



---

## Fluoride Content in Ground Water and Population Clinical Status A Case Study of Tehsil Sampla

Dr. Phool Kumar Malik,  
Associate Professor in Geography,  
Government College Sidhrawali,  
District Gurugram-Haryana  
E-mail: [p\\_k\\_malik@rediffmail.com](mailto:p_k_malik@rediffmail.com)

**Abstract:** *The source of fluoride to body is through drinking water as well as through diet. But Drinking water is considered as the major source of fluoride to the body. Ground water is one of the most imperative natural resource. It is the source of about 33 percent of the water supplied for household's chores and 42 percent for irrigation purposes. It serve up as a reliable source of drinking water for many people worldwide. Ground water contamination is reflector of soil texture, quality and level of water. Therefore, these points need to be given a primary research and quality control attention to understand possible contamination in ground water. Present study is designed to investigating the Fluoride content in ground water and prevalent clinical symptoms of fluorite patients. The study is undertaken in twenty three villages and one urban center of tehsil Sampla in District Rohtak - Haryana (India). Total 240 best representative water points (10 from each data point) selected by systematic purposive random sampling method to data source (to collect water sample of ground water sources) for assessing fluoride parameters of the water. Further sample survey 480 respondents of male and female age between 15 to 60 years at different study points (20 each from data point) used to examine the Prevalent Clinical Symptoms of Fluorite Patients, like dental and skeletal fluorosis, joint pains and gastrointestinal diseases with the help of medical practitioner. It has been observed from the collected ground water that fluoride level in 03 villages is within the range, while in 21 villages of study area it is above the permissible limits of WHO. Out of 480 examined respondent 345 (71.88%) have fluoride related clinical symptoms. Among identified clinical symptoms 44 (12.757%) recorded with Tooth decay, 67 (19.420%) Mottled Enamel, 82(23.77%) Skeletal Fluorosis, 12(3.48%) Dental Mottling with white Patches, 63 (18.26%) Dental Mottling- Black Stain and pitting teeth, 40 (11.59%) Rheumatic in Joints Cervical spines, 24(6.96%) Gastrointestinal discomfort, and 13(3.77%) crippling skeletal Fluorosis problem. It has been further observed that prevalent clinical symptoms of fluorite patients are corresponding to the level of fluoride in ground water. Consequently, it is accomplished that, the villages affected by fluorosis be supplied with safe drinking water less than 1.5 mg/L fluoride, either by changing the water source to safer one or by adapting suitable treatment technique to remove fluoride in the existing sources*

**Keywords:** *Fluoride, Clinical symptoms, Dental and skeletal fluorosis, Gastrointestinal discomfort.*



Introduction: Water is an essential natural resource for sustaining life and environment. On the other hand chemical composition of surface or subsurface water is one of the primary factors on which the suitability of water depends. Ground water is an important natural resource serving as a reliable source of drinking water for many people worldwide. Water is a major constituent of all living things which makes up approximately two-thirds of the human body weight (Gore 2006). Currently, there are about two billion people worldwide who lack access to safe drinking water (Kubakaddi 2001). The consequences of drinking unsafe, contaminated water are numerous and are still not fully understood. According to the World Health Organization (WHO), drinking contaminated water is one of the major causes of diarrheal diseases; these diseases make up the second leading cause of child mortality (WHO 1981). Overall, the provision of safe drinking water can help to reduce or eliminate preventable deaths and improve the quality of life for low-income households around the world (Danish 1952). Availability of safe and reliable source of water is an essential prerequisite for sustained population growth and development (Mathur 1976). Groundwater is a vital source of water supply for about one-third of the world's population (ISI 1983).

In India fluoride is major inorganic pollutant with natural derivation in groundwater. Fluoride is a quite widespread ingredient that does not occur in the elemental state in nature because of its high reactivity. Fluoride occurs in almost all water from trace to high concentrations. (Malik P.K.2016). Fluoride concentration in ground water depends on various factors such as temperature, pH, and solubility of fluoride bearing minerals, anion exchange capacity of aquifer materials and nature of geological formation and contact time of water with particular formation (Panadey, H.K.2015.). Anthropogenic activities such as use of phosphate fertilizers, pesticides, sewage and sludge for agriculture, depletion of groundwater, etc., are also responsible for increased fluoride concentration in groundwater. Hence, Soil is a key factor that directly or indirectly impinges on the quality of water. When groundwater is used in irrigation, the crop grown also incorporates this fluoride apart from other sources (Naik,R.G ,2017). Ground water a major and preferred source of drinking water in rural and urban areas particularly in India is an essence soil texture, quality and level of water ( Malik P.K. 2016).

Ground water is contaminated by numerous minerals like calcium, magnesium and fluoride etc physically available in soil or irrational compost use. Out of contaminated chemicals, fluoride is indispensable in minute magnitude for standard mineralization of bone; teeth, formation of dental enamel and stimulate the growth of many plant species Very low doses of fluoride (<0.6 mWlts) in water promote tooth decay. On the other hand disproportionate amount of fluoride may prove toxic to plant, animal and human as fluorosis. Fluorosis is now a worldwide problem (ICMR 1999). When consumed in higher doses (>1.5 mWlts), it leads to dental fluorosis or mottled enamel and excessively high concentration (>3.0 mg/lts) of fluoride may lead to skeletal fluorosis (WHO 1984). In general, fluoride content in water between 2.0 and 2.5 mg/ lts may lead to dental mottling, which is characterized initially by opaque white patches on the teeth and in advanced stages leads to dental fluorosis (teeth display brown to black staining) followed by pitting of teeth surfaces. High manifestations of dental fluorosis and skeletal fluorosis may occur when fluoride concentrations in drinking water exceed 2.50 mg/l (BIS,1992). The high fluoride concentration manifests as an increase in bone density leading to thickness of long bones and calcification of ligaments. The symptoms include mild rheumatic/ arthritic pain in the joints and muscles to severe pain in the cervical spine region along with stiffness and rigidity of the joints (Teotia SP, 1994). Presence of various hazardous



contaminants like fluoride, nitrate, sulfate and other heavy metals in underground water has been reported from different parts of India. It is well established that India has acute public health problem induced by utilization of fluoride contaminated groundwater as a source of drinking water, though the origin of this elements is largely ascribed to geological reasons (ICMR 1999). The disease may be present in an individual at sub-clinical, chronic or acute levels of manifestation. Crippling skeletal fluorosis can occur when the water supply contains more than 10 mg/lts of fluoride (Carlson 1960). The severity of fluorosis depends on the concentration of fluoride in the drinking water, daily intake, continuity and duration of exposure and climatic conditions (ICMR 1999)

