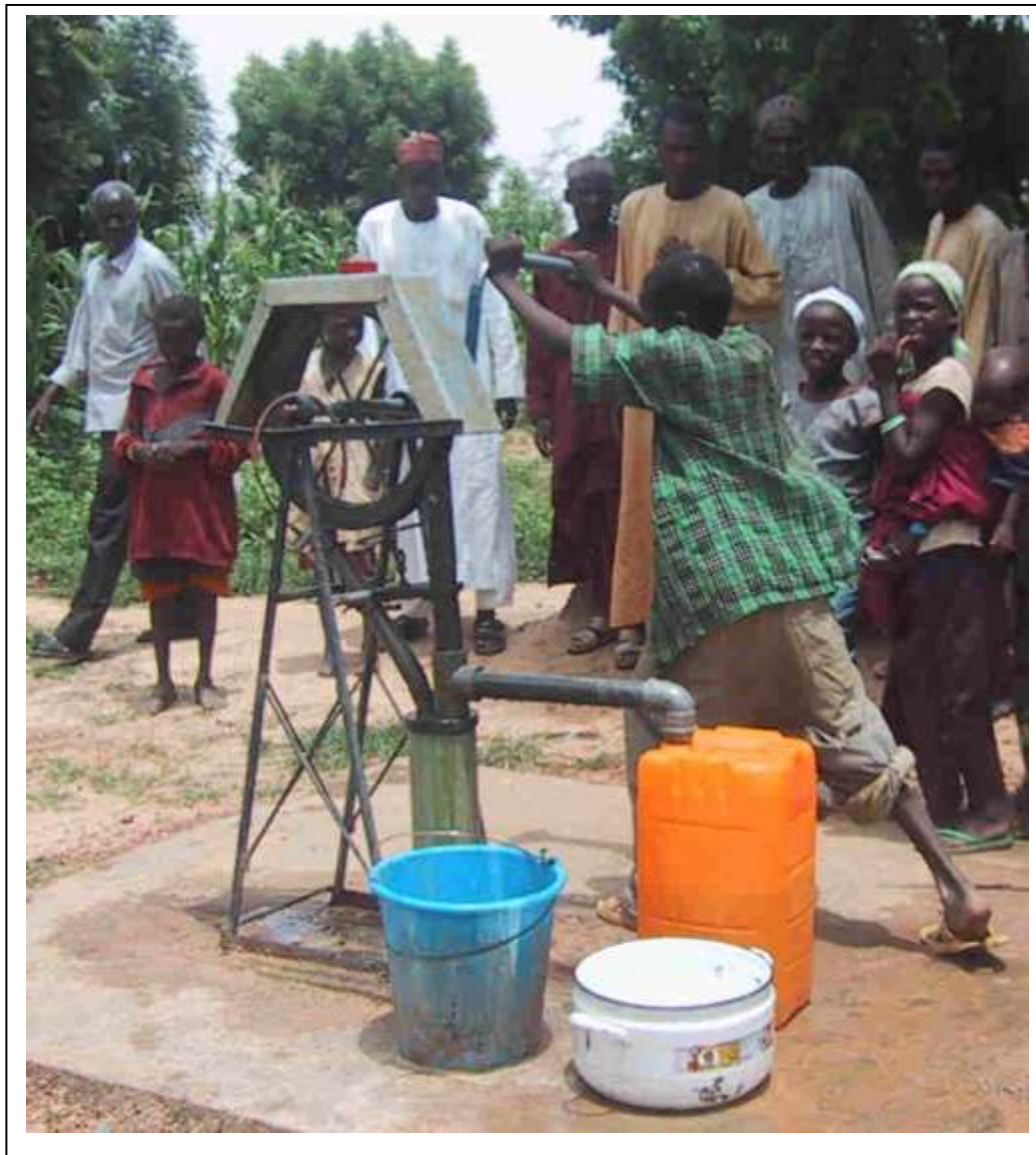


POTENTIAL FOR SELF SUPPLY AND LOW COST WATER SUPPLY OPTIONS IN NIGER.



UNICEF
Niger

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ABBREVIATIONS

DIGOH Division des Inventaires et de la Gestion des Ouvrages Hydrauliques

DNAEP Direction des Travaux Neufs d’Alimentation en Eau Potable

DRSP Division Régional de la Santé Publique

DRH Directeurat Régionale de l’Hydraulique

DHPES Direction de l’Hygiène Publique et de l’Education pour la Santé

MHELCD Ministère d’Hydraulique, de l’Environnement et de la Lutte Contre la Désertification

Potential for Self Supply and low cost water supply options in Niger.

1. INTRODUCTION

Niger lies to the South of the Sahara with 75% of the territory being desert and a third of the population living in extreme poverty. It is therefore vulnerable to all the problems which desertification brings, with minimal resources to combat them. The extreme poverty which puts the country at the bottom of the HDI ranking is coupled with the highest diarrhoeal incidence in Under 5's in the world, and a growing rate of chronic malnourishment (MICS 2000 39.4%, MICS 2006 44%). To add to these problems, cholera breaks out on a regular basis in most years, drawing attention to the poor provision of both water and sanitation, which in turn re-inforce poor hygiene practices. This year floods have followed on the two years of poor harvest, compounding the difficulties in which many *Nigeriens* find themselves.

2. BACKGROUND

2.1 Present and planned coverage.

The rural water supply coverage figures given by government are approximately 59% based on numbers of operating points (estimated at 70%) and 250 people for each one. The QUIBB survey of 2005 suggests a slightly lower coverage of 45.6% based on household surveys. Government statistics for 2004 give approximately 19,500 water points (6861 boreholes and 12,565 lined wells). In Dec 2005 DIGOH estimate of facilities is almost 25,000 waterpoints but includes mini-AEPs. These are expressed as equivalents (eg one mini-AEP= 8 water points) and the actual increase in boreholes is 306 and in lined wells 1117 (to 7167 and 13682 respectively¹) in the one and a half years. MHELCD is now planning an inventory for all regions, which has already begun, and will this year cover a further three regions, in order to provide a more accurate definition of facilities and need for rehabilitation. MHELCD is also planning rehabilitation of 3,125 water points in this year and a further 3,125 next year, based on an estimate of 30% out of operation. Planned coverage by 2015 is aimed to reach 80%.

The Director for New Works (DNAEP) estimates a necessary budget of around 3.3 milliard CFAs per year to reach this goal, and that to date progress has been at about half this rate, so coverage in 2015 would be nearer 70%.

