Huambo (Angola): Water supply in a war torn town: Evolution and impact of the different interventions since 1985

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Background

The conflict in Angola is one of the longest of this century. It began in the seventies and went through different phases, with drastic changes throughout the years, from open war to guerrilla like periods. At the end of 1975, following the Alvor agreements, a transitional government was set up, including the former occupying power, Portugal, and the different liberation movements FNLA (*Frente National de Liberaçao de Angola*), MPLA (*Movimiento popular de Liberaçao de Angola*), UNITA (*Union National de Independencia total de Angola*). Despite the agreement, the hostilities previously directed against a common adversary moved to a war for the control of the power between the different liberation movements. Gradually the role of one of the movement decreased FLNA and the conflict ended up to a confrontation between the Government (MPLA) and UNITA, with the support of different foreign armies.

Traditional relief activities were carried out since then in areas under control of each side. As during the colonial ruling time most of the major towns of the country and especially those of the Planalto, Huambo and Kuito, were under control of the Government, with UNITA controlling the land all around. Displaced people started to gather in town, seeking protection and assistance, but only in 1979 was the ICRC able to establish a sub-delegation in Huambo.

In 1984 the needs of the conflict intensity increased drastically and a major relief operation was launched to care for the needs of hundreds of thousands of displaced people arriving in the major towns of the Planalto and in most of the major municipalities still accessible by plane. All the roads were under control of UNITA and could not be used because of mines problems. The humanitarian agencies had to adapt to these changes and went through long negotiations with the different parties to obtain access to the affected areas, mainly the major towns, where many displaced people were gathering to seek protection and assistance. With the exception of the capital, where only sporadic tensions took place, all these towns experienced months of blockades, with military pressure varying from intensive shelling to long periods of calm, during which life was almost close to normality.

In May 1991, after 16 years of bloody conflict, the Angolan government and UNITA concluded a peace agreement. With "peace" returning to Angola, one of the ICRC's most extensive and longest relief operations of the last 13 years came to an end[3]. By the end of the year the ICRC had already cut back its infrastructure and most of the staff in Huambo and closed down its sub-delegation in Kuito. An emergency operation had to be launched to enable about 180,000 families to survive the interim period and efforts were concentrated on the part of the Planalto which still required assistance, prior to the deployment of other organisations. The United Nations agencies and other NGOs started to move in progressively and ICRC maintained only its traditional activities.

The social and economic situation was gradually improving and general elections could be organised at the end of September 1992. But trouble started almost immediately after the publication of the results and the situation deteriorated. Fighting broke out in Luanda at the end of October with thousands of people being killed. The unrest soon spread to all other provinces. At the end of 1992, every effort done to bring UNITA and the Government back to the negotiation table failed and because of the general increase of the insecurity all the foreign aid agencies had to withdraw. Owing to the intense and widespread fighting at the beginning of 1993 the ICRC was unable to carry out its humanitarian work and was obliged to evacuate its expatriate staff from its offices in Huambo and Kuito, withdrawing from the Planalto for the first time since the start of its operations in 1979. UNITA took the full control of Huambo and most of the cities of the Planalto.

At the beginning of June of the same year, the ICRC was finally able to re-establish its presence in Huambo, where the fighting had led to large-scale destruction, a lack of medical care and shortages of essential goods. Despite intensive diplomatic efforts to bring about a cease-fire, the armed conflict intensified in August with the government exerting growing pressure on UNITA, taking control of Huambo on 9 November and recapturing all the other provincial capitals.

The signing on 20 November 1994 of the Lusaka Peace agreement between the Angolan government and UNITA paved the way for a slow move toward normality, bringing to an official end two decades of conflict[4]. During

[1] International Committee of the Red Cross
[2] Development Workshop

[3] ICRC Annual Report 1991

1995, people were again able to move relatively freely around the country and domestic trade was gently picking up. Security improved and UN staff and other humanitarian agencies were able to return and operate more safely in many areas and to begin the rehabilitation of a country ravaged by over 30 years of almost continuous warfare. By the end of the year over 6,000 peacekeeping forces and military observers from UNAVEM III had been deployed in Angola, as stipulated in the Lusaka peace protocol.

As the situation stabilised, during 1996 and 1997, the general living conditions of the civilian population improved but remained precarious as trade was less substantial than anticipated, since the free movement of goods and people was not yet fully restored. The programmes launched in 1995 were extended and gradually handed over to the relevant provincial authorities or to other agencies that were ready to continue them. The series of delays in the implementation of the peace protocol and in view of UNITA's unwillingness to conform to the letter of the provisions of the agreement resulted in the threat of the UN Security council to take sanction against the movement, which finally came into force on 29 of October 1997, owing to the negligible progress made by UNITA.

The insecurity prevailing in the Benguela, Huila, Huambo, Malange and Uige areas spread progressively in the latter half of 1998 and the situation further deteriorated in early December, with the resumption of open hostilities between the government and UNITA troops in the Planalto area. At the beginning of 1999, the war appeared to be generalised over the country with varying degrees of intensity. Large population displacements were again observed, people having fled the rural areas to reach Huambo, Kuito and Caala, with IDP (Internally Displaced People) camps being set up within these cities, an unusual situation in Angola.

The evolution of the conflict and the implications for the programmes carried out to address the water supply problems in Huambo

The situation of the water supply of the town has evolved with the conflict. Before the war and during the initial phases of the conflict a classical system of production and distribution to almost 50,000 customers was working, totally dependent on the possibility to obtain power from the Cuando hydropower station, owned by the CFB (Camino Feral de Benguela), with whom the Water utility (*Empresa de Agua*) had specific agreements, based on an exchange of water for power. The situation deteriorated when the Cuando hydropower station became gradually threatened and had to finally cease its operation, putting the distribution of water to a standstill. The Kulimahala water treatment station stopped its operations at the end of 1992. The station was further damaged during the war of 1993/1994.

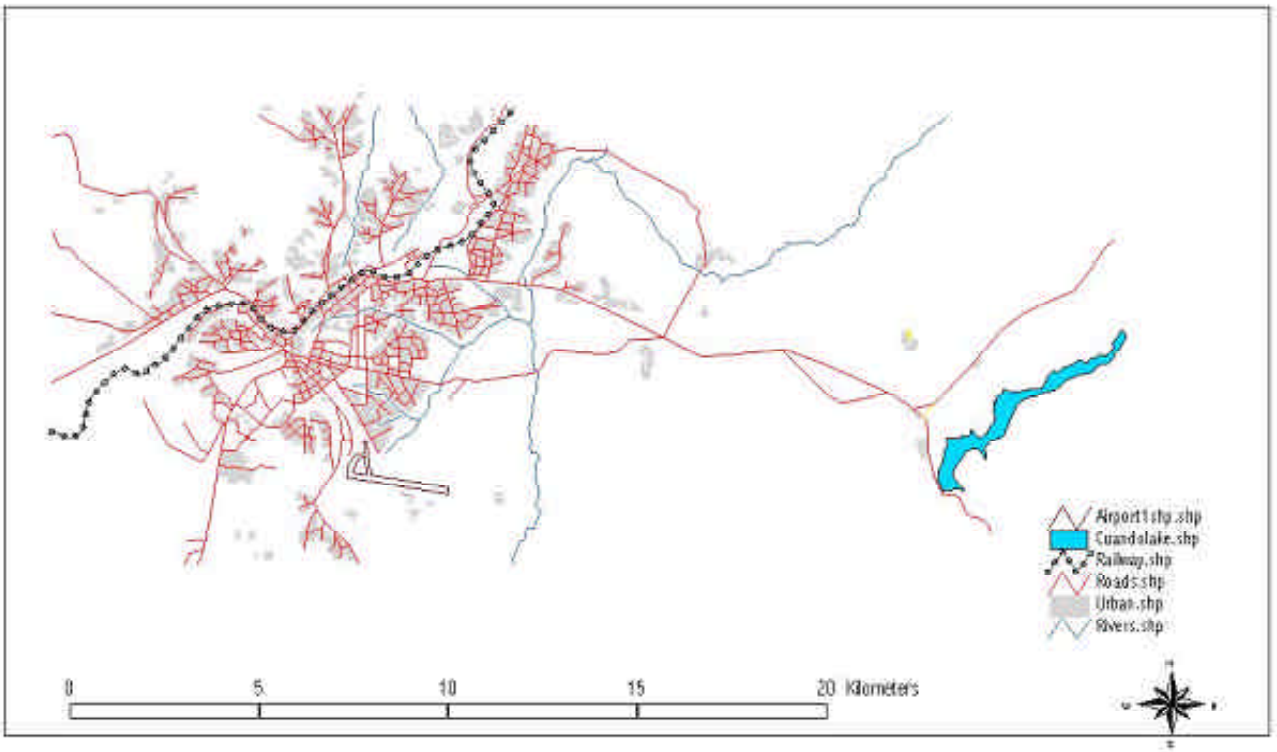


Figure 1
General map of the town of Huambo and the Cuando lake

[4] ICRC Annual Report 1995

The period considered in this report covers the water and sanitation activities of the ICRC in the town of Huambo from 1984 until the end of 1999, but also describes those of other organisations as they were gradually involved since the signature of the Lusaka peace agreements in November 1994. The major project for the town of Caala will be described in an other report[5]. Table I gives the types of problems the ICRC and other organisations had to address and the specific activities carried out during this period. Whenever possible the links with the situation of the conflict are also given, even only succinctly, together with the list of constraints present at each time.

