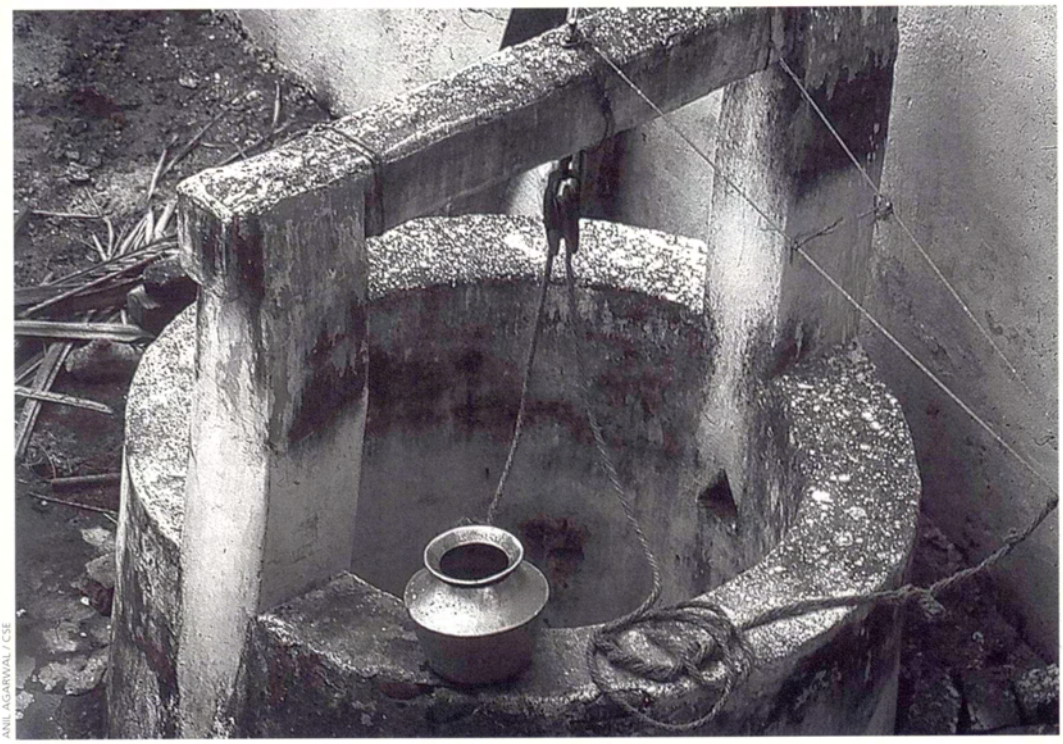
In desperation

Chennai must incessantly seek water



ANIL AGARWAL / CSE

The reason Chennai faces chronic water scarcity: it depends on the rain it captures in its lakes, ponds and groundwater aquifers. It has no perennial rivers. So, if the city has not built reservoirs of water, one or two bad monsoons leave it crippled. If the north-east monsoon (October-December) fails, the city is in deep trouble.

And the rains have failed not for one but two consecutive years — 2002 and 2003. Last year, the city received 280 millimetres of rain, almost half the normal precipitation of 580 mm. In January 2004, the combined storage in the three major reservoirs of Poondi, Redhills and Cholavaram fell to the lowest in 54 years — 268 million cubic feet, a mere 3.6 per cent of their total capacity of 7,412 million cubic feet. Is this due to siltation and poor maintenance? A study of siltation of the Poondi reservoir from 1944 to 1983 by the public works department showed the average annual rate of siltation is a mere 0.298 per cent of the reservoir's capacity of almost 80 million cubic metres (MCM). and the annual rate of sedimentation over the drainage area is 0.031 MCM per sq km.

So is Chennai's perennial water crisis a result of nature's vagaries? Or gross mismanagement? Essentially, its politicians and scientific institutions are unwilling to accept that it doesn't have a perennial river. The fantasy that water must be accessed from a river must be realised, over and over again. So it is that over time, and conveniently increasing cost, they have reached ever farther to distant rivers. The desire to be free of monsoon dependence might be justifiable but the history of attempts to fulfil this yearning shows that the exact opposite has been achieved.

