Water and Sanitation Program

An international partnership to help the poor gain sustained access to improved water supply and sanitation services

# Lower Costs with Higher Benefits

## Water and Sewerage Services for Low Income Households

Lessons from the EL ALTO - BOLIVIA / PILOT PROJECT

Vice Ministry of Basic Services

Swedish International Development Agency

FIELD NOTE

### El Alto - Bolivia Pilot Project


## Abstract

This Field Note reports lessons from a recently concluded pilot project in the city of El Alto, Bolivia. The project aimed to find innovative ways of reducing the cost of providing water and sewerage connections to poor households, while at the same time ensuring that they reap the full benefits of these services. The results are encouraging. First, costs of both water and sewerage connections were reduced by around 40%. This was achieved by adopting a 'condominial' network design (that connects groups of houses to the main supply rather than each individual home) and using volunteers from the community to carry out construction. Second, hygiene education resulted in an increase in the number of people installing bathrooms. The percentage of households who put in bathrooms (at 70%) was twice that among people who did not receive training (35%). Water consumption also rose among these households by 30%, compared to what they used prior to education. Micro-credits had a small effect in encouraging people to install bathrooms but did not succeed in reaching the poorest households and were thus eventually discontinued.

# Background

The provision of piped water and sewerage services to low income neighborhoods is a particularly challenging problem. On the one hand, the costs of such services are often prohibitively high for poor families.

On the other hand¾ even when networks can be extended¾ households do not necessarily take full advantage of these services. This can happen either because they fail to make a household connection or because they lack the necessary know-how and/or facilities to improve their hygiene practices once they have made a connection.

In July 1997, the Government of Bolivia granted a 30 year concession contract for the provision of water and sewerage services to La Paz and El Alto, adjacent cities with a combined population of 1.6 million people. The concession contract was awarded to Aguas del Illimani, a consortium led by Lyonnaise des Eaux. A major objective of the concession contract was to improve access to water and sewerage services in El Alto. The ambitious expansion targets for the first four years of the concession in El Alto included reaching 100% water coverage and making 38,000 new sewerage connections.

However, the very high levels of poverty in El Alto raised concerns about whether people would be able to afford the new water and sewerage services. About 60% of the population of that city lives below the poverty line, and about 40% below the extreme poverty line. The average monthly household income is US$122 (equivalent to US$0.80 per capita per day), compared with connection costs of US$229 for a conventional water connection and US$276 for a conventional sewerage connection.

This prompted a search for ways to reduce the cost of services to these low income households, and as a result the El Alto Pilot Project came into being. The project was conceived as a joint venture between the Government of Bolivia, the private concessionaire, the Andean Region of the Water and Sanitation Program, and the Swedish International Development Agency. The role of the Water and Sanitation Program was to facilitate the transfer of know-how about low cost water and sewerage systems from neighboring Brazil to Bolivia.

Since it began in 1998, the El Alto Pilot Project has provided water connections to 1,977 households in eight neighborhoods of El Alto, and sewerage connections to 4,050 households in nine neighborhoods of El Alto. The project combined a number of innovative components designed to reduce the costs and maximize the benefits of water and sewerage connections to poor households. The main results will be summarized here, but greater details can be found in the associated Discussion Paper (Foster, 2001).

# Reducing the Cost of Water and Sewerage

In order to improve the affordability of water and sewerage connections to poor households, the El Alto Pilot Project made use of cost-reducing 'condominial' network designs developed in Brazil, and enlisted community participation in the construction of the networks. This approach succeeded in reducing connection costs by around 40%.

## Condominial design

Condominial network designs for water and sewerage services were pioneered in Brazil during the 1980s (Watson, 1995; Bakalian *et al.*, 1994). They involve routing water and sewerage networks across pavements and yards instead of down the middle of streets (see diagram). What effectively happens is that instead of giving each *individual house* a connection to the trunk line, each *block of houses* has a single connection to the trunk line (as if the block were an apartment building that has been laid on its side).

For a number of reasons, this approach substantially reduces the cost of network expansion.