So it is extremely essential to understand the present contamination level, distribution and developing a methodology for safe drinking water source. The health problems arising as a result of fluoride contamination are more wide spread in India. The problem of excessive fluoride in ground water in India was first reported in 1937 in the state of Andhra Pradesh. At the moment fluorosis is a major public health problem in 18 out of 28 states of India. Nearly 177 districts have been confirmed as fluoride affected area. Recent studies show approximately 62 million People including 6 million children suffer from fluorosis because of consumption of water containing high concentration of fluoride (WHO (1970) Hence in the present study attempt has been made to investigate and analyze the records of clinical features of fluorosis in the study area.

**Study Area:** The Tehsil Samplalies between 28° 44'14.21" N to 28°53'16.02" N and 76°38'41.56" E to 76°51'52.53" E covering an area of 24,910 Hectare (Figure-1). It is located in state of Haryana (India). The study area is located in the Indo-gangetic plain which was formed by the deposition of the alluvial segments brought by the Himalayan River. The study area generally experience monsoon climate. The drainage system of the study area is influenced by south-west monsoon. The study area has population of 1, 23,826 (2011 census). The total numbers of villages in the study area is 23 and 01 town (Figure-2). Out of the total geographical area of the district 79.12 percent of area is used for the agriculture in 2001 but it decreases to 66.18 percent in 2010-11.

**Objectives:** The main objectives of the present studies are:

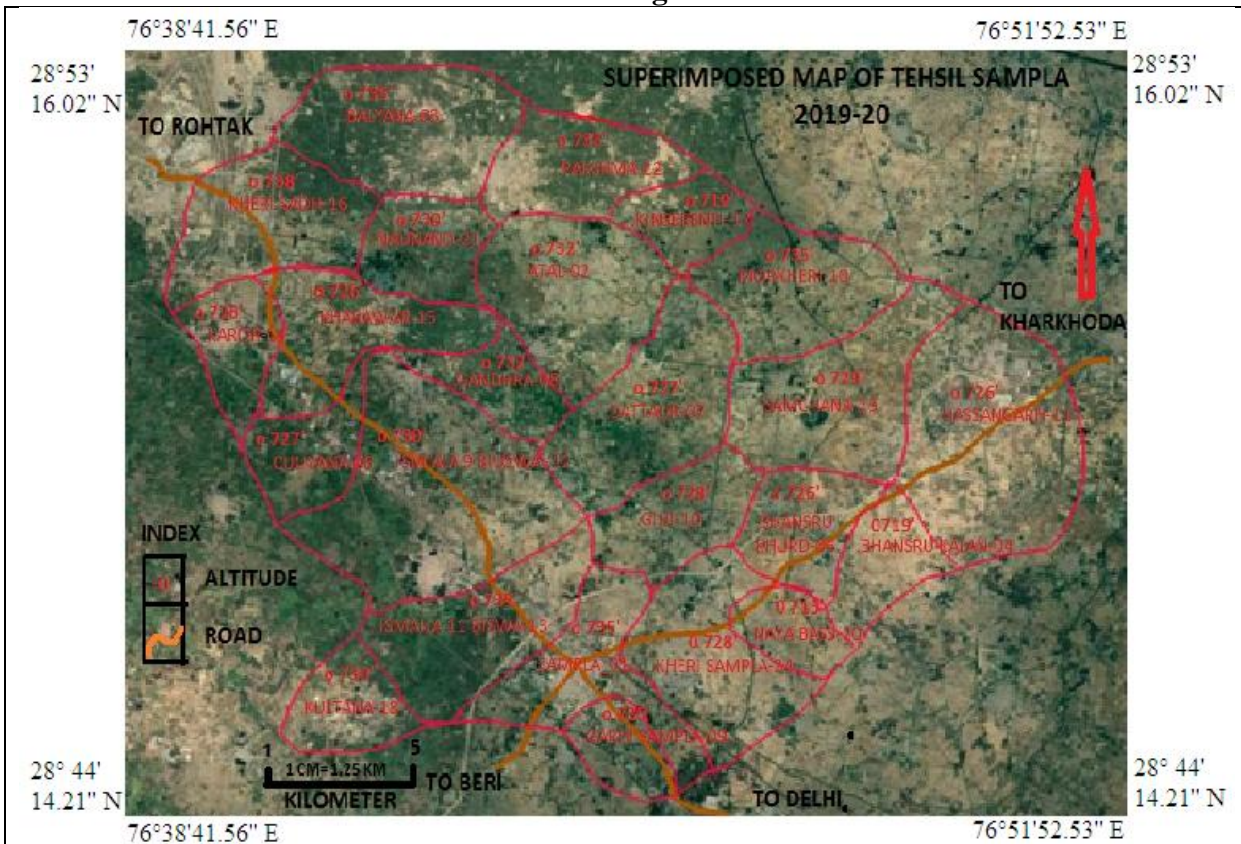
1. To investigate the impact of fluoride content on human being by drinking ground and surface water.
2. To assess the clinical symptoms like dental and skeletal fluorosis, Joint pains and gastrointestinal diseases among local population.
3. To find out the severity of the disease in the study area.
4. To analyze the records of clinical features of fluoride patients in the study area.
- 5 To understand the present contamination level, distribution and developing a methodology for safe drinking.

