

Jeopardy Situation of Depleting Groundwater Resources in Kurukshetra District, Haryana

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ABSTRACT

Groundwater is the most valuable, profitable and fair normal asset of the earth and is of most extreme significance in all aspects of human life. The paper showed the danger circumstance of exhausting groundwater assets and its suggestions in Kurukshetra area, Haryana, India. In Kurukshetra, out of 1, 51,000 ha net inundated zone, 28,000 ha region is watered by waterway and 1, 23,000 ha zone is flooded by groundwater assets. Around 81 percents of the water system depend on groundwater assets, which demonstrate the overwhelming weight on the groundwater assets for water system divisions. The draft of groundwater for water system reason has expanded in all respects quickly in last more than multi decade. The exacerbating water balance in the area has brought about the consistently expanding number of squares under the classes of the overexploited condition. As per CGWB 2013 report, the percent of absolute squares, under overexploited condition has gone up to 100 percent, the entire of 5 squares of Kurukshetra area are experiencing danger circumstance of groundwater consumption. The groundwater level in Kurukshetra area dropped up to 20.75 m amid the last one and half decade (1998-2014) at a rate of more than 1m/year in Shahabad square.

1. Introduction

Groundwater is the most important, critical and prevalence based normal resource of the earth and is of most outrageous centrality in all parts of human life. Cultivating is India's greatest customer of water as it is evident from the route that in the year 2010 out of hard and fast water required, 813 bcm for water framework, industry, drinking water, imperativeness, and others, water framework along spoke to the around 85 percent. Groundwater water system, which extended rapidly in the last three or four decades, has expediently risen to involve a prevailing spot in India's horticulture and nourishment security. The idea of groundwater in the net immersed zone is 61 percent and around 60 percent of the watered sustenance age depends upon groundwater for water framework in the country. Other than satisfying the water system need, groundwater accommodates more than 80 percent of the provincial, and 50 percent of the urban and mechanical necessities in India.

Amid the most recent four decades, uncontrolled withdrawal of groundwater for water system reason in parts of bone-dry and semi-bone-dry districts in India have truly exhausted the aquifers. An emergency circumstance currently exists in various states. In India, the phase of groundwater advancement is 61 percent (CGWB, 2009). The status of groundwater advancement is similarly high in the conditions of Delhi (170 percent), Punjab (145 percent), Rajasthan (125 percent), Haryana (109 percent), and UT of Daman and Diu (107 percent) and Pondicherry (105 percent), where the phase of groundwater improvement is more than 100 percent, which suggests that in these states the normal yearly groundwater utilization is more than normal yearly groundwater accessibility.

As per CGWB, 2009 in India, out of 5842 surveyed authoritative units (Blocks/Taluls/Mandals/Districts), 523 units (9 percent), 169 units (3 percent) and 802 units (15 percent)

are semi-basic, basic and overexploited condition separately. In for the most part areas of Haryana express, the phase of groundwater improvement is more than 100 percent which showed that groundwater withdrawal is more than its revive every year. Rice and Wheat trimming framework is predominant in Kurukshetra region, Haryana, where around 81 percent of the zone is flooded by groundwater. The groundwater improvement arrange in Kurukshetra area is 166 percent. Examination of groundwater table profundity for last one and a half decades demonstrated a declining pattern in the region at a rate shifting from 0.86 to 1.38 m/yr. (region normal 1.11 m/yr.). This has compromised the manageability of flooded farming in the area.

2. Objectives of the study

1. The main purpose of the present research study is to manifest the jeopardy situation of depleting groundwater resources and its implications in Kurukshetra district, Haryana, India.
2. The study also portrays the suggestions and recommendations for the better management of groundwater resources of Kurukshetra district.

3. Study area

Kurukshetra locale falls in the North East piece of the Haryana State and is limited by 29° 53'00" – 30° 15'02"N Latitudes and 76° 26'27" – 77° 07'57" E Longitudes. It falls in parts of Survey of India, Toposheets nos. 53 B and 53 C covering a territory of 1530 sq. km. The locale covers 3.46 percents territory of the Haryana state. The Kurukshetra region is circumscribed by the area of Haryana state specifically Karnal region in South and South Eastern, Kaithal region in the South Western and Ambala locale in the North. In North West side the area is flanked by Patiala region of Punjab state. The Eastern pieces of the area fall in the Upper Yamuna Basin and

Western parts fall in Ghaggar bowl. The waterway Markanda gives the real waste in the zone. Water system in the area is finished by surface water just as groundwater. Exhaustion in groundwater assets is the significant worry of the area.