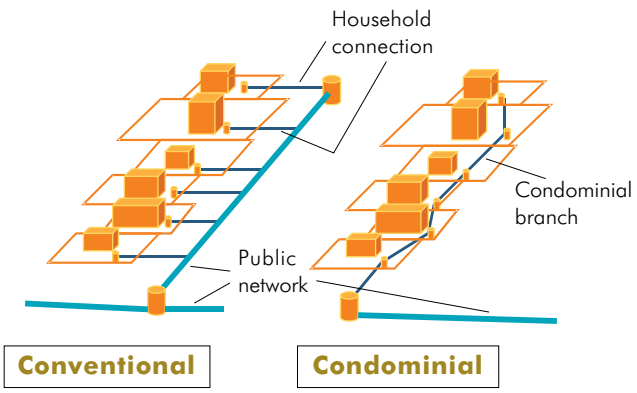
First, less pipeline is needed to serve a given number of houses because it is no longer necessary to run a pipe from the middle of the street into each dwelling.

Second, the design requires a narrower diameter pipeline.

Third, pipes can be buried at a shallower depth because there is no need to protect them from the weight of passing vehicles.

In the El Alto Pilot Project, the use of condominial designs led to 10-20% savings in the length and diameter of pipes for water and sewerage. Savings in the volume of soil excavation as a result of shallower trenches were around 45% for water and 75% for sewerage. These physical savings translate into overall financial savings of the order of 24% for the sewerage service and 40% for the water service. This is consistent with recent experience from Brasilia which suggests savings of 20% when condominial designs are used for sewerage systems (Neder, 2001).

**Conventional system and condominial system**



## Community participation

Community participation brings a number of advantages including greater acceptance of the infrastructure, an entry point for educational activities and the possibility of reducing costs since the condominial branches of the network are built by community labor. In El Alto, community participation reduced the network expansion costs by a further 26% for the sewerage service and 10% for the water service, bringing the overall cost reduction of condominial design plus community participation to 50% for both services.

However, these figures do no take into account the additional costs of social intermediation associated with community participation. The El Alto Pilot Project recruited a team of social workers to engage with the community. The social workers explained the project to the community, helped them to organize themselves into condominial units, trained them in the necessary construction techniques and supervised the construction process. Organization and training entailed three days of community workshops, and were followed up by a further six hours of personal visits to each participating household. In addition, each household contributed about one man-week of time in constructing the network and attending the associated workshops.

The total cost of this social intermediation to the utility came to US$8 per household per service; while the household's time can be valued at around US$20. When these costs are added to the network expansion costs, the overall cost saving achieved falls from 50% to around 40% for both the water and sewerage services.

Furthermore, there is some evidence to suggest that community participation, by building acceptance, serves to increase the proportion of households that connect to the sewerage network. The average connection rate was 75% in the various neighborhoods covered by the project, and 66% in a similar neighborhood that was not covered by the project. The scarcity of information on non-project neighborhoods means that this finding should be treated with some caution. Nevertheless, if this effect is taken into account, the cost savings available from condominial sewerage with community participation rise from around 40% to 45%.

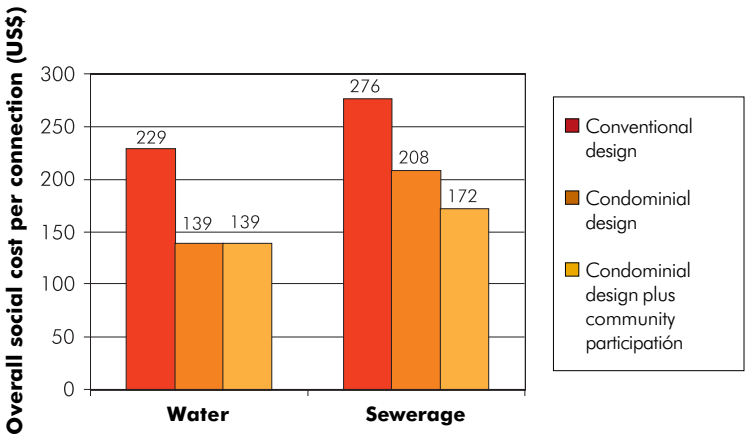
In the case of the water service, the cost savings achieved through community participation are about the same as the costs of organizing the community, so that there are no net cost savings associated with community involvement. In the case of sewerage, however, the cost savings from community participation are more than twice as high as the costs of organizing such participation.

Hence, community participation significantly reduces costs (see figure).

