Water scarcity in Chennai – the winners and losers: Top left, residents in Chennai carrying water they have to collect from the tankers; top right, water being pumped from farmers’ wells for sale in the city; bottom left, women are often the worst affected by groundwater over-exploitation in peri-urban areas; bottom right tankers waiting to fill up from private wells outside the city.
CHAPTER 3

Strengthened city, marginalised peri-urban villages: stakeholder dialogues for inclusive urbanisation in Chennai, India

S. Janakarajan, John Butterworth, Patrick Moriarty and Charles Batchelor

Dialogue in a water-stressed city
Chennai, a city of almost seven million people in Tamilnadu State, is one of the most water-stressed cities of India. While the population keeps skyrocketing, the amount of water available for them is dwindling. Scarcity intensifies conflict between Chennai (formerly Madras) and its peri-urban areas, which cannot be resolved while there remains a great institutional vacuum. When all else fails, can a multi-stakeholder dialogue help to get the situation unstuck? The Negowat project team in India succeeded in getting many key stakeholders around the table and creating quite a media stir in the process.

In this chapter, we will analyse how water conflict developed in two peri-urban villages of Chennai, and explore to what extent a multi-stakeholder approach can provide long-term, sustainable solutions to growing problems of mega-cities such as Chennai. After introducing the Negowat process in the city, its objectives and methodology, we will discuss the overall nature and intensity of water conflicts in Chennai and its peri-urban areas. Then we consider the methodology, outcomes and difficulties encountered in developing multi-stakeholder platforms and dialogues. A further section outlines the results of a water resources audit carried out in the context of Chennai and peri-urban areas that highlighted major differences between official data, the conventional wisdom and facts on the ground. Finally, we summarise key lessons learned and policy options available to move forward and have a more positive impact.

5 According to the Registrar General and Census Commissioner of India, the urbanisation rate in India is likely to go up from 27.8% in 2001 to 38.2% in 2026. Three-quarters of the population of Tamilnadu State will be urban in another two decades – a much more rapid change than the average for the whole country.

6 The term peri-urban is used in its widest context, not least because Chennai’s water demand is met by inter-basin transfers of water from many hundreds of kilometres away in the Cauvery and Krishna Basins. As ‘sustainable’ water resources in these basins are fully allocated in all but the wettest years, these transfers have a direct impact on water users in the basins.
Chennai’s fragile water balance  
According to the Chennai Metro Water Supply and Sewerage Board (MMWSSB), Chennai gets an average annual rainfall of 1,290 mm, much more than the national average. But in the urban areas only about 5% of this rainfall actually seeps into the ground. By now, 80% of Chennai’s groundwater has been depleted and any further exploitation could lead to further salt water intrusion.

### Table 3.1 Main water sources for Chennai

<table>
<thead>
<tr>
<th>Water body</th>
<th>Depth (m)</th>
<th>Normal yield (mcm)*</th>
<th>Capacity (mcm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poondi reservoir</td>
<td>2.2</td>
<td>76.7</td>
<td>77.91</td>
</tr>
<tr>
<td>Cholavaram reservoir</td>
<td>3.4</td>
<td>22.5</td>
<td>25.13</td>
</tr>
<tr>
<td>Chembarampakkam</td>
<td></td>
<td></td>
<td>103.03</td>
</tr>
<tr>
<td>Red Hills lake</td>
<td>3.8</td>
<td>71</td>
<td>80.65</td>
</tr>
</tbody>
</table>

* mcm: million cubic metre

The Chennai river basin\(^7\) consists of a group of small rivers such as the Araniyar, Kusathalayar, Cooum, and Adyar Rivers. The four rivers once supplied fresh water to the city\(^8\). Currently however, Chennai City does not have access to a perennial river and has to depend primarily on three major former irrigation tanks (reservoirs) and one small reservoir across a river that floods only for a few days during the monsoon.

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\(^7\) The total Chennai basin covers an area of 7,282 km\(^2\). A good three quarters of this area, 5,542 km\(^2\), is found in Tamilnadu State, the reminder is in the adjacent Andhra Pradesh State.

\(^8\) For instance, the Araniyar, which runs to a total length of 132 km, drains an area of 1,470 km\(^2\) of which roughly 50% falls within the state of Tamilnadu. It drains into the Bay of Bengal near Pazhaverkadu village. The Kusathalayar joins with the surplus from the Kaveripakkam tank (which is a part of the Palar Anicut system), across which the Poondi Reservoir has been constructed in 1945 with a view to supplying drinking water to the Chennai City in the year 1945. The capacity of this reservoir is 77.91 mcm. Below the Poondi Reservoirs, two regulators were constructed (namely, Thamaraipakkam Anicut in 1879, and Valur Anicut in 1872) basically with a view to regulating water during flood seasons. While Cooum river takes from Kesavaram Anicut (constructed across Kosatha-laiyar river in the upstream), the Adayar river carried the surplus water to the Chembarambakkam tank. There was another water course – a man-made canal called Buckingham Canal constructed in the year 1806 linking up various lagoons all along the east coast to a total length of 618 km of which 161 km lie within the State of Tamilnadu. During the past, it served a navigational purpose.
The north-east monsoon and surface run-off from the Araniyar and the Kortalaiyar rivers replenish the Poondi, Cholavaram and Red Hills reservoirs. These reservoirs are shallow, spread over a total catchment area of 3,513 km². On average, the total freshwater yield from these three sources is 200 million litres a day (mld). To augment this shortage Chennai City currently draws about 100 mld of groundwater from the Araniyar-Kortalaiyar basin (AK Basin). The estimated sustainable yield from this basin is 100 million cubic meters (mcm) per year but the current total extraction is 300 mcm per year, three times the sustainable yield. This over-extraction from the AK Basin leads to sea water intrusion into the aquifer and shortages for local water users.

All these sources together supply about 300 mld in a year with average rainfall, which is nowhere near enough. During the dry seasons, these sources therefore have been supplemented for the past two decades by groundwater pumped from agricultural wells in peri-urban villages in North Chennai and in particular in Manali industrial area. These supply about 125 mld of water, which is roughly equal to the shortage in normal years for city water supply. Together with the 300 mld from the AK basin, total supply comes to around 425 mld.

But the current water needs of the city and its urban agglomeration are almost double this amount, of the order of 750 mld. By 2011, at 100 lpcd (litres per capita per day), the city would require an estimated 760 mld for a population that will have grown to 7.6 million. For the rest of the Madras (Chennai) Urban Agglomeration, an estimated 300 mld would be required for its 3 million population. If the estimated industrial requirement in 2011 is also added (another 250 mld), then the total requirement of the city and its extended urban areas would be of the order of 1,310 mld. If conveyance losses are assumed to be 25%, the water requirement at the point of supply will be of the order of 1,638 mld. Excluding losses, the projected demand in 2021 is going to be around 1,763 mld (Metro Water Board, Chennai, 2006). These are only conservative estimates, but even at these figures, the current supply from the surface sources is nowhere near what is needed.

