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 MAPS AND GROUND WATER MANAGEMENT PLAN

Soygaon& Sillod Taluka, Aurangabad District, Maharashtra

(Part-II)

मध्य क्षेत्र, नागपुर

Central Region, Nagpur

भारत सरकार

Government of India

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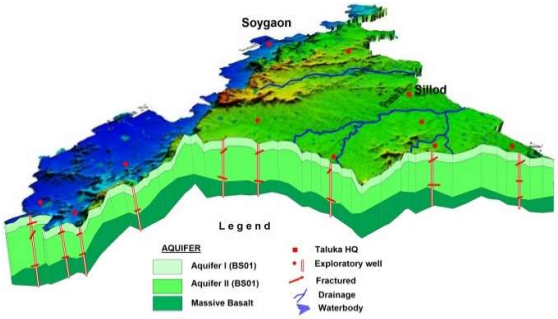
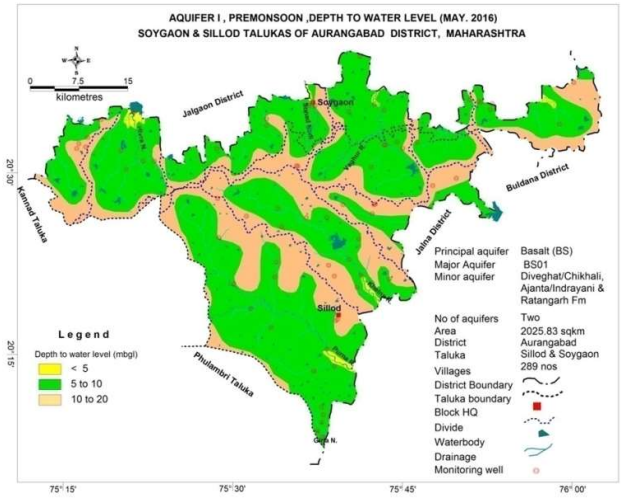
CENTRAL GROUND WATER BOARD

जल बचत जल संचय

Brief Report on Aquifer Maps and Ground Water Management Plan

जलभृत नक्शे तथा भूजल प्रबंधन योजनापर संक्षिप्त रिपोर्ट





Soygaon and SillodTalukas, Aurangabad District

सोएगाव व सिल्लोड तालुका, औरंगाबाद जिल्हा

मध्यक्षेत्र, नागपुर/ Central Region, Nagpur

जुलै / July 2016

PART-II

BRIEF REPORT ON AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, **SOYGAON AND SILLOD TALUKA, AURAMGABAD DISTRICT**

CONTRIBUTORS'

Principal Authors		
Kartik P. Dongre	:	Scientist-C
Sandeep D. Waghmare	:	Assistant Hydrogeologist
Supervision & Guidance		
D. Subba Rao	**:**	Regional Director
Dr.P.K. Jain	**:**	Supdtg. Hydrogeologist
Hydrogeology, GIS maps and Management Plan		
Kartik P. Dongre	:	Scientist-C
Sandeep D. Waghmare	:	Assistant Hydrogeologist
J. R. Verma	**:**	Scientist-D
Rahul R. Shende	**:**	Assistant Hydrogeologist
Groundwater Exploration		
Kartik P. Dongre	:	Scientist-C
Sandeep D. Waghmare	**:**	Assistant Hydrogeologist
Chemical Analysis		
Dr. DevsharanVerma	:	Scientist B (Chemist)
Dr. Rajni Kant Sharma	:	Scientist B (Chemist)
T. Dinesh Kumar	:	Assistant Chemist

