

# Social Perceptions of the Impacts of Colombo Water Supply Projects

The complexity of development activities, in which the interactions between various forces often mean that outcomes are unpredictable and unanticipated, highlights the importance of objective and comprehensive evaluations. In the specific case of the evaluation of towns east and south of Colombo water supply projects, the findings have major implications for the implementation of the Millennium Development Goals, if the water-related objectives are to be fulfilled. The study found that 30% of the households of these towns that are receiving clean, piped water are not using it for drinking. Instead, they are continuing to drink contaminated well water. Whereas it is considered that the main beneficiaries of water supply projects have been women and people who are sick, elderly, or disabled, the general perception is that the health conditions of the families have not improved with the provision of clean water (in fact, many claim that their health conditions have deteriorated). In spite of the higher cost of the supplied water, people are willing to pay for it as long as the supply is reliable.

## INTRODUCTION

Evaluations of water supply projects should be carried out objectively and comprehensively to analyze not only the impacts they have on people's lives, but also of the people's perceptions of these impacts. Evaluations should be used to learn lessons that can improve such projects in terms of the quality of life of the people and the protection of the environment, as well as to make the projects more impact-oriented. Unfortunately, such open-minded and comprehensive evaluations of water supply projects have been very few and far between.

Development is a very complex process, where numerous forces interact with each other, in terms of both space and time, and where outputs are often unpredictable. Water supply development is no exception. Within this overall context, the evaluation of the water supply projects for towns east and south of Colombo was carried out for the Japan Bank for International Cooperation to determine the perceptions of the households that received access to clean water, in terms of how water supply has affected their lives, positively or negatively, and what further policy measures need to be taken to enhance the positive effects of the projects. The evaluation revealed several counterintuitive findings that similar projects must take into consideration during their planning and implementation phases in order to have a greater positive impact on the populations who are likely to benefit.

The main objectives of the present evaluation were *i)* to assess the social and economic impacts of the projects on its expected beneficiaries; *ii)* to determine the residents' perceptions of the impacts of the projects; and *iii)* to identify both positive and negative impacts of the projects, and to recommend necessary corrective actions that would further enhance the total benefits of the projects.

## STUDY AREA

In order to assess the impacts on the beneficiaries of the water projects in towns east and south of Colombo, nine towns were

selected that could be considered to be representative of the two project areas. Five of these towns are located east of Colombo: Battaramulla, Talangama, Kaduwela, Pannipitiya, and Malambe. The other four towns are situated south of Colombo: Piliyandala, Kesbewa, Keselwatta, and Homagama. The nature of these nine towns varied from urban to *rurban* (rural/urban) to rural, like Kaduwela, Kesbewa, and Homagama. Whereas much of the focus in recent years has been on urban and rural areas, it is now becoming increasingly evident that for major Asian metropolises like Colombo, *rurban* areas will require more and more attention. The speed and extent of the rural out-migration, which in many Asian countries is now accelerating, concomitant with the inability of the major urban centers to provide adequate and appropriate infrastructures, social services, and employment opportunities to the new migrants, means that a complex new world has evolved rapidly on the edges of the urban agglomerations, having both urban and rural characteristics.

In Colombo, the *rurban* areas are being provided with basic infrastructure, such as piped water, electricity, communication, transportation, and better social, educational, and health facilities. These areas are now acting as a magnet for additional in-migration. Accordingly, even though the water supply projects were completed only recently, population in these areas already has far exceeded what was forecasted when these two projects were initially planned. Thus, water requirements of these areas are likely to increase in the coming years to meet the needs of new influxes of migrants, and the needs of the economic activities that will sustain them, as well.

## EVALUATION METHODOLOGY

The institution responsible for implementing the water supply projects for all towns is the National Water Supply and Drainage Board (NWSDB) of Sri Lanka, which has classified its consumers under the following categories: households (domestic and low-income), commercial enterprises, schools, religious institutions, government institutions, and so forth. NWSDB classifies all households that are not low-income as domestic. A list of all consumers in towns east and south was obtained from NWSDB, and from this list, 300 households were selected from the towns east of Colombo and another 300 from the towns south of Colombo. These 600 households were divided equally between domestic and low-income consumers (Table 1).