**Database and Methodology:** The calorimetric and electrode method is used to study the prevalent fluoride content in ground water of the study area. Total 240 best representative water points selected by systematic purposive random sampling method as data source (to collect water sample of ground water sources) for assessing fluoride parameters of the water. Samples are collected from borewells/hand-pumps through field visit to particular villages for assessing fluoride and other physicochemical parameters. Samples are collected in good quality polythene bottles of one liter capacity. Sampling has been carried out without adding any preservative in rinsed bottles directly for avoiding any contamination and brought to the laboratory. Fluoride concentration of sample was determined by ion electrode method. Fluoride concentration in ground water is coupled with soil



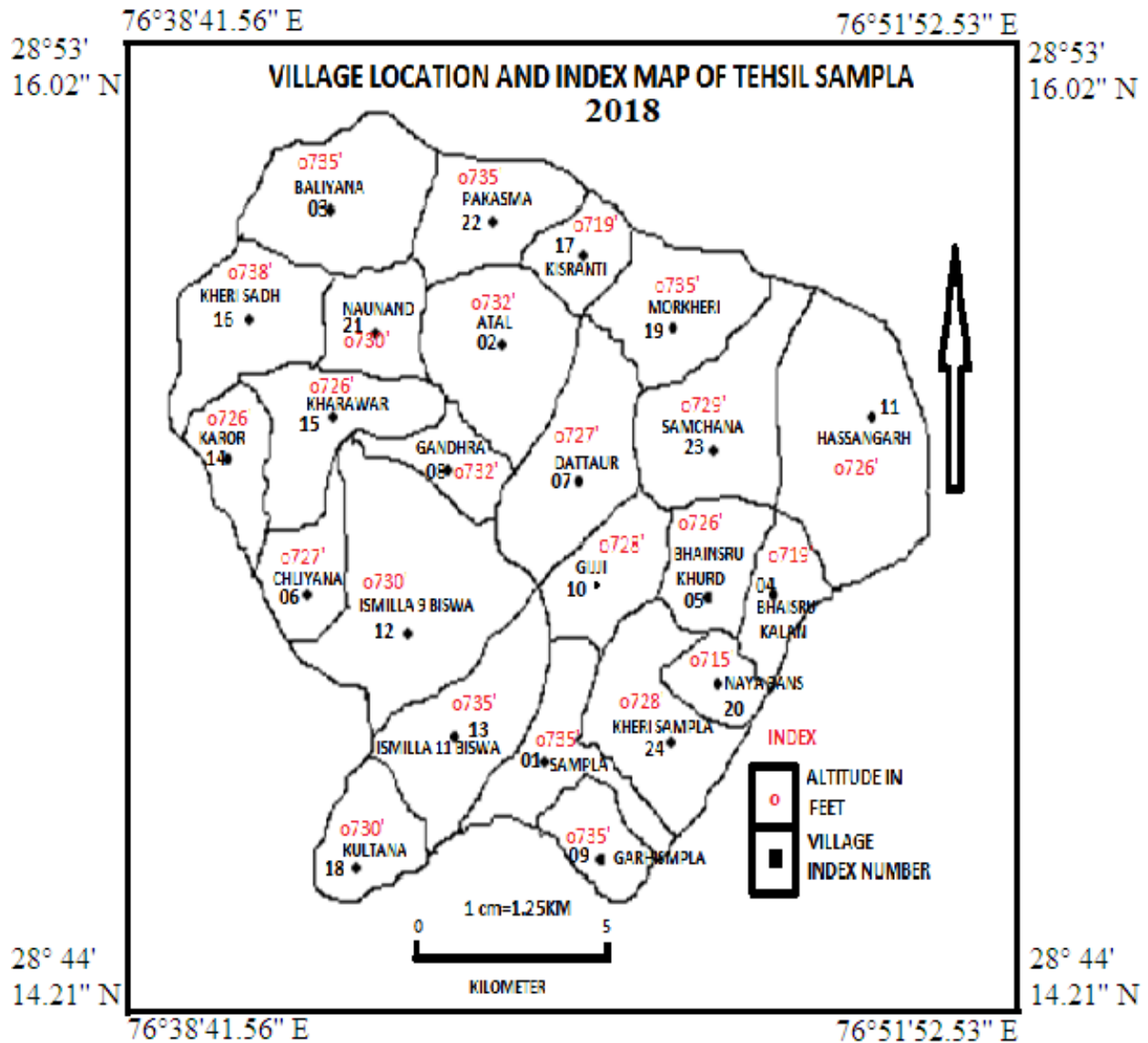
texture, Quality and level of water .Correlation and linear regression method was applied to analyze the major component of ground water. Further sample survey of 480 respondents of male and female age between 15 to 60 years at different study points (20 from each settlement) used to examine the Prevalent Clinical Symptoms of Fluorite Patients, like dental and skeletal fluorosis, joint pains and gastrointestinal diseases with the help of medical practitioner.