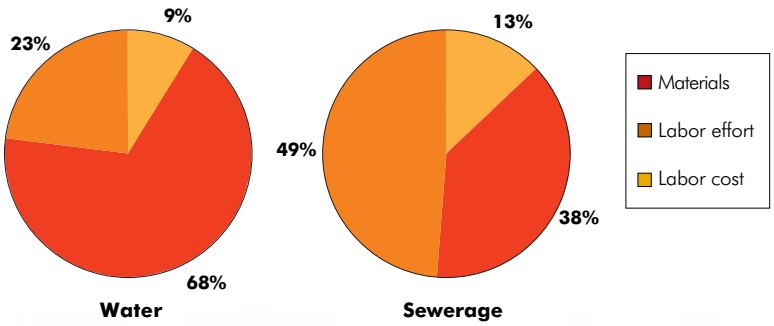
The two pie charts break down the savings in network expansion costs for water and sewerage services into three different sources: savings on building materials; savings in terms of effort needed (as a result of reducing volumes of soil excavation) and labor cost savings (as a result of using community labor). The first two sources of savings (colored in different shades of brown) essentially result from the use of the condominial design. The third source (colored in orange) is attributable to community participation. The pie charts illustrate that in the case of water three-quarters of the savings are achieved from the condominial design alone. In the case of sewerage, half are achieved as a result of the condominial design, and half as a result of community participation.

Although these represent substantial savings, connection costs of US$139 for water and US$172 for sewerage remain high in relation to average monthly household income of US$122. In the case of El Alto, the water company allows households to pay back connection costs gradually over a two-year period at an interest rate of 1.02% per month.

## How big are the cost savings?




## Where do the cost savings come from?



# Reaping the Benefits of Water and Sewerage

Connecting a dwelling to water and sewerage networks is in itself no guarantee that the residents will actually reap the full benefits of these services. This will only happen if the household makes complementary investments in sanitary installations (such as toilet, sink, shower), and household members learn to change their hygiene practices. These changes can be both costly and difficult for the families in cultural terms.

In the case of El Alto, households who built their own bathrooms spent on average about US$400 on materials and gave 16 days of their own labor. It is important to note that these costs are substantial compared with the costs of connecting to the water and sewerage networks, which come to a combined total of US$311. They are also very high in relation to the average monthly household income in El Alto which stands at US$122.

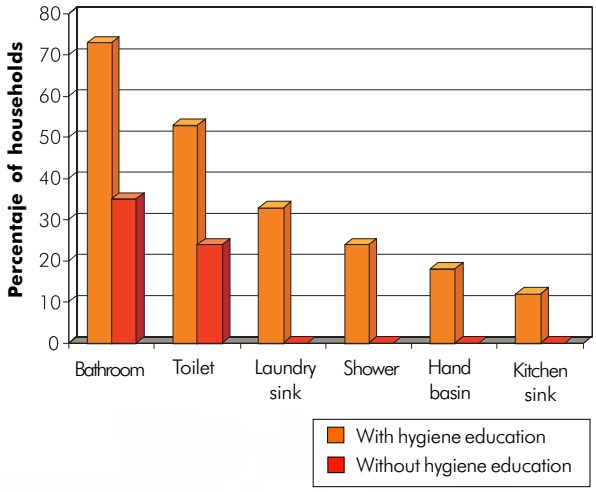
The adjustment to modern hygiene practices also proved to be particularly difficult for households in El Alto because of a variety of cultural and geographical factors. The city has been created largely as a result of recent rural-urban migration, and consequently people have had limited exposure to modern sanitation practices. Furthermore, due to the high altitude of the city (4,100 meters above sea level) overnight temperatures throughout the year drop to freezing. This means that people are unwilling to shower without hot water, which can be prohibitively expensive.

In the El Alto Pilot Project, these problems were addressed by providing hygiene education and a micro-credit line to assist households in spreading the costs of bathroom construction.

## Hygiene education

The hygiene education component was intended to provide both technical and (equally important) moral support for households to adopt modern hygiene practices, in particular by helping them to construct their own bathrooms and associated facilities. The component comprised two half-day workshops, followed up by about four hours of personal visits to each participating household. The social intermediation activity cost US$13 per household.

### What is the impact of hygiene education?




Hygiene education had a substantial impact on investment in sanitary installations. Seventy percent of households that received hygiene education construct a bathroom in their homes, compared with 35% among those that did not receive education. Furthermore, the only sanitary installation found in houses that did not receive hygiene education was a toilet, whereas two-thirds of households receiving hygiene education installed a shower and/or a sink, in addition to a toilet (see figure).

These investments had a significant effect on water consumption. Households with bathrooms increased their water consumption by 30% relative to those without. In absolute terms this represents a consumption increase of only 1.6 cubic meters per month¾ from 5.4 to 7.0 cubic meters¾ due to extremely low baseline levels of water consumption in El Alto. This increase in water consumption can be directly linked to hygiene practices. For example, households with showers and laundry facilities are estimated to devote on average one cubic meter per month to each of these purposes.