Almost exactly two-thirds of protected sources are lined wells (*puits cimentés- PC*). This level of coverage needs to be well understood, as they are not comparable to lined wells in other countries. It is not so much the distance to the waterpoint (1 km being the defined radius for service in Niger) -which is measured by QUIBB and DHS surveys as an indicator of accessibility- the main problem is the depth to water, which leads to great hardship in lifting water where it is by bucket and rope (almost all lined wells) and also great effort needed where there are 'human powered pumps'² (*pompes à motricité humaine - PMH*).

2.2 The practicalities of coverage.

Taking one district in Maradi as an example, and one commune within it, something of the realities of coverage in Niger become apparent. Within the country as a whole Madarounfa is one of the two most densely populated districts, and it is often the first to register a cholera outbreak each year.

¹ Director of Inventories, and Management of Water Supply works (DIGOH) pers comm.

² So called since many are Vergnet pumps with pedal action, rather than handpumps.

Taking one 'commune' in the district, Serkin Yamma shows the reality on the ground of what coverage means. At first sight the coverage is not bad. There are 72 water points, including 21 boreholes (a third of the total for the whole district) to serve 27,800 people. Of the PMH on boreholes 48% (10) are not working, some for many months. Thus if all were working, theoretical coverage for this commune is 65% (at 250/waterpoint). If only functioning water points are taken it is 56% - or just under the national average.

However looking at what this means on the ground gives a very different picture. Coverage is supposed to mean availability of 20l/hd/day per person. Of the operating water points in Serkin Yamma, 80% are lined hand-dug wells. These are large diameter with no lifting device, in order to allow as many people to collect water at the same time as possible. At most sites it is more than 40 metres to water (equivalent to the height of a 15 storey building). The water is a tiny dot at the bottom of the shaft, voices bounce off the wall and echo up from the bottom. Drawing water is done with small inner tube buckets holding five litres (or less by the time it reaches the top). It takes about 15 minutes to fill one 18 litre canari. Collecting for one family can take more than one and a half hours purely drawing water, without the journey from and carrying to the house. There are sometimes wooden pulleys on the wells, but people seldom use them because their ropes are so fragile and often mended with so many knots that they get stuck or wear away using the pulley. The alternative, a wooden bar at the side of the well is worn into grooves, and so rope can be slotted into a groove when the drawer needs a rest. This water is 'free'³ but at what real cost?



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A scrum of people and animals which makes it impossible to maintain water quality

The alternative is the systems where animals draw the water harnessed to the rope, and the entrepreneur who owns the animals charges people to use his larger bucket, and stronger rope. He has two animals and ropes so that one animal is walking back while the other draws the next lot of water. Meanwhile those who cannot afford his assistance draw water by hand alongside, or queue to use their own animals. Thus there is a scramble of people, animals, and associated dirt around the well. The rope harnessed to the ox or donkey is drawn out over 50 metres of sand, which is liberally mixed with

the dung of the animals, and sticks to the rope. As it is dropped down back the well, a fine dust of sand and droppings hangs over the well shaft.

There is no apron to the well and everyone stands in the wet sand/ mud and drops their 45 metres of rope onto it, as the bucket rises towards the top. As a result, the well has to be regularly de-sanded to maintain sufficient depth to serve all who draw from it. This is sometimes done as a paid task by a local well-digger but

³ In fact it is not really free at all, but there is no formal charge for the water itself. Those who draw either bring their own rope and bucket which continuously needs replacing, or they 'rent' one off a neighbour usually at a low fee (1-2 CFA a time).



Drawing water from a deep well - the distance to the well reflects its depth.

paying for this puts a strain on people and they may decide to do it themselves, mainly by sending children down to clean out the well. Many of the lined wells begin to dry up and have lower yields in the dry season, even if they are cleaned out. These all count as functioning water points but what does this really mean in terms of access, water quality and quantity?

A Vergnet pump took some 2.5 minutes to lift 18 litres, and for depths of 45 metres requires two women's weight to lift water, even at such low discharge rates. Nevertheless people remark particularly on the increases in productivity the time and energy saved have allowed them to

make. Even so, the queue of 'canaris' in the photo below represent almost two hours waiting time. At the pump people pay 10 CFAs per 20 litres. Those who cannot afford this must walk to an open well. There are large questions about a) who is excluded by this, and of those not excluded, who can afford to collect anything but the minimum amount of water? b) Hygiene promotion in these circumstances needs to consider carefully what extra burdens this would be putting on families especially women and children lifting, carrying and paying for water. Water payment comes



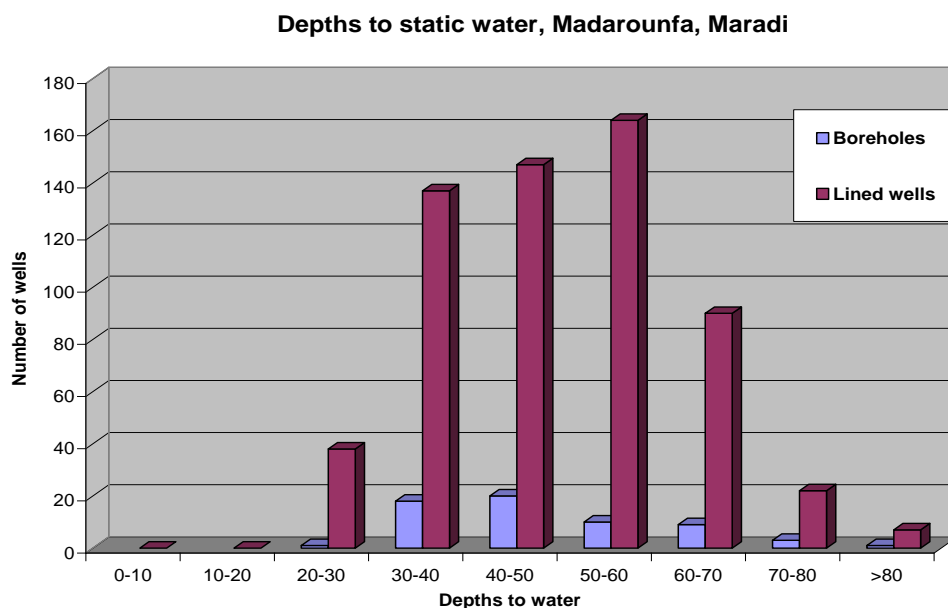
Water payment comes exclusively from the woman's purse, since men and women seem to operate almost totally separate economies, and water provision is counted as the woman's responsibility.