Water scarcity for the Chennai City is not a new constraint. The city has been historically in water deficit for lack of perennial rivers. Successive governments in the State of Tamilnadu have spent over Rs. 40 billion on various drinking water supply augmentation measures for the city. In recent times two large-scale water supply schemes have been implemented: the Telugu-Ganga project (an inter-basin transfer project to get water from the Krishna basin from the State of Andhra Pradesh over a distance of about 400 km) and the New Veeranam project to take water from the Veeranam tank at a distance of over 250 km. In addition, a large number of well fields have been identified from the two adjacent districts of Tiruvallur and Kancheepuram which have been a big source of conflict between the Metro Water Board and peri-urban villages. The latest attempt by the government (still in early stage) is desalination plants to generate 100 mld. (see Figures 3.1 and 3.2).
Peri-Urban Water Conflicts

Despite these measures, water scarcity persists. Per capita water supply in Chennai is now hardly 76 litres a day, which is lower than any other city in India (Ruet, Saravanan and Zerah, 2002). But even this supply is irregular and, if conveyance losses are taken into account, the point-of-supply figure is nearer to 50 lpcd. Only in exceptionally good years is something like 76 lpcd supplied without interruption. In bad rainfall years, which are not infrequent in Chennai, water hardly flows through the pipes.

At such times, tankers directly transport raw water from peri-urban villages into the city. The Metro Water Board started pumping groundwater from peri-urban villages to supplement the city’s water requirement as early as 1965. It identified rich aquifers (well fields) in the A-K as well as the Palar basin. The first well field identified was in Minjur in the A-K basin, about 40 km north of Chennai. Until recently, as much as 100 mld was pumped from the A-K basin well fields. Another 40 mld was pumped from the Palar Basin. Giant borewells in these well fields were installed for round-the-clock pumping. The continuous pumping from these well fields has damaged agriculture in these localities and the aquifer has become saline in parts due to seawater intrusion. During peak seasons, the Metro Water Board transports at least 6,000 tanker loads of water each day to the city from these well fields. In addition, numerous private operators also transport water from various peri-urban villages to supply many commercial establishments, hotels, construction sites and hospitals.
Acute water scarcity coupled with the ineffectiveness of government action has made the tanker water business a lucrative industry over a short span of time. In July 2000, for example, the piped water supply was only able to provide 59 lpcd. In response, the Metro Water Authority installed 4,525 tanks and hired 400 trucks of 9,000-12,000 litre capacity to make water deliveries to underserved areas. We estimate that over 13,000 tankers are mining the surrounding farmlands for water (Srinivasan, 2005) and every day at least 3,000 tanker loads of water go into the city to meet the needs of multi-storied apartments, hotels, hospitals, other commercial establishments, construction activities etc. During peak summer months this number shoots up steeply.

Inevitably, bottled water companies are also increasing in number in India. According to the Bureau of Indian Standards, there are now 1,200 water bottling companies across India, 400 of which are in Tamilnadu and over 200 in and around Chennai City. These companies make huge profits, and pay no license fee for groundwater extraction. Box 3.1 gives an impression of the bustling water market that has sprung up in and around Chennai.

**Legal remedies? Chennai’s groundwater laws**

There have been several legal attempts to regulate Chennai water supply and wastewater management. The first attempt was Chennai Metropolitan Water Supply and Sewerage Act, 1978. The three main objectives of this Act were:

- to promote and secure the planned development of water supply and sewerage services,
Peri-Urban Water Conflicts

- the efficient operation, maintenance and regulation of the water supply and sewerage systems in Chennai Metropolitan Area,
- to prepare immediate and long-term measures to meet future demand for water and sewerage services in the Chennai Metropolitan Area.

Box 3.1 Bottled water markets in Chennai City
Tamilnadu accounts for 50 per cent of the total bottled water business in India. There are more than 400 registered units in this state of which more than 220 are located in and around Chennai. The water sales figures quoted by the South India Packaged Drinking Water Manufacturers Association are stunning:

<table>
<thead>
<tr>
<th>Type of packaging</th>
<th>Price per unit</th>
<th>No of units sold per day</th>
<th>Total daily valued of sale (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 ml polythene sachet</td>
<td>Rs.1</td>
<td>5 million</td>
<td>5.0 million</td>
</tr>
<tr>
<td>One litre bottle</td>
<td>Rs. 10 to 12</td>
<td>75,000</td>
<td>0.75 to 0.9 million</td>
</tr>
<tr>
<td>12 litre cans</td>
<td>Rs. 20 to 30</td>
<td>100,000</td>
<td>2.0 to 3.0 million</td>
</tr>
<tr>
<td>25 litre bubble top containers</td>
<td>Rs. 25 to 40</td>
<td>25,000</td>
<td>0.625 to 1.0 million</td>
</tr>
<tr>
<td>Water tankers carrying 10,000 to 12,000 litres</td>
<td>Rs. 600 to 1000*</td>
<td>10,000</td>
<td>6.0 to 10.0 million</td>
</tr>
</tbody>
</table>

Note: *The price variation is due to factors such as water quality, distance transported and season (summer or monsoon months).

The total spent on bottled water or water from tankers is therefore:
- Rs.14.3 million to 19.9 million / day (US$ 0.3 to 0.4 million)
- Rs.429 million to 597 million / month (US$ 9.5 to 13.3 million)
- Rs.5.15 billion to 7.16 billion / year (US$110.4 to 159.1 million)
This would be enough money for 2.82 million to 3.92 million people to buy 500 grams of rice a day each (at Rs.10 per kilo of rice) for a whole year (515,000 to 716,000 tons of rice in a year).

Unfortunately, 25 years after the promulgation of this Act, Chennai’s water problems have grown worse. To fill the growing gap between supply and demand, the Board resorted to tapping groundwater from the peri-urban villages of the Chennai City. So rapacious was the Chennai Metro Water Board that with a view to protecting the long-term water supply to Chennai City, the Chennai Metropolitan Area Ground Water (Regulation) Act was enacted in 1987, prohibiting groundwater extraction in 229 notified villages around the Chennai City for any purpose other than domestic use. Since then, the Act has been amended twice to increase the number of protected villages to 243 and then to
Even though the main purpose was to control groundwater extraction and illegal transportation of water from these areas into the city, the Act is apparently grossly violated not only by private individuals but by the government itself.

Metro Water Board is very much a party to the over-exploitation of ground water in these villages, contributing to a serious threat to livelihoods. Furthermore, in many villages groundwater quality has turned brackish or even saline due to seawater intrusion. Thousands of truck operators are still involved in commercial transaction in water in these villages and, worse, in some villages water companies have even been established. For example, in Mathur, a village listed in the Act, there are at least two water companies – Polo and Acqua – which pump, purify and sell raw water. The Tamil Nadu Groundwater (Development and Management) Act of 2003 has been enacted and received the assent of the President, with a view to protecting groundwater from hazards of over-exploitation and to ensure its planned development and proper management. But will these Acts make any difference to the water problems of the Chennai City and its peri-urban villages? Would these Acts be an answer or add fuel to the growing conflicts between urban and peri-urban areas? So far, we are seeing little change on the ground.