Circa 1772

Chennai's primary water source used to be a network of *eris* (tanks), ponds, temple tanks and dugwells managed by local communities. Typically, several households shared each well. In 1772, when it was under the control of the English East India Company, the 'first' public water supply works was set up. It was designed to supply 0.635 million litres per day (mld) from a cluster of 10 wells to Fort Saint George (now, the state secretariat in the city). Over the next 100 years, a larger scheme was

POPULATION: **4.21** million (as per the 2001 census) • TOTAL DOMESTIC DEMAND: **880** million litres per day (mld) @ 35 lpcd • TOTAL INDUSTRIAL DEMAND: **120** mld • CHENNAI RIVER BASIN AREA: **7,282** sq km (5,542 sq km in Tamil Nadu; rest in Andhra Pradesh) • SEASONAL RIVERS: Araniyar, Kosathalayar, Coum and Adayar • MAJOR RESERVOIRS: Poondi, Redhills, Cholavaram and Chembarambakkam • TOTAL RESERVOIR CAPACITY IN RIVER BASIN: **320** million cubic metres • WATER SUPPLY BY METRO WATER (NORMAL MONSOON): **325-250** mld • WATER SUPPLY BY METRO WATER (DROUGHT YEAR): **175-200** mld

Flow and ebb

Krishna waters don't reach Chennai

The Telugu Ganga Project was conceived in the 1970s by the then prime minister Indira Gandhi, Telugu leader N T Rama Rao and Tamil leader M G Ramachandran. All the three are now dead, leaving the fate of the project to the ever fluctuating equations between the chief ministers of Tamil Nadu and Andhra Pradesh (AP). Water supply from the project to Chennai has been severely reduced by seepage as well as pilfering farmers.

As far back as 1976, AP, Maharashtra and Karnataka agreed to divert 12 thousand million cubic feet (TMC ft) to Chennai every year. But the project's first phase was commissioned only in 1996. It was expected to bring 5 TMC ft — 380 million litres per day (MLD) — from the Srisailam reservoir across the Krishna, through the Somaseelam reservoir on the Pennar river, and subsequently, through an open channel, to Poondi. The capacity of the city waterworks was increased to 300 MLD in anticipation of 8 TMC ft during July-October and 4 TMC ft during January–April.

But this amount hasn't reached Chennai since 1996. In seven years (1996-2003), the project delivered a total of 15 TMC ft to Chennai, instead of the projected 84 TMC ft. However, the water reaching the city has been considerably less than receipts at the state border show because of seepage in channels and other losses en route. It is estimated that 5 TMC ft at the state border adds a mere 1.5 TMC ft — less than one third of the original — in the reservoirs.

On February 16, 2004, the Krishna river water released from the Kandaleru reservoir in Andhra Pradesh reached the state border near Uthukottai in Tamil Nadu after travelling 152 km. It was to reach Poondi, and then course 35 km down the Baby canal to the Redhills reservoir for being treated and ferried in tankers. But such hopes evaporated on February 18 with the Poondi canal remaining dry. This was attributed to illegal tapping of water by farmers and the withdrawal of water to meet the demands of Tirupati town in AP. "The increasing height of the Almatti dam in Karnataka is also one of the reasons, as the water gets stored in Srisailam dam which then flows to Kandaleru dam," argues S Ranganathan of Metro Water.

As per a 1997 estimate, the total cost of the project is Rs 2,400 crore, of which Tamil Nadu's share is Rs 640 crore. The second phase of the project is expected to provide an additional 7 TMC ft per year at the Tamil Nadu border by 2011. But even if the water is released as scheduled, how much will reach the city? While the viability of the project is in question, there is no discussion in Tamil Nadu of its failures and potential. All politicians maintain a studied silence on the matter as the project is perceived as a legacy of former chief minister M G Ramachandran, in whose name both the main political parties slug it out at the polls.

PHOTOGRAPHS: DEEPA KOZHISSERI / CSE

completed. This brought water from two *eris* — Cholavaram and Redhills — to municipal waterworks, distributing it across the city.

