

# SHARED SOLUTIONS TO COMMON PROBLEMS



**THE STORY OF THE DRINKING  
WATER PROJECT FOR LAS MANGAS AND  
ARSENIC AFFECTED COMMUNITIES IN  
SAN ISIDRO, MATAGALPA**

## CREDITOS

### **History of the potable water project for the sleeves and communities affected by arsenic in San Isidro, Matagalpa**

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## EXECUTIVE SUMMARY

The project to provide drinking water to Las Mangas and communities with arsenic-contaminated public wells in the municipality of San Isidro, Matagalpa, is the first of its size and scope in Nicaragua and currently covers eight rural communities. It formed part of the United Nations Children's Fund's (UNICEF's) 1996-2001 and 2002-2006 Water and Healthy Environment Programmes, which have helped the state water company ENACAL respond to the basic needs of an estimated 1.4 million rural Nicaraguans deprived of a safe and reliable source of water.

The main reason for the project was the discovery of dangerous levels of arsenic in water from local public wells used for human consumption. Tests revealed that the water in five of the project's original seven communities exceeded the World Health Organisation/Pan-American Health Organisation (WHO/PAHO) safety level of 10 micrograms per litre ( $\mu$ /litre).



By February 2001, the arsenic-contaminated public wells had been sealed and the communities were receiving water from tanks trucked in by ENACAL's Rural Water Systems Department (ENACAL-DAR) and the San Isidro Municipal Government.

As a permanent solution, it was decided to drill a well in Las Mangas to supply safe drinking water. This water would be pumped to a tank in the nearby hills, from where it would be taken by gravity to two subsidiary tanks and then on to the project communities. It was hoped that in addition to resolving the arsenic problem in the affected communities, the project would also improve local access to water, as well as hygiene and sanitation in the project communities.

The project was designed by UNICEF in close collaboration with ENACAL and the proposed project was then accepted by the local inhabitants, who were

involved in the project right from the start through a participatory assessment process. They also worked on the construction of the new system, with each user household contributing voluntary labour. As they worked, they learned construction and pipe installation techniques that should help ensure the system's sustainability.

The work was very hard, with the terrain often extremely rocky and difficult to dig. Women were actively involved, perhaps motivated by the benefits it would bring to them, as they are traditionally responsible for fetching water and safeguarding their children's health.

The construction process was affected by a series of delays that, while natural in a project of this size, did generate some frustration and friction among the communities. However, a final injection of energy from UNICEF and ENACAL reinvigorated the process, proving that the inhabitants were determined and willing to finish.



The system began supplying drinking water to the seven original project communities in April 2004. The community of Santa Isabel was later connected on June 15, 2004, demonstrating the autonomous organizational capacity of the system's Administrative Board.

Now that all user households are receiving safe water from a tap in their backyards, the time and effort involved in fetching water every day have been reduced to just minutes, particularly benefiting women and children. The system appears to be running well and the Administrative Board has been able to deal with any problems so far.

The total project costs were shared by the Nicaraguan government, through ENACAL; UNICEF, which channelled funds from the Italian and Swedish

governments; and the communities, which contributed the unskilled labour involved. The San Isidro Municipal Government and the health and education ministries were also actively involved in the project.

Local people have participated and expressed their views throughout the process, and local ownership of the system has been ensured through an institutional structure consisting of community water and sanitation committees (CAPS's); a democratically-elected Administrative Board, responsible for the system's day-to-day administration, efficiency and quality; and a General Assembly of Users, the system's highest decision-making body. Their functions are defined in the system's statutes, which were established through a participatory process involving the project stakeholders. The document sets out the ground rules for the new system and will be used to resolve any future problems.

There is no reason why the system should not be financially sustainable, given the current levels of payment and the technical and administrative competence displayed by the Administrative Board. If the Board continues to operate in an efficient, transparent and accountable way that keeps the users informed and involved, local inhabitants should continue to benefit from a safe and reliable source of drinking water.

## Lessons Learned

✿ The possibility of building multi-community systems in Nicaragua; knowledge of the kind of complications that may emerge; the importance of community appropriation, encouraged by ENACAL's participatory methodology; and the value of ENACAL's "learning-by-doing" methodology and training from private companies in ensuring local skills for the system's sustainability.

✿ In projects of this size, conflict resolution and the anticipation of possible problems can reduce friction and frustration; the funding of specific technicians and social promoters to concentrate on the project helps reduce delayed implementation; and the installation of water meters appears to generate self-control and an awareness of water use, as well as reducing disparities between rich and poor.

## Challenges Ahead

❖ For the Administrative Board: guarantee transparency and payment of water bills to ensure the system's financial sustainability; inform users of the system's finances and development; achieve legal status; and connect the arsenic-affected community of El Cacao.

❖ For ENACAL and/or the San Isidro Mayor's Office: guarantee the training and auditing of the next elected Administrative Board through the National Operation and Maintenance Unit; and avoid delays in the installation of this kind of system, as this can generate frustration and even friction among the communities.

❖ To guarantee water quality, as well as its continuity and quantity.

