THE WATER CRISIS IN INDIA AND THE BIAS OF THE LAW

A Dissertation Submitted in partial fulfillment of requirement for the Degree of

MASTER OF LAWS

Submitted by

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Dedicated

to

my Parents

DECLARATION

I hereby declare that this dissertation entitled **"The Water Crisis in India and the Bias of the Law"** is the outcome of research work conducted by me under the guidance of Prof. Babu Mathew, Registrar, National Law School of India University, Bangalore.

I also declare that this work is original except for such help taken from such authorities as has been referred to at the appropriate places.

I further declare that this work has not been submitted in part or in whole for any degree at any other University.

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TABLE OF CONTENTS

LIST OF CASES

Acton V. Blundell	(1856)11Ex 602.
Attakoya Thangal V.Union of India	1990(1) KLT 550.
Babaji Ramaling Gurav V. Appa Vithvja Sutar	A.I.R 1924 Mad 334.
Bradford V. Pickles	L.R 1895 A.C 587
Chasemore v.Richards	(1859)7 H.L.C 349.
Chet Singh V.Anar Singh.	A.I.R 1982 All 468.
Chitan Baral and others V Rathia Patra and others	A.I.R 1972 orrissa 953.
F.K Hussain V Union of India	A.I.R 1990 Ker 321.
Illinois Central Rail Road V. Illinois	146U.S 387 (1892).
Karathigundi Keshav Bhatta V. Sunnagoli Krishna Bhatta	A.I.R 1946 M 334.
M.C. Mehta V. Kamalnath	(1997) 1 SCC
Mahomeddans of Lonar V. Hindus of Lonar	A.I.R 1945 Nag 106.
Manthura B V. Ithal Chiman	A.I.R 1954 N 103.
Manu Mangal V. Dhaniram	A.I.R 1963 Orissa 97.
Marks V.Whitney,	6 Cal. 3d 251 (1971).
Narsoo V.Madanlal	A.I.R 1975 M.P185.

LIST OF ANNEXURES

GLOSSARY OF TERMS

Aquifer

A geologic formation that will yield water to a well in sufficient quantities to make the production of water from this formation feasible for beneficial use; permeable layers of underground rock or sand that hold or transmit groundwater below the water table.

Check dam

A small dam constructed in a gully or other small watercourse to decrease the stream flow velocity, minimize channel erosion, and promote deposition of sediment and to divert water from a channel.

Confined aquifer

An aquifer that lies between two relatively impermeable rocks layers.

Geohydrology

A term which denotes the branch of hydrology relating to subsurface or subterranean waters; that is, to all waters below the surface.

Glacier

A huge mass of land ice that consists of recrystallized snow and moves slowly downslope or outward.

Groundwater

Water within the earth that supplies wells and springs; water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table.

Groundwater hydrology

The branch of hydrology that deals with groundwater; its occurrence and movements, its replenishment and depletion, the properties of rocks that control groundwater movement and storage, and the methods of investigation and utilization of ground water.

Gully

A deeply eroded channel caused by the concentrated flow of water.

Gully reclamation

Use of small dams of manure and straw; earth, stone, or concrete to collect silt and gradually fill in channels of eroded soil.

Hydrologic cycle

Natural pathway water follows as it changes between liquid, solid, and gaseous states; biogeochemical cycle that moves and recycles water in various forms through the ecosphere. Also called the water cycle.

Limestone

Rock that consists mainly of calcium carbonate and is chiefly formed by accumulation of organic remains.

Percolation

The movement of water through the subsurface soil layers, usually continuing downward to the groundwater or water table reservoirs.

Percolating waters

Waters passing through the ground beneath the Earth's surface without a definite channel.

Runoff

Surface water entering rivers, freshwater lakes, or reservoirs.

Spring

An issue of water from the earth; a natural fountain; a source of a body or reservoir of water.

Stream

A general term for a body of flowing water.

Surface water

Water that flows in streams and rivers and in natural lakes, in wetlands, and in reservoirs constructed by humans.

Tragedy of the Commons

The idea that no one takes responsibility for things that everybody owns.

Water

The liquid that descends from the clouds as rain; forms streams, lakes, and seas, and is a major constituent of all living matter. It is an odorless, tasteless, colorless, very slightly compressible liquid.

Water cycle

Natural pathway water follows as it changes between liquid, solid, and gaseous states; biogeochemical cycle that moves and recycles water in various forms through the ecosphere. Also called the hydrologic cycle.

INTRODUCTION

Earth is estimated to have 1400 million cubic kilometers of water of which 97.3% is the salt water in the oceans and 2.7% is fresh water. A major portion of fresh water (75%) is frozen in Polar Regions and of the 25% of fresh water, ground water constitutes of 2.3% and surface water forms a meager 2%.[1]

Water is one of the Earth's natural resources. It is a finite resource, which means that the total amount of water is limited. Most of the world's water supply is saltwater stored in the oceans. Converting saltwater to freshwater is generally too expensive to be used for industrial, agricultural or household purposes.[2]

The type of water we generally use in human activities is fresh water. Surface water is water that is visible above the ground surface, such as creeks, rivers, ponds and lakes. Ground water is water that either fills the spaces between soil particles or penetrates the cracks and spaces within rocks.

Every planet and all forms of life including animal, plant and human being needs water to stay alive. This is because all life processes require water. Thus, the survival and development of human beings depends on their efforts to

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1 M.G Chandrakanth, *Scarcity of Ground Water for Irrigation: Economics of coping mechanisms in Hard Rock Areas* 5 (Bangalore: University of Agricultural Sciences, 1998).

2 http://www.edwardsaquifer.net

harness this precious natural resource and utilize them in a judicious manner. Water is the most basic of all basic needs. Earlier, it was thought that this resource needs no management strategies, as it was bountiful in nature and was available any where and everywhere in whatever quantity it was needed. However, with the passage of time this life giving, essential resource has undergone sea change in its utilization and has been subject to numerous pressures and due to this, we have been hearing that the "future wars will be on waters". Thus, the need of the hour is for proper and judicious use and management of this resource.

Common pool natural resources in India include such diverse things as village panchayats grazing lands, privately owned fallow lands, privately owned cultivated land lying vacant in between two crop seasons, community threshing floors, degraded revenue land, degraded forests and wood lots, land lying along side railway tracks, roads, water reservoirs, tanks, ponds, lakes, rivers streams, nalas, Ground water basins, marine fisheries, public (state) and community inland fisheries and so on.[3]

Although common property resources include such diverse things as community pastures, ponds, lakes, Ground water basins, rivers etc they all face one common problem, which, Garett Hardin calls "Tragedy of the commons".[4]

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[3] Katar Singh, *Managing Common Pool Resources* 9 (New Delhi: Oxford University Press, 1994).

[4] Elinor Ostrom, *Governing the Commons* 2 (Cambridge: Cambridge university Press, 1990). Garrett Hardin illustrates the logic of the tragedy of as follows: Picture pasture open to all.... Each herdsman will try to keep as many cattle as possible on the commons.... As a rational being, each herdsman

The "Tragedy of the commons" is not a new concept in India. However it has become accentuated in the past few years. This is because of the demand for common property resources are exceeding its supply, discovery of new uses for common property resource and change in the policies. For example community pastures are rendered denuded of any vegetative cover due to over grazing and community forests due to indiscriminate lopping and illicit felling. Our lakes and rivers are polluted by discharge of toxic effluents and sewage. Ground water has faced significant depletion, which exceeds its natural recharge.[5] If this trend continues, the untoward consequences of such "mining" may lead to permanent lowering of this precious resource. It is to be taken note of that water cannot be exploited in a similar manner as other natural resources for which new sources or substitutes are available.

In India ground water has been used for irrigation and domestic water supply since time immemorial. At present, more than 70 per cent of the population uses ground water for its domestic needs and more than half of the irrigation is provided from this source.

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seeks to maximize his gain. Explicitly or implicitly more or less consciously, as asks, what is the utility to me of adding one more animal to my herd. This utility has one negative and one positive component.... Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue to add another animal to his herd. And another. But his is the conclusion reached by each and every herd's man sharing commons. There in is the tragedy. Each man is locked into a system that compels him to increase his herd without limit in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.

5 Several studies have attributed: common property rights to ground water resource. Studies like Marcus Moench, "Drawing down the buffer; science and politics of ground water management in India", 27(13) *Economic and Political Weekly*, (1992). Also see, Ratna Reddy, "Valuation of Renewable Natural Resources User perspective", *34(26) Economic and Political Weekly*, (1999).

The total replenish able ground water in India is estimated to be about 432 billion cubic meters. About 7.1 mha m/yr is consumed for domestic and industrial use. It is estimated that about 32.47264 m ha m/yr is available for irrigation. According to an estimate by the central ground water board, 32 per cent of available ground water resources have so far been developed.[6]

Karnataka has 13,759 million cubic meters (MCM) of utilizable ground water for irrigation every year, as a renewable flow resource. Fluctuation in rainfall reflects fluctuations in ground water availability. Considering the actual utilization of ground water, Kolar District tops (64 MCM), Tumkur (52 MCM) and Dakshina Kannada (50 MCM). The lowest ground water use is in Shimoga District (6.2 MCM), followed by Kodagu (7.5 MCM) Chikmagalur (8.5 MCM), Hassan (14.2 MCM), Raichur and Dharwad (19 MCM). The overall utilization of groundwater in the state is 34 per cent.[7]

Ground water has contributed significantly to the development of Indian agriculture particularly during the last four decades the decline in water levels is a warning against unlimited withdrawal of ground water and limitless sinking of additional irrigation wells.

The ground water development is mostly by the private individuals. So far no ground water management has been followed strictly. This is due to the fact that in India we follow the common Law doctrine, which makes water a

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6 India 2000, Ministry of Information and Broadcasting, Government of India, 2000.

7 M.G Chandrakanth et al., *Is there is Groundwater use? – Resource economies Study In a hard Rock Area of Karnataka* 1-2. (Bangalore: University of Agricultural Sciences, 1998).

chattel to land. The Indian Easement Act of 1882, the Transfer of property Act and the Tenancy laws follow the same rule. The lacunae in the common law Doctrine is that the dejure rights are not clearly defined. This makes water a sole property of the creamy sections of the Society. In spite of this being a clear equity issue, this cannot be challenged as this receives the legal sanction.

This dissertation seeks to explore and analyze the critical relationship between groundwater which is becoming an increasingly scarce commodity and the prevailing legal regime whose philosophy and contours were determined at a point of time when ground water was available in plenty and when scientific and technical data available could not shed much light upon the quantity, location and other vital characteristics of ground water because of its very locational specificities.

Today it is increasingly clear that many life-giving activities are increasingly dependent upon ground water. Undoubtedly the miraculous increase in the food production has been accelerated by the ability to exploit ground water through the technology of tube wells. Naturally this advantage has accrued more to the benefit of the rich farmers. The poorer farmers and the small cultivators historically dependent upon open wells for their agricultural as well as human needs. With the increase in the exploitation of the groundwater through tube wells a unique problem, which now described in the relevant literature as well interference problems has come into being. This is a state of affairs in which the yield of an open well decreases substantially or even dries up. Consequently a far-reaching issue of equity arises. Ground water, which is

considered to be common property resource by well, acclaimed in reality dissents into a private property resource of those who can afford it. While generally speaking one may respect the right to private property ownership especially in the new market economy. Here is a form of ownership which deprives a less privileged neighbor of the very right to existence.

The legal regime obtaining now came into existence through colonial legislation. The doctrine based the birthmark of the common law philosophy. It took shape during an earlier era when scientific knowledge was not advanced enough. Naturally during those days ground water was considered to be a resource, which flows in the undefined channel and therefore its regulation was considered to be impracticable at the same time the law differentiated the defined channel and enabled the legal regime to intervene.

This researcher seeks to enquire into the ethical validity and sufficiency of the old legal regime. Constitutional values clearly lay down that equity consideration must prevail in all matters concerning the common resources. Moreover there is enough scientific and technological know how including advanced satellite imagery which throw sufficient light on underground water resources. IN other words science and technology has converted the "undefined channel" into definable water bodies. It is in this changed context that a more meaningful search for an alternative legal regime needs to be carried out. Each legal regime is influenced by its own underlined philosophy. These philosophies are often known as doctrines in the area of water

resources. There are doctrines like the Riparian Doctrine, The Equitable Apportionment Doctrine, The Public Trust Doctrine and the Common Law Doctrine. They are examined in great detail in chapter IV. After critical evaluation of this doctrine the author subscribes to the view that the public trust doctrine which in harmony with the constitutional mandate. Interestingly the National Water Policy statement of the government of India 1987 subscribes to the same philosophy in its essence. Unfortunately the legal regime lacks far behind the policy statement. This author subscribes to the policy statement and therefore considers legal regime as outdated, unjust, inequitable, unsustainable and out of tune with the basic needs of the vast majority of the human beings there is a strong case for law reform. Some bills have made halfhearted attempt in this direction. They are also examined and the views of the author were made known. Unfortunately this dissertation has not been able to propose an alternative statutory framework. That task will be undertaken at a future date.

REVIEW OF LITERATURE:

Literature pertaining to the History of open wells construction and the use of Ground water in India for irrigation goes back to the early days of the Vedas (300-800 B.C). In the said literature it is mentioned that there was fairly extensive use of open wells in the agricultural sector. Similarly it is said that localized use of groundwater through open wells continued during medieval periods particularly in areas where other means of surface water supplies were not possible. Towards the end of the nineteenth century, open wells formed an

important source of irrigation and accounted for nearly 30 per cent of the total irrigation in the country.[8]

The Ministry of Information and Broadcasting, Government of India, in their report on India 2,000 say that out of 4,272 blocks in the country (except Andhra Prudish, Gujarat, and Maharastra where ground water resources assessment has been carried out on the basis of Mandals, Taluks, and Water Sheds), 231 blocks have been categorized as 'over exploited', i.e. the stage of ground water development exceeds the annual replenishable recharge and 107 blocks are "dark".[9]

At present, in the state of Karnataka Irrigation wells are increasing at an alarming rate in some parts of hard rock areas due to which there is well interference problem.[10] This has made the state and the concerned Department of Mines and Geology to declare the taluks as Dark, Grey and White depending upon the volume of extraction of ground water.[11] It is to be noted that failure of wells is not a phenomenon, which happens at one stretch, but it may take a month or years. Some times wells may dry due to poor rains coupled with poor recharge and some of these wells if they receive good rainfall may get recharged automatically. However there are other instances where the wells go

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8 T.S. Raju, *Emerging problems options and strategies in the development and management of Ground Water resources in India*, 2 (Bangalore: University of agriculture sciences, 1994).

9 Supra note 6, at 437.

10 N. Nagaraj, et al. "Ground water Institutions in US and India", 134 (26) *Economic and Political Weekly* (1999).

11 A taluk is declared as 'dark' if the volume of extraction is more than 85 per cent of recharge, if the volume of extraction is between 65 and 85 per cent of recharge, it is called as 'grey' area and 'white' if the volume of extraction is below 65 per cent of recharge.

dry due to cumulative interference. The author has focused into this type of well interference problems.[12]

The following table gives, a Birds Eye View of increase of wells in Karnataka.

DISTRICT-WISE IRRIGATION WELL STATISTICS OF KARNATAKA

Sl. No.	District	No. of wells as on 31.12.70	No. of wells as on 30.6.73	No. Of Wells as on 31.6.82 **Total**	No. Of Wells as on 31.6.87 **Total**	No. of Wells as on 31.6.94 **Total**
1	**2**	**3**	**4**	**5**	**6**	**7**
1	Bangalore	26921	35500	41441	45796	43791
2	Belgaum	36034	46943	53780	58541	72425
3	Bellary	6344	6198	10972	11161	16856
4	Bidar	8360	11571	22733	16586	20255
5	Bijapur	28323	38312	33201	44422	65944
6	Chickmagalur	1619	1800	3057	3245	7429
7	Chitradurga	11124	15532	22528	18420	29648
8	Coorg	76	100	304	423	303
9	Dakshina Kannada	25651	45539	63734	39260	62073
10	Dharwad	7492	10369	13065	15229	23127
11	Gulbarga	17519	13852	19408	20223	22052
12	Hassan	1298	1816	2952	4790	14720
13	Kolar	38625	50916	59489	52464	54558
14	Mandya	4208	5680	9391	8063	10894
15	Mysore	7671	8792	15390	15520	22072
16	Raichur	6896	11946	11835	16336	26082
17	Shimoga	1766	3534	4967	6536	13788
18	Tumkur	26558	34417	43821	47222	61886
19	Uttar Kannada	5310	5379	21789	13190	8779
	Total	255687	348196	453857	437427	576682

Source: *Bureau of Economics Statistics*
Census conducted by Department of Mines and Geology
Minor Irrigation Department
Revenue Department.

[12] Well Interference for the purpose of this research has been defined as (1) wee that dries up because of new well so coming in (but not because of decline in rainfall); (2) well that loses a large of its yield because of new well(s) coming in (but not because of decline in rainfall).

The review of literature shoed that in India, the Ground water development is mostly by private Individuals. So far no ground water discipline was followed which resulted in haphazard development leading to drastic decline of water table beyond replenishable limit in certain areas and seawater intrusion along certain coastal tracts. Well interference problem poses a grave threat to the sustainability and equity in well irrigation. A farmer who can afford to go deeper can seriously threaten the irrigation prospects of his neighboring farmer. The action of the former farmer can create instances where the latter farmer may have to move in to the other sectors. In spite of this being a clear equity issue, this cannot be challenged as it has received the legal sanction from our Indian laws.

This is due to the ambivalence in the policies and the outdated law, which govern the Ground water management. We have policies like subsidized power subsidized minor irrigation loans on the one hand which encourage overexploitation of ground water and we have Programmers, which indirectly promote recharge of ground water like the water shed development programmes

In India, the law governing ground water management is based on the Indian Easement Act 1882 and the tenancy laws. This act is based on the common Law doctrine, which makes water a chattel to the land.

The common law right of every individual owner to exclusively appropriate for his use is statutorily recognized in the Indian Easement Act of

1882.[13] According to this doctrine, every landowner through whose land the water is percolating has an absolute right in the same. He can extract as much percolating water as he likes. His neighbor has similar right so much so that he can by extracting percolating ground water leave the other man's well dry. However, in the case of ground water running in defined and known channel the doctrine of riparian right applies. As it is very difficult to assess the ground water running in defined and known channel the doctrine of riparian right is very rarely used.

Even those who have access to land to not have de facto the exclusive right to water under their land.

The Karnataka land reforms act of 1961 also indirectly promoted the ground water irrigation, since ceiling limits for land irrigated by ground water are not mentioned. The land irrigated by the ground water is considered as the dry lands and the only lands receiving surface water irrigation from government sources are considered as irrigated lands.[14] This has indirectly pushed for large conversion for dry land to irrigated lands.

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[13] Illustration (g) to Section 7 of the Indian Easement Act of 1882 says, "The right of every owner of land to collect and dispose within his own limits of all water under the land which does not pass in a defined channel...." The Terms "collect and dispose cannotes that a person by extracting percolating ground water may even drain of water of his neighbour to such an extent that he may leave that person without any percolating water though the latter was the prior user of such water.

[14] Section 66 (1) (a) Every person who on the date of commencement of the Amendment Act holds (I) ten acres or more of lands having facilities for irrigation from a source of water belonging to the State Government should furnish a declaration of holding.

The above literature review indicates that while there is a lot of interesting matter regarding ground water usage and the consequent crisis arising there from, nobody has as yet, linked up the relationship between aggravating conditions of ground water availability and the lacunae in the present legal regime.

The Author therefore tries through this dissertation to demonstrate how the existing legal regime accentuates the crisis. A further step is taken in this dissertation to explore the theoretical basis on which the existing regime rests, and to suggest a more appropriate theoretical basis in keeping with values enshrined in our constitution so that the existing statutes and case laws therein can be replaced by a alternate legal regime which ensures equality for all.

RESEARCH PROBLEM AND RESEARCH QUESTIONS:

The purpose of his research is in order to address the questions of equity among citizens of India with different holdings. Undoubtedly, the contribution of Groundwater to the Indian agriculture has been immense during the last few decades but[15] the exploitation of groundwater in India is largely in the hands of the private individuals who are undeterred by the ambiguity in property rights in ground water extraction. The introduction of the short duration high yielding crops along with intensive application of fertilizers, pesticides and mechanization-enabled farmers to adopt multiple cropping practices that

15 Supra note 5, at A-7.

increased cropping and irrigation intensity substantially. Together with inappropriate state policies pricing of electricity at subsidized rates for irrigation pumping, market forces and subsidized credit programmes for well development by farmers has made them to intensify well irrigation and convert vast tract of dry land areas to water intensive commercial crops. This provides prima facie case for increasing well failures due to causes inter alia absence of legal regime to combat over exploitation, unchecked increase in concentration of wells, increasing volumes of ground water extraction to support the high water intensive crops. Hence it is imperative to have a better management in ground water development, which will lead to sustainable development and equitable distribution. There is no doubt that we need a far more efficient system of managing our ground water resources without which there can be neither sustainable development nor equitable access to ground water. In order to address this crisis, the following Research questions have been taken up in this dissertation.

1) Whether the well interference problem is aggravated by the inadequacies of the existing legal regime?

2) Why there exists the problem of inequality among the people to access water? Is it because there in not enough water to sustain people or is there something, which stops them from having equitable access to water?

3) Do we need a change in the policy, which will ensure equitable access to water?

HYPOTHESIS

A more appropriate legal regime has the potential to reduce the inequality of access to Ground water, which exist in the present time.

RESEARCH METHODOLOGY:

The Research Design developed for this study is as follows:

Stage one: At this stage, the researcher will critically analyze the basis on which the existing Laws are based. More specifically it is the Indian Easement act of 1882 which will be examined. A brief analysis of Transfer of Property Act, the tenancy laws as well as the Bills on ground water will be undertaken.

Stage two: This stage will focus on a study Carried out by the Department of Agricultural Economics, UAS, Bangalore, regarding the problem of well interference. It is based upon a secondary source. The researcher at this stage will try to examine, whether there is a link between the data, which has been collected from the field and the lacunae in the law. The said exercise helps the researcher to assess from an empirical point of view the consequences of the existing legal regime and the practical ways in which equity in the agrarian front is emerging. The search for an alternative is attempted against such a background.

Data Collection

The dissertation will be based on both primary as well as secondary sources.

Primary sources:

The Primary data will be collected from the government officials; NGO's working on the subject, and Relevant Laws.

Secondary sources: Secondary sources will comprise of:

(1) Bills on Ground water;

(2) Paper cuttings;

(3) Books on the subject;

(4) District Gazetteers;

(5) Government records and reports.

Objectives and significance of the study:

The Well interference problem poses grave threat to the sustainability and equality issue in well irrigation. A large well to-do farmer who can afford to dig one or more irrigation wells can seriously threaten the irrigation prospects of his next neighboring farmer who may be irrigating with one or more wells. This may compel the resource poor farmer to shift his or her irrigation's operations, which becomes a clear equity issue. Management of ground water thus assumes paramount importance related to issues of inequity.

The overall objective of the study will be to study will be to inquire into the negative externality created by the Well interference problem. The research will also examine the impact of existing regime and analyze the theoretical and jurisprudential basis on which the said regime sustains itself. The objective of the study therefore is to critically look into the consequences of the prevailing legal regime and to search for an alternative jurisprudential framework in order to conserve depleting ground water resources as well as ensure equity in access to all citizens.

CHAPTER I

THE FACTORS SHAPING THE DEMAND AND SUPPLY OF GROUND WATER

Ground water resource- Status:

Ground water is one of the most important resources. It exists wherever water penetrates beneath the surface. The term ground water is usually reserved for the sub- surface water that occurs beneath the water table in soils and geological formations that are fully saturated. The ground water becomes a usable resource when the rocks in the zone of saturation are perennial.[16]

Scientifically speaking, the earth sciences, include geology, hydrology, meteorology and oceanography are concerned with earth's water. Ground water hydrology is regarded as specialized science, which involves geology[17] and hydrology[18].

The main source of Groundwater on this earth is rainfall, a portion of it is penetrated beneath the surface, a portion is evaporated into the atmosphere

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16 Gautam Mahajan, *Evaluation and Development of Ground Water* 1 (New Delhi: Ashish publishing house, 1989).

17 Geology governs the occurrence and movement of subterranean water.

18 The name Hydrology deals with the behaviour of water as it occurs in the atmosphere, on the surface of ground and underground. It deals with various forms of moisture that cause the transformation among the liquid, soil and gaseous states in the atmosphere and the surface layers and land masses. It is also concerned with the sea. Hydrology provides the basic data on the four phases of interest to the hydrologist are namely: Precipitation; run off and river flow off, evaporation, and transpiration, percolation. For further detail *See* www. Everythigaboutwater.com.

and some of it runs off. A portion, which is penetrated into the Earth, is called the Ground water. So ground water is that portion of water beneath the surface of earth that can be collected with wells, tunnels, or drainage galleries or that which flows naturally to the Earth's surface.[19]

The rainwater that percolates through the rocks cannot go down to very great depths. Usually there is limit to the downward percolation of water. In most cases, the pervious rocks of the surface are underlain by impervious strata, which check the downward percolation. Besides the pressure of rocks above, closes the pores open after a depth of a few hundreds meters and therefore, underground water is found up to that depth only. The depth of ground water may range from 1 meter to or less to 1000 meter or more. Ground water accounts for major portion of the worlds fresh water resources. Estimate of the global water supply shows that ground water represents about 0.6 percent of the worlds total water. Next to glaciers and icecaps ground water reservoirs are the largest holding basin for fresh water in the worlds hydrologic cycle.[20]

AQUIFERS:

The amount of water to be soaked by the earth depends upon the nature if rock or sediments. On the basis of the relation that rocks or sediments bear to

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19 Ibid at 14.
20 Supra note 1, at 14.

the percolation of water, these may be divided into two categories-pervious rocks that allow water to pass through them and impervious rocks that do not allow water to pass through them. The pervious structure has no connection with porous nature of rock. Many rocks, that are massive and crystalline, have so many joints that they become pervious. For the purposes of water ground water, the rocks or sediments that can hold, transit and yield water are called Aquifers and the accumulation of ground water in a particular region will depend upon the presence of water in a particular region will depend upon the presence of aquifers.[21]

The most common aquifer materials are unconsolidated sands and gravels, which occur in alluvial valleys, old stream be covered by fine deposits (buried valleys), coastal plains, dunes and glacier deposits. Sand stone are good aquifers materials. Cavernous limestone with solution channels, caves, underground streams can also be high yielding aquifers. Other sedimentary rocks like shale, solid limestone, etc generally do not make good aquifers. Small yield may be possible where these rocks are highly fractured. Some is true for Granite, Gneiss and other crystalline rocks. Basalts, lavas and other materials of volcanic origin can make excellent aquifers if they are sufficient porous.