Kurukshetra region comprises of five squares, in particular Ladwa, Pehowa, Shahabad, Thanesar, and Babain. It has 1510 km² of complete cultivable region, of which 1500 km² is watered. Region watered by waterway and tubewells is 270 and 1230 km² separately. The offer of groundwater watered territory in the all out inundated zone is 81 percent. Water system power in the locale is around 180 percent.

The region falls under semi-dry district and encounters sweltering summers and cold winters. It gets around 81 percent of its ordinary yearly precipitation 582 mm amid the long stretch of July to September. Geographically, Kurukshetra region territory is a plain surface having a normal rise changing from 274 to 241 m above mean ocean level. The general slant of the land is from North East to South westwards. The area comprises of three kinds of soil, to be specific sandy topsoil, soil and dirt topsoil having low to direct porousness. Precipitation and drainage, trench systems and water system is the primary wellspring of groundwater energize in the zone.

4. Status of Water Resources of Kurukshetra District

Long haul net difference in groundwater levels amid the period 2000 – 2011 shows a general decay (negative change) in the entire area and its reaches between 1.14 m/yr to 1.71 m/yr. The most extreme rate of decay has been seen in Shahabad square. It is appropriate to make reference to that the rate of decrease, when all is said in done, has been worked out to be more than 1.0 m/yr. Profundity to groundwater level in Kurukshetra area ranges from 20.18 m to 32.64 m bgl amid pre-rainstorm period 21.80 m to 34.41 m bgl amid the post-storm period 2011.

In the significant piece of the region, groundwater level rests in excess of 30 m bgl and spreads in Shahabad, Babain, Ladwa squares and parts of Thanesar square. The shallow groundwater levels in the profundity scope of 20 to 25 m bgl spread in Southern and Western pieces of the locale, covering Thanesar and Pehowa squares. It has additionally been seen that the amid the post-storm period the region between 20 m to 25 m bgl gets diminished and territory under in excess of 30 m bgl gets spreads demonstrating weight on groundwater to fulfill out the farming need amid rainstorm season as well as in storm period. The groundwater improvement in each of the five squares has surpassed the accessible revive, in this way every one of the squares (100 percent) have been ordered as overexploited. The phase of groundwater improvement ranges from 187 percent (Block – Pehowa) to 331 percent (Block – Ladwa). Net yearly replenishable groundwater accessibility in the locale has been surveyed as 343.23 mcm (million cubic meters). The complete groundwater draft for all uses in the entire region is 746.41 mcm, in this manner leaving shot fall (overdraft) of 40318 mcm. The phase of groundwater advancement in the Kurukshetra locale has been surveyed to be 217 percent.

5. Depth to Watertable

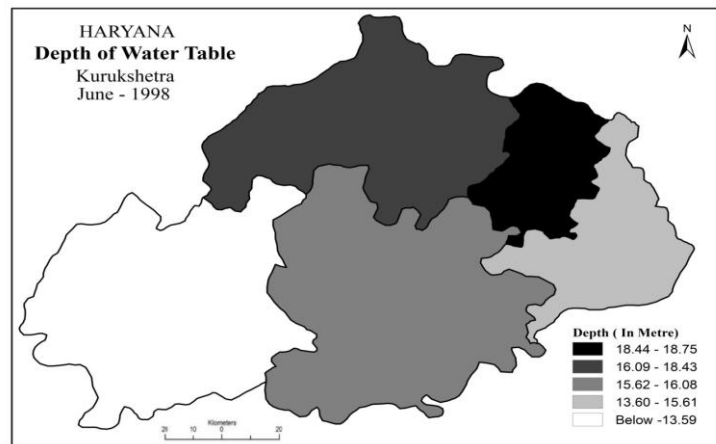
The optional information on profundity to Watertable variance has been determined for all the five squares of the region for the year 1998 and 2013 in order to watch the long haul change in water dimension of Kurukshetra area. The profundity to water table recorded in all the five squares with the entry of 10 years. In June 1998 the shallow water table (13.59 m) happened in Pehowa square while water levels were most profound (18.75 m) in the Babain square. The profundity to water table was 15.61 m, 16.08 m, and 18.43 m amid June 1998 in Ladwa, Thanesar, and Shahabad square separately. In June 1998 the entire region normal water table profundity was recorded 16.49 m (table 1 and figure 1).