## INTRODUCTION

The project to provide a drinking water system to Las Mangas and communities with arsenic-contaminated public wells was part of UNICEF's 1996-2001 and 2002-2006 Water and Healthy Environment Programmes. The current Programme is helping the state water company ENACAL respond to the basic needs of an estimated 1.4 million rural Nicaraguans who are still deprived of a safe and reliable source of drinking water. In 2003 and 2004, it helped empower 27,728 people to actively participate in achieving their constitutional right to a healthy environment.

The project started in 2001 following the discovery of dangerous levels of arsenic in a number of public wells sunk in the early 1990s. Given the scale of the problem, it was decided to drill a well in Las Mangas to supply safe drinking water and then pump it to a tank on a nearby hill, from where gravity would distribute it to the communities involved. Design work started at the end of 2001, and the system was officially handed over by ENACAL's Rural Water Systems Department (ENACAL-DAR) to a locally elected Administrative Board on May 20, 2004.

The project and the communities received institutional support from ENACAL, the San Isidro Municipal Government, the Ministry of Health (MINSA), the Ministry of Education and UNICEF, with funding from the Nicaraguan, Italian and Swedish governments. The local population was also actively involved, providing labour, participating in community assemblies and voting for the Administrative Board, as well as receiving information on sanitation, hygiene and arsenic intoxication to improve its own hygiene situation.

This rural drinking water system is the first of its size and scope in Nicaragua, covering around 400 houses in eight communities and involving nearly 40 km of pipes. It is run by a democratically elected Administrative Board, which is subject to a General Assembly of Users.

Despite the difficult work involved and a series of delays during the construction phase, the system began operating in April 2004. When asked if the project had been worth it, Juan Obando from the community of La Ceiba said, "That's not even up for discussion! It's improved our lives 100%", while Karlota Meza from Las

Mangas explained that it had “brought hope to the communities”.

Considered to be sustainable both financially and technically, this is the story of the project to provide Las Mangas and communities affected by arsenic with a safe drinking water system, describing the changes it has produced, the lessons it provides and the challenges that remain.

## THE COMMUNITIES

The eight communities currently connected to the system belong to the municipality of San Isidro in the department of Matagalpa and are located along or near to the San Isidro-León highway, which branches off from the Pan-American Highway between the cities of Sébaco and San Isidro. Only seven communities were originally connected, but the water system's Administrative Board has since extended the service to the community of Santa Isabel completely under its own initiative, connecting a further 20 houses.

At the start of the project, each community had the following number of inhabitants and houses:

| Communities        | Houses | Population | Inhabitants/<br>House |
|--------------------|--------|------------|-----------------------|
| Las Mangas         | 273    | 1,128      | 4.13                  |
| El Zapote          | 21     | 97         | 4.62                  |
| Sabana Larga       | 22     | 82         | 3.73                  |
| La Ceiba           | 11     | 67         | 6.09                  |
| Real de la Cruz    | 21     | 119        | 5.67                  |
| Soledad de la Cruz | 77     | 356        | 4.62                  |
| La Unión           | 57     | 226        | 3.97                  |

According to ENACAL-DAR's pre-project assessment report (November 2001), the main income in the area comes from paid agricultural labour, with subsistence agriculture representing a secondary activity. The average monthly family income was estimated at 600 córdobas (US\$43.80).

The health situation

Health data for the first five months after the system started operating in 2004 (April to August) show 70 reported cases of acute diarrhoeic illnesses in the Las Mangas health post, compared to 87 and 134 during the same months of 2003 and 2005 respectively. The corresponding figures for the Soledad de la Cruz health post were 88 in 2003, 51 in 2004 and 64 in 2005. The number of acute respiratory infections reported during the five months in question in Las Mangas was 693 in 2003, 493 in 2004 and 513 in 2005. In Soledad de la Cruz, the number

of cases dropped from 577 in 2003 to 570 in 2004 and 421 in 2005.

Rates of dengue and malaria were minimal in 2003 and increased slightly in 2004. There was, however, an outbreak of malaria in the Las Mangas area in 2005, with 16 cases reported at the health post there (see annex for more details on these health figures).

It should, however, be stressed that the two health posts in the area also cover communities not involved in the project, while any improvements or deterioration in the figures could be attributable to many other factors, including unusual amounts of rainfall in 2005.



## INSTITUTIONAL INVOLVEMENT

The project's financial costs were shared by the Nicaraguan government, which covered operating costs through ENACAL; UNICEF, which channelled funds from the Swedish and Italian governments; and the communities, which contributed the unskilled labour involved in the project.

| Source                         | Contribution (US\$) |
|--------------------------------|---------------------|
| Government of Italy/UNICEF     | 133,380.00          |
| Government of Sweden/UNICEF    | 90,904.00           |
| Government of Nicaragua/ENACAL | 58,064.52           |
| Community contribution         | 32,709.68           |

In addition to ENACAL and UNICEF, the following institutions were also involved in the project:



**The San Isidro Municipal Government:** The local government funds the municipal National Operation and Maintenance Unit (UNOM) representative, who was involved at all stages of the project's implementation, and coordinated with ENACAL-DAR to supply the arsenic-affected communities with water before the system came into operation.

