

# Salt Water Intrusion and Delineation of Groundwater Quality at Coastal Aquifers



M. V. Raju, M. Satish Kumar, Md. B. Wasim Akram, T. L. Rishi Vardhan, Hepsibah Palivela

**Abstract:** Ground water quality changes or depleting day by day due to various contaminated substances presence in the environment and also other factors influences of excessive drawing of ground water, intrusion of septic sewage, improper dumping of solid waste disposal, untreated industrial effluents, sludge and waste water disposal without giving any treatment and also seasonal changes, etc., all are leads to decrease the quality and depth of ground water table, which leads to cause severe health issues like diarrhea, dysentery, digestive problems etc., on human life. In this contest an attempt has been made to find the ground water quality and also to know the level of contamination presents in Akividu area. About 16 number of ground water samples were collected, which covers the entire area of Akividu, by the estimation of ground water quality parameters includes pH, CO<sub>3</sub>, HCO<sub>3</sub>, NH<sub>3</sub>, NO<sub>2</sub>, DO, Salinity, Hardness, Chlorine, Total Alkalinity and Total Ammonia, during post monsoon months of October to November 2019. It was found that many of ground water samples have excess amount salinity and hardness and reaming parameters were in permissible range. All these accumulations of salinity (more than 0.5 ppm) and hardness (more than 600 ppm) may cause due to practices of aquaculture near and around the area of Akividu, and hence it is very necessary to done the periodical examination and also need to stop contaminate sources entering into nearby water bodies

**Keywords:** Effluents, Groundwater, Hardness, Quality, Salinity, Treatment.

## I. INTRODUCTION

Water is natural resources of fundamental importance and is impartment in sustaining a healthy biosphere. Water is an internal medium for almost all organisms and principal external medium for several organisms. All organisms use water for their metabolic processes. Earth surface is covered by Seventy One percentage of water, from that about 96.3 percentage of water covered by oceans, which is not suitable for domestic purposes and remains available as 0.93

percentage of Saline ground water, 0.07 percentages as saline lake waters and 2.5 percentages available as fresh waters. From 2.5 percentages of fresh waters, 1.3 percentages of water available as surface water, 30.1 percentage as ground water and 68.6 percentage as Glaciers and ice caps . From 1.3 percentages of surface waters 20.1 percentages available in form of lakes remain 73.1% as Ice and snow mountains. Ground water commonly understands as the water occupying all the voids with a geologic stratum. Water contained in saturated zones is important for water supply development. Under ground water plays an important role in overall water balance of the environment. As a reservoir, it has an enormous capacity to store water in rainy periods which can be utilized during dry periods; ground water is a primary source of fresh water in several towns and rural areas. At present protection of groundwater at coastal zones becomes more complex issue with respect to quality as these zones are contaminating due to the over lifting of water for various domestic and industrial needs[4] of nearby coastal areas due to which the saltwater enters into the freshwater aquifers and damages groundwater. The general global distribution of water on earth shown in figure 1

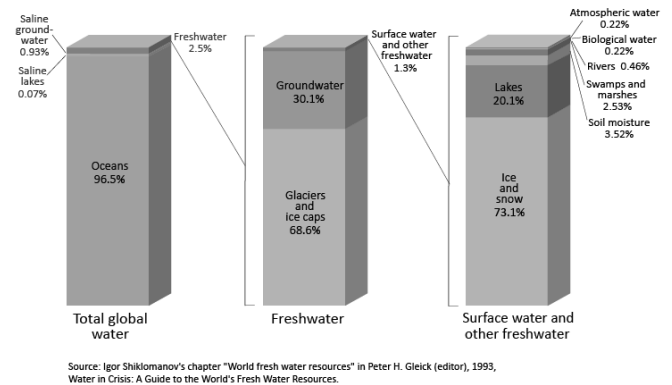


Figure 1 Distribution of water on earth

## II. ABOUT THE STUDY AREA

Akividu is the one of the urban centre in district of west Godavari of Andhra Pradesh state and it is a one of the major semi-urban place in the coastal region of Andhra Pradesh. It's Coordinates at 16.6000°N 81.3833°E. It is located in between rail route of Gudivada and Bhimavaram and is much connected with National Highway Number 214 (NH214). The town is with an average temperature of 28 degrees centigrade and annual rainfall of 103 centimeters