We can describe several phases:

The initial phase, lasting from 1984 until the end of 1991 characterised by the control of the cities and the municipalities by the governmental forces, within a **security** perimetre. All the territory around this perimetre is controlled by UNITA. The main activities are in support of the medical and nutritional programmes, with hand-dug wells located in nutritional centres, communal kitchens, health posts, etc, also supplied with tankers. Only in a few situations, the general population is assisted with programmes aimed to improve its access to water. Springs were protected to address the needs for water in the health posts, or any other medical structure, but the people were taking advantage from the continuous flow of water. This was also the case when water was obtained from wells, when the "medical" needs were covered. During this phase some water was still produced and distributed to the inhabitants of the town, even if the coverage was limited and depending from the power supply, already poor at the beginning of 1985 and becoming very erratic from year to year, when it stopped completely, when the town was taken by UNITA in 1993. At the end of 1991, after the Bicesse peace agreements, some improvements of the situation could be noticed and the accessibility of Huambo by road was becoming a reality. The ICRC began to hand-over its programmes to other organisations, as its mandate was obsolete. During this period no attempts were made to address the problem of the water treatment station, as the main concern of the water sector unit was to support classical emergency health activities.

The main reasons are historical and can be easily understood: the water section within ICRC was created in 1983 as being part of the medical division, later named health division, and its main goal was to provide water to all the health facilities, from hospitals, health posts, orthopedic centres, etc. and its approach to the general water supply not yet developed and particularly difficult to implement in a context where all the logistics had to be secured with the use of planes, with the priorities given to pure medical material and food. For **institutional** reasons but also for lack of experience and credibility within the institution the impact of the assistance in the water sector was quite limited.

A second phase, when the town was taken by UNITA and kept under its control from the beginning of 1993 until the end of 1994, when the governmental troops took control of almost the whole country. The ICRC resumed its presence in Huambo in mid-1993 with new objectives, extended from the support of health facilities to a more general support of the needs for water of the whole population, in agreement with the new water utility, a remnant of the former ones, poorly staffed and with almost no resources. The old part of the Kulimahala water treatment station was partially rehabilitated to produce roughly 250m3/day of potable water to be distributed by tankers and preparations to launch a larger well digging programme were made.

A third phase, starting with the control of the city by the governmental army at the end of 1994, all the expatriates where evacuated from Huambo for about a month. The objectives defined during the second phase could be implemented by mid-1995 after a period of reorganisation. From 1995 to the end of 1997, impressive work has been carried out with important improvements of the Kulimahala water treatment plant, a larger well programme and the extension of such approaches to Caala, Bailundo, Ganda and other municipalities. During that period the Water Utility (*Direçao provincial de Agua*) began to be functional and the activities were carried out with their involvement. Several projects were run as "delegated projects" by a national Red Cross society, as a new approach to involve such institutions in situations where the security was improving and to improve the transition from emergency to development-like programmes, thus allowing a smoother hand-over of the programmes. By the beginning of 1997 the whole well's programme in Huambo was handed over to Development Workshop, a Canadian non-governmental organisation, with financing from the Swiss Development Cooperation Fund, more prone to manage such programmes. The "urban" projects of Caala, Bailundo, etc. were put under the responsibility of the Water utility (*Empresa de Agua*).

The **present phase (4th phase**) is characterised by a renewed military pressure of UNITA on several towns, almost back to a situation similar to that described under phase one, with a much wider security perimetre around the towns and the municipalities. Logistics is difficult and has to be carried out by air, the security is volatile and the presence of a huge number of displaced is putting a further burden on the utilities. The presence on NGOs and UN agencies is however better established and the programmes of all the humanitarian agencies are also better coordinated and implemented.. The major efforts have been directed to address the needs of these displaced, particularly in Huambo, Caala and

[5] Water supply for the town of Caala (Angola)

Table I
Chronology of the activities carried out to address water needs in the town of Huambo since 1985

Period	Town's political and military control	Activities	Constraints	Remarks
End 1984	First survey	--	Security perimeter Logistic	
1985	Government	Hand-dug wells for feeding centres and support to the expatriates	Security perimeter Logistic (planes and materials) Institutional	Water activities to support medical activities
1987-1991	Government	Creation of a water point (well or protected spring) per area and in the municipalities	Security perimeter Logistic (planes and materials,, many municipalities targeted) Institutional	Water activities to support medical activities
1991 -1992	Government Peace agreement (Bicesse)	Hand-over tentative to other organisations	No more security Perimeter Institutional	ICRC activities focused on emergencies and not development-like ones
1993	UNITA	Expatriate staff Evacuated	Security and re-negotiations	
Mid-1993	UNITA	Return of the ICRC in Huambo		
1994	UNITA	Re-assessment Water distribution by tankers Hand-dug wells Water supply for	Re-negotiation of the cooperation with the water authorities	Water and sanitation for the general population as well
Lusaka Peace Agreement Nov. -Dec. 1994	Government	Evacuation of ICRC staff	Re-starting of the activities	Extension of the goal of the sector
1995	Government	Hand-dug well programme Kulihamala water treatment plant Caala water supply Boreholes for the hospital	Logistic (extension to Huambo province)	Extension to other towns and project proposals for Kuito, Ganda and Bailundo (delegated projects)
1996-1997	Government	Extension of well project in Huambo and hand-over to Development Workshop Completed rehabilitation of Kulimahala WTS	Difficult involvement of the authorities Security improves	Hand–over policy as "peace" is generalized
1999 -	Government	Water supply for displaced people in towns Assistance to authorities for Improvement of the Water treatment station	Security perimeter around towns as in former years Logistics	Other organisations well established. Coordination problems

in Kuito. A series of boreholes have been drilled and a better management of the water points has been set up. The implications of the authorities is also more important and the latter are now in quite a better position to subcontract projects to local (from Luanda) private companies, using funds made available by different donors, assisted in the management by the NGOs present in Huambo since late 1997.

The initial phase (from 1984 to 1992)

After a general survey carried during 1984 the activities started in Huambo in 1985 with the construction of several wells to supply with water the nutritional centres, the orthopedic facilities and last but not least the houses of the expatriates, poorly or not at all supplied by the precarious water distribution network. Hand-dug wells were sunk using basic techniques, owing to the lack of material and the logistical difficulties. As is the case in the initial phase of such programmes the output was quite poor, with only a dozen of wells being built and protected during the first years. Some of these wells were just dug and not lined, with only the top being fitted with an apron and a wall. Only a few were equipped with hand-pumps. Where power was available submersible pumps were installed. Activities were not limited to the town of Huambo but to the whole Planalto, including other areas like Ganda and Kubal. A total of about 70 wells and 26 springs were protected. In Huambo, wells were dug at the nutritional centres of Camussamba, Sao Pedro, Macolocolo and at the Abrigo (orthopedic centre). The two springs of Fatima and of Ciudade Baixa were protected and washing facilities were also built. During 1992 the search for a suitable institution or NGO being in a position to maintain or to develop these activities proved to be unsuccessful, despite the existence of a quite well trained team equipped with digging material.

The second phase (1993 - 1994)

The ICRC re-established a regular presence in the Planalto only at the end of 1993, when a general survey was conducted. The approach of the ICRC to cope with the needs of the displaced people and of the affected inhabitants of the town changed quite substantially during this period, when the town was under UNITA control. 18 kitchen and 2 feeding centres were operational by March 1994 and more were due to be opened, coping with the needs of about 10,000 vulnerable people scattered around the town and roughly 2,500 in the nutritional centres. Most of the kitchens could rely on existing hand-dug wells, even if poorly protected, and the feeding centres on the wells dug during the previous period and from water delivered to collapsible storage

