CHAPTER - 2

Concentrated & Galloping Demands:

Water requirement is increasing at galloping speeds that too concentrated in various urban areas , The reasons for such situation are many folds the main being abnormal increase in demand of water to cater for needs of growing population ,increase in per capita needs due to lavish life styles and improving life standards ,technological developments resulting in easy availability of water to individual house holds , possibility of water from greater depths and increasing indifference of people in general to wastage of this precious resource both during use ,storage or through supply network. The increasing industrialization and use of chemical fertilizers and seedlings is also resulting in increasing demands. Normally the increasing demands are not planned as per availability of water in nature, but are lopsided and concentrated because of mega city urbanization with very high density of users for unit area of earth. To cater for such requirements due to present day phenomenon of mega urbanization and future likely growth in population of earth in general the industries ,industrial production, services level including transportation services and agriculture production has also to grow thus the requirement of potable and unpolluted raw water will increase in future world wide and in India .India being developing country the growth rate will be more as compared to already developed countries. As per report of planning commission of India the likely total requirement of water[8] will be 1093 billion cubic meters by year 2025 against present demand of

[8] Times of India, dated 9/02/2009 New Delhi.

about 81,30,000 crore litres. The world scenario of increase has been brought out in details below :

Increase in population

According to the *2006 Revision*[9], the world population will likely increase by 2.5 billion over the next 43 years, passing from the current 6.7 billion to 9.2 billion in 2050. This increase is equivalent to the size that the world population had in 1950 and it will be absorbed mostly by the less developed regions, whose population is projected to rise from 5.4 billion in 2007 to 7.9 billion in 2050. (Table 2.1)

Table-2.1

POPULATION OF THE WORLD, MAJOR DEVELOPMENT GROUPS AND MAJOR AREAS, Population in (millions) based on (LOW Variant)[10]

Major Areas	Year 1950	1975	2007	2050
World	4076	6 671	7792	9191
More developed regions	1048	1223	1065	1245
Less developed regions..	3028	5448	6727	7946
Africa ...	416	965	1718	1998
Asia ..	2394	4030	4444	5266

As a result of declining fertility and increasing longevity, the populations of a growing number of countries are ageing rapidly. Between 2005 and 2050, half of the increase in the world population will be accounted for by a rise in the population

[9] *Source:* Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

[10] Based on Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

aged 60 years or over, whereas the number of children (persons under age 15) will decline slightly. Furthermore, in the more developed regions, the population aged 60 or over is expected nearly to double (from 245 million in 2005 to 406 million in 2050) whereas that of persons under age 60 will likely decline (from 971 million in 2005 to 839 million in 2050).

The *2006 Revision* confirms the diversity of demographic dynamics among the different world regions. While the population at the global level is on track to surpass 9 billion by 2050 and hence continues to increase, that of the more developed regions is hardly changing and will age markedly. As already noted, virtually all population growth is occurring in the less developed regions and especially in the group of the 50 least developed countries, many of which still have relatively youthful populations that are expected to age only moderately over the foreseeable future. Among the rest of the developing countries, rapid population ageing is expected. (Table 2.2)

Table- 2. 2

PERCENTAGE DISTRIBUTION OF POPULATION BY AGE GROUP FOR THE WORLD, DEVELOPMENT GROUPS AND MAJOR AREAS,

For YEAR- 2050 (WITH MEDIUM VARIANT)[11]

Major Areas	0-14 YR	15-59 YR	60-80 YR	80+ YR
World	19.8	58.3	21.8	4.4
More developed regions	15.2	52.2	32.6	9.4
Less developed regions..	20.6	59.3	20.1	3.6
Africa ...	28.0	61.7	10.4	1.1
Asia ..	18.0	58.3	23.7	4.5

[11] Based on Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision. New York: United Nations.

Population growth remains concentrated in the populous countries. During 2005-2050, eight countries are expected to account for half of the world's projected population increase: India, Nigeria, Pakistan, the Democratic Republic of the Congo, Ethiopia, the United States of America, Bangladesh and China, listed according to the size of their contribution to global population growth.

Most of NRly's activity hub lies in and around NCT region and it is expected that population in this area will steady keep on increasing at substantially high growth rate which was @ 46.31% during 1991-2001 and is likely to cross 20 Million mark[12] by 2011. The demand for drinking water is pegged at 56 BCM during the next year, it will increase to 73 BCM in 2025,[13] the report of the Steering Committee of Planning Commission on Water Resources For XI Five Year Plan (2007-2012) has said. The report has quoted the data given by the standing committee of the ministry of water resources.