The interviews were carried out in December 2002 by 15 enumerators, all of whom were graduates in sociology from the University of Colombo. A training session was organized for all the enumerators before the surveys were conducted, during which the objectives and the purposes of the survey were explained, methodologies to be used for the survey and the subsequent analyses of the data were discussed, and the processes through which the results of the surveys will be used, and by whom, were outlined. In addition to a structured questionnaire, which was very specifically developed for this survey, the enumerators were trained and were encouraged to make their own comments about each household they visited, based on their own observations, and any other relevant information they could collect during these interviews.

The questionnaire was pretested before the household interviews were conducted. Several modifications were made

**Table 1. Domestic and low-income households in towns east and towns south of Colombo.**

Area	Households		Total
	Domestic	Low-Income	
Piliyandala	56	7	133
Keselwatta	15	16	31
Kesbawa	12	26	38
Homagama	38	0	38
Battaramulla	50	41	91
Malambe	34	13	47
Kaduwela	36	75	111
Pannipitiya	32	36	68
Talangama	27	16	43
Total	300	300	600

**Table 2. Number of consumers, 1998–1999 and 2001–2002.**

Locations	1998	1999	2001	2002
Towns east of Colombo				
Domestic	7806	10 398	15 267	17 696
Low income	0	0	396	657
Towns south of Colombo				
Domestic	–	–	4321	7626
Low income	–	–	794	1799

on the basis of the pretesting. In addition, after the first 2 days of interviews, the results were reviewed. Additional adjustments then were made to the questionnaire so that better and more relevant information could be elicited from the interviewees.

## SOCIOECONOMIC PROFILES OF THE HOUSEHOLDS

The 600 households surveyed had a total population of 2549, which translates to an average family size of 4.25 people. The age structure of the heads of the households indicated that the majority of the heads of the households are in the 50 to 59 years age group (27.3%), followed by the 40 to 49 years age group (25.8%), 30 to 39 years (19.3%), and then 60 to 69 years (15.7%). In the survey sample, the number of women (50.7%) was slightly higher than the number of men (49.3%).

Female-headed households represented 18.3% of the population interviewed, which is similar to the figures at the national level (1). The interviews also indicated that 53.6% of female-headed houses are in the category of low income, 38.2% belong to the lower middle class, and only 8.2% are in the upper middle class. There were no female-headed households in the category of rich. It should be noted that female-headed families have become a steadily growing phenomenon in Sri Lanka. These households have been identified as being more vulnerable to poverty due to the lack of financial and social support from their partners, compared with the families who benefit from the combined incomes of both spouses (2).

In terms of education, nearly 17% of the heads of household had either no schooling (3.5%) or only primary education (13.5%). Nearly 38% of the heads of household had secondary education (6 to 10 years of education) and 6.7% had access to higher education. Men who were heads of household were more educated than were women who were heads of household.

In terms of economic characteristics, 78% of the male heads of household were employed, compared with only 26% of the female heads of household, a gender ratio of 3 : 1. Nearly half (49%) of the female heads of household were involved in household work, but 78% of the male heads of household were skilled laborers. Among the employed female heads of household, the highest number of individuals was in the clerical/teaching category. The monthly income of the households ranged from less than Rs. 1000 to more than Rs. 20 000 (in 2002, the exchange rate was 0.0104 US dollars for 1 Sri Lankan rupee). However, the majority of the households had incomes within the range Rs. 10 000 to Rs. 20 000. Slightly more than half of the female-headed households (54%) could be considered to be poor, which indicated their high level of economic vulnerability.

The overwhelming majority of the households owned their own houses (95%), with only about 5% renting. Nearly all the households had radios and televisions (91%), nearly half had refrigerators and gas cookers, and more than one third had

telephones. Nearly 15% had motor vehicles and washing machines.