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[21] Ibid at 21.

KINDS OF AQUIFERS:

There are four types of aquifers based on the permeability of the covering layers.

(a) Unconfined Aquifer

(b) Confined Aquifer

(c) Semi-confined Aquifer

(d) Semi-unconfined Aquifer.

An unconfined aquifer is one in which the water table serves as the upper surface of saturation. It is also known as free phreatic or non-artesian aquifer. There is no clay or other restricting material at the top of ground water, so the ground water levels are free to rise or fall. Unconfined aquifers are commonly found in alluvium valleys, coastal plains, dunes and glacial deposits. They may range in thickness from a few meters or less to hundreds of meters or more.

Confined aquifer is a layer of water bearing material that is sandwiched between two layers of much less pervious like a sandy layer between two clay layers or sand stone between layers of shale or solid limestone.

If the confining layers are essentially impermeable, they are called Aquicludes. If they are sufficiently permeable to transmit water vertically to or from confined aquifer, but not permeable enough to laterally transport water like

an aquifer, they are called aquitards. An aquifer bound by one or two aquitards is called semi-confined aquifer.

GROUND WATER AND ITS OCCURRENCE IN INDIA:

It is well known that occurrence and storage of ground water is governed by three important factors namely geology, topography and climate in the form of precipitation. Apart from the geology, there is wide variation in topographic setting and in quantum and duration of rainfall (not only from season to season but also from region to region), which constitutes the principal recharge of ground water. It may be pertinent to mention that nearly 40%of the Country falls in arid –semi arid tract with an annual rainfall of 500-100mm. These are vulnerable to drought. Approximately two third of the country is underlain by the fissure formations, popularly known as hard rocks and characterized by secondary porosity and permeability.[22]

The Ground water occurs almost universally; however, not always in extractable quantities. Its occurrence at any place on earth is not a matter of chance but a consequence of the interaction of climatic, geologic, hydrologic, physiographic and ecological factors. In India the ground water occurs mainly in three types of geological formations:

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[22] N Kittu, Status of ground water development and its Impact on Ground water quality 1 (Workshop held at Ahemedabad on ground water 1994)

(1) Unconsolidated:

This covers about 30 percent of land area, primarily, the Indo Gangetic plain. The lithology comprises sands, gravels, pebbles, etc, which can store large quantities of groundwater.

(2) Semi-consolidated:

This covers only about 5 percent of the geographic area. This lithology includes primarily semi-consolidated sand stone, formations of Mesozoic and tertiary age and,

(3) Consolidated:

This constitutes 65 percent of the geographical area comprising hard-rock formations. These include crystalline rocks- granites, gneisses, Schists, etc, basaltic rocks and compact sedimentary formations like cuddapahs, etc.

Ground water[23] and surface water contribute equally to the 44% of the gross area irrigated in India. Ground water, the most widely distributed and replenish able water resources of the country. Recent estimates show that 45.22 Mham per annum is the total replenishable ground water resource. Ground Water extraction is largely a private investment by farmers who are undeterred by the

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[23] M.G Chandrakanth et al.. *Interplay of markets, Externalities and Institutions* 3 (New Delhi: Ford Foundation, 1997).

ambiguity in property rights in ground water extraction. In areas where Surface Water for irrigation cannot be provided due to the distance and topography characteristics, private investment in Ground Water investment extraction is the common practice.

In the arid Zones of the Earth, Ground Water is primary Source of supply to the people. Thus in Saudi Arabia a 100% of the water used is from underground sources; in Israel the percentage of the use of underground water is 70% and in morocco and Tunisia the figures respectively are seventy-five and ninety five percent. In spite of these advantages of ground water, national laws of the different countries did not control the use of Ground Water until two decades back or so. The reasons were several:

First, the ground water was mainly used for domestic purposes, which did not have an impact on its supply.

Second, due to the lack of scientific knowledge, it was considered to be secret and uncontrollable.

Third, the relationship of groundwater with the surface water was not known. Fourth, the surface water was considered sufficient by and large to supply men's needs, which were limited.[24]

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[24] S.N Jain, "Legal aspects of Ground Water management", 23 *Journal of Indian Law Institute* 181 (1981).

However, over the years, we have witnessed a sea change in the exploitation of Ground water. This can be clearly understood by examining the economics of ground water, which depends upon the demand and supply. Let us throw some light on the Factors contributing to the demand for Ground Water:

(1) Growth in Industrialization and urbanization:

India has a varied hydrological setting. The utilization of Ground Water in the country is 45.34 million ha meter per year. The present ground water use is not uniform throughout India. While the advancement of modern civilization has created greater needs for using more and more water in the intensive and extensive cultivation, hectic industrial production and increased domestic urban and commercial activities, it has also catered new techniques of effectively abstracting Ground Water from a deeper level and in a very huge quantity. In addition to the dug wells, bore wells are drilled in umpteen numbers and centrifugal pumps are used to abstract ground water quickly and in greater quantity. Easiness to drill bore wells in a fast manner, ability to extract water from deeper levels, no hazels of constant maintenance to keep the sides from collapsing have a made a big rush for bore wells. As a result the stress on the Ground Water has been very drastic in the present century after making exhaustive use of consumable surface water.[25]

[25] B.B.Radhakrishna et al, Ground water development in hard rocks of Karnataka State, India Monograph No.150 11-12 (Bangalore: Department of mines and geology, Government of Karnataka).

Our model of development, which relies so heavily on Industrialization, naturally attracts migration from rural areas into the urban areas and as a result there is exponential growth in urban centers of India. Naturally this generates unnatural pressure on civic amenities out of which water is in great demand. Efforts by public authorities to harness enough water to have proved to be extremely daunting and it are urban rich who extract underground water resources in order to tied over the accentuating crisis.

(2) Green Revolution:

The coming of the Green Revolution witnessed the augmentation of agricultural growth and productivity substantially in some parts of India particularly in the cultivation of wheat (in north India) and paddy (also in cauvery basin) Green Revolution thrived better on the well irrigated lands and surface irrigated lands due to the flexibility it offered in terms of farm management. The well to do farmers raced to well irrigation throughout India. In addition, the advantages of ground water use in terms of quality and volume have encouraged farmers to extract more area under cultivation of water intensive crops coupled with financial assistance provided by the Banks. This is in turn lead to tremendous interference in ground water extraction by many ground water users contributing to the scarcity of ground water.

No doubt, the Green Revolution indeed helped in raising the productivity of food grains, but if one looks at the other end of the story there is more harm

than good has been done. The Green Revolution not only catered to only a particular section of the society[26]but it also acted as one of the factor for the present water crisis in India.

Both in Karnataka and in Tamilnadu there has previously been a tradition of maintaining and desilting canals and tanks by communal labor. This institution has now largely broken down in both states. The Green revolution has entailed a more individualistic approach to agriculture and brought about a greater differentiation among the farmers. The proliferation of bore wells has in particular reduced the interest of well to do farmers in the collective maintenance of canals and tanks and thus contributed to the breakdown of the old institution.[27]

Thus the development of science and technology has accelerated the demand for extraction of ground water resources. In this sense the needs of modern times are being met by modern innovations but unfortunately the legal regime of the past unaltered.

(3) Growth in population:

India's population is doubling in increasingly shorter time. It rose from 238 million in 1901 to 439 million in 1961 and again doubled in only 30 years to

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[26] For further details on this please see articles by Satya Paul, "Green revolution and poverty among the farm families in Haryana, 1969/70-1982/83", 25(39) Economic and Political Weekly (1990). And Biplab Dasgupta, "India's Green Revolution", 12(6-8) *Economic and Political Weekly* (1977).

[27] Steen Folke, "Conflicts over water and land in south Indian agriculture and political economy", 33(7) *Economic and Political Weekly* 348 (1998).

846 million in 1991. The figure is expected to touch 1533 million by 2025, by which time India will overtake China to earn the dubious distinction of being the most populous country.[28]

Phenomenal explosion in population has resulted in greater usage in various natural resources. Water is one such resource, which is not able to cope up with man's needs due to unproportionate population explosion. As a result, man has started exploiting the ground water resources unscruloupsly, thus accentuating the crisis.

(4) Water Extraction mechanisms:

While the advancement of modern civilization has created a greater demand for this resource, it has also created new technologies for effectively abstracting ground water from deeper and deeper levels[29]. This has lead to the

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[28] Nirmala George, "4 States Fuel India's Population boom", *The New Indian Express*, May 11, 2000 at 1.

[29] When the amount of ground water actually tapped and used by a community is a very small proportion of the potential available to it, the real value of water itself is close to zero at the margin and a higher than an average rate of use by some members of the community is not perceived as an infringement of others rights. This was the situation which prevailed in India until the beginning of wide spread adoption of modern extraction technologies in the 1960's. Under traditional technology, the value of water was close to zero at the margin because traditional lifts such as charas, mhot, rant or Persian wheel using animal and human energy, could only produce very small quantities of water per unit of time. This period also witnessed simultaneously the emergence of green revolution technology in farming and the tube well technology in water extraction during the 1960's. This produced several drastic changes such as -

(A) Since water had very high marginal productivity when used in conjunction with High Yielding Varieties and chemical fertilizers, the use of irrigation in augmenting labor and land productivity became wide spread.

(B) The use of diesel and electric motive power increased the water extraction capacity of individual pampers manifoldly.

(C) The new water extraction technology reduced the human and animal labor cost but increased the cash cost (of diesel and power) of water extraction

(D) It increased the gap between the resource poor and resource rich farmers since the latter could make the large and chunky investments in modern Water Extraction mechanisms far more easily

crucial problem of over exploitation of Aquifers, leading to the depletion of Ground Water and the impairment of Water quantity due to Chemicalisation of agriculture and allied activities. This could be a grave threat to the sustainability of ground water resource.

Thus, till the advancement of technology there seemed to be little competition for water. Things changed with the advancement of technology, a shift happened where in water was regarded as a commodity. It no longer remained as a common property. Modern technology accentuated the inequality of access to water especially among the farmers because the well to do farmers could go in for better water extraction mechanisms.

(5) Water markets:

Water markets[30] are informal institutions, which provide costly access to the small and marginal farmers who cannot afford to invest on privately owned irrigation facilities. Poor well yield and increased probability of well failure had led to different coping mechanisms, purchasing of water is one such measure. These water markets are the exclusive property of rich farmers .No one in India has yet challenged this iniquitous form of existing "legality".

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than the former. For further details *See* Tushaar Shah "Externality and Equity Implications of private Exploitation of Ground Water Resources," 28 *Agricultural Systems* 125 (1988).

30 For further details *See* Tushaar Shah, *Ground Water markets and irrigation development: political and practical policy* (Bombay: Oxford University Press, 1997).

The entrenched view of groundwater as a private resource has lead to the wide spread development of Groundwater markets. Take the inhabitants of titlagarh in rocky Bolangir District in the state of Orissa. The Mercury is 46 degrees Celsius and climbing, and there is no sign of rain clouds. Taps tanks and wells –everything is bone- dry and Titlagarh has earned itself a new name Tatalagarh –tatala meaning, "sizzling hot" in Oriya. At Berhampur, people buy locally made sachets of water for Rs 3.[31]

In rural Gujarat, for example, well owners commonly sell water to others in the command area. Individuals with access to water via their ownership of a well or location in proximity to surface sources, frequently sell water to others in need of it. Most of the agricultural ground water markets consist of local exchange mechanisms rather than long distance transfers.

The rapid growth of urban areas with poor municipal services has created markets for drinking water even in relatively water rich regions. In Tamil Nadu, Ground water in areas adjacent to Chennai is pumped and sold in the city. Those living in semi-urban areas that own wells or other water resources frequently supply these markets. The issue of their right to sell the water they have access to be rarely questioned in the day to day transaction involved in meeting local needs. Water markets virtually exist in India without its legality being questioned.[32]

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31 Ruben Banerjee, "Sizzler of a State", *The India Today*, May 8, 2000 at 52.

32 Marcus Moench, "Allocating the common Heritage: Debates over Water Rights and Governance Structures in India", *Economic and Political Weekly*, A-48 June 27, (1998).

(6) Priority of use:

In India, those who own land have access to subterranean water as water is attached as chattel to land. Hence all the landless and downtrodden people are left out of this privilege and also the people who can afford to have better infrastructure can withdraw as much of water without even bothering to make good the loss. This is possible because there exists a notion called priority of use.

The invisible and open access nature of ground water resources also contributes to the potential for over exploitation. In the case of other natural resources, take for example forest, it is easy to establish ownership rights, document who is using the resource and how much they are extracting. Whereas in the case of ground Water, resource ownership, availability, the relationship between actions and consequences are difficult to identify and document.

(7) Policy Intervention:

It is widely recognized that the state has played a vital role in the introduction of modern water lifts in Indian agriculture. Though all the open wells equipped with the power pumps are mostly private owned, the state has provided a tremendous boost to their growth through massive programmes of rural electrification and provisions of liberal capital finance through institutional

sources. Ground Water development is subsidized through the NABARD, which provides refinancing facilities to other banks to support loans for electricity, which is priced at subsidized rates for irrigation purposes.

Exponential increase in the demand for ground water is due to technological factors, soft loans for ground water extraction, zero priced electrical power to lift ground water, remunerative relative price ratio in favor of water intensive commercial and horticultural crops.

There exists tremendous amount of policy ambiguity by virtue of the fact that on the one hand we see that the State has indirectly acted as cause for the over draft of ground water and at the other hand it is taking steps through regulations to combat the overexploitation.[33]

(8) Crop pattern:

Crop pattern includes the growing of water intensive food/ cash crops, which needs a very high rate of water supply, and the shift to this has created over exploitation of ground water. The proximity to metropolitan centers also creates a demand for diverse horticultural produces like vegetables and fruits. This shift has happened ever since we adopted the New Economic Policy, which pushes for Market driven modern Agriculture. This market driven modern agriculture generates the need for use of more water.

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[33] Gujurat was the first state to pass the Law on Ground water. Tamil Nadu and Karnataka have a bill, which is yet to be implemented.

It is in the field of agriculture that the impact of the new Economic Policy is most visible. Among the major industries receiving boost in our export oriented growth are agro based industries and food processing units. There is a noticeable shift from rain fed food crops to irrigated cash crops, which are water intensive. While a hectare of jowar uses only 21 cubic meters of water, one hectare of sugarcane uses 300cubic meters of water[34].

To illustrate the above shift from rain fed food crops to cash crops in Maharashtra, sugarcane occupies about 4-5 percent of the cultivated land but consumes about 70 percent of the state controlled water supplies through canal and lift irrigation schemes. This has resulted in Stalinization of [35]soils of large areas reducing their productivity. About 2000wells[36] in Tasgaon Taluk area are reported to have dried up and also water was denied to some 23,000 villages as a result of ground water exploitation to provide water to sugarcane industries in Maharashtra.

While on the one hand, most surface water resources are drying up and the villagers without irrigation facilities are forced to grow only one rain fed crop, on the other hand one finds that the agri business of water -intensive crops is flourishing. The official approach seems to be to encouraging uncontrolled

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[34] Vandana Shiva, *Ecology And Politics of Survival* 186-87 (New Delhi: Sage publications, 1991).

[35] D.N Dhanagare, "Drought in Maharashtra; Misplaced priorities, mismanagement of water resources", 27(27) *Economic and political weekly* 142-25 (1992).

[36] Meinzen-Dick et al., "Alternative water allocation Mechanisms; Indian and International experiences",31(13) *Economic and political weekly* A-29(1996).

exploitation of ground water by those who can afford to do so, since the promotion of exports at any costs is one of the main objective of the New Economic Policy. Dependence on Ground water has risen sharply as surface water source are lost-today eighty five percent of rural India's drinking water source is Ground water.[37]

Factors, which contribute to the supply of ground water:

Tanks:

India's water policy has always given higher priority to large dams and canals than to indigenous low costs tanks and minor irrigation projects. Tanks now account for only 10 percent of the gross irrigated area largely in the southern states and unfortunately even in southern states this ancient form of water harvesting is being grossly neglected in recent times. It is estimated that if tanks are built over 3 percent of India's land area, they can store about one-fourth of the rainfall the country receives.[38] Tanks are thus a rich source not only for recharging the ground water but also generating silts, which are extremely useful to the farmer in his agricultural farmer in his agricultural operations.[39]

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37 Samar Halarnkar, "The Drying of India", *India Today*, June (16-22) 1998, at 62-68.

38 State of India's Environment, 1984-85, Citizens Report, (Centre for Science and Environment, New Delhi, 1995)

39 The decline of tank irrigation in the decades following the 1950's was caused by the continuation of a policy, which had its origin in the very early phase of the British rule in India. It was policy based on the need to propagate an impression that smaller irrigation works were uneconomical and an unnecessary burden on the revenue officials. This impression arose out of a long neglect of the

Rainfall and surface water bodies:

Rainfall is considered as the natural re charger of ground water. Surface water bodies includes ponds, rivers, lakes and it is to be noted that in these places the ground water gets naturally recharged.

Recharge Efforts:

The recharge efforts are made by the State to augment the availability of ground water. Some of the artificial recharge methods used in recharging ground water are Gully plugging, Khadin, water spreading, water harvesting dams, anicut.

We have thus seen above the demand and supply factors of ground water. The property rights to ground water are however, dynamic and change with supply and demand factors. A farmer who may be a early comer using manual lifts to lift water from the dug well thinking that he is enjoying private property rights may be completely shattered, when another farmer with better financial access may go in for bore well which in turn resulting in permanent failure to the dug well. Here we encompass a situation where in de-jure and defacto the earlier farmer had a right to access groundwater but defacto the

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ancient, locally maintained tank irrigation system of south India because of changes in the tenurial system towards Ryotwari or zamindari. The notion that small tanks were unremunerative and their maintenance an unnecessary burden on the state remained alive and got further strengthened in the post independence period. The thrust was set on ambitious major multi purpose river valley projects. Minor Irrigation, especially in dry regions, got neglected .In fact, irreversible damage was done to minor works by assigning some of the tank beds the private individuals for cultivation under the grow more food campaign.

latter farmer with a better financial background is enjoying the resource and thus paving way to iniquitous access to this precious resource. In addition to the already existing inequity, the distribution of landholding further exaceberates the predicament of the farmers as their access to this resource is often conditioned by their size of the land holding, savings, investments made etc. Thus, the right to ground water is available only to the rich landlords. They are in fact considered as the water lords of our country. This situation has made ground water a common property resource[40] Water which was once considered to be a free good available to all, is becoming the scarce resource available only to the creamy sections of the society.

Amartya Sen in his book, talks about the forms of relief given during the famines. He says " the traditional form of relief has, of course, been that of providing free food in relief camps and distribution centers. There can be no doubt that relief in this form has saved lives in large scale in various famines around the world. But to understand precisely what free food distribution does, it

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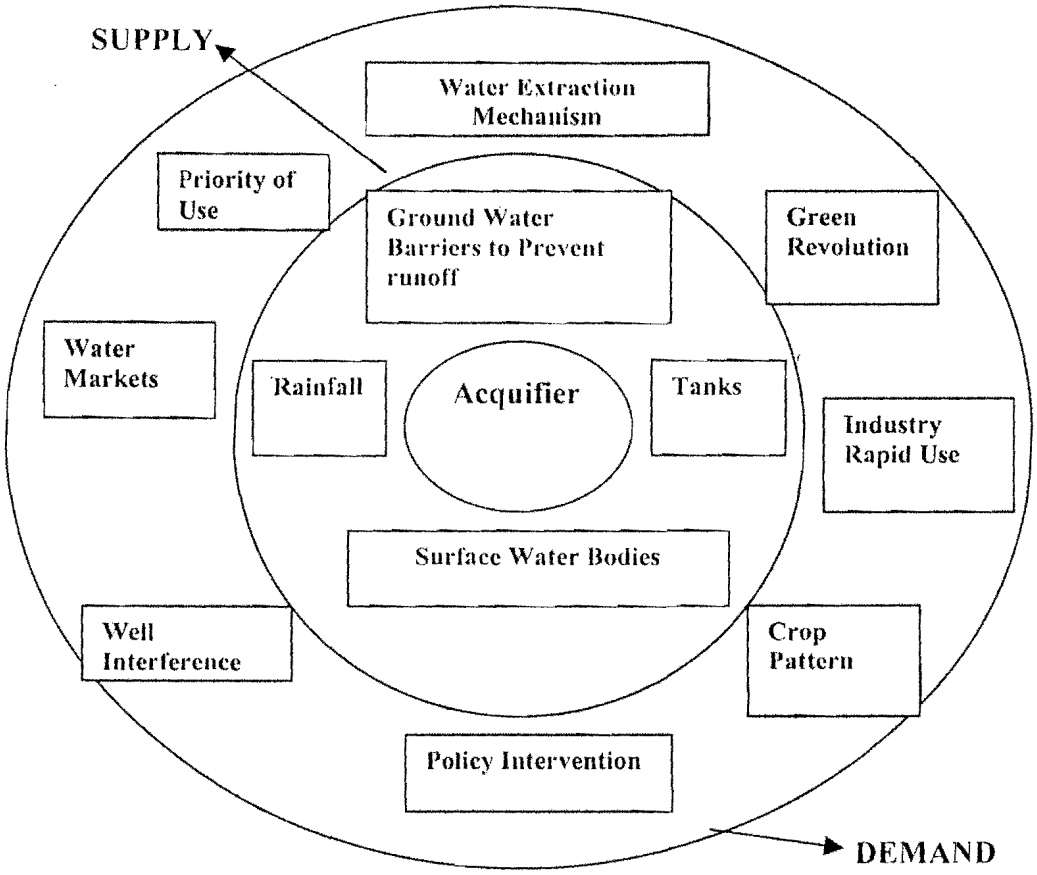
[40] Common Ground water, like common grazing Land Sea, river and lake, is a potentially productive resource with an open public access. In the year 1980 it was estimate in Asia that more than 50 million farmers, with only one hectare or less if land lived in farms with undeveloped fresh water within two meters of the surface. However at the other extreme, there us a growing realisation that there are now a number of areas where overexploitation is likely or has already resulted in either falling water tables or saline water intrusion into fresh water aquifers, or both. Open access to exploitable communal resources without any control eventually leads to losses for all involved, whether it is in the form of less or more costly irrigation an rinking water from underground. It is very pertinent here that this resource requires some kin f control be that may be private control or public control. The more profitable the exploitation to private exploiters the more urgent is the need for effective control. Open access nature to ground water has lead to severe problems in India, some of which are over exploitation of ground water, saline water intrusion, exclusion of the land less people, even with those with land need capital investment to obtain access. Supra note 3, at 9.


SUPPLY
Water Extraction Mechanism
Priority of Use
Ground Water Barriers to Prevent runoff
Green Revolution
Water Markets
Rainfall
Acquifier
Tanks
Industry Rapid Use
Surface Water Bodies
Well Interference
Crop Pattern
Policy Intervention
DEMAND

may be useful to distinguish between two different aspects of the act of providing, which are both involved in the food relief operation. One is to give the destitute the ability to command food, and the other is to give him this ability in the actual form of food itself. When we relate this to the water crisis, we know that we are not giving people the ability to command water instead during the crisis we take short term measures. Unless we give the people, the ability to command water, the landlords will continue to be the water lords of the country.

CHAPTER II

MANIFESTATION OF GROUND WATER CRISIS IN STATE OF KARNATAKA.

Karnataka has a geographical area of 1,92,000 Square Kilometers. It has a cultivable area of 1,03,810 Square Kilometers, (54%) forest area of about 30,755 Square Kilometers Kilometers, land not available for cultivation is 20,306 Square Kilometers, cultivable waste, pastures and groves is about 18,184 Square Kilometers, and fallow land is about 17,056 Square kilometers. Out of the total cultivable area, area under irrigation is about 24,000 Square Kilometers, (23%) and area under well irrigation is about 10-12,000 Square Kilometers, (50%).[41]

The occurrence and distribution of rainfall in the state is highly erratic. The annual normal rainfall is 1138mm received over 55 rainy days. It varies from as low as 569 mm in the east to as high as 4029 mm in the west. About 2/3rd of the geographical area of the state receives less than 750 mm of annual rainfall. Even the assured rainfall areas of the state like Dakshina Kannada, Uttara Kannada and Kodagu districts experience scarcity of water in some years.[42]

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41 Dr. Basappa Reddy and Dr.T.N Venu Gopal, *Ground water resources and management strategies for the 21st century, workshop on Ground water monitoring development and management* (Central Ground Water Board,Bangalore,2000) at 218

42 Supra note 27, at 218.

The erratic rainfall has lead to uneven distribution of surface water. As a result, even the major irrigation projects cover only parts of Gulbarga, Bijapur, Raichur, Bellary, Mysore and Mandya districts. As a result of this, the use of ground water for irrigation, drinking water and industrial purposes has increased manifolds. In may districts intensive development of ground water has lea to critical situations resulting in manifestations of problems like declining ground water levels, shortage of water supply, well interference problem etc. This situation warrants for taking up necessary steps and manages ground water resources

HYDROGEOLOGICAL SET UP:

Physiographically Karnataka state covers an area of 1,91,000 Square Kilo Meters with four different morphological setup namely Malnad area, North Maidan South Maidan and Coastal Tract. Hydro geologically the State has five sets of Hydro geological provinces. They are

(A) Granite and Gneisses,

(B) Dharwian Schist,

(C) Deccan Trap,

(D) Lime Stones, Shales, Sand Stones and

(E) Coastal and river bank alluvium.

As far as major aquifers are concerned, the Granite and gneiss aquifer occupies about more than half of the state's geographical area followed by Schistose aquifers. Other large aquifer is Deccan Trap aquifer. Limestone, Shale and Sand stone aquifers are limited when compared to other geographical provinces. Coastal aquifer is also limited and it is not extensive in lateral as well as in Depth.[43]

The distribution of network stations are given below:[44]

BASIN	AREA (Sq.Km)	No. of Stations	Hyrogeological Province
Godavari	4405	38	Laterite & Deccan Trap
Krishna	113271	680	Granite, Gnesiss, Schist, Sand stone, Lime stone, shale and Deccan Trap
Cauvery	34273	245	Granite gneiss and schist
West Flowing	26214	97	Granite gneiss and schist
Palar	2826	37	Granite gneiss and schist
Ponnaiyar	3638	47	Granite gneiss
Pennar	7146	52	Granite gneiss

[43] K. Keerthiseelan and K.N nagaraja, *Status of ground water monitoring in Karnataka, workshop on Ground water monitoring development and management* (Central Ground Water Board,Bangalore,2000) at 49

[44] Ibid. at 50.