The Mayor's Office also negotiated with the cooperative that provided land for the system's well and UNICEF funds were channelled to the municipality to be used by the Administrative Board of the Water System.



**The Ministry of Health (MINSA):** The municipal health centre in San Isidro coordinated with ENACAL-DAR to provide training and activities related to community hygiene and sanitation. It also distributed water filters and monitored the health situation through its two health posts in the area.

Health centre personnel were involved in a UNICEF-funded study of the effects of arsenic on the population of El Zapote carried out by a team led by Dr. Alina Gómez, Dermatologist, in 2002, as well as the distribution of multivitamins and ointments provided by UNICEF to help treat the effects of arsenic poisoning.



**The Ministry of Education, Culture and Sports** was involved indirectly through the local schools, with the children receiving educational talks and secondary school pupils making house-to-house hygiene and sanitation visits.

## The Situation Before

### *Arsenic contamination*

The main reason for the project was the discovery of dangerous levels of arsenic in drinking water from local public wells. Tests revealed that the arsenic concentrations in five of the project's original seven communities exceeded the national safety level of 10 µ/litre (see text box).

As the president of the water system's Administrative Board, Ezequiel Martínez, explained, "In the areas where the arsenic was most concentrated, people started suffering from a series of problems: short-sightedness, calluses on their hands, cracked skin in their armpits, and stomach and liver problems..."

### *Water supply problems*

Prior to the discovery of arsenic in 1996, inhabitants of El Zapote, Sabana Larga, La Ceiba, Real de la Cruz, La Unión and Soledad de la Cruz relied on community wells, but by February 2001, all of the public wells in the contaminated communities had been closed.

As an emergency measure, ENACAL-DAR and the municipal government trucked in drinking water once a week and inhabitants either lugged water from private wells or walked to rivers four to

**"In my  
community, we  
had to go to  
a well about 2  
kilometres away."**

Pupil from the Las  
Mangas  
secondary school

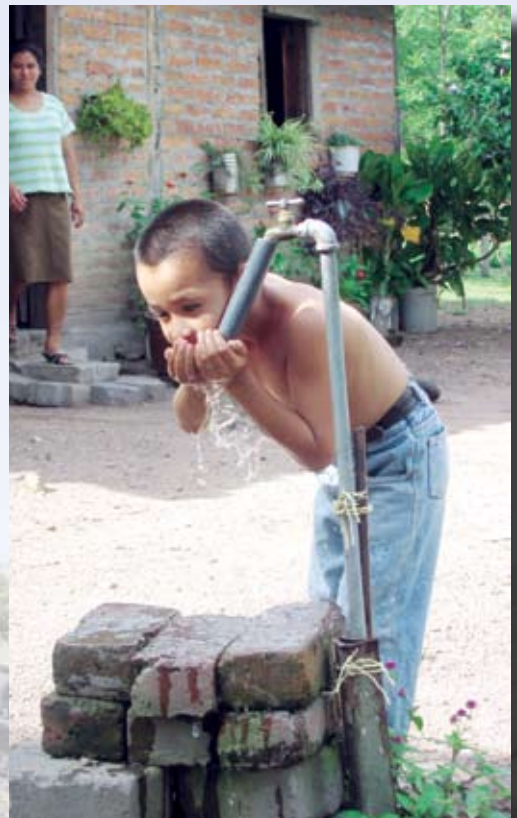
six kilometres away to wash clothes or wash themselves down. Silvia García from La Ceiba recalled how difficult it was “getting up at 4am to fetch water before taking the kids to school in Las Mangas.”

The community of Las Mangas had its own safe water supply system before the project began, but a reduction in the well's capacity meant that the service was rationed to just six hours a day.

A survey of 20 user households for the project's evaluation in September 2004 revealed that they spent an average of 1 hour and 50 minutes fetching water before the project, implying a considerable amount of time and effort, which was the responsibility of either women or women and children in 75% of cases.

### ***Sanitation and hygiene in the communities***

According to ENACAL-DAR's pre-project assessment report, families had to store the limited drinking water that was brought in. This created a risk of water-borne infections as the containers were often placed near the floor and unclean receptacles used to scoop out the water. This was further aggravated by a lack of hand-washing facilities and hygiene awareness, which implied the contamination of drinking water by dirty hands. The under fives were particularly at risk and had reportedly suffered from diarrhoea, skin complaints, eye infections and stomach-ache. There were also problems with drainage in the backyard, where puddles provided potential breeding grounds for mosquitoes.



### *The human right to water*

According to the General Comment issued by the United Nations Committee on Economic, Cultural and Social Rights on November 26, 2002, "Water is fundamental for life and health. The human right to water is indispensable for leading a healthy life in human dignity. It is a prerequisite to the realization of all other human rights." The supply of clean, safe drinking water was a basic human right for these poor rural communities, which were affected by arsenic poisoning and limited access to water.



## PRE-CONSTRUCTION

The UNICEF/ENACAL cycle for rural water projects, which normally cover just a single community, includes five stages before the water system's physical implementation (promotion, evaluation, organization, planning and training, as shown in the project cycle diagram). At the end of these five stages, the community should have agreed on the kind of system to be installed and be trained and organised to play its part in the system's construction and administration.

