

Hydro geological Studies of Chitoda Village from Yawal Taluka of Jalgaon District, Maharashtra

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Abstract

The present paper deals with the hydro-geological studies of a village in Jalgaon district of Maharashtra. Data on geological conditions, soil, hydrology and existing groundwater occurrences have been integrated for management of aquifer for drinking water requirement in the area.

Introduction

The aim of the study for the management of aquifer for meeting drinking water requirement on priority basis. The existing dug well are for mainly for Irrigation purposes. The shortage of groundwater in future may affect the cropping yield however in case of shortfall in surface water in future. The groundwater should be kept intact by way of AQMP and adopting various suggested measures under such circumstances. The groundwater recharge and draft need to be balanced by adopting various techniques recommended to keep the safe Environmental Intact.

Location

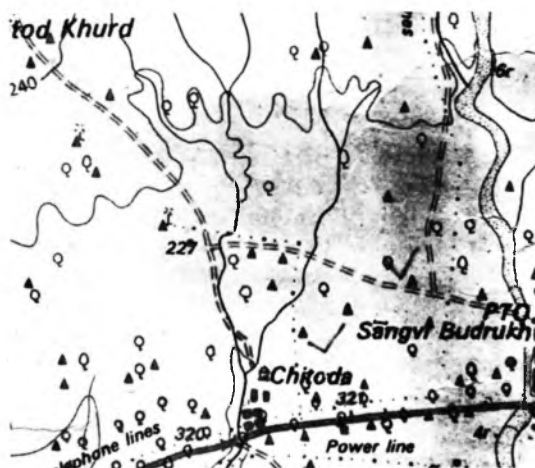
Village Chitoda is located in Yawal Taluka of Jalgaon District in Maharashtra. It is located towards East of Yawal Taluka at a distance of 3 Kms. It falls In Survey of India Toposheet No 46 O/12 in 1 - C quadrant between 21° 10' 60" North latitude & 75° 44' 00" East longitude. Area belongs to Tapi Basin and includes in National Watershed No TE-11. Area of the village is 208 Hectors.

Landuse

DETAILS	AREA IN HECTOR
Forest	0.00
Irrigated area (Well irrigation)	35.87
Urinated	148.92
Culturable waste	23.00
Area not available for cultivation	0.00
Total area	208.79

Physiography

Physiography of this village is typical and forms valley fill and in Northern part of the village is situated at an elevation of > 237.00 meters altitude and is moderately sloping towards South direction attending minimum elevation 220.00m .The slop of the area is 5 to 6 %. There is drop of 17 m in ground level between North and Southern part of the village.



Drainage

The area is drained by three numbers of seasonal nallas flowing from North to South direction. Out of which One flows through the Western border of the village, Second flows all along the Central Western boarder of the area and third is flowing from central part of the village. General drainage pattern type is

parallel to sub-Parallel of 2nd and 3rd order and having U shape valley. All this nallas having base flow up to October.

Sr. No.	Year	Annual rainfall	Rainfall deficit/ excess (%)
1	2	3	4
1	1995	605	- 21. 22
2	1996	738	- 3. 80
3	1997	622	- 19. 01
4	1998	1045	+ 36. 06
5	1999	357	- 53. 51
6	2000	560	- 27. 08
7	2001	552	- 28. 12
8	2002	705	- 8. 20
9	2003	952	+23.95
10	2004	657	- 14.45

Climate

The study area is close to Yawal town where the nearest Rain Gauge Station is located. Hence for all computations, rainfall recorded at this station has been adopted. This area receives an average annual rainfall of 768 mm.

The rainfall data from 1995 to 2004 is shown at Table

Rainfall data for Yawal rain Gauge Station

Above data shows that, out of 10 years the deficit rainfall has occurred for 08 years and deficiency varies from -3.80 % to - 53.51 %, while two years show excess of rainfall (1998 & 2003). The average rainfall of last 10 years is 679 mm, as compared to normal rainfall of 768 mm (- 89 mm). Except for monsoon period (i.e. June to September), entire year is dry. The maximum temperature during summer averages to 44°C, while the lowest temperature during winter averages to 9°C.

