

Chapter 3

SURFACE AND GROUNDWATER FEATURES

1.1 Natural Drainage Pattern and River Basins

All the river in Pune District originate in the Western part of Sahyadri Hill ranges in Junnar, Ambegaon, Khed, Maval, Mulshi, Velhe and Bhore Taluka and flows through the Eastern part of the district.

The district is divided into two major river basins, *Bhima* and *Nira*. NorthEast, Eastern and Central part of the district comes under the *Bhima* river basin and the SouthEast and the Southern part of the district under the *Nira* river basin. River *Bhima* is the main river flowing through the district. River *Bhima* has its origin at 'Bhimashankar' located in the Khed taluka and it flows through the central part of the district towards the SouthEast. The *Ghod*, *Mula-Mutha* and *Nira* are tributaries of river *Bhima*. River *Ghod* is a perennial river and flows across the Northern region of the district. River *Kukdi* and *Mina* are the two tributaries of river *Ghod*. *Ghod* river originates in the Ambegaon Taluka. The confluence of the *Bhima* and *Nira* is at Nira-Narsingpur in Indapur Taluka.

Eastern flowing *Nira* River flows along the Southern boundary of Pune district. The *Karha* River is a tributary of river *Nira*. Total length of the rivers in the district is about 1296 km.

1.1.1 Drainage with Watershed Map

Drainage with Watershed Map (**Map No. 9**) shows the major rivers passing through the district, basin boundaries, watersheds and drainages. The map also shows the drainage categories based on availability of water i.e. first order, second order and third order. The district is divided in to two river basins, *Nira* and *Bhima*. The map also shows the sub-basins and watershed numbers and watershed boundaries.

Bhima basin has large coverage and covers 51 Nos. of watersheds. *Nira* river basin covers Taluka Velhe, Bhore, Purandhar, Baramati and Indapur.

1.2 Surface Water Flow and Use

1.2.1 Surface Water Flow

The flow rate available in a river helps in determining the dilution factor available for effluents and in self-purification.

Depending upon the flow, the drains are divided into three flow categories i.e. high, medium and low relative to each other. This is done to differentiate the different drains according to their dilution capacity, which is based on their flow characteristics within the district.

High flow stands for perennial flow, **medium flow** stands for seasonal with good flow and **low flow** stands for seasonal with insignificant flow.

Normally, perennial flow in a river is due to the discharges from all the watersheds. Some upstream watersheds may be contributing to such flows and other may be contributing to seasonal flows. Hence, although a river may be having good flow, effluents cannot be discharged in the entire watershed, as dilution factor is not available in all the drains in that watershed.

1.2.2 Surface Water Flow Map

Area wise distribution of the 'high', 'medium' and 'low' surface water flow is depicted in the Surface Water Flow Map (**Map No.10**), by giving a buffer of 5km from the high and medium flowing rivers.

The three zones are;

- **'High' flow areas:** This includes the rivers/drainages with high flow and a buffer of 5 km to these drainages (River *Indrayani, Mula, Mutha, Nira, Bhima and Ghod.*)
- **'Medium' flow areas:** This includes the rivers/drainages with medium flow and a buffer of 5 km to these drainages (Rivers *Karha, Bhama etc.*) and
- **'Low' flow areas:** This includes the seasonal streams and remaining watersheds. Area wise distribution of these zones has been given below Table X.

Table I. Surface Water flow characteristics in Pune District

Surface Water Flow Category	Area		Location
	Sq. km.	%	
High	7740.23	51.61	'High' flow exists in river Mula, Mutha, Nira, Ghod, Bhima throughout stretch & except small stretch, river Indrayani & Pauna
Medium	5128.36	34.19	'Medium' flow exists in Karha river- Baramati Taluka, Bhama river- Khed Taluka, Indrayani and Pauna river- Maval Taluka, Mina river in Junnar Taluka.
Low	2129.89	14.20	'Low' water flow areas are found along the Western boundary of the district covering seven taluka. Low water flows areas also found in some portion of Taluka Baramati, Indapur, Daund, Shirur, Haveli and Purandhar