Occurrence of Ground water:

In the crystalline aquifers of the state ground water occurs in the weathered and fractured horizons under phreatic conditions. Confined aquifers are not unknown in the state, but are not precisely identified and delineated. However, pheratic aquifers are common in the state. Thickness of the weathered zone from a few meters to as much as 30m depending on the rock formation and topography. Weathered horizon is followed by fractured zone, which extends up to 150m in some areas. However, intensity of fractures decreases with depth. [45]

Measures to rejuvenate Ground water Regime:

According to the department of mines and geology, in view of the declining trend of ground water levels, there is an urgent necessity of taking suitable measures to reverse the process. Some of the measures, which they recommend to be taken up in, a programmed manner on war rooting basis are as follows:

(1) Indiscriminate well drilling should be checked. This should be strictly enforced in the dark and grey areas. In other taluks, there should be planned development of ground water. In these taluk extraction should not be allowed to exceed the annual recharge.

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[45] Supra note 27, at 220.

(2) Rainfall in the dry districts of the state is low and not uniformly distributed. There are periods of flash floods, which are generally of transient nature. These flash floods have to be arrested through construction of suitable structures at feasible sites. For effective utilization of excess surface run off, percolation tanks may be located in areas with considerable weathered zone or in highly fractured areas. Also, percolation tanks may be taken up in pediments with fracture traces or upstream portion of the pediplains. Check dams may be constructed across major discontinuities or lineaments or fractures. These structures will help in recharging the deeper aquifers. Sub surface dykes and invert wells may also be used as artificial recharge structures. Sub surface dykes not only arrests sub surface flows going as unutilized waste but also helps in recharging the aquifers upstream of the structure. These structures may be located in shallow valley fills. Invert wells located upstream of a check dam also helps to recharge the phreatic and fracture aquifers.

(3) Better land management practice and soil conservation measures to be taken up in the recharge areas. Napa and gully plugging and contour bunding will help in recharging the aquifer to a greater extent. It also avoids wasteful surface run off during flash flood periods and reduces lifting in tanks.[46]

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[46] Supra note 30, at 223.

The Current Rural Water Supply Position

At present, Karnataka[47] depends mainly on Ground Water resources for water supply to rural habitations. In most parts of the state groundwater is generally free from bacterial and mineral contamination when tapped from deep aquifers through bore wells. Therefore, in Karnataka over 97% of the rural water supply schemes depend upon ground water. Drilling bore wells under piped water supply and mini water supply scheme s and bore wells fitted with hand pumps has been the strategy followed in the last twenty years.

Most rural water supply schemes aim at setting up water works at the village and habitation level to pump, store and distribute groundwater available in the vicinity of a habitation to ensure adequacy of water supply. However, in about 4500 habitations, the ground water available is not potable as it contains high levels of chemicals like fluoride and iron. Consumption of contaminated water with fluoride in excess of 1.5ppm and iron in excess of 1mg./litre is highly hazardous to health and can cause diseases like dental and skeletal fluorisis.[48]The Human Development report of Karnataka is self-contradictory. On the one hand, the report states that Ground water in Karnataka is not polluted and most sections of the people rely on this at the same time in other part of the report we find wherein the report states that the Ground water in Karnataka is contaminated by chemicals like and iron.

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47 Human Development in Karnataka 1999 158 (Bangalore: UBS publishers,1999).

48 Supra Note 5, at 160.

At present we are facing this water crisis, which will grow rapidly unless serious measures are taken to combat the existing problem. The damage caused to this fragile and fugitive resource could be irreversible in many areas, resulting in a secular overdraft. The emerging problems on account of overexploitation include increased depth to water due to deepening, reduced life of all types of wells, high rate of initial well failures. Reduced gross irrigated area per well reduced groundwater output and increased cost of well drilling and repairs to pump sets. This has severe implications on investments, incomes, crop patterns, equity and ecology. Most of the small and marginal farmers have abandoned well irrigation and shifted to dry land agriculture owing to the drying up of their wells.

According to one study[49], the State of Karnataka have taken only half hearted steps to combat this issue of overexploitation by stipulating a minimum distance of 600 feet to be observed between two boreholes. In principle this distance must be respected if the farmer gets government assistance to finance the well. But there are many instances where this is not respected, and the farmers who can afford to finance their own wells are in a position to disregard the rule all together. Moreover the Government of Karnataka have directly encouraged the indiscriminate proliferation of bore wells through their policies of free supply of electricity to pump sets and bore wells through policies of free

[49] Supra Note 26, at 347.

supply of electricity to pump sets and bore wells in Karnataka up to 10hp motors, but that is the same as virtually all privately owned motors. These policies have been introduced around 1990 by the then congress Government (under Bangarappa) with the obvious aim to secure the farmers votes.

The problem of overexploitation is widespread and alarming, threatening the very sustainability of the groundwater resource. The driving force for such exploitation is an undeniably high rate of returns to investment on groundwater. Although, every appropriator knows of this problem there is no collective concern or involvement in groundwater resource management in order to tackle this critical issue implying, lack of institutional framework, Since Groundwater regulation is considered as a politically sensitive issue, it is not able to enforce the regulatory measures for correcting the distortions. And also in India the data the people does not know bases for ground water estimates as this issue is known only in the academics. Sensitization of this water crisis is the need of the hour. Thus, the keen competition and economic freedom on the part of users (specially the upper section of the society) to exploit the open access resource (without compensating the people) indiscriminately has resulted over-mining, leading to total bankruptcy of aquifers in many areas. .

CHAPTER III

THE WELL INTERFERENCE PROBLEM

The state of Karnataka has around ten lakhs irrigation wells, however there are no reliable estimates of the number of functioning wells. With the shallow knowledge base about the availability of ground water in hard rock areas, farmers are taking chances by investments in drilling wells. A major factor contributing to this is the relatively large internal rate of return of 26%, and a short pay back period of 2.8 years even after imputing the cost of well failure and charging for electricity to pump water at 50 Paise per kilo watt hour.[50]

First phase of well development:

The sprawl of well development began in the 1950's in peninsular India. The Karnataka State has witnessed three distinct phases in the growth of ground water development. The first phase of groundwater extraction was dominated by traditional dug wells with a depth of 25-30 feet depth, till the mid 1960's. Historically, traditional labor-intensive water lifting devices like Persian wheel and other labor-intensive devices were use prior to mid 1960's. These devices formed around 62 percent of all irrigation devices in 1960's. There was

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[50] Supra note 36, at 7.

conjunctive use of ground water with tank water during this period implying hydrological nexus between well irrigation and tank irrigation. The cropping pattern was in consonance with well productivity. Though there was some seasonal and secular overdraft due to low rainfall, the depletion problem was not pronounced. The depth of available water over time in wells was subjected to minimum fluctuations as the demand and supply was matching and dug wells were functioning for a longer span. Moreover, the distance between well to well were beyond the hydrological threshold limits of 600feet. Another striking feature with regard to distribution pattern of the wells was that most of the wells was located nearby water bodies, which use to recharge the wells. The water quality was also not a problem as farmers used less quantum of chemical fertilizers and pesticides. Some of the measures reflecting the sustainable use of ground water during this phase include depth of availability of water over time, the use of traditional lifts for extraction of water that is within the recharge capacity of the wells, spacing of the wells and cropping pattern. Thus there was an overall balance between extraction and recharge.[51]

Second Phase of well irrigation development:

The second phase of well development between 1970 an 1980 was characterized by the predominance and growth of the use of dug –cum-bore-wells. In the early 1970's farmers were drilling one or more bore-wells inside

[51] N. Nagaraj, et al., "Ground water Institutions in US and India, Sustainable and Equitable resource use", 34(26) *Economic And Political Weekly* A-94 (1999).

their dug wells (dug-cum-bore-wells). The in bores had a depth ranging from 45 to 100 feet and centrifugal pump was the major more of extraction. The water yield of the dug-cum-bore-wells was higher compared to dug-well yield; hence farmers brought more area under ground water irrigation. During this period there was a gradual shift in the cropping pattern from food to commercial crops, which are hydrophilic remaining more water. Since, farmers were using centrifugal pumps they started pumping more water to meet the increased demand, without regard to the recharge capabilities of wells. This caused recurring shortfall of water in the wells for the assured crop production. Further, to augment more water yield in the dug wells they ventured on multiple bore-wells with in the dug-wells involving additional investments and increased extraction cost as farmers were paying electricity charges based on pro-rata. Thus, as compared to dug wells, the dug-cum-bore wells served for a shorter period, the depth to water table increased over time, extraction rates were more than recharge rates causing draw down of water in the wells. These changes leaned towards unsustainable development of the resource. With a marked shift in the cropping pattern from food crops to commercial water intensive crops, the demand for ground water escalated sharply. The dug-cum-bore wells capacity to meet increased demand for ground water reduced. This force farmers to venture further in exploring ground water through deeper fractures of aquifer by means of deeper surface bore-wells. Since the nationalization of commercial banks in 1969, agricultural sector has been considered as a priority sector an

hence received liberal credit incentives for well drilling credit for well irrigation increased many folds in the state. Thus, access to institutional credit for well irrigation increase many folds in the state. Thus, access to institutional finance has largely been responsible for a rapid spurt in the wells all over the state. With the gain of well irrigation, the dependence on tank irrigation has considerably reduced. In addition the irrigation tanks have also become unreliable source of water supply due to siltation and poor management causing further pressure on ground water development.[52]

Third phase of well development:

The third phase began from the early 1980's with surface bore-wells with a diameter of 6 inches and a depth of 300-450 feet. Compared to dug wells and dug-cum-bore-wells, the surface bore-wells yielded more water an the extraction mechanisms shifted towards submersible pump sets of high capacity up to 10 Horse power. Thus, with the introduction of modern extraction mechanisms, the ground water extraction scenario has drastically altered. Further, during this period government completely subsidized electricity to the agricultural pump sets, as a result the marginal extraction cost became zero. This acted as a strong incentive to go for more number of wells and draw more volumes of water instantaneously for meeting the increase demand of the commercial agriculture. The bore-wells constructed after 1980's virtually spread

[52] Supra note 38, at A-94.

all over without consideration to isolation distance and water bodies. This is also one of the reasons for well Interference and high degree of well failures. The share of less water intensive food crops dropped drastically. The high value water intensive crops like vegetables, flowers, fruit crops, cereals, sugarcane has been gained.[53]

The three phases of ground water development clearly connotes, over the years the pressure on ground water use has increased tremendously. We have seen that till early 1980's, open wells serve for a longer period ensuring sustainability. But the changes that took place after shows that there has been constant over extraction of ground water that took place due to advancement of technology, free electricity and access to credit.

The central Dry Zone, which was ground water scarce, was considered for the study and Madhugiri Taluk which topped the list of taluks in this zone in respect of the number of wells per million cubic meter of ground water was considered. This taluk has 156 wells per million cubic meter of groundwater available for irrigation.[54]

Features of study area:

Madhugiri taluk of Tumkur district is in the central dry zone. Located at 2889 feet above the mean sea level, the taluk receives an annual rainfall of 612

[53] Supra note 38, at A-95.
[54] Supra note 36, at 8.

mm. The maximum temperature is 40 c and the minimum is 10 cc. The taluk has no perennial rivers and a number of streams originating from the hills and they feed a number of tanks downstream. These flow only during the rainy season and totally dry- up during the summer. The river 'Jayamangali' originates in Devarayanaurga and flows in Madhugiri in the rainy season. Earlier the farmers use to irrigate their fields with the help of "kapile'- a bullock drawn equipment to lift the water from the river. Such streams as well as tanks are drying up. At present, farmers are irrigating from their wells. The net area irrigated is 20,859 hectares forming 35 percent of the total cultivated area of 59,000 hectares. (1994-95). The tank command area is7, 812 hectares forming 38 percent of the irrigated area, while wells provide irrigation to13, 047 hectares forming 62 percent of the area.[55]

With the meager rainfall of 482 mm, the irrigation by tanks and wells is playing a crucial role in supporting the agricultural production by irrigating 35 percent of the total cultivated area. The irrigation wells are the dominant partners in sharing 62% of the total irrigated area.

The ground water in Madhugiri is estimated to be 147 million cubic meters. The villages are sorted in the descending order of magnitude of the chosen criterion. The village wise number of wells per MM of utilizable ground water is computed and the villages are ranked in the descending order of the

[55] Supra note 36, at 9.

magnitude. The village with high well interference problem in tank command area is siddapura (575), that in non-tank command is Thippanahalli (487) are chosen. A control Village Devanahalli (112) is chosen to represent the low well interference village scenario for the sake of comparison.[56]

The control villages are taken from the same taluk because, it is necessary to investigate the well interference problem under ceteris paribus, which in turn necessitates that aquifer conditions, hydro-geological characteristics have all to be same for examining the well interference problems in both study and control villages. If the villages are not taken from the same taluk, it is likely that the difference can be seen, in rainfall pattern, cropping pattern, etc, that would be difficult to compare the villages.[57]

VALIDATION:

In order to confirm, whether the villages chosen do reflect the problems of well interference, discussions were held with Karnataka Electricity Board, Agricultural assistants of the Department of Agriculture Madhugiri in Addition to pre testing. This validated the choice of the high well interference village[58] and Low well interference village[59] so chosen.

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56 Ibid. at 10.
57 Supra note 36, at 9.
58 Here in after referred as HWIV.
59 Here in after referred as LWIV.

In this study, the HWIV had two villages one with irrigation tank (42 farmers from siddapur) and the other without irrigation tank (40 Farmers from thippanahalli) there were no villages with and without irrigation tank for comparisons the LWIV. One village (41 farmers from devanahalli) representing LWIV is considered for comparison. The classifications of farmers to small and large farmers closely follows the definition of NABARD for Madhugiri taluk, which says that 6.25 acres of gross irrigated area or below for small farmers and above for medium farmers. In this study this definition is modified to consider the farmers above 6.25 acres of gross irrigated area as large farmers.

The methodology for establishing the inequity in ground water irrigation are developed around the framework of efficiency and externality in groundwater use in ground water use in the situation of ground water scarcity. The implicit costs of ground water irrigation are computed by considering the amortized cost of ground water irrigation, where the number of year's wells functioned below their average well life is the element of negative externality, while its converse is the element of positive externality. The negative externality cost (economic loss) of well failure reflects the forced investment(s) farmers have to incur on well irrigation due to the problems of cumulative well interference. Negative externality is manifested due to the premature failure of wells, as they did not serve for the average life. Amortized cost measure of negative externality is estimated for the failed wells only. Failed wells inter alia included those, which were totally abandoned, as they did not yield any water.

(20) The costs of coping Mechanisms adopted represent yet another dimension of negative externality. These costs are estimated for farmers located in HWIV and LWIV to explore the magnitude of inequity.[60]

Negative externality cost due to cumulative interference:

Effects of cumulative well interference are threatening negative externality wells. Any fresh investment on irrigation well is accordingly influenced inter alia by the historical factors such as the number of wells which are already tapping groundwater, the actual volume of groundwater extracted by them, the inter well distance, the capacity of the irrigation pump set used, the quality of electrical power supply, probability of well failure. If these factors are at modest levels, the fresh investment on irrigation wells will also be modest, if not, the investment would increase in leaps and bounds. Precisely it is the forced additional investment, which is a negative externality and is an unreimbursed cost to farmer due to cumulative actions of farmers. This cost of negative externality is for all the wells, which failed prior to the average well life. For those wells, which worked about the average well life, the externality is positive. Since the farmers have a mix of both types of wells, externality computed subsumes the net effect of positive and negative externalities.[61]

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60 Supra note 36, at 20.
61 Ibid at 17.

For small farmers in HWIV tank command, the negative externality is 18,000 per are of GIA, while for large farmers it is Rs 3071. For small farmers in HWIV non-tank command, the negative externality is 9036. In LWIV, the negative externality is Rs 854 for small farmers and Rs 400 for large farmers. The gross area irrigate for small farmers is way behind that for large farmers, which is manifested in the per unit cost of negative externality. A small farmer in HWIV tank command had negative externality of Rs 13 for every one rupee negative externality faced by small farmers in LWIV, an small farmers in HWIV non tank command had negative externality of Rs six for every one rupee of negative externality cost for small farmers in LWIV.[62]

Cost of coping mechanisms:

Farmers in HWIV and LWIV with large proportions of well failure, negative net returns and with substantial negative externality are forced to cope with the scarce ground water. The coping mechanisms adopted are:

(1) Going for an additional well,

(2) Buying water from others, and

(3) Rainfed farming.

Investment on Additional wells:

After the failure of first well, having realized the advantages of well irrigation. Farmers invest in additional well(s). Small farmers in HWIV tank

62 Supra note 36, at 20.

command and non-tank command invest, Rs, 60,000 on additional well, approximately covering the cost of drilling one bore well. The investment per functioning well amounted to Rs 1,00,000. This meant that farmers in HWIV have to incur additional cost of RS, 60,000. This difference of Rs 40,000 is due to the high rate of well failure and negative externality cost faced by them. In LWIV both small and large farmers are in better placed as the majority of the wells drilled by the farmers are yielding good volume of water. The investment made on additional well is around Rs 20,000. Here the aim of the farmers has been to expand their area under irrigation. As surface bore well drilling is a recent phenomena, and the number of wells per unit of ground water are relatively lower, their negative externality is lower. The investment per functional well amounted to Rs. 30,000.

Cost of coping mechanisms of farmers thrown out of well irrigation due to interference:

Due to higher rate of well failure, 32 percent of farmers (13) from HWIV non-tank command village were virtually force out of well irrigation. The average net return from dry land is 1,648 annum. In the HWIV tank command, 17 percent of farmers (7) were thrown out of well irrigation due to increasing ground water scarcity. Two farmers kept land fallow because of inability to cultivate. Perhaps if these farmers had invested in additional wells after irrigation, it is likely that they would have received negative externality.[63]

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[63] Supra note 36, at 17.

Economics of buying water:

A few Farmers have resorted to buying water from others. In the entire sample, 11 Farmers bought ground water. This shows that water buying or ground water market is not a common phenomenon in areas of ground water scarcity and abundance in the central dry zone. All the farmers who bought ground water owned irrigation wells and their wells had suffered from Cumulative interference effects. The volume of ground water bought depends upon willingness of the seller, the availability of ground waters the crop and the season. Among the 13 buyers, three (23 percent) bought for growing paddy, seven (53 percent) bought for growing areca nut, one each (8 Percent) bought for growing groundnut, kakada and ragi. Paradoxically 12 buyers (92percent) were located in HWIV. [64] There are two main crops agricultural season followed by farmers using well irrigation in Madhugiri taluk; kharif a summer. Among seasonal crops, farmers grow paddy and groundnut during kharif. In the summer season, they grow groundnut and/ or ragi in the kharif season. In the HWIV, both seasonal crops of paddy, groundnut and ragi an the perennial crops of area nut are grown. IN LWIV, only annual crops of pay an groundnut are grown. Mulberry is cultivated in patches. This crop pattern represents an extreme situation of high water use by paddy an a crop groundnut with low water use the gross cropped area per small farm in HWIV tank command is 3.62 acres of which 65 percent is irrigated, and the gross cropped area per large farm of 17 acres of which 85 percent is irrigate. The gross cropped area

64 Ibid at17.

per farm in HWIV non-tank command is 5.25 acres of which 38 percent is irrigated. Among 40 farmers in this group, 13 farmers (32 percent) lost about 21 acres of net irrigated area due to well interference and were forced out of well irrigation.

In HWIV tank command the small farmers devote 66 percent of the gross irrigated area to food crops. In large farms, a major portion of gross irrigate is under perennial crops (commercial) crops. The equity issue is that if there is well failure, small farmers suffer in the form like:

(1) Their food production will be at stake;
(2) Since their capital formation is limited to the extent they devoted a large part of the area to food crops, their future investment capacity in well irrigation is affected.
(3) That as small farmers already bore the brunt of well failure as 70 percent of the failed wells belong to their group; they would be the first set of farmers to be thrown out of irrigated agriculture due to well failure in future.[65]

Irrigation wells are increasing at a compound rate of ten percent in some parts of hard rock areas. There is a wide variation in the distribution of wells and ground water use. The density of wells per unit area as well as the number of wells per million cubic meter of ground water which determines the degree of interactive effects of wells, are increasing over time in hard rock areas. In these circumstances, the ground water rights are obscure since farmers are tapping

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65 Supra note 36. at 20.

the resource from a common aquifer, not realizing that each one's extraction is a function of the neighboring well's extraction at a time and over time. In the hard rock areas, the cumulative interference of wells is increasing over time and has led to reduction in life of the wells, increasing initial failure to strike ground water, and reduction in the gross area irrigated by wells.[66]

Ground water is another important resource available for extraction. The use of ground water for agriculture began in the early 1950's and in 1985 the net area under groundwater irrigation was 14.8 million hectares. Ground water irrigation was 14.8 million hectares. Ground water irrigation is more efficient than canal irrigation because there is less water loss. In India ground water potential is estimated to be 10 times its rainfall but its use shows wide regional variations the green revolution states report a much a higher use: punjab-73 percent, Haryana 70 percent and Tamil nadu 37 percent. What is more important about ground water irrigation is that most of the expense is borne by private individuals with the state playing a very minor role. In practice this means that those who can afford to avail of this common resource without any hindrance while those who cannot are denied this use. In other words, this speaks of the growing privatization of a common resource. One therefore finds that in rural India the richer farmers an in urban India the better to do house holds is able to exploit and use ground water. A common resource like water that should be available to all becomes the privilege of a minority.

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[66] M. G .Chandrakanth et al.. *Resource Economics Study of valuation of well Interference Externalities in Central Dry zone of Karnataka* 7 (Bangalore: University College of Agricultural Science, 1998).

CHAPTER IV

THE ROLE OF REMOTE SENSING IN GROUND WATER STUDIES

Ground water constitutes a substantial portion of the earth's water circulatory known as hydrologic cycle. In recent years much progress has been made in the application of remote sensing techniques to ground water. The techniques of remote sensing have emerged as an indispensable tool in ground water exploration and development. Exploration procedures can ideally adopt remote sensing as the first step to be followed by field geological studies, geophysical prospecting and test drilling. This helps in concentrating the field efforts in areas where greater potential exists and eliminating other zones, thus reducing the cost and time involved in exploration procedures.[67]

The existing legal regime is based upon the earlier state of knowledge pertaining to science of underground water resource. There was the blanket assumption made that the ground water resource flows either in defined channel or undefined channel. The defined channel meant that the body of water flowed through a defined channel, having a bed or banks on both the sides.[68] Modern science and especially the science of remote sensing reveals

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[67] Hydrogeomorphologial Mapping and delineation of ground water potential zones using satellite data district Panchkula V (Hisar: Harsac, 1999).

[68] Infra note 94 and 107.

that the underground water, which flows in the defined channel may not be connected with the stream. Hence the existing legal regime rests on antiquated notion of knowledge pertaining to underground water resources. The need for more contemporarily valid legal categories is therefore a matter of scientific compulsion. Law cannot seek to arrest the progress of science and technology merely because a jurisprudence, which corresponds to the development of knowledge in this field, has not yet arisen. It is this factor, which the author seeks to examine in this chapter.

What is remote sensing?

Remote sensing refers to the branch of science, which derives information about objects from measurements made from distance that is without actually coming into contact with them. Such measurements would require a medium of interaction. Conventionally remote sensing deals with the use of electromagnetic radiation as the medium of interaction. Remote sensing refers to the identification of earth features by detecting the characteristics electromagnetic radiation that is reflected/emitted by the earth surface.[69]

Every object reflects/scatters a portion of the electromagnetic radiation incident on it depending upon its physical properties. In addition, objects also emit electromagnetic radiation upon their temperature and Emmisivity.

[69] Remote sensing and GIS Applications in Remote sensing, Workshop on remote sensing and GIS technology 1 (Nadiad: Department of Civil Engineering 1997).

Reflectance/emittance pattern at different Wavelengths for each object is different. This enables identification and discrimination of objects.[70]

Remote sensing is not a new concept. Visual perception of objects by the human eye is the best example of remote sensing. The light/electromagnetic radiation reflected by the object gets focused on to the retina of the eye. Information of the image is carried to the brain through the nervous system. The brain interprets this information and identifies the object. Remote sensing, as we understand today, is nothing but opposite of astronomy. As part of astronomy, man looked from the earth towards heavenly bodies to understand, gain more insight about them. He built instruments to measure 'light coming from these bodies' to understand their movements, evolution etc. On the other hand, remote sensing refers to going up in the sky and looking downwards towards the earth itself to learn more about the place, we have inhabited.

Remote sensing system:

A remote sensing system consists of a data acquisition, data processing and analysis system. Data acquisition system comprises, the source of radiation, the atmospheric path, the earth surface or the target and the sensor/platform. The radiation from the sun passes through the intervention atmosphere and is incident on the earth surface. Some of the radiation gets

[70] Supra note 55, at 2.

absorbed or scattered by the atmosphere. The radiation of the sun scattered by the atmosphere forms the sky diffuse radiation. The radiation incident on the earth surface gets reflected/transmitted and or absorbed. If the surface is smooth compared to the wavelength of radiation then it will be specular reflection where the angle of reflection is equal to the angle of incidence. The reflected radiation again passes through the atmosphere, may get absorbed/scattered and then reaches the sensor placed on a platform. This energy received/detected by the sensor forms the basic premise for identification, discrimination and classification of earth surface features that have unique reflectance/emittance properties in different parts of the electromagnetic spectrum. Spectral signature of any object and/or its conditions comprises a set of values for its reflectance and/or its emittance in different spectral bands. [71]

Concept of signatures:

Identification, discrimination and classification of earth surface features using remotely sensed data is based upon the basic premise that different objects have unique reflectance/emitance properties in different parts of the electromagnetic spectrum. Spectral signature of any object and/or its condition comprises a set of values for its reflectance and/or its emittance in different spectral bands. Concept of spectral signature is a subset of the broader definition of the term 'signature'. It is defined as any set of observation of an

[71] Ibid at 2.

object and/or its condition. Four principal characteristics of signatures which facilitates discrimination are:

(1) Spectral variations,

(2) Spatial variations,

(3) Temporal variations,

(4) Polarization variation.

Spectral variation is the changes in the reflectance or emittance of objects as a function of wavelength. Spatial arrangements of terrain features, providing attributes such as shape, size, and texture of objects, which lead to the identification of objects, are termed as spatial variations. Temporal variations are the changes of reflectivity or emissivity with time. They can be diurnal and/or seasonal. The variation in reflectivity during the growing cycle of a crop helps distinguish crops which may have similar spectral reflectance but whose growing cycle may not be the same. Polarization variations relate to the changes in the polarization of the radiation reflected or emitted by an object. The degree of polarization is a characteristic of the object and hence can help in distinguishing the object from others. Each of these four features of radiation interacts with the others. Signatures are not, however, completely deterministic. They are statistical in nature with a certain mean value and some dispersion around it.[72]

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[72] Supra note 55, at 3.