As this project covered seven different communities, however, all of the stages were much more complicated and some overlapped well into the construction, including the administrative training and the calculation of the tariff.

### *Promotion, evaluation and organisation*

The emergency nature of the arsenic problem made these communities an obvious priority. Once identified, ENACAL-DAR's pre-project assessment process involved real participation and input from the community. "We helped doing censuses, drawing up maps, going house to house inviting people to meetings and doing surveys," recalled Ileana Martínez, the coordinator of the La Unión drinking water and sanitation committee (CAPS).

Such participation is essential if the project is to assess the real situation in the communities in order to respond to the local people's claim to safe and clean water and determine the responsibilities of the relevant institutions. The communities also expressed their willingness to participate, which is vital in ensuring their organization in the project's physical implementation and their genuine appropriation of the system. As Socorro Rivas from the Real de la Cruz CAPS insisted, "They took us into account right from the start, holding meetings and asking if we were willing to work, to give support, and we said that we were."



The fact that all of the communities already had drinking water and sanitation committees was an obvious advantage when it came to organising the

communities in the construction work. However, the sheer scale of the new system led to the creation of an Administrative Board to run the system once installed.

The Board was elected on September 29, 2002, with several candidates standing in each community. There was a good turnout (66% of inhabitants over 16 years of age), which legitimised the Board as democratically and transparently elected.

## Planning

According to Silda Leyton, the current director of ENACAL-DAR in Region VI and previously head of the social promotion team for the Las Mangas project, ENACAL-DAR used the information from the assessment process to draw up a single plan of action for all of the communities involved. This was then divided into community plans that included actions to improve local hygiene and sanitation and organise community participation in the construction work. These were then discussed with local inhabitants and approved during community assemblies.

In a normal, community-level ENACAL/UNICEF project, ENACAL-DAR presents the community with a number of alternative services. The inhabitants then decide which they prefer, based on information and advice from the ENACAL-DAR promoters. In this case the process was slightly different, given the technical difficulty of resolving such a complicated, multi-community problem.

The system and its design were therefore determined by UNICEF in close collaboration with ENACAL. The project



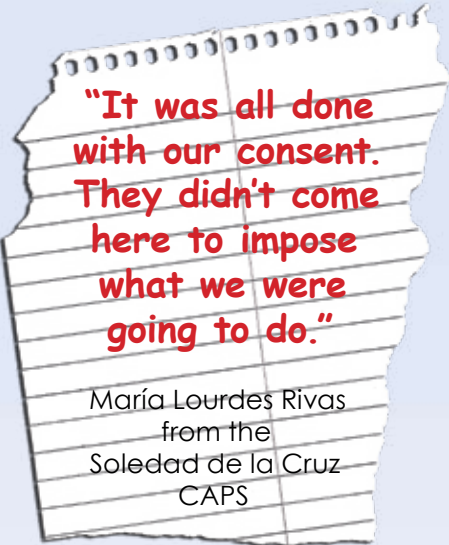
was then explained during community assemblies and the inhabitants expressed their agreement with the solution and their desire to participate. The main role of the ENACAL-DAR social promotion team in this process was to supply the communities with information and help them act in a collective way.

## Training

### Technical training

The local inhabitants were taught on the job by the ENACAL-DAR engineers, which allowed them to learn the different techniques involved in building the system and how to connect and repair PVC pipes. This knowledge has been left behind in the community and should help ensure the system's sustainability.

Two companies also gave training: AMANCO, which supplied the PVC pipes and related accessories, and McGregor, which supplied and installed the pumping system. The practical and theoretical information they provided should help ensure good maintenance practices and the system's technical sustainability. This linkage with private companies is also important in terms of identifying future suppliers and repair experts.



**"It was all done with our consent. They didn't come here to impose what we were going to do."**

María Lourdes Rivas  
from the  
Soledad de la Cruz  
CAPS



### **Administrative and hygiene training**

Training was also provided in the following areas by ENACAL-DAR Region VI's social promotion team, with UNICEF and Health Ministry support:

- ❑ The different posts and functions corresponding to the CAPS's
- ❑ The system's operation and maintenance
- ❑ Arsenic intoxication
- ❑ Community and personal hygiene

In relation to health and hygiene, the idea was for those attending the sessions to “multiply” what they had learned by passing on the knowledge in their own communities.

The Administrative Board has also received advice on aspects related to management, marketing and accounting from the Water and Healthy Environment Project (ENACAL-UNICEF-MINSA-MECD) with the aim of helping it run a more effective system, reduce operating and maintenance costs and ensure the system's future. The Project has also organized financial audits. For Administrative Board president Ezequiel Martínez, “the accompaniment has been very important in helping us get our paperwork right and deal with other organizations.”

## THE CONSTRUCTION PHASE

The construction work was originally planned to take place between July 2002 and July 2003, but a series of delays meant that water finally started to be supplied to the first seven communities in April 2004. A request from Santa Isabel to be connected to the system was later approved by the General Assembly of Users and the community started receiving water on June 15, 2005.

