Access to adequate water in post-apartheid South African provinces: An overview of numerical trends

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Abstract

This paper presents an insight into water service access and demand, with a numerical review of official data from the national household survey from 1995 to 2006, and the 1996 and 2001 census data. The findings show that in provinces (Eastern Cape, Limpopo and Mpumalanga) where the existing service base is low, with a relatively high level of outmigration leading to a decrease in household numbers, the annual rate of delivery is lower than in other areas and percentage access has risen marginally (from about 68% to 70%). In provinces (North West, Northern Cape and KwaZulu-Natal) where the existing service base is higher, with relatively lower levels of out-migration, there is a marginal change in household numbers and the annual rate of delivery is higher and percentage access has risen remarkably (from about 72% to 88%). In the provinces (Gauteng, Western Cape and Free State) with the most favourable initial conditions, that is, where the existing service base is the highest, there is a remarkable change in household numbers, possibly as a result of in-migration and the annual rate of delivery is quite sustainable. Percentage access rises at an early stage and remains stable at the limiting value of about 98%.

Keywords: water access, water demand, piped water, backlog, households, population, in-migration, out-migration

Introduction

Access to water is basic to life and is recognised as a fundamental human right. A healthy human life demands sufficient and safe water. In South African law and policy, basic water supply must be sufficient, safe, accessible and affordable. Basic water must also be provided continuously with a stipulated minimum rate of flow and quality (Hemson and Galvin, 2006).

During the apartheid era, there was no central department of Government that was dedicated to universal supply and management of water resources in South Africa. Homeland governments ran water service infrastructures (DWAF, 2004). In poorer black rural areas these were run inefficiently by uncoordinated homeland government structures that were almost completely dependent on the South African Government for funding. Consequently, in 1994 it was estimated that 30% of the South African population lacked access to adequate water supply services and that 50% were without adequate sanitation (DWAF, 2004).

The post-apartheid government instituted the Reconstruction and Development Programme (RDP) as the policy foundation stone of the new government. The RDP gave the Department of Water Affairs and Forestry (DWAF) the responsibility of ensuring universal access to basic water services for all South Africans. Subsequently, the White Paper on Water and Sanitation was released in 1994, with emphasis on speedy delivery of water and sanitation services to ensure that all South Africans have access to a basic water supply (DWAF, 2004). Exactly 10 years (2004) into democracy the then President of South Africa, Mbeki, in one of the most remarkable State of the Nation addresses, made various time-bound promises on the key issues around household services, education, health care and security. Regarding access to water, President Mbeki promised that 'within the next 5 years all households will have access to clean running water' (Mbeki, 2004). The RDP and subsequent development programmes, the presidential targets and, at the international level, Target 10 of the Millennium Development Goals (halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation), are all time-bound development commitments that require consistent measurement of progress towards achieving the targets.

The work of Hirschowitz and Okin (1997) was one of the earlier attempts in using official statistics to measure development and living conditions in South African households, on a relative basis, in the post-apartheid era. Using the October 1994 household survey the study found wide disparities in the odds of access to basic services for different demographic segments of South African society. Black African households were found to be more likely to lack access to basic services: housing, water, sanitation and electricity, amongst others (Hirschowitz and Okin, 1997). A similar study that was done in 1999 compared access to basic services on the basis of household income; this study found that access to basic services was closely related to income. Households that belonged to the low-income group were more likely to be excluded from access to basic services (Budlender, 1999). Therefore, one of the primary focuses of various regimes of the new era has been service delivery and infrastructural development for previously disadvantaged communities.

