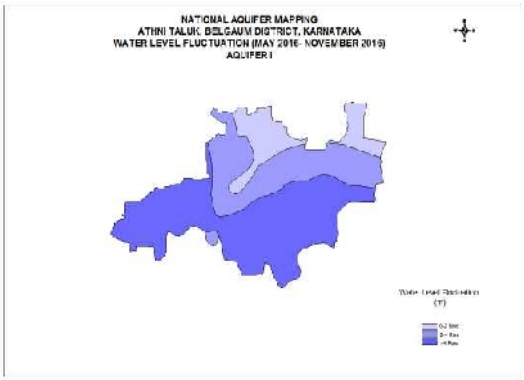

Fig 8: Water level fluctuation Map (Aq-I)

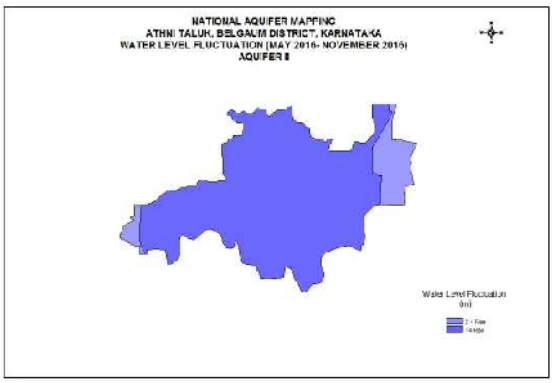

Fig 9: Water level fluctuation Map (Aq-II)

2. AQUIFER DISPOSITION

2.1 Number of aquifers: In Athani taluk, there are mainly two types of aquifer systems;

i. **Aquifer-I (Phreatic aquifer)** comprising Weathered Basalt
ii. **Aquifer-II (Fractured aquifer)** comprising Fractured Basalt

In Athani taluk, fractured weathered and fractured Deccan basalt are the main water bearing formations (Figure-10). Ground water occurs within the weathered and fractured Deccan basalt under water table condition and semi-confined condition. In Athani taluk bore wells were drilled from a minimum depth of 80 mbgl to a maximum of 150 mbgl .Depth of weathered zone (Aquifer-I) ranges from 15 mbgl to 30.0 mbgl.

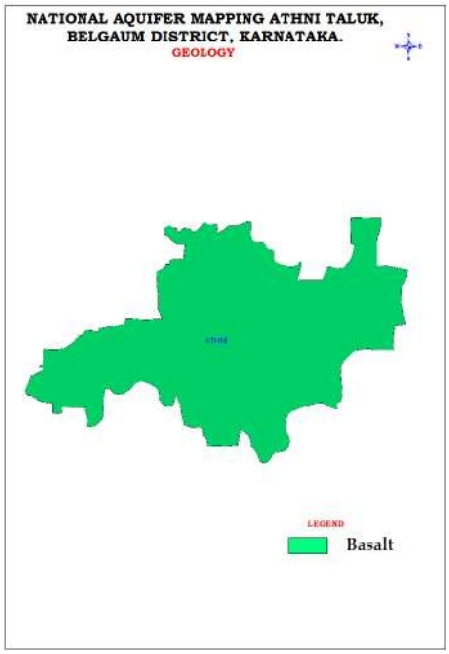

Fig 10: Geology Map

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2013)

Taluk	Net Annual Ground Water availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground Water Draft For Domestic And Industrial Water Supply	Existing Gross Ground Water Draft for All Uses	Allocation for Domestic and Industrial Use for next 25 years	Net Ground Water Availability for future Irrigation Development	Existing Stage of Ground Water Development	Category
Athani	8757	9428	738	10166	814	105	116	OE

(b) Present total Ground Water Resource (in ham)

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of GW resource
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Athani	8293	17233	1803	27329

(c) Comparison of ground water availability and draft scenario

Taluk	GW availability (ham)	GW draft (ham)	Stage of GW development	GW availability (ham)	GW draft (ham)	Stage of GW development,%	GW availability (in ham)	GW draft (in ham)	Stage of GW development
	2009			**2011**			**2013**		
Athani	9013	12466	138	8770	9917	113	8757	10166	116

b. Chemical quality of ground water and contamination

Interpretation from Chemical Analysis results of 9 samples in Athani taluk is mentioned as under:

Electrical Conductivity: Out of 9 samples, EC values ranges from 520 to 2800 µ/mhos/cm at 25^{o}C which indicates ground water has EC value within the permissible limit except at Athani station.

