ASSESSMENT OF PHYSICO-CHEMICAL STATUS OF GROUNDWATER SAMPLES IN AND AROUND HOSUR TOWN, TAMILNADU, INDIA

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ABSTRACT

Groundwater is contaminated due to leakage of refuse dumps, domestic and industrial waste water seepage and spillage. Ground water acts as a reservoir and source of water for wells, springs, bore wells and pumps. The increase in human population and fast development lead to the scarcity of drinking water. The inadequate and irregular supply of water through piped water system has forced the population to use the ground water especially of hand pumps. Therefore, in the present study an attempt has been made to characterize the ground water quality of this hosur town with respect to physical and chemical parameters. Hosur town is blended with industrial, commercial and residential settlements. The major source of drinking water for hosur town is underground water though some part is supplied by kelavarapalli dam water. In the present study the total hosur town is divided into different zones like residential, commercial and industrial etc, fifteen sample stations were selected and samples were collected and tested for various physical and chemical parameter. According to our study, the Total dissolved solids; Total Hardness, magnesium, and fluoride in some station are above the permissible limits.

Keyword:- *Groundwater, Physical parameters, Chemical parameters, Permissible limits, Standard*

1. INTRODUCTION

Water is rightly described as support of life. Although water can often serve as a carrier of diseases, life on earth is impossible without water [1]. The demand for continuous supply of water is steadily increasing. In rural Areas the demand has been much lower, but the requirement. For agricultural use are increasing rapidly. The standards of potable water are for strongest now than what were considered adequate only a few years back. Due to an ever-increasing growth of urban as well as rural population and modern industrial and agricultural programs, water requirement will be ever on the increasing in future [2]. In Tamilnadu state, the per capital availability of Water in, major cities is limited to 60lpd, whereas in medium cities it is only28lpd, needless to say that the per capita availability areas is for less than needed for hygienic living. Chemically pure water rarely occurs in nature [3]. Numerous factors Influence the quality of natural water. Water is classified depending on its physical, chemical and biological characteristics. Standards are laid down, based on limits of permissiveness of the impurities. Ground water qualities are influenced both by the subsurface environment and by the environment where recharge takes place. The quality of a ground water supply is as important as quality, the required quality being dependent on the nature of its use [4]. Water always contains dissolved and suspended matter of organic and Mineral origin. Groundwater contains mostly dissolved impurities unlike surface water which have rich suspended matter. Common constituents of natural water are the four cations like Ca^{++}, Mg^{++}, Na^{++}, and K^{+}, they are generally present together with anions like CO_3, HCO_3, SO_4, NO_3, and Cl [5]. Ground water is usually cool, colourless and free from turbidity expect when iron or manganese salt are present. It is often hard, containing excessive amounts of calcium and magnesium [6]. By leaching with the calcium and magnesium carbonate in the soil, the dissolved carbon dioxide can produce temporary hardness of water. It can also dissolve iron and magnesium salt. The average hardness of groundwater is greater than of surface water. Nitrate are also found in soils due to bacterial fixation of atmospheric Nitrogen, applied fertilizer, nitrogenous manures, etc. minerals may also Contribute them [7]. When nitrate exceed the safe limits of about 45ppm in

well water, the source needs to be abandoned. Occasionally dilution with nitrate, free water to ensure limits in a reservoir has been practiced. Water quality means different thing to different people [8]. Quality usually denotes "suitability" for use and is difficult to evaluate except in terms related its specific use. Ground water is an economical resource and more than 85% of the public water supplies are obtained from wells [9]. Ground water supplies have advantage over surface water because of the fact that the supply is invariably near the water is more uniform character and relatively free from harmful bacteria and can be developed at a small cost in a short time [10]. It is necessary to examine carefully such factor that adversely the water quality for the use of drinking purpose from a particular source. The main objective of carrying out this study is to determine the physical and chemical characteristics of groundwater samples in Hosur town.