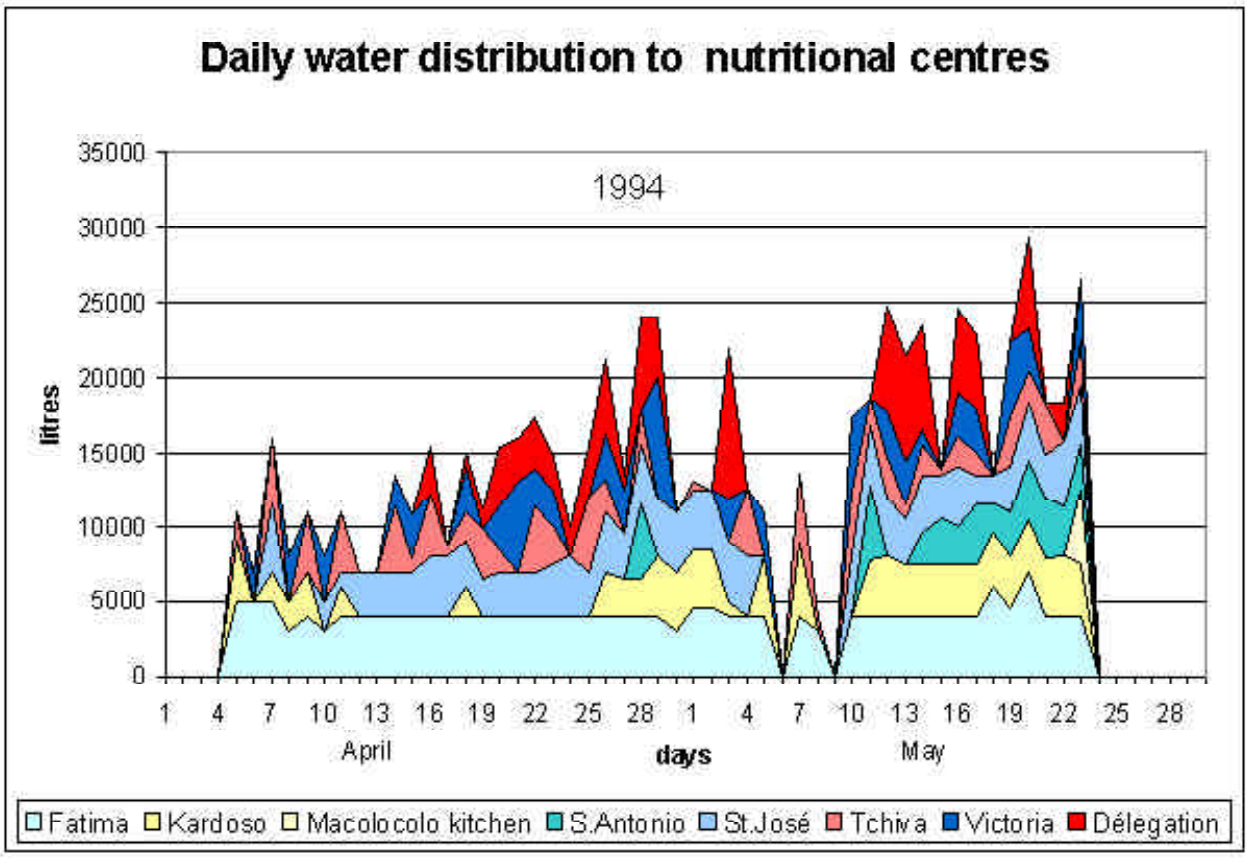


Figure 2
Daily water distribution to nutritional centres

tanks using a water-trailer. As the programme was expanding it was necessary to improve the pumping and the filling station, located at the old Kulimahala water treatment plant, where water was obtained directly from the river. After chlorination the water was distributed to the feeding centres by tankers. The next figure shows the quantities supplied daily to the centres and to the kitchen without a regular water supply.

A detailed assessment carried out jointly with OXFAM, showed that the town water treatment plant was technically repairable but only if a stable political situation would commence and last. Some treatment steps of the old station had to be improved and the new one, in operational conditions but in need of a limited amount of spare parts, could have been easily put into operation, if power could be made available from the Cuando hydropower station, located at about 15 km from the town. Valuable information on the water distribution network was obtained from the newly formed Water Department. Attempts to improve the Water board premises were also taken, in order to begin to strengthens its future operational capacity.

The joint assessment also looked at the future drilling programmes to be done in Huambo, following the encouraging results in Kuito, where the light drilling rig was successfully used to drill 9 boreholes at strategic locations. Some thirty initial sites were selected but the activities were finally started with a new drilling rig, brought in Huambo at the end of June. 8 boreholes were drilled but only about 5 were successfully developed and equipped. By the end of 1994 the town was again under the control of the governmental forces and a new approach had to be defined. Most of the equipment was looted or destroyed.

The third phase (1995 - 1997)

A new strategy was adopted as it was considered that quite a stable period would take place. Also the situation had changed quite dramatically. Most of the displaced people had returned to their villages (municipios). Almost all the communal kitchens were also gradually closed, as a result of the improvement of the nutritional situation, thanks to the ICRC food distributions and to the agricultural programmes carried out in 1994.

The Kulimahala water treatment plants and the CFB water treatment station

The initial pumping station, presently named “Central Velha” was built around 1950 by the Portuguese, close to the Kulimahala river, near Bomba Alta, in the western area of the town. The total raw water pumping capacity of 100m3/h, was increased to 500m3/h by 1960 but, as the intake was not sufficient to cope with the demand, the station started to take the water directly from the river. The raw water pumping capacity was then increased to 900m3/h with the river flow able to supply. Only during the drought of 1979 did the river prove to be insufficient. The construction of a new station (Nova Station) began in 1971/1972. It was damaged in 1983, when a pump was destroyed, but was finally completely renovated in 1991. By 1992 two new pumps were installed, one with a capacity of 500m3/h and another of 360m3/h, and were operated regularly throughout 1993, delivering a mean amount of about 600m3/day. As a result of the last confrontation most of the equipment of the old station were vandalised or looted but those of the Nova station remained almost intact, with the exception of the electrical control panel.

The CFB station (*Camino Ferral de Benguela*), was working until January 1993 when it stopped. Both stations were able to pump water to the Cuca water tower (and Tchiva), to supply the industrial area and the domestic users of the “bairro” of Tchiva through a 150mm line and to the town, supplying the Rua do Comercio water tower, via a 350mm pipe, from where the water was distributed to the users and to a small industrial area. Another line, of 300mm diametre was supplying the booster station at San José from where the main city storage reservoir, located within the Water board premises, was supplied. The main problem to run the water distribution was the lack of power, and any attempt to run the system without a reliable source of power would lead to poor results. Much of the equipment would require large

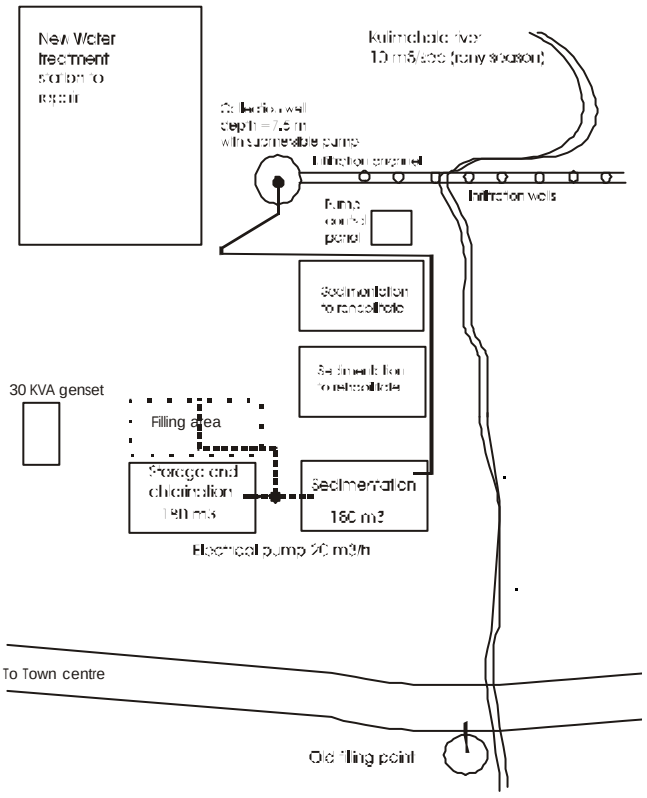


Figure 3
Schematic layout of the temporary Kulimahala WTP

amounts of spare parts and maintenance and the state of the network would have to be considered too and would probably need total reconstruction in many sections.

Temporary rehabilitation of the old station (Velha)

Even if it was quite clear that the communal kitchens and the CRN would be gradually closed down during the year, owing to the gradual improvement of the situation, their immediate needs for water had to be covered. At the beginning of the year it was decided to improve the quality of the water distributed by tankers by shifting the direct intake point at the river to an improved one based at the old station, taking advantage of a possible rehabilitation of the treatment process.

The collection channel and the collection well at the river were cleaned and repaired. A new submersible pump was installed in the collection well. After addition of aluminium sulphate the water was allowed to settle in a sedimentation tank. The overlying clear water was then pumped into a storage tank and chlorinated. The same pump was used to supply the filling line. A 30KVA power generator was installed to run the system. This makeshift treatment system was operational by January 1995 and began to supply the water tankers of a few organisations as well of several private water vendors later in the year. The system was fully managed by the ICRC, which supplied diesel to operate the generator, the chemicals and paid the salary of the two operators, as most of the water was used for its operations (hospital) and to supply the expatriate residences, with running costs being close to 450-500 USD/month. In the beginning months of 1995, MSF (*Médecins sans Frontières*) also used this water to supply its residences and various health and nutrition centres supported by them.