Spectral Reflectance properties of water:

Understanding of spectral reflectance of water under different conditions of its occurrence is important in the utilization of remote sensing data for different applications. Water absorbs most of the radiation in the near infrared and middle infrared regions. This property enables delineation of even small water bodies in space borne images. In the visible region, the water surface, bottom material and other suspended materials present in the water column influence spectral reflectance of water. Turbidity in water generally leads to increase in its reflectance and the reflectance peaks shifts towards longer wavelength. Increase in the chlorophyll concentration leads to greater absorption in the blue and red regions. Dissolved gases and many inorganic salts do not manifest and changes in the spectral response of water. On the other hand, snow has very high reflectance, up to 0.8 micrometers and then decreases rapidly afterwards. In case of clouds, there is non-selective scattering and they appear uniformly bright throughout the range 0.3 and 3 micrometers. The cloud tops and snow generally have same temperature and hence it is not easily possible to separate these in the thermal infrared region. Hence, the two atmospheric windows in the middle infrared wavelength region 1.55 to 1.75 micrometers is important for snow cloud discrimination.

APPLICATIONS IN WATER RESOURCES:

Surface water body inventory:

The near infrared region of the electromagnetic spectrum helps in providing best information on water bodies due to high absorption of light by water in this region. Satellite images provide information in the size, shape, pattern, aerial extent and spatial distribution of water bodies. Surface water bodies inventory is being done operationally using remote sensing data. IRS-1CLISS-III data have helped in mapping as small as 0.5 ha. Since surface water spread area is related to volume of the water body, monitoring of water availability is possible on periodical basis.[73]

Ground water targeting and recharge:

Remotely sensed data has also been found to extremely useful in ground water targeting. The rock types, structures, geomorphology, soils etc basically control groundwater. Usefulness of remote sensing data in identifying linear features such as fractures/faults and geomorphic features such a buried channels etc has been established. Besides, the multi spectral data provide information on crop types which are highly useful in estimating the season-wise form a critical input in ground water usage in different areas which form a critical input in ground water resources estimation, planning and water budgeting.

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[73] Supra note 55, at 4.

A country-wide hydro geomorphic mapping showing ground water prospect areas has been done on 1:250000 scale using IRS 1A data under National Technology Mission for Drinking water. These maps have been extensively used for locating prospective ground water sites around problem villages.

Through remote sensing, the suitable areas for recharging the aquifers can also be brought out as the better rechargeable areas are those which have porous lithologies, maximum fractures, highly weathered regions, flood plains, regions of null slope etc. Such sites are being located and recommended for selected districts in the country.[74]

Use of Remote sensing data in ground water studies:

The advent of remote sensing has opened new vistas in geological, geomorphological and structural mapping for the ground water exploration. Earlier these maps were prepared by conventional ground water surveys based on the information collected along traverse lines. While plotting such information on to the topographic base and ultimately preparing the final maps by extrapolating the details, unavoidably certain errors to creep in leading to inaccuracies in these maps. Hence, by and large the geological community was in search of a suitable database for preparing accurate geological maps.

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[74] Ibid at 5.

Since the development of remote sensing technology, the mapping procedures have undergone drastic change. Currently, the remote sensing techniques have assumed great significance and have become an integral part of the mapping program, especially the regional level and semi-detailed surveys. The scale corrected satellite imagery in the form of black and white and false color composite (FCC) prints act as better data set for mapping. This pictorial data improves the accuracy of maps and reduces the number of field traverses/observations, thus saving time and cost of the investigations. However, it is only a complimentary, thus saving time and cost of the investigations. However, it is only a complimentary tool and not a supplement to the conventional ground surveys.[75]

The synoptically of the satellite data helps in mapping of various lithologic, structural and morphological features in their correct spatial relationship with each other and the multi spectral data provide certain additional information which is not easily observable on the ground whereas, the repetitive coverage provide information on time variant features/ phenomena. The satellite imagery portrays an unbiased picture of the area providing integrated information on different factors controlling the ground water regime and offers a common data base for conjunctive study of all the factors for evaluating their relative significance in different hydro geological domains.[76]

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[75] Supra note 54, at 1.
[76] Ibid at 2.

Hydrologic Information and recharge to ground water:

The ground water regime depends more on the recharge conditions, than any other factors. However, the recharge conditions in turn depend on many other factors. By providing integrated lithologic, structural, geomorphic and hydrologic data, the satellite imagery facilitates better appreciation of the recharge conditions. Based on geomorphic and hydrologic analysis the areas can be classified into runoff, recharge, storage and discharge zones. The surface water bodies like reservoirs, tanks, lakes, canals and perennial stream/river courses which form the sources of recharge to ground water. Multi-data satellite facilitates easy identification, mapping and monitoring of surface water bodies. Due to strong absorption in the near infrared spectrum, the water bodies appear as dark patches on the satellite imagery giving strong tonal contrast with that of the surrounding land areas. Thus, by using satellite data all the surface water bodies can be accurately mapped both by visual and digital techniques and continuously monitors by multi –data imagery. As surface water bodies act as recharge zones for ground water the faults and fractures passing through these water bodies, which act as, conduits for ground water movement can also be mapped. Thus the satellite imagery with synoptic view helps identifying such inter linkages leading to better understanding of the ground water regime.[77]

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[77] Supra note 54, at 7.

Limitations of remote sensing in ground water explorations are:

(1) Correlative quantitative estimates of expected yield in specific hydro geological environments may be given very broadly form remotely sensed data.

(2) Depth estimation of aquifers is very difficult.

(3) Assessment of quality of water is difficult.[78]

Advantages of remote sensing for ground water exploration:

(1) Quick an inexpensive technique for getting first –level information on occurrence of ground water.

(2) Aids to select promising areas for more detailed hyrogeological/ geophysical investigations, thus reducing fieldwork.

(3) Provides better geologic and hydrologic information (particularly on a regional scale) because of synoptic, multispectral and multi-temporal character of the imagery.

(4) Obtaining information over large area about soil moisture and vegetation patterns. Often such information is indicator of occurrence of ground water shallow depths.[79]

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[78] Ibid at 26.

[79] supra note 54, at 24.

CHAPTER V

LAW AND POLICY ON GROUND WATER

According to Keilrack (1912) the origin of ground water was mentioned in Book 21 of Homer's Iliad written about 100 B.C. as follows: Sith Zeus neither does the mighty river Achelous fight nor mighty strength of the deep flowing oceans from which flow all rivers and every sea and all springs and deep wells. Herodotus (484-425 B.C.) reasoned that the sun attracts the water. After attracting, it (sun) again repels it into the upper regions, where the winds lay hold of it, scatter it and reduce it to a vapor.

Thales (640-546) who was an Ionian philosopher of the School of Miletus has been called a true scientist. He thought that the water was driven into the rocks by wind and it was forced to the surface by rocks pressure, hence, it merged as springs. Anaxagoras (500-428 B.C.) recognized the importance of evaporation and rainfall as a source of water for river, but thought in terms of great reservoirs probably of the Tartarus vast-cavern type. Anaxagoras also recognized the important of rainfall, recharge, and underground storage even though he incorrectly understood the nature of this storage. Plato (427-346 B.C.) wrote in Critias about the rainfall runoff segment of the cycle, the infiltration of surface water and underground storage segments. The driving mechanism for this circulation was not fully explained. Krynine (1960) pointed

out that the foregoing interpretation of Plato's ideas, which influenced medieval science was probably not a correct interpretation of his more serious thoughts on the subject. Plato's "Critias" also contains a description of the hydrologic cycle, which is quite accurate. Although Aristotle (383-322 B.C.) was a student of Plato, he modified considerable Plato's concepts of the origin of ground water. Aristotle recognized the cyclic path of water between land and air, evaporation and condensation and their importance in rainfall, and streams discharge some rain, while some percolates into earth and appears in springs. Aristotle, however, recognized that some cavern water, which originated from rainwater, had infiltrated into ground and had entered cavern in liquid form rather than as vapor (Adams, 1938; Baker, 1936).

Since Vedic times the main motto of social life was to have in harmony with the nature. Vedas, Upanishads, Smritis and Dharmas preached in form or the other a worshipful attitudes towards plants, trees, mother earth, sky aakash, air vayu, water jal and animals and to keep a benevolent attitudes towards them. It was regarded a sacred duty to protect them. The Hindu religion enshrined a respect for nature and environmental harmony and conservation. It instructed man to show reverence for the presence of divinity on nature.[80]

Many verses in Rived and Atharvaveda have been devoted in the praise of Lord Surya (sun), vayu devta (Lord Air), Agni Devta (god Fire), Varuna Devta

[80] R.B. Singh Suresh Misra, *Environmental Law in India* 99 (New Delhi: Concept Publishing Company, 1996).

(God of water), Prithvi Mata (mother Earth), Vanya Devi (Goddess of Forest) etc. Therefore, cutting of trees, polluting Air, water, Land was regarded as sin as they were to be respected and regarded as God and Goddesses. Maintaining them pure was considered to be the duty of everyone. Hindu Society did not consider it proper to throw dust on a public path. Rigveda, Manusmriti, charak Samhita have emphasized on the purity of water and healing and medicinal value of the water. Because of these injunctions a system of Maryada (code of conduct0 developed on the society to keep water clean pure and pure.[81] The dharma-sutra (aphorismic form of teaching imparted by a master to his disciples) of apasthamba, an authority on civil and criminal law, lays down that one who has taken the property of another unintentionally shall be reprimanded, if the property were, among other things water. But if the same is done intentionally his garments shall be taken away. As per other sutra the King as a sovereign, has immunity from consequences of such acts, he could take or receive water form any place without its being considered a theft.[82]

In India, Vedas and Upanishads which constitute the ancient literature contain hymns referring to precipitation as the source of all waters and to the concept of what is recognize as the ' hydro geological cycle' an to the role of solar energy in its operation. Recorded history of over 5000 years shows the

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81 Ibid at 100

82 Chatrapati Singh, *Water law in India* 290 (New Delhi: India Law Institute, 1992).

evidence of open wells an other hydraulic structures tapping ground water in china, India and Iran. Some of the sages like varahamihira in India codified their keen observations on ground water occurrence and movement. Exhaustive list of bio indicators to locate ground water were provided in Brihatsamhita a work of varahamihira during 6^{th} century A.D

In India the statutory law is an imposition of a colonial law over the traditional practices. A brief review of this colonization process in other countries will be helpful in putting the Indian situation in a relief. The precise relationship between local customary law and the imported law of a colonial relationship between local customary law and the imported law of colonial power has been and still is a matter of considerable judicial controversy. An outline of some of the common features in this controversy is nonetheless possible.

In United States, Canada, New Zealand, the doctrine of "discovery" as laid down by Justice Marshal in Johnson v McIntosh has prevailed. In this view, discovery of a new land by the colonial power gave it ultimate dominion, its sovereignty, however, was limited by indigenous rights of occupancy. These were legal rights that could not be transferred by the indigenous people except to the colonial power, which had the power to extinguish native titles.

In extending the British Common law to India, the colonial powers did not employ the Marshal's Discovery principle or Blackburn's Conquest principle, nor

the recognition of the Prior appropriation principle, as applied in United States. Instead, they manufactured new "act of the state" jurisprudence, such as first explicitly evidenced in vajssingi joravarsigni v secretary of the state of India, which simply stated, asserts that when sovereignty changes property, by decree or fiat. This ideology, of viewing land primarily as an economic asset, was not only engrafted on to all customary or traditional legal systems in colonial countries, including India, but has also become the dominant ideology in the post colonial era.[83] The first major development in water resources regulation came through the Bengal Regulation VI of 1819, which empowered the government to Invade, "private rights" of ferry by establishment of "public ferry". Later the Regulation was extended to Punjab also. This paramount claim (sovereignty) over water by the government marked radical shift from earlier practices, which treated the resources as common property of all, with control lying in the hands of the people. These developments were preceded by another step of similar nature by British in 1793, introducing permanent settlement, thus affecting the relationship between government and its subjects over land resources in a major way.[84]In retrospect, the consequences of an ideology, which treats land as a commodity and attaches water as an attribute to land, has been manifest. Individualization of titles has certainly empowered a whole range of people to deal with it as a marketable commodity, but has it has

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[83] Chatrapathi Singh, *Water Rights and Principles of Water Resources Management* 57 (Bombay: N.M Tripathi pvt.ltd, 1991).

[84] Supra note 82, at 297.

displaced a greater number of people from having access to land and its resources. Land and water have moved into the hands of land classes and irrevocably away from traditional users. It has led to the collapse of traditional structures of authority and community resource management systems, hastened the drift of the traditional people to the new urban areas, and substituted the tragedy of the humanly degrading urban poverty for the simple but balanced traditional subsistence communities.

Under the Constitution, legislative subject on "water" is vested upon the states[85]. When the constitution of India came into force it did not contain a specific provision for the protection and promotion of the Environment. However, in the year 1976, the constitution (forty second Amendment) Act[86] was passed which expressly incorporated into the constitution of India specific provisions for environmental protection and improvement in the form of Fundamental duty and Directive Principles of State Policy. The constitution of India has aimed at a social order in which "justice, social, economic and political shall inform all the institutions of national life". This is ordained to be attained particularly by states endeavor of minimizing the inequalities and groups of people. The constitutional duty of the state and citizens to protect and improve the natural environment, the thrust for economic democracy and recognition of

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85 Entry 17 list II of seventh Schedule states water that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of entry 56 of list I

86 The Forty Second Amendment Act passed A.48 and A. 51A(g) into the constitution.

right to drinking water as a component of fundamental right to life have been given thoughtful guidance for sustainable development with justice.

Recent judicial activism about right to life under Article 21 of the constitution has been a ray of hope to check overexploitation of groundwater in extreme cases like Salinasation of groundwater due to excessive withdrawals and diminution of drinkable water. The kerala high court in F.K Hussain V/s Union of India[87] held that " the right to sweet water and the right to free air, are attributes of the right to life, for, these are the basic elements which sustain life itself.

In the case of Attakoya Thangal V. Union of India[88] excessive withdrawal by rich farmers had lead to the salinisation of ground water. In the present case the court held that the right to sweet water, and the right to free air, are attributes of the right to life, for these are the basic elements which sustain life itself.

India has followed the common Law Doctrine approach of Land Ownership in the sphere of Ground Water Rights. The first and foremost Act, which explicitly provides for rights of the People, is the Easement act of 1882.

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[87] A.I.R 1990 Ker 321

[88] 1990(1)KLT 550.

INDIAN EASEMENT ACT, 1882

The law of easements in India is not the same for the whole of the country. Some of the territories are governed by this Act, while some, to which the Indian Easements Act is not applicable, are governed by other laws, and in the absence of any other law, by the principles of Justice, Equity an good Conscience.

Easement is defined in Section 4 of the Indian easement act.[89]

We have seen that "Land" has not been exhaustively defined in The Indian Easement Act. The explanation to the section 4 only says; land includes also things permanently attached to the earth". The term "land", as used under this Act does not appear to be synonymous with the term "immovable property" as defined in the General Clauses Act[90].

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[89] An easement is a right which the owner or occupier of certain land possesses, as such, for the beneficial enjoyment of that land, to do and continue to do something, or to prevent and continue to prevent something being done, in or upon, or in respect of, certain other land not his own.
Dominant and servient heritages and owners: The land for the beneficial enjoyment of which the right exists is called the dominant heritage, and the owner or occupier thereof the dominant owner; the land on which the liability is imposed is called the servient heritage, and the owner or occupier thereof the servient owner.
Explanation. In the first and second clauses of this section, the expression "land" includes also things permanently attached to the earth; the expression "beneficial enjoyment " includes also possible convenience, remote advantage, and even a mere amenity: and the expression :to do something" includes removal and appropriation by the dominant owner, for the beneficial enjoyment of the dominant heritage, of any part of the soil of the servient heritage or anything growing or subsisting thereon.

[90] The definition of "immovable property" in the General Clauses Act is as follows:
' Immovable property' shall include land, benefits to arise out of land, and things attached to the earth.

The phrase "attached to the earth" which is not been defined in this Act has been defined in the Transfer of property act, IV of 1882 in section 3[91]

According to the Transfer of Property Act, Land in its legal acceptation comprehends every species of ground on earth, as meadows, pastures, woos, moors, **waters,** marshes, furze an heath. It includes house, mills, castles, and indeed all sorts of buildings. The term " land' not only includes dry land but also land under water. Besides an indefinite extent upwards, land extends downwards to the earth's center.

Easements in Water:

The nature of the right conferred by the acquisition of an easement in water is to restrict in some particular respect the enjoyment of those natural rights in water, which form part of the ordinary incidents of property. It is laid down in this act that water in general cannot be the subject matter of property" water as such must continue common by the law of nature.

Easements relating to the subterranean flow of water:

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[91] Things attached to the earth includes –
(a) Things rooted in the earth,
(b) Things embedded in the earth,
(c) Things attached to what is so embedded, and
(d) Chattel attached to earth or building.

It is probable that the legislature used this phrase in this Act in the same sense as it is defined in the Transfer of property Act. The section has added the word "permanently" to qualify the phrase "attached to the earth" with the view to exclude temporary fixtures which also would otherwise be included. So building an trees on "land" an a right of easement can be acquired for the beneficial

A man has no natural right to water under his own ground, whether collected in a well, or passing through springs, or streams in no defined or known course. Any diminution of such water by his neighbor can be treated only as **damnum absque injuria**[92] and gives no ground of action. " In the case of a well sunk by a proprietor in his own land, the water which feeds it from a neighboring soil does not flow openly in the right of the neighboring proprietor but through the hidden veins of the earth beneath the surface. No man can tell what changes these underground sources have undergone in the progress of time. It may well be that it is only yesterdays date, that they first took the course and direction which enabled them to supply the well. Again, no proprietor knows what portion of water is taken from beneath his own soil, how much he gives originally or how much he transmits only, or how much he receives, on the contrary, until the well is sunk. And the water collected by draining into it, there cannot properly be said, with reference to the well, to be any flow of water at all. In the case, therefore, of the well there can be no ground for implying any mutual consent or agreements, between the owners of several lands beneath which the law as to running stream is supposed to be built' nor, for the same reason, and any trace of a positive law be inferred from long continued

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enjoyment thereof, or in or upon, or in respect of them also, by or against the owners or persons in possession thereof irrespective of their being owners or in possession of their site.

92 It means damage, which is not coupled with an unauthorized interference in the plaintiff's lawful right. causing of damage , however substantial, to another; persons is not actionable in law unless there is also violation of a legal right of the plaintiff. This is generally so when the exercise of legal right by one results in consequential harm to the other.(the law of torts Dr.R.K Bangia, (Aallahabad: Allahabad Law Agency: 1991)at 23

acquiescence and submission, whilst the very existence of the underground springs or the well may be known to the proprietors of the soil.

Illustration *g* of section 7 states:

The right of every owner of land to collect an dispose within his own limits of all water under the land which does not pass in a defined channel, and all water on its surface, which does not pass in a defined channel.

The term stream has been defined in the Narsoo v Madanlal case[93]

Indian Easement act makes a distinction between under ground percolating water and underground stream. Underground stream means water running underground in defined or an ascertained course. Underground percolating water does not flow in a defined channel. Accordingly the rules also differ, as regards water flowing underground in a defined channels, the same rule which applies to the surface water which flows in the defined channel applies that is land owner's rights are limited by corresponding rights of other riparian rights. Every riparian owner has a right to the accustomed flow of water without material alteration in a quantity, direction, fore or temperature. No such

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93 A.I.R 1975 M.P185. The word "stream" means water running in a defined channel, and the term "natural stream" denotes a stream that flows at its source by the operation of nature, and in a defined channel, whether on the surface of the land or underground. when one uses the "stream", the idea conveyed is that the body of water flows through a defined channel, having a bed and banks on both the sides. A flow of excess rainwater, though in a body and in one direction, spread over a very large area in width without any bed or having any banks within which the flow is confined, cannot be treated as a stream. The stream thus consists of a bed, banks and watercourse.

limitation is placed in respect of ground water running in undefined and unknown channels. This is stated in the section 17 of the Indian Easement Act of 1882.[94]Section 17 of Indian easement Act deals with the limitations, which the nature of rights of easement imposes on their acquisition by prescription. The clause (a), (b) an (c) of section 17 contains the limitations as to the acquisition of the prescriptive easement relating to air, light and water.[95]

Right to underground water:

As regards water flowing through a natural watercourse having a channel at once defined and known but which is underground, the owner of the soil under which the water flows can maintain an action for diversion or obstruction if it took place under such circumstances as would have enabled him to recover if the watercourse had been wholly above ground.

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94 Section 17: Rights which cannot be acquired by Prescription:- Easements Acquired under section 15 are said to be acquired by prescription and are called prescriptive rights. None of the following rights can be so acquired
(d) a right to underground water not passing in a defined channel.

95 The reasons given are the following
(1) Air, light an water are the property of nobody in particular as long as they are free to move in any direction and in any quantity nature may lead them to .(colls v home an colonial stores, 1904 A., 170, per lord halsbury,L.C) A right to their appropriation in their free state is too vague an indefinite to be recognised as a legal right.(goodard pg. 455). Therefore a right to light, air an water does not arise as an easement until they become capable of appropriation and of being enjoyed in well-defined an ascertained method through a defined channel, which. in the case of light an is efinite aperture in a wall or buliding through Which they pass, and in the case of water, a stream, or pool or tank or any other reservoir through which it flows or wherein it collected permanently.(456)
(2) Another reason for the rules laid down therein is that the rights referred to therein are too vague an indefinite to be the subject of a proper grant an their enjoyment uncertain an unascertainable to be a proper subject of acquiescence or obstruction. So long as the light or air does not pass through a defined aperture, it is not capable of any interruption or obstruction by erecting building or raising a screen. Similarly, so long as the water is flowing underground, or on the surface of the soil at random an not in a defined channel, the owner of the soil cannot interrupt or obstruct the flow. The law, therefore, forbids the acquisition of such vague an indefinite rights by prescription.

Underground water not passing in defined channels:

By Statutory Provision. Illustration (g) to Section 7 of the Indian Easement Act of 1882 Says, "The right of every owner of Land to Collect and Dispose within his own limits of all water under the land which does not pass in a defined Channel" The term "defined Channel " is understood to be a contracted and bounded Channel, although the course of the stream may be undefined by human knowledge. The terms "collect and dispose all water under the land " suggests that person by abstracting percolating ground water may even drain so much water that his neighbor may be left without any percolating ground water even though the latter were the prior users of such water.

The arguments advanced for the acceptance of this rule was that the source and flow of these waters were so unknown and that percolating groundwater may even drain water to such an extent that his neighbor may be left without any it is impossible to formulate any legal rules governing them. This connotes that that a person by abstracting percolating groundwater even though the latter were the prior user of such water. The owner by such tapping is said not to infringe any right of his neighbor even if the effect of his action is to affect the quality of water in the neighbor's land. This common law doctrine of land ownership, which is adopted under the Easements Act, is playing havoc in the coastal regions. In coastal regions fresh groundwater supplies are susceptible to contamination by salt-water intrusion. Invasions of saline water

into fresh groundwater due to excessive withdrawal of groundwater commonly occur in coastal aquifers.

"Percolating water below the surface of the earth is a common reservoir in which nobody has any property, but which everybody has (as far as he an) the right of appropriation the whole. An this right the land owner can exercise not with standing that the stream which the neighbor owns may be diminished in consequence of the diverted or appropriate water not coming into it.[96] Again, it has been laid down that no action will lie against a man who by digging in his own land drains his neighbors land either by intercepting the flow of water percolating through the soil, or by causing water already collected on his neighbor's soil to percolate away.

In Acton v Blundell[97] the court of Exchequer was of the opinion that the owner of the surface might apply subterranean water as he please an that any inconvenience to his neighbor from so doing was damnum absque injuria, gave no ground of action.

In Chasemore v. Richards, the plaintiff, a mill owner, was using for his mill for about 60 years water from a stream, which was fed by rainfall

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96 Bradford v pickles (1895) A.C. 587.

97 (1856) 11 Ex.602. In the present case, the defendants by digging a coal pit intercepted the water, which affected the plaintiff's well, less than 20 years old, at a distance of about one-mile. Held, they were not liable. It was observed that " The person who owns the surface, may dig there in and apply all that is there found to his own purposes, at his free will and pleasure, and that if in the exercise of such rights he intercepts or drains off the water collected from underground springs in the neighbour's well, this inconvenience to his neighbour falls within description damnum abseque injuria which cannot become the ground of action".

percolating through underground strata to the stream, but not flowing in defined channels. The defendants sunk on their land and pumped large quantities of water, which would otherwise have gone to the plaintiff's stream. For this the defendants were held not liable which shows that if a man has the misfortune to lose his spring by his neighbors digging a well, he must dig his own well deeper.

The maxim was also applied by the Andhra Pradesh high court in P.Seetharamayya v. Mahaakshamma[98].

The high court held that the owner of land on or near a river has to build a fence upon his own ground to prevent damage to his ground by the over flow of river even though as a result of the same the overflowing water is diverted to the neighbors land and cause damage. This being a clear case of damnum sine injuria, the defendants were not liable for the harm to the plaintiffs.

In the case of BabajiV. Appa[99] a landowner and mill owner who had for about six years enjoyed the use of a stream, which was chiefly supplied by percolating underground water, lost the use of the stream after an adjoining owner dug on his own ground an extensive well for the purpose of supplying

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98 A.I.R1958 A.P 103 In this case the four defendants tried to ward off the flow if water into their plot from a stream by digging a trench as well as putting up a bund on their lands. The fifth defendant also, acting independently, put up bunds on her land to prevent the flow of water to her land. As a result of the act of these five defendants the rainwater now flowed to the plaintiff land causing damage to them. The plaintiff requested for a mandatory injunction to demolish the bunds and to fill up the trench on the defendants lands, for a permanent injunction preventing them from king bunds or making such trenches and also for damages amounting to Rs 300 for the loss already caused due to the low of the water to their land.

99 A. I.R1924 Bom154.

water to the inhabitants of the district. In an action brought by the landowner it was held that he had no right of action.

In Bradford corporation (Mayor of) v. Pickles the House of Lords went a step further and held that even if the harm to the plaintiff has been caused maliciously no action can lie for the same unless the plaintiff can prove that he has suffered injuria.