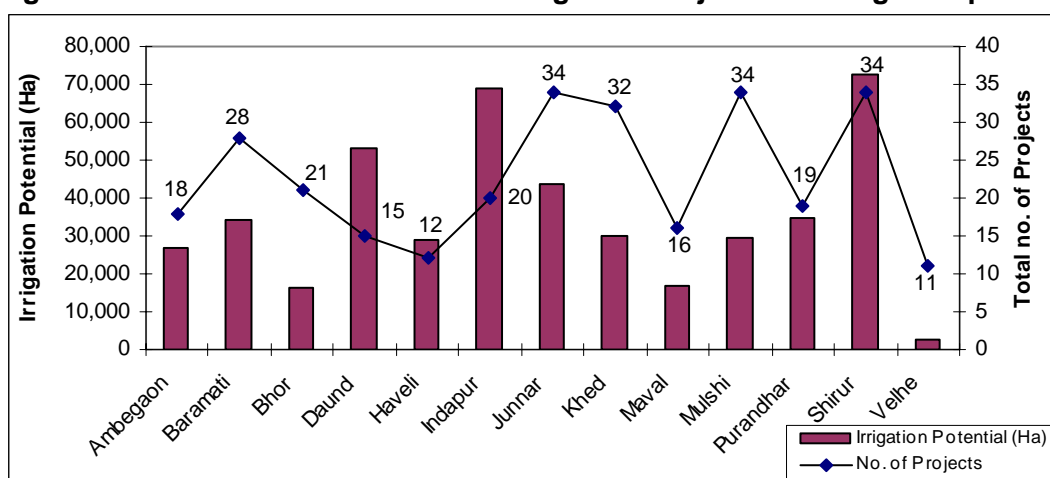
Source: Based on Surface Water Flow Map (Map No. 10).

1.2.3 Irrigation Projects and Dams

The district has 12 major, 8 medium and 274 minor irrigation projects (completed and under construction). Taluka Haveli and Velhe has least number of irrigation projects, whereas maximum number of irrigation projects is in Taluka Baramati, Junnar, Khed, Mulshi and Shirur (Fig.20).

Talukawise list of major and medium irrigation projects (completed and under construction) and minor irrigation projects (completed, under construction and proposed) in Pune District has been given at **Annexure 1:** Table 23.

Figure 1. Talukawise total number of Irrigation Projects and irrigation potential



Source: Superintending Engineer, Pune Irrigation Circle, Pune (2002).

The Shirur, Indapur and Daund have maximum irrigation potential, whereas least irrigation potential is in Taluka Velhe (Table XI). The table also depicts the talukawise irrigation potential of Major, medium and small irrigation project.

Table II. Irrigation potential of completed and on going irrigation projects (ha)

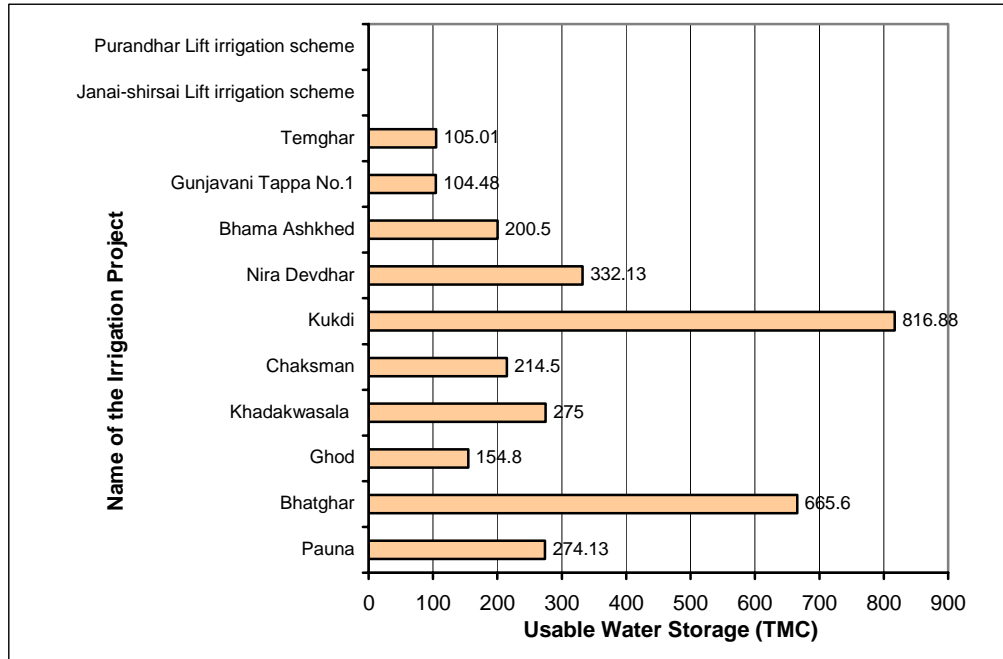
Taluka	Irrigation Potential			Total Irrigation potential
	Major Irrigation Project	Medium Irrigation Project	Small Irrigation Project	
Ambegaon	15,418	3,440	8,158	27,016
Baramati	22,533	1,223	10,214	33,970
Bhor	11,080	--	5,164	16,244
Daund	41,340	--	12,026	53,366
Haveli	12,869	7,362	8,788	29,019
Indapur	57,500	--	11,205	68,705
Junnar	27,115	8,001	8,517	43,633
Khed	17,371	3,071	9,815	30,257
Maval	6,364	5,139	5,126	16,629
Mulshi	11,800	7,684	10,252	29,736
Purandhar	26,610	1,972	6,006	34,588
Shirur	55,914	--	16,520	72,434
Velhe	410	--	2,196	2,606