These two tanks met the growing city's demand till the early 1900s. Between then and the 1940s, the city's population doubled to almost one million. To meet the growing demand, a reservoir was constructed at Poondi across the Koratallaiyar river. This raised the total surface storage capacity from 100 MCM to 180 MCM. Till the 1970s, the city's public water supply system depended exclusively on these three reservoirs, located 20-50 km to its northwest.

Chennai's water worries had already begun in the 1950s. R Muthuswamy Pillai was the mayor in 1954. He contacted an American firm to explore the possibility of arranging artificial rain to combat drought. In 1957-58, the then chief minister C N Annadurai invited the United Nations Development Programme (UNDP) to find out the feasibility of setting up a desalination plant. "But the (UNDP) team recommended that instead of seawater, the groundwater in the Araniyar-Koratallaiyar basin (northwest of the city) be utilised to fulfil the drinking water requirements... when UNDP started drilling borewells in the area, the farmers realised the groundwater potential and started doing the same," says R Sakthivadivel, Patancheru-based senior fellow of the International Water Management Institute, a think tank in Colombo, Sri Lanka.

As the city continued to grow, water availability fell from a comfortable 140 litres per capita per day (LPCD) to a low 80 LPCD in 1971. The public system was under additional pressure to extend its distribution network to new areas being developed. This led to installation of public taps, borewells fitted with hand pumps and large tanks to store municipal water. In 1976, the politicians became fixated with the idea of the river as the source of water. The closest was Krishna, 170 km north of the city, and the Telugu Ganga Project was drawn up.

Ecological misfortune or chronic mismanagement? Chennai's water crisis is primarily the latter

But work proceeded at a snail's pace: the first phase of the project was commissioned in 1996. However, the scheme has failed to live up to its promise (see box: *Flow and ebb*).

Chennai's water search also took it to the well fields of the Araniyar-Koratallaiyar basins 40 km northwest. More sources were brought under the control of Metro Water when it was formed in 1978. The wells in Tamaraipakkam, Panjatty and Minjur fields were reserved for industry in north Chennai. Over the years, these wells were diverted for domestic use, forcing several industrial units to sink private borewells. As the shortfall in water supply continued to rise, Metro Water later insisted that industries use treated sewage for part of their needs.

As surface water projects couldn't meet the increasing demand of Chennai, more borewells were sunk in newer well fields. By 1987, there were five well fields supplying water to the city. To cope with the worsening situation from the early 1980s, aquifers in Poondi, the floodplains of the Koratallaiyar and Araniyar rivers and

Withdrawal symptoms

Groundwater extraction from well fields

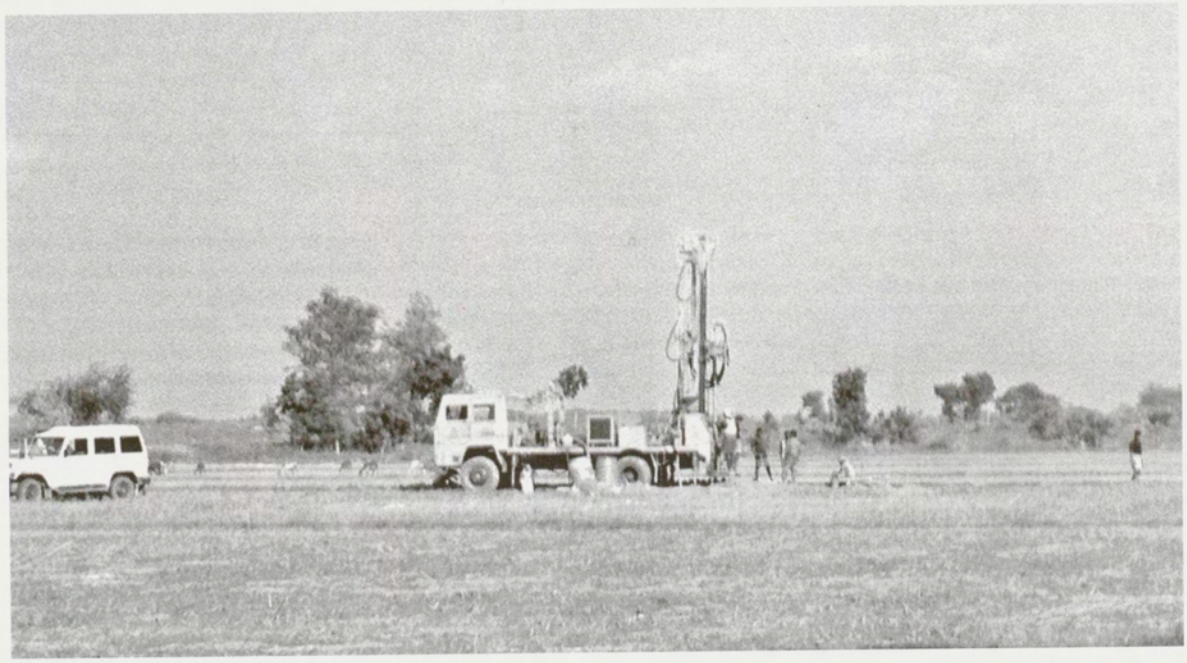
Well fields	Year of commission	Number of wells	Safe yield (in MLD)
Minjur	1965	12	25
Tamaraipakkam	1979	22	32
Panjetty	1969	12	36
Flood Plains of Koratallaiyar	1987	5	13
Kannigaiper	1987	9	15
Poondi	1987	15	27
Total		75	148