Soil Condition

Black cotton soil with fine to coarse-grained loamy clay types of soil has been observed in the village Chitoda. The data collected on soil type indicates that, in the southern part of the village deep loamy soil with 1.00 to 2.00 Mt thickness. Near drainage clayey

yellow soils with 1.00 Mt thick is observed (Medium shallow soil).

Geology

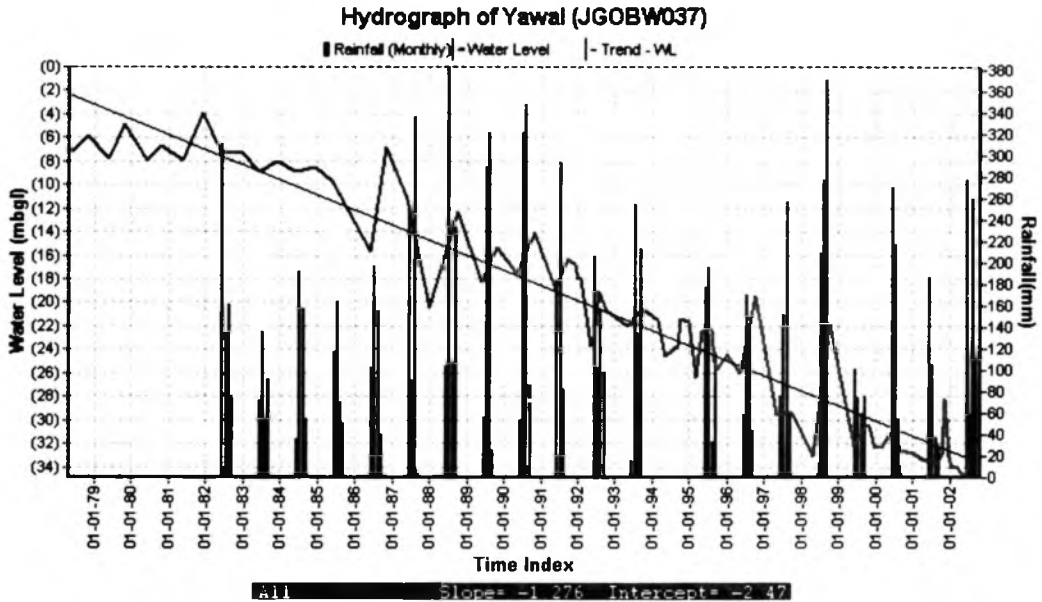
Mostly the surface area is occupied by black cotton soil except the surrounding area of nalla beds, which is occupied by alluvium. The alluvium mostly consists of boulders, pebbles, cobbles, gravels, coarse sand, medium sand, fine sand silt and clay. Boulders are mostly weathered especially of zeolitic basalt and Porphyritic Basalt. Boulder pebbles, cobbles and gravel material is perfectly rounded in nature indicates long transportation. Percentage of a sand zone is less in this area as compare to boulders, pebbles, cobbles and gravels.

Hydrogeology

In Chitoda village one aquifer is encountered which is alluvium mostly consists of silt admixed with pebbles, cobbles, gravels, coarse sand, of various size This aquifer occurs between 191 meters to 185 meters altitude. The average thickness of aquifer is 3 to 6 Mt. The wells fully penetrating these aquifers are yielding groundwater @ 54 to 120 kiloliters per day during winter and the yield reduces 33 to 80 kiloliters during summer. Due to the high density of dug wells tapping this aquifer, it has started showing the signs of over development by way of reduction in annual yield / water availability period.