Increase in agriculture requirements

To cater for needs of future population, the requirement of agricultural produce will substantially increase. Even area under irrigated agricultural will change as has been seen during past requiring more water for irrigation. These have been shown in table 2.3 and graphs 2.1 given below :

[12] DPS Nagal (2003-04) Rain water harvesting in the NCT of Delhi IIPA New Delhi
[13] Times of India, dated 9/02/2009 New delhi.

Table-2.3

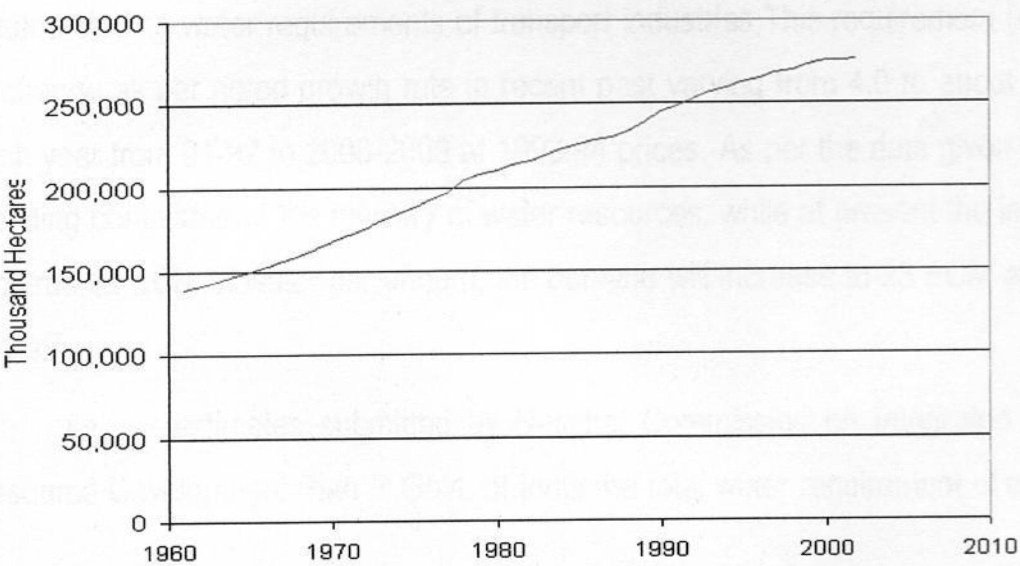
World Irrigated Agricultural Area, 1961-2002[14]

Year	Irrigated Area	Annual Addition	Annual Change	Irrigated Area Per Person	Annual Change Per Person
	Thousand Hectares	Thousand Hectares	Percent	Square Meters	Percent
1961	139,136			452	
1962	141,829	2,693	1.9	452	0.0
1963	144,501	2,672	1.9	451	-0.1
1964	147,161	2,660	1.8	450	-0.2
1965	150,155	2,994	2.0	450	0.0
1966	153,462	3,307	2.2	451	0.1
1967	156,492	3,030	2.0	450	-0.1
1968	159,922	3,430	2.2	451	0.1
1969	164,115	4,193	2.6	454	0.6
1970	168,034	3,919	2.4	455	0.3
1971	171,809	3,775	2.2	456	0.2
1972	175,488	3,679	2.1	457	0.1
1973	180,591	5,103	2.9	461	0.9
1974	184,177	3,586	2.0	461	0.1
1975	188,637	4,460	2.4	464	0.5
1976	192,853	4,216	2.2	466	0.4
1977	196,297	3,444	1.8	466	0.0
1978	204,442	8,145	4.1	477	2.4
1979	207,917	3,475	1.7	477	0.0
1980	210,222	2,305	1.1	474	-0.6
1981	213,554	3,332	1.6	473	-0.1
1982	215,772	2,218	1.0	470	-0.7
1983	219,373	3,601	1.7	470	-0.1
1984	223,641	4,268	1.9	471	0.2
1985	225,686	2,045	0.9	467	-0.8
1986	228,205	2,519	1.1	464	-0.6

[14] Compiled by Earth Policy Institute from U.N. Food and Agriculture Organization, FAOStat, statistics database, at apps.fao.org, updated 2 July 2004 .