Migration has contributed to increasing population in the townships surveyed. Nearly 60% of the households are local, in the sense that the heads of household were born in the areas concerned. The rest had migrated to the project areas from other parts of the country. According to the surveys, migration rates have increased significantly in the post-1991 period, during which nearly 20% of the families interviewed had moved to the areas.

## EVALUATION RESULTS

### Access to Water and Water Use Patterns

The water supply projects for the towns east of Colombo were completed before the towns south. Based on the data available from NWSDB, the numbers of consumers in the domestic and low income categories who were connected to the system progressed as shown in Table 2.

During 1998 and 1999, there were no low-income consumers in the towns east of Colombo, because they had considerable financial difficulty paying the initial connection charges. Once NWSDB became aware of this constraint, it decided to remove public taps and instead supply piped water directly to the low-income households for a total sum of Rs. 4400 (initial payment of Rs. 2000 and four installments of Rs. 600). This new installment plan has resulted in better access to the water supply for the low-income families. When the installment plan was introduced in 2001, the ratio of program participants was 1 low-income household to nearly 39 domestic households. This ratio had improved to 1 : 27 by 2002. Similar improvements can be noted for the towns south of Colombo as well. It is likely that an increasing number of low-income consumers will connect to the water supply system in the coming years. The current installment plan for the connection charges should be reviewed further to see if the system can be made more economically attractive so that more low-income households can benefit.

Once a water supply was available in the townships, slightly more than half the households surveyed (51.2%) requested and obtained water connections. When asked the reasons for the delay in getting the water connections, nearly 61% cited financial constraints. The next most-common reason (12%) was that water connection was not necessary, because families already had access to well water.

### Water Availability Before the Projects

Before the two water supply projects were implemented, the only source of water in all the townships was groundwater, which was extracted primarily through wells. Because groundwater levels fluctuate with seasons, depending upon the rainfall, a major cause of human suffering was the unavailability of water during every dry season, December to February.

The survey indicated that the vast majority of people (95%) were satisfied with the quality of well water they used before the projects. The percentages of households who felt that their well water was good, average, or bad, by the appropriate parameters, are shown in Table 3. It should be noted that the above perceptions were based on the physical characteristics of water

**Table 3. Opinions of households regarding the quality of well water (percentage).**

Characteristics	Good (%)	Neutral (%)	Bad (%)
Color	80.9	15.4	3.7
Odor	77.5	19.8	2.7
Taste	75.3	18.5	6.2
Contamination	75.9	19.5	4.6

only. People generally have no idea of the bacteriological quality of the water they use, which is a very important consideration for health reasons.

### Water Use after Completion of the Projects

There is no question that water use patterns have changed significantly since the two water supply projects have been completed. Even considering the fact that piped water has been available for only 2 to 4 years, many changes already can be noted.

Prior to the implementation of the two projects, nearly two thirds of the households surveyed had a well within their properties. The vast majority of these households (81.6%) have retained these wells, even after piped water became available. The majority of all households (53.5%) now consume only piped water. The rest (46.5%) consume both piped and well water. The actual percentages vary significantly from one township to another. For example, 80% of the households in Battaramulla, 77% in Talangama, 67% in Kaduwela, and 65% in Keselwatta are exclusively consuming piped water. In contrast, 61% of the households in Piliyandala, 58% in Homagama, 53% in Kesbewa, and 51% in Malambe are using both piped and well water. The main advantage of using both piped water and well water is that it reduces the monthly average water consumption, and hence, the bill.

An important, but somewhat unexpected, finding of the current assessment is that an unusually high number of households that are receiving piped water are still using well water for drinking purposes (30%), and slightly more (33%) are using well water for both drinking and cooking. This is a very important finding that could have very significant implications for the water supply profession, because provision of clean water alone may not necessarily mean that the consumers will automatically start to use it. The Colombo experience indicates that even when clean water is available, a large number of households still may not use it.