Note: ‘--’ Not Available

Source: Superintending Engineer, Pune Irrigation Circle, Pune (2002).

The usable water storage of completed and under construction major and medium projects (dams) have been shown in at **Annexure-I** Table 23. The Kukdi Project in Taluka Junner and Bhatghar dam in Taluka Bhore has a maximum capacity of usable water i.e. 816.88 and 665.6 TMC with an irrigation potential of 56370 ha and 47,540 ha respectively (Fig. 21). This is about 11.3% and 9.5% of the total irrigation potential of the entire district.

Figure 2. Usable water storage capacity of major dams in Pune district

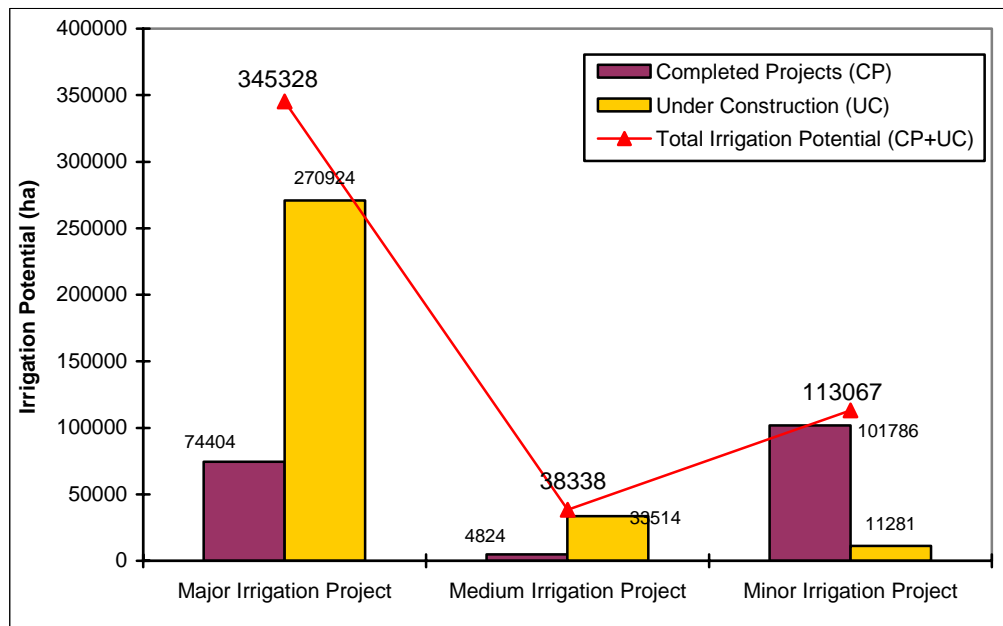


Note: Data on usable water storage capacity of Purandhar and Janai-Shirsai lift irrigation scheme is not available.

Source: Superintending Engg. Pune Irrigation Circle, Pune (2002).

The total irrigation potential of all the Major, Medium and Minor Irrigation Projects is 4.97 lakh hectares, which is about 31% of the total geographical area of the district (Fig. 22).