More recent studies on the issue of measurement of service delivery and living conditions in South African households confirm that the focus is to deliver to poor households. For instance Bhorat and co-workers (Bhorat et al., 2004; Bhorat and Canbur, 2005; Bhorat et al., 2008a;b), in their studies on the shift in non-income welfare in South Africa, reveal that the focus of the government welfare services in the post-apartheid

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era has been pro-poor. Households at the bottom of the expenditure deciles (poorest of the poor) were found to have benefited more from government services. However, even though delivery seems to have been pro-poor, significant backlogs were noted in these studies among poor households, especially with respect to housing, sanitation and piped water. These results are further confirmed by the work of Hemson and O'Donovan (2006), in which it is also observed that substantial progress has been made, but that a lot more effort is needed for universal access to basic services in South Africa. These studies also observed that a major impediment towards reaching service delivery targets for water and other household-based services is the issue of the rapid increase in the number of households in recent years in South Africa, a phenomenon which operates somewhat independently of increases in population. This has complicated and dramatically added to the numbers demanding access to basic services. The 1996 census recorded about 9 million households; this number increased by almost 38% to about 12.5 million households in 2007, as revealed by the 2007 community survey, while the individual population increased by about 20% from 40.5 million to 48.5 million over the same period.

This research has responded to debates about water service delivery at the national and provincial levels by undertaking a comprehensive numerical review of trends of access to and demand for adequate water supply in South African provinces. The emphasis is on the review of numerical trends in absolute number, for purposes of practical planning and logistics. Numerical trends in absolute number values are vital, even though historical data may sometimes yield inconsistent values during analysis. As stated earlier, without good information on the trends in terms of numbers it becomes quite cumbersome to measure progress on targets, prepare dynamic budgets and make forecasts for the future. This gap is partly what this study intends to fill, by providing a numerically-based approach with most results in absolute numbers, geared towards the purpose of practical planning.

This paper concentrates on the question of whether the reported substantial unevenness in delivery according to provinces exists, and further whether there is a narrowing of any identified divide between provinces in favour of the poorest. The research thus examines whether there are leads and lags among provinces and whether these variances are narrowing or increasing. The expectation of comprehensive delivery to all is that those provinces identified as having the largest backlogs will advance in delivery at the most rapid pace and that the differences between provinces should narrow steadily. The household data from the 1995 October Household Survey (OHS), 1999 OHS and the 2005 General Household Survey (GHS) were analysed to identify backlogs and trends and to draw conclusions, by province, about progress towards social goals.

The objectives of this study were to carry out a numerical analysis to answer the following questions:

- Are there substantial differences between provinces in terms of access to and demand for piped water and, if so, to what can these difference be attributed?
- Is unevenness in delivery being remedied in light of governmental and institutional targets of universal access to adequate water?

It is obvious that the delivery of adequate water supply succeeds or fails at local government level; therefore, it is interesting to measure and observe variations at this level of government. However, this analysis is geared towards contributing to the pool of information for national and various provincial governments and other stakeholders; such information could be valuable for these tiers of government in various ways, for instance, the assessment of progress and the preparation of the provincial growth and development strategies of various provincial governments with respect to supply of adequate water.

Ideally, the analysis of supply of adequate water is done along with that of sanitation. Sanitation was not included in this review because this is intended to focus on water; secondly, there is controversy as to the definition of what constitutes adequate sanitation. In some areas the ventilated improved pit (VIP) toilets are accepted as minimum standard while the urine diversion (UD) toilet is the accepted minimum standard in other areas. Some communities regard the flush toilet system as their operational standard. With these ambiguities analysis of sanitation is left to be treated as a separate study. It is worth mentioning though that sanitation delivery has lagged behind adequate water supply by a significant margin over the period examined, irrespective of the standard of measurement. The 2007 community survey shows that about 21% of South African households are still using the pit toilet system without ventilation, while 8% have no toilet facilities at all (Statistics South Africa, 2007).

Data sources and methodology

This study is secondary research in that a desktop approach was used. The bulk of data used for this study are from the South African national censuses of 1996 and 2001, and national household surveys conducted by Statistics South Africa. The surveys include the October Household Surveys from 1994 to 1999, the General Household Surveys from 2002 to 2005 and the Community Surveys of 2007. Ten per cent samples of these data sets have been accessed through the national data archive. The census and survey basically collected socioeconomic person and household data on the following themes; demographics, household services and welfare, income and expenditure, land access and use and general perceptions of household dwellers, amongst others. These data sets are explored and analysed using the Statistical Package for Social Sciences (SPSS).