There are also noteworthy changes regarding the types of wells used after piped water became available. Before the two projects were completed, 30% of the households used wells outside of their premises. Use of such wells has declined very significantly, and only about 5% of the households still use them. Unprotected wells outside the households have disappeared completely.

There is also a reduction in the households that use electric pumps. It has changed from 20% before the projects to 16.2% after the projects were completed. It is mainly the lower and upper middle classes who are not using the electric pumps any more, because poorer families could not afford to use them earlier.

### Perception of Water Quality of Piped Water

In view of the fact that some 30% of the households are still using well water for drinking, it is important to consider the people's perceptions of the quality of the piped water they receive. Table 4 indicates how the households of the nine townships perceive the quality of piped water.

There appears to be an inverse relationship between the residents' perceptions of piped water and their earlier water availability situations. For example, in Pannipitiya, where there

**Table 4. Perception of the population on the piped water quality by townships (percentage).**

Areas	Good (%)	Neutral (%)	Bad (%)
Piliyandala	50.8	47.7	1.5
Keselwatta	71.0	29.0	
Kesbewa	68.4	31.6	
Homagama	25.7	68.6	5.7
Battaramulla	60.9	39.1	
Malambe	67.4	32.6	
Kaduwela	52.3	45.8	1.9
Pannipitiya	43.3	50.7	6.0
Talangama	61.9	38.1	
Total	54.5	43.8	1.7

was the least water stress and where the quality of well water has been consistently good, the highest percentage of households rated piped water as bad (6%) and another 51% showed a neutral attitude toward it. In contrast, in Keselwatta, which had the worst water stress conditions, 71% rated piped water as good and not even a single household rated it as bad.

Chlorination was never practiced for well water, but it is an essential for treating piped water. Because residual chlorine gives tap water a distinctive taste, noticeable when drinking and when making tea, it is likely that many people prefer to use well water with no chlorine. Accordingly, when asked if the households considered residual chlorine to be a problem, slightly more than half answered positively.

### Perception of the Performance of NWSDB

When the households were asked for their opinion on the overall performance of NWSDB, nearly three quarters judged it to be good to very good, and another one quarter considered it to be average. Only one fifth of 1% considered the performance of the NWSDB to be "very bad."

When asked about the levels of satisfaction with the services received from the NWSDB, 93.4% of the consumers said they were satisfied or highly satisfied with the services they have received from the Board. Only 6.6% declared themselves to be unsatisfied. The overall opinion of the performance of the NWSDB was identical, irrespective of the towns or the socioeconomic classes of the households surveyed.

In terms of water bills, nearly all the households surveyed (97.4%) said that they regularly received them on time. In terms of water pricing, slightly more than two thirds of the households felt that the price was "not so high." Around 28% considered the price to be high and another 5% to be very high. Nearly four fifths of the households said that they could afford to pay for the water, and similar numbers felt that their water bills were accurate. However, 84% of the families surveyed said that they would not approve additional increases in the water tariff, and 9% had no comments.

An important issue that also was noted during the survey is continuing land fragmentation. As more and more people move into these towns, the areas are becoming rapidly urbanized, with higher population densities. As the land values in the townships increase, average family land holdings are becoming smaller and smaller, which means finding lands for wells often is no longer an economically attractive option or is not desirable due to health considerations, because appropriate distances must be maintained between the septic tanks and the wells. In addition, as more houses are constructed for the new migrants, water demands in the towns will continue to increase substantially. There simply is not enough groundwater in these areas to provide adequate water quantity and quality to satisfy what is expected to be rapidly escalating demands from residential, commercial, and industrial establishments.

Also, as lowlands and paddy fields in the townships are being progressively reclaimed for urban uses, a major concern now is

water contamination of the wells during the rainy seasons. In addition, many small-scale industries and car repair shops are dumping their liquid wastes on the land, without obtaining the required authorization or providing the necessary treatments. Consequently, these hazardous wastes are infiltrating the groundwater and contaminating the water sources. During the assessment, some families mentioned that they were beginning to find strange and unusual tastes in their well water, which probably is due to increasing water contamination.