In this case the plaintiffs had been deriving water from the adjoining land of the defendant, which was at a higher level. The defendant sank a shaft over his own land which diminished and discolored the water flowing to the land of the plaintiffs the plaintiffs claimed an injunction to restrain the defendant from sinking the shaft alleging that the sole purpose of the same was to injure the plaintiffs as they did not purchase his land at an exorbitant price. The House of Lords held that since the defendant was exercising his lawful right he could not be made liable even though the act, which injured the plaintiff, was done maliciously. Lord Ashbourne said: " The plaintiff have no cause unless they can show that the defendants has no right to do what he is doing... The law stated by this House in Chase more V. Richards cannot be mentioned. Mr. pickles has acted his legal rights throughout and is he to forfeit those rights and be punished for their legal exercise because certain motives are imputed to him? If his motives were the most generous and philanthropic in the world, they would not avail him when his actions were illegal. If his motives are selfish and

mercenary, that is no reason why his rights should be confiscated when his actions are legal".[100]

It has again been recently reiterated in Stephens v. Anglian water authority (1987) 3 all ER379 (CA) that a landowner to exercise his right to obstruct subterranean water flowing in undefined channels under his land regardless of consequences, whether physical or pecuniary, to his neighbor and regardless of consequences, whether physical or pecuniary, to his neighbor and regardless of his motive or intention or whether he anticipated damage. On this view, it was held that a landowner was not liable to his neighbor, whose land subsided damaging her house, for extracting of underground water despite warning that it was likely to result in collapse of neighboring land. But this case also brings forward the necessity of change in law by judicial decision or legislation as modern methods of extraction of underground water without any restriction may bring down the water levels in the neighboring area to such an extent as to dry up all the wells and seriously affect life and vegetation in the neighborhood.[101]

Indian decisions on ground water, which goes in the undefined channels: Easements right in respect of underground water, which flows in unknown and undefined channels, cannot be acquired. The reason for this rule of law is that there cannot be any visible or ascertained means of knowing as to what extent,

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[100] Supra note 93, at 27.

[101] Ratanlal, Law of Torts, 316-320 (Naghpur: Wadhwa and Company Pvt, Ltd, 1988)

if at all, the accustomed supply of water allege to have been received by the claimant during the prescriptive period was affected by that percolating water which is alleged to have been cut off by the other party[102]. It was held in Mantura Bai V. Ithal Chiman[103] that the underground water not running in a defined stream cannot be the subject of prescriptive right since there will be no visible means to know how far the percolating water will be affected. Also in the case of Het Singh V. Anar Singh[104] it was held that since the right to draw water from a well is a right relating to underground waters, such right could not be acquired as prescriptive right in view of section 17(d) of the Act.

In India, the principles which regulates the rights in respect of water flowing in known and defined channels, whether upon or below the surface of the ground, do not apply to water runs in no defined channel, or merely percolates through the strata. No action, therefore, lies for the abstraction or diversion of such water[105]. It may be observed that the right to running water is properly described as a natural right just like the right to air. They are gifts of nature and no one has a right to appropriate them to the detriment of his neighbors. There is no difficulty in enforcing that right, because running water is

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102 Perumal v Ramasami chetti, 11M 16, secretary of state v zamindar of saptur 1938 MM 180) It was held by a learned judge of Allahabad high court , since right to draw water from a well is a right to underground water, no prescriptive easement for taking such water can be acquired because of illustration (d) of section 17of the At.

103 A.I.R 1954 Nag 103

104 A.I.R 1982 All 468

105 Chaitan Baral and others v Rathia Patra and others, A.I.R 1972 Orissa 53 at page 55: Manu Mangal v Dhaniram. A.I.R 1963 Orissa 97

something visible, and no one can interrupt it without knowing whether he does or does not do injury to those who are above or below him. But if the doctrine were to be applied to water merely percolating through the soil an eventually reaching some stream, the matter would require the evidence of scientific men to state whether or not there has been interruption an whether or not there has been injury. It is a process of nature; and not apparent, and therefore, such percolating water has not received the protection which water running in a defined channel has received[106].

"The mere fact that a man is injured by another's act gives in itself no cause of action; if the act is deliberate, the party injured will have no claim in law even though the injury is intentional, so long as the other party is exercising a legal right"[107].

In the case of Mohamoddans of Lonar V. Hindus of Lonar[108] the defendants has obstructed the underground water flowing to the plaintiff's land. The obstruction of water by the defendant began only fourteen feet from the sources of the springs. It was held that there is clear justification for presuming under section 114 of the Indian Evidence Act that there is a direct and defined channel known to the defendants by which the water sought to be tapped finds its way to the adjacent springs and to such cases section 7 does not apply. The

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106 Lord Ransworth in Chasemore v Richards (1859) 7 H.L.C 349:29 L.J .ex81)
107 Grant v. Australian Knitting Mills (1935)All E.R 209.
108 A.I.R 1945 Nag 106 at 110.

close proximity favours a direct connection between the flow tapped by the defendants and the springs and there is no room for the uncertainty and indefiniteness, which underlie the principles of in Bradford V.Pickles.

In another case Karathigundi Keshavbhatta V. Sunnanguli Krishna Bhatta[109] the defendant had digged a pond, which lead to the diminution in the supply of the channel water, which the plaintiff was entitled to use for his lands lower down. The pond dug by the landowner on his land had got its own springs and only a part of the water in the pond came into it by means of percolation from a defined channel flowing in his neighbours land. The court held that the land owner should not be asked to fill up or obliterate the pond altogether by a mandatory injunction directing him to cover with cement mortar only that portion of it from which water of the defined channel percolated.

Considering the need for regulating abstraction of ground water an enabling equitable use of ground water, in 1992 the Ministry of water resources, Government of India prepared a **Model Development of Ground Water (Regulation and Control) Bill 1992** for the Guidance of State Legislatures. Under the Constitution the legislative subject relating the water that is to say water supplies, irrigation, and canals, drainage and embankments, water storage, and waterpower..."is conferred upon the states as per Entry 17, List II of the seventh Schedule. The Union Government can almost guide and direct

[109] A.I.R 1946 Mad 334.

Since Law relating to Water is under the exclusive Domain of States. The 1992 Bill Empowers the State Government/Union Territory to establish a Ground Water Authority.[110] The State/Union Territory is authorized to declare any area as notified areas for the purposes of regulating extraction or use or both of Ground Water, on a report of Ground Water authority, if it is of the opinion that it is expedient to do so regulate in the interest of the public. [111]In such notified areas no person is entitled to sink a well, for any purposes either on personal or community basis, unless they have been granted the permit. However Small and marginal Farmers do not come within this provision if they desire to sink a well for exclusively personal purpose excluding Commercial use.[112] The Ground Water Authority in granting or refusing a permit shall have to regard to the certain matters.[113] The registration of the Existing users have to be within the 90 days from the date Specified in the notification provided that Ground Water Authority may also entertain any such application after the expiry of the said period if it is satisfied that user was prevented by sufficient cause from filling the application in time.[114] The Ground Water Authority has also the power to alter, amend or vary the terms of the permit. The Ground Water Authority has also

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110 Section 3 of the bill states: The State government/Union Territory shall, by notification in the official gazette, establish with effect from such date as may be specified in the notification, an Authority to be known as the Ground Water Authority.

111 Section 5

112 Section 6

113 Section 6(5)

114 As provided in 7(1)

been provided wide Power [115] but there is little chance of it being misused because the framework of the measure is clear about the purpose of regulation.

The Central Ground Water Authority has been conferred power under Section 5 of the Environment protection Act, for issuing directions and taking measures as may be necessary to regulate indiscriminate withdrawal of groundwater in the country and to issue necessary regulatory directions with a view of preserving and protecting the ground water resources. The jurisdiction of the Authority extends to the whole of India. In this context the central Ground Water Authority has prepared a bill Environment Protection Rules for The Development and Protection of Ground Water for implementing the conferred powers to protect this precious resource. To serve as a model for the states to enact Legislations. The bill is titled as **"Environment Protection Rules for the Development and protection of Ground Water 1998 "** This bill is similar to the earlier discussed bill of 1992 except with some following differences. The bill proposes to create a Ground water authority, which has the power to regulate the extraction of ground water in areas notified for the purpose. Section 7mandates license to be taken in the notified areas for a drinking and domestic purpose either on personal or community basis. Whereas the earlier bill of 1992 excluded the marginal farmers from obtaining the license, this bill does not mention about them. The landless laborers are excluded. This is the only

[115] Section 12

difference between the earlier bill and the present bill. The bill does not speak of community users nor does it speak about how to ensure that there is equal access of water, which is a basic need of every human being. Though bill speaks in section 8 about the details to be filled in for registration, the problem of priority of use still continues.

RESPONSE RECEIVED FROM THE STATES/UNION TERRITORIES

Response received from various State/Union Territory Government to the Model Bill circulated in June, 1996 is summarized below:

Sl. No.	Name of the States/UTs	Response
1.	Andhra Pradesh	Receipt of the Bill has been acknowledged.
2	Assam	Receipt of the Model Bill has been acknowledged.
3	Arunachal Pradesh	------
4	Bihar	It is felt unnecessary to make legislation to requlate over exploitation of ground water in the state at this stage.
5	Goa	The matter is being examined.
6	Gujarat	------
7	Jammu & Kashmir	The draft bill is being examined.
8	Karnataka	The matter is being
9	Kerala	---------

10	Mizoram	It is felt unnecessary to make legislation to regulate over exploitation of ground water in the state at this stage.
11	Maharastra	Suitable legislation has been enacted.
12	Meghalaya	-------
13	Manipur	--------
14	Nagaland	At this stage it may be quite necessary to enact any law.
15	Orissa	The matter is being looked into.
16	Punjab	The matter is being looked into.
17	Rajasthan	The state has forwarded at all Ground Water Act to center for comments.
18	Sikkim	Enactment of legislation to control the extraction of ground water is considered unnecessary in the State.
19	Tamil Nadu	The matter is being examined.
20	Uttar Pradesh	-------
21	Tripura	The Govt. shall seriously contemplate introduction of appropriate legislation in the state legislation Assembly.
22	West Bengal	The matter is being examined in consultation with Law Department of the State.
23	Haryana	Receipt of the Model Bill has been acknowledged.
24	Himachala Pradesh	The Government is considered to notify the bill at the earliest opportunity.

25	Madhya Pradesh	The matter is being examined.
26	Andaman & Nicobar Islands	-----
27	Chandigarh	Receipt of Model Bill has been acknowledged.
28	Dadra & Nagar Haveli	-------
29	Deman and Diu	--------
30	Lakshadweep	Necessary guidelines have been prepared and sent to Union Ministry of Home Affairs for Necessary action.
31	Pondichery	The draft ground water act has been submitted to union Ministry of Home affairs for necessary action.

In the above context, Gujarat seriously considered the necessity of introducing legislation on ground water in nine feasible districts in the first instance. In one of these nine districts, viz. Mehsana district, the rate of exploitation of ground water was found to be much higher than the rate of recharge of ground water and hence the ground water levels were also receding at an alarming rate. In quite a few tubewells, the low-head pumps had to be replaced by high-head pumps and where this was not feasible, the tubewells had to by abandoned. In absence of any Law, only the poor class of farmers owning such wells suffers the consequences of such precarious situation. The State has also taken some administrative measures to regulate development of ground water by prescribing distance and density criteria for

wells and preventing new wells in the command areas of existing wells by refusing permission to provide electric connection etc. since there is no force of law behind these administrative measures, they also hit hardly only the poor class of farmers desiring to avail of institutional finance for undertaking such activity of drilling new wells. Such farmers are denied grant of No objection Certificates by the department if their proposal of drilling new wells fail to comply the technical requirement of distance and density criteria laid down by the department and without No Objection Certificate from the department, the Bank do not grant this, the elite or the affluent class of farmers who can afford to make their own capital investment are free to drill new wells anywhere they like even if they cause undue interference to the near by wells, the yield from which thus deteriorates. The poor farmers who own wells in the neighborhood of rich farmers have to suffer because the yield of their wells gets reduced and/or water levels of their wells go deeper on account of a new well of the rich farmer within the zone of influence of poor farmers wells.

After protracted deliberations at various levels in Government and long procedural formalities essential for enacting a new law in the State, Gujarat could succeed in having a law on 'ground water' only as President's Act during 1976 and that too on the last day of the then President's rule in the State 43. This president's Act No.45 of 1976 was subsequently inserted as part XII in the Bombay Irrigation Act, 1879, operating in Gujarat. Soon after the President's rule, the responsibility of bringing in to force and implementing the above-said

President's Act, developed on the popular governments. The hesitation to take any further action has once again prevailed until this time (Octovber,'83) as the said Act has not been formally brought into the force even though detailed guidelines and rules to implement various provisions thereof were also framed in September 1977.

The Gujarat Act, which has so far remained only on paper, has following main provisions:

b) Definitions of various terms such as "artesian well" "Bore well", "Ground water", "Regional Canal Officer", "tube well" etc.

c) Areas of the State where the Act shall apply.

d) Power to regulate construction of new tube wells, bore wells, artesian wells exceeding 45 meters in depth in specified areas of the State.

e) Provisions regarding grant of a license for new wells.

f) Power to regulate drawl of ground water from existing wells.

g) Power to cancel the use of ground water and prevent waste etc.

h) Power to levy penalty for contravening the relevant provisions of the Act and the rules made hereunder.

i) Power to make detailed rules for implementation of the Act.

j) Provisions for appeals to higher authority by persons aggrieved against the orders of Regional Canal Officers etc.

The detailed rules made and published in September 1977, for implementing the parent Act in Gujarat have the following main provisions:

a) Definitions of various terms.
b) Form for making the application for a license and fees to be paid therefore are prescribed.
c) The obligation is cast on the Regional Canal officer to obtain and consider before granting a license, an opinion of technical expert viz. the geohydrologist, regarding availability and quality of ground water and the desired density of wells in specified areas.
d) A form is prescribed for granting a license.
e) A form is prescribed for furnishing information regarding existing wells to the Regional Canal Officer.
f) The authority for making appeals, the time limit and fees therefore are prescribed.

THE NATIONAL WATER POLICY 1987

The national water policy states that exploitation of ground water resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity. Ground water recharge projects should be developed and implemented for augmenting available supplies. It adheres to integrated development of ground water and surface water. It also states that

overexploitation of ground water should be avoided near the coast to prevent an ingress of seawater into sweet water aquifers.

The National Water Policy of 1987 recognizes

"Water as resources one and indivisible: Rainfall, river waters, surface ponds and lakes and ground water are all part of the system. Water is also apart of the larger ecological system".

The present existing legal regime over ground water fails to recognize this explicit fact of nature. The law fails to consider this delicate interlink ages. As management of water resources in the light of increasing demand on the resource is impossible without a concerted comprehensive management plan for all water bodies, the need of the hour is water law unambiguously addressing all the issues involved.

No management system operates in Vacuum. The same applies to the management of water resources in general and ground water in particular. Laws and regulation with respect to water, rules prescribed by the socio economic and political system are constraints that restrict the feasible action space of the water management system.

Legal constraint has often been a major obstacle to efficient management of ground water resources in India. For example: Despite the fact that ground water and surface water are interrelated, In India it has still legally been defined

as being physically disconnected. The Indian Easement act makes a fiction-based division of water into four legal classes:

(1) Surface streams which flows in the defined channel.

(2) Ground water, which flows in the defined channel.

(3) Surface water, which goes in the undefined channel.

(4) Ground water, which goes in the undefined channel.

It has been echoed that the ground water and surface are all part of the hydrologic system.[116]However our legal system, fails to understand this delicate interlinkages. But the most powerful legal constraints have been the property rights in ground water. Since water right is clubbed with land right in India, over exploitation cannot be stopped. As we all know in India land belongs to only a fraction of the upper class section, they enjoy the privilege of extracting as much of ground water as they can without being penalized. Even if some of the lower classes have some small fragment of land, they won't be having the necessary infrastructure to install water extraction mechanisms. Although the actions of individual users affect the state of ground water beyond their area, the property right protects them from bearing all of the consequences of their

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[116] Underground and surface water constitute a closely related interrelated hydrologic system, which should be managed as a single entity in order to prevent uncontrolled pollution and depletion of these resources. In particular , all quantitative and qualitative aspects, and activities of abstraction and discharge, are so interdependent that they should be managed in an integrated manner and should not be dissociated; thus they should whenever possible be under the same authority and fully coordinated. In certain countries, traditional practices and structures such as water rights and similar privileges have built up attitudes and customs, which are generally incompatible with a modern and rational water policy, and should be progressively amended. For further details *See* Herald Hobman, *Basic Documents of International Environmental Law* Volume I, (London: Graham & Trotman, 1992)

actions. Hence, wherever property rights treat ground water as private property resource, it cannot be managed efficiently, because the property rights allow unlimited use of the resource a discouraged conservation.

One of the important flaws is that the law tends to fix the rights and responsibilities in terms of the customs values at a particular time. The law tries to solidify customs so that there is stability to the system. As time passes and new priorities determine the public policies, the surprising fact is that the laws and the institutions underpinning the old policies remain the same. Thus there occurs a problem when mores, Customs, values, economic conditions, scientific understanding change but the law and its appendages remain stable.

TOWARDS A JURISPRUDENCE OF WATER RIGHTS

In a rule of Law based society, state activities are to be backed by legal considerations. Legal developments with regard to water resources have not come up to the constitutional standards or failed in meeting the challenges of rendering justice to the people as regards water. Hence it is imperative to compare the alternative legal models. This comparison has the advantage of exposing the strength and shortcomings of the legal models and may also pave a way for the change of the Legal model, which is being followed.

The Common Law Doctrine:

According to this doctrine, every Land Owner through whose land the water is percolating has an absolute right in the same. He can abstract as much percolating water he likes. His neighbor has a similar right so much so that he can by extracting percolating water leave the others man well dry. So we have a situation in India, where the De-Jure rights are not well defined. De-facto whoever has the land has an exclusive right to draw the water as much as he can. As Quoted in Acton v Blundell[117]... that the person who owns the surface may dig there in: and apply all that is there found to his own purposes sat his will and pleasure: and that if, in the exercise of such right, he intercepts or drains off the water collected from underground springs in his neighbors well, this inconvenience to his neighbor...cannot become the ground of an action".

We have seen in the previous chapter how this common Law right of every individual owner of land to exclusively appropriate ground water for his use is statutorily recognized in India by the Indian Easement Act of1882, The Transfer of property Act, The land acquisition Act, 1894.In India the Laws on Ground water is based on the common Law Doctrine. According to this Doctrine, every Landowner through whose land the water is percolating has an absolute right in the same. He can abstract as much percolating water as he likes. Though this law was well suited in the earlier times with lots of water and

[117] Supra note 98.

the science was not so much advanced. It does not fit in the present context because a farmer who may be early comer in ground water irrigation growing low water intensive crops feeling that he his enjoying private property rights to ground water may suddenly be shattered if a neighbor who had the access to well advanced water extraction mechanisms installs a bore well causing well interference resulting in permanent failure of the dug well of the poor farmer. Here we have see a situation how the modern technology has brought problems to the property rights. Though the earlier farmer is the de-facto owner to the water but the other farmer who had access to this water extraction mechanisms method became the de jure owner. Here the problem is more because water is a very fragile resource.

The Riparian Doctrine:

The doctrine of riparian doctrine applies for the underground water running in defined and known channel. It means that an upper riparian owner cannot so use the water of a stream, which has the effect of perceptibly reducing the supply of water to the lower riparian owners.

The private property right in water, only to those whose land abutted the river, was viable theory so long as people living away from the river satisfied their needs from other sources. With the rise of modern technology where water from a river can be canalized, lifted or taken through pipes to other areas, or where the whole river course itself can be diverted to some other area, the

geographical or geological connection between water and land property has been served. The customary acceptance of riparian rights was tenable in Law so long as there were no demands for justice in the distribution of water.[118] There was plenty of water for every one, there were fewer people, and moreover, people lived where there was water, water was not taken to where people lived.

In India the riparian doctrine has been rejected in one way or the other in all river Tribunals awards. To state some of the few instances where this doctrine has been rejected is the Narmada Water Disputes Tribunal, The Krishna Water tribunal, The Godavari Water Tribunal. The court also has in some cases upheld this doctrine[119].

The Prior Appropriation Doctrine:

The basic concept of doctrine of prior appropriation is that the land owner has no inherent right to use Water from sources underlying his lands but that the right to use these sources is based on priority in time of beneficial use, a compared to others using the same source, and maybe lost after the use ceases. In short it believes in "prior in time, prior in right" This rule has both advantages as well as disadvantages. The advantage of the rule is that

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118 Supra note 17, at 69.

119 *See* cases like Ramesevakkazi v. Ramgir Choudhary AIR 1954 pat 320. Hanuman Prasad v. Mendwa, AIR 1935 All 876, Jaganath v. Chandrika, AIR 1919 Oudh 74.

legitimate expectations of the prior user will not be disturbed by a neighbor's interference. In the areas where there is scarcity of water, this principle confers security to the landowner and eliminates hostile competition. The disadvantage of the rule is the have-nots won't have access to water and also this rule ignores the needs and demands o neighbors when the latter intend to use water for the same use.

The Equitable Apportionment Theory:

The equitable apportionment is based on this basic premise: Whether the claimants are individuals groups or states: Treat all claimants as equal right holders and through fair legal means apportion eh resource in accordance with their individual needs. Equity entails the notion of equality and fairness the people amongst whom the resource is to be distributed must be treated equally before the law. Fairness involves that distribution must be done in accordance with due legal process.

The national water policy, 1987 has drawn its philosophy from this doctrine. It clearly says the ground water resources should be so regulated so as to not to exceed the recharge possibilities and also to ensure social equity.

The Public Trust Doctrine:

The Public Trust Doctrine has the potential to provide a water policy to guide decision making both now and in the future Under this doctrine, all

decision makers must act in a fiduciary capacity, which holds them to a high standard of impartiality an requires them to weigh both short and long costs and benefits very carefully in the decision making process. Under this doctrine, the criteria are firmly set and the standard of performance clearly explained. Yet they contain enough flexibility to change with the circumstances, mores, values over time. This doctrine recognizes that water is the property of the people and held in trust for all citizens. Thus, the decisions to be made with respect to water must balance the impacts that these decisions will have on various groups affected by them.

The theory, which is based on the notion of trusteeship (and not property), is the only theory, which is radically different from all other theories above mentioned. In Law 'trust' can have both a wide as well as a narrow meaning. In the widest Gandhian Sense the whole state or Government is trustee of the interest and will of the people: in its narrowest sense, such as under the Indian Trusts Act, an individual or a group of individuals can be entrusted with certain Specific tasks, which oblige them, in accordance with assumed promises of the trust, are supposed to utilize the resources in some ways and not others.[120]

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[120] Chatrapathi Singh, *Water Law in India* 75 (New Delhi: Indian Law Institute, 1992).

Development and scope of Doctrine:

The public trust Doctrine originated in Roman law, which considered "air, running water, the sea and with it the shares of the Sea" as res communes omnium, the common property of all. Everyone was entitled to his or her use. With the decline of the Roman Empire, Europe retrogressed in terms of effective governmental administration and public ownership gave way to ownership by local powers and feudatories. The king claimed a private interest in the sea and sail and the Lords received by grant or took by prescription public lands. This led to excessive public inconvenience but it was not until the Magna Carta that the doctrinal trend began to shift back in the direction of protecting the public interest. The Magna Carta recognized limited pubic rights in navigation and fisheries. Through the writings of Bracton, the doctrine in United Kingdom developed into the concepts of, (i) just privatum, the right to private ownership; and (ii) just publicum, the right vested in the king to hold such property as the sea, rivers, and land below the high water mark for the benefit of the public. Though references to public rights continued for a few centuries, during the Industrial Revolution the concept of exclusive ownership flourished and the courts and legislature were willing to overlook private use and misuse of common property and resources to foster industrial growth and economic prosperity.[121]

[121] Lavanya Rajamani, "Doctrine of public interest: A tool to ensure effective State management of natural resources",38(1-4) *Journal Of The Indian Law Institute* 74 (1996).

Conceptual Support for Public trust Doctrine

Public rights under the Public trust doctrine are entitled to special judicial attention and protection. This special status can be attributed to three historical beliefs:

(1) Certain interests are so intrinsically important to every citizen that their free availability tends to mark the society as one of citizens rather than as serfs. These interests have to be protected against acquisition by individuals or groups.[122]

(2) Certain interests are so particularly the gifts of nature's bounty that they ought be preserved for the whole of the populace.[123]

(3) Certain uses have a particularly public nature that makes their adaptation to private use inappropriate.[124]

Outline of Public Trust Doctrine – Its present scope:

The modern revival of this traditional doctrine took place in America. Through a series of nineteenth century cases jurists incorporated the public trust doctrine into American common Law. In the Land mark case, Illinois Central Railroad V. Illinois[125] the opined: the state can no more abdicate its trust over property in which the people are beneficially interested... than it can

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[122] L.Joseph Sax, "The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention",68 *Michigan Law Review* 471(1970).

[123] Ibid. 453.

[124] Ibid. 485.

[125] 146 U.S 387 (1892)

abdicate its police power. The court also recognized the "public trust doctrine as a "trust connected with public property and property of a special character" implying thereby that the doctrine is open ended. Today any natural resource or public property, which is of special consequence, can be impressed with public trust. The California supreme court recognized as "one of the most important public uses the need to preserve lands in their natural state to serve as ecological units for scientific study, as open space, and as environments which provide food and habitat for birds and marine life and which favorably affect the scenery and climate of the area.[126] It is the expansion of this doctrine in these two aspects that has made the public trust doctrine an extremely attractive environmental remedy.[127]

In the case of M.C Mehta V. union of India[128], the court has held that Public Trust Doctrine is part of the Indian Law. This view taken by the Supreme Court to squeeze in public trust doctrine is a welcome step. The publics trust doctrine has been to some extent incorporated in our new bill on ground water[129].

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126 Marks V.Whitney, 6 Cal. 3d 251at 259-60 (1971).

127 Supra note 118, at 75.

128 (1997)1 SCC 388.

129 The first model bill on Ground water was passed in the year 1992.The state of Gujurat has passed this Law. The new bill on ground water is titled as "Environment protection rules for the development and protection of Ground Water" 1998.

INTERNATIONAL INSTRUMENTS

INTERNATIONAL COVENANT ON ECONOMIC, SOCIAL AND CULTURAL RIGHTS:

This covenant was adopted by the general Assembly on 16th December 1966. Economic, social and cultural rights are an integral part of International rights Law.

The covenant states that all people may, for their own ends, freely dispose of their natural wealth and resources without prejudice to any obligations arising out of international economic cooperation, based upon the principle of mutual benefit, and International law. In no case may a people be deprived of its own means of subsistence[130].

The part II of the covenant cast duty on the state party to undertake steps, individually and through international assistance and cooperation, especially economic and technical, to the maximum of its available resources, with a view to achieving progressively the full realization of the rights.[131]

The state has to ensure the equal right for men and women to the enjoyment of all economic, social and cultural rights.

The covenant also talks of the right of everyone to an adequate standard of living for himself[132]

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130 Article1(2)
131 Article 2
132 Article 11

The Limburg Principles on the Implementation of the International Covenant on Economic, Social and Cultural Rights:

The Limburg principles paved the way to examine the nature and scope of the obligations of state parties to the International Covenant on Economic, social and cultural rights.