1987	229,770	1,565	0.7	459	-1.1
1988	232,847	3,077	1.3	457	-0.4
1989	239,073	6,226	2.7	462	0.9
1990	244,988	5,915	2.5	465	0.8
1991	248,758	3,770	1.5	465	-0.1
1992	252,380	3,622	1.5	465	-0.1
1993	256,568	4,188	1.7	465	0.2
1994	258,993	2,425	0.9	463	-0.5
1995	262,304	3,311	1.3	462	-0.2
1996	264,586	2,282	0.9	460	-0.5
1997	267,918	3,332	1.3	459	-0.1
1998	269,900	1,982	0.7	456	-0.6
1999	273,318	3,418	1.3	456	-0.1
2000	275,188	1,870	0.7	453	-0.6
2001	275,881	693	0.3	449	-1.0
2002	276,719	838	0.3	445	-0.9

World Irrigated Agricultural Area, 1961-2002



Source: FAO

Figure -2.1

As per studies conducted by International Water Management Institute (IWMI),a research centre of consultative group on international Agriculture Research (CGIAR) primary water supply for Irrigation has to be increased by 17% by 2025 to meet the food requirements of that period from 1990 levels[15]. Further as per data given by the standing committee of the ministry of water resources. the demand for irrigation in the country will increase by several billion cubic metres in the next 15 years. While it is estimated[16] that farmers will require 688 billion cubic metres (BCM) of water for irrigation in 2010, the demand will increase to 910 BCM in 2025.

Increase in industrial requirements

To cater for needs of future population, the requirement of industrial produce will increase substantially further likely boost and increase in industrial activities will require higher quantities of water for same thus increasing overall requirements of water including water requirements of transport industries This requirement is likely to change as per noted growth rate in recent past varying from 4.0 to about 7.7 % each year from 91-92 to 2008-2009 at 1993-94 prices. As per the data given by the standing committee of the ministry of water resources, while at present the industry requires 12 BCM of water per annum, the demand will increase to 23 BCM after 15 years[17].

As per estimates submitted by National Commission on Integrated Water Resource Development Plan [18] Govt. of India the total water requirement of country

[15] D .K. Rudola (2001-2002) *Community Water Harvesting in Hilly Areas Of Uttaranchal.* New Delhi Indian Institute Of Public Administration

[16] Times of India, dated 9/02/2009 New delhi.

[17] Times of India, dated 9/02/2009 New delhi.

[18] D .K. Rudola (2001-2002) *Community Water Harvesting in Hilly Areas Of Uttaranchal.* New Delhi Indian Institute Of Public Administration

would go up to 710 Km3 in 2010 , 850 Km3 by 2025 and from 973- 1180 Km3 by year 2050.

Diminishing Availability

The telling affect of various factors affecting the eco system in recent times and in turn the availability of water, is resulting in water table contours receding in general world over and this disastrous trend has resulted in bed levels of lakes ,rivers, local ponds etc to rise i.e. the depth of stored water reducing drastically and in cases drying up. This rising bed level is contributed by lot of garbage, filth and other pollutant flowing in to and clogging such water bodies and with sub optimal flow also failing to self clean specially the rivers and allowing silting makes the self cleaning cycle vicious.

Few of recorded details illustrate the same aptly reinforcing the alarming nature of this problem not limited to local areas but affecting the areas world over:

WATER TABLES FALLING AND RIVERS RUNNING DRY[19]

As the world's demand for water has tripled over the last half-century and as the demand for hydroelectric power has grown even faster, dams and diversions of river water have drained many rivers dry. As water tables fall, the springs that feed rivers go dry, reducing river flows.

Scores of countries are over pumping aquifers as they struggle to satisfy their growing water needs, including each of the big three grain producers—China, India, and the United States. More than half the world's people live in countries where water tables are falling.

[19] Adapted from Chapter 3, "Emerging Water Shortages," in Lester R. Brown, Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble (New York: W.W. Norton & Company, 2006

There are two types of aquifers: replenish able and non replenish able (or fossil) aquifers. Most of the aquifers in India and the shallow aquifer under the North China Plain are replenishable. When these are depleted, the maximum rate of pumping is automatically reduced to the rate of recharge.

In India, water shortages are particularly serious simply because the margin between actual food consumption and survival is so precarious. In a survey of India's water situation, Fred Pearce reported in *New Scientist* that the 21 million wells drilled are lowering water tables in most of the country. In North Gujarat, the water table is falling by 6 meters (20 feet) per year. In Tamil Nadu, a state with more than 62 million people in southern India, wells are going dry almost everywhere and falling water tables have dried up 95 percent of the wells owned by small farmers, reducing the irrigated area in the state by half over the last decade.

As water tables fall, well drillers are using modified oil-drilling technology to reach water, going as deep as 1,000 meters in some locations. In communities where underground water sources have dried up entirely, all agriculture is rain-fed and drinking water is trucked in. Tushaar Shah, who heads the International Water Management Institute's groundwater station in Gujarat, says of India's water situation, "When the balloon bursts, untold anarchy will be the lot of rural India."