**Figure 1**



**Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth**

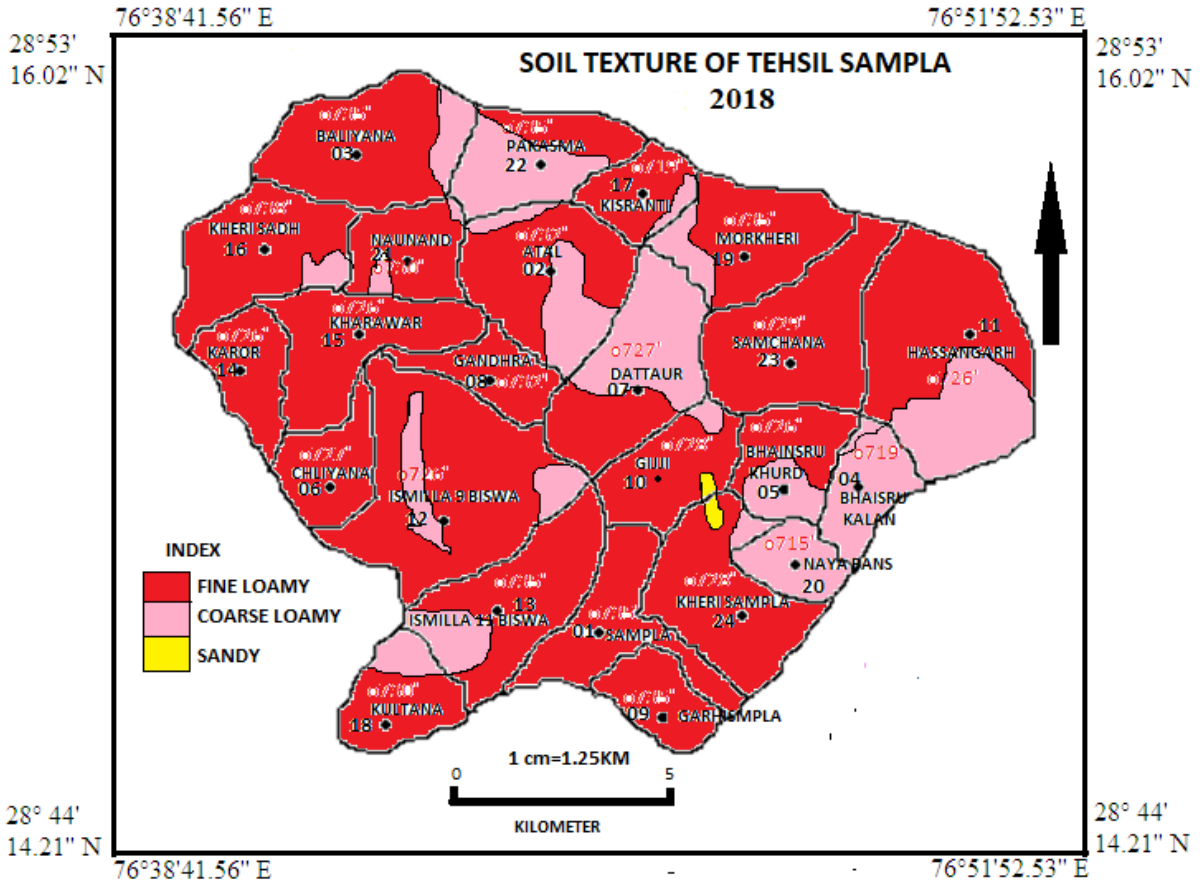
**Figure 2**



**Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth**

Note:  
 1S-Sampla MC, 2S-Atal, 3S-Baliana, 4SBhainsruKalan, 5SBhainsruKhurd, 6SChulliana, 7SDattar, 8SGandhra, 9SGarhi Sampla, 10S-Gijji, 11S-Hassangarh, 12S-Ismaila 9-B, 13S-Ismaila-11B, 14S-Karaur, 15SKehrawar, 16SKheriSadh, 17S-Kisranti, 18S-Kultana, 19S-Morkheri, 20S-Naya Bans, 21S-Nunond, 22S-Pakasma, 23S-Samchana, 24S-Kheri Sampla,

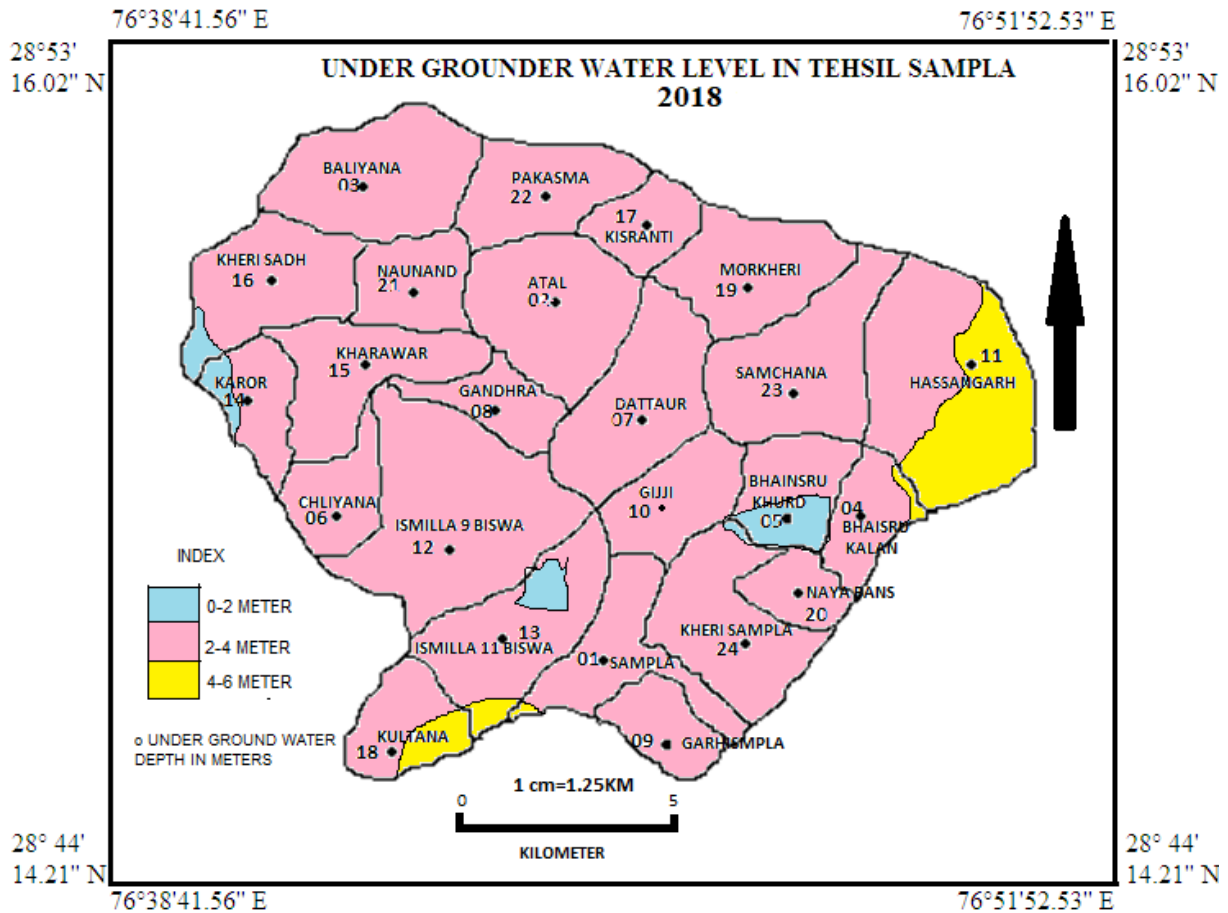
**Figure-3**



**Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth**

In the study area soil texture varies from Fine Loamy, Coarse Loamy to Sandy Soil. Soil texture is one of the major determinants for water contaminations. In the Study area ( 14,572.4 Hectare) 58.5 percent area identified with Fine Loamy Soil,(9,216.7 Hectare) 37 Percent Coarse Loamy Soil and (1,120.9 Hectare) 4.5 Percent Sandy soil. (Figure-3).