### Community participation

Households willing to provide labour to install the system and therefore earn the right to be connected had to contribute 30 “man-days” of work, which involved a number of different tasks, including helping construct the tank or installing pipes under the guidance of the ENACAL technicians. They also had to dig a determined length of trenches (between 50 and 70 metres, depending on the community) for the distribution network.

The work was very hard as the land is rocky and difficult to dig. As María Lourdes from Soledad de la Cruz recalled, “Some people took 3 to 4 days digging a metre because certain places were very rocky and they came back in really bad shape.”



The tank proved particularly difficult as workers had to cut into the side of a rocky hill. In addition, it was only possible for vehicles to take materials part of the way up the hill, from where they had to be physically lugged the remaining 400 metres to the construction site.

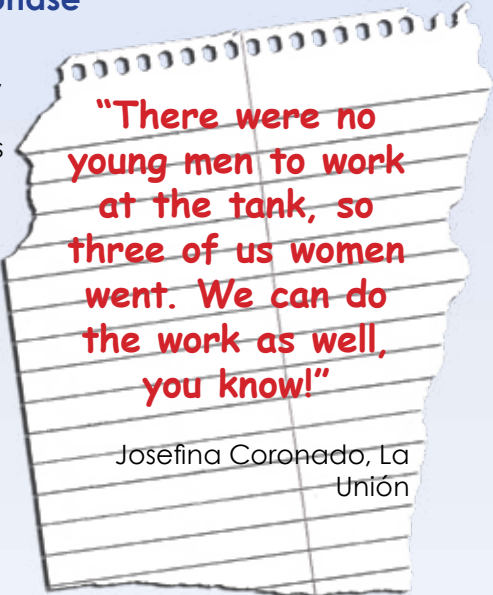
While most of the manual work was done by men, women also participated. Ileana Martínez and Josefina Coronado from La Unión both volunteered to work on the tank when there was a shortage of labour. “We were up at the main tank carrying sand,” explained Martínez, “and I even came back without my shoes!”

But it was something we wanted and now we've got it."

This may have been because women were more conscious of the need for a safe, accessible source of water as they are traditionally responsible for fetching it and for safeguarding their children's health.

### Problems during the construction phase

Although difficulties and delays are only natural in a project of this scope and size, they do generate frustration and friction in the communities, among other reasons because local people have paid work or have to tend crops and cannot work indefinitely on the project. Contracting specific ENACAL-DAR personnel for the social component and the technical supervision appeared to have a positive impact on progress, and a final injection of energy from UNICEF and ENACAL was enough to see the project through to its conclusion, proving that the inhabitants were determined and willing to finish.



**"There were no young men to work at the tank, so three of us women went. We can do the work as well, you know!"**

Josefina Coronado, La Unión

## CHANGES

### The system

The water system now supplies safe drinking water to eight rural communities. It uses a 50 horsepower pump to send safe water from a well in Las Mangas up to a main tank with a capacity of almost 100 m<sup>3</sup>. From there, the water is carried by two pipelines, one running to the old Las Mangas tank (38 m<sup>3</sup>), which was rehabilitated for the project and supplies Las Mangas and El Zapote, and the other all the way to two plastic tanks (10 m<sup>3</sup> each) in the hills above La Unión, at the opposite end of the project's area of influence. The main tank supplies the communities of La Ceiba, Sabana Larga, Real de la Cruz and Santa Isabel, while the tank at La Unión supplies La Unión and Soledad de la Cruz.



The system as a whole involves just under 40 km of pipes, and the distribution network leads to individual meters outside the user houses, so that each household is charged according to the amount of water it consumes.

### The water supply

When asked in what way having water in their backyards had improved their family's life, 14 of the 20 user households interviewed during the evaluation survey said that they no longer had to fetch water. A considerable amount of time and effort have been saved in this respect. Women are still mainly responsible for obtaining water, but when asked how long it takes them, most laughed and said that they just have to open the tap.

Schoolchildren interviewed at the same time also appreciated the difference made by the new system. "It's easier now," explained one ten-year old. "We don't have to go the wells to draw water. We can use the tap water to wash

dishes and wash ourselves, and there's more time to study".

Given its considerably increased availability, it is perhaps no surprise that the survey showed the families using slightly more water just after the system was installed. However, all six families from Soledad de la Cruz and Las Mangas interviewed in October 2005 mentioned ways of using less tap water. This helps them save money given that the minimum water rate is 47 córdobas (about US\$2.70) up to 10 m<sup>3</sup>, and then increases by 4.7 córdobas with each extra cubic metre used.

As system user Adela Rivas from Soledad de la Cruz explained, "I only pay the minimum rate now because we use the well to water the plants and use rainwater to wash clothes." This is very important, suggesting that the individual water meters have had a positive effect, leading to an element of self-control, turning water use into an issue in these communities and helping reduce disparities between rich and poor.

There does seem to be general satisfaction with the way the system has operated so far. In the words of Ventura Ruiz from El Zapote, "A few pipes have caused problems, but the maintenance people are good and move quickly to repair them."

The evaluation survey also suggests that increased water availability has encouraged local households to make certain improvements in their hygiene situation. For example, more households have erected a screened-off area in the back yard where family members can wash themselves down in privacy. All but one of the 20 households interviewed had such an area following the project, compared to only 16 before.