Furthermore, households receiving hygiene education were also found to significantly reduce insanitary practices (Canelli, 2001). The percentage of households throwing out used water into the streets fell from 77% before the project to 58% thereafter, while those recycling water within the home fell from 36% to 25%. Although these benefits are hard to quantify in monetary terms, they are nonetheless important from a health and environmental perspective.

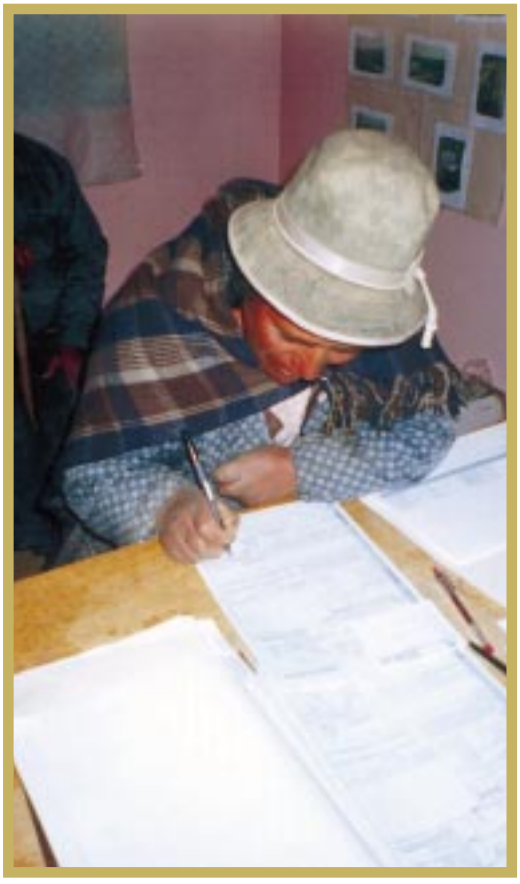
## Micro-credit line

The purpose of the micro-credit line was to help households finance the US$400 worth of materials required to construct a fully-equipped bathroom. A total of US$500,000 of capital was secured for this purpose from a local second-tier bank (FUNDAPRO), and the retailing of the loans was contracted to Caja Los Andes; a local micro-credit institution with a well-established reputation in El Alto. The social workers involved in the El Alto Pilot Project provided households with general information about the micro-credit line, while Caja Los Andes representatives visited the project sites once a week to process applications.

About a quarter of households applied for credit, and three-quarters of these had their applications approved. The average value of credits was US$406, with a 32-month term. At an interest rate of 1.92% per month, this represents a monthly repayment of US$14.21 or about 6.2% of the income of participating households. However, households applying for credit tended to have incomes that were substantially higher than the average for El Alto.

The level of interest in the micro-credit line was lower than anticipated, so that little more than 20% of the original capital of US$500,000 was ultimately placed. There are a number of possible explanations for this, such as: the availability of alternative traditional forms of finance like revolving funds (in local parlance, 'pasanaco'); the unwillingness of households to get into debt for investments that do not yield a direct financial return; the delegation of the marketing activities to a team of social workers rather than to financial sector specialists; and the wider economic downturn in Bolivia that happened to coincide with the timing of the project.

While the provision of credit undoubtedly eased the payment of the costs for beneficiary households, there is no evidence to suggest that bathroom construction rates were significantly higher in neighborhoods where micro-credit had been offered. The micro-credit line was therefore dropped at an early stage of the project.



## Conclusions

The innovations adopted in the El Alto Pilot Project made it possible to reduce the costs of water and sewerage connections by 40%. In the case of the water service, these savings came entirely from the adoption of a condominial network design. In the case of the sewerage service, about half of these savings are attributable to a condominial design, and the other half to the use of community volunteer labor to build the networks.

Furthermore, a higher percentage of households connected to newly installed sewerage networks at project sites (75%) compared with a control neighborhood (66%).

Households receiving hygiene education were twice as likely to install a bathroom in their homes as those that did not; a proportion of 70% as opposed to 35%. Moreover, they increased their water consumption by 30% for hygiene related activities. However, the micro-credit facility¾ although used by about 20% of households¾ did not appear to make a significant impact on the percentage of households constructing bathrooms. Moreover, it appears to have been taken up primarily by the better-off.

The results of the pilot project undoubtedly reflect the specific circumstances of El Alto, and would not necessarily be exactly replicated elsewhere. Nonetheless, in broader terms, the experience demonstrates that with a combination of technological innovation and human capacity building it is possible to make piped water and sewerage services both more affordable and more beneficial to poor households.

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