**Figure 4**

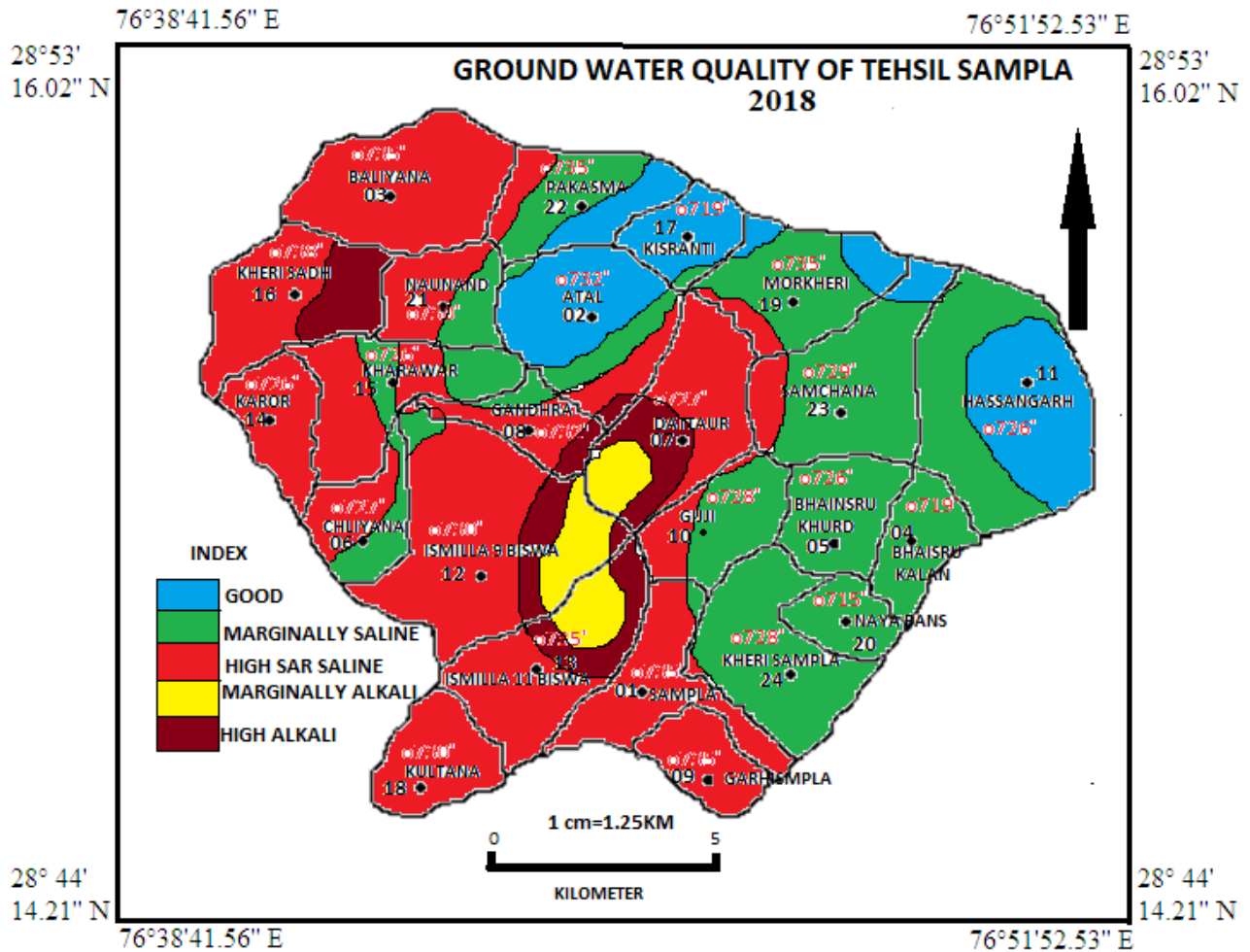


**Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth**

It has been observed that underground water level in the study area varies from 2 Meter to more than six meter. Low level of ground water is directly linked with high fluoride contamination. In the study area (2,266.8 Hectare) 9.1 Percent area identified with Less than 2 meter water level, (16,689.7 Hectare) 67 Percent with 2 to 4 meter water level (4,659.2 Hectare) 18.7 Percent 4 to 6 Meter water level and (1,295.3 Hectare) 5.2 Percent area more than 6 meter water level (Figure-4)