### **Social Impacts**

Some of the households pointed out that the availability of the house connections has had tremendous beneficial impacts on women and people who are elderly, disabled, or sick. As noted earlier, 15.7% of the population in the surveyed households is elderly. The percentage of elderly people is likely to increase in the future. This has been an important, unanticipated benefit of providing piped water in the houses.

The projects had both positive and negative impacts in terms of social interactions. On the positive side, people are relieved that conflicts between neighbors over the use of well water, especially during dry periods of water stress, have now basically disappeared. These conflicts occurred because not all households had their own wells within their premises, and, hence, they had to use either common wells or wells that belonged to somebody else. Some families also felt that the availability of piped water has given them more leisure time, because they do not have to travel to the wells any more. This has allowed them to see their friends more frequently. On the negative side, some households felt that interactions with their neighbors earlier occurred at the wells, where they used to meet to collect water, take baths, or wash clothes. Such interactions have now declined, and in many cases have totally disappeared.

### **Economic Impacts**

The study was unable to find any major significant economic impact on the families. Only limited impacts could be noted in some lower middle class and low-income families. This is because the connection charges (installment payments) and monthly water payments are additional expenses that they did not incur before, because well water is free. Hence, some families have started small-scale new activities to earn extra income to pay for these additional water-related expenses. These new activities include preparation and selling of sweets, sewing garments and selling them, renting parts of the houses, or increasing the rents to cover the water costs.

### **Health Impacts**

The development profession considers that one of the major benefits of the provision of clean water is the improvement of the health conditions of the people. However, based on the interviews, no definitive conclusion can be drawn in terms of improved health in the project areas.

Most households felt that their health conditions were "normal" before the two projects. Interestingly, a majority of the respondents said that their health conditions have deteriorated since implementation of the two projects.

When asked specifically about the extent of the incidences of water-borne diseases before and after the projects, people felt there has been no change. It is difficult to say whether these are perceptions or reality. If this assertion is true, on medical and scientific grounds, it is not possible for health conditions to deteriorate due to the provision of clean water alone. In fact, exactly the reverse is expected. However, health conditions depend upon complex interactions of many forces, of which water is only one factor, albeit an important one. Thus, without

additional studies, no definitive conclusions can be drawn, especially in terms of isolating the effects of water on health.

Several respondents felt that before the projects, infectious diseases used to spread quickly due to the use of common wells, because of the aggregation of people around such wells. This probably was more applicable to low-income households who did not have their own wells and thus had to use common wells. Some households also pointed out that often women had back pains due to drawing and carrying water from the wells. This problem basically has disappeared now.

Another health issue relates to boiling of water. Because well water is not treated, for health reasons it should be boiled before drinking. However, boiling of water needs fuel, and thus money, and low-income people often do not have the financial resources to pay for the fuel. During the survey, families were asked if they boiled the well water and/or the piped water. The results indicated that

- the percentage of households boiling piped water is slightly higher after the projects compared with the earlier conditions: (27.1% vs. 26.7%).
- all rich households interviewed boil both piped and well water, a practice followed, in both cases, by the upper middle, lower middle, and low-income classes.
- lower percentages of low income families are boiling piped water (18.3%) than well water (20.5%).

The project had expected that families would save on fuel costs because it would not be necessary to boil piped water (3). The survey indicated that exactly the reverse has happened, because slightly more households are boiling water now compared with preproject conditions.