The part B which deals with interpretative principles specifically relating to part II of the covenant

It clearly states that state parties. Have an obligation to begin immediately to take steps towards full realization of the rights contained in the covenant.[133]

At the national levels states parties shall use all appropriate means, including legislative, administrative, judicial. Economic, social and educational measures, consistent with the nature of the rights in order to fulfill their obligations under the covenant.

It also recommends[134] to take legislative measures where the existing legislation is in violation of the obligations assumed under the covenant.

The Limburg principles clearly say that in determining whether adequate measures have been taken for the realization of the rights recognized in the

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133 Article 16
134 Article 18

covenant attention should be paid to equitable and effective use and access to the available resources.[135]

Agenda 21

Agenda 21 is one among the three non-binding instruments opted by UNCED[136]. It represents a blue print for the 21st century in the field of environment. The preamble of Agenda 21 contains the following of the instruments ambitious goals. " Agenda 21 addresses the pressing problems of today and also aims at preparing the world for the challenges of the century.[137]

Agenda 21 consists of four sections: section I Social and Economic dimensions; Section II, conservation and Management of resources for Development; Section III, Strengthening the role groups; and Section IV, means of Implementation. Each section addresses one of the broad cross- cutting themes of the Rio declaration.

The basic Approach of Agenda 21 to Fresh water problems:

Agenda 21's fresh water Programmes is contained in section II, " Conservation and management of resources for Development. Section II deals with fourteen different sectors or problems in Chapters 9-22.Water is dealt with

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135 Article27

136 The other two instruments are the Rio Declaration and the principle for a global consensus on the management, conservation and sustainable development of all types of forests.

137 Luige Campiglio, *The Environment after Rio International Law and Economics.* (London: Graham & Trotman, 1994).

in chapter 18, which is entitled, "protection of the quality an supply of fresh water resources; application of integrated approaches to the development, management an use of water resources. Chapter 18 contains seven program's areas, which are as follows:

(1) Integrate water resources development and management;

(2) Water resources assessment;

(3) Protection of water resources, water quality and aquatic ecosystems;

(4) Drinking-water supply and sanitation;

(5) Water for sustainable urban development;

(6) Water and sustainable food production and rural development; and

(7) Impacts of climate change on water resources.

The introduction states the "general objective" of the water programme as being "to make certain that adequate supplies of water of good quality are maintained for the entire population of this planet, while preserving the hydrological, biological, and chemical functions of the ecosystems, adapting human activities within the capacity limits of nature an combating vectors of water related diseases".

It further notes that the " wide spread scarcity, gradual destruction and aggravate pollution of freshwater resources.... Demand integrated water resources planning and management ", which "must over all types of interrelate fresh water bodies, including both surface water resources an ground water,

and duly consider water quantity an quality aspects. The introduction emphasis the nee to take into account the many different activities that place demands upon the water resources, giving as examples "water supply and sanitation, agriculture, industry, urban development hydro power generation, inland fisheries transportation recreation, [and] low an flat lands management ..... Thus agenda 21 recognizes the importance of preserving natural processes and lays stress on the need to manage water resources in an integrated manner.

The U.N Declaration on the Right to Development:

In October 1986, the African Charter on human and people's rights came into force. One of its, most noteworthy features is the incorporation of the Right to Development as a "peoples" right. It says "all people shall have the right to their economic, social and cultural development with due regard to right to their freedom and identity and in the equal enjoyment of the common heritage of mankind "and that "states shall have the duty, individually and collectively to ensure the exercise of the right to development".

Later that year in december1986, the UN General Assembly adopted the Declaration on the Right to Development almost unanimously with the sole dissent of the United States of America The Declaration as adopted was substantially based on a Yugoslav drat which itself reflected a consensus amount the governmental experts from the non-aligned countries in the UN

Working Group. The core conception of the Right to Development is the principle of balance between civil and political rights on the one hand and economic, social and cultural rights on the other. The western bloc wanted priority to b given to the former category of rights and the Eastern bloc sought priority for the latter.

The non-aligned bloc struck a balance by making the Declaration record that the two sets of rights are interdependent and indivisible and that equal attention and urgent consideration should be given to both sets of rights.

The Right to Development has rightly not been defined by the Declaration. A definition at this stage would present to borrow Upendra Baxi's memorable phrase " the development of the Right to Development". Some idea of what the Right means is furnished by Judge Kaba M'Baye, now a Judge of the International Court of Justice an the First President of the Senegalese Supreme court. While first articulating the concept in 1971 as the right of all men he said, " each has the right to live better". Almost contemporaneously Professor Carillo Salcedo of Spain, in a series of lectures on the international law of development said: " The right to development a right of States and peoples must unavoidably be founded on the recognition of every man to a free and worthy life in his community. Every human being has the right to live, which implies the right to aspire to an increasingly better existence. The right to a full individual development which has made it possible to consider the right to

development as an essential human right serves as a foundation of, and implies, also, the right of peoples as underdeveloped nations to development. His or her progress is only justified as long as development serves to improve the economic, social and cultural level of every person."[138]

The U.N Declaration on the Right to Development requires that State parties have an obligation to undertake all necessary steps for the realization of the right to development. It also requires that the State Parties should ensure inter alia equality of opportunity for all in their access to basic resources, education, health services, food, housing and employment.[139] Thus equitable access to the basic resources in a country forms the integral part of the right to development.

States have the primary responsibility for the creation of national and international conditions favorable to the realization of the right to development.[140]

It also requires the state to cooperate with a view to promote, encourage and strengthen universal respect for and observance of all human rights.[141] The Right to development includes that the state should undertake, at the

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[138] Raju Ramachandran, "The Right to Development: Paradigm-Shift in Human Rights",4 SCC 9-10 (1990).

[139] Declaration on the Right to development 1986,Article 8(j)

[140] Ibid, Article3

[141] Ibid, Article 6

national level, all necessary measures for the realization of the right to development and shall ensure, inter alia, equality of opportunity for all in their access to basic resources, education, health services, food, housing, employment and the fair distribution of income.[142]

How far these ideals been followed in the legislative policies towards utilization of the natural resources in India? Development should not mean development of the elite and the underdevelopment of the poor. This is exactly the situation, which is prevailing in India. There is no drinking water in most of India's villages. Farmers do not have enough water for irrigating their crops. Under world bank prescriptions water is being privatized and farmers are being asked to compete with multinationals corporations for access to water markets. These markets in water will create a new Zamindari in which large corporations and agribusiness enterprise will have monopoly control over scarce water resources. Water is in the exclusive domain of the upper strata of the society as land is held only by a few sections of the society. The most important factor is that women are the worst sufferers because of the existing situation. Bina Agarwal[143] in a study of the interrelationships between gender, environment and poverty in rural India has listed out some of these consequences. Since rural women are the main gatherers of fuel, fodder and water, it is primarily their working day that lengthens with the depletion of and reduced access to forests,

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[142] Ibid, Article 8

[143] Supra Note 5, at 112.

water and land. The necessary steps to combat this issue are not taken even though the government knows that water crisis exist in India. (Water markets are a live example).

We also saw on the chapter on economics of Ground water that with the implementation of New economic policy, there has been switch over to cash crops which further accentuates the inequality among the farmers to access water. This competing claim (as they are grown by private companies and big land lords) has put further pressure on this fragile resource.

The Judiciary seems to be the only ray of hope for this resource. Article 21 was liberally interpreted in the case of Attakoya Thangal case where the court held that right to life includes right to sweet water. The Judiciary has squeezed in some of the provisions of the International Instruments. [144]

[144] The judiciary has made use of Article 16 of the Limburg principles , which states that at the national level states parties shall use all appropriate means, including legislative, administrative, and judicial. Economic, social and educational measures , consistent with the nature of the rights in order to fulfill their obligations under the covenant. Article 11 of the covenant on economic, Social and Cultural Rights which states about the right of everyone to an adequate standard of living for himself.

CONCLUSION AND RECOMMENDATIONS

"Many of the wars this century were about oil, but those of the next century will be over water" so said World Bank vice bank president Dr. Ismail Seragaldin in a 1995 interview to Newsweek. The water crisis, denying millions of people safe water is already existing in India. The poor management of water resources became a nightmare this year in Gujarat, Rajasthan, and Andhra Pradesh. No one denies the importance of water to human civilization, although to paraphrase the American writer, Joan Didion, it is especially important to those who do not have it. Water being the most basic among the basic needs is becoming available to fewer and people who can afford it.

The thesis "water crisis in India and the Bias of the Law" examines one aspect of fresh water crisis aggravated through well-interference problem. This thesis revolved around the core issue that is "whether the said problem is aggravated by the inadequacies in the legal regime?"

Ground water exploitation has increased exponentially over the years. The first chapter examines the factors shaping the demand and supply of ground water. It clearly shows that the demand for ground water outweighed the supply. Even though Water was considered to be free good and was once used by everyone, at present has become the free good available only to the creamy section of the society. As a result the Rich landlords have become the water

lords of our country. This situation has lead to ground water resource into a common property resource among the rich and accelerated the iniquitous access to this resource.

Karnataka has a geographical area of 1,92,000 Square kilometres. The occurrence and distribution of rainfall in the state is highly erratic. The erratic rainfall leads to uneven distribution of surface water. As a result of this, the use of groundwater has increased manifold. In many districts intensive development of ground water has lead to critical situations resulting in problems like declining ground water levels, shortage of water supply, well interference problem etc. This has made the authorities to declare the Taluks as dark, grey and white areas depending on the overexploitation. Irrigation wells are increasing at an alarming rate of ten percent in some places in the hard rock area of Karnataka. The state of Karnataka has around ten lakh irrigation wells, however there are no reliable estimates about the number of functioning wells... Does the increase in the number of wells connote wider access to the ground water resource? This question was answered by analysing a case study of what is known as the problem of well interference done at Madhugiri Taluk of Tumkur district. This study found that among the farmers who have been affected, 70% belonged to the group of small farmers. The study revealed that an increase in the number of wells does not connote equitable distribution of water On the other hand it makes it clear that the brunt of the well failures were faced by the small farmers

and the lion share of the benefit due to the increase in the number of wells went to the rich farmers.

The iniquitous distribution of Ground water has been accentuated by the Legal Regime which is biased towards to the Rich People. The law, which is based on Common Law Doctrine is of colonial origin. This Doctrine treats water a chattel to land. The same philosophy informs The Indian Easement Act, The General Clauses Act, and the Transfer of property Act. As long as water is treated as chattel to land the inequitable access to water can be stopped.

Another important lacunae is that the Indian Easement Act makes fiction based distinction of ground water and surface water flowing in the defined channel from water that flows undefined channel. For surface and ground water, which flows in the defined channel a landowner does not have the exclusive right to appropriate as much water as he wants. In this case the rule of Damnum sine Injuria does not apply whereas in the case of surface and ground water which does not flow in a defined channel, the landowner has the exclusive right to appropriate as much water as he wants. This is clearly stated illustration g to section 7 of Indian easement Act. This is one of the important reason for the well interference problem where the study found that some of the farmers buying water from others, some were literally thrown out of the well irrigation because that could not afford to go deeper. Those who could afford to go deeper did not had to suffer from well interference problem. The small

farmers who were affected by the well interference problem were denied the basic among the basic need which, is also recognised by the international instruments like International covenant on Economic, social and cultural rights, the U.N Declaration on the Right to Development, Agenda 21.

WHERE DO WE GO FROM HERE?

No management system operates in vacuum. Legal constraint has been a major obstacle to efficient management of ground water resources in India. One of the important flaws is that the law tends to fix the rights and responsibilities in terms of the customs, values that suit to the particular time. As time passes and new priorities determine the public policies, the surprising fact is that the laws and the institutions underpinning the old policies remain the same. Thus there occurs a problem when mores, customs, values economic conditions, scientific understanding change but the Law and its appendages remain status quo.

The possible solution for the current crisis is to change the outdated common law Doctrine. Instead we should adopt the Public trust doctrine. The judiciary has already taken a great step by stating in case of Kamalnath, that the Public Trust Doctrine is Part of the Indian Law. Some suggestions in this regard, however are the following. How these suggestions should be incorporated into the law is indeed a worthwhile task but not taken up in this dissertation.

(1) Both surface and Ground water should be managed in an integrated manner. The fiction based division of ground water and Surface water into defined channel and undefined channel does not hold good in the present time with the advent of remote sensing. The author strongly feels it is wrong to classify water as ground water and surface water. Ground water surface water, ponds, lakes etc are all part of one common water system. Water is also part of the larger ecological system. While, the National water policy recognises these delicate inter linkages, the Indian Easement Act, the Bills on ground water, fails to do so. This Legal constraint has become a major obstacle to efficient and equitable management of ground water in India.

(2) Licensing System, which is adopted in the Model Bill of 1992, should be adopted in a way that is not harmful to the small farmers. At present since the spacing norms are enforced through financial institutions, the well off farmers who can afford to finance their own investment and make use of some what costlier diesel engines remain completely uncontrolled by them. The spacing norms, which came in recently, has excluded the poor who are normally the late comers in the game.

(3) In the area of scarcity of water, the government who will be the trustee of the people can take the help of remote sensing to prescribe the particular type of vegetation, which would suit the scenario.

(4) Last but not least, there should be priority of users within the priority of use, which will be prescribed by the Law.

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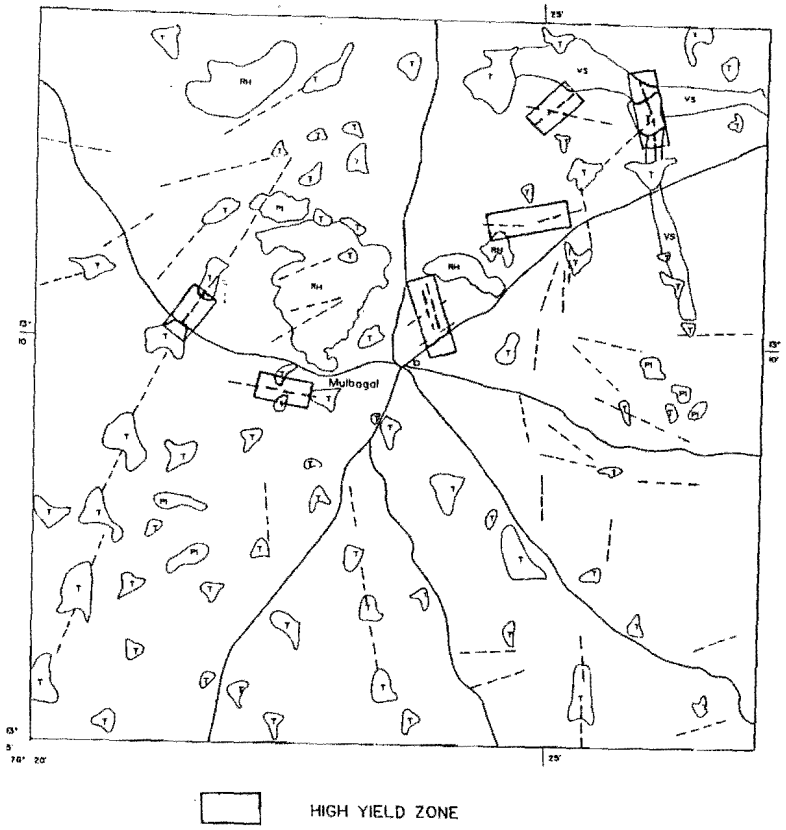
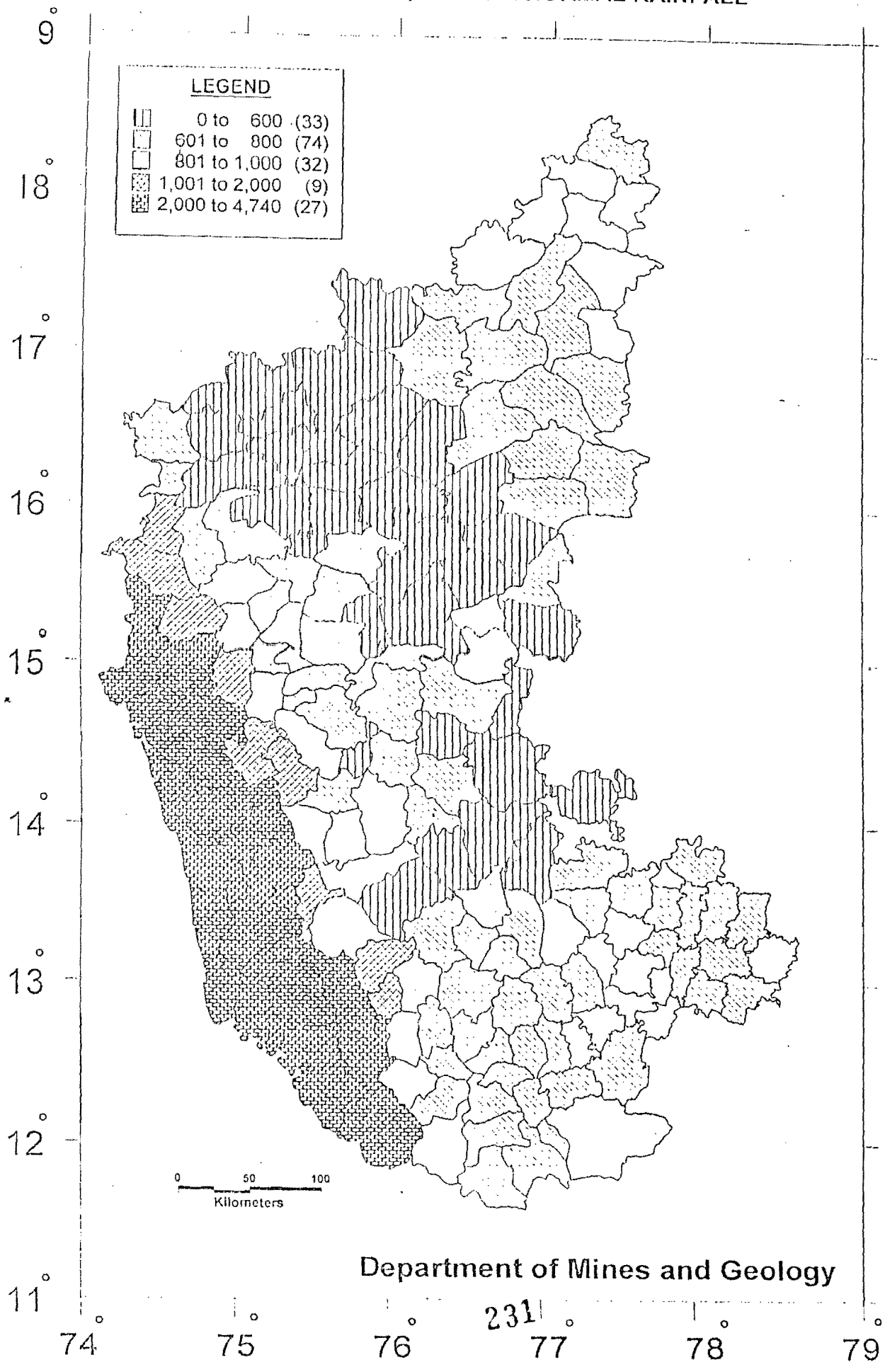


Groundwater potential zones around Mulbagal town of Kolar District and surroundings.

KARNATAKA STATE, ANNUAL NORMAL RAINFALL



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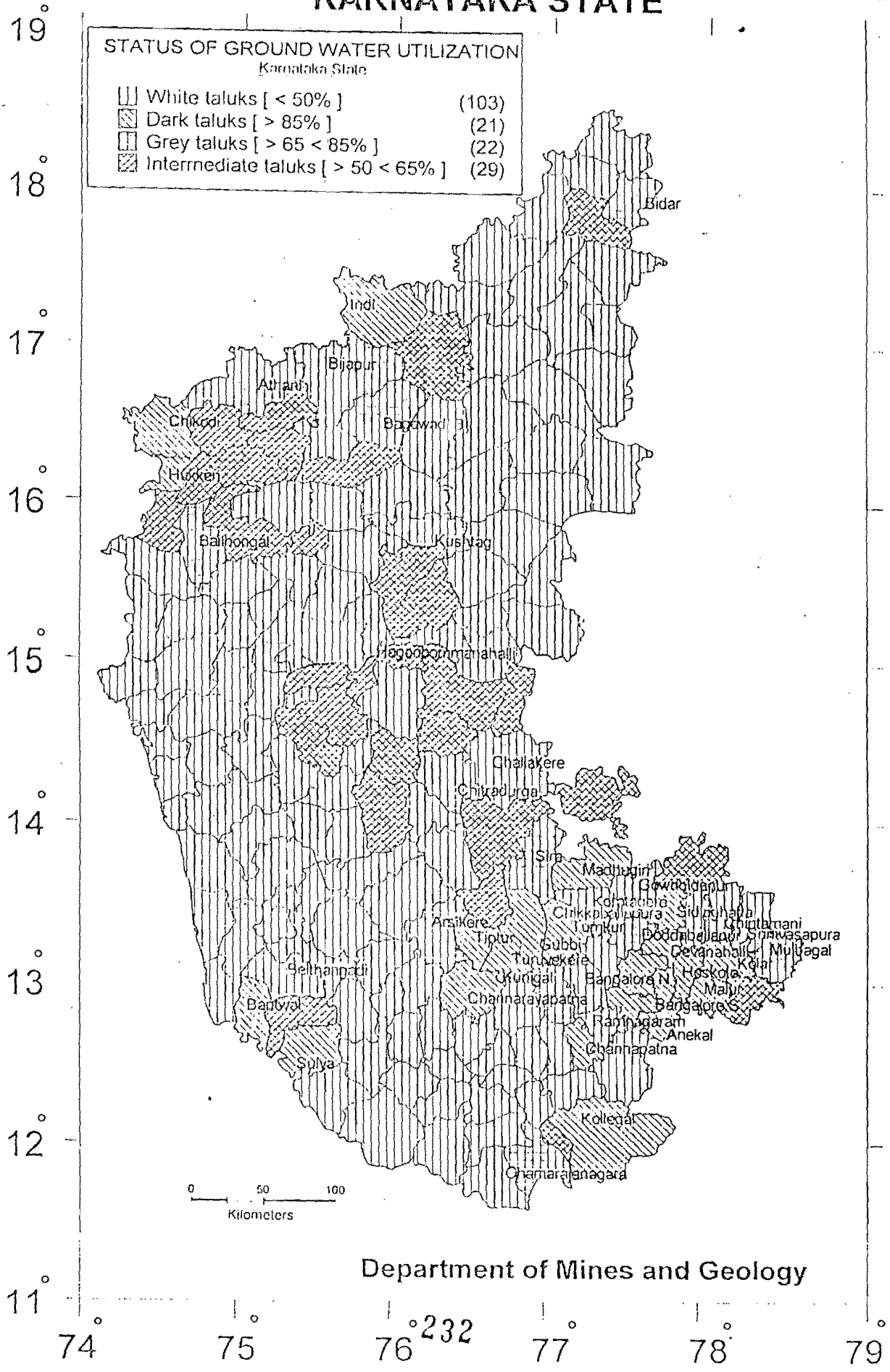
KARNATAKA STATE

MAP -



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IRRIGATION MAP OF KARNATAKA

MAP-1

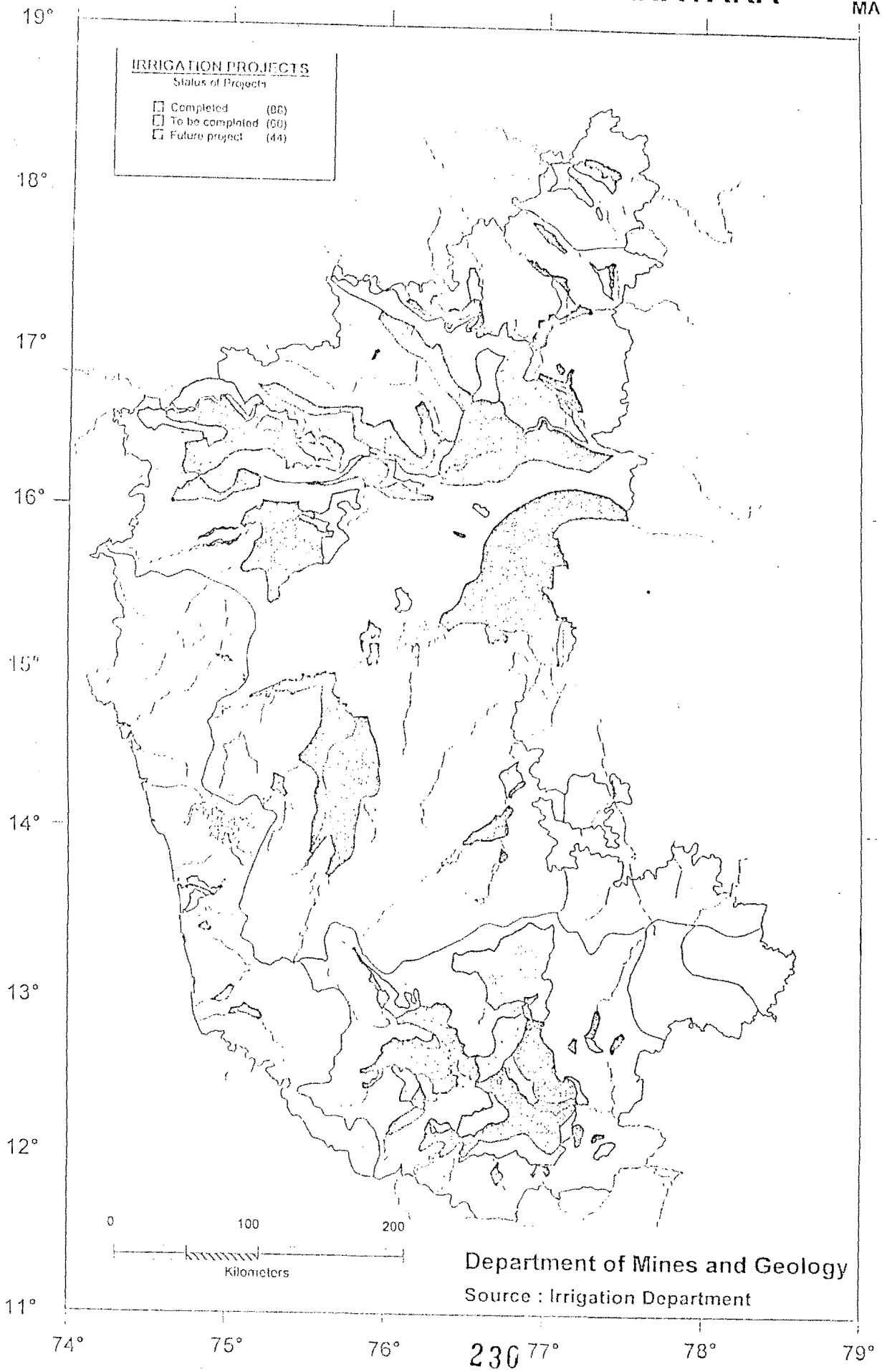

Table - 1A

DROUGHT PRONE TALUKS OF KARNATAKA
(IRRIGATION COMMISSION - 1972)