PART-II

BRIEF REPORT AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, **SOYGAON AND SILLOD TALUKA, AURAMGABAD DISTRICT**

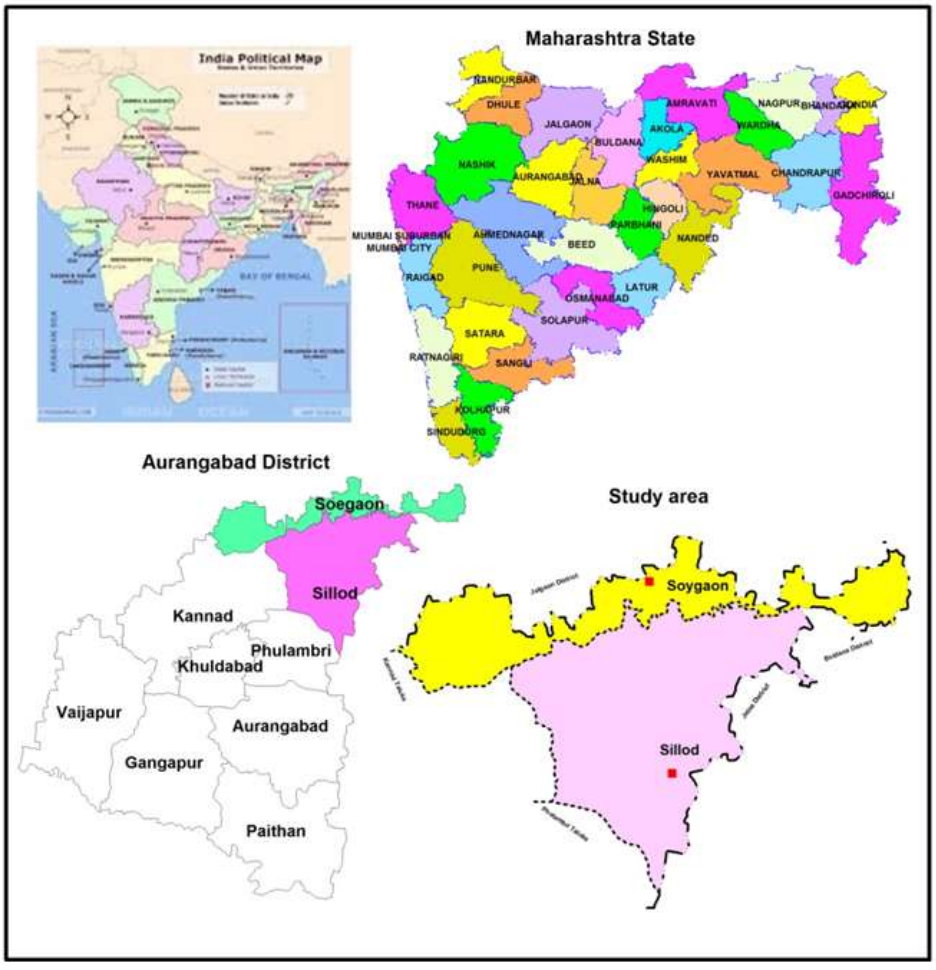
CONTENTS

BRIEF REPORT ON AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, **SOYGAON AND SILLOD TALUKA, AURAMGABAD DISTRICT**

1 BRIEF INTRODUCTION

In XII five year plan (2012-17), National Aquifer Mapping (NAQUIM) has been introduced to carry out detailed hydrogeological investigation on topo-sheet scale (1:50,000).Keeping in view the current demand vis-à-vis supply and futuristic requirement of water, Central Ground Water Board has taken up NAQUIM inprioritised areas. Soygaon and Sillodtaluka of Aurangabad district covering an area of 2025.83sq.km. wastaken up to carry out detailed hydrogeological investigation in the year 2015-16. The index map of the study area is presented below.

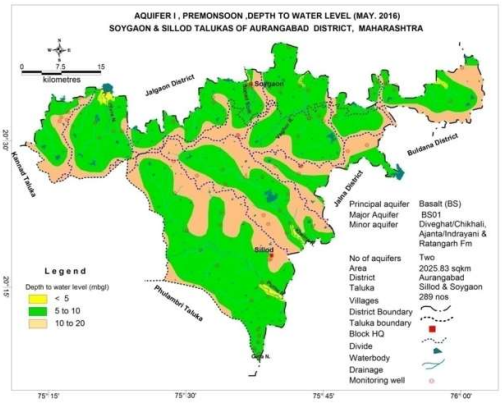
Location Map



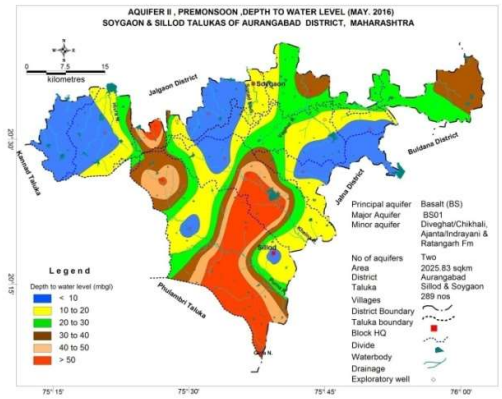
2 SALIENT FEATURES

	Soygaon	Sillod
Area (sq.km.)	741.69	1284.14
Population (no.'s) (2011)	113087	301733
Rainfall (mm)		
i. Normal Annual Rainfall	783.20	707.60
ii. Recent Rainfall (2015)	608.20	746
iii. Rainfall Trend (mm/yr)	-1.122	-1.98
Agriculture & Land Use (sq.km.)		
i. Principal Crops	Cotton, Cereals, Food grains, Fruits & Vegetables	Cotton, Cereals, Food grains, Fruits & Vegetables
ii. Cultivable Area	351.43	1110.25
iii. Net Sown Area	351.43	1110.25
iv. Forest Area	125.11	28.27
Irrigation Sources (sq.km.)		
i. Ground water	42.00	192.60
ii. Surface Water	28.84	37.26
Data Utilised		
i. Key Observation Wells	19	23
ii. Exploratory & Observation Wells	10	16
iii. GWQ sampling locations	8	11