In late June 1995, UNAVEM (United Nations Angola Verification Mission) arrived in Huambo and from that time most of the water produced at the station was used to supply their tankers. By the end of the year a mean amount of 1,000m3 per week was distributed, with UNAVEM using about 60%. Other users, including NGOs, religious and governmental institutions, as well as private companies were using the water, including the FAA (*Fuerças Armadas de Angola*). The respective consumptions are given in the figure below.

As the ICRC would not pursue its activities in 1997, negotiations were initiated in late September with "*Empresa de Agua*" the local water company, for a hand-over of the management of this plant. The hand-over took place on 20 October 1996 but problems arose almost immediately with some confusion as to who would be responsible for supplying diesel, wages for the operators and chemicals. The management of the plant became quite difficult with distributions exceeding the treatment capacity, resulting in poor quality of the water produced. An agreement was finally obtained between the main users and the government but its long-term role to supply treated water until a better solution was found, remained unclear.

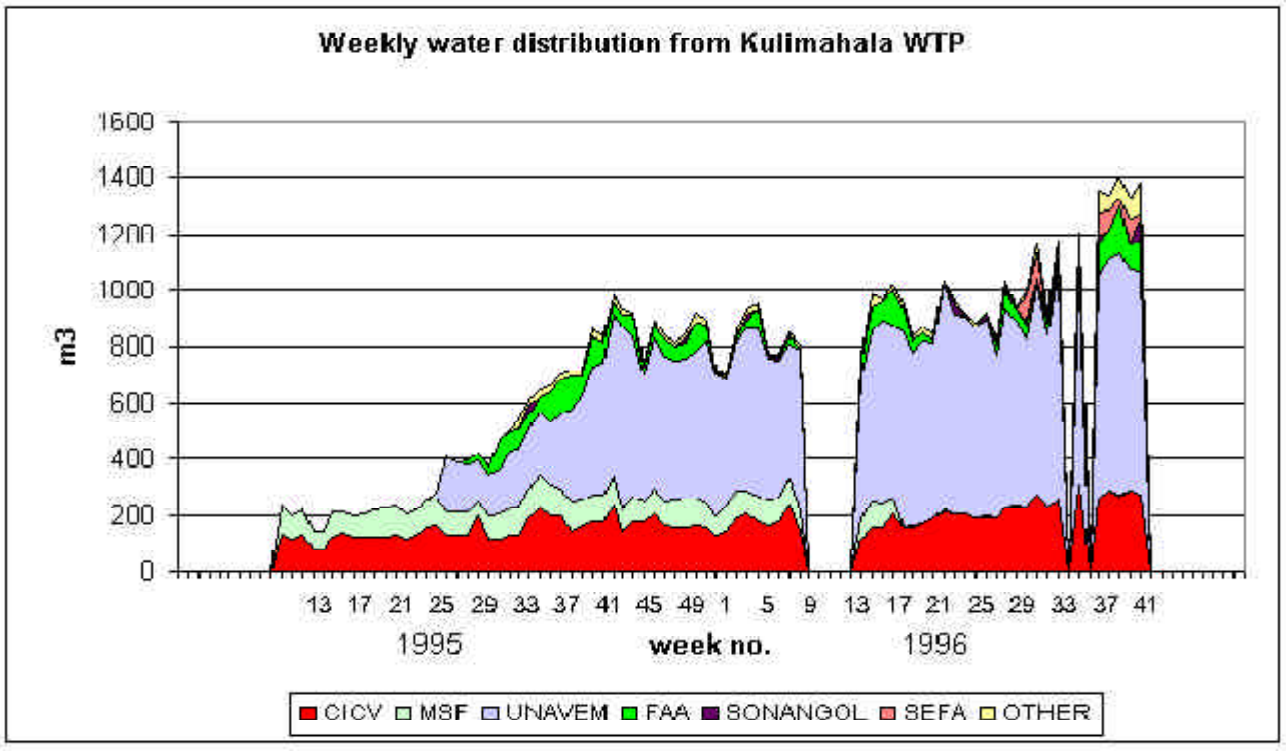


Figure 4
Weekly water distribution from Kulimahala WTP

New shallow wells programme

A new water and sanitation programme was launched in July 1995 to provide most of the health posts with a protected and permanent water supply. After a survey carried out to define the needs of the town's inhabitants it was found that a large number of people living in the "bairros" lacked a safe water source. A programme was therefore designed to address the needs of the people living too far from a safe and reliable water source, by rehabilitating old colonial public wells and by digging new wells. At the same time, due to the poor permeability of the soil, and in order to increase the recharge rate of most of the wells, the diametre of the reinforced culverts was increased from 1.2 to 1.50 metres. The storage capacity of each well was almost doubled and the deepening procedure was also made easier, as more space was given to the teams in charge to install the inner permeable rings used to re-line the well at the end of the dry season. But the usual constraints remained: access to the coast and essential material such as cement, steel, etc. was only possible using air transport.

Material and equipment problems at the beginning of the programme

Owing to the increased consumption of materials to cast the rings used to built the plain lined column of concrete rings and the porous ones inserted for the deepening procedure it was necessary to install and repair an old rock-crusher, as appropriate aggregates could not be sourced in sufficient quantities. A ring moulding factory was set up and several gangs were formed and trained first in the rehabilitation of the existing wells. Only when all the necessary equipment and materials were made available the construction of new wells began. A target of about 40 wells with at least 2/3 of them being rehabilitated wells, was set for the end of 1995.

The same programme was pursued during 1997 and the outcome improved. A total of 80 water points (72 wells and 8 springs) were built since the beginning of the programme, July 1995. Most of the wells were equipped with hand-pumps (SWN 80 type). By the end of 1996, when it was clear that ICRC would reduce its activities by the beginning of the following year, the project was handed over to the authorities in charge (Provincial Water Company). Training and spare parts were provided to ensure a proper continuation of the maintenance.

Hand-over of the programme to DEVELOPMENT WORKSHOP (Canadian NGO)

Learning from previous poorly successful hand-overs the ICRC contacted several NGOs during the last months of 1996. The aim was to find a suitable partner capable to continue the project in and around Huambo, to strengthen and manage it in a way to make it relatively sustainable. A Luanda-based Canadian NGO known for its long experience in the urban context of Luanda in the field of water supply and management was finally chosen. Material, equipment and staff support were provided and a 2 year urban water and sanitation programme, designed jointly with their engineers and the water authorities in Huambo. The overall project was funded by Swiss Aid (*Aide Humanitaire Suisse*) and by CIDA (Canadian International aid Agency). 4 vehicles and equipment worth around 55,000 USD were made available to allow a smooth continuation of this work, aimed to further improve the environmental health condition of the urban and peri-urban population of the town.

Development workshop programme (1997 - 2000)

During the hand-over process the whole approach had to be changed. Despite the impressive outcomes of the ICRC programme several problems had to be faced, as the situation moved from a strictly emergency one to a more developmental one, with a need to launch a more sustainable approach. The main problem to tackle was to develop a community based responsibility and management of the water points. During the ICRC involvement all the wells and the springs built or repaired were done on a free of charge basis. The materials and the manpower costs were covered by the institution budget. The introduction of a community based participation proved quite difficult at the beginning as communities did not understand why they had to contribute not only with their labour in the construction of the wells but also financially, at least to support a normal maintenance of the premises - modify some of the technical approaches to guarantee a permanent and reliable source of water.

A survey carried out at the beginning of the involvement of DEVELOPMENT WORKSHOP (DW), showed that out of 72 wells and 7 springs, 46 were considered to be working well, but that some were not deep enough and also used by too large a number of families. This problem was not really unknown by the ICRC engineers and the technique developed was in principle allowing the further deepening of the new wells which needed it, operation which would gradually be done during the dry season, as has always been the case in the Planalto. But the density of such water points was not sufficient.

If in the 1997/1998 period the intervention was concluded in a period of relative peace, in March 1999 the country was plunged again into war, with the city being under siege again, with a huge number of IDPs seeking refuge in town. The next figure gives the estimated number of IDPs arriving in Huambo and in two other cities.

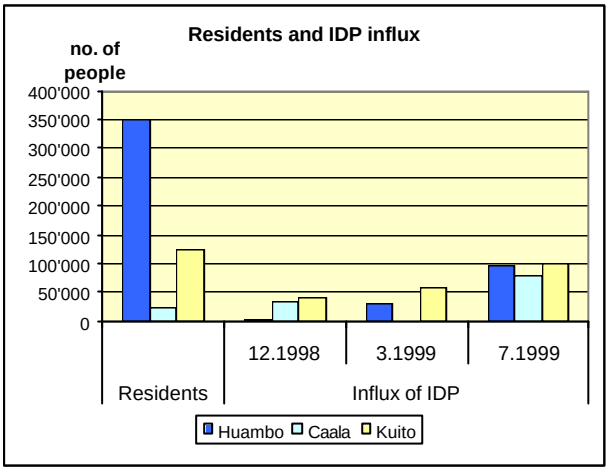


Figure 5
Number of IDPs seeking security in several towns of the Planalto

In April 1999 the projects objectives changed slightly and were designed to respond mainly to the need of the **displaced people** and to support the activities of other organisations in the field of water and sanitation, owing to the experience gained during the first two years of the project. In the two and a half years project DEVELOPMENT WORKSHOP made an impressive work. A total of 230 wells were built during this period, benefitting an estimated 160,000 people[6,7]. Technical support and materials were also provided for the construction of 64 latrines. A database was also set up and updated on a monthly basis. Previous data from ICRC wells and data of their programmes were stored using a GIS (Geographical Information System) software, allowing easier consultation and better monitoring of the evolution of the different parametres.