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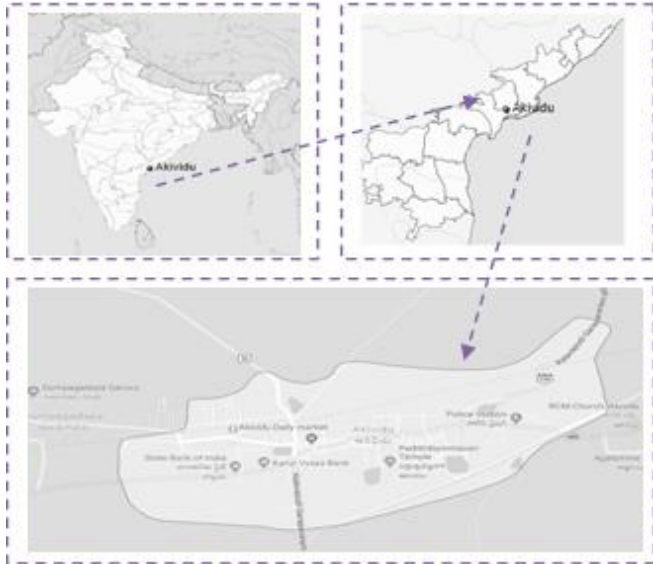
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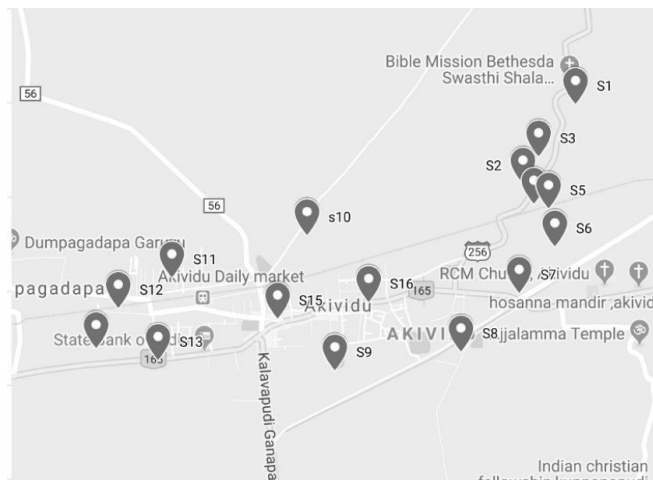


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Akividu is one of the major panchayati in district of W.G. and it contains 15 revenue villages of Mandal head quarters. The town had a population of 24,506, with male population 11963 and female population about 12543, and it stands with 73% of literacy rate. The area, where practicing more in aquaculture and more demand on domestic water supply, which leads to attentions on quality of water in and around the town. The location map of Akividu town shown in figure 1.



**Figure 2. Location Map of the Akividu, W.G. Dist., Andhra Pradesh**



**Figure 3. Ground Water Sampling Locations Map at Akividu, W.G. Dist., Andhra Pradesh**

### III. OBJECTIVES

Water is said to be polluted when it is unfit for its intended use. The quality of ground water [7] is an important as its quantity. A potable water supply, which is needed for the existence of a population, has to be in the right quantity and of right quality.

In the present study, the ground water quality in akividu areas Viz: Kalavapudi Ganapavaram Road, 16 building centre, MAA Kali Ice Plant area, Hope Baptist Church area, PP Road area, Market Area, Old Sivaalayam Road and many parts of akividu has been surveyed. The samples have been

collected from dug wells and bore wells [10] for quality estimation. The objective of the present study is to access the ground water quality status [3] in the study area and its portability.

**Table:1 Sampling Details at Akividu**

Sl.No.	Sample Details	Area Details in Akividu	Location Details
1	S1	Kalavapudi Ganapavaram Road	16°35'43.4"N 81°23'40.8"E
2	S2	16 building centre	16°35'24.6"N 81°23'27.8"E
3	S3	MAA Kali Ice Plant	16°35'30.1"N 81°23'32.1"E
4	S4	kalavapudi ganapavaram road	16°35'19.9"N 81°23'30.5"E
5	S5	Akividu	16°35'18.8"N 81°23'34.1"E
6	S6	Akividu	16°35'09.8"N 81°23'35.7"E
7	S7	Hope Baptist Church area	16°34'58.9"N 81°23'26.9"E
8	S8	Akividu	16°34'45.0"N 81°23'12.5"E
9	S9	Akividu	16°34'40.6"N 81°22'41.4"E
10	S10	Akividu	6°35'12.5"N 81°22'34.5"E
11	S11	Akividu	16°35'02.5"N 81°22'01.1"E
12	S12	Shanthi Nagar	16°34'55.3"N 81°21'47.9"E
13	S13	PP Road	16°34'43.0"N 81°21'57.7"E
14	S14	Akividu	16°34'45.8"N 81°21'42.4"E
15	S15	Akividu Market Area	16°34'52.8"N 81°22'27.2"E
16	S16	Old Sivaalayam Road	16°34'56.7"N 81°22'49.7"E