2. MATERIALS AND METHODS

2.1 Study Area

Hosur, also known as Little England, for its climatic conditions, has a history of more than 800 Years. Hosur is known on these days not only for its climatic condition but for the Thousands of industries located here. Hosur is at the height of about 900 meters above the sea level, the average temperature during Summer is 25° to 30° C and during Winter is 13° to 25° C as shown in Figure 1. Hosur was founded by King Ramah Nathan during the year 1290, he also belonged to Housel Dynasty. During 1980s industrialization began with the help of SIPCOT and Hosur became an industrial town. After that the basic development started taking place, hosur is today well connected by road (NH 7), by Railway (direct trains to Delhi, Mumbai, Combater etc.,), by sea (Harbor located just 340 Kms away) and by air (airport is 35 Kms), Population about Approximately 95,000 people by 2001 survey, altitude is 950 mts above sea level, average Rainfall is 892 mm per annum, recent rainfall 605 mm per annum. Water requirement is 66, 50, 000 liters /day, Present Supply is 31, 00,000 liters/day (before project implementation), with water source of Kelavarappally Dam (Poniard River). The major industries are present in the Hosur town such as Engineering Industry, Plastic Industries, Granite polishing, Biotech Products, Rubber & Plastic Industry, Coir Products, Auto two wheeler, Food Processing Industry etc., Hosur - territorial forest division as given in Table 1.

Table -1: Hosur - Territorial Forest Division

Location	Hosur And Krishnagiri District, Tamilnadu
Area	1280Km^2
Status	Territorial Forest Division
Latitude	12^{O}7'-12^{O}44'N
Longitude	77^{O}30'-78^{O}27'E
Min Elevation	635m
Max Elevation	1395m
Highest Peak	Guttirayan Durg(1395M)
Min Rainfall	700m
Max Rainfall	900m

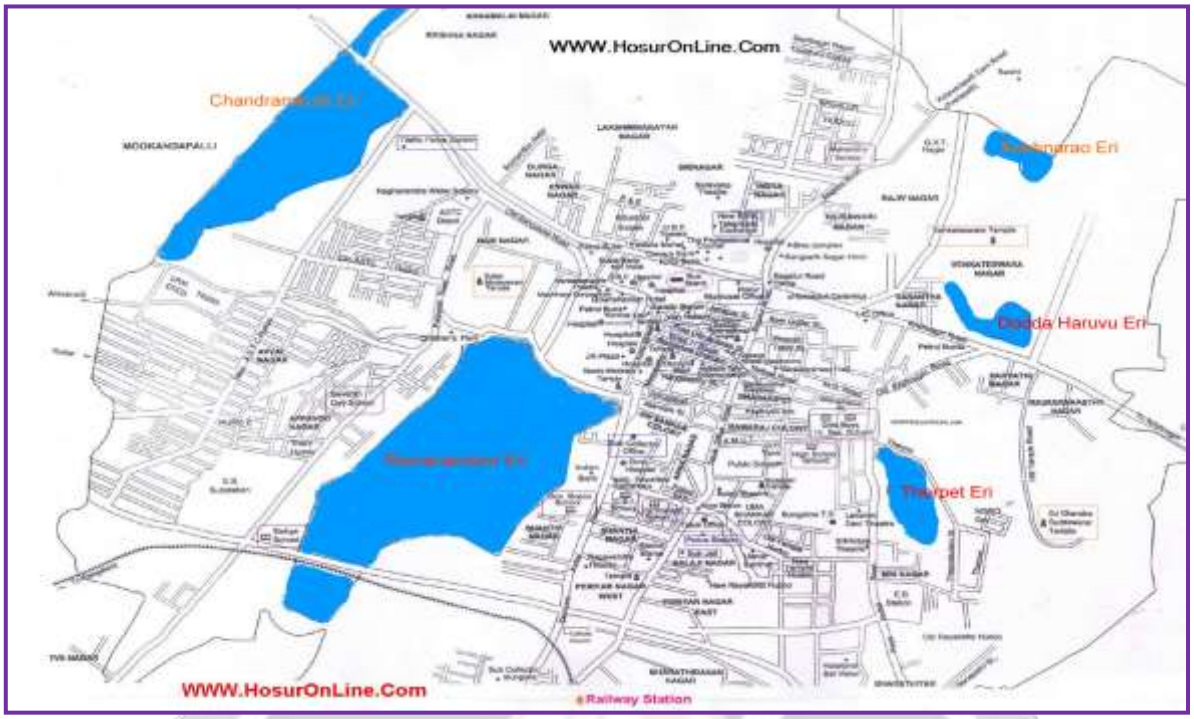

Fig -1: Map of study area

2.2 Sampling

For Physical and Chemical parameters: Two liters plastics cans were used with properly washed and rinsed with distilled water. Before sample water collection hand pumps are drained for about 15 minutes. For B.O.D Parameter, 300 ml sterilized BOD bottles were used. Before sample water collection the mouth of the hand pump is burnt properly and cooled.