Water Level Aquifer-I



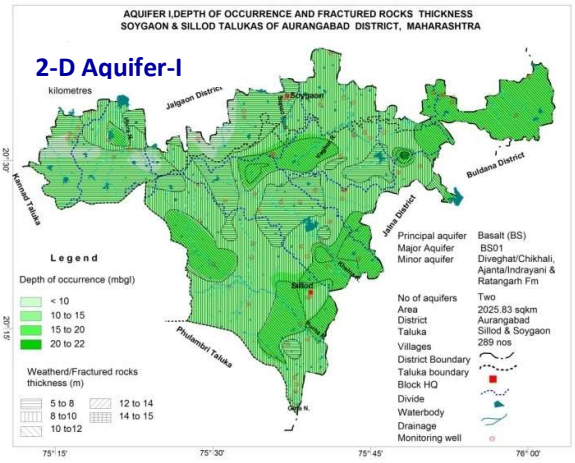
Water Level Aquifer-II

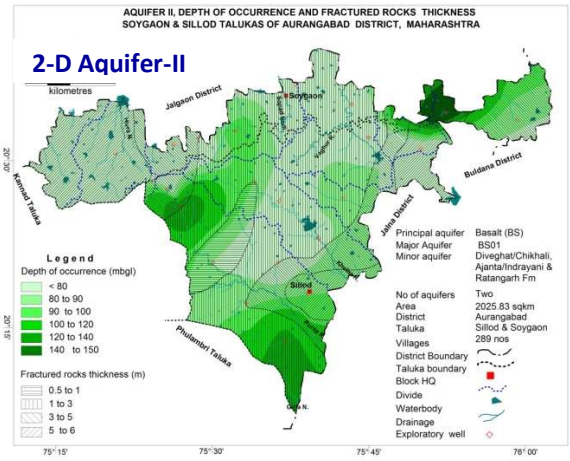


Taluka	**Soygaon**	**Sillod**
Water Level Behaviour - Aquifer-I		
Premonsoon WL 2016 (m bgl)	5.62 to dry	6.90 to dry
Postmonsoon WL 2016 (m bgl)	1.30 to 13.90	0.60 to 15.20
Premonsoon WL Trend 2006-15 (m /yr)	Fall –0.01 to 0.51 m/yr Rise – 0.001 to 0.29 m/yr	Fall –0.03 to 0.16 m/yr Rise – 0.03 to 0.50 m/yr
Aquifer-II		
Premonsoon WL 2015 (m bgl)	6.70 to 32.00	5.00 to 67.00
Postmonsoon WL 2015 (m bgl)	2.34 to 22.00	2.50 to 36.00
Existing / Future Water Demands (MCM)		
Domestic&Industrial	0.97 / 1.89 (2025)	3.72/7.54 (2025)
Irrigation	35.26/19.54 (2025)	91.58/28.38 (2025)

3 AQUIFER DISPOSITION

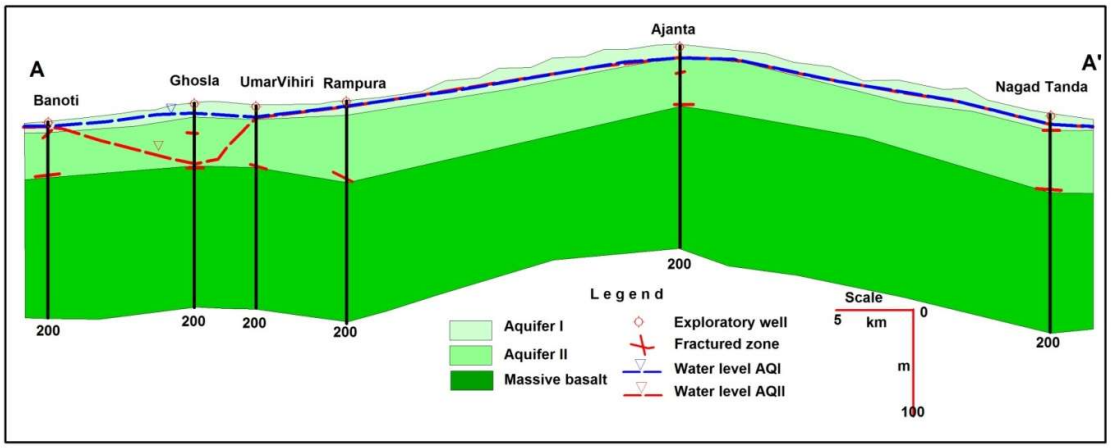
2-D and 3-D Aquifer Disposition	**Aquifer**: **Basalt**; **Aquifer I** - Weathered Basalt: Depth range- 10 to 32 mand thickness of 5 to 15 m. **Aquifer II** - Jointed/Fractured Basalt: Depth range - 25 to 160 m, Thickness – 0.50 to 6.00m