Rs 1 crore every day

Metro Water's daily water sheet

	November 2003	January 2004	March 2004	May 2004
Amount of water ferried over long distances by tankers (MLD)	38	74	140	203
Number of tankers hired	595	726	1,100	1,300
Number of daily trips	6,733	7,555	9,500	12,000
Number of fixed plastic tanks installed	10,030	10,430	11,315	13,500
Number of new borewells sunk	5,500	6,500	7,000	7,500
Daily expenditure (in Rs lakh)	55	70	85	100

Source: Metro Water



Chennai has a long history of overexploiting its natural water resources: its past is now catching up with it

the south coastal aquifer began to be exploited (see table: *Withdrawal symptoms*). In 1993 and 1999, water from Chembarambakkam lake, 26 km southwest of the city, was diverted for the city.

In the 1970s, Chennai's water search turned southwards, beyond Pondicherry, to the Veeranam lake 235 km away. Work began on the Veeranam project, which envisaged a pipeline from the lake. But the project had to be shelved in 1975 amid allegations of corruption that brought a lot of bad press to chief minister K Karunanidhi of the Dravida Munnetra Kazhagam (DMK) party. In 1995, his political opponent and the then chief minister Jayalalithaa took up the project at a budgeted cost of Rs 464 crore.

In 1996, the DMK was back in power and it dropped the project after the World Bank raised objections and refused to fund it. In 2001, Jayalalithaa returned to power. She relaunched it in February 2003 as the New Veeranam Project. It was completed in June 2004, when the lake was dry (it remains dry from February to July every year). The lake is supposed to get water from the Cauvery river, but the long standing dispute with Karnataka has ensured this doesn't happen. To feed the pipeline, borewells were sunk in a 25 km stretch, causing the water table to plummet and the farmers to agitate (see box: *Water doesn't flow*).

Over the years, groundwater has become *the* major source of water (see table: *Overdraft account*). But the city's falling water table impelled exploitation of distant aquifers, adding to the costs (see table: *Rs 1 crore every day*). In 2004, Metro Water supplied water to the city through tankers for about six months at a cost of Rs 1 crore per day.

On an average, Metro Water gets 70 MLD of water through 1,700 tankers from neighbouring villages. The board buys this water from farmers after obtaining an acceptance letter from them. The state government also drew up a Rs 145 crore relief plan for additional borewells near the existing well fields to the north of the three major storage reservoirs. But this level of groundwater mining will last, at best, a few years.