Table: 1 Kurukshetra District: Average Depth to Water table last one and half decades and its fluctuation (June 1998- June 2013)

Blocks	Depth to Water table		Total Fluctuation during 15 years (1998-2013)	Average Fluctuation (1998-2013)	2013-1998
	1998 (J) (m)	2013 (J) (m)			
1	2	3	4	5	6
Thanesar	16.08	32.15	-16.07	-1.071	-107.1
Shahabad	18.43	39.18	-20.75	-1.383	-138.3
Pehowa	13.59	30.86	-17.27	-1.151	-115.1
Ladwa	15.61	28.48	-12.87	-0.858	-85.8
Babain	18.75	35.55	-16.8	-1.12	-112
DistrictAverage	16.49	33.24	-16.75	-1.116	-111.6

Source:-For Col. No. 1, 2 and 3 Groundwater cell, Agriculture Department Govt. of Haryana for Col. No. 4,5 and 6 computed by Authors.

Fig. 1



Amid June 2013, the shallowest (28.48 m) in Ladwa square while the most profound (39.18 m) happened in Shahabad square. The profundity to water table was 35.55 m, 32.15 m, and 30.86 m amid June 2013 in Babain, Thanesar, and Pehowa square separately. In June 2013 the entire locale normal water table profundity was recorded 33.24 m. In spite of the fact that, the profundity to water table declined in all the five squares, in any case, the rate of decay was distinctive in various squares (table 1 and figure 2).

In the last one and a half decade, the profundity to water table declined most extreme by about 20.75 m for example at a rate of more than 1m/year in Shahabad square. The base decrease in the profundity of water table happened in Ladwa square (12.87 m) for example at a rate of about 0.858 m/year. The profundity to water table declined 17.27 m, 16.8 m, and 16.07 m at a rate of more than one meter/year in Pehowa, Babain and Thanesar squares separately, amid the last one and half decade (1998-2013). These outcomes (Table 1) recommend that exorbitant water has been pulled back from all the five squares amid the last one and half decade.