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But is Serkin Yamma exceptional in Madarounfa,? *Ministère d'Hydraulique, de l'Environnement et de la Lutte contre la Desertification, Division des Inventaires et de la Gestion des Ouvrages Hydrauliques, (DIGOH)* data for Madarounfa shows that actually Serkin Yamma is fortunate in its depths to water, and in the number of boreholes it has. Overall in the district, for 70% of wells it is more than 40 meters to water, and 20% more than 60 metres. At 7 wells it is more than 80 metres to water.

Fig 2.1 ⁴



Only 10% of water points in Madarounfa district are boreholes, compared with almost 30% in Serkin Yamma, so the dependence on deep lined wells in the district as a whole is even higher.

2.3 The regional and national contexts for low cost solutions.

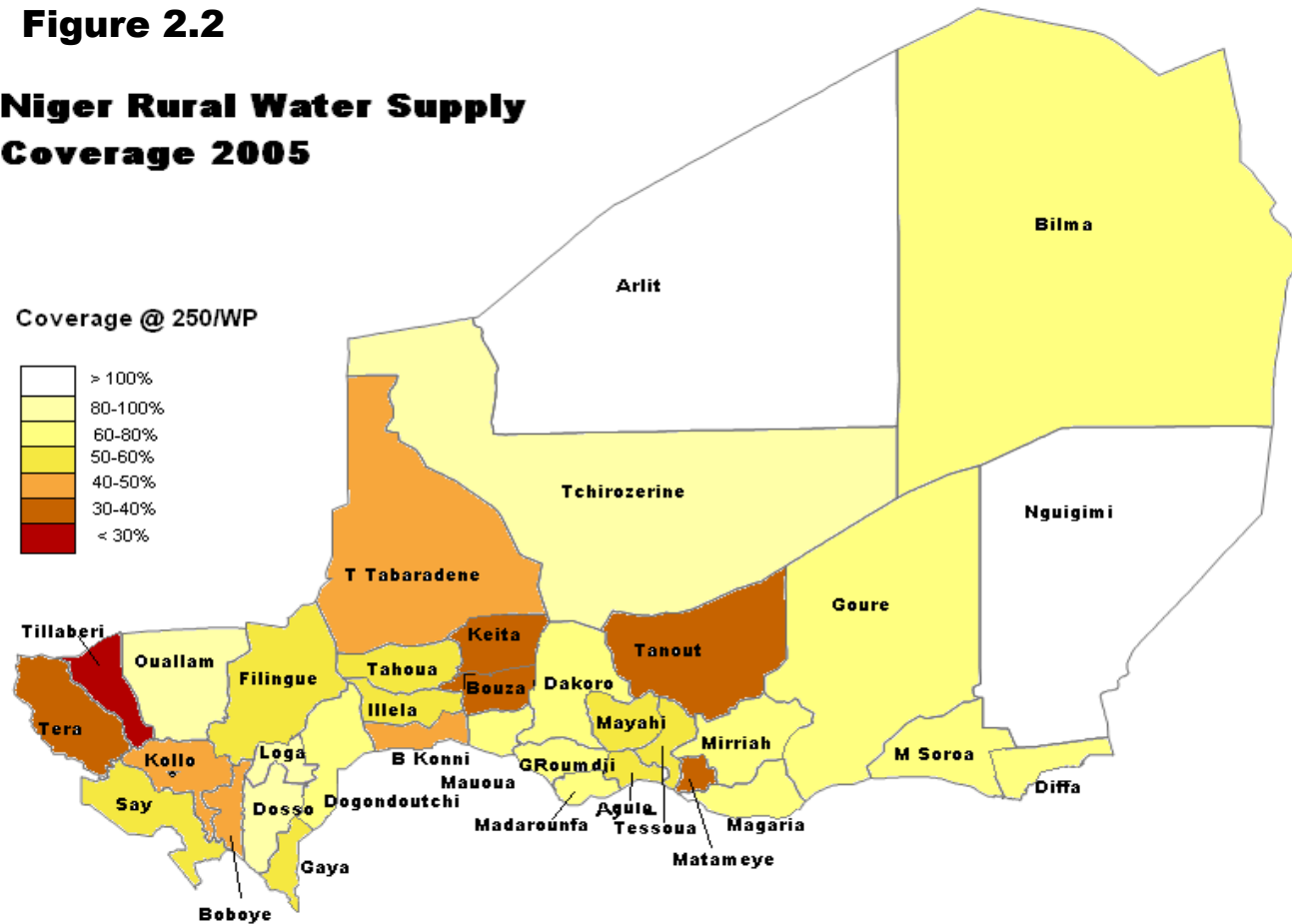
It might be considered that Madarounfa is one of the most difficult districts for access to groundwater, but it is quite representative of the rest of Maradi region. Figure 2.2 shows that within the region 6% of water points have water within 20 metres of the surface, and 26% are less than 40 metres deep. Thus low cost pumps would be of limited relevance in the region, but low cost drilling could perhaps be more widely employed.

DIGOH groundwater maps (see Appendix 1) show that countrywide just under 10% of wells have water within 12 metres of the surface. The main areas where low cost solutions may be most relevant are the two main valley areas of Dosso, southern Tahoua and to the East in Zinder region south of Zinder town and towards Lake Chad in Diffa. In these areas water lies within 12-15m of the surface in the alluvial areas, and there may be a large number of small communities (hamlets) which remain un-served. However in national terms these areas of shallow groundwater are regarded by DNAEP as being the best served in the country, so government at national level sees less importance in increasing coverage within them. However a map taking the data from the Committee on Monitoring and Evaluation of coverage suggests whilst coverage may be higher in many of the southern districts, population density differences mean that actually greater numbers of water-points are required in some of the districts with highest water levels (compare Fig 2.2 and 2.3 with Appendix 1.1) especially in Dosso and Zinder. Matameye itself is one of the districts with lowest coverage in the country, and with Magaria, Boboye, and B Konni offer opportunities for low cost systems to contribute to the 6-800 water points each of these districts need.