### IV. MATERIALS AND METHODS

16 Ground Water samples have been collected Kalavapudi Ganapavaram Road, 16 building centre, MAA Kali Ice Plant area, Hope Baptist Church area, PP Road area, Market Area, Old Sivaalayam Road and many parts of akividu, during post monsoon months of October to November 2019. Sampling location details shown in table 1

Ground water Samples were collected [9] according to procedures of UNESCO. And clearly give details, where the samples were collected. Parameters includes pH, CO<sub>3</sub>, HCO<sub>3</sub>, NH<sub>3</sub>, NO<sub>2</sub><sup>-</sup>, DO, Salinity, Hardness, Chlorine, Total Alkalinity and Total Ammonia were by estimated by standard methods [6] of APHA (1998). Methods used for the estimation of ground water samples shown in table 2. And few samples collection and estimation shown in figure 4

**Table 2 Methods followed for estimation of ground water samples (APHA) 1998**

Name of the Parameter	Method Used for Quality
Temperature (°C)	Precision thermometer, measured in situ
EC (Mhoms)	Conductivity meter
Turbidity (NTU)	Nephelo meter
TS (mg/l)	Evaporation process
TDS(mg/l)	Evaporation and filtration
pH (range)	Digital pH meter
Total Alkalinity (CaCO <sub>3</sub> ) (mg/l)	Titration Process
Phenolphthalein Alkalinity (CaCO <sub>3</sub> ) (mg/l)	



**Figure 4. Images of few Samples Collections and Estimation**

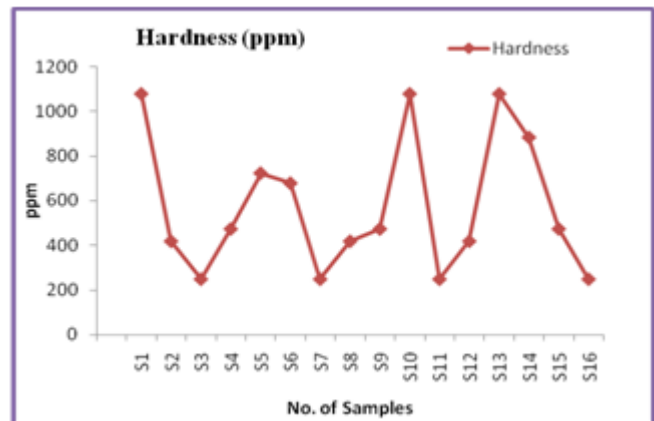
**V. RESULTS AND DISCUSSIONS**

The determination included chemical quality parameters[2] for ground water samples with 16 ground water samples collected at various wells/bore, which covers total area [10] of Akividu area and sampling has been done during post monsoon months of October to November 2019. Salinity is increasing in ground water samples {i.e. S1,S4,S5,S7,S8,S9,S14,S15,S16 = 1 ppm avg. salinity } and hardness is more than desirable limits in ground water samples {i.e. S2,S3,S6,S10,S11,S12,S13 } and more than permissible limits in ground water samples {i.e. S1,S5,S6,S10,S13,S14 =1080 ppm,725 ppm, 680 ppm, 1080 ppm, 1080 ppm, 885 ppm } and pH, salinity in remaining samples, Carbonates, Bi-Carbonates, Total Alkalinity, Total Ammonia, NH<sub>3</sub>,Nitrites, Dissolved Oxygen, Hardness in remaining samples, Chlorine are less than their desirable limits. The optimum standard values were shown in table 3 and results are showed in table 4. And graphical