The survey questionnaire from Statistics South Africa, on the question of the source of water for households included the following options: piped water to dwelling, piped water to yard, neighbours' tap, piped water to community stand, borehole, spring, river, dam, stagnant water/pool, water tanker, and rain water. Although there are slight variations in the definition of access levels from the earlier October Household Surveys to the recent General Household Surveys, the variations do not make any significant difference. For simplicity we proceeded by summarising the levels of household access based on 2 broad categories of water sources, that is, households that met the minimum basic regulatory standard of water access (households with access to piped water not more than 200 m away from their dwelling) and those that do not. Households under the first category 'Piped Households' or 'Basic Access' are those with running tap-water in the dwelling, running tap-water on site and households with access to public taps. All other sources of water are considered not to be to regulatory standards and therefore are referred to as 'Backlog' or 'No Access'. The computations are based on the primary assumption that new or fragmenting households require state assistance for access to piped water.

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The computations are presented in tables with consideration of the following elements: the existing number of households without services, changes in the number of households leading to additional demand and a calculation of the rate at which additional access is being provided. Yearly additional access is the difference between total access in the current year and total access of the previous year. Backlog is computed with the expression below, where the first 2 elements provide a figure for the historical element carried over from previous years, to which the current additional demand is added, from which the additional number having access can be subtracted. The current backlog is the result of the following: Carryover Backlog + Additional number of households - Additional number of households gaining access. The notational description is as follows; $B_t = (B_{t-1} + AD) - AC$, where B_t is the backlog for the current year/time, B_{t-1} is the carryover of historic backlog from the previous year, i.e. (current year − one year). The backlog computation does not account for other constitutional dimensions of basic water, such as water quality and rate of flow. *AD* is the additional demand for the current year resulting from increase in households and *AC* is the additional access/connection for the current year.

The main issue pertaining to the difficulty of working with historical survey data in South Africa could be that of the fluctuating population base from which the national surveys are sampled and benchmarked. For instance, the Household Surveys done after the 1996 census used 1996 population census as a base while the earlier surveys used the 1991 census as the base. The 1991 census did not include Transkei, Venda, Bophuthatswana and Ciskei (the so-called TBVC states) and hence the size of these populations had to be estimated and added later. Consequently, survey data are always reweighted as new information emerges; this is one of the possible causes of fluctuations and inconsistency in trends of various variables. We used a grouping strategy which matched the provinces into 3 groups according to levels of access to water; auspiciously the majority of the provinces from the former TBVC states (the main source of the fluctuations) belong to 1 group, and this reduced the fluctuation, especially within the other 2 groups. Comparison is then made in 2 periods or phases, i.e. the periods 1995-1999 (Phase I) and 1999-2005 (Phase II), to identify any changes in the pace of delivery. The dynamics of access within the groups are identified and differences related to the proportion of households connected and to previous trends in delivery are analysed. Finally, the trends in access for the different provincial groups are mathematically modelled using the logistic, exponential and linear models, respectively.

Findings and discussion

The dynamics of access at national level and within the provinces are identified and differences related to the numbers and proportions of households connected are analysed. The data is examined to identify the extent of 'catch up' development whereby lesser developed provinces advance in the pace of delivery.

National scenario

Household water access at the national level was computed based on the 2 categories, i.e. Piped and Backlog, as defined in the methodology section. The results that are presented in Table 1 are derived from the SPSS output from the analysis of data from national household surveys.