Most communities appear to have a satisfactory health and hygiene situation, although there is still work to be done, particularly in terms of controlling domestic animals and eliminating backyard puddles, which offer potential breeding grounds for mosquitoes. The Administrative Board could coordinate with the community CAPS and the local health authorities to provide more follow up in this area.

## EMPOWERMENT

### Community organisation

The organisational structure established by the project consists of an Administrative Board, seven CAPS's in the original seven communities and a General Assembly of Users. Their functions are defined in the system's statutes, which were established through a participatory process.

The Administrative Board is responsible for the day-to-day running of the system. It was democratically elected on September 29, 2002, with each of the seven original communities electing its own representative. The elected members then voted to select four paid members: the president, secretary, treasurer and maintenance person.

The Board has received ongoing accompaniment from ENACAL, MINSA, MECD Y UNICEF, including regular audits of the system's financial situation. One pending and important task for the Board is to achieve legal status so that it can act in its own name and open a bank account. It has contracted a lawyer to help with its application, and is currently awaiting National Assembly approval.

Interviews held with six user households in October 2005, a year and a half after the system began operating, revealed general satisfaction with the Board's work. Several stated that they had "no complaints" because they were receiving a constant supply of water.

However, the interviews did suggest that the users are not receiving regular information on the system's financial situation or the Administrative Board's activities. Keeping the users informed therefore represents a challenge for the Board, whether through the local CAPS's or by posting reports on church, school or health-post notice boards.



In addition to the Administrative Board, each community also has an elected drinking water and sanitation committee (CAPS). These existed before the project and are now responsible for local-level oversight of the system and of sanitation and hygiene.

The highest decision-making body is the General Assembly of Users, which is responsible for ratifying the most important decisions concerning the system. It consists of the six members from each community CAPS, for a total of 42 representatives. According to the system's statutes, ordinary Assembly sessions should be held at least every 6 months.

## Gender

Water projects tend to benefit women, who are invariably responsible for obtaining the family's water, often helped by their children. The amount of time and effort dedicated to this task has been considerably reduced now that most families have a safe source of water in their backyards.

But while women have participated in community meetings and in the construction work, they have less participation in leadership posts. Although the vast majority of CAPS members are women, only two of the committees have a female coordinator and the elections resulted in an entirely male Administrative Board.

## Children and adolescents

Children and adolescents have also benefited from not having to invest time and effort in hauling water, as well as a positive impact on their health situation. They were involved in the project implementation through talks on hygiene given at the schools and, in the case of 5th year secondary school students, by making house-to-house sanitation and hygiene visits in the different communities.

It could be interesting to see more community-level adolescent participation, in the CAPS for example, as a way of providing representation for the younger age groups and helping groom future community leaders.



## SUSTAINABILITY

### Financial sustainability

The project's financial sustainability depends on the administrative capacity to ensure that users continue paying their water rate. In this sense, the Administrative Board cuts off the water service to people who have not paid for three months, established on the regulations accepted by all the parts involved, although Administrative Board president Ezequiel Martínez stated that there is a good level of payment and that people rarely allow themselves to be disconnected.

The water rate established by the Administrative Board is a minimum monthly payment of 47 córdobas for the first ten cubic metres, with each additional cubic metre costing 4.7 córdobas.

The money collected needs to cover monthly administrative, repair and maintenance costs. Given that the system is supposed to be self-financing for its 20-year estimated useful life, it also needs to generate enough savings to cover replacement of the most expensive piece of equipment, the submersible pump, which would cost 227,000 córdobas (about US\$13,350) to replace.

The Board has already managed to save 64,692.81 Córdobas (US\$ 3,700.96) in just under a year and a half, suggesting that there will be no problems replacing the pump if its useful life is conservatively estimated at six years. There is therefore every chance that the project will be financially sustainable for the next 20 years.



### Technical and administrative sustainability

The Administrative Board appears more than capable of repairing and maintaining the system and has developed the necessary contacts to seek professional help for more complicated technical problems. It also appears to be providing an efficient and transparent administration, as reflected in the financial audits carried out to date.

The real challenge, however, will be continuing the good work after 2006, when the current Administrative Board finishes its term and a new Board is elected. In this sense, the UNOM in the San Isidro Mayor's Office could play an important watchdog and auditing role in line with its responsibility for following up on finished ENACAL projects.

### Hygiene and sanitation

The municipal UNOM has been analysing local water samples in conjunction with MINSA to ensure the quality of the drinking water. One challenge for the Administrative Board is take an active role in coordinating with these institutions to ensure regular analysis, sharing the information with users through the CAPS's.