2.3 Location of Water sampling

For the present study, the area in and around Hosur town, Tamilnadu was selected. Totally fifteen sampling stations were selected and analysed the various physic – chemical parameters to the samples as shown in Table 2. Finally, analyzed samples were compared with the Indian Standard Drinking Water – Specification as Per IS 10500-1991[11].

Table- 2: Name of location in Hosur town used for water sampling

Sample Number	Sample stations	Zone	Sample Number	Sample stations	Zone
1	RAJESHWARI LAYOUT	SIPCOT I	9	BAGLUR HUDCO	TOWN (SOUTH)
2	MOOKANDAPALLI	SIPCOT I	10	GRAVE YARD	TOWN (EAST)
3	ANNAMALAI NAGAR	SIPCOT I	11	MARKET	TOWN (EAST)
4	PINK HOUSE	SIPCOT II	12	ANNA NAGAR	TOWN (NORTH)
5	K.S.MANSION	SIPCOT II	13	APPAVO NAGAR	TOWN (WEST)
6	MORANAPALLI	SIPCOT II	14	RAILWAY STATION	TOWN (NORTH)
7	BUS STAND	TOWN (CENTER)	15	VINAYAKA TEMPLE	TOWN (WEST)
8	TIRUMALA DEVASTHANA	TOWN (SOUTH)			

3. RESULTS AND DISCUSSION

The Physico-chemical analysis of the groundwater samples of fifteen sampling points of Hosur town was carried and their permissible limits of IS 10500 are presented in Table (3) and (4).

Table- 3: Physico-chemical parameters of groundwater

Sample Number	TEMP °C	pH	TH ppm	Ca ppm	Mg ppm	Total Alk ppm	Cl ppm	TS ppm	NO_3 ppm
1	25.8	6.7	534	**432.69**	**101.93**	75	384.74	1040	13.9
2	26.1	6.8	**944.23**	**821.15**	**123.08**	401	369.49	1700	14.53
3	25.2	7.1	538.46	**548.08**	**101**	198	273.04	1820	16.2
4	26	6.8	342.31	**242.31**	100	241	49.64	270	18.42
5	25.2	6.8	424.04	**376.92**	47.14	204	125.88	610	24.2
6	25.8	6.7	458.65	**265.36**	**193.27**	200	60.99	530	28.83
7	25.8	7.86	**927.8**	**711.53**	**216.27**	318	306.72	240	24.53
8	25.2	7.1	**990.3**	**961.53**	28.77	265	287.22	**2190**	14.53
9	26	7.6	**1046.4**	**688.46**	**357.64**	346	437.93	**3800**	22.6
10	25.2	7.1	674	**657.6**	16.31	362	264.17	750	18.42
11	25.6	7.3	**1156**	**692**	**463.7**	550	464.52	552	18.84
12	26.1	7.8	**786.53**	**565.38**	**221.15**	**774**	328	1300	18.14
13	25.5	7.9	355.76	200	**155.76**	350	150.70	452	9.43
14	26.1	7.4	480.76	**346.15**	**134.61**	150	106.38	509	12.43
15	25.5	7.9	**665.38**	**452.69**	**232.69**	402	216.30	808	19.41
As Per IS 10500-1991[11]	27	8.5	600	200	100	600	1000	2000	>45