Table 1
Water access at national level

Year	HH	Total piped	Backlog	+Connection	% Piped
1994	8 651 815	6 555 466	2 096 350	455 770	75.8
1995	8 802 344	7 011 235	1 791 109	412 562	79.7
1996	9 053 596	7 423 797	1 629 799	188 931	82.0
1997	9 301 283	7 612 728	1 688 555	7 470	81.8
1998	9 283 513	7 620 198	1 663 315	1 402 012	82.1
1999	10 798 643	9 022 209	1 776 434	121 671	83.5
2000	10 944 768	9 143 880	1 800 888	723 371	83.5
2002	11 780 379	9 867 251	1 913 128	933 890	83.8
2003	12 538 588	10 801 141	1 737 447	32 832	86.1
2004	12 624 143	10 833 973	1 790 170	254 756	85.8
2005	12 726 270	11 088 729	1 637 542	250 000	87.1

Source: Computed from Stats SA Household Surveys 94 - 05

In Table 1 we see that total households increased from 8.7 million in 1994 to about 12.7 million in 2005, i.e. about a 46% increase. Households with access to piped water increased from 6.6 million in 1994 to 11 million in 2005, an increase of above 69% in percentage terms. This implies that, all things being equal, about 4 million additional connections were delivered over that period, but these additional connections must be considered against the 4.5 million additional demand or addition to backlog as a result of rapidly-growing household numbers, neglecting particular households that were formed and dissolved within the period as these cancel out. Column 5 (+Connection) in Table 1 shows an indicator of yearly delivery or additional connection on a yearly basis, i.e., the difference between total households with piped water in the current year and total households with piped water in the following year. The yearly delivery data are very erratic and this clearly illustrates the difficulty of undertaking a year by year monitoring and evaluation of delivery of basic services in numerical terms. The last column in Table 1 shows the percentage of households with access to piped water. This increased from 75.8% in 1994 to 87.1% in 2005, which is a reasonable achievement over the period. On the other hand, the backlog was still lingering at 1.6 million households.

The figures presented in Table 1 and the rest of the analysis for backlog, should be interpreted with caution because all of the constitutional dimensions of adequate water access, such as water quality, and rate of flow of taps, are not factored into the computations for backlog. This implies that the actual backlog values, when these technical dimensions are considered, could be greater than reported here. For instance the water services information system reported a backlog of about 3.9 million for 1994, when all of the dimensions of water quality are considered, in comparison to the value used in this study, of about 2.1 million for the same period (DWA, 2011). Here the focus is on connection of households and communities to the national and provincial grid bringing piped water to the dwelling, yard or at distances less than the stipulated 200 m.

Even though the data is erratic, the trend line (95% confidence interval for *x*: -.0541329, 0456231) in Fig. 1 shows that the new connection (i.e. delivery) to backlog ratio has remained almost static throughout the period 1994 to 2005. This is why the backlog was still at about 1.6 million in 2005 despite the 4 million connections over the period. With an average household size of about 3.7 in the series as shown by the data, the 1.6 million household backlogs would translate to about 6 million persons. Therefore the mass action/service delivery

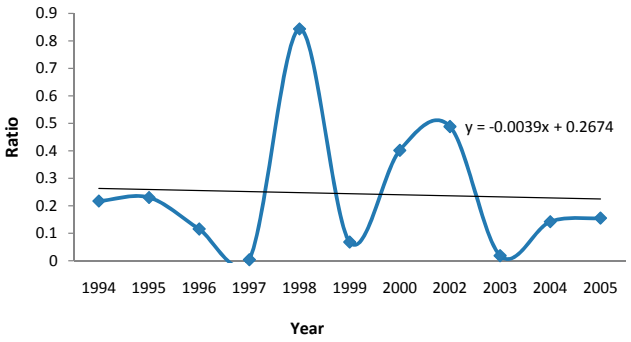

Figure 1
Matching new connection with backlog

protests should not be surprising, even though some of the indices are showing remarkable progress in delivery.

For simplicity we denote the time periods 1995 to 1999 and 1999 to 2005 as Phase I and Phase II, respectively. We break the analysis down into these 2 periods; this breakdown was mainly for computational convenience and to make it easier to conceptualise progress for periods close to 1994 and onwards.