**Social consequences and conflict in Chennai and peri-urban areas**

Water transport from Chennai’s peri-urban villages has been on the road for nearly four decades since the Metro Water Board started pumping groundwater, which has led to salinisation and groundwater depletion. But the conflict has intensified since the year 2000, since when Chennai and its peri-urban villages have faced continuous drought leading to a serious decline in the water table and water yields. To make up for the reduced yields, the Metro Water Board started purchasing water from private agricultural wells. Over 180 private agricultural wells were identified from which raw water was purchased at prices varying with the season and quality of groundwater. From each well at least 10 to 18 loads of water were pumped (0.1 to 0.2 mld). Many of these wells are now connected to the existing Metro Water system. The total estimated cost of hiring these agricultural wells is Rs. 85 million per year including the cost of civil works, hiring charges and current consumption charges.

We have seen that the water resource base is deteriorating. But what about the social aspect? To what extent is the decline in agricultural employment compensated for by non-farm job creation in peri-urban villages? To what extent is the conventional notion that cities are engines of growth true? This side of the story is even more depressing. The water transported from peri-urban villages to Chennai has created serious livelihood problems in the villages (Janakarajan, 2005). Continuous water transport to supplement the city’s drinking water needs has drained water resources in peri-urban villages. The water table has dropped to an unsustainable low and in many parts groundwater has completely dried up. Existing surface water bodies are either completely neglected or encroached on.
Many farmers have become heavily indebted due to large investment that has gone into developing well irrigation without adequate returns. This has seriously affected agricultural activities in the peri-urban villages resulting in decimated agricultural incomes and considerably reduced employment opportunities. As a consequence, unemployment is now emerging as a major problem in the villages. Many landless agricultural labourers and marginal farmers have started migrating to other villages and towns and cities to find employment, becoming a sort of footloose population, putting extra pressure on the already stressed urban infrastructure.

**Figure 3.3 Pressure building between urban and peri-urban areas: The vicious circle**

Whatever non-farm job opportunities have emerged in the peri-urban villages are incidental and unplanned. Some groups have obviously gained in the last two or three decades – water sellers, those employed in urban areas, traders, sand miners, brick manufacturers, a sugar factory in Palayaseevaram (PS) village, many bottling water companies, chemical units, etc. (See Box 3.2). The majority, however, have suffered from lack of assured and gainful employment, whether on-farm or non-farm. Even water sellers who benefited greatly by supplying the Metro Water Board started feeling the pinch after their bore-wells started drying up. Quite a number of water sellers started constructing houses when business was good; many of these houses remain incomplete. The drying up of aquifers led to the cancellation of contracts between the water sellers and the Metro Water Board. Many purchased tractors on loan but, in some cases, these remain disused because of lack of agricultural activity.

Many new housing colonies and settlements have sprung up recently in Chennai metropolitan area without adhering to any planning rules or regulation. Haphazard urban expansion has resulted in severe problems in managing civic
amenities such as drinking water supply, sanitation, solid waste and sewage management. Hundreds of civic associations in these areas struggle with local administrations (local Panchayats and municipal towns) to get people connected to such basic amenities. The facilities are not a patch on what is needed. As a result, not only the city but also the newly developing towns around metropolitan areas dump their solid and liquid waste in peri-urban locations.

A vicious circle has developed in which people migrate to the city for want of employment, for reasons such as the drying up of groundwater resources, the decline in agricultural employment and the overall degradation in the ecology and environment. On the other hand, the city experiences increasing demographic pressure which in turn puts enormous pressure on urban infrastructure such as land, housing, drinking water, sanitation, solid, liquid and bio-medical waste management, etc. To ease this population pressure, the city keeps extending its limits and thus the vicious circle continues (Figure 3.3).

The main reason for conflicts in the peri-urban areas of Chennai is that urban stress is transferred to peri-urban areas leading to a drain on natural resources such as land and water. Urban settlements and housing colonies in peri-urban villages are mushrooming, escalating drinking-water demand and posing a much bigger threat from solid-waste and wastewater disposal (Lakshmi and Janakarajan, 2005a and 2005b). This problem is aggravated by an institutional vacuum in peri-urban villages. Urban infrastructure such as good roads, drainage facility and sanitation, solid waste management and so forth are absent in these areas. The existing democratically elected bodies such as the Panchayat suffer from lack of resources and support from government.

Industries relocate to peri-urban regions to gain access to land and water, so that peri-urban land is bought for urban use. Increasing urban activities in the peri-urban areas lead to pollution and degradation of natural resources.

The village commons - land and traditional water bodies such as tanks - are encroached on or suffer neglect. The dramatic changes in land-use patterns in turn lead to falling agricultural employment in peri-urban areas, and serious livelihood problems. Women who lose agricultural employment are the worst hit.
Box 3.2 Changing occupational characteristics in peri-urban areas

A study in two of Chennai's peri-urban villages compared the number of people in various types of employment in 2005 with the situation in 1985. The results from this study are summarised below:

<table>
<thead>
<tr>
<th>Type of occupation</th>
<th>Magaral Past</th>
<th>Magaral Present</th>
<th>Palayaseevaram Past</th>
<th>Palayaseevaram Present</th>
<th>Present/Past (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivators</td>
<td>71</td>
<td>70</td>
<td>87</td>
<td>39</td>
<td>45</td>
</tr>
<tr>
<td>Landless agricultural labourers</td>
<td>442</td>
<td>510</td>
<td>445</td>
<td>324</td>
<td>73</td>
</tr>
<tr>
<td>Total agricultural</td>
<td>443</td>
<td>580</td>
<td>532</td>
<td>363</td>
<td>68</td>
</tr>
<tr>
<td>Govt. employees</td>
<td>14</td>
<td>20</td>
<td>52</td>
<td>62</td>
<td>119</td>
</tr>
<tr>
<td>Business</td>
<td>5</td>
<td>25</td>
<td>21</td>
<td>81</td>
<td>386</td>
</tr>
<tr>
<td>Industries and transport</td>
<td>7</td>
<td>39</td>
<td>7</td>
<td>132</td>
<td>1886</td>
</tr>
<tr>
<td>Other workers</td>
<td>14</td>
<td>61</td>
<td>115</td>
<td>338</td>
<td>294</td>
</tr>
<tr>
<td>Livestock</td>
<td>2</td>
<td>11</td>
<td>4</td>
<td>23</td>
<td>575</td>
</tr>
<tr>
<td>Total non-agricultural</td>
<td>42</td>
<td>156</td>
<td>199</td>
<td>636</td>
<td>320</td>
</tr>
<tr>
<td>Studying</td>
<td>162</td>
<td>382</td>
<td>240</td>
<td>598</td>
<td>249</td>
</tr>
<tr>
<td>Children below 3 years</td>
<td>182</td>
<td>166</td>
<td>351</td>
<td>200</td>
<td>57</td>
</tr>
<tr>
<td>House work</td>
<td>76</td>
<td>181</td>
<td>65</td>
<td>233</td>
<td>358</td>
</tr>
<tr>
<td>Unemployed</td>
<td>Not available</td>
<td>71</td>
<td>---</td>
<td>2</td>
<td>284</td>
</tr>
<tr>
<td>Sick, retired and old age</td>
<td>Not available</td>
<td>95</td>
<td>Not available</td>
<td>133</td>
<td>---</td>
</tr>
</tbody>
</table>