Fluoride: Fluoride concentration in ground water is of geogenic origin in areas underlain by younger granites/ gneisses containing minerals like Flurospar & fluroapatite F value ranges between 0.17 – 1.80 mg/l. Out of 9 samples, 1 sample indicate fluoride greater than the permissible limit of 1.5 mg/l at Radderatti.

Nitrate: Nitrate value ranges between 18 to 110 mg/l. Out of 9 samples, 5 samples indicate nitrate greater than the permissible limit of 45 mg/l, which constitutes 55% of the samples analyzed. Nitrate contamination is due to extensive use of fertilizers, hence is anthropogenic in origin.

In general ground water quality in Athani taluk is good for drinking purpose except in some areas where nitrate & fluoride is found to be greater than the permissible limit as per “Indian Standard Drinking Water Specification 2009”. Ground water samples have also been tested and found suitable for agriculture & irrigation purposes. The results of chemical analysis are given in given table-8.

Table 8. The results of chemical analysis is given in given

LOCATION	pH	Specifc Conduct. in µS/cm at 25°C	$C0_3$	$HC0_3$	Cl	$N0_3$	$S0_4$	F	Ca	Mg	TH	Na	K	PO_4
Athani	7.70	2800	0	159	550	110	390	0.17	160	48.0	700	359	20.0	ND
Badchi	8.10	930	0	67	178	86	89	0.18	80	24.0	300	75	4.7	ND
Halyal	8.5	1370	30	110	188	62	216	0.17	100	36.0	400	108	35.0	0.20
Kakmari	8.2	1930	0	177	270	18	398	1.40	120	36.0	450	230	7.8	ND
Khotanatti	8.7	520	21	79	75	20	38	0.76	36	15.0	150	46	12.0	ND
Mallabad	8.1	1110	0	153	160	81	139	0.38	60	29.0	270	133	2.4	ND
Parthanhalli	8.2	560	0	140	39	74	48	0.27	36	15.0	150	60	1.6	ND
Radderhatti	8.2	1400	0	177	320	41	106	1.80	98	38.0	400	156	3.9	ND
Navalihal	8.4	840	30	73	167	22	58	0.40	60	24.0	250	78	4.7	ND

4. GROUND WATER RESOURCE ENHANCEMENT

4.1 Aquifer wise space available for recharge and proposed interventions

Recharge dry phreatic aquifer (Aq-I) in the taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & point recharge structures (Table-9). The choice of recharge structures should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge.

Table 9: Quantity of non-committed surface runoff & expected recharge through AR structures

Taluk Area (sq Km)	Surplus water Resource Available (MCM)	No of Check Dams Feasible	No of Percolation Feasible	No of Point Recharge Structure Feasible	Total Cost including impact asessment (lakhs)	Total Rechage (MCM)	Cost Benefit Rs in Rs/cub m of harvested water	Expected Rise of water Level (m)
1984	15.15	93	6	10	365.10	8.58	4.26	0.23

Artificial Recharge Structures Proposed	Athani taluk
Non committed monsoon runoff available (Ham)	15.15(MCM)
Number of Check Dams	93
Number of Percolation Tanks	6
Number of Point Recharge structures	10
Tentative total cost of the project (Rs. in lakhs)	365.10
Excepted recharge (MCM)	8.58
Expected rise in water level (m)	0.23
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.26

4.2 Improvement in GW availability due to Recharge, Athani taluk

Table 10. Expected improvement in overall stage of ground water development after implementing AR schemes

Taluk	Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of ground water development	Expected recharge from proposed artificial recharge structures	Additional potential from proposed irrigation development schemes through interbasin transfer	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
	HAM	HAM	%	HAM	HAM	HAM		%
Athani	8757	10166	116	858	0	9615	106	10

4.3. Improvement in GW availability after using water efficient methods

Table 11. Expected improvement in overall stage of ground water development after using water use efficient methods

Taluk	CUMULATIVE ANNUAL GROUND WATER AVAILABILITY AFTER IMPLEMENTING AR STRUCTURES & IRRIGATION DEVELOPMENT SCHEMES	EXISTING GROSS GROUND WATER DRAFT FOR ALL USES	STAGE OF GROUND WATER DEVELOPMENT AFTER IMPLEMENTING AR STRUCTURES & YETTINAHOLE PROJECT	SAVING DUE TO CHANGED CROPPING PATTERN	SAVING DUE TO ADOPTING WUE MEASURES	CUMULATIVE ANNUAL GROUND WATER AVAILABILITY	EXPECTED IMPROVEMENT IN STAGE OF GROUND WATER DEVELOPMENT AFTER THE IMPLEMENTATION OF THE PROJECT	EXPECTED IMPROVEMENT IN OVERALL STAGE OF GROUND WATER DEVELOPMENT
	HAM	HAM	%	HAM	HAM	HAM		%
Athani	9615	10166	106	0	2710	12325	83	23