Fig. 2

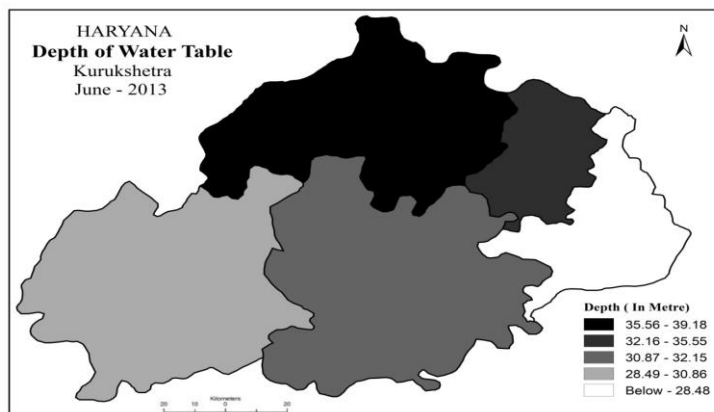


Fig. 3

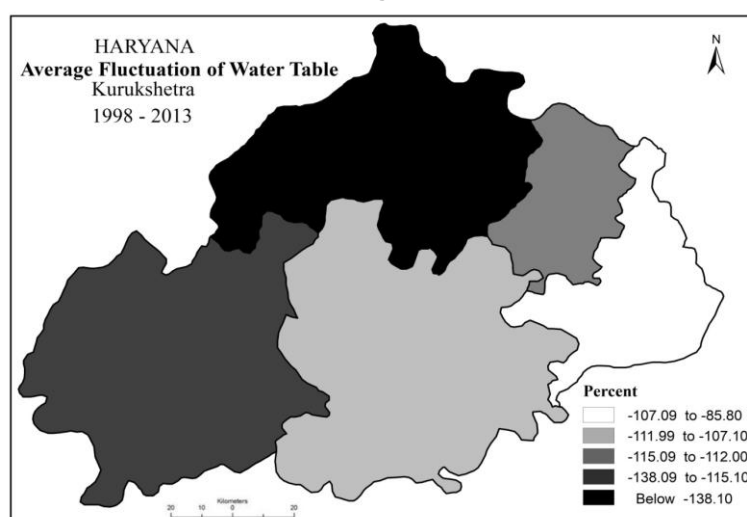
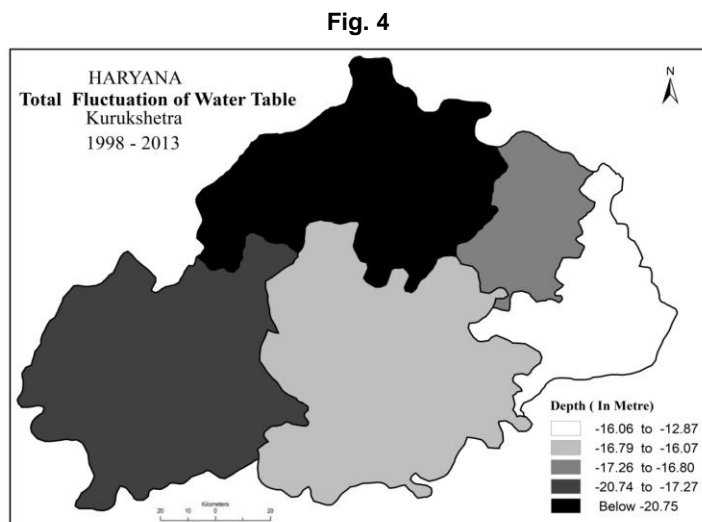


Figure 3 and 4 shows the categorization of blocks in Kurukshetra district according to the average fluctuation and total fluctuation of water table from 1998 to 2013.



In spite of the fact that groundwater is of low quality in numerous pieces of the area, entire five squares are enduring groundwater overexploitation. Notwithstanding, because of the accessibility of lacking waterway water, the extraction from the underground pool has been expanding step by step to fulfill the need.

On the off chance that this circumstance is permitted to win for quite a while without presenting adequate revive offices, the issue of consumption may invade complex that would at last increment the stress of ranchers and groundwater the board organizers.

6. The Range of Depth to Watertable

By and large, the water levels are more profound in the Kurukshetra area. Table 2, 3 and figure 5, 6 demonstrates that in June 1997 and June 2014 no piece of the region showed beneath 3.0 m the range to the water table. In June 1997 all the five hinders, the considerable territory under the range 10 – 20 m profundity. About 96.92, 87.01, 84.87, 75.87 and 66.88 percent region fall under the range between 10 - 20 m profundity in Thanesar, Ladwa, Babain, Pehowa and Shahabad squares, individually. Just 33.12, 15.13, 4.89 and 3.1 percent region fall the range between 20 – 30 m profundity in Shahabad, Babain, Ladwa and Thanesar squares, separately. This recommends in June 1997 most extreme zone in every one of the five squares falls in the range between 10 – 30 m profundity to water table (figure 5).

In June 2014 all the five obstructs, the calculable region under the range 30 – 40 m profundity. Around 100, 67.17, 63.68, 62.37 and 49.29 percent zone fall the range between 30 – 40 m profundity in Babain, Pehowa, Ladwa, Shahabad and Thanesar squares, individually. Another calculable territory is found under the range in the middle of 20 - 30-meter profundity. About 43.69, 32.83 and 29.64 percent region fall the range between 20 – 30 m profundity in Thanesar, Pehowa, and Ladwa squares, individually. The most noteworthy most profound region about 35.98, 7.01 percent falls in the Shahabad and Thanesar square, separately and the least most profound zone about 0.28 percent falls in additionally Shahabad square (figure 6).

There was not really just 7.25 percent zone in the region which falls in the scope of under 10 m profundity. This unmistakably delineates water level is more profound in this area. Precipitation and different sources for example channel organize are restricted (just 280 sq. km. Inundated by the trench), in this area; groundwater is the fundamental wellspring of water for various employments. This might be the primary explanation behind extending water level in the region.