Both villages are severely affected due to over-exploitation of water resources but there is a major difference in occupational characteristics between Palayaseevaram and Magaral villages. In Magaral, agriculture continues to be the major occupation whereas in Palayaseevaram agriculture as an occupation has reduced in importance. The main reasons for this difference are the location of the villages and the different hydrogeological conditions. Palayaseevaram is located close to the national highway and is well connected by road and train. Since there are major towns on both sides of the village and since the Chennai City is also easily accessible, people find it easy to commute and seek employment elsewhere. In contrast, Magaral is not well connected by road, which makes it difficult for people to commute.

Another notable feature, which indicates decline in the importance of agricultural employment, is the increasing number of women reporting housework as their major occupation at present as compared to two decades ago. For instance in Palayaseevaram, 65 women reported housework as their major occupation in 1985 and this number has gone up to 233 in 2005. In Magaral, this figure has gone up from 76 to 181. Similarly, there is a large increase in the number of people reporting to be unemployed in both villages. Unemployment did not exist in either village two decades ago.
Farmers whose land is most in demand for urban activities – roadside plots and those that have good groundwater potential – are real gainers and make windfall profits, but there are only few of them. A few landless agricultural labourers who migrate temporarily or permanently to look for jobs, are likewise better-off due to better wages. But for a majority, opportunities are scarcely available for a decent living (Janakarajan, 2005). The worst affected are women and the aged who are confined to villages and undertake all kinds of odd jobs for a meagre wage.

In between these two extremes are those farmers whose lands are not in demand (or suitable) for urban activities and who can no longer undertake successful cultivation due to a lack of labour force and water, as traditional irrigation institutions such as tanks and springs become defunct. This class of farmers faces a dilemma of whether to stay in villages and agriculture or seek different employment and leave the village. Prospects and opportunities for a decent living are not easily available.

Responses to all these pressures are not uniform. Some villages have meekly surrendered to the urban pressure; in others frustration with the situation has translated into widespread conflict and unrest. What follows are two examples, one each from the A-K basin and the Palar basin showing how water scarcity has precipitated tensions in two villages, Velliyur and Palayaseevaram. Many villages face similar issues.

**Velliyur village in the A-K basin**

Velliyur village is located 50 km from Chennai in the A-K basin, with a population of 4,379 (2003 survey). Conflicts broke out here and took a violent turn after continuous pumping of groundwater for over 30 years. Although the village has one large tank, with a command area of 804 acres, groundwater remains the primary source of irrigation for paddy and groundnut, the main crops.

Since 1990, at least 60 dug wells have been abandoned due to the falling water table. While in 1980 there were 280 agricultural wells dug to a depth of 50-80 feet, now there are 220 wells and the depth is in the range of 130-160 feet. Water quality has also deteriorated compared to 10 years ago. Local domestic water supplies have been affected. While in 2000 drinking water was still supplied round the clock from four bore wells, by 2004 a total of 12 bore wells were required of which four have already stopped supplying water while the others can supply water for only two hours a day.

In 1969, 11 bore wells were installed to pump water from the common land of the village to supplement water supply to Chennai City and to supply nearby industries, representing a total of 16 mld. By 2000, however, 9 out of these 11 bore wells have been abandoned.
bore wells had failed. Since then water has been purchased from 75 farmers in the village, collecting at first 40 mld, an amount that fell to 16.84 mld in 2004. Of 75 bore wells which originally supplied water, only 55 were working by 2004. Moreover, the Tamilnadu Water Supply and Drainage (TWAD) Board\(^\text{10}\) was planning to install seven more bore wells in the common lands of Velliyur in order to supply water to Thiruvallur town. Due to resistance from farmers, only four were actually commissioned.

Until 1995, the people of Velliyur village had been quite passive. They did not resist water being pumped from the common lands of the village for more than 30 years. But as the groundwater table decreased progressively, farmers had to spend substantial sums on deepening wells. Agriculture was very badly hit resulting in reduced farm income and employment, especially affecting the livelihoods of small farmers and landless agricultural labourers. It should be noted that groundwater levels are also falling in villages that are not a source of water supply for Chennai. In most cases, this is a result of unsustainable groundwater extraction for irrigation.

Local self-help groups (SHG) started to oppose transporting water out of the village in 1995. SHGs insisted that the village Panchayat should pass a resolution banning water sales from Velliyur village. But the Panchayat declined, since groundwater is pumped only from government land. When water purchases from farmers started in 2000, the village population again revolted. Again the village Panchayat refused to pass a resolution against water sales on the grounds that individual farmers sell water from their own land. Since the property rights on groundwater are undefined, nothing much could be done. Some village residents filed a court case to ban water sales from the village. They were successful in getting a stay but this was quashed by an appeal petition filed by a water-seller supported by the Metro Water Board. Under such duress, in the year 2003, almost all the agricultural land was left uncultivated and the landless population either had to seek engagement from companies that mine sand from the river or to migrate in search of employment.

As a consequence of extensive sand mining, water yields from wells reduced considerably\(^\text{11}\). When water-selling farmers protested against it, the Metro Board took up the issue with the government and stopped the sand mining. This has affected the livelihoods of landless agricultural labourers. This is another vicious circle in which agricultural labourers were pushed into sand mining due to the distressed state of agriculture, and when sand mining was banned, they also joined the protesting masses of the village. Thus, violent conflict broke out on 15 August 2004. Over 400 people gathered near the Metro Water Board pumping

\(^{10}\) While the Metro Water Board is responsible for supplying water to the city, the TWAD Board is responsible for supplying water to all other parts of the state.

\(^{11}\) Sand mining, which is quite extensive in the Kosathalaiyar riverbed, also drastically reduced water yields in the riverbed aquifer.
station. Metro Water officials and higher officers of the revenue department arrived on the scene and tried to resolve the issue. To stem the crisis, a peace committee was formed consisting of water sellers, non-sellers, SHGs and officials. During the peace committee meeting, it was decided that water sales from farmers to the Board would stop after 15 September 2004. Everyone including the Metro Water officials, sellers, non-sellers and all other villagers agreed to abide by this decision.