Figures 6 and 7 on the following page give the number of wells achieved during the ICRC programme, at the beginning of 1997, when the programme was handed over to DEVELOPMENT WORKSHOP together with those completed by the same agency within the time frame of their project, up to mid-2000. A total of 275 water points have been included in the database and are regularly monitored.

GIS database and thematic maps

GIS software have been used to manage the information of the whole project. They allow to monitor the evolution of the number of water points, their characteristics (type of water point, equipment, depth, depth of the water, number of people supplied, etc.). In this report MAPINFO data from DEVELOPMENT WORKSHOP have been translated in ARCVIEW (ESRI). New shapefiles, digitised from the geo-referenced topographic maps have been added to simplify the reporting and to produce the thematic maps shown below. Urbanised areas, roads, and rivers have been added, shown in the figure on the next page (figure 8).

In the figure the type and the equipment of the water points are shown. As far as access is concerned, of a total of 275 wells166 are communal ones, 80 are institutional wells (schools, health posts, etc.) and 24 private ones. 5 of them have no definite attribution. The majority of the communal (114) wells were managed by a water committee and continuous efforts were made by the social mobilisation teams of DW to increase this proportion. Most of the water points are shallow wells (239), 21 are protected springs and 15 are boreholes. After an initial attempt by the ICRC to drill boreholes by the end of 1995, using a technique aimed to speed up the water points coverage, a second attempt was initiated by OXFAM in 1999, mainly to cope with the needs of displaced people. A total of 26 boreholes were drilled but only half of them are reported in the DW database. A total of 53 wells are still equipped with the SWN 80 series (Van Rekkum) hand-pump used by the ICRC in their programme, installed between 1995 and 1996. DW decided to move to a more VLOM (Village level operation and maintenance) pump and installed AFRIDEV up to a total of 123 wells. Only about 10 INDIA MK II are reported to be equipping some wells, as part of a consignment supplied by UNICEF which was left in the EPASH stores and partially looted by the end of 1994, when the government again took control of the town and UN ITA had to leave.

[6] Emergency Water and Sanitation Project, Final Report, April 1999 to March 2000. Development Worshop, March 2000
[7] Huambo Water and Sanitation Project Reports, 1997 - 1998 and 1998 - 1999. Development Workshop, March 2000

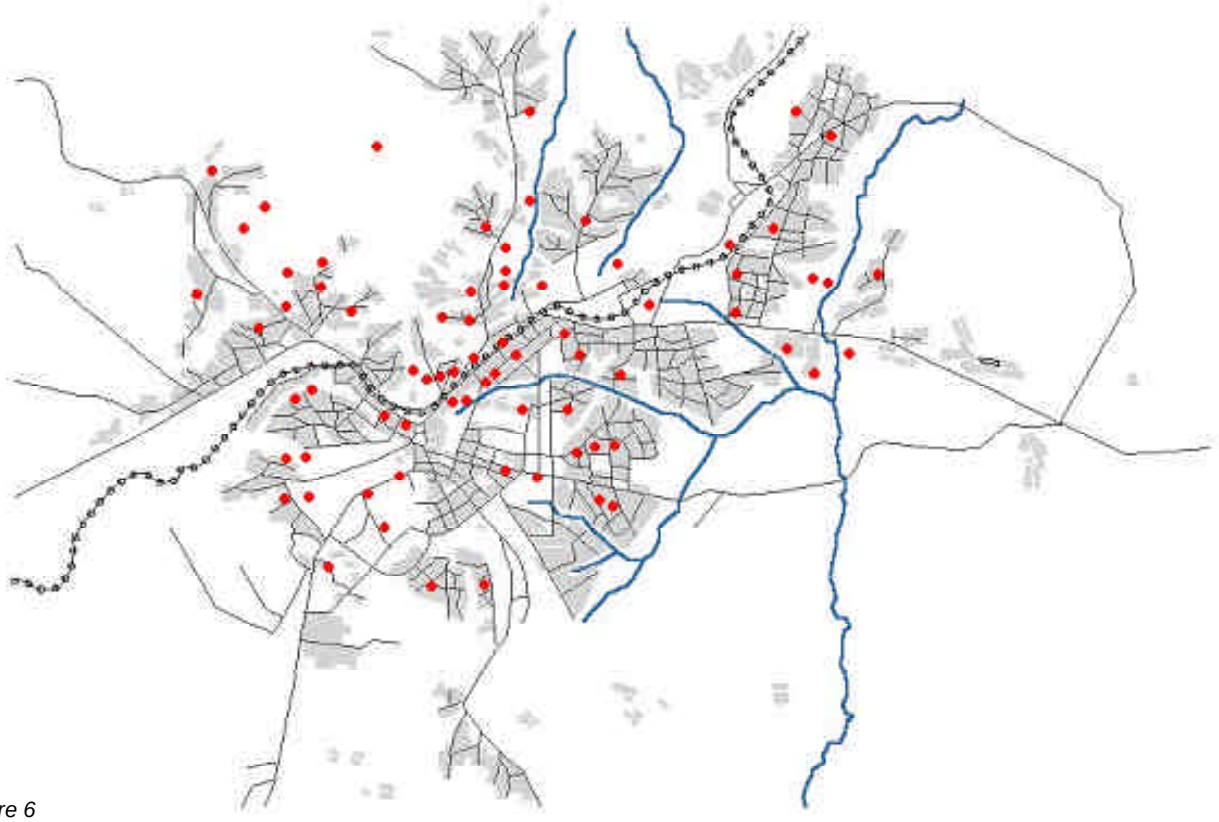
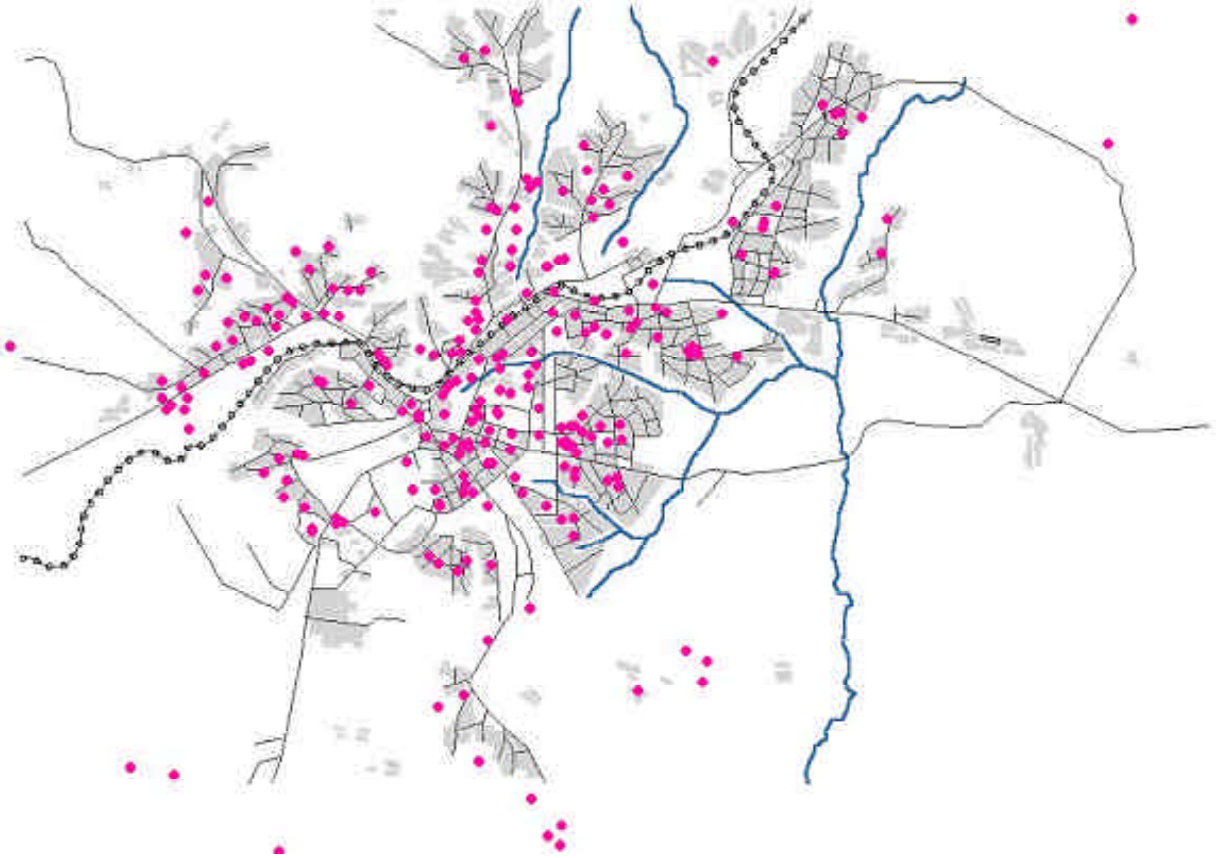


Figure 6
Huambo (Angola) ICRC protected wells and springs as handed over to Development Workshop at the end of 1996, after a two-year programme. The location is tentative. No database was yet available for GIS software.