**Figure -5**

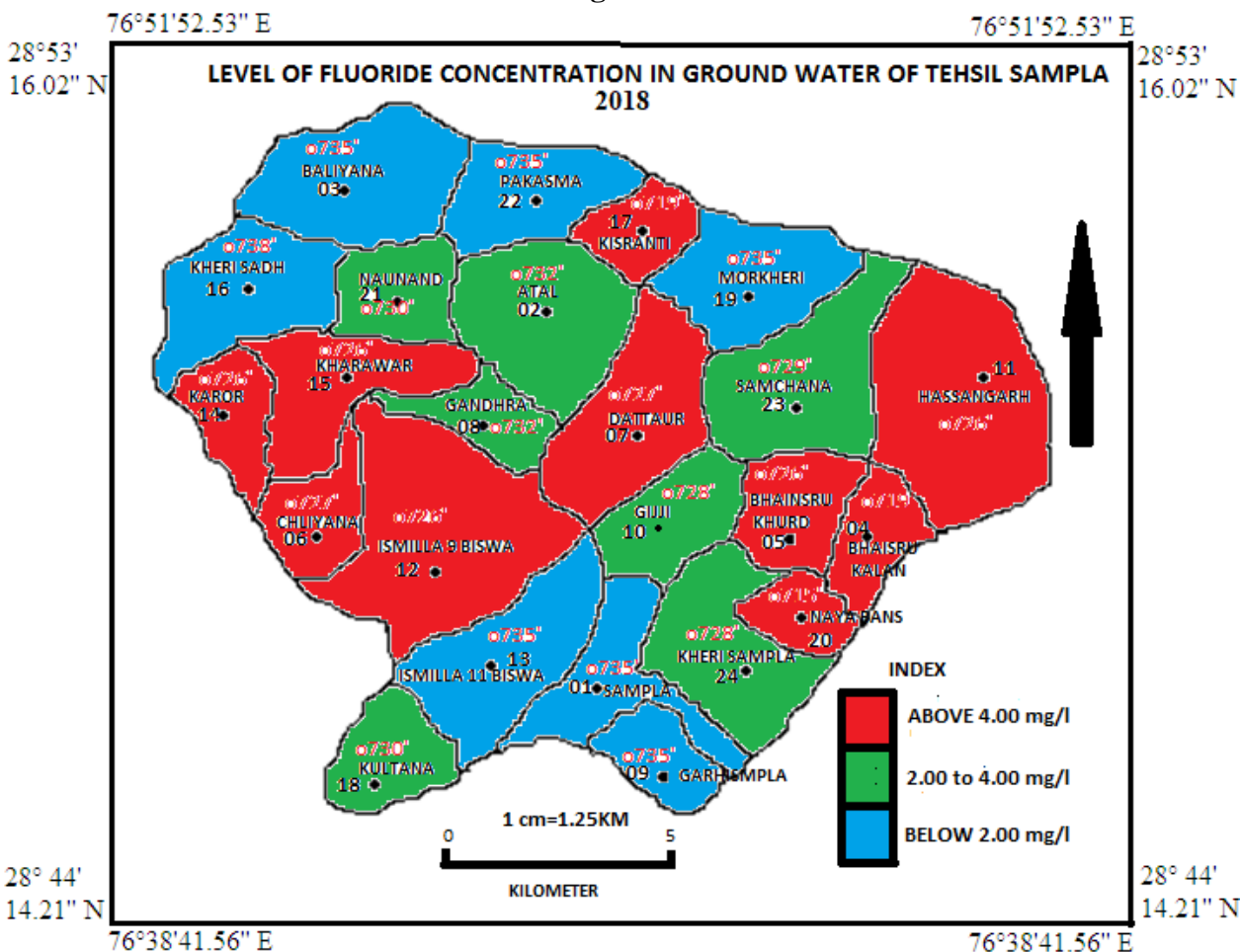


**Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth**

It has been observed that underground water quality in the study area varies from Good Quality, Marginally Saline, High SAR Saline, Marginally Alkali and High Alkali..Quality of water too is directly linked with high fluoride contamination. In the study area (921.7 Hectare) 3.7 Percent area identified with Good Quality Water , (6,725.7 Hectare) 27 Percent with Marginally Saline , (10,213.1 Hectare) 41 Percent with High SAR Saline , (2,266.8 Hectare) 9.1 Percent with Marginally Alkali and (4,782.7 Hectare) 19.2 Percent area with High Alkali (Figure -5). It is remarkable that (7,049.5 Hectare) 28.3 Percent area has alkali , (16,938.8 Hectare) 68 Percent salty has water characteristic and only (572.9 Hectare) 2.3 percent area is marked with Good Quality Water.



**Figure-6**



**Table-1**  
**Level of Fluoride Aggregation in Ground Water in the Study Area 2018**

Sr. No	Contagion Level (mg/l)	Number of Villages	Name of the Village
1	High – above 4.00 mg/l	12	1S-Sampla MC,5S-Bhainsru Khurd,6S-Chulliana, 9S-Garhi Sampla,10S-Gijji,12S-Ismaila 9-B,13S-Ismaila11B,14S-Karaur, 15S-Kehrawar,,21S-Nunond, ,23S-Samchana, 24S-Kheri Sampla,
2	Medium-2.00-4.00 Mg/l	09	2S-Atal,3S-Baliana,8S-Gandhra,11S-Hassangarh,16S-KheriSadh,18S-Kultana,19S-Morkheri,20S-Naya Bans, ,22S-Pakasma,
3	Low- Below 2.00 mg/l	03	4S-BhainsruKalan,,7S-Dataur,17S-Kisranti,

Source: Field Survey

**Analysis of the Results:** It has been noticed that fluoride contagion is chiefly an ordinary course of leaching of fluorine-bearing minerals. Fluorite, apatite, mica and a variety of other minerals play a part



for the extent of rock, water interface and unshackle fluoride into the groundwater. A large number of people are subject to suffer from dental and skeletal fluorosis such as mottled enamel, deformation of ligaments, bending of spinal column and ageing problem. In the dearth published data on the presence of fluoride in the groundwater and its adverse effect on health the study has carried out to Investigations on the fluoride content in ground water and prevalent clinical symptoms among people in the study area. Out of 240 collected samples 59 samples (24.60%) of the ground water are within the permissible limits in the study area and 8 (3.35%) samples below the requisite limit and remaining 172 (72.05%) samples records are exceeds the maximum permissible limit of fluoride ( 2.00Mg/Its) content set by the ISI and WHO.(Annexure-1)

In the present study 90 samples of 12 villages found in the range of more than 4 00 mg/Its which shows that most of these samples were noticed much higher than the permissible limits. However it is indicating high Fluoride contamination confined to Saline water area, Fine loamy Soil structure and low level of ground water.(Table-1) In 82 samples of 09 villages characterized with Coarse Loamy ,Marginally Saline water and low level of ground water sample of fluoride content observed in the category (2.00 to 4.00 mg/Its) . Remaining 68 sample of 03 villages range in the fluoride limit (>2.00) characterized with deep level of water, Coarse loamy to sandy soil structure and good to alkali quality of water (Figure-6)

It is evident that Fluoride content of below 2 mg/L in drinking water has no biological side effects. It has been noticed that consumption of drinking water with more than the permissible limit of fluoride for a period of 5 to 10 years results in dental fluorosis. Consumption of water with fluoride level between 4 to 8 mg/L for a period 15 to 20 years cause severe form of dental and mild form of skeletal fluorosis and if it exceeded 8 mg/L and consumed for 5 to 10 years or more results severe form of dental and skeletal fluorosis. Thus, drinking water is enough to bring into being severe form of dental and mild form of skeletal fluorosis if consumed for a period of 15 to 20 years. Clinical symptoms of dental and skeletal fluorosis are common in the study area which pretense a grave menace to population health. Hence it desires instant consideration to find out the feasible solution and supply of safe water . Health status of the people is varied in different villages because of severity of fluorosis, which is direct reflection of fluoride content of drinking water.