Pakistan, a country with 158 million people that is growing by 3 million per year, is also mining its underground water. In the Pakistani part of the fertile Punjab plain, the drop in water tables appears to be similar to that in India. Observation wells near the twin cities of Islamabad and Rawalpindi show a fall in the water table between 1982 and 2000 that ranges from 1 to nearly 2 meters a year.

Iran, a country of 70 million people, is overpumping its aquifers by an average of 5 billion tons of water per year, the water equivalent of one third of its annual grain harvest. Under the small but agriculturally rich Chenaran Plain in northeastern Iran, the water table was falling by 2.8 meters a year in the late 1990s.

New wells being drilled both for irrigation and to supply the nearby city of Mashad are responsible. Villages in eastern Iran are being abandoned as wells go dry, generating a flow of "water refugees."

In Mexico—home to a population of 107 million that is projected to reach 140 million by 2050—the demand for water is outstripping supply. Mexico City's water problems are well known. Rural areas are also suffering. For example, in the agricultural state of Guanajuato, the water table is falling by 2 meters or more a year. At the national level, 51 percent of all the water extracted from underground is from aquifers that are being over pumped.

Since the over pumping of aquifers is occurring in many countries more or less simultaneously, the depletion of aquifers and the resulting harvest cutbacks could come at roughly the same time. And the accelerating depletion of aquifers means this day may come soon, creating potentially unmanageable food scarcity.

While falling water tables are largely hidden, rivers that are drained dry before they reach the sea are highly visible. Two rivers where this phenomenon can be seen are the Colorado, the major river in the southwestern United States, and the Yellow, the largest river in northern China. Other large rivers that either run dry or are reduced to a mere trickle during the dry season are the Nile, the lifeline of Egypt; the Indus, which supplies most of Pakistan's irrigation water; and the Ganges in India's densely populated Gangetic basin. Many smaller rivers have disappeared entirely.

Since 1950, the number of large dams, those over 15 meters high, has increased from 5,000 to 45,000. Each dam deprives a river of some of its flow. Engineers like to say that dams built to generate electricity do not take water from the river, only its energy, but this is not entirely true since reservoirs increase evaporation. The annual loss of water from a reservoir in arid or semiarid regions, where evaporation rates are high, is typically equal to 10 percent of its storage capacity.

The Colorado River now rarely makes it to the sea. With the states of Colorado, Utah, Arizona, Nevada, and, most important, California depending heavily on the Colorado's water, the river is simply drained dry before it reaches the Gulf of California. This excessive demand for water is destroying the river's ecosystem, including its fisheries.

Pakistan is essentially a river-based civilization, heavily dependent on the Indus. This river, originating in the Himalayas and flowing westward to the Indian Ocean, not only provides surface water, it also recharges aquifers that supply the irrigation wells dotting the Pakistani countryside. In the face of growing water demand, it too is starting to run dry in its lower reaches.

Disappearing Lakes, Shrinking Seas[20]

It has been noted that West Africa's Lake Chad has shrunk to a mere 5 percent of its former size. Central Asia's Aral Sea is shrinking, gradually turning into desert. In Israel, the receding shores of Lake Tiberias—also known as the Sea of Galilee—sometimes allow mere mortals to walk where the water once was.

Thousands of lakes in China have disappeared entirely. The diversion of river water in India and Pakistan that allowed for a doubling of irrigated area over the last four decades has depleted many lakes. All told, more than half of the world's 5 million lakes are endangered.

For more than 4,000 years, farmers have diverted river water for crops in dry areas and dry seasons, reducing the flow into nearby lakes and seas. Over the last half-century world water use has tripled, expanding faster than population. Today

[20] Source: compiled by Janet Larsen, Earth Policy Institute, from various sources, April 2005.

irrigation accounts for two thirds of global water use. With the advent of diesel and electrically driven pumps, groundwater extraction in some areas has exceeded recharge from precipitation, also causing water tables and lake levels to fall.

Growing water demands are causing other lakes around the globe to vanish. Irrigation withdrawals from the waters that feed Africa's Lake Chad quadrupled between 1983 and 1994. Water consumption, combined with low rainfall levels since the 1960s, has shrunk the lake by 95 percent, from 25,000 square kilometers to 1,350 square kilometers, over the past 35 years.