But on 15 September 2004, Metro Water officials reported that water purchases would not be stopped, since the higher authorities at Metro Water did not agree with the agreement. Water-sellers were also willing to continue to sell water, and had meanwhile tried to obtain a stay from the court against the decision taken during the peace committee meeting. Since the non-sellers suspected the sellers might seek legal protection, they had also moved the court to award a stay on water sales. Both moves were unsuccessful. On 16 September 2004, the entire village gathered near the Metro Water Board’s giant water storage tank from where water was pumped, and at 11am blocked the road. When the higher revenue department officials arrived, they refused to agree to stop water purchases from private wells. At this point, some people from the protesting group broke the pipeline structures, which belonged to the Metro Water Board. After this, the police arrested 44 people from Velliyur under the Public Property Damaging Act and remanded them in judicial custody for 15 days. The Metro Water Board demanded compensation of Rs. 30,000 from the protestors. The court in fact instructed the arrested farmers to pay the compensation but the Water Board case has never been withdrawn. Water selling started again, and Metro Water officials are openly soliciting more farmers to come forward to sell water. The Board put up a notice and even circulated it among the farmers stating that whoever is willing to sell water can approach Metro Water to have a one-year agreement.

**Palayaseevaram village in the Palar basin**

This village of 5,285 people (according to the 2001 census) is located 50 km from Chennai City close to the national highway. Its location right on the Palar River means that it has benefited a great deal from the river water for irrigation. This used to be an agriculturally prosperous village that had access to 8 surface sources for irrigation with a total command area of 1,191 acres. Groundwater only provided supplementary irrigation. In 1980, there were 71 wells (24 in wet lands and 47 in dry lands) supplying water from depths in the range of 24 to 27 feet. Now there are 150 wells (50 bore wells, 100 open wells) whose depth is in the range of 60 to 100 feet. At the time of the survey in 2004, only 20 of these wells were in use. The quality of water has declined drastically along with the water table. Agricultural land was fully cultivated until 1985, but by 1990 the area under paddy and sugarcane – the main crops – had reduced to 200 and 100 acres respectively, and by 2004, to only 15 and 10 acres. Weeds and wild vegetation currently invade most of the area. Drinking water services in the village have worsened to the same degree. In 1990, drinking water was supplied for 5 hours per day; by 2002 the service had reduced to one hour per day.
In 1972, it was decided to pump water from the Palar riverbed at this village to supply water to areas adjoining the city such as Alandur, Pallavaram, Chrompet, Tambaram, Anakaputhur, Pammal, Chithilapakkam, Vandalur Zoo, etc. The people of Palayaseevaram village opposed this move on the grounds that it would affect the groundwater availability in the region. A memorandum was also submitted to the District Collector and the issue was taken up for discussion at the Chief Minister level. However, in the end, the government took a decision in favour of the city and, accordingly, that same year the TWAD Board dug five wells and subsequently six more wells in the Palar riverbed. For the past five years, supply of water in these wells has fallen drastically. By 2004, the estimated demand for this region was at least 45 mld up from 22 mld in 1972. Six more wells were dug in 2004 on the other side of the river bank, which is part of the village called Pullambakkam / Thirumukkodal. The main reasons for the dwindling water supply from these wells are round-the-clock pumping for over three decades and substantial and illegal sand mining in the riverbed far beyond permissible limits. All these have adversely affected the agriculture in the village. Groundwater has even become scarce for drinking.

Not only Palayaseevaram, but all villages in this stretch, including Thimmavaram, Athur and Palur, were badly hit due to round-the-clock pumping either by the Metro Water Board or by the TWAD Board. In fact, there is a virtual competition between these two State agencies in pumping water to supply to their respective constituent populations. And wherever these agencies were not pumping, private tanker trucks pumped water to sell in the city. The sugar mill, which was constructed in 1987 in Palayaseevaram village, was strongly opposed by the people. At present, the mill generates a good deal of effluent and discharges it into a village tank that provides irrigation for 423 acres in this village. The sugar factory has also blocked the water flow in one of the main canals that eventually supplies water to the big tank of the village. In parallel to the damage caused by the State agencies, the sugar factory has also been instrumental in destroying livelihoods in the village.

Several petitions and memorandums were sent to the government and a group of NGO organisations organised a series of demonstrations and a public hearing. The jurists of the public hearing committee (one of them a retired Supreme Court Judge) severely condemned the illegal sand mining and competitive water pumping and suggested that the Government appoint a Committee to investigate the damage done to the river. But despite these efforts, both activities continued.

The response on the part of the people of this village was weak and passive. People either absorb the shock of water depletion or leave the village for urban employment. Many have sold their lands and many more are planning to sell. If there are no severe conflicts despite severe damage to the ecology and livelihoods of this village, it is because of reasons such as the following:

- The village is located on the main corridor linked to Chennai.
• Sand mining is a lucrative activity for the small farmers and landless agricultural population.
• There is a growing number of absentee landlords.
• A very powerful sugar mill lobby has the highest political connections and local people feel intimidated.
• There has been growth of non-farm employment such as the construction industry in urban areas, railway contract work, employment in the local sugar mill, vegetable and fruit selling in urban areas, other petty business etc., and a scarcity of farm labourers who find more gainful employment in non-farm activities such as sand mining, and construction.

Intervention objectives and methodology
The Negowat project in Chennai aimed to document and analyse the impact of unregulated and unchecked horizontal urban expansion on natural resources, in particular water and its impact on poverty, livelihoods, environment and health conditions of people living in peri-urban areas. We also developed and tested tools and institutional structures to support and enable effective stakeholder-led water resources management for negotiating emerging conflicts and water rights. These aimed to draw upon contemporary developments in Integrated Water Resources Management (IWRM), and decision support methodologies that can be readily understood and adapted to meet the needs of multi-stakeholder groups. Broadly two segments of the Chennai peri-urban area were identified: the A-K and Palar catchments.

The methodology of the study comprised a variety of components. Besides official sources of data, we conducted a meso-level survey in these adjoining basins of the city (covering 23 villages and 41 villages respectively from Palar and A-K river basins) and, in 2004-05, a detailed survey in two villages (Palayaseevaram in the Palar and Magarel in the A-K basin) with a view to collecting information on various aspects such as poverty and livelihoods, current and past water use pattern, nature, extent and history of rural-urban water market, impact of water sales on agriculture, employment, income, ecology and environment and so on.

We conducted a water resource audit in MAG village block and the Chennai City. We used Geographic Information Systems (GIS) to map over 2000 surface water bodies (tanks) in the two adjoining districts of Chennai City. Furthermore, we built agent-based models or Bayesian networks, and carried out stakeholder analysis and conflict analysis to understand and characterise multi-stakeholder groups and their conflicting interests. Last but not least, we developed multi-stakeholder platforms (MPSSs) and user groups for shared learning and for a sustained dialogue to promote stakeholder-led Integrated Water Resources Management. The next section relates our experiences with two of our methodologies: multi-stakeholder dialogue and the water source inventory.
**Stakeholder analysis**
An in-depth conflict analysis between urban and peri-urban areas throws interesting light on clashing viewpoints of various stakeholders. This is summarised in Table 3.2.