Table 4: Physico-chemical parameters of groundwater

Sample Number	SO_4 ppm	Na ppm	Fe ppm	F ppm	As ppm	Pb ppm	K ppm	CONms	TURNTU
1	63.48	52	0.05	**1.65**	0.02	0.05	5.65	1595	3
2	48.43	58.1	0.05	**1.75**	0.02	0.05	4.35	1833	1
3	45	42.6	0.05	**1.68**	0.02	0.05	3.24	2243	3
4	64.38	12.68	0.05	**1.92**	0.02	0.05	1.29	2290	2
5	72.48	22.68	0.05	**1.84**	0.02	0.05	2.65	1804	4
6	59.45	26.85	0.05	**1.74**	0.02	0.05	1.94	974	2
7	82.43	31.28	0.05	**1.85**	0.02	0.05	1.24	1322	4
8	69.42	19.68	0.05	**1.91**	0.02	0.05	0.95	1664	3
9	17.89	31.14	0.05	1.48	0.02	0.05	1.13	2630	2
10	84.42	27.88	0.05	**1.72**	0.02	0.05	0.9	2790	2
11	91.41	31.41	0.05	**1.64**	0.02	0.05	1.41	1200	1
12	64.47	18.41	0.05	**1.65**	0.02	0.05	0.95	1666	3
13	48.41	13.41	0.05	1.42	0.02	0.05	3.21	915	4
14	42.56	25.4	0.05	1.46	0.02	0.05	8.33	1085	2
15	66.6	40.84	0.05	1.48	0.02	0.05	3.45	1667	3
As Per IS 10500-1991[11]	400	-	>0.05	1.5	>0.01	>0.05	-	-	10

3.1 pH

The concept of ph is very important for the drinking purposes and in the chemical co-angulations, corrosion control etc. It is the one of the important index of acidity or alkalinity and is the resulting values of the acid/basic interaction of its mineral and organic compound. The test results of the study indicate that the ph value varies from 6.7-8.5 in different points. Hence pH values are within the permissible limits (6.5 to 8.5).

3.2 Turbidity

Suspension of the particles in water interfering with passage of light is called turbidity. Turbidity is caused by wide variety of suspended matters, which range in size from colloidal to coarse dispersion depending upon the turbulence and also range from pure inorganic substances to those that are highly organic in nature.