There are 46 wells existing in the village. Out of them 37 wells and 4 tube wells are used for irrigation purpose. Out of them 37 are irrigation wells and 16 wells are inventoried. The well density in this part is 5.07 wells/ Km². The village is electrified and there is all irrigation wells fitted with electric motors. In general the depth of the wells is ranging from

- Annual net groundwater Recharge = 3092.58 Ham
- Annual groundwater withdrawal = 2197.21 Ham
- Allocation for Domestic & industrial use = 109.80 Ham
- Balance available for future usage = 785.57 Ham
- Stage of development of the watershed = 71.05%
- Status of watershed = Semi critical



45 Mt. to 66Mt with the diameter ranging from 2.00mt to 3.80Mt. Water tables in the village exist at a depth of 35.30 to 65meter below ground level during winter and 34 to 64meters during summer.

Groundwater occurrence

Village Chitoda is included in-group watershed TE-11. This watershed has been assessed for its groundwater potential recently during 2005. The result of the assessment is as follows.

Village include in Non-command area of the watershed

Sr. No.	Type of requirement	Population	Requirement per unit	Total requirement in HAM
	Drinking (Human)	1468	40 Lit/unit	5.872
	Animals	2587	50 Lit/unit	12.935
	Total requirement			18.791

Following graph shows the water level trends recorded at this hydrographic station.

From the hydrograph it is observed that water level decline trend @ of 0.50 to 1.0 m per year it causes to increase in well depth for 1 to 1.50 m per year.

Drinking water supply status of the village

In village Chitoda there is one dug well and two tube wells for drinking water supply. On dug well and one tube well EMs are installed. at present there is adequate water supply in the village from existing structure.

The information on drinking water requirements should be enlisted:

Status of Irrigation

The existing 86 dug wells irrigate 105 hectares in the village Chitoda. Irrigation activity is to production of food crops like Wheat, Gram and Jawar and Cash crops like Banana and Sugarcane.

Due to the high density of wells and the high water requirements of the crops grown in the village, dis-harmony in the groundwater recharge and withdrawal conditions has been observed.

Conclusions

On the basis of Hydro geological, geophysical surveys and geo-chemical studies the following conclusions are made.

- The entire village is covered by alluvial of sand and silt. Sand is of various size and thickness.
 - Upper part of aquifer is dry. Present aquifer is at bottom of well of about 3.00 to 4.00mt.
 - The density of irrigation wells is high and sprayed all over the village area.
 - The depth of the irrigation wells varies from 37 meters to as deep as 50 meters and the diameter from 2 meters to 3.5 meters. The groundwater potential is moderate.
 - The alluvium mostly consists of boulders, pebbles, cobbles, gravels, coarse sand, medium sand, fine sand silt and clay. Boulders are mostly weathered especially of zeolitic basalt and Porphyritic Basalt.
 - The aquifers are confined to semi confined.
 - The groundwater movement is towards south direction. The groundwater quality is potable for drinking and irrigation yield.
 - As per the village audit there is shortfall of 49.73 ham mainly due to excessive withdrawal of groundwater.
- adaptable acceptable and manageable from maintenance and operation point of view.
- Additional irrigation borewells should not be constructed.
 - Change in cropping pattern – Low water requirement, high yield and pricing crops should be encouraged. Mindsets of the people need to be oriented in this regard.
 - Change in irrigation system – Drip and sprinklers irrigation system is the need of hour. It is suggested to adopt them in place of conventional flood irrigation system.
 - Recharge structures like recharge shaft will be constructed in consultation with local people to improve the groundwater potential along local streams. Suitable measures will be adopted in consultation with local bodies to bridge the gap between recharge and withdraw so that deficit can be meet out.

Recommendations

The multidisciplinary surveys undertaken in the village have given much needed technical input to plan optimum development of water resources in the village. The following recommendations are made.

In order to meet out the shortfall or to maintain groundwater level within the safe limit during hydrological cycle and sustainability for years together involvement of the community may be sought, both in supply side and demand side management interventions.

Technical options for water harvesting may be chosen considering community's traditional wisdom integrated with scientific techniques, so that options become

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