4.4. Outcome of AR scheme implemented in parts of Hallalli and Artal villages of Athani taluk

Under Artificial recharge sceheme 21 nalabands and 5 checkdams were constricted in parts of Hallalli and Artal villages UNDER CENTRAL SECTOR SCHEME DURING XI PLAN at the cost of 114.96 lakhs. The impact assessment was carried out in terms of built up in ground water levels in representative wells (21 Dug wells and 7 bore wells), change in productivity of bore wells, change in cropping pattern in surrounding areas of artificial recharge structures and improvement in ground water quality**.** The impact assessment of the structures has proved that Artificial Recharge measures taken in the area has helped to improve ground water levels, sustainability of bore wells and increase in the area of irrigation. It has also helped in providing rural employment to the farmers with impetus on participatory ground water management.

To study the impact of the scheme 21 dug wells and 7 bore wells were established for monitoring the water levels. To ascertain the quality of the water and change in the quality of ware 26 and 17 water samples were collected at two different time period. The quality of the ground water in general is good.

4.4. a. Improvement in Water level

From the water level data it is observed that water level in dug wells showed rise between 2 m to 5m. Six dug wells which were dry since many years in the project area have got water column. Of the total 7 bore wells monitored, all shown rise of water level in the range of 3.40 to 21 m with an average rise of 12.2 m 39 bore wells, which were dry in the project area, have started yielding after the implementation of the project.

4.4. b. Change in yield of the wells

There is increase of sustainability of pumping in the range of 30 minutes to one hour. Some wells, which were discharging water intermittently, are having continuous flow during the post project

period. Yield of bore wells has increased in the range of 0.45 to 6 lps. The yield of the dug wells has also increased from half an hour pumping to 3 to 4 hr of pumping per day. The wells which are dry for many years and defunct were become active and are in use after the implementation of the scheme. There is an increase in the area of cultivation. The comparison of yield of wells, sustainability of wells, crops in Project area for few wells is tabulated in the table-12.

Table 12. Comparison of yield of wells, sustainability of wells, crops.

Village	Beneficiary	Kharif 2012				Kharif (Ha) 2013				Change		
		Crops	Crop area (Acres)	Yield (Lps)	Pumping sustainability	Crops	Crop area (Acres)	Yield (lps)	Pumping sustainability	Change in crops (Acres)	Change in yield (lps)	Increase in pumping sustainability (hours/minutes)
Halalli	Smt. Dundavva S Athani	Bajar	2	1.5	15 mins	Maize, Sugarcane	2.5	1.5	1 hour	0.5		45 min
Halalli	Shri. Murageppa M Bedaratti	Bajar		0.5	4 hour	Maize, Sugarcane	0.5	1.5	4	no change	1	same
Aratal	Shri. Bhimu P Redekar	Bajar	0.5	1	10 mins	Maize, Sugarcane	1.25	2	1 hour	0.75	1	50 min
Aratal	Shri. Yallappa K Vaddar	Bajar	0	0	0	Maize, Sugarcane		6	4	no change	6	4 hours

After the implementation of the scheme some of the wells which were dry have got water column. A glance of the wells benefitted by the implementation of the scheme and change in water level is shown in the table -13.

Table 13. A glance of the wells benefitted by the implementation of the scheme and change in water level.

Sl. No.	Village	Sy. No.	Name of the farmer	Borewell / Open well	Total depth (Mtr)	Water level before (Mtr)	Water level present (Mtr)
1	Halalli	165	Basavaraj Virupakshayya Hiremath	Open well	8.00	8.00	4.50
2	Halalli	164	Vishwanath Basalingayya Hiremath	Open well	8.50	8.50	4.60
3	Halalli	-	Village water supply open well	Open well	9.50	9.50	2.00
4	Halalli	-	Village water supply open well	Open well	8.00	8.00	2.00
5	Halalli	47	Hanamanth Shivappa Pujari	Open well	9.00	9.00	2.50
6	Halalli	54	Sangappa Annappa Honagoud	Open well	8.00	8.00	4.00
7	Halalli	120/7	Muttappa Dhareppa Byadaratti	Open well	10.00	10.00	5.00
8	Halalli	120/2	Smt. Danavva Shivaling Athani	Bore well	90.00	80.00	70.00
9	Halalli	120/2	Smt. Danavva Shivaling Athani	Open well	7.00	7.00	5.00