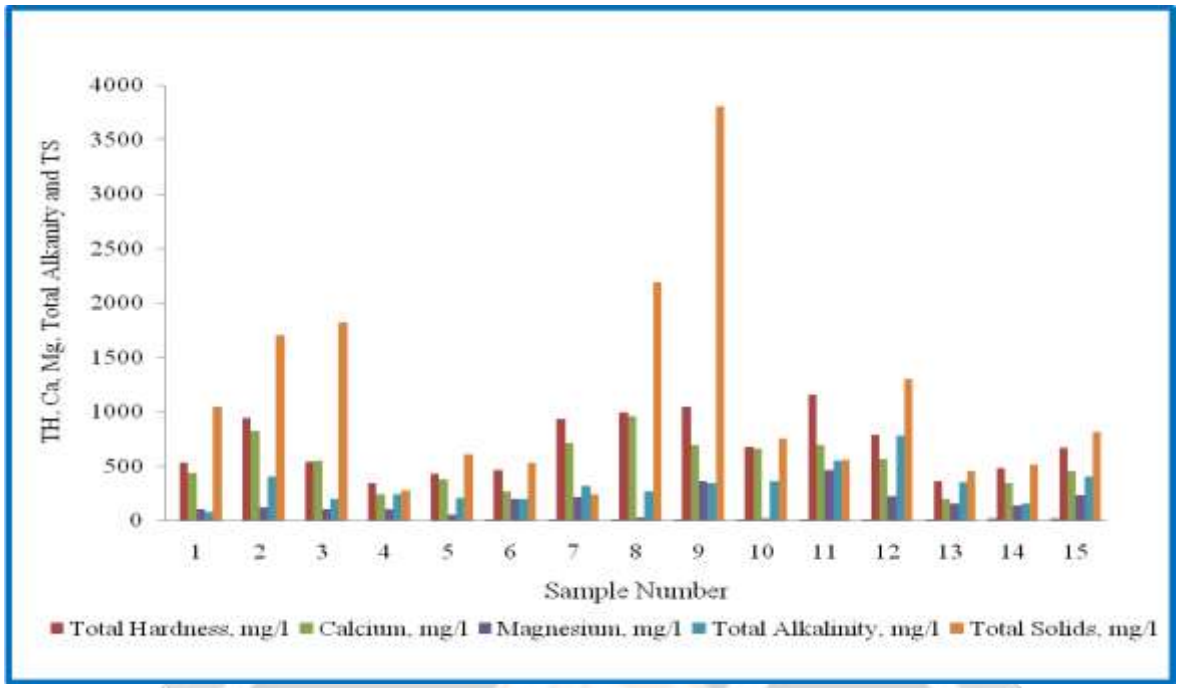

Fig -2: Analysis of parameters in different samples

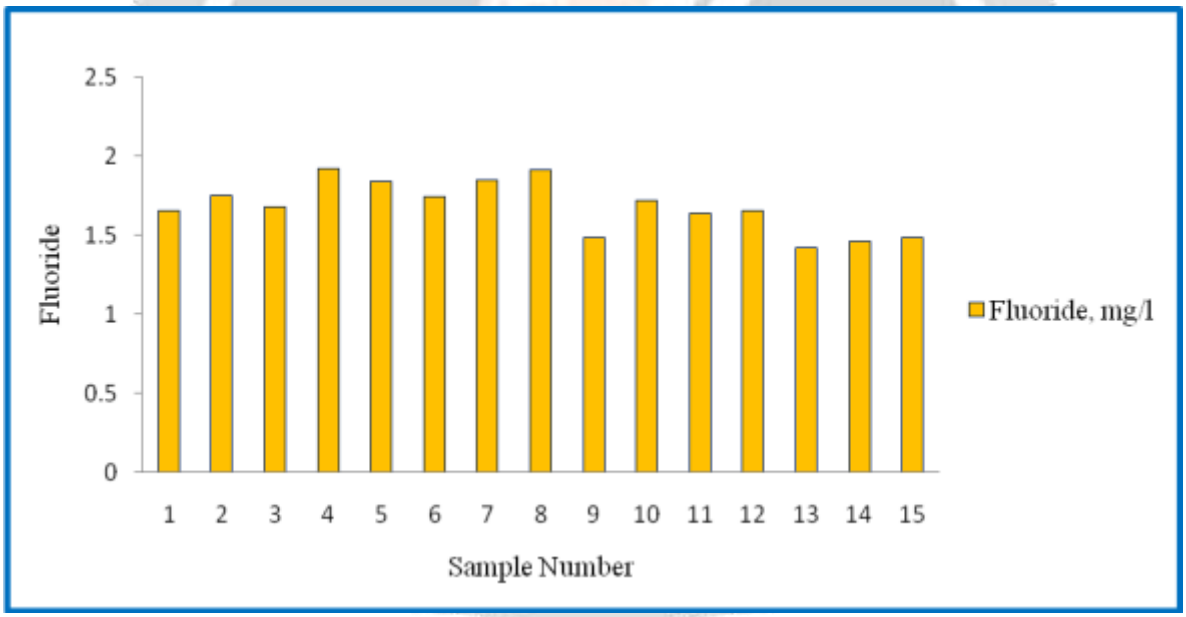

Fig -3: Fluoride variation of the study area

Turbidity Water is undesirable from aesthetic point of view in water. Permissible limit of water is 10NTU. The test results of the study indicate that the turbidity value varies from 1 to 4 in different points. Hence turbidity values of various stations are within the permissible limits.

3.3 Conductivity

The total amount of dissolved solids present in water can be easily estimated by measuring the conductivity of water is expressed in micro –holms and permissible limits are not known.

3.4 Hardness

Water hardness is the traditional measure of the capacity of water to react with soap, hard water requiring a considerable amount of soap to produce lather. Hardness is caused due to the presence of dissolved salts like carbonates, bicarbonates, chlorides, sulphate of the calcium and magnesium. It is the responsible for the deposition of scale in boilers and other house hold appliances. The test results of the study indicate that the hardness value varies from 342.31mg/l to 1046.4 mg/l in different points. Hence Value of the hardness in

ground water for the samples 2, 7, 9, 10, 11, 12 and15 is more than the permissible limit (200-600 mg/l). Here majority of the samples are within the town area as shown in Figure 2.

3.5 Alkalinity

The Alkalinity of the water is due to more number of hydroxyl ions in water. Alkalinity in water is measure of its capacity to neutralize acid. Alkalinity of natural ground water is primarily due to the salts of weak acids. The three major classes of material, which hydrides (OH), carbonates (CO_3), and bicarbonates (HCO_3), cause the major portion of the Alkalinity in the natural ground water. The test results of the study indicate that the alkalinity value varies from 150 to 550mg/l in different points. Hence Value of the in alkalinity in ground water for the samples12 (Anna Nagar) is more than the permissible limit (300 to 600mg/l) as shown in Figure 2.