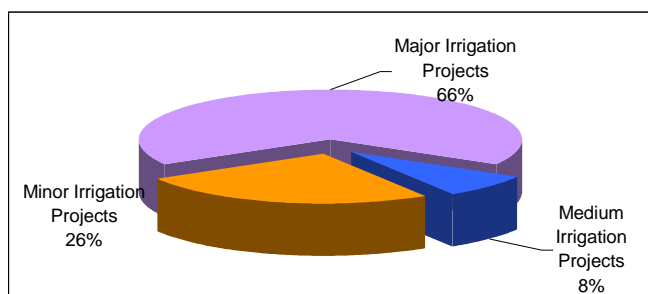
Figure 3. Irrigation potential (ha) of Major, Medium and Minor Irrigation Projects



Source: Superintending Engg. Pune Irrigation Circle, Pune (2002).

Major irrigation projects cover 66% of irrigable land, whereas medium and minor irrigation projects cover 8% and 26% irrigable land, respectively (Fig. 23).

Figure 4. Irrigation potential (%) of Major, Medium and Minor Irrigation Projects in Pune District



Source: Superintending Engg. Pune Irrigation Circle, Pune (2002).

1.2.4 Irrigation Map

The Irrigation Map (**Map No.11**), shows location of Major and Medium irrigation projects (completed, under construction), catchment and command areas of the projects (completed & under construction) and the canal distribution. The following Table XII shows the catchment and command area of irrigation projects in the district.

Table III. The Catchment, Command area in Pune District

Sr.No.	Description	Area (sq.km.)	% To the District
1	Catchment area	3198.8	20.45
2	Command area of completed projects	3515.6	22.47
3	Command area of under construction projects	2455.2	15.69

1.2.5 Surface Water Use

Surface water throughout the district is used for drinking, irrigation and bathing purpose. Some villages use the surface water for fishing purpose. Industrial water requirement is primarily surface water dependent. Details of intake points for drinking water/ industrial water supply are given in Table 27 of **Annexure -1**.

The areas where surface water is being utilized, either for irrigation or for drinking purposes has been earmarked in order to understand areas suitable for the siting of industries. Classification criteria of river water (MPCB), based on best designated use has been given in the Table XIII below:

Table IV. Classification of River water based on Best Designated Use

Sr. No.	Classification	Designated Best uses
1.	A-I	Drinking water source without conventional treatment but after disinfection. Point from where the river originates upto first designated notified dam/ weir.
2.	A-II	Drinking water source with conventional treatment followed by disinfection. River stretch below first designated/ notified dam/ weir upto A-III / A-IV class of waters.
3.	A-III	Fish and Wildlife propagation
4.	A-IV	Agriculture, Industrial cooling and processing

Source: MPCB, Mumbai

Table 25 and 26 at **Annexure- 1** shows the classification of rivers in *Nira* River Basin and the Upper *Bhima* River Basin.

Following Table XVI shows major watersheds, area covered in each taluka and predominant landuse in respective watersheds.

Table V. Basin wise Surface Water Use in Pune District

River	Perinnial/ Seasonal	River Basin	River flowing through Taluka	Watershed Number*	Predominant Landuse
Nira	Perinnial	Nira	Bhor, Purandhar, Baramati and Indapur	BM (81,56,57,72,73,74, 75,76,77)	Forest land, Waste land, Single and Double crop
Karha	Perinnial	Nira	Purandhar and Baramati	BM (58,59,60,69,70)	Waste land, Single and Double crop
Welvend	Perinnial	Nira	Velhe, and Bhor	BM 71	Forest land, Waste land, Single crop
Mutha	Perinnial	Bhima	Haveli and Pune-city	BM (54,55)	Forest land, Waste land, Single crop
Mula	Perinnial	Bhima	Mulshi and Haveli	BM (44,45,43)	Forest land, Waste land, Single crop
Andhra	Perinnial	Bhima	Maval	BM 24	Forest land, Waste land, Single and Double crop
Indrayani	Perinnial	Bhima	Maval, Khed and Haveli	BM (25,37,38,39)	Forest land, Waste land, Single and Double crop
Bhima	Perinnial	Bhima	Khed, Haveli and Shirur	BM (11,21,20,19,18,36, 35,49,48,61,68,67,66,78)	Forest land, Waste land, Single and Double crop
Bhama	Perinnial	Bhima	Khed	BM (22,23)	Forest land, Waste land, Single crop
Pauna	Perinnial	Bhima	Maval and Haveli	BM (40,41,42)	Forest land, Waste land, Single crop
Ghod	Perinnial	Bhima	Ambegaon and Shirur	BM (10,12,9,17,13,27,34)	Forest land, Waste land, Single crop
Mina	Perinnial	Bhima	Junnar, Ambegaon and Shirur	BM (7,8)	Forest land, Waste land, Single and Double crop
Kukdi	Perinnial	Bhima	Junnar and Shirur	BM (3,4,5,6), GV 14	Forest land, Waste land, Single and Double crop
Pushpa-vati	Perinnial	Bhima	Junnar	BM 1	Forest land, Waste land, Single and Double crop
Aar	Perinnial	Bhima	Junnar	BM 2	Forest land, Waste land, Single and Double crop