Table 2
Changes in households, backlog and delivery

Parameter	Phase I	Phase II
Average annual change in backlog	-9	22 111
Average annual additional demand	502 743	355 975
Average annual delivery	502 734	382 508

Source: Computed from Stats SA Household Surveys 94 - 05

A deeper enquiry into the volume of delivery on a progressive annual basis, within the phases, reveals in Table 2 that the average annual additional access (delivery) declined from 502 743 to about 355 975 from Phase I to Phase II. Annual additional demand also declined to almost the same measure between the phases. Therefore, the increasing percentage access does not really imply accelerated delivery in all of the provinces, but could be as a result of changing household dynamics impacting upon additional demand over these phases.

The critical issue is to investigate whether targets like the presidential time-bound promises and the Millennium Development Targets could be reached, first at national level and then in the provinces, if the existing level of delivery is boosted and sustained. We also assess whether there is evidence of disparity and unevenness in terms of backlogs and delivery among the provinces, establishing whether additional delivery is increasing or decreasing in provinces and the corresponding impact on backlogs. In order to do so it is necessary to analyse delivery at provincial levels.

Provincial level

The provincial differences and the role of initial conditions of access on the delivery of water services among the provinces, was investigated, to establish whether the higher levels of delivery are in the provinces that had the highest existing level of access in 1994, in other words, whether the lower levels of delivery are in the provinces that had the lowest existing level of access (low initial conditions). In Tables 3a to 3b we present numerical records of total household numbers, households with access to piped water, backlog and percentage of households with access to piped water at provincial level, for the period 1995 to 2005.

Table 3a
Water access at provincial level

Province	HH 1995	1995 Piped	1995 Backlog	% Piped
Western Cape	960 450	915 842	44 608	95
Eastern Cape	1 244 999	701 598	543 401	56
Northern Cape	188 782	178 050	10 732	94
Free State	662 654	571 331	91 323	86
KwaZulu-Natal	1 575 726	1 031 198	544 528	65
North West	730 646	594 651	135 995	81
Gauteng	2 079 563	2 014 663	64 900	97
Mpumalanga	535 123	407 884	127 239	76
Limpopo	825 945	596 018	229 927	72

Source: Computed from Stats SA Household Surveys 95

Backlogs can be seen from a number of perspectives. From one perspective the increased numbers represent the increase in the number of households; from another perspective this could be the decline in operational water schemes in rural areas.

Table 3b
Water access at provincial level

Province	HH 2005	2005 Piped	2005 Backlog	% Piped
Western Cape	1 283 775	1 261 052	22 723	98
Eastern Cape	1 731 898	1 132 238	599 660	65
Northern Cape	243 429	232 013	11 416	95
Free State	857 775	817 068	40 707	95
KwaZulu-Natal	2 456 962	1 950 712	506 250	79
North West	1 032 969	879 847	153 122	85
Gauteng	2 983 460	2 891 100	92 360	97
Mpumalanga	792 524	664 975	127 549	84
Limpopo	1 344 574	973 077	371 497	72

Source: Computed from Stats SA Household Surveys 2005

Tables 3a and 3b above show that over the period 1995 to 2005 the Eastern Cape was found to have the largest backlog, followed by KwaZulu-Natal and then Limpopo. What is clear is that several provinces, such as Limpopo, the Eastern Cape and Gauteng, have an increased backlog while the Free State, KwaZulu-Natal, and the Western Cape show a decline. In Table 4 the actual numerical changes over Phases I and II are presented.

In Phase I we observe from Table 4 (ranked by volume of change in backlog in descending order, where Ch I and Ch II represent changes in backlog in Phases I and II, respectively) that the backlog decreased in the Western Cape by 72%, in the Free State by 64%, in North West by 14%, in Gauteng by 60% and in Mpumalanga by 34%. Backlog increased in the other provinces, with the highest increase, of over 100 000 (20%) being in the Eastern Cape. We observe a different scenario in Phase II from Table 4. The provinces (Gauteng, Western Cape, Free State, Mpumalanga and North West) that manifested a decreasing trend in backlog in Phase I show increase in backlog in Phase II, while provinces like the Eastern Cape that reflected huge increases in backlog in Phase I show a decreasing backlog in Phase II.

We proceed in Table 5 by showing total delivery among the provinces in the 2 phases as a major indication of the efforts of the provinces towards eliminating the backlogs.