3.6 Chlorides

The chlorides are one of the consistent components of water. Chlorides concentration hardly changes when physical-chemical process takes place in water. Considerable increase in the concentration of chlorides may be due the pollution of the industrial and domestic waste water. The test results of the study indicate that the chloride value varies from 49.64 to 437.93mg/l in different points. Hence the values are obtained from hosur town such samples are within the permissible limits (500 to 1000mg/l).

3.7 Total dissolved solids

The term solids impurities refers to matter, which are not water, contained and stay in liquid material. Total solids are the residues lift out after the evaporation and subsequent drying in oven at specific temperature 103^0C.The total solids are high when depth of groundwater is at low level. The test results of the study indicate that the total dissolved solids value varies from 240 to 3800mg/l in different points. Hence the values are obtained from hosur town such samples shows that except samples number 6,13,14 exceeds the permissible limits(500 to 2000mg/l).This indicates that majority of the samples ,including town and industrial area are affected as shown in Figure 2.

3.8 Sulphates

Iron is the one of the major ions occurring in the natural water. The presence sulphates in natural water are due to the reaction of water with the sulphates containing Rock and with bio-chemical oxidation of sulphities and other components of sulphates. Sulphates combines' alkali earth causing noncarbonated hardness, which may result in severe scaling in pipes, condenser and boilers. The test results of the study indicate that the sulphate value varies from 17.89 to 91.41mg/l in different points. Hence the Value of the sulphates in ground water for the samples is with in the permissible limit. (100 to 150 mg/l).

3.9 Calcium

The presences of salts of calcium in water which forms scum when react with soap and cause soap consumption, scaling of boilers etc the permissible limits for calcium is 200ppm. The test results of the study indicate that the calcium value varies from 200 to 961mg/l in different points. Hence the values are obtained from hosur town such samples shows that except samples number 13,ie., majority stations in town and industrial area exceeds the permissible limits (45 to 200mg/l) as shown in Figure 2.

3.10 Fluorides

If fluorides concentration is more may be harmful causing spotting and de colourisation of teeth. If it is less than 1 or more than 1.5 it may be harmful for fever activities. The test results of the study indicate that the fluoride value varies from 1.42 to 1.91mg/l in different points. Hence the value content in the sample station is all exceeding the permissible limit except sample number 9, 13, 14, and 15(town area)(0.5 to 1.5mg/l) as shown in Figure 3.

3.11 Nitrate

The presence of nitrates indicates pollution or contamination of bacteria in ground water. The permissible limit of nitrate in ground water is less than 45ppm. The test results of the study indicate that the nitrate value varies from 9.43 28.83mg/l in different points. Hence the Value of the nitrate in ground water for the samples is within the permissible limit (less than 45mg/l).

3.12 Iron

The water irons occur in the divalent and trivalent state (ferrous and ferric) the concentration of iron in well-aerated water in seldom high, but under reducing condition, which may exit in some ground water, lake and reservoir. This ion concentration is, if greater than .03ppm in water is highly undesirable and causes de-colourisation of cloths, they may also cause encrustation in water due to deposition of ferric hydroxide which

promotes the growth of iron bacteria. The test results of the study indicate that the iron value is 0.05mg/l in different points. Hence the Value of the iron in ground water for all the samples is within the permissible limit (0.3 to 1mg/l).

3.13 Magnesium

The presence of salt of magnesium in water which form scum, when react with soap and cause corrosion, making food tasteless and incrustation of pipes etc. The test results of the study indicate that the magnesium value varies from 16.31 to 357.64mg/l in different points as shown in Figure 2. Hence the value content in the sample station including industrial and town area are all exceeding the permissible limit(30 to 100mg/l) except sample number 8, 9 and 10(south town).

4. CONCLUSION

The important conclusion arrived as the study area is summarized below:

- Hardness of the ground water trough the hosur town was found to be high (more than permissible limit)
- Total dissolved solids of ground water of the hosur town was found to be high (more than permissible limit)
- Magnesium of the ground water through the hosur town was found to be high (more than permissible limit)
- In most of the samples fluoride was found more than the permissible limits.

The results revealed that some of the parameters within the permissible limit throughout the Hosur town, therefore it better to go for partial treatments before public use.

5. ACKNOWEDGEMENT

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