Source: 1) MRSAC, Nagpur, Landuse Map (2000-01).
 2) Superintending Engg. Pune Irrigation Circle, Pune (2002)
 3) *Watershed nos. from Drainage & Watershed Map No.9

1.2.6 Surface Water Use Map

The Surface Water Use Map (**Map No.12**) is prepared using the drainage map, which demarcates the watersheds. The map depicts category wise areas based on the existing usage of surface water in that particular area. It shows the locations of various irrigation projects (major, medium and minor) and locations of public water supply intake points for drinking purpose and pilgrim places having organized mass bathing.

The information on surface water intake point is made available from the office of the Supdt. Engg. Maharashtra Jeeven Pradhikaran, Pune. The identified location from the

available information is marked on the map. Due to constraint in the information, the name of the project is considered as surface water source location and marked by the village name. It might be possible that the precise intake point location is differing from the location marked on the map.

Available data (**Annexure-I** at Table 27) shows the more number of drinking water intake point location than the location marked on map. The Table XV shows the talukawise surface water intake point location marked on the map.

Table VI. Talukawise Locations of Surface water intake point in Pune District

Taluka	Location of Surface Water intake points (Village)
Ambegaon	Pokhari, Manchar
Baramati	Mekhali, Morgaon
Bhor	Shind, Mhalavadi, Kiwat, Angasule, Kari, Korle, Titeghar, Vadtumbi, Bhatghar
Daund	Sonwadi, Nangaon, Kangaon, Panwali, Bharatgoan, Dalimb, Kusegaon, Chincholi
Haveli	Dhanori, Manjari Bk., Shindwane, Warje, Katraz
Indapur	Shetphalgadhe, Udhat, Sirsatwadi, Shetphal Haveli, Shirsadi, Indapur
Junnar	Otur, Ralegan, Narayangaon, Belhe, Yenere, Manjarwadi
Khed	Chakan, Kadus, Rajgurnagar
Maval	Karunj, Bedse, Tikona, Shivane, Kusgaon Kh., Kurvande, Ghonshet, Mau, Karla, Ukasan, Ambale, Kusgaon Bk., Talagaon Dhabhade, Lonavala, Wadgaon
Purandhar	Malshiras, Mawadi Supe, Kolvihire, Dhanakwadi, Dive, Pargaon, Jejuri
Shirur	Karandi, Shirur, Nhavara, Jambut
Mulshi	Wadgaon
Vehe	Velhe Bk., Antroli, Vinzar, Dhanep

1.3 Ground Water

1.3.1 Hydrogeomorphology Map

Hydrogeomorphology map (**Map No.13**) has been prepared using the Geomorphological features of Geomorphological Map supplied by MRSAC, Nagpur.

The map shows the locations of lineaments (Major and Medium faults) in the district. The lineaments are scattered in all taluka of the district except in Pune city. The map shows the geomorphological features- Alluvial plain, Denudational Hill, Flood Plain, Highly Dissected Plateau HDP-A, Medium Dissected Plateau MDP-A, Plateau, Structural Hills, Water Body Mask. The geomorphological features, area covered and locations in the district are shown in below Table XVI.