Table: 2 Kurukshetra District: Block wise Range of Depths to Water table in June 1997

Blocks	Total Geographical Area (Hects)	0-1.5 (m)	1.5-3.0 (m)	3-10 (m)	10-20 (m)	20-30 (m)	30-40 (m)	>40 (m)
Thanesar	46827	0	0	0	45385(96.92)	1442(3.1)	0	0
Shahabad	37712	0	0	0	25222(66.88)	12490(33.12)	0	0
Pehowa	50700	0	0	12235(24.13)	38465(75.87)	0	0	0
Ladwa	16230	0	0	1315(8.10)	14122(87.01)	793(4.89)	0	0
Babain	16784	0	0	0	14211(84.87)	2540(15.13)	0	0

Source: Groundwater cell (CGWB) Note: Figures in parentheses are percentage in total.

Table: 3 Kurukshetra District: Block wise Range of Depths to Water table in June 2014

Blocks	Total Geographical Area (Hects)	0-1.5 (m)	1.5-3.0 (m)	3-10 (m)	10-20 (m)	20-30 (m)	30-40 (m)	>40 (m)
Thanesar	46827	0	0	0	0	20460(43.69)	23082(49.29)	3285 (7.01)
Shahabad	37712	0	0	105(0.28)	210(0.56)	305(0.80)	23522(62.37)	13570 (35.98)
Pehowa	50700	0	0	0	0	16645(32.83)	34055(67.17)	0
Ladwa	16230	0	0	0	1085(6.69)	4810(29.64)	10335(63.68)	0
Babain	16784	0	0	0	0	0	16784(100)	0

Source: Groundwater cell (CGWB) Note: Figures in parentheses are percentage in total.

Fig. 5

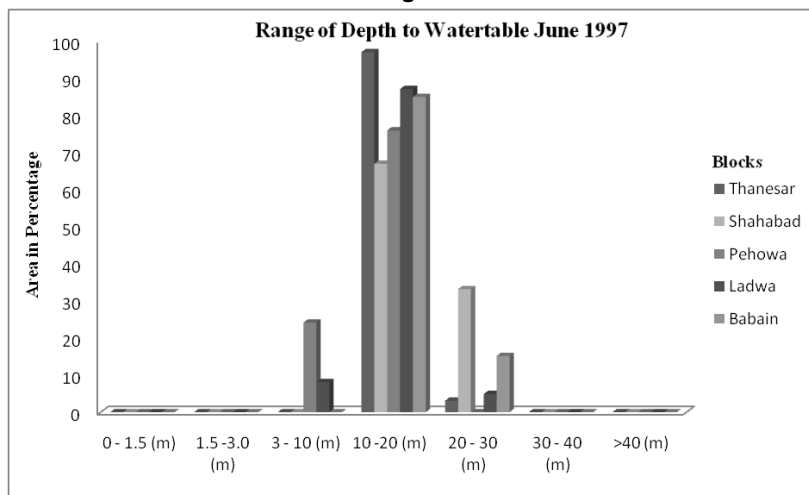
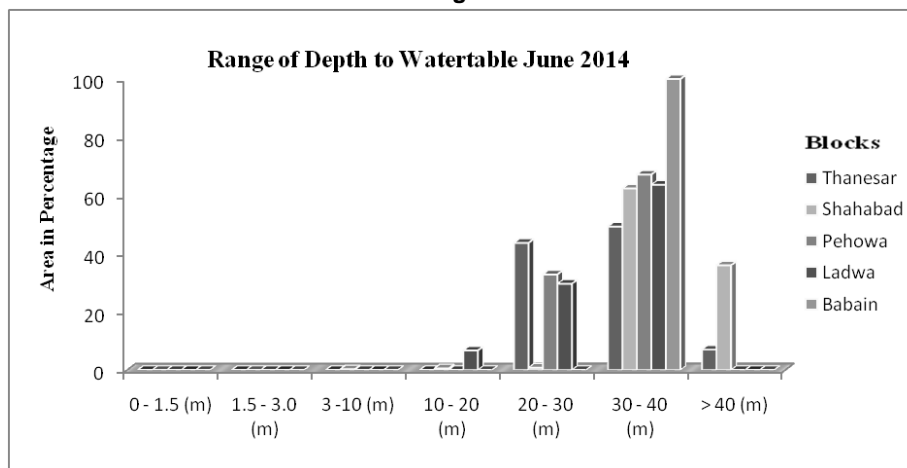


Fig. 6



7. Implications of the Depleting Groundwater Resources

Quickened groundwater exhaustion, can effectsly affect the vocations of the provincial poor ranchers that depend on agribusiness, particularly in semi-bone-dry zones where supplemental water system is basic for yield development. The decrease in groundwater table offers ascend to innovative externalities as far as expanding expenses of putting in new tubewells, extending of existing wells and siphoning and other support exercises.