## LESSONS LEARNED AND CHALLENGES AHEAD

### Lessons Learned

- ✱ This project has proved the viability of building and administering systems that cover multiple communities in the event of serious problems such as arsenic contamination. However, this kind of project is much more complicated than single community solutions and should therefore be implemented only in the absence of other alternatives.
- ✱ The project has also shown that with an appropriate organizational structure, local communities are capable of running multi-community water systems in an efficient and transparent way. The Administrative Board has even proved capable of organizing the system's extension to a nearby community with water supply problems.
- ✱ All projects—particularly ones of this size and scope—inevitably generate conflicts, resistance to change and a certain redefinition of power. Conflicts came up and had to be dealt with, demonstrating the importance of developing conflict resolution skills among the local inhabitants and the institutions accompanying them. Special attention should also be paid to anticipating and therefore avoiding possible problems.
- ✱ This system would not have been successfully installed and administered without community appropriation. Local people were involved in the assessment process and voted to accept the project, while their participation in the physical construction work and in the elections for the Administrative Board have also helped increase their appropriation of the system and contribute to its sustainability.
- ✱ By employing a participatory methodology, the ENACAL promoters were able to facilitate the process rather than imposing their ideas on the local communities, providing key information so that local inhabitants could take important decisions in an informed way.
- ✱ The “learning by doing” methodology allows local people to acquire the building and plumbing skills required to ensure the system's sustainability. This has helped the Administrative Board to deal successfully with all of the problems to emerge so far.



- ✦ The training provided by private companies should also help guarantee good maintenance practices and the system's technical sustainability. Linkage with these companies is important in terms of identifying future suppliers and technical assistance.
- ✦ Funding specific technicians and social promoters to concentrate on the project helped guarantee ongoing social and technical attention.
- ✦ Installing meters to measure each household's consumption and charge accordingly appears to have generated an element of self-control and made users more conscious of water use, as well as reducing disparities between rich and poor.

## Challenges ahead

- ✦ The main challenge is to continue guaranteeing the system's technical and financial sustainability, which implies the transparent handling of the savings accrued and ensuring that the users keep up to date with their payments.
- ✦ The organizational and technical methodology employed has proved to be appropriate and could be easily adapted to smaller communities, as an administration system run by a few well-trained, paid members could be a key to guaranteeing sustainability.
- ✦ More care needs to be taken to keep users informed of the system's development and how their payments are being used and invested. As well as being a basic right for all users, such information should generate confidence and commitment to the system, helping guarantee its sustainability and the users' right to water.
- ✦ Although the system is currently being run in an efficient and transparent way, the real challenge will be continuing the good work after 2006, when the current Administrative Board finishes its term and a new Board is elected. The National Operation and Maintenance Unit could play an important watchdog and auditing role in this respect in line with its responsibility for following up on finished ENACAL-DAR projects.
- ✦ The Administrative Board is still working to achieve legal status. This is important in terms of negotiating with and receiving funds from other organisations and opening a bank account in the Board's name.

- ❖ Although women have participated in the system by providing labour and through their posts in the community CAPS's, their increased participation as CAPS coordinators and on the Administrative Board remains a challenge in an area in which traditional gender roles are deeply ingrained.
- ❖ To keep water quality, as well as its continuity and quantity.

## Conclusions

The supply of clean, safe drinking water was a basic human right for the poor rural communities of Las Mangas, El Zapote, Sabana Larga, La Ceiba, Real de la Cruz, La Unión, Soledad de la Cruz and Santa Isabel, which were affected by arsenic poisoning and limited access to water. Despite its challenging scope, the drinking water system was successfully installed, is operating with relatively few problems under a dedicated and capable Administrative Board and there is every reason to believe that users will continue paying as long as they receive a reliable and quality service. There has also been a positive impact on the local health situation.

While the system should prove financially and technically sustainable, it is essential that the new Administrative Board elected in 2006 benefits from the experience of the current members and receives adequate training and supervision. The municipal National Maintenance and Operation Unit representative could provide permanent supervision in this respect and take responsibility for financially auditing the system. If the Board continues to operate with an efficient, transparent and accountable administration that keeps the users informed and involved, then the inhabitants of these eight rural communities should continue to benefit from a safe and reliable source of drinking water.



In Sabana Larga, system user José Benito Ruiz reflected that the hard work had all been worth it in the end. "Despite the poverty in this area, the illnesses caused by the water and the very difficult work," he said, "we've got water now and it feels like we never worked at all!"

# Text Box



## Text Box

### Tackling arsenic contamination in Nicaragua

Arsenic poisoning is a serious debilitating health problem, although it can take years for symptoms to show, including discoloured patches on the skin and a hardening of the skin into nodules. If contaminated water continues to be taken, internal organs such as the liver, kidney and lungs can be affected. Severe cases include cancer of the skin and internal organs and limbs affected by gangrene.

A study carried out in May 1996 diagnosed 71 inhabitants of the community of El Zapote with clinical manifestations of chronic arsenic intoxication. The people of El Zapote had been drinking water from a community well with 1,320 micrograms of arsenic per litre between 1994 and 1996.