Figure 7
DEVELOPMENT WORKSHOP protected wells at the end of 1999. Exact location. Database completed.



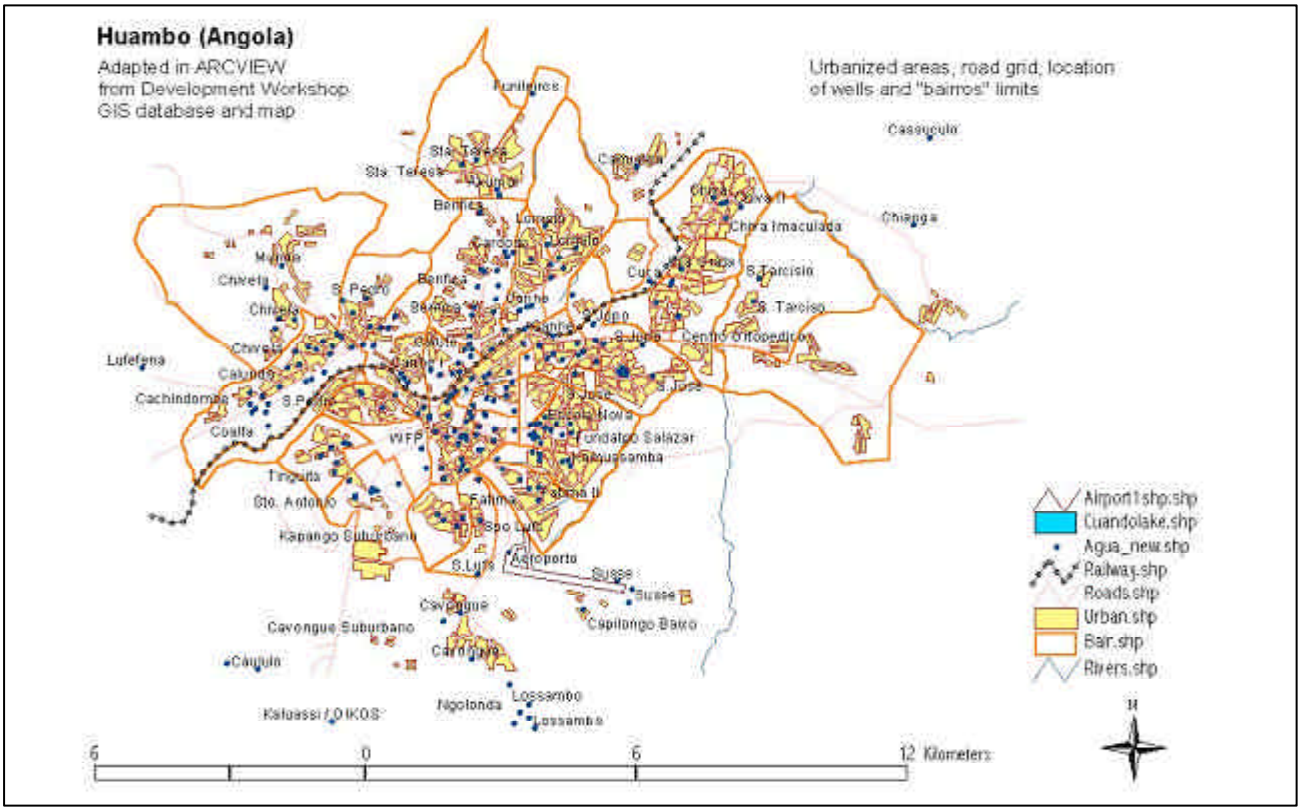


Fig
Urbanised areas, road grid, location of wells and limits of the “barrios”

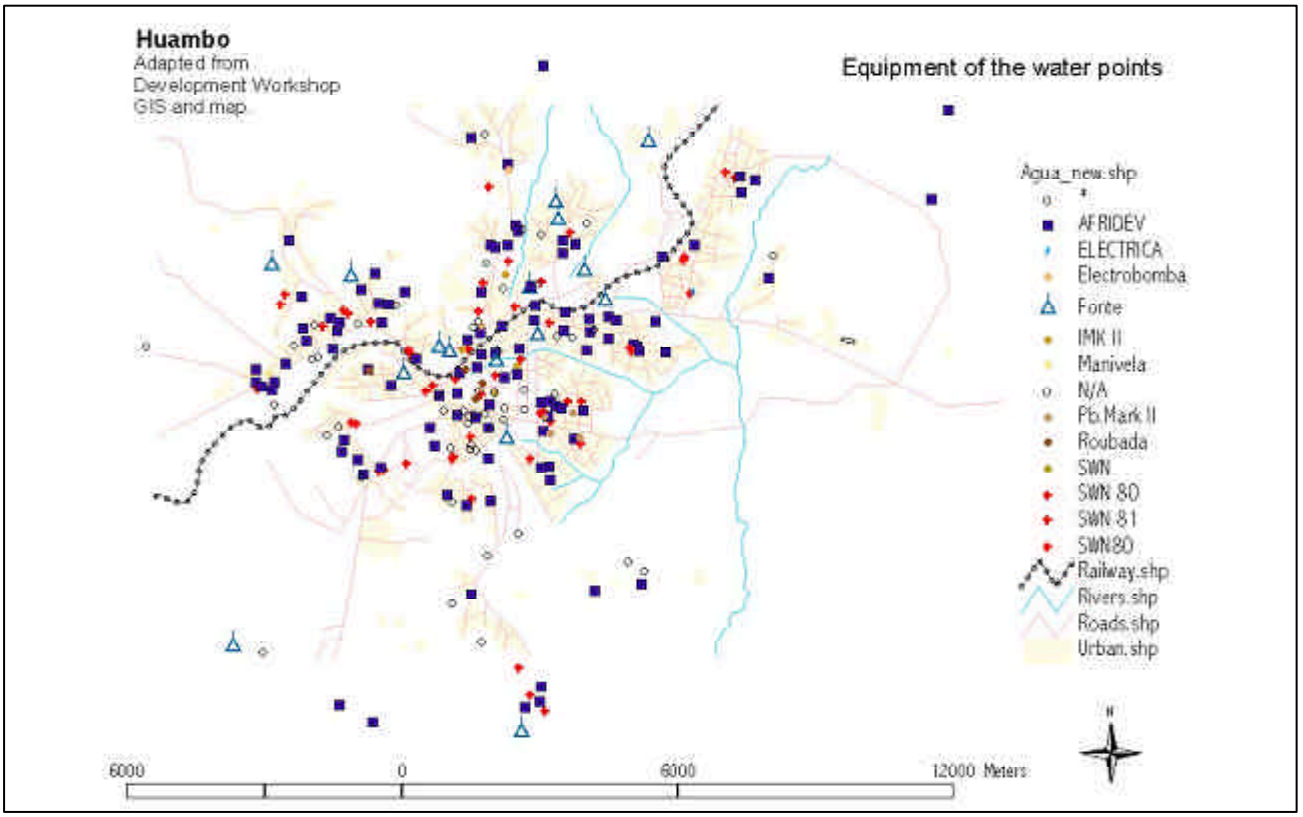


Figure 9
Type of equipment of the wells

Coverage

When the hand-over took place it was found that most of the wells were used by far more than 125 families, that means one well for every 500 to 600 people, depending on the mean number of a family. There was an obvious need to increase the density of the water points to allow for better coverage, and to decrease the collection time. In the next figure the number of wells which were used at the end of 1999 by less than 125 families is shown (yellow dots), together with the density of water point/km2 and the urbanised areas (red surfaces). At the end of 1999, according to the database about 236 wells met this target, with only about 20 being overused. It is estimated that a total of 156,000 people were benefiting from this programme, even if it not known how this figure has been obtained. Unfortunately, data about the population density were not yet known otherwise it would have been easy to compute a relative density of water points per inhabitants and plan for future interventions.

The present phase (2000 - 2001)

Previous attempts to resume the network distribution

If the well programme was able to cover the needs for the city during the unstable periods it became evident that the city would not remain with the wells as unique water supply for its inhabitants. As the main problem to restart the new water treatment station was the lack of power, a survey was carried out to assess the feasibility of the resumption of the production of electricity from the Cuando hydropower station mid-1994, during the period of UNITA's ruling, when the station was again accessible.