Inequity in profit margin:The overall revenues crosswise over various landholding classes decrease with the decrease in the water table and the little and peripheral landholding classes are the most noticeably terrible sufferers of

groundwater exhaustion. This demonstrates the way that the cost of regular asset consumption is excessively conceived by the asset poor ranchers since they are unfit to put resources into innovation, and henceforth remain rejected from its helpful ambit. The disparity in the net returns particularly in the total groundwater subordinate horticultural economy winds up unavoidable with groundwater exhaustion.

Increasing price of groundwater extraction: With fall in the groundwater table, the cost of extraction increments, as it is unmistakably clear from an investigation of focal belt of Punjab, and different states like Haryana, wherein it was discovered that cost of siphoning out water has expanded as the power required for lifting groundwater from more profound

surface is a lot higher than that from the shallow one and submersible siphons set are supplanting the divergent siphons set.

Change in the quality of groundwater: Because of mind blowing utilization of groundwater for water system and different purposes, it has brought about sharp decrease of groundwater levels and realized unfavorable changes in the geochemistry of groundwater. Characteristic contaminants, for example, fluoride, nitrate, and chloride salts are expanding in groundwater making it unfit for drinking and presenting danger to wellbeing.

Inequity in access to groundwater irrigation: As draining groundwater table is past the scope of poor ranchers, under such conditions, they need to rely on other great proprietors for groundwater water system. Else, they would be denied of the asset rich people would pursue groundwater table by making a substantial interest in separating water on the other. It might be construed that expanded utilization of groundwater results in a biased conveyance of this valuable water assets.

Impact on groundwater markets: It is seen that with groundwater tables subsiding, a bigger number of little and minimal landholding families rely upon groundwater advertise for water system. At the point when groundwater assets drain and the cost of tubewells development and siphoning builds, along these lines, the arrangement of exchanging water gives more prominent monetary chances to tubewell proprietors having expansive property, and lesser chances to tubewell proprietors having littler possessions and water purchasers. This is because of the way that for a vast rancher, the verifiable unit cost of water is much lower when contrasted with little ranchers. In the meantime, a little rancher won't probably raise the groundwater accuses to match of the understood cost of siphoning, as the costs are dictated by the market powers.

8. Suggestions and Recommendations

- On-ranch water the executives systems, for example, Laser Leveling and Zero Tillage, utilization of Tensiometer in paddy development, reception of improved water system strategies and smaller scale water system procedures (sprinkler and dribble), mulching for decrease of vanishing misfortunes, convenient transplanting of paddy development, conjunctive utilization of channel and groundwater, and so forth ought to be successfully received.

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9. Conclusion

Groundwater in agronomically predominant Kurukshetra area of Haryana is overexploited, which has been confirmed by the declining patterns in groundwater profundities amid the last one and half decades (1998 – 2014). The groundwater improvement arrange in every one of the five squares is more than 100 percent and has been put under the overexploited class. The groundwater level in Kurukshetra area dropped up to 20.75 m amid the last one and half decade (1998-2014) at a rate of more than 1m/year in Shahabad square. Precipitation and waterway organize are restricted in the region, as per CGWB 2013 just 280 sq. km. the region is flooded by waterways organize. Groundwater is the main significant wellspring of water to satisfy the need. On the off chance that the groundwater deliberation proceeds at a similar rate in Kurukshetra locale the groundwater level may achieve a profundity from where its lifting may not be workable for water system reason. Accordingly, there is an extraordinary danger of the change of this colossally profitable region into the infertile district. There is a dire requirement for facilitated endeavors and wills by different governments and non-legislative offices, social administration associations and the partners for developing implementable arrangement for viable administration of this valuable normal asset. For the better administration of groundwater, teach the general population and diverse landholders to make mindfulness among clients about the significance of groundwater and its administration.

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