⁴ Data from DRH Maradi

Figure 2.2

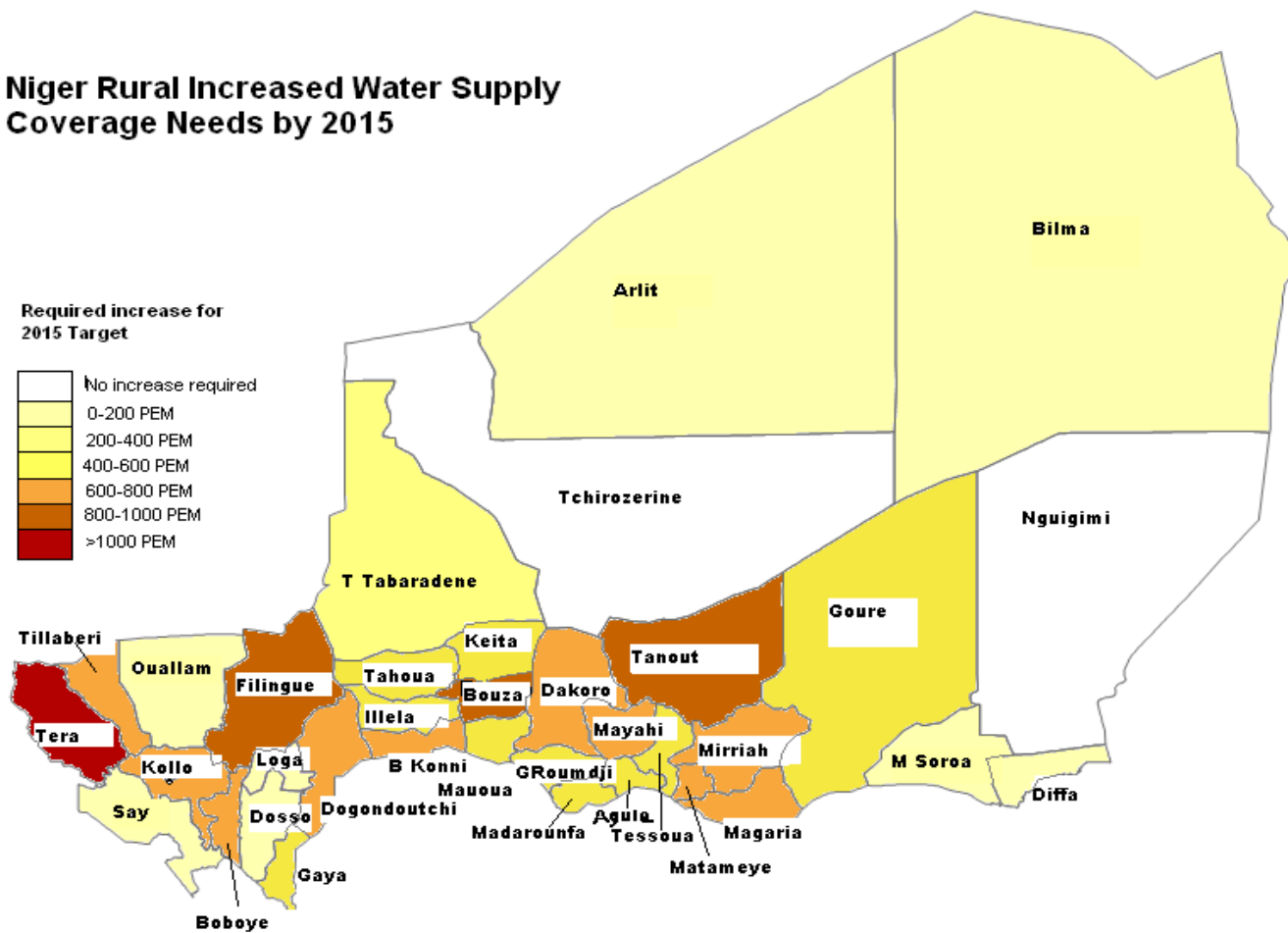
Niger Rural Water Supply Coverage 2005



Data from Comité technique permanent d'Evaluation et de Suivi du Taux de Couverture des besoins en Eau Potable en Milieu Rural. 2005