Maximum that it can get

Available sources under normal conditions

Source	Location	Water obtained (MLD)
Surface water	Poondi, Redhills, Cholavaram	200
	Veeranam lake (235 km away)	180
	Kandaleru dam (175 km away)	130
Groundwater	Well fields in A K basin, southern coastal aquifer and municipal sources	233
	Borewells in Neyveli–Panruti belt (when the Veeranam dries up)	90
Total		833

Overdraft account

Metro Water's sources during the 2004 drought

Source	Location	Water obtained (MLD)
Groundwater	Transported through tankers	98
	Transported through pipelines from private agricultural wells and Metro Water wells along the north western fringes	95*
	Southern coastal aquifer (through pipeline)	3
	From Palar river bed (through pipeline)	2.5
Surface water	Redhills	2
Sea	Desalination plants	0.5
Total		201**

*From June 2004, an additional 75 MLD came from borewells in Neyveli area
**From October 2004, an additional 180 MLD was supplied from Veeranam lake
Source: Metro Water

Water doesn't flow

Out of the barrel of a pipeline

Touted as the solution to all the water problems of Chennai, the New Veeranam Project is Tamil Nadu chief minister J Jayalalithaa's hobbyhorse. Under the project, a pipeline has been built to bring 180 million litres of water per day to Chennai from the Veeranam lake in Sathiathopu, Cuddalore district, 235 km away. The project was launched in February 2003 and completed in June 2004. But the World Bank-funded, Rs 720 crore-project was unable to provide the lake's water to Chennai when it needed it the most. This is because every year, from February to July, the lake stays dry.

The Veeranam lake gets 75 per cent of its water from the Cauvery river, according to a study conducted by Annamalai University in 2002 (the remaining coming from the 427.5 sq km catchment during the northeast monsoon). Tamil Nadu and Karnataka have been locked in a 30-year-old bitter dispute over the river's water. As the lake was dry when the project was completed, Jayalalithaa had 45 borewells sunk along the length of the pipeline and connected to it. But villages located along the pipeline feel cheated — the water going into the pipeline is the irrigation they are denied.

On November 5, 2004, villagers of Kannakudi in Cuddalore district held a protest, demanding water for their fields. The demand was ignored; Chennai's thirst was more important than irrigation. "Then came the rains. The lake got filled up. They released the floodwaters on to our fields, inundating about 5261 hectares (ha)," says V Vijayaragavan, a farmer from Kannakudi. On November 11, the villagers held a protest, this time

Farm water for the city

During the 2003 drought, Metro Water bought from farmers the rights to pump water from nearly 164 borewells. In 2004, it bought rights to another 44 borewells from farmers. Under the

demanding flood relief. Due to repeated droughts, several farmers in the region are in heavy debt.

Says K Venkataraman, who represents a farmers' collective in Chidambaram district and is organising a farmers' movement to demand their riparian rights: "The government says it is supplying only the excess water from Veeranam to Chennai. The reality is that farmers here don't have enough water for a single crop." Most farmers have stopped growing their first crop (July-September) over the past 30 years because the dam gets very little water from the Cauvery. They started relying solely on the second crop (September-January) irrigated by the lake's waters during the northeast monsoon. Now, the northeast monsoon water is being taken away from them to quench Chennai's thirst. Farmers with large landholdings dug borewells. And then saw them go dry. In May-June several farmers migrated to towns in search of casual employment. "People here are willing to sell their land. But who will buy it?" wonders M S Rajendran of Mailimulanggadi.

The Veeranam lake, constructed more than a millennium ago by the Chola dynasty, irrigates 7,200 ha through 24 canals and is the only source of irrigation in the area. S Ranganathan, engineering director of Chennai Metro Water, maintains the Veeranam project takes the farmers' rights into consideration. How? By raising the lake's bund by 0.6 metre, thereby increasing the lake's capacity. One visit to the lake nails the lie — several gaps have been left in the overlying bund to allow villagers access to temples and the lake for their day-to-day activities. The money spent on the overlying bund under the New Veeranam Project is a complete waste.