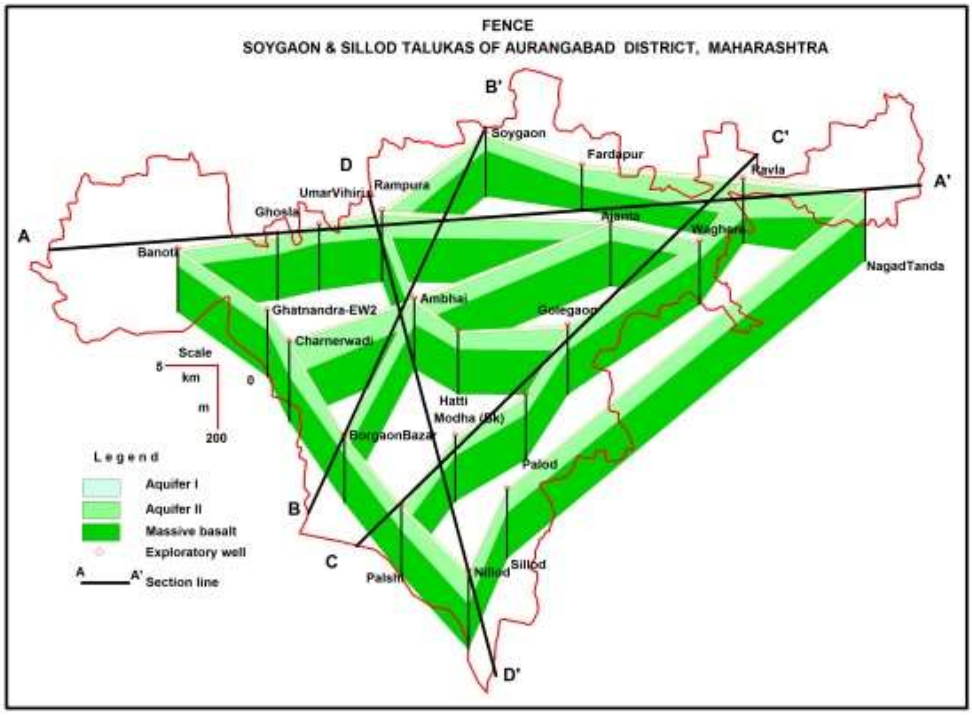




Type of Aquifer	Formation	Depth range (mbgl)	SWL (mbgl)	Fractures / weathered Zones encountered (m bgl)	Fractures / weathered rocks Thickness (m)	Yield	Sustaina-bility	Aquifer parameter (Transmissivity – m^2/day)	Sy/S	Suitability for drinking/ irrigation
Aquifer-I	Deccan Trap-Weathered/ Fractured Basalt	8 - 32	5.60 to 23.40 (May-16)	Up to 32	5 to 15	Upto 50 m^3/day	1 to 2 Hours	3 to 60	0.019-0.028	Yes , suitable for both Except high NO3
Aquifer-II	Jointed/ Fractured Basalt	25 - 160	0.02 to > 50 (May-16)	Up to 160	0.5 to 6	Upto 1 lps	0.5 to 2 hours	Upto 50	1.5×10^{-4} – 9.0×10^{-4}	Yes, suitable for both, except High NO3

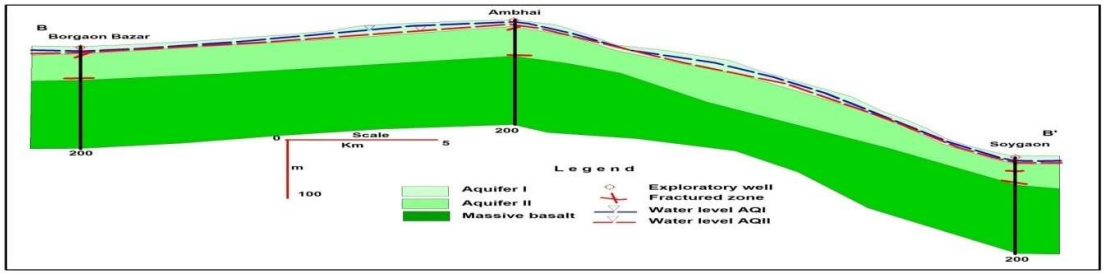
Section A-A 2 / 3-D DISPOSITION: FENCE / PANEL DIAGRAM / SECTIONS





3-D DISPOSITION: FENCE / PANEL DIAGRAM

Section B-B



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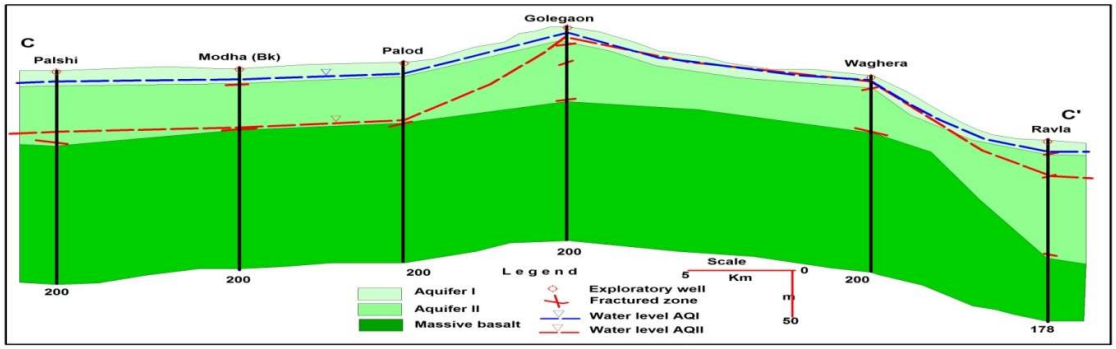