10	Halalli	145/6	Ramappa Kallappa Satti	Open well	8.50	8.50	5.00
11	Halalli	127	Bhimappa Balesh Allagi	Open well	7.50	7.50	4.50
12	Halalli	130	Basappa Sikareppa Kalashetti	Open well	8.50	8.50	7.00
13	Halalli	130	Basappa Sikareppa Kalashetti	Bore well	80.00	76.00	50.00
14	Halalli	136	Channappa Mallappa Kalashetti	Open well	9.00	9.00	7.50
15	Halalli	161/2 A	Smt. Nilavva Sangappa Kalamadi	Open well	5.50	5.50	3.00
16	Halalli	150/5	Shrisail Mallappa Honagoud	Open well	8.00	8.00	6.00
17	Halalli	99	Sivappa Shesappa Honagoud	Open well	9.00	9.00	4.50
18	Halalli	99	Sivappa Shesappa Honagoud	Bore well	90.00	86.00	65.00
19	Halalli	-	Village water supply open well	Bore well	85.00	81.00	60.00
20	Halalli	126	Mallappa Bhimappa Honagoud	Open well	7.50	7.50	5.00
21	Halalli	130/3	Shankreppa Annappa Daddi	Open well	8.00	8.00	6.00

4.4. c. Change in cropping pattern

There was increase in irrigated area between 0.5 to 3.4 hectares in the command area of the individual well.

4.4. d. Cost Benefit

The cost of one cubic meter of water harvested is Rupees 1.05 considering 20 years as life of the structure. The activities carried out has proved the benefits of such schemes to conserve water, the efficacy of artificial recharge structures, the willingness of the local / farming community, capacity building, participatory monitoring, etc. Involvement of beneficiaries in the scheme helped in maintenance and sustainability of the scheme.

4.4. e. Benefit of Artificial recharge scheme

- Artificial recharge structures namely check dams and Nala bunds can be taken up on large scale in the over-exploited areas as a management plan to tackle falling ground water levels.
- These structures have proved in building-up of ground water levels and sustainability of ground water abstraction structures, mainly in bore wells.
- An increase in the area irrigated by ground water source is also observed in the area of influence.
- Such activities help in providing sustainable drinking water to the rural population.The qualitative result from farmer's perception indicate that, there is rising trend in ground water levels in the area of influence, productivity of crops enhanced and improvement in yield is observed in bore wells.

- The cropping pattern has shown that farm households have resumed growing crops such as grapes which were not previously grown in the area.

5. DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

It is observed that bore wells and canals are the prevalent source for irrigation in the taluk. Thus, by adopting the below mentioned techniques will contribute in ground water resource enhancement in the long run.

- Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers in the existing 35995 ha of gross irrigated area by borewells and dug wells.
- Irrigation draft is 9428 ham.
- Efficient irrigation techniques will contribute in saving ground water by 2710 ham and thus will improve stage of development by 23 % from 116% to 93% (Table-9).

5.2 Change in cropping pattern

Water intensive crops sugarcane is grown in 68811 Ha from lift irrigation from Krishna River and well irrigation in the Athani taluk. Hence, change in cropping pattern is required in well irrigated area. There will be improvement in GW availability due to change in cropping pattern in the well irrigated area.

5.3 Regulation and Control

- Athani taluk has been categorized as **over exploited**, since the Stage of ground water development has reached **116%** (GE March 2013). Hence, stringent action has to be taken up through Karnataka Ground Water Authority to control further ground water exploitation in the taluk**.**
- Ground water recharge component needs to be made mandatory in the non-command area of the taluk for further development of ground water.

5.4 Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess nitrate concentration is found in ground water sample all along the Krishna River requires remedial measures viz.
    - Minimizing the use of chemical fertilizer for sugarcane crop.
    - Improving the drainage system.
    - Roof top rain water harvesting.
    - Micro irrigation.

5.5 Summary

The summary of Management plan of Athani taluk is given in Table-14.

Table 14: Summary of Management plan of Athani taluk

Huvinahadagali taluk is over-exploited & present stage of GW Development (2013)	116%
Net Annual Ground Water Availability (HAM)	8757
Existing Gross Ground Water Draft for all uses	9428
Total GW Resources (Dynamic & Static upto the depth of 200 mbgl) (HAM)	27329
Expected additional recharge from monsoon surplus runoff (HAM)	858
Change in Stage of GW development, %	116 to 106
Expected Saving due to adopting WUE measures (Ham)	2710
Change in Stage of GW development, %	106 to 83