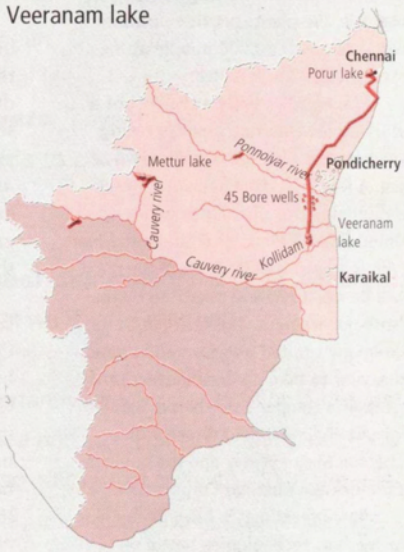
Kodumpully village doesn't mind Chennai getting Veeranam waters. But the borewells dug to compensate for the absent lake water hurts them. These bores have been sunk in close proximity. As a result, farmers' borewells and dugwells within a 3 km radius are showing alarming groundwater depletion. E Velmurugan of Marua village can irrigate only one-third of the land he irrigated last year. "If they run their borewells through the year, we will be wiped out," he fears. Between the villages of Marua and Vadalur are 15 Metro Water borewells. "We sunk a borewell to 27 metres 30 years ago, then another at 60 metres 15 years ago, and now we are plumbing depths of 76 metres, at a cost of Rs 1.5 lakh each. There is no recharge of groundwater," says A M Das of Vadalur.

"If their bores operate for two hours, we lose water for irrigating 45 cents (0.18 ha)," calculates A Raja of Vadalur. Villagers of Marua and Oonamkupam submitted a petition to the district collector against the Metro Water borewells, but there was no response. The villagers' main complaint: the government bought land from them to lay a pipeline, not to sink borewells. Now, the government plans to sink borewells upstream of Veeranam lake, in the basin of the Kollidam river, which is supposed to bring water from the Cauvery to the lake.

Pattali Makkal Katchi (PMK), a political party that is part of the United Progressive Alliance government at the Centre, has filed a petition in the Madras High Court against this groundwater exploitation. "The borewells will lead to a water crisis in Neyveli area — being close to the sea, it will witness greater sea water intrusion into the ground," says K Balu, the party's advocate. PMK's petition warns that the entire Cuddalore district would turn into a desert, causing irreparable damage to the farmers. The court has asked the state government to respond.

Dry run: 235 km

Borewells substitute for the dry Veeranam lake



agreement, farmers are paid Rs 40 per a 10,000-litre tanker. A majority of the farmers have small landholdings that don't earn them much. They prefer to sell water from their borewells as that earns them more money.

And Metro Water isn't just drawing from well fields but also from irrigation tanks. In January 2004, thousands of farmers, residents and members of political parties from Maduranthakam and neighbouring villages formed a human chain on either side of the Grand Southern Trunk Road. They were protesting the government move to pump water from their 810-hectare irrigation tank to give Chennai some drinking water — the tank hasn't filled up for several years. It irrigates more than 10,100 hectares in Maduranthakam and 20 neighbouring villages. It also provides drinking water. The pressure mounted by farmers compelled Metro Water to drop its plan to tap 2 MLD of water from the Maduranthakam tank.

This raises a great fear: irrigation enables almost 40 per cent of the water to seep back in to the aquifer. Now, the water is being drawn up and out without that level of recharge, shows a micro-level status report of the Chennai basin, commissioned by the Centre for Science and Environment (CSE), New Delhi. The study, conducted by hydro-geologists K R Sivaramanan and S Thillaigovindarajan, who formerly worked in the state government's groundwater unit, sounds another alarm.

Hydrogeology says once the dynamic groundwater reserves are exhausted and the deeper, static reserves are exploited, replenishment of groundwater levels can't happen to the previous levels. Doesn't matter if irrigation is resumed, rainfall is good, or even a flood occurs. The farmers' borewells have been drawing water continuously. The aquifers are so exhausted that these

Overexploitation has depleted groundwater to irreparable levels: and still they drill deeper

The final option

Desalination

With the surface and groundwater options either running dry or proving highly undependable, Chennai is now looking at the sea. In several parts of the world, desalination projects have reliably met the water needs of large urban populations and in a cost-effective manner. Chennai's experience with treating brackish groundwater has been positive (see table: *Saline features*). Metro Water has established five such units. Using the technology of reverse osmosis, the plants provide potable water to about 40,000 people at the rate of Rs 36 per kilolitre.