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Table 4 Water access at provincial level						
Province	**Ch I**	**% Ch I**	**Rank I**	**Ch II**	**% Ch II**	**Rank II**
Western Cape	-31 966	-71.7	4	10 081	79.7	5
Eastern Cape	109 756	20.2	9	-53 497	-8.2	2
Northern Cape	5 099	47.5	6	-4 415	-27.9	3
Free State	-58 039	-63.6	1	7 423	22.3	4
KwaZulu-Natal	35 151	6.5	7	-73 429	-12.7	1
North West	-18 827	-13.8	5	35 954	30.7	6
Gauteng	-39 129	-60.3	3	66 589	258.4	8
Mpumalanga	-43 734	-34.4	2	44 044	52.7	7
Limpopo	41 655	18.1	8	99 915	36.8	9

Source: Computed from Stats SA Household Surveys 95-05

Table 5 The Provincial level additional delivery Phases I & II				
Province	**Ph I Total Delivery**	**Ph I Rank**	**Ph II Total Delivery**	**Ph II Rank**
Western Cape	195 152	5	150 058	4
Eastern Cape	42 893	9	312 859	3
Northern Cape	43 494	8	10 469	9
Free State	159 973	7	85 764	7
KwaZulu-Natal	393 254	1	526 260	2
North West	177 615	6	107 581	6
Gauteng	304 636	2	571 801	1
Mpumalanga	244 713	4	23 511	8
Limpopo	259 519	3	117 540	5

Source: Computed from Stats SA Household Surveys 95 - 05

Table 5 analyses how the provinces have performed in terms of delivery. Total additional delivery is presented in Table 5 (ranked by volume of delivery, where Del I and Del II represent total delivery in Phases I and II, respectively). Dramatic changes in total delivery between Phase I and II could be noted in the Eastern Cape, where delivery increased from 43 000 in Phase I to 313 000 in Phase II, delivery in Free State decreased from 160 000 in Phase I to 86 000 in Phase II while Mpumalanga was shown to have made a dramatic decrease in delivery from 245 000 in Phase I to 24 000 in Phase II.

Figure 2 graphically highlights the outcome of strides in delivery compared with changes in households in the provinces, to further draw attention to some conception of effectiveness in the provinces, as in the previous tables. On this basis, KwaZulu-Natal, Western Cape, Free State, Northern Cape and Mpumalanga appear to at least be measuring up with the pressure of additional demand as a result of household growth. However, this does not take into account the demands due to prior backlogs.

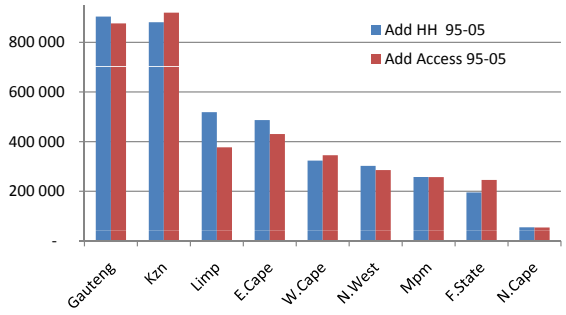

Figure 2
Comparing change in household numbers and access

Another approach towards the comparative analysis of performance of provinces would be to make an assumption that holds the total numbers constant at 2005, assuming no additional demand, and then computing the time it would take the provinces to eliminate backlog at the rates of delivery in Phases I and II.

Table 6 The number of years to end backlog			
Province	**Average annual deliver**	**2005 Backlog**	**Years to end backlog**
Western Cape	30 012	22 723	01
Eastern Cape	62 572	599 660	10
Northern Cape	2 094	11 416	05
Free State	17 153	40 707	02
KwaZulu-Natal	82 285	506 250	06
North West	21 516	153 122	07
Gauteng	114 360	92 360	01
Mpumalanga	2 476	127 549	52
Limpopo	23 508	371 497	16
South Africa	355 975	1 925 284	05

Source: Computed from Stats SA Household Surveys 95 - 05

Even on this unrealistic basis, as shown in Table 6, it will take Mpumalanga (which is not close to meeting the annual increase in households) up to 52 years to meet the demand posed by the historic backlog, Limpopo (which is also in a similar position) will take 16 years, and the Eastern Cape (which has annual access greater than the annual increase in households) 10 years. By way of comparison, the Western Cape and Gauteng could end the backlog in a single year.