Sl. No.	Station	Sl. No.	Station
1.	ANEKAL	45.	MALAVALLI
2.	CHANNAPATNA	46.	NAGAMANGALA
3.	DEVANAHALLI	47.	PANDAVAPURA
4.	DODDABALLAPURA	48.	ARASIKERE
5.	HOSAKOTE	49.	CHANNARAYAPATNA
6.	KANAKAPURA	50.	HOLENARASIPURA
7.	MAGADI	51.	BELLARY
8.	NELAMANGALA	52.	HADAGALI
9.	RAMANAGARA	53.	HARAPANAHALLI
10.	BAGEPALLI	54.	HOSPET
11.	BANGARAPET	55.	HAGARIBOMMANAHALLI
12.	CHIKKABALLAPURA	56.	KUDLIGI
13.	CHINTAMANI	57.	SANDUR
14.	GAURIBIDANUR	58.	SIRUGUPPA
15.	GUDIBANDA	59.	DEODURGA
16.	KOLAR	60.	KOPPAL
17.	MALUR	61.	KUSHTAGI
18.	MULABAGILU	62.	LINGSUGUR
19.	SRINIVASAPURA	63.	YELBURGA
20.	CHIKKANAYAKANAHALLI	64.	AFZALPUR
21.	GUBBI	65.	ALAND
22.	KORATAGERE	66.	CHINCHOLI
23.	KUNIGAL	67.	CHITTAPUR
24.	MADHUGIRI	68.	GULBARGA
25.	PAVAGADA	69.	JEVARGI
26.	SIRA	70.	SEDAM
27.	TIPTUR	71.	SHAHAPUR
28.	TURUVEKERE	72.	SHORAPUR
29.	CHALLAKERE	73.	YADGIR
30.	CHITRADURGA	74.	BADAMI
31.	DAVANAGERE	75.	BAGALKOTE
32.	HIRIYUR	76.	BAGEVADI
33.	HOLALKERE	77.	BIJAPUR
34.	HOSADURGA	78.	BILGI
35.	JAGALUR	79.	HUNGUND
36.	MOLAKALMURU	80.	INDI
37.	CHAMARAJANAGARA	81.	JAMKHANDI
38.	GUNDLUPET	82.	MUDDEBIHAL
39.	HUNSUR	83.	MUDHOL
40.	KOLLEGAL	84.	SINDGI
41.	NANJANGUD	85.	GADAG
42.	PERIYAPATNA	86.	MUNDARGI
43.	T.NARASIPURA	87.	RANEBENNUR
44.	KRISHNARAJAPET	88.	RON

Table -3

GROUNDWATER STATUS AS ON 31.12.1994

Sl. No.	Name of the District	Recharge Net (HaM)	Total No. of Wells	Draft Net (HaM)	Balance Recharge (HaM)
A	B	C	D	E	F
1.	Bagalkot	44796	21313	17757	27039
2.	Bangalore (R)	52772	30834	30822	21950
3.	Bangalore (U)	12193	12957	13959	1761 (-)
4.	Belgaum	95315	72425	50782	44533
5.	Bellary	50280	14075	14072	36208
6.	Bidar	44952	20255	14801	30151
7.	Bijapur	52248	44631	32679	19569
8.	C.R.Nagar	23969	14045	12988	10981
9.	Chickmagalur	50145	7429	7573	42572
10.	Chitradurga	43822	22256	22689	21133
11.	Dakshina Kannada	52720	44572	29927	22793
12.	Davanagere	47201	17476	19321	27880
13.	Dharwar	23375	3047	3217	20158
14.	Gadag	23675	7991	7101	16574
15.	Gulbarga	83409	22052	13523	69886
16.	Hassan	42364	14720	15982	26382
17.	Haveri	41454	12099	13861	27593
18.	Kodagu	14074	303	252	13922
19.	Kolar	68325	54558	54214	14111
20.	Koppal	51699	14031	14327	37362
21.	Mandya	67016	10894	8965	58051
22.	Mysore	45078	8927	6775	38303
23.	Raichur	39430	11251	7840	31590
24.	Shimoga	109128	6435	5891	103237
25.	Tumkur	75904	61886	60318	15586
26.	Udupi	53112	17501	11067	42045
27.	Uttara Kannada	66652	8779	5438	61214
	Total	1375683	576682	496141	879462

Table - 4

STATUS OF GROUND WATER DEVELOPMENT OF THE TALUKS WHICH ARE CONSIDERED AS CRITICAL BLOCKS

Sl. No.	District	Dark Taluks > 85%	Grey Taluks > 65 to < 85%	Intermediate Taluks > 50 to < 65%
1	2	3	4	5
1.	Bangalore (Urban)	1. Anekal 2. Bangalore North 3. Bangalore South	1. Doddaballapur 2. Ramanagar	
2.	Bangalore (Rural)	1. Channapatna 2. Devanahalli 3. Hoskote		
3.	Belgaum	1. Chikkodi 2. Hukkeri	1. Athani 2. Bailhongal	1. Belgaum 2. Gokak 3. Raibagh 4. Soundathi
4.	Bellary		1. H.B.Hally	1. H.Hadagali 2. Kudligi
5.	Bidar		1. Bidar	1. Humnabad
6.	Bijapur	1. Indi	1. Bagewadi 2. Bijapur	1. Mudhol 2. Jamkhandi 3. Sindhagi
7.	Chitradurga		1. Challakere 2. Chitradurga	1. Hiriyur 2. Jagalur 3. Molakalmuru
8.	Dakshina Kannada	1. Bantwal 2. Sulya	1. Belthangadi	1. Puttur
Sl. No.	District	Dark Taluks > 85%	Grey Taluks > 65 to < 85%	Intermediate Taluks > 50 to < 65%
9.	Hassan	1. Channarayapatna	1. Arasikere	
10.	Kolar	1. Chikkaballapur 2. Kolar 3. Malur	1. Chintamani 2. Gowribidanur 3. Mulbagal 4. Sidlaghatta 5. Srinivasapur	1. Bagepalli 2. Bangarpet 3. Gudibande
11.	Koppal		1. Kushtagi	1. Koppal 2. Yelburga
12.	Tumkur	1. Gubbi 2. Madhugiri 3. Tiptur 4. Tumkur 5. Turuvekere	1. Kunigal 2. Sira	1. Chikkanayakanahalli 2. Pavagada

Sl. No.	District	Dark Taluks > 85%	Grey Taluks > 65 to < 85%	Intermediate Taluks > 50 to < 65%
1	2	3	4	5
13.	Davangere			1. Davangere 2. Channagiri
14.	Bagalkot			1. Bagalkot
15.	Chamarajanagar	1. Kollegal	1. Chamarajanagar	1. Yelandur
16.	Haveri			1. Hirekerur 2. Ranebennur 3. Haveri
17.	Gadag			1. Naragund

TABLE 4.1: Particulars of holding size and well command area in HWIV and LWIV (ACRES)

	Tank Command Village		Non Tank Command village	Low Well Interference Village	
	Small farmers	Large farmers	Small farmers	Small farmers	Large farmers
	n = 21	n = 21	n = 40	n = 27	n = 14
Net cropped area	3.8	10.3	4.9	5.39	7.92
Dry land	1.28	2.54	3.25	2.42	1.5
Net area under well command (Before interference)	2.53	7.76	1.65	2.97	6.42
Gross area under well command (After interference)	49.25	307.25	80	101.75	133.75
Gross dry land area	26.88	53.34	130	65.34	21
Gross cropped area	76	361	210	167	155
Gross cropped Area per farm	3.62	17	5.25	6.18	11
Gross area under well command per farm (After interference)	2.34 (62)	14.63 (142)	2 (41)	3.76 (70)	9.55 (21)
Gross irrig area per well	1.11	4.73	0.76	2.48	3.82
Gros irrig area per functional well	3.78	8.53	3.2	3.28	6.68

Note:Figures in the parentheses indicates percentage of gross area irrigated under well command

Table 4.2 : Distribution of different types of wells

CENTRAL GROUND WATER AUTHORITY

ENVIRONMENT PROTECTION RULES FORTHE DEVELOPMENT AND PROTECTION OF GROUND WATER

NOTIFICATION

S.O.....In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986) and with a view to regulate indiscriminate boring and withdrawal of ground water in the country and to issue necessary regulatory directions with a view to protect and preserve ground water, the Central Government hereby make the following rules, namely :-

1. (1) These rules may be called the **Ground Water (Development & Protection) Rules, 1998**

(2) These rules shall come into operation on the date to be notified for the purpose in the Official Gazette,

(3) These rule shall apply to whole of India and or areas as specifically notified from time to time.

2. **Application of rules:**

(1) The rules shall be applicable to all aspects of mangement of the ground water resources including their prospecting, assessment, development, protection, conservation and augmenting, etc.

(2) These rules shall also apply to all users and suppliers of ground water (persons, agencies or organisations, whether government or private) involved in the abstraction and / or supply of ground water in any manner and for any purpose,

(3) These also apply to all activities related to the protection and conservation of ground water from pollution and depletion.

(4) These rules shall be applicable to the following specific aspects / cases

(i) extraction of ground water for any use, except for drinking and domestic purposes and matters connected therewith.

(ii) Clearance of well construction

(iii) Control on disposal of untreated / treated urban and industrial wastes,
(iv) Pumpage of ground water within limits laid by the Authority
(v) Planning and implementation of projects for enhancing recharge ground water,
(vi) Reassessment of ground water resources as per directions of the Authority
(vii) Performance of business of drilling of wells,
(viii) Sale of ground water,
(ix) Registration of ground water abstraction structures,
(x) Supply of data on demand on the structure, pumpage and use of ground water, etc.
(xi) Change in the horse- power of the pump without approval.
(xii) Management of ground water in coastal aquifers,
(xiii) Clearance of solid and liquid waste disposal sites,
(xiv) Clearance for setting up ground water based industries,
(xv) Conservation and artificial recharge of ground water including roof-top run off harvesting and storm water recharge etc.
(xvi) Degradation in quality of ground water on account of ground water extraction.

(5) Any other matter as may be considered expedient may be notified by the Authority in a similar manner as at sub rule (4) above.

3. Definitions

(a) 'Act' means the Environment (protection) Act, 1986.

(b) 'Authority' means the Central Ground Water Authority.

(c) 'Chairperson' means Chairperson of the Authority.

(d) 'Member' mean a Member of the Authority

(e) 'Concerned Departments' means the organisations, agencies, departments of the Central and State governments dealing with ground water investigations, development, assessment, protection, conservation and management of ground water and matters connected therewith.

(f) 'Authorized Officials' means officer/ officials of the Concerned Departments of the Central and State governments authorized to perform functions relating to any or all aspects described in (f) above.

(g) 'Ground Water' means the water existing in aquifers beneath the ground surface or discharged from below the ground surface on the earth or rivers.

(h) 'Sink' with all its grammatical variations and cognate expression in relation to a well includes digging ,drilling or boring of new well or an existing well and deepening carried to the existing wells,

(i) 'User' means the person or persons or an institution including a company or an establishment , whether Government or not who or which extract, use and / or sell ground water for any purpose including domestic use made either on a personal or community basis,

(j) 'Well' means a structure sunk for the search or extraction of ground water by a person or organisation or agency and shall include open well, dugwell, borewell and infilteration gallery or any of their combinations or variations. However the wells sunk by the authorized officials of the State or Central Governments for carrying out scientific investigations, exploration,augmentation, conservation, protection or management shall be exempted from the application of these rules .

(k) 'Notified Area' may be defined as the area where any activity affecting any aspect of ground water has been restricted / prohibited by the Authority.

(l) "Agency" means a company, an industry, municipal body, government organisation or any other body that is performing or participating or is required to perform or participate in any activity covered under this Act or rules made thereunder.

4. Functions of the Authority:

The Authority in pursuance of the directions contained in section 2(iii) of the notification issued under S.O.38(E) dated the 14 January, 1997 constituting the Authority, lays down the following detailed functions to be performed by it:

(1) Notifying areas for the protection and conservation of ground water from pollution and depletion.

(2) Regulating construction of wells, borewells, tubewells, and any other ground water abstraction structure.

(3) Issuing of guidelines for conservation of ground water

(4) Give directions for recirculation of water in industry including hotel, tourism and related areas.

(5) Issue directions for the protection of ground water consequent to human interference in natural processes.

(6) Promulgate directions for monitoring the behaviour of ground water system and quality regime ,

(7) Formulate guidelines for augmenting ground water recharge, conservation of water and recharge of treated urban waste water using conservation of water using roof-top and storm run-off rechargeof the treated urban water etc.

(7) Direction to identify and monitoring of ground water vulnerable zones.

(8) Technical clearance of schemes by the State governments, financial and other Agencies,

(9) Issue guidelines for maintenance of ground water levels at minimum depth below ground in different areas.

(10)Issue directions and take measures for the implementation of the above guidelines and all matters considered relevant in this connection.

(11)Formulate and issue guidelines for data collection and setting up of Information Centers at the various levels.

(12) Recommend norms for the allocation of ground water for the various sub-sectoral uses like domestic, irrigation and industry and suggest interse priorities.

(13)Issue direction for the identification and monitoring of ground water vulnerable areas.

(14)Issue directions for the control of wastage of water in artesian wells.

(2) Any other function as may be considered expedient may be notified by the Authority in a similar manner as at sub-rule (1) above.

5. **Guidelines for the declaration of areas, industries, processes or an activities as 'Notified'**

1. The Authority may declare any area and / or an industry, a process or an activity as "Notified" covered by the under-mentioned guidelines.

(1) Areas falling in open river basins (basins flowing to the sea) where an average fall of about 50 centimeters (cm) per year has been recorded *with*

a cumulative decline of more than 4 meters (m) over a period of 10 (te years inspite of the rainfall being normal

(2) Areas where a total fall of more than 4 m has been observed over period of three consecutive years due to changes in natural phenomenon i rainfall quantity and / or pattern and that has affected the water level water supply wells leading to scarcity conditions.

(3) Areas falling in inland basins where a fall of more than 4 meters h been recorded over a period of ten years. (This shall particularly apply areas having saline water at shallow depths and where the wat recharged every year floats as a lens. The fall in arid / semi-arid are has been observed to be of the order of 5 m)

(4) Ground water abstraction structures used for drinking and domestic wat supplies provided these are fitted with electric pumps having horsepower exceeding 1.00.

(5) Areas / ground water abstractions structures the water from which may l reserved for drinking and domestic or any other specific use to me emergent situations arising from natural or man-made factors.

(6) Areas falling in the irrigation commands of the surface irrigation projec where a rise in water levels has been recorded and where the depth water has reached within of 2 meters below ground level and the risi trend is persisting,

(7) Areas where the fresh water / sea water interface has advanced up 30m per year during the past ten years.

(8) Areas where any evidence of upcoming of saline water lying below fresh water has been observed in the pumping wells.

(9) Areas around industrial areas, estates & surrounding areas / urbe complexes where deterioration in ground water quality has bee observed since the industry / urban complex was set up or where tl disposal of wastes is likely to affect the quality of ground water.

(10) Industries involving large use and recirculation of water provided tl water is of high temperature, has toxic elements and the recirculatic reservoir is partially or wholly unlined.

(11) Oil refinaries / distribution points disposing off organic wastes and o spills.

(12) Mining complex using or pumping large quantities of water.

(13) Urban complexes where untreated / treated urban wastes are being utilised for direct irrigation in areas where the depth to water is less than 15 meters.

(14) Urban complexes where solid waste disposal sites have not been identified and used.

(15) Areas where pumping of ground water is likely to effect the physiographic conditions and result in sliding and subsidence of land in piedmont areas / Coastal areas.

(16) Ground water vulnerable areas involving large scale use of fertilizer, pesticides and herbicides etc.

(2) Any other criteria, as may be considered expedient, may be notified by the Authority in a similar manner as in (1) above.

6. **Information to users:**

1) If the Authority is of the opinion that it is necessary and expedient in the public interest to control and/or regulate any of the activity listed in rule 2 and / or covered under rule 4 for any specific period or permanently , it may by official communication and publication through local news papers and / or Press notification in the official Gazette, declare any such area, industry, process or activity to be a notified area, industry, process or activity with effect from such date as may be the specified therein.

Provided that the date so specified in the communication and publication and / or notification shall not be earlier than fifteen days from the date of the issue of the said communication or its publication or notification as the case may be and whichever may be earlier.

2) Every such communication shall be published in not less than one Daily regional language newspaper having wide circulation in the State/Union Territory, and also be served in such a manner as the Authority may deem fit and all or any of the following modes may be followed by the Authority in affecting such service, namely :

(a) by affixing a copy of the notification to some conspicuous part of the offices of the village Panchayats/government offices located in the said area or set up for any purpose.

(b) by proclaiming by beat of drum or by means of loudspeakers the contents of the notification in the said area,

(c) in such other manner as may be prescribed.

(3) Once the situation improves, the Authority may withdraw the restrictions and regulatory orders and declare the area, industry, activity or process to be a De-Notified.

(4) In case the necessity of notifying any area or aspects escapes the notice of the Authority, the same may be brought to the notice of the Authority by any person/agency and the Authority may consider notifying it.

(1) ..... De-Notification of Notify Area

a) In case the necessity of notifying any area or aspect escapes the notice of the Authority, the same may be brought to the notice of the Authority by any person and the Authority may consider notifying it.

b)Once the situation improves, the Authority may withdraw the restrictions and regulatory orders and declare the, industry, activity or process to be non-notified.

7. Grant of Permit to extract and use Ground Water in an Area:

(1) Any user of ground water desiring to sink a well in the notified area for drinking and domestic purpose either on personal or community basis, shall apply in prescribed form to the designated officer in Administrative block in State / Union Territory. The information will be passed by the designated officer at the administrative block level to the authorized officer of the Authority at the State level for the grant of a permit for this purpose. The user shall not proceed with any activity connected with such sinking unless the Authority issues the necessary permit.

Provided that the user will not have to obtain a permit if the well is fitted with manual/ animal lifting device or fitted with a motorised pump of one HP or less power and the well is proposed to be sunk for exclusively drinking and domestic water supply excluding commercial use. Such user will, however, have to intimate the designated officer at the Administrative Block level before construction of such a structure.

(2) Every application under sub-section (1) shall be made in such form, shall contain such particulars shall be accompanied by such fee and in such manner as may be prescribed.

(3) On receipt of an application under Sub-section (1), if the Authority is sa... that it shall not be against public interest to do so, it may grant, subject to s... conditions and restrictions as may be specified, a permit authorizing the extractio... and use of the ground water.

Provided that no application shall be refused a permit unless he has been given an opportunity of being heard.

(a) The decision regarding the grant or refusal of the permit shall be intimated by the Authority to the designated office within a period of 60 days from the receipt of the application.

(b) In granting or refusing a permit under sub-section (3), the Authority shall have regard to provision in section 5 or any other factor relevant thereto.

(4) The permit shall be in such form as may be prescribed.

(5) Before refusal to issue permit / license etc. for construction of a well, the user has to be invariably given reasonable time of being heard of represent. In case where the Authority is of the opinion that there is likelihood of a grave injury to the environment and it is not expedient to provide an opportunity to file objections against the proposed direction, it may, for reasons to be recorded in writing, issue direction without providing such an opportunity.

8. Registration of Existing Users

(1) Every existing user of ground water in the State of Union Territory shall within a period of ninety days from the date specified in the communication, news publication and / or notification under sub-section (I) of section 6, apply to the Designated Officer at the Administrative Block level and shall submit the details to the Authority to obtain permission for the grant of a certificate of Registration in such manner as may be prescribed by the Authority.

Provided that the Authority may entertain any such application after the expiry of the said period of ninety days if it is satisfied that the user was unable to apply for grant of certificate for valid reasons or on valid grounds.

(2) The details to be furnished in an application under sub-section (I) .
Section 6, shall be in the proforma prescribed for the purpose but shall include the following information:

a) the description of the source of ground water abstraction structure , such as type of well, its exact location.

b) the lifting device used.

c) the quantity of ground water withdrawal and hours of operation per day.

d) the total period of use in each year.

e) the purpose for which ground water is being extracted.

f) in case of irrigation well, the location and extent of area irrigated.

g) in case of State, Municipal Community run water supply schemes, the details of the services involved in addition to the quantities of water extracted, the diversion or the pumpage.

h) Any other relevant information as desired by the Authority.

(3) The certificate of registration shall be in such a form as may be prescribed.

(4) Pending the communication by the Authority of the decision on an application under sub-section (1), Section 8, every existing user of ground water shall be entitled to the continued use of ground water in the same manner and to the same quantity as he was using prior to the date of submission of his application.'

9. Power to alter, amend or vary the terms of grant of Permit:

(1) If at any time after a license or certificate of registration, as the case may be has been granted the Authority may, for technical reasons, alter amend or vary the terms of the permit or certificate of registration as the case may be, provided that the user has been given an opportunity of being heard.

Provide further that before taking such acion, the Authority shall ensure that the standing crops(s) are not damaged.

10. Prohibition of carrying of the Business of Sinking of wells:

No person shall, himself or his representative, or any business enterprise can carry on the work of sinking wells or extraction of ground water or any other activity connected with the sinking of wells and / or extraction of ground water in any notified area after 30 days of publication of notice for notification of the areas in News paper except under special conditions, permission is granted to Govt. organisation for supply of water for drinking purpose to public.

11. Grant of Registration to person / agencies engaged in the construction of water wells:

(1) Any person/agency desiring to carry on the business of sinking wells and installation of devices for extraction of ground water in the country may make application to the Authority for the purpose.

(2) Every application under Section 11 shall be made in such form and shall contain such particulars and shall be accompanied by such fees as may be prescribed.

(3) On receipt of an application Section 11, the Authority may, after such enquiry as it deems fit and after satisfying itself that the person concerned has the means to undertake sinking operations and or extraction of ground water grant a license in such form as may be prescribed and subject to conditions as may be specified therein.

12. Cancellation of Permit / Certificate of Registration of License:

(1) If the Authority is satisfied either on a reference made to it in this behalf or other wise and after giving sufficient opportunity to the holder of the permit or certificate of registration or license to represent that the permit, certificate of registration or the license granted under sub-section (3) of Section 7 or under sub-section (3) of Section 8 or under Sub-section (3) of Section 11 , as the case may be is not based on facts or the holder of the permit or certificate of registration or licence has without reasonable cause failed to comply with the conditions subject to which the permit or certificate of registration or license has been granted or has contravened any of the provisions of this Act or the rules made there under, or

(2) A situation has arisen which warrants limiting of the use or extraction of ground water, then without prejudice to any other penalty to which the holder of the permit or of the certificate of registration or license may be liable under the Act, the concerned State / Union Territory Departments will accordingly after giving the holder of the permit, certificate of the registration or license an opportunity of show cause, advice the Authority to cancel the permit, certificate of registration or license as the case may be and the Authority after examining the merit of the case in turn inform the State / Union Territory Government to take necessary steps accordingly

13. Recirculation and re-use of industrial and urban waste waters:

(h) If the Authority with due regard to the hydrogeological set-up prevailing ground waer levels and ground water quality and related conditions is satisfied that the disposal of the wastes from the industrial and urban activities is causing and / or is likely to cause degradation in the ground water quality in the area, it may issue directions:

(i) Prescribing minimum standards for the chemical quality of the effluents from an industry or a process or an urban sewerage system to be disposed off on the surface or in natural channels or underground.

(ii) Prohibiting the use of any specific chemical compound in any industry or process.

(iii) Regulating and / or prohibiting disposal of municipal waste or residue from any industrial, urban activity or process in the area.

(iv) Regulating disposal of urban solid wastes in specified areas, sites and structures.

(v) Requiring an industry, municipal body or an agency for information regarding the quality of wastes disposed off and the manner of disposal at the time and intervals as prescribed etc.

(3) The Authority shall take action under sub-section 1 (ii) & (iii) and issue prohibitory directions only after affording an opportunity to the person, company, industry, municipal body or the agency to be heard.

(4) The Authority may issue directions to any person, company, industry, municipal body or agency to use the treated waste water for recharging ground water at any specific site.

14. Recharge and re-use of surplus monsoon run-off

(1) If the Authority is satisfied in the basis of the data available to it that large quantities of water, which otherwise used ti infilterate to ground water, are now lost to runoff due to evaporation or due to any activity and paving of the open area, it may

(a) Prescribe that it will be obligatory for any house owner or plot owner to construct a structure or well or any other strucutre or as is prescribed for harvestting & recharging the roof top run off to ground water,

(b) Direct any municipal or development body or agency resposible for clearing civil constructions in an area that provision for the construction of the structure as prescribed in the Sub-section(a) may be made in the by-lawa for the construction in towns, cities or unban agglomerates.

(c) The cost of construction of the structure shall be deemed to the part of the construction on the plot and shall be borne by the owner of the plot.

(d) The municipal body resposible for approving the construction shall not accord approval without the structure as prescribed in the subsection(a) above.

(2) The Authority may direct municipal or development body or any agency to construct suitable structures for recharging the strom water run-off that is originating from construction other than those on individually or community owned plots,

(3) For the harvesting and recharging the surplus runoff available during the rainy season in areas outside the municipal or unban agglomerate boundaries, the

Authority may direct the State or UT government, as the case may be , to construct conservation and recharge strucures.

15. **Maintenance of ground water system behaviour and quality regime in areas irrigated from surface water sources.**

(1) If the Authority is satisfied that the ground water levels and / or quality in a particular area have undergone and/ or undergoing modifications consequent to the introduction of the irrigation from canals and other surface water sources further, if in its opinion, continuation of the prevailing irrigation practices are likely to result in further rise in water levels and / or deterioration in ground water quality, it may

(i) Direct the concerned agencies to reduce / regulate the supply of water from surface water or any other sources as prescribed.

(ii) Direct the construction of wells to meet the gap in the demand and supply of water, if any, from surface water sources.

(iii) Direct maintenance of ground water levels at the depth prescribed for the Notified areas under sub-section 1 (vi) of Section 5.

(iv) Take any other measures as may be required to ensure balanced utilization of water from all the sources.

16. **Modification of ground water regime due to mining activities.**

(I) If the Authority is satisfied that to facilitate mining or querring of any mineral or rocks, large scale pumping of ground water is taking place and that:

(i) The mining activity has led to a fall in the water levels in the vicinity of mines as prescribed under sub-section 1 (i), (ii) & (iii) of Section 5.

(ii) The fall in water levels has affected the agricultural and social activity (s) of the people living in the area.