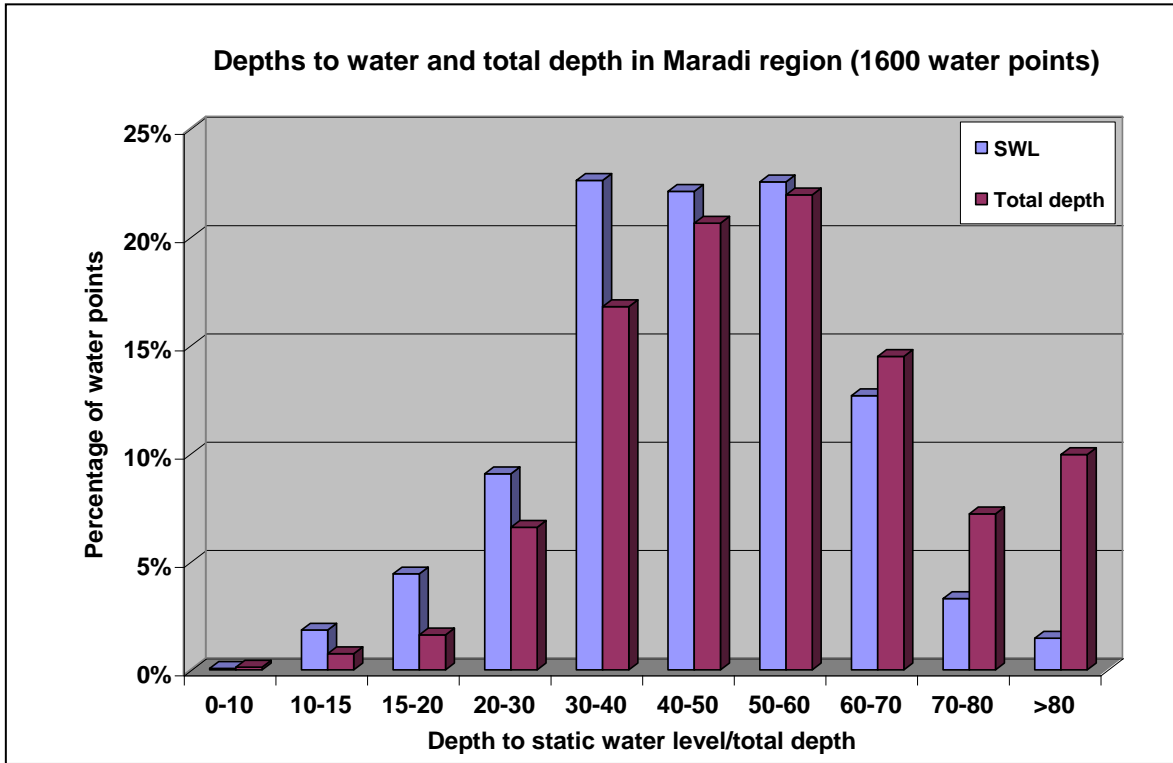
Figure 2.3

Niger Rural Increased Water Supply Coverage Needs by 2015

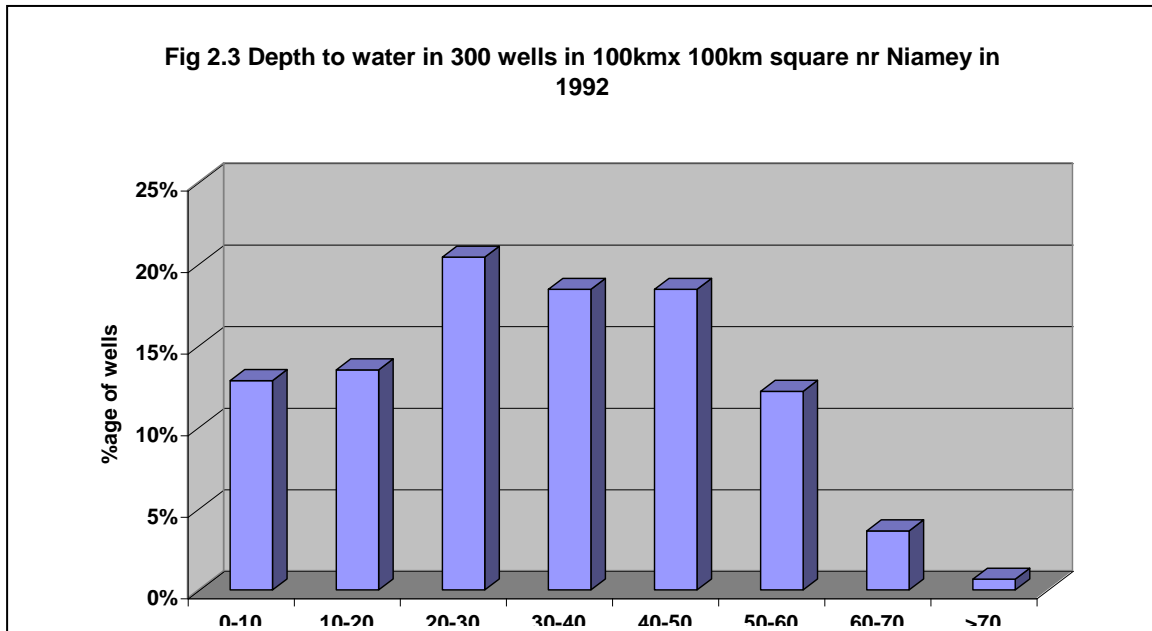


Data from Comité technique permanent d'Evaluation et de Suivi du Taux de Couverture des besoins en Eau Potable en Milieu Rural. 2005

Fig 2.4 Depths to water and to base of wells/ boreholes in four districts of Maradi⁵



Piezometric readings for a 100km square around Niamey on the North bank of the Niger river (in 1992) show that the higher water levels associated with the main river



⁵ Data compiled from various sources – DRH Maradi, and newly completed boreholes/wells since 2004 from

valleys are more common, as in Dosso and Tahoua but still do not penetrate far into the surrounding plateau areas which constitute the major part of the country⁶.

Artesian water is found mainly in Diffa and Agadez (see map 2 Appendix 1.1) regions, but to reach the confined aquifers usually requires drilling to several hundred metres. Thus both drilling and water lifting conditions are generally not well geared to low cost solutions for domestic supply, since maximum drilling depths for low cost methods are some 40-50 meters and maximum lift is generally less than 20 metres. In terms of a major contribution to reaching MDG target for rural water supply coverage, Niger cannot be said to be a country which offers the highest potential for low cost solutions. This is not to say that they do not have a role to play, but simply that the areas where they can significantly contribute to MDG targets are quite limited.

However in terms of increasing choice, empowering households, communities and '*communes*' to exercise their rights under de-centralisation, and serving smaller communities not covered in national policy (under 250 people) low cost solutions can have a value in particular areas, and Self Supply principles may have some potential.

3. EXPERIENCES TO DATE.

3.1 Low cost options

Some 19 low cost boreholes and handpumps have been installed in Matameye (Zinder region) with UNICEF funding. 18 with rope pumps locally manufactured in Maradi by Sani Rabo blacksmiths supported by Enterprise Works, one with an India Mark 2 pump. 3 rope pumps were visited at Dadin Kowa, Angoal Biri and the Feeding Centre at Dan Bato, and there was no news of others not working.

In all cases the communities had replaced the rope themselves during the year and felt capable of maintenance, Though they also have the back-up of a trained mechanic locally if they require it, they prefer to save the cost of calling him out, and to do the work themselves. Rope quality would seem to be questionable meaning that Dadin Kowa had had to change the rope twice in the year.



At 16m to water it takes two children to raise the water easily with the rope pump.

The Feeding Centre at Dan Bato obtained funds from the COGES⁷ for rope and had no system to recover costs, but the other two villages both had full-time water seller at the waterpoint, and have amassed around 20,000 CFA⁸ in the 10 months or so, as well as having paid the water seller and bought the rope. Women say that if given the opportunity they would 'multiply it many times' – suggesting a need to consider options for fund retention and investment. They want very much to get a hammer mill for the village, and would like now to find ways to finance this through the pump – the beginning of independent thinking and planning, and of opportunities to develop Self Supply.

Women's view is that they save so much time by using the pumps that they are mostly happy to pay. They say that before they often had to pay anyway – mostly in time but also often to

⁶ Efforts are being made to get a more detailed picture of the situation in the country as a whole.

⁷ The management committee for the health centre, which gets its income from the fees paid for registration and treatment (150 and 1000 CFAs per person respectively)

⁸ Approximate equivalent. All these villages near the Nigerian border trade in Nira.

borrow a bucket and rope, and in filtering water. Now they can get it quickly and relatively effortlessly. The men's point of view is that with the new well (even though distance is not much different to the old traditional source) women have much more time, and the family can now eat earlier as women have time to prepare the food quickly when they get back from the fields. All prefer the taste and year-round clarity of the water (water from traditional wells is often sandy/silty/ cloudy).