Over pumping groundwater in China's Hebei province has lowered the water table, resulting in the loss of 969 of the province's 1,052 lakes. Madoi County in northwest China's Qinhai province, the first through which the main stream of the Yellow River flows, once had 4,077 lakes. Over the past 20 years, more than half have disappeared. eroding deforested and farmed land is silting up the lakes and reducing their storage capacity,

Mono Lake, North America's oldest, dating back some 760,000 years, is an important feeding stop for migrating birds, especially as southern California has lost over 90 percent of its wetlands. Since the first diversions of its tributaries to quench the thirst of growing Los Angeles in 1941, the lake has contracted dramatically, with water level dropping by 11 meters (34 feet) and volume down 40 percent. As a result, its salinity has jumped to three times that of the ocean—far too salty to sustain most fish.

Mexico's largest lake, Chapala, is the primary source of water for Guadalajara's growing population of 5 million. This lake's long-term decline began in the 1970s, corresponding with increased agricultural development in the Río Lerma watershed. Since then, the lake has lost more than 80 percent of its water. Between 1986 and 2001, Chapala shrank in size from 1,048 to 812 square kilometers. Climbing municipal and industrial water demands now exceed the sustainable supply by 40 percent.

Position of various water bodies covering entire world as recorded is represented for sample cases in table 2.4.

Table – 2.4

Disappearing Lakes, Shrinking Seas

Jordan, Israel, and Palestine	**Dead Sea**	At 417 meters below sea level, the Dead Sea is the lowest place on earth, and is falling by up to 1 meter per year. Much of the water that would otherwise feed it is tapped by Israel and Jordan for irrigation. Overpumping Jordanian groundwater at more than twice the rate of aquifer recharge also has dropped the water table. The Sea has shrunk in length since the early 1900s, from over 75 to 55 kilometers long, and has split in two, with the southern basin turned into evaporation ponds for potash extraction. Its retreat has spawned more than 1,000 "sinkholes" of up to 20 meters deep and 25 meters across, forcing the evacuation of more than 3,000 people along the Jordanian shore alone. The salty lake could disappear entirely by 2050, along with the 90 species of birds, 25 species of reptiles and amphibians, 24 species of mammals, and 400 plant species that live on its shores.
India	**Dal Lake**	Lake Dal has shrunk from 75 square kilometers in 1200 AD to

		25 square kilometers in the 1980s, to smaller than 12 square kilometers today. Over the last decade the lake has dropped 2.4 meters in height. Debris from floating gardens has accumulated and uncontrolled building activity has filled in large areas of the lake. All the untreated sewage of Srinagar city and some 1,400 houseboats is deposited directly into the lake. Other lakes in the Kashmir Valley are facing similar problems.
Pakistan	**Lake Manchar**	Diversion of the Indus River, largely for irrigation schemes, has deprived Manchar, Pakistan's largest lake, of fresh water. Salt content has increased dramatically in recent years and the polluted water fosters diseases previously absent from the region. The lake had been a source of fish for at least 1,000 years, but due to its deterioration some 60,000 fishers have left the area.
China	**Northwest China's Xinjiang Uygur Autonomous Region**	Lop Nur covered 2,000 square kilometers in the 1950s but since losing water to irrigation it has turned to salty land and desert. The western and eastern Juyan lakes, Aydinkol Lake, and Manas Lake have all suffered similar fates, losing water and shrinking to salt marshes and desert.
China	**Yangtze River Basin**	More than 13,000 square kilometers of lakes in the middle and lower reaches of the Yangtze River were lost over the last 50 years More than 800 lakes disappeared entirely.
Cambodia	**Tonle Sap**	siltation from eroding farmland and deforested areas has reduced the lake's capacity and has destroyed aquatic habitat.

Russia	**Lake Baikal**	Lake Baikal, the world's oldest and deepest lake, contains nearly one fifth of the world's unfrozen freshwater. Over the past century the amount of soil flushed into the lake increased by two and half times due to regional agricultural and industrial development. Agricultural chemicals (including pesticides like DDT), power plants, and industry (particularly a large pulp mill on the lake's southern end) have polluted the lake.
Macedonia and Greece	**Dojran Lake**	Overuse of water from the lakes and streams that feed Dojran Lake has caused the lake to shrink to a third of its former size and the water temperature to rise. More than 50 islands have appeared in the middle of the lake as the water level has dropped by up to 3.48 meters, and without action it soon may disappear.
Mexico	**Lake Chapala**	Its long-term decline began in the late 1970s corresponding with expanded agricultural development in the Río Lerma watershed. Since then, the lake has lost more than 80 percent of its water. Between 1986 and 2001, Chapala shrank from 1,048 to 812 square kilometers and its level dropped by up to 4 meters. Climbing municipal and industrial water demands now exceed sustainable supply by 40 percent.
United States, California	**Mono Lake**	Since the first diversions of its tributaries to quench the thirst of growing Los Angeles in 1941, the volume of the lake has contracted dramatically, going from 5.3 billion to 3.2 billion cubic kilometers. Its salinity climbed to almost three times that of the

		ocean--far too salty to sustain most fish..
United States, California	**Owens Lake**	This perennial lake in southeastern California held water continuously for at least 800,000 years, spanning 518 square kilometers at its peak, but since the mid-1920s, after a decade of diverting water from the Owens River to Los Angeles, the lake has been completely drained.