### **Environmental Impacts**

The main environmental impact of the two projects is unquestionably due to wastewater generation, for which there are no facilities for collection, treatment, and disposal. The two new projects are continuously introducing additional water into the townships. Because households do not "consume" water, nearly 100% of water introduced has to be disposed of as wastewater. Accordingly, wastewater is disposed of on the land nearby, either in gardens or communal lands, or drained to the streets. None of these disposal practices are satisfactory or environmentally sound, and they carry significant health risks. As more and more households join the two new water systems, more and more wastewater will be introduced into the townships. This is likely to worsen the situation steadily. Considerations are now being given to introduce sewage systems. The costs of such systems will be high. Under the most optimistic scenario, it is highly unlikely that all the towns east and south of Colombo will have access to operational sewerages systems for at least another decade.

Disposal of wastewater to the gardens, common land, or streets has major health and environmental implications. For example, stagnant pools of dirty water are likely to provide good habitats for disease vectors, such as mosquitoes. This could increase the incidence of diseases such as malaria and dengue, unless very specific and regular actions are taken to control mosquito populations. In addition, in a few instances, social conflicts have arisen because wastewaters from one house are being drained to the properties of the neighbors and/or are becoming stagnant pools in front of the houses of the neighbors. It is likely that such conflicts will increase in the future.

### **Gender Impacts**

The general development thinking is that availability of potable water has beneficial impacts on the entire households, but the impacts are often greater on women than men. It is further

assumed that the impacts are generally greater on poorer women than their richer counterparts. Because of these expectations, the survey used a special set of questions that were specifically directed to the women of the households to better understand their perceptions of the benefits that they may have received from the two projects.

When asked who in the family made the decision to apply for water connections, the respondents indicated that the economic level of the family was an important factor. In rich families, two thirds of the decisions were made jointly by husbands and wives, and the other one third were made by the husbands alone. Rich wives did not make any water connection decision on their own. However, as one progressed down the economic levels, wives became increasingly more important as decision-makers. Thus, for both upper and lower middle class families, nearly half the decisions were made jointly by husbands and wives, one quarter by the husbands only, and one-quarter by the wives. For lower middle class households, children made nearly 5% of the decisions. In the case of low-income families, where wives and children had to go out to collect water, 40% of the decisions were made by wives, approximately 12% by husbands, 10% by the children, and 38% were made jointly by the wives and husbands.

When asked the reasons why water connections were requested, the responses also varied by economic classes. Convenience was the dominant reason for all the social classes, ranging from 80% for the rich families, and then steadily declining by class to reach 50% for the low-income families. The second most important reason was that no other source of water was available. In this case, the responses were the reverse: 20% for the rich and upper middle class families, and increasing to 50% for the low-income households. Quality of water was an important consideration for 25% of the poor families, who felt well water was not appropriate for drinking. However, water quality was not a factor for rich families, presumably because they had their own wells, which they maintained properly.

When asked if women received any benefits from the two water supply projects, most felt that it had made a difference in their lives. Several benefits were attributed and these often varied by economic classes. For example, nearly two thirds of the poor families felt that an important benefit was the saving of time. The comparative figure for the rich women was only 20%. All the families felt that water supply made washing easier (60% for rich families, and gradually increasing by class to 80% of poor families). Similarly, 40% of the rich women found it made cooking easier, and this percentage increased to 64% for poor families. Surprisingly, however, only rich women (10%) felt that piped water had improved the health conditions of the family. This benefit was not perceived by any other social class.

It is thus very evident that women from all economic classes felt that the two water supply projects had made very significant differences in their lives. However, the perceptions of the extent and type of the benefits received varied from one social class to another.

## IMPLICATIONS OF THE FINDINGS

Unquestionably, the most important finding of the evaluation is that nearly 30% of the households are not using the piped water for drinking: they continue to use well water. This is because the families feel that well water is "better" than piped water. The piped water is being used by these households for washing and bathing purposes only.

In order to check the perception of these households that well water is better, an independent laboratory, Sri Lanka Standards Institution (SLSI), an internationally certified water quality laboratory, was commissioned to analyze the quality of both piped water and well water in 25 selected households that

were using only well water for drinking and cooking. SLSI collected and analyzed all the water samples for this analysis. For drinking water standards, the Sri Lanka Standard Specification for Potable Water (SLS 614), based on World Health Organization standards / requirements for potable water (4), was used for reference purposes.