Slabs around 2/3 pumps had no rim or drainage so that hygiene around the point is poor. Women remarked on this and wanted to improve the situation, but were not sure quite how to set about it. New slab (Angoal Biri) was better designed and constructed but still had no channel and soak away.

The cost for 15 metre deep borehole and rope pump is around 200,000 CFA not including transport. People say that given time they could raise this sort of level of payment. However costs seem to rise steeply for deeper wells- being almost double the drilling cost (150,000) for 20m especially if encountering clay or harder formation as is often the case. However it is still a fraction of the cost of a lined well or conventional borehole and might attract private investors in the areas of shallower groundwater.

A rope pump costs approximately 70,000 CFA's at present (risen quite quickly from 50,000) – one of the problems of being linked to projects. However at the two villages (both of which have traditional wells) people said that they would consider trying to raise money to pay to put a pump on the old wells to reduce pressure on the one new water point, and have a nearer source for people the other end of the village. Since two pumps would cost almost the same as one shallow borehole + pump, or considerably less than a deep hand-drilled borehole +pump, it would be worth while thinking less of a package and more of developing a strategy with villages to make maximum use of available funds. Thus they might decide to protect traditional wells and install pumps or to put the new borehole at a greater distance from the existing well, so that there would be a water source on two sides of the village. The advantages that this gives might encourage the whole community to consider raising funds from the water to allow installation of a second pump later. (a strategy that Dadin Kowa suggested they would like to discuss in their village assembly).

A small degree of marketing of rope pumps has taken place in peri-urban Niamey, in Bobiel quarter. One pump was installed free for two weeks, after which the well owner decided to purchase it. Since then three others have installed pumps and the idea is spreading slowly, with little or no further promotion. Some well owners sell the water to neighbours as it is cheaper and closer than the piped supply and few can afford to pay for house connections. Most would be likely to change to small electric submersibles with overhead storage once the electricity supply is connected, as they mention wanting to try and adapt the rope pump for elevated storage (usually not possible). There is a lack of anywhere to go for technical advice on improving supplies. More importantly several visiting relatives from rural areas have seen the pumps and would like to install them, but there is no follow-up or stocking of pumps to encourage promotion and sale, either in Niamey or Maradi.

In the short term lower cost options seem to have worked well. The benefits are obvious and convincing to users, and could be used, through exchange visits, to convince others. To date piloting has all been with communal users in mind, but there would seem to be a market both for communal and private investment especially in peri-urban areas. However the greatest development so far of low cost options has been for use in small -scale irrigation (See Kerstin Danert⁹) limited mainly to low lying areas associated with river valleys and their better quality soils, using pedal pumps on low cost boreholes. Several thousand of these exist, providing mainly irrigation but also some domestic water supplies.

⁹ Cost effective boreholes. Niger Scoping Study Jan 2006 K Danert for RWSN

A brief history of hand-drilled wells in Niger. April 2006. K. Danert.

Matameye is also an area of higher potential for low cost options because, despite the relative shallowness to water, coverage is far below the national average (37%¹⁰ compared with 59%), which is in contrast to the view that areas of shallow groundwater are generally the best covered in the country. Matameye is calculated to need 646 new water points to reach MDG target and Magaria the neighbouring district with similar conditions, needs 725, so there is much still to be done, and in this area low cost options can help.

3.2 Self Supply.

In this situation where water seems almost always expensive to access, the opportunity to invest in water seems limited, bearing in mind that a) water is regarded as the woman's financial and practical responsibility and b) that most households have insufficient food each day for more than half of each year. Any attempt to market different water supply options would need to convince men of the benefit as well as women, if their spending power is to be accessed. In rare cases this has already happened purely through market forces, but such initiative is not recognised or promoted at present.

In Bamo (Zinder) a local entrepreneur (Elhadji Koni) offered to take over the local borehole with its Vergnet pump, and to install a mechanised pump. This was in association with his hammer mill, which initially provided the power (now they are separate engines). The borehole is near the road which makes it easy both to receive fuel and to sell water in bulk to passing vehicles and so to be able to keep down the cost for local households. It appears that local demand, even with higher costs than for any other water supply visited, is sufficient to keep the system pumping for at least five hours a day, with storage to provide continuous supply of at least 15 cubic metres a day.

Nevertheless the price is rising, as fuel becomes more expensive and as the aging machinery uses more fuel and oil. It is one of the paradoxes of rural water supply especially in Niger, that a cubic metre of water is as expensive or more so for the rural poor who walk and lift water than for urban householders who turn on the tap in their house.

Examples of the Cost of water				
Area		Volume	Unit cost	Cost/m3
Urban	Piped			250
	Rope pump	18	10	556
Rural	Mechanised (priv)	36	25	694
	Mini AEP	20	10	500
	PMH 1	18	5	278
	PMH 2	20	10	500
	Rope pump1	10	2	200
	Rope pump 2	20	5	250
	Lined well	Rope/ bucket/ water drawing		

Cost in CFAs

The value of water is such, however, with the problems of lifting water from great depths, people are mostly prepared to give payment a priority in household budgets. However what is not known is how much consumption is limited by the cost of water as well as by the difficulties of access.

Elhadji Koni has adapted three other old boreholes to mechanically pumped supplies in the region, and appears to find that it pays sufficiently to cover his costs and provide some return on investment. There are many people who go to Nigeria or North Africa to work in the oilfields and

¹⁰ Taux de couverture national des besoins en eau potable en milieu rural. 31/12/05 (Comité technique permanent d'évaluation et de suivi du taux de couverture des besoins en eau potable en milieu rural. (see Appendix 1.2)

who could possibly invest in such systems, but it is unlikely that they would be able to pay the very high costs of boreholes as well, (average \$20,000) unless some financing mechanisms were put in place to encourage such investment.

However they could perhaps be encouraged to provide better water lifting devices and storage for lined wells, or boreholes using solar panel/ pumps, since it does appear that women put a high value on not having to lift water from depth (especially over 30 metres or so, when pumping and bucket and rope are time consuming and use much energy). The question that would remain is the degree to which such systems (requiring higher payment) exclude the most vulnerable or reduce or increase the amount of water used.

Paradoxically in areas where self supply is more affordable the demand for improved systems may initially be less because water lifting is not so difficult and so the value put on better access and water lifting may be lower. However the first results from Matameye suggest that interest quickly grows and people begin to see the possibility of becoming more 'masters of their own destiny' in being able to improve the situation themselves and to benefit from it.