Ministry of water resources informed Lok Sabha that during 1982 -2001[21] under ground water level in country has declined by 4m to 6m and in few areas the decline noted was even more than 6M . The total no of affected union territories and states was 17 . The situation in some areas had taken alarming proportions .and needs to be ratified on an emergent basis.

In NCT Delhi drastic reduction in water table has been noticed[22] in 40 years or so whereas in 1960s the water table was about 0.47M below ground level it declined by 2M or less in most part of Delhi up to 1977.During 1977-83 it declined further by about 4M this decline continues further and in some areas fall of 25M has been noticed in a very small period of 8 years which is quite alarming.

Such developments has been finding mention in public domain regularly:

[21] DPS Nagal (2003-04) Rain water harvesting in the NCT of Delhi IIPA New Delhi

[22] DPS Nagal (2003-04) Rain water harvesting in the NCT of Delhi IIPA New Delhi

Noida water table plumbs to new depths[23]

The industrial town of Noida is sandwiched between the Yamuna and the Hindon rivers. Yet water is scarce in this concrete jungle. The spurt in construction activity — virtually reducing the city to a maze of building blocks, commercial plazas and industrial complexes — has drained the city of its meagre water resources. The underground water table has depleted from a depth of 25 feet in various sectors, especially in Sectors 15-A and 16-A, to 40 feet. The conditions in other sectors, which are at some distance from the riverbed, is even more alarming, say the experts.

According to officials of the Water Works Department, water conservation and harvesting are the only viable alternatives, if Noida is to be saved from a serious water crisis.

The underground water table in Noida is constantly receding. Near Mullaur village, the Water Works Department recently attempted to sink a tubewell, but even after boring at 20 different places they failed to hit water.

Water can be pumped out only by boring up to a depth of 200 feet. But when water is drawn from such depths, the underground reservoir does not get replenished. This is perceived to be a grim development by some Water Works Department engineers.

Delhi water bodies battle for survival[24]

Though 629 water bodies have been named for revival, there are still many which don't figure in the list

"Fast depleting water resources in the Capital have raised concerns in the corridors of power so much so that 629 such water bodies have been listed for revival and maintenance. However, several water bodies that are struggling to survive rapid urbanisation don't figure in this list for

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[23] May 26 2003, The Tribune

[24] Neha Lalchandani | Times of India New delhi dated Sept. 08, 2008.

reasons varying from their strange disappearance to officials not attending the meeting.

The 36,000 sq feet Mayapuri lake is one such water body that was reduced substantially when its 18,000 sq mt area was filled up for a common effluent treatment plant (CETP). However, the PWD, under which the lake was listed in 2002, says that its revenue records show that no such lake existed. In a reply to an RTI plea filed by NGO Tapas recently, the department has denied that the water body was ever under its jurisdiction.

''When the CETP was being made, the department was asked to create another water body of the same size in Bawana for which the Delhi Jal Board (DJB) had given an affidavit. PWD also claims to have paid the Municipal Corporation of Delhi Rs 1.5 crore for removing encroachment on the lake. Now they are saying that it doesn't exist,'' said Vinod Jain of Tapas.

In 2001, the MCD had identified 177 water bodies in the Capital but this figure was challenged since an earlier report had identified 355. The court formed another survey committee which, in 2002, came up with a list of 508 water bodies. However, there were several discrepancies in this list over the size of water bodies. Finally, an independent body was set up by the court which has identified 794. Of this, at present, 629 water bodies exist officially in Delhi which are being revived by various agencies.

Strangely, missing from this most important list are prominent water bodies, including the IG stadium lake that is right next to Delhi secretariat. Another water body in Sainik Farms, that was listed in 2002, is not in the current list as the surveyor's were unable to find it. Similarly, three water bodies in JNU, which were mentioned in the 2002 list, did not find a place in the current list as nobody from JNU attended the meeting to finalise the list.

In the absence of official recognition, it is the easiest thing to encroach upon the water bodies. Several have already disappeared under concrete structures. A park has come up on the 31,000 sq mt huge water body in Vinod Nagar. A hospital is to come up on an 8,400 sq mt water body in Jhilmil Tahirpur.

The L-G's office confirmed that it had asked all owning agencies to send it a list of water bodies under them.