**Table 3.2 Stakeholder perspectives on water conflict in peri-urban Chennai**

<table>
<thead>
<tr>
<th>Type of stakeholder</th>
<th>Reasons for conflict</th>
<th>Challenging whom?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers / well owners / water-sellers</td>
<td>Reduction in profit due to not selling water to Metro Water Board</td>
<td>Those who protest against water sales to Metro Water and TWAD Board</td>
</tr>
<tr>
<td>Farmers (non-water selling well owners and all others in the village)</td>
<td>Destruction of livelihoods in villages due to declining water table and agriculture</td>
<td>Water sellers, Metro Water Board and TWAD Board</td>
</tr>
<tr>
<td>Landless agricultural labourers</td>
<td>Loss of income and livelihoods</td>
<td>Metro Water Board, TWAD Board, water-sellers who protested against sand mining since their wells do not recharge due to sand mining</td>
</tr>
<tr>
<td>Metro Water Board</td>
<td>Compulsion to supplement the city's water needs</td>
<td>Village population protesting against water sales and competing with TWAD Board</td>
</tr>
<tr>
<td>TWAD Board</td>
<td>Compulsion to supply water to the city's adjoining areas</td>
<td>Protesting village population against water sales and competing with Metro Water Board</td>
</tr>
<tr>
<td>Private tanker operators</td>
<td>Reduction in profit</td>
<td>Those who protest against water sales to Metro Water and TWAD Board</td>
</tr>
<tr>
<td>Water companies</td>
<td>Reduction in profit</td>
<td>Those who protest against water sales and civil society organisations</td>
</tr>
<tr>
<td>City dwellers and residents’ welfare associations</td>
<td>Reduction in drinking water supply</td>
<td>Metro Water and TWAD Board</td>
</tr>
<tr>
<td>Civil society organisations</td>
<td>Destruction of livelihood and falling water table</td>
<td>Water sellers, illegal sand miners, Metro Water and TWAD Board</td>
</tr>
</tbody>
</table>
From this stakeholder analysis, four sets of stakeholders can be identified in the context of Chennai peri-urban water markets. These are:

- The State (all official agencies and political leaders)
- Peri-urban agricultural and non-agricultural population
- Other urban stakeholders
- Civil Society

Table 3.3 details the different groups that belong to those categories.

Table 3.3 Inventory of stakeholders by category

<table>
<thead>
<tr>
<th>State Representatives</th>
<th>Peri-urban population</th>
<th>Other urban interests</th>
<th>Civil society</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Metro-Water Supply and Drainage Board</td>
<td>Farmers:</td>
<td></td>
<td>Non-Govern-</td>
</tr>
<tr>
<td>• Tamilnadu Water Supply and Drainage Board</td>
<td>• Land and well owners</td>
<td></td>
<td>mental Organi-</td>
</tr>
<tr>
<td>• Chennai Metropolitan Development Authority</td>
<td>• Water sellers</td>
<td></td>
<td>sations (NGOs)</td>
</tr>
<tr>
<td>• Village Administrative Officer (VAO)</td>
<td>• Non-water sellers</td>
<td></td>
<td>• Activists</td>
</tr>
<tr>
<td>• Block Development Officer (BDO)</td>
<td>• Land owners who</td>
<td></td>
<td>• Researchers</td>
</tr>
<tr>
<td>• Thasildar (the Revenue Department taluk-level head)</td>
<td>do not own wells</td>
<td></td>
<td>• Media</td>
</tr>
<tr>
<td>• District Collector</td>
<td>• Tenant cultivators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Public Works Department (water resources)</td>
<td>• Landless agricultural labourers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• State and Central Groundwater Boards</td>
<td>• Women Self-Help Groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Chennai City Municipal Corporation</td>
<td>• Tanker-truck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Departments of Agriculture, Revenue, Forest and a few others concerned with water</td>
<td>operators and their Association</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Tamilnadu Pollution Control Board</td>
<td>• Water companies who sell purified drinking water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Member of Legislative Assembly (MLA) and Member of Parliament (MP)</td>
<td>• High-profile hospitals and hotels</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Commercial enterprises, industries, major educational institutions and government offices. Flat promoters, Residents' Welfare Associations and other urban water users</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Relative strengths and weaknesses of stakeholders

The State has enormous power, control and authority. Other urban stakeholders go hand-in-hand with the State in the context of exploiting resources from peri-urban villages. This set of stakeholders also demonstrate urgency and claim legitimacy in transporting water from peri-urban areas. In other words, the State and other urban stakeholder groups strengthen each other and eventually their strength and power develops so that they become a really threatening alliance. They constitute a market that is profit-driven rather than anything else. The third set of stakeholders, civil society organisations, activists, researchers and media, indulges in investigating, writing and campaigning against depletion and pollution of resources in the peri-urban and rural areas. They play a critical role, but this set of stakeholders lack power and may not have a clear constituency.

Unlike other stakeholders, the peri-urban population does not constitute a single homogeneous group. The water-selling farmers align themselves with the State and urban stakeholders and make a short-term profit. But it is very difficult to say whether they sell water voluntarily. Available evidence suggests that water-sellers are encouraged or even feel compelled to sell water to Metro Water Board. In other cases, farmers feel entrapped into selling water to private truck operators or private companies. All other farmers perceive the water sellers as enemies, and ultimately all are affected, since their wells go dry due to round-the-clock pumping. They are a voiceless and powerless community, suffering the brunt of water transport and other damages to the local ecology and environment. They are left with two options: to stay and suffer or to flee to the city. The second option is generally exercised by a few who are educated and resource-rich. Even the democratically elected village Panchayat Board becomes powerless. As a result, we find a virtual institutional vacuum.

Building multi-stakeholder platforms for dialogue

An ideal situation would be one in which both Chennai City and peri-urban villages co-exist and co-operate with each other for each other’s benefit; while cities can act as engines of development of both city and peri-urban areas, the latter can contribute to urban development in a win-win situation.

But how do you move from conflict to cooperation? It is neither easy to define this path nor to define the time frame for the trip. After all, conflicts occur in this case primarily because a group of independent operators who are politically and economically powerful can dominate decision-making. This group will lose out if a high degree of cooperation is achieved among all stakeholders. On the other hand, the majority of the peri-urban population are losing out anyway, so they are more than happy to participate in dialogue and reach a level of cooperation.

In this situation it is possible that, until one reaches a threshold level of crisis, those who have so far gained may not be interested in dialogue because of the advantage of the free operation of the market and the support they enjoy from the State. This does not mean that one should not start the dialogue process
before a crisis develops. This is precisely where MSPs and multi-stakeholder dialogues (MSDs) can play a key role.

In the case of Chennai City and peri-urban villages, conflicts have reached an intense level but not yet reached the threshold level of crisis – unlike the situation in the Palar and Cauvery Basins\textsuperscript{12}. Nevertheless, we managed to initiate an MSD in Chennai’s peri-urban area. A committee of stakeholders with 64 members drawn from all sections of society has been formed and held a series of multi-stakeholder meetings. Since July 2004, many key issues have been brainstormed and the process continues to date. The stakeholder committee has discussed at length, not only threats to livelihoods in peri-urban villages, but also possible solutions to the drinking water problems of Chennai City. Several issues and solutions were discussed.