The pervasiveness of more advanced fluorosis, joint pains, gastrointestinal discomfort and excessive thirst in the area owes of high aggregation of fluoride level in ground water.( Table -2,3,4& 5) The result shows that,Out of 480 examined respondent 345 (71.88%) have fluoride related clinical symptoms. Among identified clinical symptoms 44 (12.75%) recorded with Tooth decay, 67 (19.42%) Mottled Enamel, 82(23.77%) Skeletal Fluorosis, 12(3.48%) Dental Mottling with white Patches, 63 (18.26%) Dental Mottling- Black Stain and pitting teeth, 40 (11.59) Rheumatic in Joints Cervical spines, 24 (6.96%) Gastrointestinal discomfort, and 13(4.77%) crippling skeletal Fluorosis problem. Consequently, it is accomplished that, the villages affected by fluorosis be supplied with safe drinking water less than 1 mg/L fluoride, either by changing the water source to safer one or by adapting suitable treatment technique to remove fluoride in the existing sources.



**Table-2**  
**Correlation of Fluoride Content in Ground Water, Quality of Water, Level of Water and Texture of Soil in the Study Area-2018**

Variable	Fluoride Content in Water	Quality of Water r-value(p-value)	Level of Water r-value(p-value)	Texture of Soil r-value(p-value)
Fluoride Content in Water	1	0.510 (P= < .00001)	0.830 (P= < .00001)	0.640 (P= < .00001)
Quality of Water		1	0.310 (P= < .000063)	0.690 (P= < .00001)
Level of Water			1	0.450 (P= < .00001)
Texture of Soil				1

\*0.01 Significance Level

**Table-3**  
**Regression Analysis of Fluoride Content in Ground Water, Quality of Water, Level of Water and Texture of Soil in the Study Area-2018**

Variable	Regression Analysis
Fluoride Content in Ground Water V/S Quality of Water	0.576
Fluoride Content in Ground Water V/S Level of Water	0.763
Fluoride Content in Ground Water V/S Texture of Soil	0.693
Quality of Water V/S Level of Water	0.459
Quality of Water V/S Texture of Soil	0.525
Level of Water V/S Soil Texture of Water	0.419

**Table-4**  
**Correlation of Fluoride Content in Ground Water and Clinical Symptoms in the Study Area-2018**

Variable	Fluoride Content in Water	Clinical Symptoms r-value(p-value)
Fluoride Content in Water	1	0.910 (P= < .00001)
Clinical Symptoms		1

\*0.01 Significance Level

**Table-5**  
**Regression Analysis of Fluoride Content in Ground Water and Clinical Symptoms in the Study Area-2018**

Variable	Regression Analysis
Fluoride Content in Ground Water V/S Clinical Symptoms	0.975

**Conclusion** It is decided that, the role of drinking water in the growing occurrence fluorosis affliction is understandable. It is therefore, essential that the village's affected by fluorosis be supplied



---

with safe drinking with requisite fluoride content. Since vegetables and milk are also significant sources to add on the fluoride content in human being hence their fluoride content too could be taken into account. Fluoride in groundwater is mainly due to dissolution from fluoride bearing minerals like Fluorspar, Fluorite, etc. In this area 172 (72.05%) samples are found exceeding permissible limit and 345 (71.88 percent) of total sample observed with Clinical Symptoms. Since these people are dependent on the groundwater for domestic use. So, remedial measures such as de-fluoridation techniques and rain water harvesting are needed. Nutritional diet such as calcium and phosphorus rich food should be recommended to those affected with fluorosis. There is urgent need to conduct awareness programme on how to reduce the fluoride and fluorosis content of the ground water through new innovative techniques, for better health. The concerned government and non-government authorities should plan to supply the safe and good quality drinking water to build sound body citizens in the region.

### *References*

1. Bell, M.C. and T.G. Ludwig, (1970) "The supply of fluoride to man: indigestion from water, fluorides and human health", W.H.O. Monograph series 59, World Health Organization, Geneva.
2. BIS (Bureau of Indian Standards) (1992) Indian standard specification for drinking water, IS:10500
3. Carlson. H, Armstrong W D and Singer L, (1960) Distribution and excretion of radio-fluoride in the human. Proc Soc Exper Biol Med.,(NY), Vol: 104, pp.235-239.
4. Daines, R.H., I.A. Leone and E. Brennan, (1952) "Phyto-pathology (Abstr)", Vol:42, p.112'.
5. Gore A.,(2006) "Earth in the balance: ecology and the human spirit", Assessment of the quality of groundwater for drinking purposes in the Upper West and Northern regions of Ghana), New York: Rodale Press; 2006.
6. ICMR (1999) Manual of standard of Quality for drinking water supplies. Indian Council of Medical Research, pp 4-8
7. ISI, Drinking water standards, (1983) "Substance and characteristics affecting the acceptability of water for domestic use", Series- 18, p.1050. Indian Standard Institution, New Delhi.
8. Malik, P.K. (2016) "Fluoride Content in Ground Water and Population Clinical Status: A Case Study Published in the Book titled on the Theme" Sustainable Development Environmental Issues and Self Sustained Society" Published by R.K. Books Publishing House, 4286/3 Ansari Road Daryanganj, New Delhi-110002, November 2021, Pg.117-132, ISBN :978-81-951923-4-2,
9. Mathur, G.M., Tamboli, B.I., Math R.N., Ray, A.K., Mathur, G.L., and Goy O.P.; (1976) "Preliminary Epidemiological Investigation of Fluorosis in Surajpura and Pratappura Village in Sarwar Tahsil Ajme District", Vol:7, p.90.
10. Naik, R.G., Dodamani, A.S., Vishwakarma, P., Jadhav, H.C., Khairnar, M.R., Deshmukh, M.A., and Wadgave, U. (2017) Level of Fluoride in Soil, Grain and Water in Jalgaon District, Maharashtra, India, Published in Journal of Clinical and Diagnostic Research, Vol-11(2) ISSN-0973-709X, Feb 2017. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5376803/>)
11. Pandey, H.K., Duggal, S.K. & Jamatia, A. (2015) "Fluoride Contamination of Groundwater and Its