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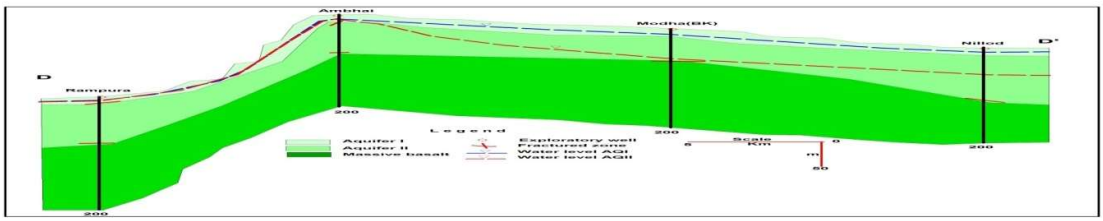
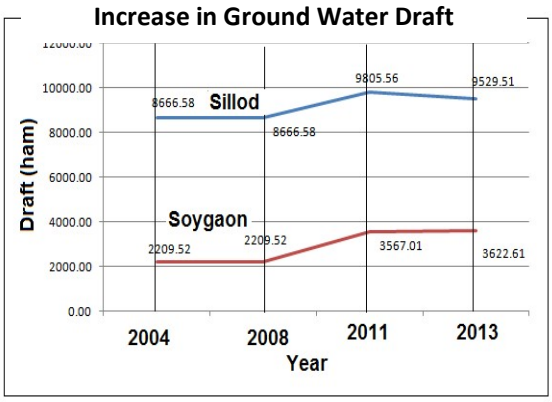
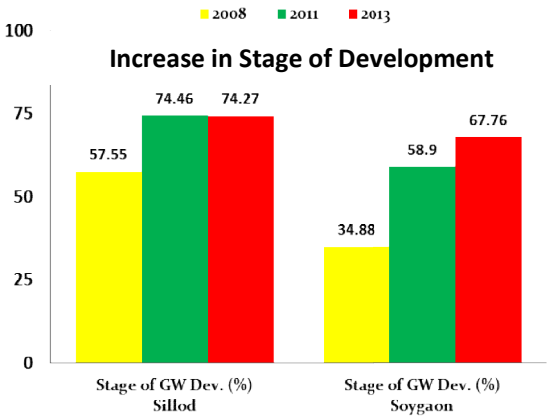


4 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

	SOYGAON	SILLOD
Aquifer wise Ground Water Resource availability and Extraction		
Ground Water Resource (MCM) **Aquifer –I:** upto 32 m Availability Withdrawal	 55.08 36.23	 128.31 95.29
Ground Water Resource (MCM)**Aquifer –II:** 25 to 160 m Availability Withdrawal	 1.23 0	 3.175 0
Present Category	**Safe**	**Safe**
Ground Water Related Issues		
Over Exploitation	Stage of GW Development has increased over the period of time. Draft for irrigation purpose also increased over the period of 5 years.	
Declining Water Level trend	Declining Water Levels trend in Premonsoon=417 sq.km and postmonsoon = 300.5 sq. km. (Falling Trend > 0.20 m/yr)	
Low Ground Water Potential	Both the aquifers are having limited potential (Aquifers – I: upto 50 m3/day and Aquifer – II: upto 1 lps)	
GW based irrigation (sq. km.)	Soygaon-42.00 and Sillod-192.60	