Firstly, there was unanimity in emphasising the need for revamping water storage bodies such as tanks in peri-urban villages and suggesting ways and means to the government for modernising and strengthening them. Through this measure, an improved groundwater level would not only protect local agriculture but also enable the excess or unclaimed water to contribute to the City’s needs. This was seen as a priority issue.

What have we done so far?
• All records about water in 2,600 tanks in two adjoining districts have been collected from government records.
• We gathered all relevant topographical maps relating to the year 1971 and digitised them in GIS.
• All the details recorded in the original tank records are being fed into the digitised maps.

What are we planning to do next?
• The next step is to get the latest satellite imageries and super impose them on the 1971 maps.
• A survey of the current state of all 2,600 tanks will be fed into the database. A survey of 30 tanks has already been conducted with the help of stakeholders.
• Building up a picture of the state of the tanks at three different time periods will help us identify those tanks that are still in retrievable shape. We will work out the rehabilitation costs and submit a bid to government through the stakeholders’ committee.

\textsuperscript{12} The lead author has initiated MSD initiatives in the conflict-ridden river basins of Palar and Cauvery in South India. In these river basins, conflicts have reached a threshold level of crisis in which even the highest judicial authority of the country could not travel too far. When everything has failed, the MSD among all stakeholders seems the only option for arriving at some kind of consensus and cooperation.
Secondly, the committee of stakeholders felt that solutions to the Chennai water crisis need to be approached carefully and not with *ad hoc* measures as in the past. Many stakeholders expressed the opinion that before launching any mega projects – like bringing water from other basins, such as Telugu Ganga or Veeranam – it is absolutely necessary to examine what is available locally. It is true that Chennai City is neither located on the banks of a perennial river nor has any big perennial reservoirs from which water can be drawn, but local resources is still an extremely relevant question. There are at least 70 temple tanks and ponds in different parts of the city, which used to fill during the monsoon months. Now most of them are silted up, and the supply channels have disappeared under building work. The need of the hour is to restore all these tanks to their original condition and to restore the flow of rain/flood water to them during monsoon months. The simplest way would be to link storm water drains with these tanks; at present huge amounts of floodwater flow into sewage drains or into the city’s polluted rivers.

This measure would not cost much, compared with what is spent on big projects. The potential benefits would be significant. However, this measure can only be part of a solution to Chennai’s water supply problems because the scope for augmenting water resources via tank rehabilitation is relatively small when compared to current and project demand. Similarly, the proposed construction of a series of check dams along Araniyar and Kosathaliyar rivers is likely to augment water resources, particularly during above average rainfall years, but have only a limited impact in terms of overcoming current and projected imbalances between water demand and water supply. The simple fact is that Chennai’s current and future water supply can only be met by accessing large volumes of ground and surface water (i.e. ‘blue’ water) from peri-urban and more distant rural areas.

The city also generates about 680 mld of sewage water which is at present not properly utilised. Except for 100 to 150 mld, supplied to Chennai Petroleum and others after primary treatment for industrial uses, the rest is let into the city’s rivers either untreated or after primary treatment. There is huge scope for recycling this water, even for domestic uses. Environmental engineering experts point out that the cost of sewage water treatment is lower than seawater desalination.

**Multi-stakeholder dialogue in the final analysis**

On the whole, a threshold level of crisis seems to be necessary to make the dialogue initiative more sustainable and to ensure the active participation of all opposing stakeholders. Otherwise, only one set of stakeholders – those who are already losing out – will participate. In the case of Chennai peri-urban villages, stakeholder participation is less than expected and many villages are getting swamped in the urbanisation process.
Box 3.3 Water resource audits

The rationale behind water audits is that, in the absence of good quality information, stakeholder dialogue is uninformed and stakeholders have no basis to challenge factually incorrect or biased positions. Similarly, effective cross-sectoral and/or multi-scalar planning is near to impossible if stakeholders are working with their own differing information bases. Hence, the main challenge of water resource audits is to establish a common information base that is acceptable and accessible to all stakeholders.

The initial steps in performing a water resource are to:

- Specify initial spatial and temporal boundaries for information collection. The spatial boundaries can be physical or institutional, for example village boundaries, watersheds or aquifers. The temporal boundaries are the time limits (both past and future) for considering key trends. While the focus of analysis may be primarily at one particular level (e.g. the intermediate level), it is important to collect sufficient information at higher and lower levels to be able to make judgements regarding, for example, upstream and downstream impacts and dependencies.

- Specify the required degree of disaggregation of information collection and analysis, the scales of maps, and levels of precision that are required.

- Identify sources of easily available secondary information; and decide what primary data will have to be collected to fill gaps and to bring existing information up to date.

- Decide on the level of specialist support (if any) and analytical tools that may be needed.

Although there is no fixed formula or iterative sequence for undertaking a water resource audit, in generic terms, there are five main steps:

- **Awareness raising.** This is vital if stakeholders are to become fully involved. Particular attention has to be given to ensuring that the poor and other marginalised groups are both aware of what is happening and are able to participate or are sufficiently represented.

- **User group analysis.** This is critical to ensuring that water resource audits are poverty and gender focused. Essentially this step revolves around building a complete understanding of different water-user groups; who has access and who maintains control over water.

- **Gathering information and quality control.** This involves identifying and accessing sources of secondary information, quality controlling and consolidating this information into an information-base using the Resource-Infrastructure-Demand-Access (RIDA) framework and, where necessary, collecting and quality controlling additional primary data (primary data collection will almost invariably be required for access and demand related aspects). Triangulation between data from different sources and levels is useful in ensuring internal consistency.

- **Data analysis.** This can involve a whole range of analytical and statistical techniques that include time series and water balance analysis, structured using the RIDA framework. The aim of data analysis is to further investigate the causes (and possible solutions) of water-related problems. This step will require the development of information systems, using at least spreadsheets and GIS, and in more complex cases data-bases and modelling.

- **Dissemination.** Dissemination of information to key stakeholders in a format that will support stakeholder dialogue

*The RIDA Framework helps to structure water audits logically in a way that aids and improves analysis and stakeholder dialogue. The concept of RIDA framework is simple. It is that users (their demand for and access to water) are linked to water resources by water supply infrastructure. And, that each of these three components of water systems has its own institutions and issues.*
Dialogue is never smooth: a lot of ups and downs should be expected. Sound research as well as active and sustained support is therefore a necessary condition for undertaking and carrying forward dialogue. In this respect, the MSD needs an untiring facilitator who can carry on with the job of facilitating and sustaining a platform where the dialogue can continue.

Multi-stakeholder dialogue is not a panacea; the final outcome is uncertain and difficult to judge. Still, in the absence of a viable alternative, there is a case for pushing the dialogue initiative as far as possible until one approaches a viable solution.