According to the Sri Lankan standards, the results of the analyses should comply with the following requirements:

- Piped public water supply. Throughout any year, 95% of the samples shall not contain any coliform organisms in 100 mL. None of the samples examined shall contain more than three coliform organisms in 100 mL. Coliform organisms shall not be detectable in 100 mL of any two consecutive samples. None of the samples examined shall contain *Escherichia coli* in 100 mL.
- Individual or small community supplies. None of the samples examined shall contain more than 10 coliform organisms per 100 mL on repeated examinations. No sample shall contain *E. coli* in 100 mL. Individual or small community supplies include wells, bores, and springs.

The results of the laboratory test are shown in Table 5. As can be observed from Table 5, the analyses indicate that coliforms were detected in 100% of the samples of well water from the households, ranging from 1 to  $1.6 \times 10^2$ . *E. coli* was detected in all samples, except for two cases, and the values ranged from 1 to  $1.6 \times 10^2$ . The analysis for piped water samples showed a better water quality. Even then, coliforms were detected in 28% of the samples, the values ranging from 1 to more than 180, and *E. coli* was detected in one case.

Based on the water quality analyses carried out, it is evident that piped water is of a much higher quality than the well water, even though 30% of all the households perceived water quality of wells to be "better." The perception that water quality of wells is better comes most probably from the presence of residual chlorine in the piped water. In Sri Lanka, drinking tea is a well-established social habit. The taste of tea prepared with chlorinated tap water is somewhat different from that made with nonchlorinated well water. It is thus possible that perception well water is "better" than piped water comes from the fact that tea is tastier when it is made with well water, but is not based on water quality considerations.

The evaluation raises a very important issue. The Government of Sri Lanka is spending millions of dollars to bring clean water to the urban sector, yet nearly one third of the households in the project area are using this expensive and clean water only for washing and bathing. This is clearly a very inefficient and uneconomic use of tap water.

It is thus evident that the provision of clean water to urban centers will not automatically mean that this water will be used by the families, as is implicitly assumed by the Millennium Development Goals and the national governments and donor agencies. The fact that one third of the families surveyed in the Colombo project area are not using the water for drinking and cooking means that this is a serious problem that should be addressed by an extensive education and communication program for the consumers of water. Such educational and communication programs are for the most part nonexistent at present in nearly all developing countries.

The Millennium Development Goal in the area of water is a worthy target. However, even if this target is reached, its effectiveness will be very significantly reduced, if, as observed in Colombo, one third of the families still would not use the available piped water for drinking and cooking. In addition, people are boiling water as much as when they had access only to well water. The independent water quality analyses establish that piped water supplied is mostly within the Sri Lankan standards. Accordingly, households may be wasting money and

**Table 5. Analysis of samples of well and tap water.**

Sample No.	Source	Results	
		Coliforms MPN per 100 mL	<i>E. coli</i> MPN per 100 mL
1	Well water	90	7
2	Tap water	Not detected	Not detected
	Well water	> 180	> 180
3	Tap water	Not detected	Not detected
	Well water	30	Not detected
4	Well water	Not detected	Not detected
	Tap water	> 180	> 180
5	Well water	13	Not detected
	Tap water	> 180	5
6	Well water	Not detected	Not detected
	Tap water	> 180	35
7	Well water	Not detected	Not detected
	Tap water	> 180	1.6 × 10 <sup>2</sup>
8	Well water	Not detected	Not detected
	Tap water	90	5
9	Well water	1	Not detected
	Tap water	90	50
10	Well water	Not detected	Not detected
	Tap water	90	8
11	Well water	5	Not detected
	Tap water	> 180	1
12	Well water	Not detected	Not detected
	Tap water	> 180	5
13	Well water	Not detected	Not detected
	Tap water	1	Not detected
14	Well water	Not detected	Not detected
	Tap water	> 180	5
15	Well water	Not detected	Not detected
	Tap water	> 180	> 180
16	Well water	> 180	> 180
	Tap water	> 180	2
17	Well water	Not detected	Not detected
	Tap water	> 180	1.6 × 10 <sup>2</sup>
18	Well water	Not detected	Not detected
	Tap water	> 180	1
19	Well water	Not detected	Not detected
	Tap water	90	1
20	Well water	1	Not detected
	Tap water	90	20
21	Well water	Not detected	Not detected
	Tap water	> 180	90
22	Well water	Not detected	Not detected
	Tap water	90	8
23	Well water	5	Not detected
	Tap water	>180	35
24	Well water	12	3
	Tap water	35	7
25	Well water	Not detected	Not detected
	Tap water	1.6 × 10 <sup>2</sup>	3