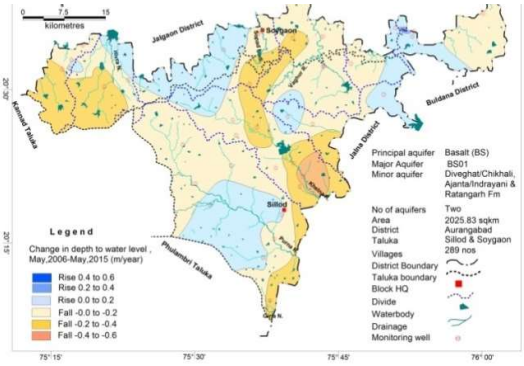
ISSUE: OVER - EXPLOITATION

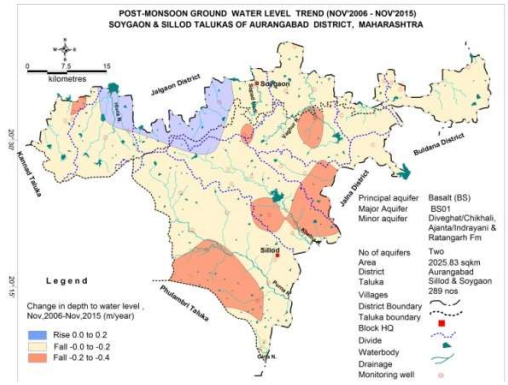




ISSUE: DECLING WATER LEVEL TRENDS IN PRE AND POST MONSOON

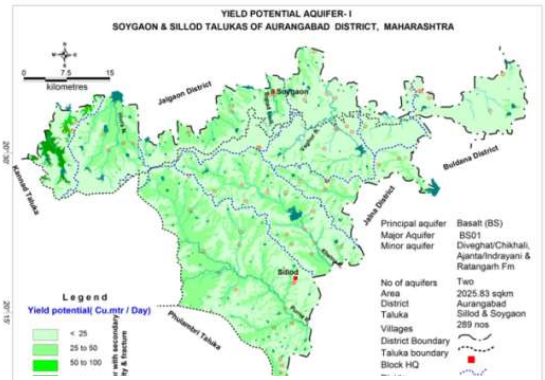
PREMONSOON DECLING WATER LEVEL TRENDS



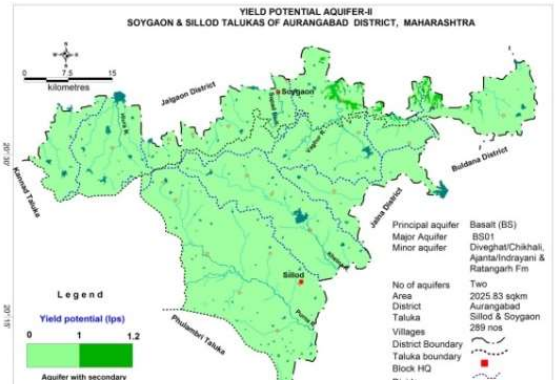


POSTMONSOON DECLING WATER LEVEL TRENDS

ISSUE: LOW GROUND WATER POTENTIAL OF AQUIFER – I & II



GROUND WATER POTENTIAL AQUIFER – I

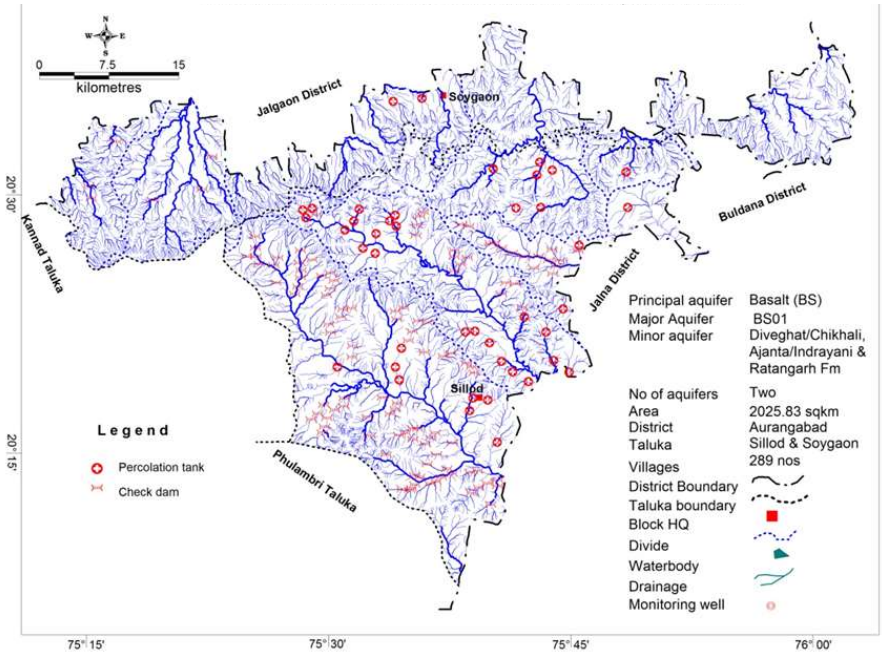


GROUND WATER POTENTIAL AQUIFER – II

5 PROPOSED MANAGEMENT INTERVENTIONS FOR GROUND WATER RESOURCE DEVELOPMENT AND ENHANCEMENT

5.1 Ground Water Resource Enhancement by Supply side Interventions		
Rainwater Harvesting and Artificial Recharge Plan		
TALUKA	**Soygaon**	**Sillod**
Volume of unsaturated granular zone (MCM)	58.95	1085.36
Recharge Potential considering Sp. Yield of 2% (MCM)	1.18	28.71
Surface water requirement @ 75% efficiency (MCM)	1.57	28.95
Availability of Surplus surface runoff (MCM)	0.62	11.38
Surplus runoff considered for planning (MCM)	0.62	11.38
Proposed Structures		
Percolation Tank (@ Rs.150 lakh, Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	**2 no.'s** will be able to recharge 0.30 MCM @ 75% efficiency, Cost – Rs. 3Cr	**40 no.'s** will be able to recharge 6.00 MCM @ 75% efficiency, Cost – Rs. 60Cr
Check Dam (@ Rs.30 lakh, Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	**6 no.'s** will be able to recharge 0.14 MCM @ 75% efficiency Cost – Rs. 1.80Cr	**114 no.'s** will be able to recharge 2.57 MCM @ 75% efficiency Cost – Rs. 34.20 Cr
Roof Top Rain Water Harvesting (RTRWH)		
Households to be covered	5890	17630
Total RWH potential (MCM)	0.17	0.45
Rainwater harvested / recharged @ 80% runoff co-efficient	0.13	0.36
Estimated Expenditure (Rs. in Cr.) @ Rs. 15000/- per HH	8.84	26.45
Economically not viable & Not Recommended		
Total volume of water expected to be recharged by AR (MCM)	0.44	8.57
Total Estimated Expn. for AR	4.80	94.20