''The fact that there is still no consensus on the number of water bodies made us take this step. There are a little over 400 water bodies that can be revived and we have asked all agencies for a list of the same. In about a couple of months, we will start compiling the list,'' said an official. "

Polluted Ground Waters

One of the major factors affecting the water availability of requisite quality is pollution as If the water becomes polluted, it loses its value to us economically and aesthetically, and can become a threat to our health. Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, like serving as drinking water, and/or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water. Water pollution has many causes and characteristics.as described below (Fig. 2.2 & Fig. 2.3) :

Fig -2.2 Water pollution (Typ.)

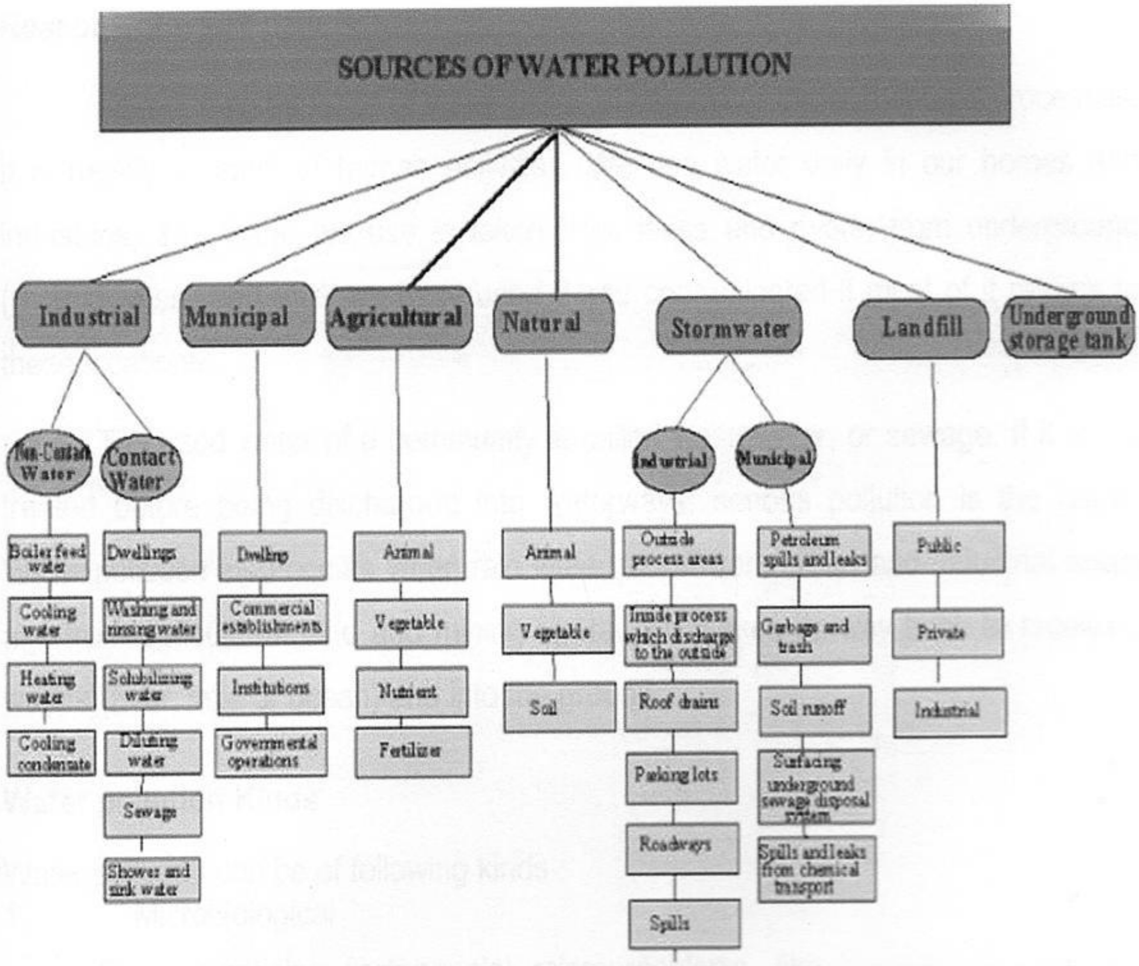

Fig -2.3 Water pollution sources.

Water bodies are also dying from contamination. Farm wastes, sewage, and nitrogen fallout from fossil fuel burning, fertilize lakes, causing excess algal and plant growth that depletes water oxygen levels..