There are several other noteworthy findings. First, people had no complaint that they have to pay for water, even though water was provided earlier for free. Water prices have increased significantly in recent years, and yet the vast majority felt the current price is acceptable. Second, in order to pay for these additional water-related expenses, many women have started economic activities. Thus, contrary to the current belief, reduction or elimination of water collection chores does not necessarily translate on a one-to-one basis to an increase in the leisure time of the women concerned. Third, an unanticipated positive impact of the water supply has been the benefits it has brought to elderly, sick, and disabled people. Generally, such benefits have not, up to now, been considered in the water supply planning (8).

All development projects are complex, and it is essential that their benefits and costs be evaluated objectively without any preconceived notions. Evaluators must go into the field with completely open minds and report the situations as they exist. Only with such a scientific and independent approach, will it be possible to find out the benefits and costs of specific projects and the policy measures needed to improve significantly their overall benefits. The importance of objective and comprehensive evaluations is amply supported by the results of the Colombo water supply projects.

#### References and Notes

1. Department of Census and Statistics. 1997. *National Statistics*. Sri Lanka.
2. World Bank. 2004. *World Development Indicators*. Washington, DC. 400 pp.
3. NWSDB. 1998. *Towns East of Colombo Water Supply Project. Project Completion Report*. Ministry of Housing and Urban Development, Sri Lanka.
4. Sri Lanka Standards Institution. *Sampling and Analysis of Water Samples. Water Supply Project for Towns East and South of Colombo, Sri Lanka*. Report submitted to the Third World Centre for Water Management, Mexico. January 2003. 10 pp.
5. Gordon, B., Mackay, R. and Rehfuess, E. 2004. *Inheriting the World*. World Health Organization, Myriad Editions, London. 64 pp.
6. United Nations Human Settlement Program. 2003. *Water and Sanitation in the World's Cities*. Earthscan, London. 320 pp.
7. Vaz, L. and Jha, P. 2001. *Note on the Health Impact on Water and Sanitation Services*, Commission on Macroeconomics and Health Working Paper Series 23. World Health Organization, Geneva. 15 pp.
8. Biswas, A.K. 2005. *Institutions for Resources Management: A Case Study from Sri Lanka*. In: *Water Institutions: Policies, Performance and Prospects*. Gopalakrishnan, C., Tortajada C. and Biswas, A.K. (eds.). Springer, Berlin. pp. 24-45.
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energy, because boiling of piped water may not be necessary. Again, education and communication will be needed to overcome this social perception and the current practice.

There is the general assumption that provision of clean water, both in terms of quality and quantity, will improve the health conditions of the people (5-7). However, an important finding of this evaluation is that the perception of the families in towns east and south of Colombo does not bear this out. According to people interviewed in the area of the projects, they do not find a direct relation between the availability of piped water and improvement in health conditions of their families. In some cases, people even mentioned that their health conditions had actually deteriorated. Additional studies are needed before any definitive conclusions can be drawn regarding the role of water on improving health, if provision of water is not accompanied by communication, education, and dissemination of information.

Water authorities also should consider the challenges they face if quantity and quality of water provided is improved, but educational aspects are not considered, bearing always in mind that water and sanitation are among the most important determinants of public health.