Subsequent tests have shown that wells in five of the project's original seven communities had arsenic concentrations that exceeded the national safety level (10  $\mu$ /litre). The two communities with safe arsenic levels were Las Mangas and La Unión, which registered 1.2  $\mu$ /litre and 2.5  $\mu$ /litre respectively in the most recent UNICEF-financed tests. Those tests also showed three of the communities (El Zapote, Sabana Larga and La Ceiba) with concentrations exceeding even the US Environmental Protection Agency's 50  $\mu$ /litre safety level, as well



as dangerous levels in El Cacao (12.5  $\mu$ /litre), which has not yet been connected to the system.

| Community          | Arsenic concentration ( $\mu$ /litre) |
|--------------------|---------------------------------------|
|                    | UNICEF/PIDMA-UNI                      |
| Las Mangas         | 1.20                                  |
| El Zapote          | 69.30                                 |
| Sabana Larga       | 55.00                                 |
| La Ceiba           | 50.00                                 |
| Real de la Cruz    | 31.20                                 |
| Soledad de la Cruz | 11.70                                 |
| La Unión           | 2.50                                  |
| El Cacao           | 12.50                                 |

Source: *Memoria Técnica del proyecto de agua potable Las Mangas y seis comunidades anexas*

There has been no overall study of the effects of arsenic on the local population, but some idea of the impact was provided by a 2002 study of people who lived in the community of El Zapote between 1994 and 1996, when the community used the well with arsenic levels of 1,320  $\mu$ /litre. This study, funded by UNICEF as part of the project, also points out that the population previously used private artesian wells with levels of between 45 and 66  $\mu$ /litre. In other words, the inhabitants had been exposed to arsenic over a long period of time, which increases the risk of developing pathological illnesses .

1 The National Engineering University's Environmental Research and Teaching Programme

2 The National Engineering University's Environmental Research and Teaching Programme

The study highlighted the incidence of paresthesia (tingling, burning and numbness of the skin), stinging eyes, skin lesions and respiratory problems among those who consumed the highest levels of arsenic. Two patients also had a pathological enlargement of the spleen (splenomegaly) and hypertension of the portal vein. Although no cases of cancer of the skin or internal organs were detected, close monitoring is essential as such problems can remain latent for over 20 years. There is no known cure for arsenic intoxication; the most effective treatment is to stop the contamination, as the condition is reversible if treated early enough.

Rural communities with high levels of arsenic in their water have the same right as any other community to clean and safe water, regardless of the relative magnitude or cost of the solution. As well as resolving the problem, this project has also helped raise awareness of potential contamination in the country, where it is estimated that the water in 8% of wells could have dangerous levels of arsenic. Through related UNICEF-sponsored initiatives, ENACAL now has the capacity to test all new wells for arsenic and other dangerous minerals. As a result, no communities should ever be exposed to arsenic contaminated water in the future.

## Annex

### Illnesses reported by the Las Mangas and Soledad de la Cruz health posts

#### Acute diarrhoeic illnesses

| <b>Las Mangas</b> | <b>April</b> | <b>May</b> | <b>June</b> | <b>July</b> | <b>August</b> | <b>Total</b> |
|-------------------|--------------|------------|-------------|-------------|---------------|--------------|
| 2003              | 7            | 7          | 28          | 38          | 7             | 87           |
| 2004              | 11           | 10         | 26          | 9           | 14            | 70           |
| 2005              | 13           | 19         | 52          | 37          | 13            | 134          |

| <b>Soledad de la Cruz</b> | <b>April</b> | <b>May</b> | <b>June</b> | <b>July</b> | <b>August</b> | <b>Total</b> |
|---------------------------|--------------|------------|-------------|-------------|---------------|--------------|
| 2003                      | 9            | 19         | 23          | 22          | 15            | <b>88</b>    |
| 2004                      | 4            | 4          | 21          | 17          | 5             | <b>51</b>    |
| 2005                      | 4            | 5          | 31          | 19          | 5             | <b>64</b>    |

Source: San Isidro Health Centre

#### Acute respiratory infections

| <b>Las Mangas</b> | <b>April</b> | <b>May</b> | <b>June</b> | <b>July</b> | <b>August</b> | <b>Total</b> |
|-------------------|--------------|------------|-------------|-------------|---------------|--------------|
| 2003              | 123          | 91         | 116         | 132         | 231           | <b>693</b>   |
| 2004              | 90           | 86         | 118         | 72          | 127           | <b>493</b>   |
| 2005              | 76           | 62         | 108         | 93          | 174           | <b>513</b>   |

| <b>Soledad de la Cruz</b> | <b>April</b> | <b>May</b> | <b>June</b> | <b>July</b> | <b>August</b> | <b>Total</b> |
|---------------------------|--------------|------------|-------------|-------------|---------------|--------------|
| 2003                      | 100          | 86         | 127         | 115         | 149           | <b>577</b>   |
| 2004                      | 71           | 113        | 125         | 111         | 150           | <b>570</b>   |
| 2005                      | 65           | 64         | 143         | 60          | 89            | <b>421</b>   |

Source: San Isidro Health Centre



### Dengue and malaria

| <b>Las Mangas</b> | <b>2003</b> | <b>2004</b> | <b>2005</b> |
|-------------------|-------------|-------------|-------------|
| Dengue            | 1           | 3           | 4           |
| Malaria           | 0           | 0           | 1           |

| <b>Soledad de la Cruz</b> | <b>2003</b> | <b>2004</b> | <b>2005</b> |
|---------------------------|-------------|-------------|-------------|
| Dengue                    | 0           | 2           | 3           |
| Malaria                   | 0           | 2           | 16          |

Source: San Isidro Health Centre