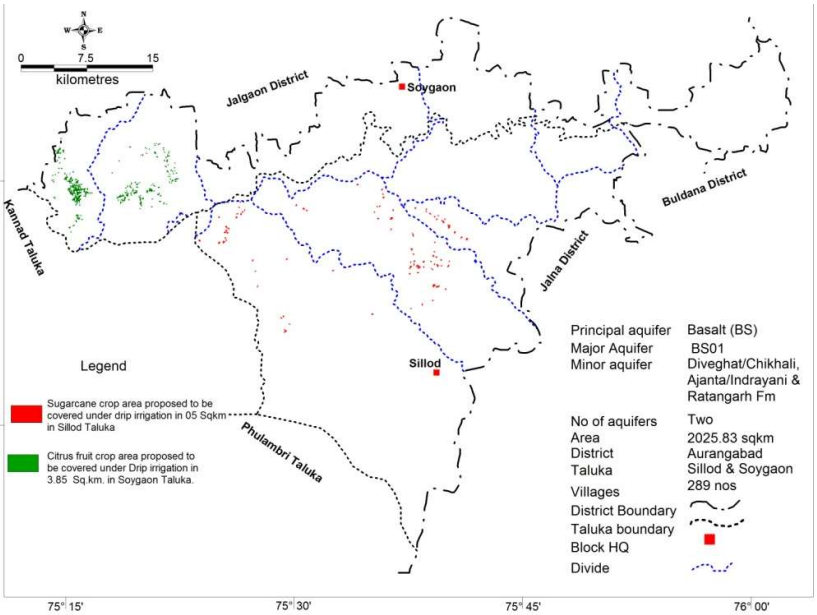
SUPPLY SIDE INTERVENTIONS – LOCATION OF ARTIFCIAL RECHARGE STRUCTURES



5.1 Ground Water Resource Enhancement by Demand Side Interventions

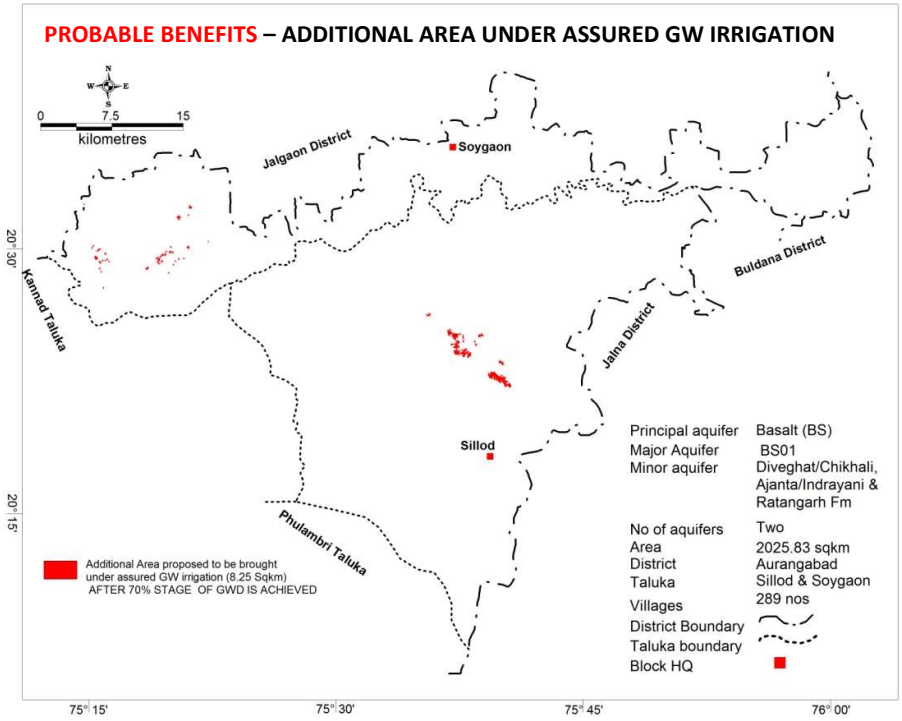
SOEGAON		SILLOD		TOTAL
100 % of citrus fruit crop area proposed to be covered under Drip (sq.km.)	3.85	100 % of sugarcane crop area proposed to be covered under Drip (sq.km.)	5	8.85
Volume of Water expected to be saved (MCM). Surface Flooding req-1.05 m. Drip Req. - 0.70, WUE- 0.35 m	1.35	Volume of Water expected to be saved (MCM). Surface Flooding req- 2.45 m. Drip Req. - 1.88, WUE- 0.57 m	2.85	4.20
Estimated Expenditure (Rs. in Cr.) @ Rs. 30,000/- per acre	2.85	Estimated Expenditure (Rs. in Cr.) @ Rs. 60,000/- per acre	7.41	10.27

DEMAND SIDE INTERVENTIONS – AREA PROPOSED UNDER DRIP IRRIGATION



5.2 Probable Benefits

BENEFITS	SOEGAON	SILLOD	TOTAL
Additional GW resources available after implementing above measures (MCM)	1.78	11.42	13.20
Volume of Water Required TO BRING STAGE OF GWD UPTO 70%	0.00	7.83	7.83
Balance GWR available for GW Development	1.78	3.58	5.36
Reduction in Stage of GW Development	-	from present 74.27% to 70%	
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m	2.74	5.51	8.25
Strengthening of the drinking and domestic water sources. Arresting the decline in water levels of Aquifer-I and raise the water levels in Aquifer-II. Reduction of electricity consumption as the water will need to be lifted from shallower depths from the borewells.			



