Groundwater Governance in Over-exploited/Dark and Saline Areas of Gujarat State

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INTRODUCTION

The Gujarat state comprises 25 districts having geographic area of 1,96,024 sq.km. The population as per 2001 census is 50.67 million. Gujarat state can be divided into five major physiographical zones: (1) alluvial plains extend from Banaskantha in North Gujarat to Valsad in the South. It also extends westward to Kachchh, (2) eastern hilly tract, (3) uplands of Kachchh-Saurashtra, (4) the low-lying coastal tract, and (5) marshy to saline desert of Kachchh and little Rann of Kachchh.

Drainage of all the five physiographical regions of Gujarat state is distinct with the prevailing topographical and physical characteristics of the rock formations thereof. The flow direction of some of the major rivers is controlled by major tectonic activity, which occurred during the geological past.

Last decade average rainfall varies from 300 mm in Kachchh district to 2750 mm in Dangs district. The total annual precipitation is about 1,02,023 MCM/year.

GEOLOGY AND GEOHYDROLOGY OF THE STATE

Geological formations ranging in age from Pre-Cambrian to Recent occurs in the State. The alluvial and sedimentary formations constitute 45% area while igneous and metamorphic formations constitute 55% area of the state.

The igneous and metamorphic rocks are exposed in N-E parts of the state. Basaltic rocks are exposed in Saurashtra, Kachchh and Southern part of the state. The sedimentary rocks occur in Kachchh, Sabarkantha, Surendranagar, Vadodara districts and along the coast line. The huge thickness of recent alluvial deposits occurs in Northern and Central parts of the state.

The geohydrological conditions prevailing in the state can be categorized mainly into rocky and alluvial formations.

Archaean and Proterozolic Rocks: These rocks mainly occupy the northeast and eastern parts of the state. These rocks do not form good aquifers.

Mesozoic Formation: Jurassic and Cretaceous formations are mainly sedimentary formations occurring in Vadodara, Kachchh, Surendranagar and Sabarkantha districts. In this formation groundwater condition is poor to moderate.

Tertiary Formation: These sedimentary formations are exposed between the Narmada and Tapi rivers in parts of Bharuch and Surat districts. They also occur along the coastal areas of Saurashtra and Kachchh. In general it does not form good aquifer.

Quaternary Formation: This group includes miliolitic limestone, alluvium and aeolin deposits. The Miliolitic limestone with karstic topography form good aquifers. However, along the coastal belt of Saurashtra, the quality of ground water in Miliolitic limestone aquifer has gradually deteriorated due to seawater ingress.

Ground water in the alluvial areas occurs both under unconfined, semi-confined and confined conditions. In north and central Gujarat multi-layered aquifer system with a depth of about 300 m is observed. The recharge areas of confined aquifers occur along the contact areas with the hilly region in the east.

Due to over-exploitation of ground water in north, central and Kachchh region of the state, decline in water level at alarming rates is observed in these regions.

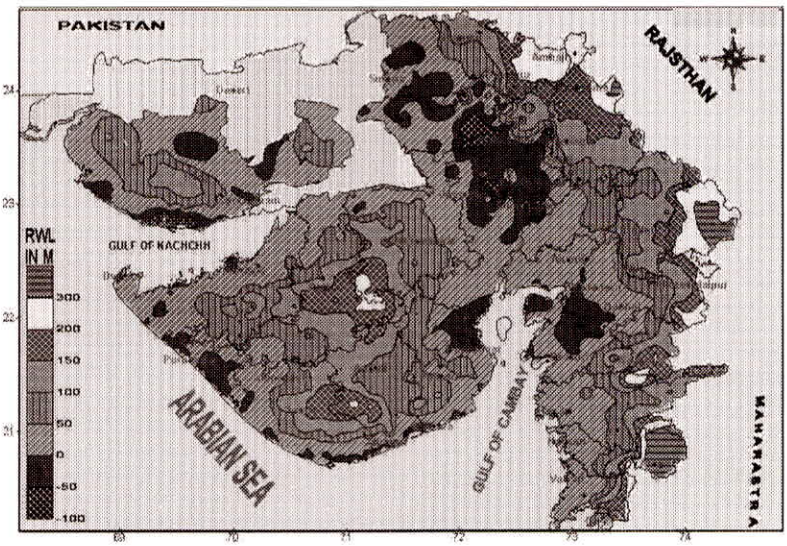

Fig. 1. Reduced water level (Pre-monsoon – 2005).

WATER SCENARIO OF THE STATE

The total available water resources in the state are 53,180 MCM of which surfacewater resources are 38,100 MCM and groundwater resources are 15,080 MCM. The availability of surface and groundwater resources in different regions of the state is quite varying. The Kachchh region is poor in ground water and surface water. In Saurastra and north Gujarat regions, groundwater resources are 20% more than surfacewater resources. In south and central region surfacewater resources are 68% more than the groundwater resources.

Total irrigable area of the state is 125 lakh ha. The irrigation facilities are available in 28% of the area. About 60% of irrigation water requirement is fulfilled from ground water.

Groundwater Development and Issues

In view of scanty and irregular rain fall in north Gujarat, Saurashtra and Kachchh regions and inadequate surfacewater resources, groundwater resources are utilized as the chief source for agriculture, industries and drinking water supply. As groundwater exploitation is far more than the groundwater recharge, the groundwater levels are depleting at an alarming rate and resulting in deterioration of groundwater quality. There is continuous rise in the number of over-exploited, dark and saline category talukas in the state. As per the estimation committee report, in 1986, five talukas were in over-exploited, one in dark and two in saline category, while as per year 2002 estimation now 30 talukas are in over-exploited, 12 in dark and 14 in saline category.