4. CONCLUSIONS AND PROPOSED WAY FORWARD

4.1 Summary of conclusions

Preliminary meetings were held with DIGOH, CREPA, DNAEP to discuss next steps. Despite the fact that low cost solutions may have only limited application in the country as a whole, the idea of establishing them as an option in areas where they are relevant was welcomed at all levels (national, regional, district, commune and community). This was partly because it reduces the need for public investment in these areas (lower unit costs and also higher possibility of private investment), but also because it empowers people to make choices, and even makes it possible for them to copy improvements largely or completely at their own cost, reducing donor dependency.

The systems were felt to be especially relevant to smaller communities (which become a higher proportion of target villages as coverage increases), and those areas with collapsing strata, or p/ urban water supply problems. Peri-urban sites in Niamey with rope pumps on shallow wells were found to have sealed pit latrines, which are emptied by tanker and so do not pose a major threat to the aquifer.

Low cost boreholes and hand-pumps are within reach financially of some individuals, or communities, appear to be easily and well maintained (at least so far) and to be suitable where water is within 20m and an aquifer within 40m. However the ground conditions are also a constraint, and while 25% or so of wells/ boreholes may be less than 40 metres deep perhaps half of these would be in ground conditions unsuitable for low cost drilling.

Self supply may be a relevant concept at other technology levels since much value is put on reducing the effort and time needed for lifting water where it is more than about 30 metres below ground level. Investment in solar and mechanised pumping could be encouraged to make better use of existing water points, even if people do not have sufficient means to pay for new boreholes.

4.2 Proposed Actions.

4.2.1 Data acquisition from DIGOH to better define actually in what parts of country low cost options can be relevant. More detailed mapping and analysis of inventory data on static and dynamic water levels and total depths would help to provide a better picture at district level. DIGOH have a good database and may be able to extract the necessary information. It may also be available at regional level. Where possible it should be linked to any drilling logs of the shallower layers to 50m.

4.2.2 Research in unconfined aquifer water quality and relative water quality of different source types. It is proposed that water quality sampling should be carried out in Maradi and Zinder (and Tahoua?)¹¹ alongside the planned waterpoint inventory. This would require also inputs from the Direction de l'Hygiène et de l'Education pour la Santé on bacteriology and possibly commercial labs for pesticide analysis. DIGOH have a GIS system for waterpoints and so can produce maps of the results. The costs of these various aspects need to be clarified and agreement reached on timing, sampling methods and presentation of results before the World Bank funded inventory starts.

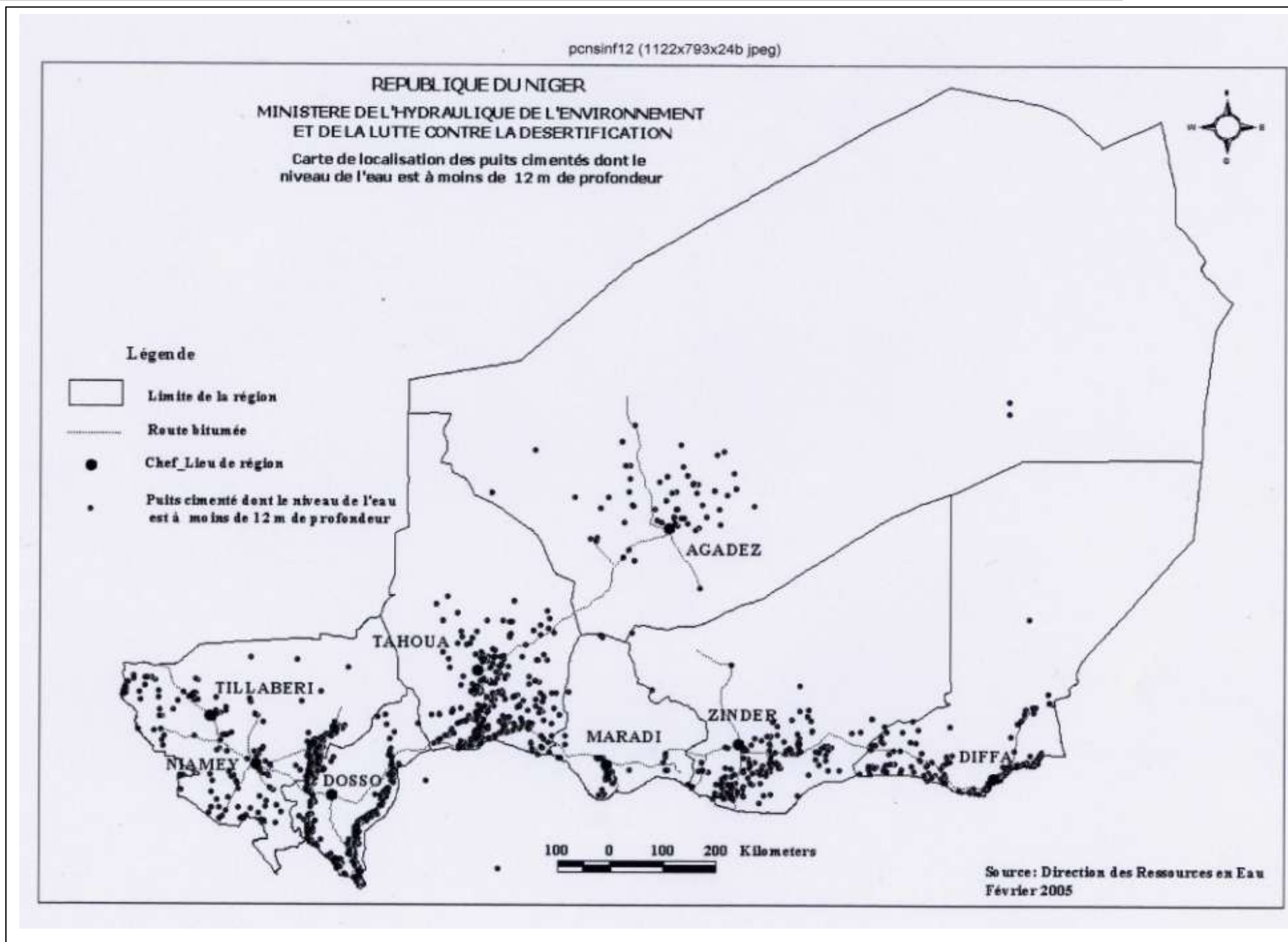
4.2.3 Evaluation of performance of existing low cost communal domestic water supply systems in Matameye. UNICEF has funded 19 low cost boreholes and 18 rope pumps to date, and is planning another 39 in southern Zinder. A preliminary evaluation of performance should be made prior to the new phase, to see if there are any lessons to be learnt which would improve the effectiveness of the systems about to be installed. A more complete evaluation should be made when the new phase is completed, including both sets of water points.