Hydro-geological Evolution in District Sonbhadra (U.P.) India” Published in Proceedings of the National Academy of Sciences, India Section A: Physical Sciences volume 86, pages81–93(2016) (<https://link.springer.com/article/10.1007/s40010-015-0228-y>)

12. Teotia SP, Teotia M (1994) Endemic fluorosis in India: a challenging national health problem. J AssocPhys India 32:347–352

13. WHO (1970) "Fluorides and human health", Monograph Serial No: 59, World Health Organization Publ., WHO, Geneva.

14. WHO (1981) "Standard Methods for the Examination of water and Waste Water", American Publication of Health Association., New York. .

15. WHO (1984) Environmental health criteria for fluorine and fluorides, Geneva; V pp.1-136.

16. Kubakaddi A B, (2001) "Epidemiology of fluorosis and Educational Intervention in HunagundTaluka", M.H Sc. Thesis, University of Agricultural Sciences, Dharawad.

### Annexure-1

#### Fluoride Content Level in Ground Water and Prevalent Clinical Symptoms of Fluorite Patients in Tehsil Sampla 2019-20

S. N.	Name	Location	Altitude	Soil Texture	Ground Water Level in Meters	Ground Water Quality	Fluoride level (1.0 - 1.5 mg/l)	Prevalent Clinical Symptoms of Fluorite Patients								
								Tooth Decay	Dental Fluorosis or Mottled Enamel	Skeletal Fluorosis	Dental Mottling-White Patches	Dental Mottling- Black Stain and pitting teeth	Rheumatic in Joints Cervical spines	Gastro-Intestinal discomfort	Crippling Skeletal Fluorosis	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1S	Sampla (MC)	28°47'N 76° 46'E	735'	FL, SN	<4	HSS	5.90	1	4	6		2	3	2	1	19
2S	Atal	28° 50'N 76° 45'E	732'	FL, CL	<4	G,M S,H SS	3.10	2	3	4		2	2	1		14
3S	Baliana	28° 53'N 76° 41'E	735'	FL	<4	HSS	2.90	2	2	3	1	1	2	1		12
4S	Bhainsru Kalan	28° 49'N 76° 49"E	719'	CL	<4	MS	1.50	1	1	1		2	2			07
5S	Bhainsru Khurd	28° 49'N 76° 48'E	725'	FL, CL	<4	MS	4.25	3	3	4	1	1	2	1		15
6S	Chulliana	28° 48'N 76° 41'E	732'	FL	<4	MS, HSS	4.90	2	3	3		3	3	1	2	17
7S	Dataur	28° 49'N 76° 46'E	732'	CL	<4	HSS ,HA, MA	1.60	1				2	2	1		06
8S	Gandhra	28° 50'N 76° 44'E	735'	FL	<4	HSS ,HA	3.80		2	4		2	1	2	1	12
9S	GarhiSampla	28° 47'N 76° 47'E	735'	FL	<4	HSS	5.85	3	4	6		4		1	1	19
10S	Gijji	28° 49'N 76° 45'E	732'	FL,CL, SN	<4	HSS (MA RK)	4.60	1	3	4		5	1	1	1	16
11S	Hassangarh	28° 50'N 76° 50'E	732'	FL, CL	<6	MS, G	2.60	2	3	3		3	2			13



12	Smaila 9-B	29° 00'N 76° 14'E	732'	FL, CL	<4	HSS ,MA ,HA	5.30		3	5	2	4	2	1	1	18
13	Smaila-11B	28° 57'N 76° 23'E	735'	FL	<6	HSS ,MA ,HA	5.10	2	3	4	1	4		2	1	17
14	Karaur S	28° 50'N 76° 40'E	728'	FL	<4	HSS	4.90	1	3	3	2	4	3			16
15	Kehrawar S	28° 50'N 76° 41'E	728'	FL, CL	<4	HSS ,MS	5.30	4	5	3		2	1	1	1	17
16	KheriSadh S	28° 52'N 76° 40'E	738'	FL, CL	<4	HSS ,HA	3.20	3	3	2		2	3	1		14
17	Kisranti S	28° 52'N 76° 28'E	719'	FL, CL	<4	G,M S	1.68	1		2		1	1	1		06
18	Kultana S	28° 56'N 76° 23'E	732'	FL, CL	<4	HSS	2.50	1	2	3		3	2		1	12
19	Morkheri S	28° 55'N 76° 23'E	735'	FL, CL	<4	MS, G,H SS	3.30	1	2	3	1	2	1	2	1	13
20	Naya Bans S	28° 58'N 76° 18'E	715'	CL	<4	MS	2.80	3	2	2		4	1			12
21	Nunond S	28° 56'N 76° 17'E	732'	CL, FL	<4	HSS ,MS	4.75	3	3	4	1	2	2	1	1	17
22	Pakasma S	28° 56'N 76° 27'E	735'	CL, FL	<4	MS, HSS ,G	3.70	2	5	4	2	2		1		16
23	Samchana S	28° 56'N 76° 25'E	732'	FL, CL	<4	MS, HSS	4.95	2	4	4	1	3	2	2		18
24	KheriSampla S	28° 46'N 76° 47'E	732'	FL, SN	<4	MS, HSS	5.40	3	4	5		3	2	1	1	19
	Sampla Tehsil							<b>44</b>	<b>67</b>	<b>82</b>	<b>12</b>	<b>63</b>	<b>40</b>	<b>24</b>	<b>13</b>	<b>345</b>
								<b>12.75%</b>	<b>19.42%</b>	<b>23.77%</b>	<b>3.48%</b>	<b>18.26%</b>	<b>11.59%</b>	<b>6.96%</b>	<b>4.77%</b>	<b>100%</b>

Source: Field Survey