Acid precipitation, largely from fossil fuel burning emissions, is killing thousand of lakes. A survey of remote mountain lakes throughout Europe found that even lakes far from human development were acidified by sulfur and nitrogen deposition and that virtually all were contaminated by heavy metals (such as mercury, lead, and cadmium) and fly ash particles.

Reasons of water pollution

Although some kinds of water pollution can occur through natural processes, it is mostly a result of human activities. We use water daily in our homes and industries, The water we use is taken from lakes and rivers, from underground (groundwater); and after we have used it and contaminated it most of it returns to these locations.

The used water of a community is called wastewater, or sewage. If it is not treated before being discharged into waterways, serious pollution is the result. Water pollution also occurs when rain water runoff from urban and industrial areas and from agricultural land and mining operations makes its way back to receiving waters (river, lake or ocean) and into the ground.

Water pollution Kinds

Water pollution can be of following kinds :

1 Microbiological

Disease-causing (pathogenic) microorganisms, like bacteria, viruses and protozoa can cause this pollution. Some serious diseases like polio and cholera are waterborne.

2 Chemical

A whole variety of chemicals from industry, such as metals and solvents, and even chemicals which are formed from the breakdown of natural wastes (ammonia, for instance) are poisonous to fish and other aquatic life. Pesticides used in agriculture and around the home-- insecticides for controlling insects and herbicides for controlling weeds-- are another type of toxic chemical. Some of these can accumulate in fish and shellfish and poison people, animals, and birds that eat them. Materials like detergents and oils float and spoil the appearance of a water body, as well as being toxic; and many chemical pollutants have unpleasant odors

3 Oxygen-depleting Substances

Many wastes are biodegradable, that is, they can be broken down and used as food by microorganisms like bacteria. Too much biodegradable material, can cause the serious problem of oxygen depletion in receiving waters.

4 Nutrients

The elements phosphorus and nitrogen are necessary for plant growth, and are plentiful in untreated wastewater. Added to lakes and streams, they cause nuisance growth of aquatic weeds, as well as "blooms" of algae above (and below). If the water is used as a drinking water source, algae can clog filters and impart unpleasant tastes and odors to the finished water.

5 Suspended matter

Some pollutants, referred to as particulate matter, consist of particles which are just suspended in the water. Although they may be kept in suspension by turbulence, once in the receiving water, they will eventually settle out and form silt or mud at the bottom. These sediments can decrease the depth of the body of water. Also, some of the particulate matter may be grease or be coated with grease, which is lighter than water, and float to the top, creating nuisance.

Water pollution categories

Surface water and groundwater have often been studied and managed as separate resources, although they are interrelated. Sources of surface water pollution are generally grouped into two categories based on their origin.

Point source pollution

Point source pollution refers to contaminants that enter a waterway through a discrete conveyance, such as a pipe or ditch. Examples of sources in this category include discharges from a sewage treatment plant, a factory, or a city storm drain.

Non-point source pollution

Non-point source (NPS) pollution refers to diffuse contamination that does not originate from a single discrete source. NPS pollution is often a cumulative effect of small amounts of contaminants gathered from a large area. Nutrient runoff in stormwater from "sheet flow" over an agricultural field or a forest are sometimes cited as examples of NPS pollution.

Contaminants may include organic and inorganic substances.

Organic water pollutants include:

- Detergents
- Disinfection by-products found in chemically disinfected drinking water, such as chloroform
- Food processing waste, which can include oxygen-demanding substances, fats and grease
- Insecticides and herbicides,

- Petroleum hydrocarbons, including fuels and lubricants from storm water runoff
- Tree and brush debris from logging operations
- Volatile organic compounds (VOCs), such as industrial solvents, from improper storage.
- Various chemical compounds found in personal hygiene and cosmetic products

Inorganic water pollutants include:

- Industrial discharges (especially sulfur dioxide)
- Ammonia from food processing waste
- Chemical waste as industrial by-products
- Fertilizers containing nutrients
- Silt (sediment) in runoff from construction sites, logging, slash and burn practices or land clearing sites

Study of NCT region[25] has brought out that in recent past over exploitation of water in various region has led to water quality deterioration which has been made critical by pollution specially the industrial there has been complaints of saline water in Najafgarh , Dwaraka and over pumping in west Delhi areas of Rohini , Narela has provided ingress of saline water in thin fresh water strata. About 30% area of NCT is having fluoride content > 1.5 mg/lt the prescribed limit by WHO contributed by human activities of using fluoride salts in steel,

[25] DPS Nagal (2003-04) Rain water harvesting in the NCT of Delhi IIPA New Delhi

aluminum and tile industries etc on other hand use of fertilizers ,sewage effluent etc has resulted in nitrate concentration of .100 mg/lt the permissible limits.