Table VII. Geomorphological Features and its area in Pune District

Sr. No.	Geomorphology Features	Area (sq.km.)	Location in the district
1.	Alluvial Plain	388.33	It represents the area under the river flow. Due to the river flow the characteristics of the soil get changed. District is well served by the river and the alluvial plain area. This area is found scattered in all Taluka of the district along the river stretches.
2.	Denudational Hill	144.87	Small patches scattered in all Taluka except Bhor & Velhe
3.	Flood Plain	1.73	Negligible area in the district. Very small patches are scattered in Taluka Pune-City,

			Daund, Maval, Khed, Baramati, Indapur
4.	HDP-A	1053.92	Major portion of Taluka Ambegaon, Khed and small portion of Taluka Junnar and Maval
5.	MDP-A	1032.58	Continious stretch spread in Taluka Haveli, Bhor, Purandhar, Baramati, Daund and Indapur
6.	Plateau	12654.91	Major portion of the district is covered by this area
7.	Structural Hills	79.38	The regid small area in Taluka Ambegaon, Khed, Maval, Mulshi.
8.	Water Body Mask	275.21	It shows the area under waterbody. It covers the lake/reservoir areas in Taluka Junnar, Ambegaon, Khed, Maval, Mulshi, Velhe, Bhor, Haveli, Purandhar, Shirur, Baramati, Indapur and Daund

Note: HDP-A : Highly Dissected Plateau, MDP-A Medium Dissected Plateau

1.3.2 Ground Water Table

The depth of ground water table plays an important role in determining the risk due to contamination to groundwater. The details of talukawise public water supply schemes from river and ground water in the district have been given in **Annexure 1:** Tables 27.

Depending on the groundwater occurrence (as per MRSAC), the district is divided into three zones 'high', 'medium' and 'low'. 'High' ground water potential areas are those having ground water table less than 5 m below ground level, 'Medium' areas are those having water table in the range of 5 to 15 m below ground level and 'Low' ground water potential areas are those having water table more than 15 m below ground level (Table XVII).

1.3.3 Ground Water Table Map

The Ground Water Table Map (**Map No. 14**) has been prepared based on the Hydro-geomorphology map supplied by the MRSAC. As data from the source department GSDA, Pune was not available.

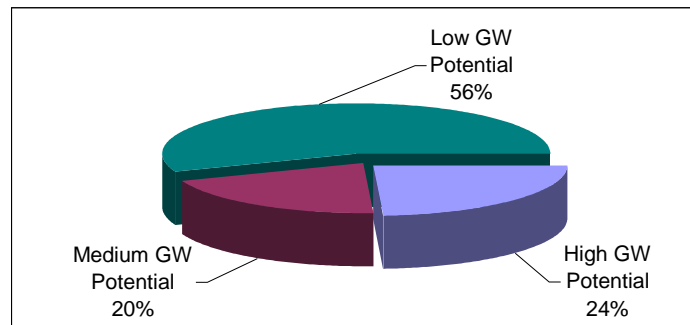
The map shows the depth of ground water table in the district. 3 categories have been made based on the level of ground water table (<5m, 5-15m and >15m).

Table XVII shows the location having different ground water potential and Fig.24 shows the percent area based on potentials of ground water in the district.

Table VIII. Ground Water table and potential in Pune District

Zone	Area		Location in the District
	GW Potential	sq. km.	
Less than 5.0m below ground level	High	3638.66	Scattered in all taluka of the district. Covers major area of Northen, Central, Eastern and Southeastern side of the district. It shows major portion in Taluka Junnar, Pune city, Haveli, Daund, Indapur and Baramati. Small portion scattered in Taluka Purandhar, Shirur, and Ambegaon. Small narrow streps are scattered in Taluka Maval, Khed, Mulshi and Bhor and small-patched portion in Velhe.
5-15m below ground level	Medium	2964.33	Small patches are scattered in all Taluka of the district. Shows major portion of Taluka Shirur, Indapur.
More than 15m below ground level	Low	8381.11	Major portion of the district is covered by this area. This portion is scattered in all taluka, shows the Major portion of Western seven taluka, Northeastern and Southeastern area of the district.

Figure 5. Ground Water Potential (%) in Pune District



Source: Based on Ground Water Table Map (Map No. 14)

1.3.4 Ground Water Use Map

The Groundwater Use Map (**Map No.15**) shows the ground water intake points within the district and linaments (Major and Medium faults). The information of GW intake points is made available from the Maharashtra Jeeven Pradhikarn office-Pune (**Annexure 1: Table 27**). The identified location from the available information is marked on the map. Due to limitations of the information, the name of the project is considered as ground water source location and marked as village name. It is possible that the exact intake point location may differ from the location, which marked in the map.