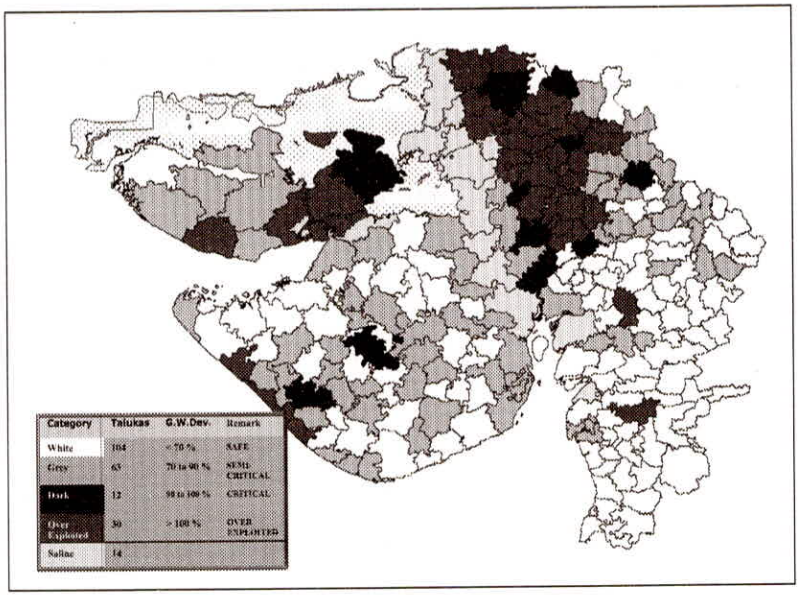

Fig. 2. Groundwater development in Gujarat state (Year 2002).

Issues Due to Over-exploitation of Ground Water

- Increase in construction cost of hydraulic structures.
- Reduction in agricultural production due to deterioration in groundwater quality.
- Irrigable land has become barren due to seawater intrusion in coastal areas of Saurashtra and Kachchh.
- Reduction in irrigation has affected agricultural production and the agricultural economy of the area.
- Increase in fluoride and chloride contents has created many human diseases.
- Increase in cost and consumption of electric power.
- Migration of people for survival.

Groundwater Monitoring—A Basic Need for Governance

Gujarat Water Resources Development Corporation carries out groundwater monitoring in the state. The monitoring is carried out on the open wells, tube wells and piezometers. The purpose of the monitoring is to study the behaviour/fluctuation of groundwater flows, variation in groundwater quality and scientific assessment of ground water.

It was possible to evaluate the changing scenario of ground water in the state through groundwater monitoring. The excessive extraction of groundwater resources, specially in north Gujarat has resulted in the alarming depletion of water levels and drastic deterioration in groundwater quality.

In this region due to extensive exploitation groundwater trough has been developed. In 1991, the spreading area of trough was 600 sq. km., which has now extended to 3470 sq. km.

The continuous deterioration in groundwater condition in the state urged the need of groundwater governance for better management of groundwater development in the state. The districtwise details of existing monitoring stations are shown in Table 1.

Table 1. Districtwise monitoring of groundwater in Gujarat

District	*Open well*	*Tube well*	*Piezometers (HP)*	*Piezometers (NCCA)*
Ahmedabad	45	27	42	57
Amreli	75	-	32	-
Anand	30	25	13	-
Banaskantha	71	83	63	45
Bharuch	35	3	19	27
Bhavnagar	81	-	39	14
Central Territory	12	-	-	-
Dohad	38	-	9	-
Gandhinagar	7	32	23	-
Jamnagar	90	-	38	-
Junagadh	99	-	38	-
Kachchh	79	15	32	16
Kheda	37	22	8	18
Mahesana	28	40	41	29
Narmada	29	2	10	-
Navsari	30	-	10	-
Panchmahals	65	-	13	1
Patan	15	41	33	-
Porbandar	27	-	11	-
Rajkot	139	-	41	5
Sabarkantha	121	12	34	-
Surat	80	-	21	-
Surendranagar	107	17	31	53
The Dangs	8	-	12	-
Vadodara	61	15	36	50
Valsad	52	-	17	-
Total	1461	334	666	315

NCCA: Narmada canal command area

GROUNDWATER GOVERNANCE

Preventive Measures

As per the directives of Government of India, State Ground Water Authority has been constituted in 2001. Government of Gujarat has imposed restrictions vide resolutions on issuing new electric connection/shifting of old connection, on well/tube well for irrigation purpose in 57 over-exploited, dark and saline talukas of the state to control the groundwater exploitation.

Draft bill for formulating groundwater conservation and management act, on the line of Central Government Model bill is prepared and is under process of enactment.

Management

Encouragement to drip and sprinkle irrigation system for economical use of water resources and to educate the farmers for conjunctive use of surface and groundwater by mass awareness programme.

Encouragement to water conservation such as construction of check dams, recharge tanks, recharge wells etc., to enhance groundwater recharge. More than 50,000 check dams are constructed in last five years in the state under different schemes and encouraging results are observed.

Government of Gujarat has taken up an integrated project to provide surfacewater resources from other surplus regions to strengthen the water resources infrastructure in 10 worst scarce districts of north Gujarat, central Gujarat, Saurashtra and Kachchh region, comprising almost all over-exploited, dark and saline category talukas of the state.