4.2.4 Promotion of low cost drilling and water lifting to the private sector as this could increase coverage, encourage non-donor dependent solutions, and hopefully also productive use. A strategy needs to be developed for this with government and key NGOs, including financing systems which could help encourage private investment and phased cost recovery. As a start the idea could be raised with the *Commission Nationale de l'Eau et l'Assainissement* and RWSN could also assist with this, especially outside UNICEF focal areas. At a more local level in Zinder a local workshop at district level in Matameye (with Zinder regional staff too)¹² and local private sector (drilling contractors and pump manufacturer) could underline the potential and costs and explore how people could be encouraged to invest at community or individual levels. This offers a real opportunity for communes (which have very limited funding but large responsibilities) to begin to be able to respond to local demands.

¹¹ As Tahoua is not a focal area for UNICEF it may be that this could be funded through RWSN by WAWI?

¹² Including Community Development, Hydrauliques,





APPENDIX 1.1 Water level information from DIGOH data and DRE mapping.

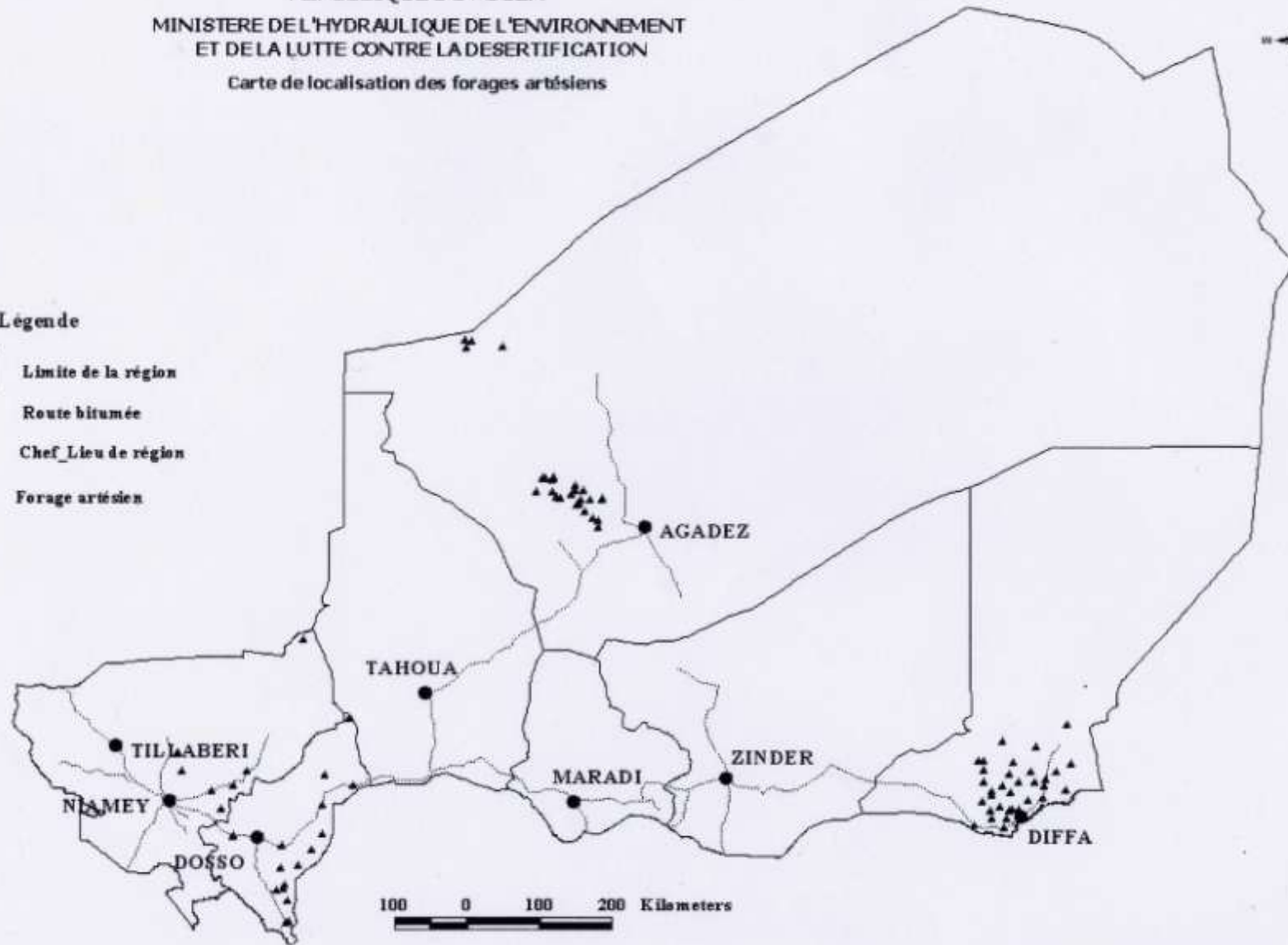


REPUBLIQUE DU NIGER
MINISTRE DE L'HYDRAULIQUE DE L'ENVIRONNEMENT
ET DE LA LUTTE CONTRE LA DESERTIFICATION
Carte de localisation des forages artésiens



Légende

-  Limite de la région
-  Route bitumée
-  Chef_Lieu de région
-  Forage artésien



Source: Direction des Ressources en Eau
Février 2005

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Ibrahim Malam Issoufou	Directeur DIGOH, MHELCD
Barbizo Aboubacar	DRH Director Maradi
Elhadj Rabo Dan-Dadi Bako	Sociologist DRH Maradi
Sani Rabo	Maker of rope pumps Maradi
Sani Moussa	Mayor Sanka Yamaa, Madarounfa
Mohamed Abdoulaye Mamane	Enterprise Works trainer, Maradi
Issoufou Dan Doua	DDAF/DC Développement Communautaire, Matameye
Ada Issoufou	Hydraulique, Matameye
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Mamadou Ibrahim	CD Enterprise Works Niger
Olivier Reboul	Hydrogeologist BCEOM Société Française d'Ingénierie

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