The power station is supplied by the Cuando dam, located at about 13km from the Kulimahala WTP (see map). The dam was considered in good condition and only a few repairs on the sluice gates were necessary

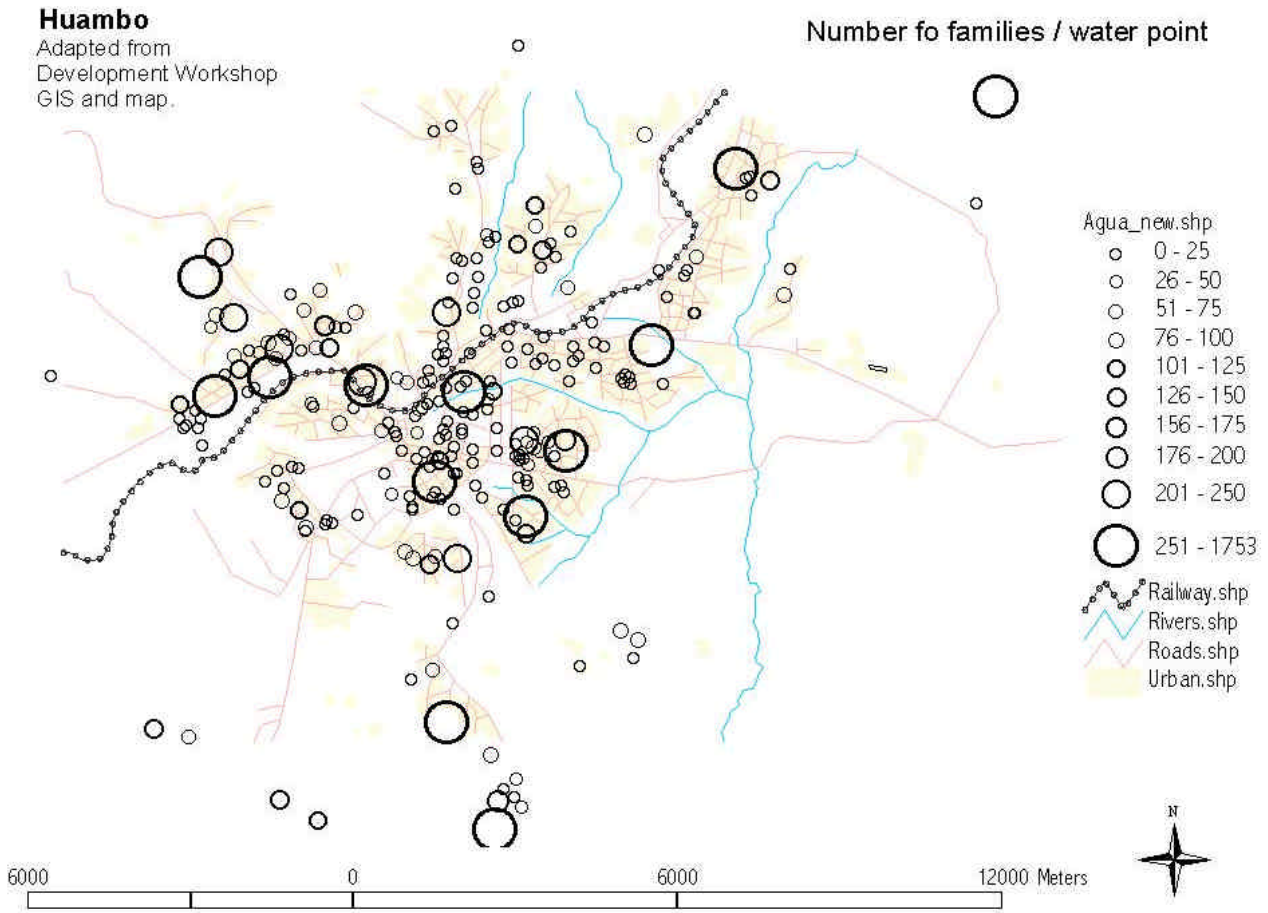


Figure 10
Number of wells used by less than 125 families

to bring it on-line. The hydro-electrical station, built by the British in 1937, had an initial capacity of 1.1kW produced by 4 turbines. The installation was done by General Electric and some repairs were carried out in 1983/1984 by the same company. During the survey two turbines (500kW and 200kW) were found in working conditions, one (200kW) requiring some repairs and the fourth (200kW) was under service. With some optimism it was then estimated that it would take roughly a month of work to re-commission the whole plant, provided that ICRC would supply about 5,000 litres of insulating oil for the step-up transformer (from 550kV to 22.5kV of the high tension line) and lubricant for the turbines. As the station was repeatedly targeted and as nobody knew how the situation would evolve, the request was considered with some reluctance, even if everybody believed that this would be the only solution to restore a regular water supply to the town. The events at the end of 1994 proved that the project was premature.

The recent rehabilitation

The water treatment plant was re-commissioned in 1997. The repair work was carried out by EPASH. (*Empresa de Agua. e Saneamento do Huambo*). The main problem was power. The station was tested and found in working condition but due to lack of power, not able to pump any water into the two main delivery lines supplying the town as well the one supplying the water tower located in Cuca. The main pipeline, of 350mm of diametre, delivers water to the R.do Comercio booster station, to the water tower (250m3) and fills up the 1,900m3 storage reservoir. The other pipeline, starting from Central Velha, but interconnected with the new station, supplies the St. José booster station from whom the water is pumped to the main city underground reservoir and water tower (*Estacao de Alta*), located within the Agua e Saneamento premises. A smaller diametre line, of 150mm, supplies the water tower located in Cuca (brewery), from where it supplies the industrial area but also the domestic users of Tchiva. The pumping station and water system located in R. do Comercio was attacked and damaged in 1983 and was never repaired. It was included in the second phase of the rehabilitation project of Tecnico Electrico. At the St. José booster station two out of three pumps were operational, but again, not functional due to the lack of power. The city's main storage system, located at Agua e Saneamento was considered to be in working condition, but in a precarious state. The different distribution lines and the network was considered to be in great disrepair and would need to be rehabilitated and probably completely reconstructed in many sections. A total of 50,000 private connections were active in the town. The figure of the next page gives a schematic view of the system and the approximate location of the main stations.

Rehabilitation of the station

Due to lack of power and diesel to operate the existing stand-by generators in town almost no water distribution had been functional since November 1998 and only the section of the Central Velha, rehabilitated by the ICRC in 1995 was still in operation. The town resident had access to limited quantities of water through the wells and springs managed by the DW programme. The IDPs were concentrated at the boundaries of the town, at Coalfa and at the CFB site. The majority, located at Coalfa, were receiving a mean amount of 20,000 litres/day, supplied by water tankers, managed by SHA (Swiss Humanitarian Aid), but were also using the nearby existing wells. It was clear these quantities were not sufficient to cope with their needs, estimated to be as high as 500,000 litres/day, and that a solution would have to be found.

A first proposal was made by DEVELOPMENT WORKSHOP at the end of May 1999. The idea behind it was to solve in priority the problem of the displaced people, but also to ensure a regular and permanent supply for the town. As a first step, power to the Water Treatment Station of Kurimahala would be secured with the installation of a transformer to step down the nearby 22.5KV line, then the electrical control panels repaired and the line supplying Sao Pedro from R.do Comercio would have to be rehabilitated. By mid-1999, when the influx of the displaced people in Huambo was at its highest, and to prevent the possible disastrous effects of the onset of the wet season, when outbreaks of water-washed diseases would appear, an evaluation study was also made by the ICRC. The aim was to re-assess the water supply situation of the displaced people but also that of the resident population. The conclusions were similar to those outlined by DEVELOPMENT WORKSHOP and EPASH.

An action plan was prepared to resume the water distribution for the whole town, thus allowing Empresa do Agua to extend the distribution up to the IDP camps, pumped from the Rua do Comercio water storage, booster and elevated tank system. Following a technical review meeting, the following conclusions were reached:

- restablish the production at Central Nova and Velha (nominal capacity 20,000,000 litres/day) by connecting the power line reaching CFB from the hydroelectric plant of Cuando with the installation of a transformer
- re-commission the R. do Comercio booster station and rehabilitate the supply line to S.Pedro and Coalfa to supply the main IDP camps
- re-commission the pumping and booster station at St. José and Estacao de Alta (*Agua e saneamento*)
- bring the "zona industrial" pumping station on line
- rehabilitate the main distribution network which will show important leaks at different location

Figure 11
Schematic layout of the pumping distribution system

It was recognised that almost all the necessary equipment was available within EPASH, CFB and the Ministry of Energy, and that DEVELOPMENT WORKSHOP would assist the governmental bodies with their technical and logistical know-how. On the other hand, ICRC was asked to assist EPASH in the rehabilitation of both the water treatment stations located at Kurimahala.