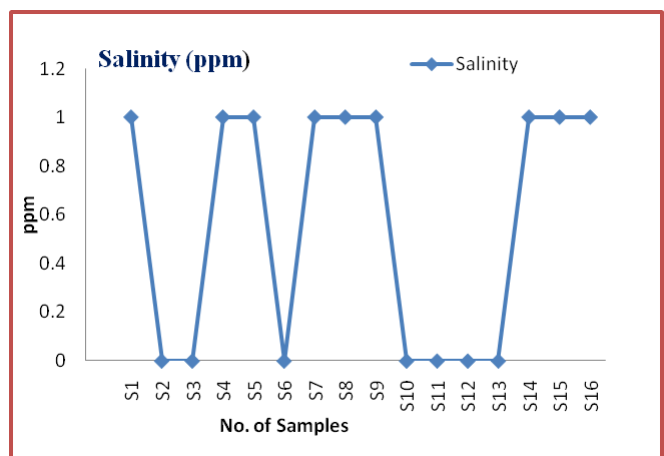
representation of major quality parameters salinity and hardness are shown in Figure 5 and figure 6 respectively.

**Table 3 Optimum standards levels for various samples**

Name of Chemical Parameter	Optimum Standard value
pH	6.5-8.5
Salinity (ppm)	<0.5
CO <sub>3</sub> (ppm)	No Limits
HCO <sub>3</sub> (ppm)	No Limits
Total Alkalinity (ppm)	200-600
Total Ammonia (ppm)	0.25-32.5
NH <sub>3</sub> (ppm)	45-100
NO <sub>2</sub> - (ppm)	45-100
DO (ppm)	<2
Hardness (ppm)	300-600
Chlorine (ppm)	250-100



**Figure 5. Graphical representation of Salinity of respective samples**



**Figure 6. Graphical representation of Hardness of respective samples**

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Table 4. Quality Characteristics of Ground Water at Study Area

Sl. No.	Sample Code	Chemical Quality Characteristics (Units = ppm , except pH)										
		pH	Salinity	CO <sub>3</sub>	HCO <sub>3</sub>	Total Alkalinity	Total Ammonia	NH <sub>3</sub>	NO <sub>2</sub>	DO	Hardness	Chlorine
1	S1	8.4	1	0	135	135	0.25	Nil	Nil	4.8	1080	Nil
2	S2	7.8	0	10	125	135	Nil	Nil	Nil	4.2	420	Nil
3	S3	8.5	0	0	90	90	Nil	Nil	Nil	5.4	250	Nil
4	S4	7.6	1	5	105	110	0.1	Nil	Nil	5.2	475	Nil
5	S5	8.4	1	0	115	115	Nil	Nil	Nil	6.2	725	Nil
6	S6	7.8	0	5	100	105	Nil	Nil	Nil	4.7	680	Nil
7	S7	8.1	1	5	95	100	0.15	Nil	Nil	6.3	250	Nil
8	S8	8.4	1	10	110	120	Nil	Nil	Nil	4.8	420	0.01
9	S9	8.4	1	5	90	95	Nil	Nil	Nil	5.2	475	0.01
10	S10	7.6	0	0	135	135	Nil	Nil	Nil	5	1080	Nil
11	S11	7.6	0	0	125	125	Nil	Nil	Nil	3.4	250	Nil
12	S12	7.8	0	10	95	105	Nil	Nil	Nil	6	420	Nil
13	S13	8.4	0	5	115	120	Nil	Nil	Nil	4.8	1080	0.01
14	S14	7.6	1	10	115	125	0.05	Nil	Nil	5.8	885	Nil
15	S15	8.4	1	0	110	110	Nil	Nil	Nil	5.2	475	0.01
16	S16	8.4	1	5	105	110	0.25	Nil	Nil	6.5	250	Nil

## VI. CONCLUSIONS

Water supply is one of the factors of fundamental importance of dwellers, who require 135 liters per head per day for their domestic activities. The ground water quality in the Akividu of West Godavari district has been monitored and the ground water quality in Akividu area, few sources at Kalavapudi Ganapavaram Road, Akividu, Hope Baptist Church area, few parts of Akividu has high concentrations of Salinity , range of 1 ppm and Hardness, ranges from 680 ppm, to 1080 ppm, which were more than permissible limits and indicating that the ground water in few areas of Akividu town is unsatisfactory with respect to quality parameters that had been estimated. For direct consumption of water is not recommended [8] due to excessive amounts of salinity and hardness content and treatment must be given [5] before utilization and also require periodical monitoring of ground waters.

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