Exactly what will be the cost of a working desalination plant (treating seawater) in Chennai is not known as yet. A Rs 1,000 crore seawater desalination plant for Chennai is on the anvil. Union finance minister P Chidambaram, who is from Tamil Nadu, said the plant will be executed and operated by the state government. The Chennai Desal Company Limited was formed in June this year to take up desalination projects. The company's directors would include the managing director of Chennai Metro Water and the commissioner of the Chennai Corporation.

Varying estimates have been given for various technologies based on model desalination plants, with the minimum treatment cost of Rs 50 per kilolitre. The cost of desalinated water will far exceed the cost of water from other sources.

Saline features

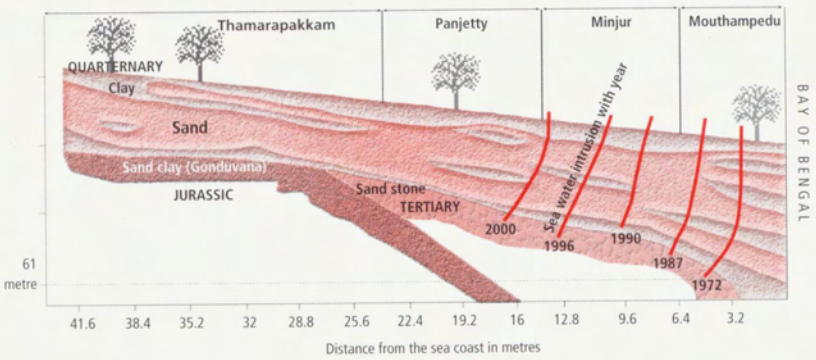
Treating brackish water

No of desalination plants	5
Plants in operation	4*
Aggregate capital cost	Rs 1.73 crore
Quantum of water produced	500,000 litres per day
Cost of water	Rs 36 per 1,000 litres

*The fifth plant is closed for maintenance
Source: Chennai Metro Water

Salt attack

Seawater is increasingly infiltrating the drained well fields north of Chennai



bores now yield less than half of what they used to in 2003, while some have dried up completely. This is drawing in seawater into the aquifers, taking the problem to another level (see map: *Salt attack*). The groundwater of agricultural areas will suffer the same fate as the groundwater of Chennai city. What is this fate?

Groundwater decline

Overexploitation and limited recharge have severely depleted groundwater in Chennai. Open dugwells, the most important source of groundwater, have had to be replaced with the deeper borewells. In the coastal areas, this has led to seawater ingress, irreparably damaging the coastal aquifers. Borewells drilled in Triplicane, Royapettah, Besant nagar areas now yield brackish water with high salt content.

To estimate the change in Chennai's water table, the CSE study prepared maps using data from observation wells, which are borewells used solely to monitor the groundwater, for 1991 and 2002. In 2002, the water table had fallen throughout Chennai by 7-10 metres as compared to the 1991 level. Northern Chennai and the coastal areas showed the greatest decline. Metro Water's data also shows similar level of decline. According to Ranganathan, the water level fell by 10 metres between 1999 to 2004.

The borewells are plumbing deeper every year. For instance in North Chennai, particularly in Thiru-vi-ka Nagar, bores go deeper than 100 metres. Even at this depth, some of them are going dry. In central Chennai, water was previously tapped from the alluvium formation at a depth of 25 metres, followed by hard rock. Now, this resource is exhausted and borewells are tapping the underlying rock formation. In southern Chennai, which has hard rock formation, borewells are drilled to a depth of 50-60 metres through minor fractures. This desperation to tap into any groundwater anywhere obviously overlooks quality issues.

Taking note of declining water table in the city and its surroundings, the state government passed the Madras Metropolitan Area Groundwater (Regulation) Act in 1987. It applied to 285 notified villages where free extraction of groundwater is permitted only for domestic use, and extraction for commercial activities requires a permit. But the act has failed because private tanker operators were allowed to draw water without permits in 2004 in the face of the water crisis.

One-fifth of Chennai's water supply comes from private operators who form a powerful lobby. In 2002, the government amended the act, making it applicable to 305 villages. But even the amendment has failed to check the private tankers, who have become quite influential.