Implementation of the project

An agreement was signed at the end of 1999 between the different partners. They included the Provincial Government, who also contributed financially, DEVELOPMENT WORKSHOP who was in charge of the coordination of the whole project, EPASH was the implementation partner of DW, mainly on the field of water, CFB, owner of the hydroelectric power plant at Cuando, involved in a bilateral agreement with EPASH, ENE (*Empresa National de Electricidade*), implementation partner for all the electrical interventions and USAID, main donor for the entire project, estimated to be close to 400,000 USD.
ICRC was not formally part of this agreement. Its involvement was limited to the rehabilitation of the water treatment station, namely in the following tasks:

- desilting of the different abstraction systems supplying raw water to the new station
- replacement of one 37kW electrical motor of the three 500m3/h low lift pumps
- installation of one air compressor unit to carry out the backwash of the filters
- supply and installation of several dosing pumps for the chemicals
- supply of chemicals (Aluminium sulphate, calcium hydroxide and calcium hypochlorite) to cover 3 months of production, from October to December
- replacement of a 230kW electrical motor for the high lift pumps

By the end of the year 2000, most of the work outlined in the agreement was completed. Several transformers were installed to supply the stations and all the high tension lines were installed to power the different pumping station within the town. When power was available from Cuando, not yet fully rehabilitated, or from the town, a mean quantity of 14,000m3/day of potable water was pumped into the distribution network, reaching about 70% of the nominal capacity of the Kurimahala station. As foreseen, it became clear, by the beginning of 2001, that the distribution network would have to be rehabilitated and a specific evaluation focusing to that particular point was under way.

Impact on health

Properly protected and managed shallow wells are in principle not contaminated by pathogens responsible for water related diseases. To test their wells the presence of more than 10 thermo-tolerant bacteria was used as an indicator for faecal contamination, as it is almost impossible to reach a zero value, owing to possible preferential infiltration routes during the recharge process. Bacteriological tests carried out regularly by DEVELOPMENT WORKSHOP teams showed that most of the wells were free of thermo-tolerant bacteria contamination. On average 78% of the wells tested were free of faecal coliforms throughout the year (4 campaigns) with only a slight increase after the onset of the rainy season.

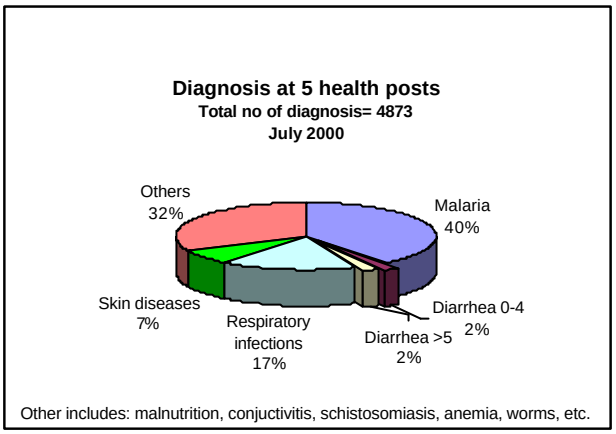


Figure 12
Diagnosis at five health posts

This is confirmed by the low proportion of diarrhoeal diseases observed at the health posts. Data from 5 health posts supported by the ICRC showed that in July 2000 the proportion of the attendance for diarrhoeal diseases in children under 4 years of age was low, less than 3%, at it is shown in the next figure, with malaria and respiratory infection respectively up to 40% and 17% of all the diagnosis. This proportion is almost the same in January, when a slight increase of the “contaminated” wells has been observed.

Discussion

The evolution of the water supply situation of the city has changed drastically during the last 15 years. From a quite normal supply on the onset of the war it went down to a complete stop during the direct confrontation for the control of the city. Obviously the operation of the station depended mainly from the possibility to supply it with power and on the pressure UNITA was able to put on the governmental perimetre around the town. Adding to the lack of power the damages inflicted to the different installations by both the belligerents made the resumption of the water distribution quite problematic.

Impact of the initial activities

Between 1985 and 1994, the impact of the ICRC activities was quite limited. This reflected the role of its water and sanitation section within the institution, mainly devoted to the support of classical health programmes, providing water to health post, hospitals, feeding centres and prisons. The approach chosen by the ICRC in 1995, to address the needs of the town's population, was triggered by the precarious situation of the water distribution within the town, but also by the more large role the section was able to play within the institution, acknowledged by the recent previous successful programmes carried out during the Gulf war and in other contexts (Rwanda, Liberia), where its role was to address the needs of the whole population of the affected towns, thus reflecting a more "public health" approach and not just a classical "medical one". When one of the main problems is malnutrition it proved quite difficult to convince the hierarchy of the institution that access to clean water was as important in the prevention of malnutrition than just food, and that cement, pipes, irons bars, pumps were part of the items to be transported by plane. Strict medical supply do not really compete with the logistics as their cargo requirements are modest.

This was also possible thanks to the experience gained during the previous years, when about 70 wells and springs could be protected throughout the Planalto. During that period the methodology could be improved and a better understanding of the constraints allowed to launch in 1995 a more ambitious programme. Other rather "unknown" crucial steps were important: for instance the repair and the installation of a rock-crusher, allowing to produce aggregates to cope with the larger quantities needed for a more important programme, involving more sustainable technical options, like complete lining of the wells with concrete rings and larger diameters to increase the amounts of water to be used daily by the people.

Hand-over

The hand-over with DEVELOPMENT WORKSHOP in 1997 allowed this agency, more specialised in development-like projects to boost the outcome and to set up a well-managed programme with a strong involvement of the users of the water. The set-up of the users committees was proved to be quite difficult at the beginning due to the purely assistance approach used by the ICRC, where almost everything was provided to the users to sunk and equip the wells. The transition to a more participating one, where the community was asked to contribute to well-digging and maintenance was difficult and long. At the same time some of the wells were considered as private and the set-up of a user's committee difficult to establish. The participation was also weaker in the more "urban" areas and collection of fees more problematic during the rainy season, where water was easier to fetch, even if of doubtful quality.

The aim to reach, at the end, a partial cost-recovery for the maintenance and for the management of every water point was also explored. The onset of the war in 1999 resulted in a drastic increase of market prices and in a loss of strength of the local currency against the dollar, shown in the next figure, with a further consequent burden put into the already poor economic status of the families, leading to a poor collection rate of the contributions. One of the strengths of the programme was its social mobilisation component. The creation of high number of functional water committees (179 over 181 functional in March 2000) was essential in the maintenance of the different premises, but also to create a ground for a network of community based organisations which would serve as a departure point for community development initiatives.

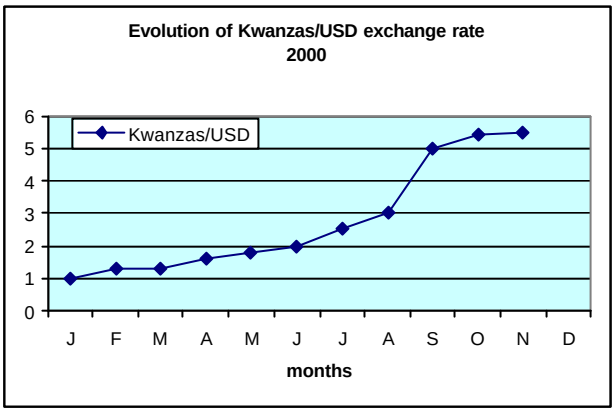


Figure 13
Evolution of the Kwanza/USD exchange rate

Transition to a centralised distribution system

If the shallow wells approach was appropriate during the difficult years, allowing to cope with the needs of the inhabitants as well of those of the displaced people, it was evident that the town's central distribution network had to be resumed. The re-commissioning of the Central Nova end of 1997 was an important step but power remained a problem, as diesel could not be secured in sufficient quantities to run the 4.2MW city's generator, to whom the station was connected. Distribution of water was occasional since February 1999.

In early 1999 a first proposal was made to tackle the rehabilitation of the Cuando hydropower station and an agreement was reached between the different partners with funds secured by USAID. Activities to repair the slight problems of the water treatment stations were carried out during the year 2000 but also on the power lines, on the installation of the transformers, with the work on the power station beginning only in mid-2000. By the end of the year 2000 it was expected that the work on the 4 turbines would be completed by April 2001 but that the main turbine, producing 500kW would be put in operation in January 2001. By the end of the year 2000 most of the major problems linked with the production of power and consequently on the production of water were solved or were due to be solved in the following months.

From the time when the ICRC decided to stop its activities in the Planalto, in early 1997, 4 years were necessary to reach a final agreement and to take the necessary steps to resume the water distribution through the existing network. Only in 1999, after two years of relative stability a precise proposal was put forward. Some work has been done in between but with poor continuity, when equipment could be found and transported to Huambo. It took again another two years to bring online a sufficient and regular production of power and to secure a regular production of water. But the problems linked with the distribution network are still not solved and it is clear that they can only be tackled when the system will be put under pressure.