5.3 Regulatory Measures

Regulatory Measures	None, as stage of GW development is only below 70%

6 SUM UP& RECOMMENDATIONS

The highly diversified occurrence and considerable variations in the availability and utilization of groundwater makes its management a challenging task. Scientific development and management strategy for groundwater has become imperative to avert the looming water crisis. In this context, various issues such as, prioritization of areas for development of groundwater resources vis-a-vis its

availability, augmentation of groundwater through rainwater harvesting and artificial recharge, pricing and sectoral allocation of resources, demand side interventions and participation of the stakeholders must be considered. In view of the above, it is necessary to develop as suitable groundwater management plan.

A thorough study was carried out based on data gap analysis, data generation, data acquired from State Govt. departments and GIS maps prepared for various themes. All the available data was brought on GIS platform and an integrated approach was adopted for preparation of aquifer maps and aquifer management plans of Soygaon and Sillodtaluka.

The study area is spanning over 2025.83 sq.km, out of which 153.38 sq.km is forest area and land available for cultivation is 1461.68 sq.km. Geologically the entire area is occupied by Deccan Trap Basalt.

In Sillod and Soygaon, the main ground water issues are Low Ground Water Potential / Limited Aquifer Thickness / Sustainability, Deeper Water Levels particularly in Aquifer-II, Declining Water Levels and increase in Ground Water Development over the period of time with respect to ground water availability which are all inter-related or inter dependent.

During postmonsoon seasons Rabi crop is entirely dependent on ground water. The inherent hetrogenety and low storage capacity of the basaltic aquifers also hampers equitable distribution of ground water. In Aquifer II, the water levels of more than 50 mbgl have been observed with limited potential. The ground water quality particularly of Aquifer-II is good both for irrigation and drinking.

The present stage of ground water development is 74.27 % in Sillod and 65.76% in Soygaon with net ground water availability of 55.08 MCM and gross draft of 36.23 MCM in Soygaontaluka. Whereas, in Sillod, the net ground water availability of 128.31 MCM and gross draft of 95.30 MCM.Both these talukas have been categorised as Safe, however they are water stressed on account of high stage of ground water development in some of the watersheds.

Thus, the focus of proposed management plan was to use ground water very effectively with supply and demand side interventions. The perusal of above ground water management plan lays stress on adopting micro-irrigation techniques and artificial recharge measures.

However, considering the low storage potential of hard rock aquifer in the area this should also be coupled with ground water augmentation plan, so that there is no stress on ground water regime of the area.

The proposed management plan envisages Rainwater Harvesting and Artificial Recharge structures in the areas feasible for construction of recharge structures based on the long term water level scenario and recharge potential of the aquifer. It envisages construction of 42 percolation tanks @ Rs. 1.50 crore each and 120 check dams @ Rs. 0.30 crores each in feasible areas to fulfil the recharge potential of 9.01 MCM available in Soygaon and Sillod. The proposed expenditure on these structures will be Rs. 99 crores. Roof top Rain water harvesting is not recommended, as the volume of water harvested would be 0.17 MCM with an estimated cost of Rs. 8.84 corers. This seems to be economically unviable and hence not recommended, however in cases of extreme emergencies, the RTRWH scheme can also be taken up.

Similarly, with implementation of proposed demand side intervention viz., shifting from flood irrigation to drip irrigation in 3.85 sq.km. areaof citrus fruit crop area in Soygaontaluka and entire 5.00 sq.km. areaof sugarcane crop area in Sillodtaluka will result in saving of water to the tune of 4.20 MCM.

Thus total savings/augmentations from supply side and demand side interventions will be 13.20 MCM and out of this, 7.83 MCM in Sillodtaluka will be utilised for bringing the stage of ground water development down to 70 % from existing 74.27%.

6.1 Tangible and Non Tangible Benefits

The timely and proper implementation of the above suggested management plan will have many tangible and non tangible benefits for Sillod and Soygaontalukas. Some of the major benefits are listed below.

The proposed construction of the artificial recharge structures viz., 42 percolation tanks and 120 check dams at the estimated cost of Rs. 99 crores to augment the ground water resources to the tune of 9.01 MCM.

Similarly, with implementation of proposed demand side intervention viz., shifting from flood irrigation to drip irrigation in 3.85 sq.km. areaof citrus fruit crop area in Soygaontaluka and entire 5.00 sq.km. areaof sugarcane crop area in Sillodtaluka, this will result in saving of water to the tune of 4.20 MCM.

By implementing above supply side and demand side interventions, following tangible benefits can be accrued by these 2 talukas

- A total of 11.42 MCM of ground water resources will be additionaly available.
- The stage of ground water development of Sillodtaluka can be brought down from present 74.27% to 70%.
- An additional area of 5.51 sq.km can be brought under assured ground water irrigation considering the average crop water requirement (CWR) of 0.65 m.

The implementation of above water conservation, artificial recharge and RTRWH measures will have a positive impact on drinking water sources of the area. It will ensure that the wells don't go dry during summer/lean/stress period in the areas of implementation and sufficient ground water availability is there in the wells even during the summer season. Thus the drinking and domestic water sources will be strengthened. These measures will also be able to arrest the decline in water levels of Aquifer-I and raise the water levels in Aquifer-II. This will result in reduction of electricity consumption as the water will need to be lifted from shallower depths from the borewells.

Further the IEC activities and capacity building activities needs to be aggressively propagated to educate the end user and establish the institutional framework for participatory groundwater management.