(iii) The pumpage and / or disposal of water from the mining activity has led to degradation in ground water quality.

(2) In full regard to any one or more of the situations as in Sub-rule (1) above, the Authority may direct.

(i) Disposal of mine water in a manner that it may be directly used by the farmers.

(ii) May direct its recharge, if feasible, to augment ground water storage.

17. **Periodic assessment of ground water resources:**

(1) The ground water system is undergoing a continuous change consequent to the stress exerted by the interference of the human activities. To ensure a balanced and optimal development of ground water and sustainability of works and schemes, a sound management strategy shall need to be evolved and adopted.

(2) If the Authority is satisfied that it is expedient in public interest to reassess the ground water resources and re-evaluate the system behaviour, it may.

(i) Lay a time schedule or direct, when required, the agencies engaged in the work of ground water resources assessment to undertake a fresh exercise keeping in view the advancement in the techniques and technology that have / are taking place and the modern tools that are now available, within the time prescribed.

Provided where the agency is not able to undertake the work within the prescribed time frame, the Authority may get the work done by making its own arrangements and recover the entire cost from the concerned agency (s).

(ii) Direct the agency (s) to redesign, improve, strengthen, etc, the ground water levels and quality monitoring net-works within the time prescribed.

Provided where the agency fails to execute the directions the Authority may invoke penal action under any of the provisions of the Act.

18. Powers of the Authority:

(1) The Authority or any person by it in writing in this behalf shall have the power to:

(i) enter at any reasonable time any property (private or Government owned) with the right to investigate and make any measurement concerning the land or the water located on the surface or the underground.

(ii) To inspect the well which has been or is being sunk and the soils and other materials excavated therefrom;

(iii) To take specimens of such soils or other material or of water extracted from such wells.

(iv) To require by order in writing the persons sinking a well to keep and preserve in the prescribed manner specimens of soils or any material excavated there from for such period not exceeding three month from the date of completion or abandonment of the work as may be specified by the Authority and there upon such person shall comply with such requisition.

(v) To inspect and to take copies of the relevant record or documents and ask any question necessary for obtaining any information (including diameter or depth of the well which is being or has been sunk; the level at which the water is or was struck and subsequently restored / rested, the types of

strata encountered in the sinking of the well and the quality of the w... struck) required for carrying out the purpose of this Act.

(vi) To require the user of ground water install water measuring device on any water supplies when necessary to properly administer the water or where there is reason to believe that the user does not comply with the provisions contained in the Act or any other sufficient reasons for defending the public interest;

Provided that where the us... of ground water does not comply with the requisition issued to him wit...in a period of thirty days, the Authority shall arrange to install such water measuring device and recover the cost from the defaulting user of ground water and, if need be, seize any equipment/device utilized for illegal sinking and to ensure that no further use of the wells takes place.

(vii) To require any user of ground water who does not comply with the provisions of this Act and rules framed there under to close down any water supply or destroy and hydraulic work found to be illegal according to the provisions of this Act and the rules framed thereunder.

Provided where the user of ground water does not comply with the requisition issued to him within a period of thirty days, the Authority shall itself carry out the necessary work and recover the cost from the illegal user of ground water.

(viii) To enter and search at all reasonable times with such assistance, if any as it considers necessary, any place in which it has reason to believe that offence under this Act has been or is being committed and order in writing the persons who has been or is committing the offence not to extract or use the ground water for a specified period no exceeding thirty days.

(ix) To exercise such other powers as may be necessary for carrying out the purposes of this Act or any rules made there under;

(a) The power conferred by this section includes the power to enter any premise where sinking, extraction and use of ground water may be going on;

Provided that the power to enter the premise shall be exercised only after the owner or any other person in occupation of the premises, if he is present therein, refuse to allow on being called to do so.

(b) the provision of the Code of Criminal procedure, 1973 (2 of 1974), shall so far as may be, apply to any search or seizure under the authority of a warrant issued under section 93 of the said code.

(x) To require any person, industry, municipal body or any agency to stop any activity which is illegal according to the Act or the Rules made thereunder.

Provided where the person industry municipal body or an agency does not comply with the requisition issued within thirty days, the Authority shall itself close such activity and recover the cost from the concerned.

19. Offences and Penalities:

(I) Whoever

a) contravenes or fails to comply with any of the provisions of this Act or any rule made thereunder or
b) obstructs the Authority or any other person authorised by it to exercise any of the powers under this Act, or
c) fails to comply with the requisition made in different clauses of the Act or the Rules.
d) Having been required to furnish any information or return
(i) Wifully refuses or, without lawful excuse, neglects to furnish such information or return, or
(ii) Wilfully furnishes or causes to be furnished any information or return which he knows or has reasons to believe to be false.

Shall on conviction be punished:-

(e) For violation of Rule 7

(i) for the first offence with fine which may extend to one hundred rupees and
(ii) for the second and subsequence offence with fine at the rate of fifty rupees per day till such contravention continues.

(f) Contraventions under Rule 8 – Registration of Existing users

(i) for the first offence with time which may extend to five hundred rupees and
(ii) for the and subsequent offences with fine at the rate of fifty rupees per day till such contravention continues.

(g) For contravention of Rule 11 – Grant of registration to person / agencies engaged in the construction of water wells

(1) for the first offence with fine which may extend to two thousand rupees and

(2) for the second and subsequent offence with imprisonment which may extend up three months and fine at the rate of fifty rupees per day till such contravention continues, or both, and further.
(3) Confiscate the equipment used for the construction of wells and allied works.

(h) For contravention of Rule 13 – Recirculation industrial and urban waste waters:

(1) for the first offence with fine which may extend to five thousand rupees, and
(2) for the second and subsequent offence, with imprisonment which may extend upto six months and fine at the rate of five hundred rupees per day till such contravention continues, or both , and further
(3) close the industry of the process.

Provided that nothing contained in this sub-section shall render any such person liable to any punishment under Act if, he proves that the offence was committed without his knowledge or that he exercised all due diligence to prevent the commission of such offence.

The responsibilities for the offences by the companies and the government department shall on the persons as defined in section 16.

20.

(1) Any order under Sections 7 to 17 and every notice under these Sections shall be served:-
(h) by giving or tendering the orders of notice by sending it by post to the user for whom it is intended or.
(iii) If such user cannot be found by affixing the order of notice on some conspicuous part of his last known abode or place of business or by giving or tendering the order of notice to some adult male member or servant or his family or by causing it to be affixed on some conspicuous part of the land or building in which the well is being sunk.
(2) Where the person on whom an order or a notice is to be served is a minor service upon his guardian in the manner provided in sub-section (1) shall be upon the minor.

21.Communication:

All communication and for behalf of the Authority in carry out its functions shall be issued under the signature of the Chairperson or by member Secretary or such officer as may be authorized by the Authority or Chairperson.

22.Authorization:

Members including Chairperson and Regional Officer(s) as may be authorized by the Authority or the Chairperson thereof, shall be empowered to exercise power under such 9, 10, 11, 15, 16, 17, 19, 20 & 21 of the Act.

Any direction issued by the Authority under Section 5 shall be issued in writing under the signature of Chairperson or Member Secretary or an Authorized officer of the Authority.

23.Saving:

Actions already initiated or undertaken by the Authority before the commencement of these rules shall not invalidate the force of action already taken.

MODEL BILL

A

BILL

to REGULATE AND CONTROL THE DEVELOPMENT OF GROUNDWATER and the matters connected therewith.

BE enacted by the Legislature of the State .....in the ..... year of the Republic India as follows :

SHORT TITLE, EXTENT AND COMMENCEMENT.

(1) This Act may be called the Ground Water (Control and Regulation) Act,1992.

(2) It shall extend to the (whole or part) of the State/ Union Territory of.....

(3) It shall come into force on such date as the State Government or Union Territory may, by notification in the Official Gazette, appointed for different areas of the State/ Union Territory.

DEFINITIONS.

In this Act, unless the context otherwise requires :

(a) "groundwater" means the water which exists below the surface of the ground at any particular location;

(b) "prescribed" means prescribed by rules made under this Act;

(c) "sink" with all its grammatical variations and cognate expression in relation to a well includes any digging, drilling or boring of new wells or deepening carried to the existing wells;

(d) "Small farmer" means a person as prescribed;

(e) "Marginal farmer" means a person as prescribed;

(f) "user of groundwater" means the person or persons, an institution including a company or an establishment, whether Government or not who or which use ground water for any purpose including domestic use made either on a personal or community basis;

(g) "well" means a well sunk for the search or extraction of ground water by person or persons except by the authorized officials of the State or the Central Governments for carrying out scientific investigations, exploration, development or management work for the survey and assessment of groundwater resources or for providing water to the small or marginal farmers and includes open well, dug well, bore well, dug-cum-bore well, tubewell, filter point, collector well and infiltration gallery.

3. ESTABLISHMENT OF A GROUND WATER AUTHORITY.

(1) The State Government/Union Territory shall, by notification in the official Gazette, establish with effect from such date as may be specified in the notification, an Authority to be known as the Ground Water Authority.

(2) The Ground Water Authority shall consist of :

(a) A Chairman to be appointed by the State Government/Union Territory;

(b) ..(NUMBER)...representatives of the Departments as are concerned with SURVEY, exploration, development or protection of ground water to be appointed by the State/ Union Territory Government;

(c) such number of other members who, in the opinion of the Government have special knowledge or practical experience in matters relating to ground water, to be appointed by that Government;

(3) The term of office and the manner of filling vacancies and other conditions of service of the Chairman and other members shall be in such a manner as may be prescribed.

4. STAFF OF THE GROUND WATER AUTHORITY.

(1) The State/Union Territory Government may for the purpose of enabling the Ground Water Authority efficiently to perform its functions or exercise its powers under the Act appoint such number of technical and other staff as it may consider necessary;

(2) The functions and the terms and conditions of service of such employees shall be such as may be prescribed.

POWERS TO NOTIFY AREAS FOR CONTROL AND REGULATION OF GROUND WATER DEVELOPMENT.

(1) If the State/Union Territory Government on a report received from the Groundwater Authority is of opinion that it is necessary or expedient in the public interest to control and/or regulate the extraction or the use or both of ground water in any form in any area, it may, by notification in the Official Gazette, declare any such area to be a notified area for the purposes of this Act with effect from such date as may be specified therein:

Provided that the date so specified in the notification shall not be earlier than three months from the date of publication of the said notification.

(2) Every such notification shall, in addition to its publication in the Official Gazette, be published in not less than one daily regional language newspaper having wide circulation in the State/ Union Territory, and shall also be served in such manner as the State/Union Territory Government may think fit and all or any of the following modes may be followed in affecting such service, namely :-

(a) by affixing a copy of the notification to some conspicuous part of the offices of the village panchayats located in the said area;

(b) by proclaiming by beat of drum or by means of loudspeakers the contents of the notification in the said area;

(c) in such other manner as may be prescribed.

GRANT OF PERMIT TO EXTRACT AND USE GROUND WATER IN THE NOTIFIED AREA.

(1) Any user of groundwater as defined under Section 2, sub-section (f) desiring to sink a well in the notified area for any purpose either on personal or community basis, shall apply to the Ground Water Authority for the grant of a permit for this purpose, and shall not proceed with any activity connected with such sinking unless a permit has been granted by the Ground Water Authority.

Provided that the small and marginal farmers will not have to obtain a permit if the well is proposed to be sunk

for exclusively personal purposes excluding commercial use. They will, however, have to notify the Groundwater Authority before taking up construction of a structure.

(2) Every application under sub-section (1) shall be made in such form, shall contain such particulars and in such manner as may be prescribed.

(3) On receipt of an application under sub-section (1), if the Ground Water Authority is satisfied that it shall not be against public interest to do so, it may grant, subject to such conditions and restrictions as may be specified, a permit authorising the extraction and use of the water.

Provided that no person shall be refused a permit unless he has been given an opportunity of being heard.

(4) The decision regarding the grant or refusal of the permit shall be intimated by the Ground Water Authority to the applicant within a period of ninety days from the receipt of the application.

(5) In granting or refusing a permit under sub-section (3), the Ground Water Authority shall have regard to :

(a) the purpose or purposes for which water is to be used.

(b) the existence of other competitive users;

(c) the availability of water;

(d) quality of groundwater with reference to use;

(e) any other factor relevant thereto.

(6) The permit shall be in such form as may be prescribed.

7. REGISTRATION OF EXISTING USERS IN NOTIFIED AREAS.

(1) Every existing user of ground water in the State or Union Territory shall within a period of ninety days from the date specified in the notification under sub-section (1) of section 5, apply to the Ground Water Authority for the grant of a certificate of Registration recognising its existing use in such form and in such manner as may be prescribed.

Provided that the Ground Water Authority may entertain any such application after the expiry of the said period of ninety days, if it is satisfied that the user was prevented by sufficient cause from filling the application in time.

(2) The details to be furnished in an application under sub-section (1) shall include the following, namely :-

(i) the description of the source of water, such as type of well, its exact location;

(ii) the device used for lifting water;

(iii) the quantity of groundwater extracted;

(v) the purpose or purposes for which the water is being extracted;

(vi) the period of use in each year for the purpose or purposes;

(vii) in the case of irrigation, the location and extent of the area served;

(viii) in the case of State, Municipal or community run water supply schemes, the details of the services involved in addition to the quantities of water extracted, the diversion or pumping points and their locations.

(3) On receipt of an application under sub-section (1), if the Ground Water Authority is satisfied, that it shall not be against the public interest to do so, it may grant, subject to such conditions and restrictions as may be specified, a certificate of registration authorising the continued use of the water.

Provided that no person shall be refused a certificate of registration unless he has been given an opportunity of being heard.

(4) The decision regarding the grant or refusal of the certificate of registration shall be intimated by the Ground Water Authority to the applicant within a period of ninety days from the receipt of the application.

(5) In granting or refusing a certificate of registration under sub-section (3) the Ground Water Authority shall have regard to :-

(a) the purpose or purposes for which water is being used;

(b) the existence of other competitive users;

(c) the availability of water

(d) any other fact relevant thereto.

such

(7) Pending the communication by the Ground Water Authority of the decision on an application under sub-section(1), every existing user of ground water in the notified area shall be entitled to the continued use of the ground water in the same manner and in the same quantity as he was entitled to prior to the date of his application.

8. POWER TO ALTER, AMEND OR VARY THE TERMS OF THE PERMIT.

At any time after a permit or certificate of registration, as the case may be, has been granted the Ground Water Authority may, for technical reasons, alter, amend or vary the terms of the permit or certificate of registration, as the case may be, with a view to limit the use of water either permanently or temporarily.

Provided that no such alteration, amendment or variation shall be made unless the permit holder or certificate of registration holder, as the case may be, has been given an opportunity of being heard;

Provided further that before taking such action, the Ground Water Authority shall ensure that the standing crop(s) are not damaged.

9. PROHIBITION OF CARRYING ON THE BUSINESS OF SINKING WELLS IN NOTIFIED AREA.

No person shall, himself or by any person on his behalf, after six months of the enforcement of the Act, carry on the work of sinking of wells or extraction of groundwater or any other activity connected with the sinking of wells and/or extraction of groundwater in any notified area except under and in accordance with a licence granted in his behalf. Such a licence shall be obtained within 6 months of the enforcement of the Act.

10. GRANT OF LICENCE FOR SINKING OF WELLS.

(1) Any person desiring to carry on the business of sinking of wells and/or installation of devices for extraction of groundwater in the notified area may make an application to the Ground Water Authority for the purpose.

(2) Every application under sub-section (1) shall be made in such form, shall contain such particulars and shall be accompanied by such fees as may be prescribed.

(3) On receipt of an application under sub-section (1), the Ground Water Authority may, after such enquiry as it deems fit and after satisfying itself that the person concerned has the means and the knowledge to undertake sinking operations and/or extraction of groundwater grant a licence in such form as may be prescribed and subject to such conditions as may be specified therein.

11. CANCELLATION OF PERMIT/CERTIFICATE OF REGISTRATION OR LICENCE.

If the Ground Water Authority is satisfied either on a reference made to it in this behalf or otherwise, that:

(a) the permit, certificate of registration or the licence granted under sub-section (3) of section 6, or sub-section (3) of section 7 or under sub-section (3) of section 10, as the case may be, has been obtained by fraud or misrepresentation as to an essential fact, or

(b) the holder of the permit or certificate of registration or licence has without reasonable cause failed to comply with the conditions subject to which the permit or certificate of registration or licence has been granted or has contravened any of the provisions of this Act or the rules made thereunder, or

c) a situation has arisen which warrants limiting of the use or extraction of groundwater,

then, without prejudice to any other penalty to which the holder of the permit or of the certificate of registration or licence may be liable under this Act, the Ground Water Authority may after giving the holder of the permit, certificate of registration or licence, an opportunity of showing cause, cancel the permit, certificate of registration or licence, as the case may be.

12. POWERS OF THE GROUND WATER AUTHORITY.

(1) The Groundwater Authority or any person authorised by it in writing in this behalf shall have power -

(a) to enter at any reasonable time on any property (private or Government owned) with the right to investigate and make any measurements concerning the

land or the water located on the surface or underground.

(b) to inspect the well which is being sunk or has been sunk and the soils and other materials excavated therefrom;

(c) to take the specimens of such soils or other materials or of water extracted from such wells;

(d) to require by order in writing the persons sinking a well to keep and preserve in the prescribed manner specimen of soils or any material excavated therefrom for such period not exceeding three months from the date of completion or abandonment of the work as may be specified by the Groundwater Authority and thereupon such person shall comply with such requisition;

(e) to inspect and to take copies of the relevant record or documents and ask any question necessary for obtaining any information (including diameter or depth of the well which is being or has been sunk; the level at which the water is or was struck and subsequently restored / rested, the types of strata encountered in the sinking of the well and the quality of the water struck) required for carrying out the purposes of this Act;

(f) to serve or cause to be served a notice requiring any user of groundwater to furnish such information or returns in such form, at such intervals and with such particulars, as may be prescribed and thereupon such person shall comply with such requisition;

(g) to require the user of groundwater to instal water measuring devices on any water supplies when necessary to properly administer the water or where there is reason to believe that the user does not comply with the provisions contained in this Act or any other sufficient reason for defending the public interest;

Provided that where the user of groundwater does not comply with the requisition issued to him within a period of thirty days, the Groundwater Authority itself may instal such water measuring device and recover the cost from the defaulting user of groundwater;

(h) to seize any mechanical equipment utilised for illegal sinking;

(i) to require any user of groundwater who does not comply with the provisions of this Act and rules framed thereunder to close down any water supply or

destroy any hydraulic work found to be illegal according to the provisions of this Act and the rules framed thereunder;

Provided that where the user of groundwater does not comply with the requisition issued to him within a period of sixty days, the Groundwater Authority itself may carry out the necessary work and recover the cost from the illegal user of ground water.

(j) to enter and search at all reasonable times with such assistance, if any as it considers necessary, any place in which it has reason to believe that offence under this Act has been or is being committed and order in writing the person who has or is committing the offence not to extract or use the groundwater for a specified period not exceeding thirty days;

(k) to exercise such other powers as may be necessary for carrying out the purposes of this Act or any rules made thereunder;

(2) The power conferred by this section includes the power to break open the door or any premises where sinking, extraction and use of groundwater may be going on;

Provided that the power to break open the door shall be exercised only after the owner or any other person in occupation of the premises, if he is present therein, refuse to open the door on being called upon to do so.

(3) The provisions of the Code of Criminal Procedure, 1973 (2 of 1974), shall so far as may be, apply to any search or seizure under this section as they apply to any search or seizure made under the authority of a warrant issued under section 93 of the said Code.

(4) Where the Ground Water Authority seizes any mechanical equipment under clause (h) of sub-section (1), it shall as soon as may be, inform a magistrate and take his orders as to the custody thereof.

13. RESTRICTION ON PUBLICATION OF INFORMATION AND RETURNS.

Any user of ground water may give notice in writing to the Ground Water Authority to treat as confidential any specimen taken under clause (c) of sub-section (1) of section 12 or any other information or return furnished by him under clause (f) of sub-section (1) of that section and thereupon the Ground Water Authority shall not allow that specimen or other information or return, except in so far as it contains or affords information as to water resources and supplies and geological conditions to be published or

shown to any person (not being an officer of the Government) unless the person giving the notice consents thereto.

14. SERVICE OF ORDERS, ETC.

(1) Every order under clause (d) of sub-section (1) of section 12 and every notice under clause (f) of sub-section (1) of that section shall be served -

(a) by giving or tendering the order of notice or by sending it by post to the user for whom it is intended, or

(b) if such user cannot be found, by affixing the order of notice on some conspicuous part of his last known abode or place of business or by giving or tendering the order of notice to some adult male member or servant of his family or by causing it to be affixed on some conspicuous part of the land or building in which the well is being sunk.

(2) Where the person on whom an order or a notice is to be served is a minor, service upon his guardian in the manner provided in sub-section (1) shall be deemed to be service upon the minor.

15. DELEGATION OF POWERS AND DUTIES.

The Groundwater Authority may, by general or special order in writing, direct that all or any of the powers or duties which may be exercised or discharged by it shall, in such circumstances and under such conditions, if any, as may be specified in its order be exercised or discharged also by any employee of the Groundwater Authority specified in this behalf in the order.

16. MEMBERS AND EMPLOYEES OF THE GROUNDWATER AUTHORITY TO BE PUBLIC SERVANTS. CENTRAL ACT 45 OF 1860.

All members and employees of the Groundwater Authority shall when acting or purporting to act in pursuance of the provisions of this Act or of any rules made thereunder be deemed to be public servants within the meaning of section 21 of the Indian Penal Code.

17. PROTECTION AGAINST ACTION TAKEN IN GOOD FAITH.

No prosecution, suit or other legal proceeding shall be instituted against the Government or the Groundwater Authority or any other officer of the Government or any member or other employees of the Groundwater Authority for anything done or intended to be done in good faith under this Act, or the rules made thereunder.

18. COGNIZANCE AND TRIAL OF OFFENCES.

(1) No prosecution for an offence under this Act shall be instituted except by or with the written consent of the Groundwater Authority or a person authorised in this behalf by the Groundwater Authority.

(2) No court inferior to that of a Metropolitan Magistrate or a Magistrate of the first class shall try any offence under this Act.

19. OFFENCES AND PENALTIES.

(1) If any user -

(a) contravenes or fails to comply with any of the provisions of this Act or any rule made thereunder, or

(b) obstructs the Groundwater Authority or any other person authorised by it to exercise any of the powers under this Act, or

(c) having been required to furnish any information or return under clause (f) of sub-section (1) of section 12 -

(i) wilfully refuses; or without lawful excuse, neglects to furnish such information or return, or

(ii) wilfully furnishes or causes to be furnished any information or return which he knows to be false,

he shall be punishable -

(i) for the first offence with fine which may extend to five hundred rupees, and

(ii) for the second and subequent offence, with imprisonment for a term which may extend to six months, or with fine which

... of sub-section (1) of section 6 or section 9, he shall be punishable with a fine of rupees fifty, in addition to the penalties under sub-section (i) and (ii) above, for everyday till such contravention continues.

20. COMPOUNDING OF OFFENCES.

Any offence under this act may before or after the institution of the proceedings be compounded by the Groundwater Authority, as prescribed.

21. OFFENCES BY COMPANIES.

(1) Whenever an offence under this Act has been committed by a company, every person who at the time the offence is committed was in charge of, or was responsible to the company for the conduct of the business of the company, as well as the company shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly :

(2) Nothwithstanding anything contained in sub-section (1), where an offence under this Act has been committed by a company and that the offence has been committed with the consent or connivance of, or is attributable to any neglect on the part of, any director, manager, secretary or other officer of the company, such director, manager, secretary or other officer shall also be deemed to be guilty of that offence and shall be liable to be proceeded against and punished accordingly.

Provided that nothing contained in this sub-section shall render any such person liable to any punishment under this Act if he proves that the offence was committed without his knowledge or that he exercised all due diligence to prevent the commission of such offence.

EXPLANATION :- For the purpose of this section,-

(a) "Company" means any body corporate and includes a firm or other association of individuals, and

(b) "director", in relation to a firm, means a partner in the firm.

22. APPEALS.

(1) Any person aggrieved by a decision or action of the Groundwater Authority under this Act may, within a period of thirty days from the date on which the action is taken or the decision is communicated to him and on payment of such fees as may be prescribed, prefer an appeal to such authority as may be specified by the State Government or Union Territory in this behalf.

Provided that appellate authority may entertain an appeal after the expiry of the said period of thirty days, if it is satisfied that the applicant was prevented by sufficient cause from filing the appeal in time.

(2) on receipt of an appeal under sub-section (1), the appellate authority shall, after giving the appellant an opportunity of being heard, dispose of the appeal as expeditiously as possible.

23. BAR OF JURISDICTION BY CIVIL COURTS.

No civil court shall have jurisdiction in respect of any matter which the State Government or the Groundwater Authority is empowered by this Act to determine and no injunction shall be granted by any court or any other authority in respect of any action taken or to be taken in pursuance of any powers conferred by or under this Act.

24. POWER TO MAKE RULES.

(1) The State Government may, by notification in the Official Gazette, make rules to carry out the purposes of this Act.

(2) In particular and without prejudice to the generality of the foregoing power, such rules may provide for :-

(a) the term of office and manner of filling vacancies and other conditions of service among the members and Chairman of the Groundwater Authority;

(b) the functions and the terms and conditions of service of the employees of the Groundwater Authority;

(c) any other manner of affecting service of the notification under clause (c) of sub-section (2) of section 5;

(d) the form of application under sub-section (2) of section 6, and sub-section (2) of section 1[illegible] and the particulars that may be furnished with these applications;

(e) the form of application under section 7;

(f) fees to accompany the application of licence under sub-section (2) of section 10;

(g) the form of the permit and certificate of registration under sub-section 6 of section (6) and sub-section (6) of section 7;

(h) the form of the licence under sub-section (3) of section 10 and the conditions that may be specified therein;

(i) the manner in which the specimens of soils or other material shall be kept and preserved under clause (d) of sub-section (1) of section 12;

(j) the form in which and the interval at which the information or return under clause (f) of sub-section (1) of section 12 shall be furnished and the particulars which such information or return shall contain;

(k) specifying the appellate authority under sub-section (1) of the section 22 and the fees to accompany the application for appeal;

(l) any other matter which is to be or may be prescribed.

(3) Every rule made under this section shall be laid, as soon as may be after it is made, before the Legislative Assembly while it is in session for a total period of fifteen days, which may be comprised in one session or in two successive sessions, and if before the expiry of the session in which it is so laid or the session immediately following, Assembly agrees in making any modification in the rule or the Assembly agrees that the rule should not be made, the rule thereafter shall have effect only in such modified form or be of no effect, as the case may be, so however that any such modification or annulment shall be without prejudice to the validity of anything done earlier under that rule.