The water resource audit
The Negowat-India project also made a wider assessment of the capacity of the Chennai City to manage the available water resource within its command, both for the current and the expected population (Janakarajan et al., 2005). The main motivation behind this exercise was to:

• identify and evaluate potentially viable options for tackling Chennai’s water problems,
• develop a water-related vision for what might be achieved by 2015,
• develop a range of demand scenarios that take account of some of the most important factors that influence demand,
• develop and evaluate a number of strategies for achieving the vision taking account of demand scenarios and negative impacts on peri-urban areas.

The best estimates of Chennai’s water supply and water demand indicate that the amount of water that can be accessed and used practically is of the order of 75 lpcd in good years – or at best approximately half the demand based on a domestic demand of 150 litres per capita per day (lpcd). Demand is increasing rapidly, in line with a rapidly increasing population, increasing rural–urban migration and industrialisation. Taken as a whole, the available evidence suggests that Chennai’s water supply situation is at crisis point, in particular, for the poorer social groups.

As households in relatively wealthier areas of the city are reportedly using well above this daily volume of water, it means that households in poorer areas use much less. There are also severe problems with sanitation and sewage treatments, and there is also plenty of evidence that indicates that Chennai’s ever-increasing water footprint is causing real hardship for many water users in peri-urban villages. In this study, it is estimated that by 2015 the demand of the Chennai metropolitan area will be in the range of 425 – 830 mcm/year.

Most demand estimates do not include pipe leakages or losses from tankers. Quite obviously the lower these losses, the lower the infrastructural capacity required and the lower the pressure on water resources. Estimates of demand calculated here include a 25% allowance for conveyance losses.

The starting point for better management of Chennai’s water services must be a long-term vision that also takes into account water resources development in the
districts from which water will be supplied to the metropolitan area. This vision should be SMART (Specific, Measurable, Achievable, Realistic and Time-bound) and be the output of a consultative process that has the active involvement of all primary stakeholders.

Four scenarios have been developed from the water resource audit, based on the assumption that issues linked to changing demand and population growth will continue to be the major drivers of water demand. Many other factors will also have a major bearing on demand for ‘blue’ water (surface water or groundwater) as opposed to recycled water, treated wastewater or desalinated seawater.

The audit report lists twenty-two options for tackling Chennai’s water problems. None are entirely new; they have all been identified by individuals and organisations with a long history of working in and around Chennai. With the help of demand scenarios, which themselves include options for demand management, the report identifies different water supply strategies and then evaluates these against the vision.

If Chennai’s demand continues to increase at current rates and if the major source of ‘blue’ water supply is rainfall in the metropolitan area and adjacent districts of Kancheepuram and Tiruvallur, we estimate that – in an average rainfall year – domestic and urban demand in the metro area and these two districts will be equivalent to 50% of all the renewable ‘blue’ water.

**Summary, lessons learned and moving forward**

We have tried to answer some fundamental questions in this study.

- Since urbanisation is an inevitable process, should we let the peri-urban population and areas suffer?
- Is there a way in which the spread of urbanisation could be harnessed better for the advantage of both populations?
- Why have most policy options tried so far failed in this regard?
- What policy measures would not only contribute to resolving urban and peri-urban conflicts but also contribute to improving livelihoods and environmental conditions in peri-urban villages?

For a long time, social-science or hydrology-related research has focused mainly on urban or rural issues. However, peri-urban problems have surfaced as a major issue, which policymakers no longer can ignore during the last couple of decades, as is clear from the way that many urban expansion plans have stalled due to stiff resistance shown by peri-urban farmers. Most approaches towards solving urban

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13 Two important projects of the Government of Tamil Nadu could be cited as examples in this regard. First the project which entailed shifting of the entire State secretariat to peri-urban villages at a distance of 40 km in about 2,000 acres. The second was the construction of a satellite town at a distance of 50 km from Chennai in an area of over 4,000 acres. Both projects, announced in the State Legislative Assembly, had to be abandoned due to stiff opposition from the peri-urban population.
problems and water stress have so far failed because rural, peri-urban and urban issues were treated in isolation. There is now an urgent need to view urban, peri-urban and rural segments of a region as a part of a single but integrated livelihood and ecosystem. In other words, all three segments are very much a part of an integrated socio-economic developmental process of an economy, or as Iaquinta and Drescher (2000) express it: “rural, peri-urban and urban form a linked system (R-PU-U), which constitutes an uneven multidimensional continuum”. A fragmented approach would only bring about rural/urban and peri-urban/urban divide, besides contributing to the destruction of ecology, environment and livelihood options in the rural and peri-urban areas.

Horizontal urban expansion encroaches upon natural resources, in particular land and water, enjoyed hitherto by rural and peri-urban communities. As a consequence, severe competition and conflicts flare up between urban and peri-urban areas. While Municipal Corporations, Housing Boards and State Metro Water Agencies collectively negotiate claims over land and water rights on behalf of urban areas, the peri-urban areas are represented individually and often are subject to threats. These kinds of negotiation are often one-sided because of the unequal bargaining power enjoyed by these Agencies. This is precisely the context in which a collective multi-stakeholder dialogue approach and a participatory planning process would be useful for a better negotiated democratic settlement.

Although urban interests are deeply committed to making the most of the available land and water resources in rural and peri-urban areas, hardly any State Agencies pay sufficient attention to documenting or analysing patterns and intensities of vulnerabilities and their long-term implications. The peri-urban population depends upon land for livelihood, commons for fuel wood and water for agriculture, animal rearing and drinking. Therefore, the whole range of livelihood options is affected when water is transported to urban areas. These areas are in a state of decay, in particular for those who depend upon agriculture for their livelihoods, who make up the majority population. Those who benefit from the spillover effects of urban development (e.g. enhanced land values, or water sales) constitute a minority. It is important to focus on how the majority, whose livelihoods are affected, cope with these effects. Are there any institutional mechanisms to cope with peri-urban issues relating to natural resource management? Are Panchayat bodies aware of this and what concrete actions have they taken so far to deal with urban expansion? The State institutions do not take any coordinated action to preserve the local natural resources; instead they pull in opposite directions – due to a fractured institutional set-up. There is no legal mechanism to protect livelihoods and the ecology of peri-urban areas.

This was the context in which the multi-stakeholder dialogue in the peri-urban areas of Chennai was organised. In the stakeholder committee meetings, several measures were discussed to see if we could come up with solutions that were good for both Chennai City and the peri-urban areas. The MSD meetings created a stir in Chennai, with the media reporting extensively on the dialogue process.
Most importantly, the multi-stakeholder dialogue initiative has an agenda of social learning as well as a negotiation process that seeks a win-win settlement. This process provides an alternative to centralised decision-making, which often fails. But clearly there is a limit to the extent a researcher can sustain the MSD process. NGOs need to be trained in conflict resolution. Ensuring stakeholder participation in multi-stakeholder dialogue is a gradual process that requires research and ongoing stakeholder analysis.

References