There is a considerable range of differences in the changes in backlog at the provincial level. Although in the tables above it has been shown that there has been a substantial increase in delivery, which in most provinces has approached meeting the increasing number of households in each province, this increased delivery has unexpectedly not made major inroads into the prior backlog.

Provincial grouping

A suitable comparative analysis of water service delivery in the provinces would require fairly consistent data sets for each of the provinces. In an effort to control for the inconsistency we employ a grouping system of provinces with similar characteristics. Though this does not entirely eliminate the inconsistency, it could give a better depiction of events between the phases over time. We made use of 3 groups of the 9 South

African provinces; the grouping was made with respect to their initial conditions and rate of basic water service delivery over time. This was done to control for inconsistent data, as explained above, and also to reduce the problem of mismatching comparisons of provinces that initially had very different circumstances in terms of level of access, socioeconomic and political scenarios.

The groups and basis for the grouping

Table 7
The provincial groups

Group A	Group B	Group C
Western Cape	Northern Cape	Eastern Cape
Gauteng	North West	Mpumalanga
Free State	KwaZulu-Natal	Limpopo

Table 7 shows the provincial groups A, B and C with Group A consisting of Gauteng, Western Cape and the Free State. These provinces have similar initial conditions and are economically/technically more empowered to deliver; provinces in this group had recorded basic access above 95% at the start of the research period (1994/5). The intermediate group, Group B, consists of the Northern Cape, North West and KwaZulu-Natal. KwaZulu-Natal had lower initial percentage access than the two other provinces in this group, but it was included in this group based on progressive trend in delivery. Group C comprises of the Eastern Cape, Mpumalanga and Limpopo, which ranked lowest in terms of access. The prominent feature of the grouping is the reflection of the historical subdivision of the country during the apartheid era according to 'homelands', as shown in Fig. 3. Group C, which ranks lowest in terms of adequate water access, provides a good representation of the former homeland states.

Apart from looking at backlogs, initial basic access levels and the trend over time, another important basis for the grouping was to look at provincial advances at the 'rudimentary level'. Here rudimentary access as the next level of delivery is created to account for households which, although they did not fall into the basic service delivery category, have access to some sort of water delivery which may not meet the basic service standards. This category helps to clarify who is served and at what level of service delivery, and also enables community

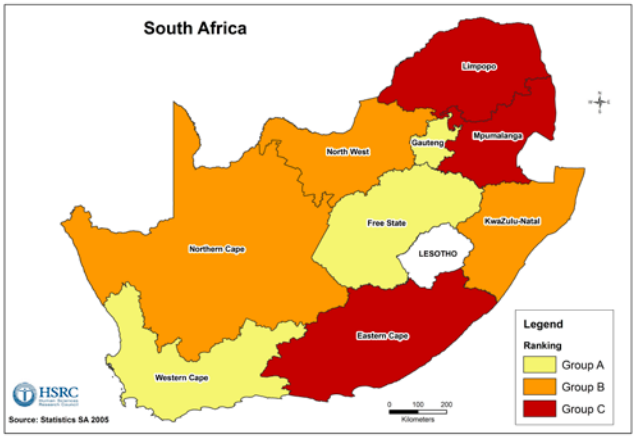

Figure 3
Location of the provincial groups
Source: Prepared by Zama S of GIS Unit of the Human Sciences Research Council

and individual self-help efforts towards service delivery to be represented in the delivery analysis. Under the rudimentary access category are households whose main water source are a public tap more than 200 m away from the dwelling, neighbour's tap, borehole (on-site or off-site), water-carrier/tanker, dam/pool or well. Studies (Hemson and Nnadozie, 2006) have shown that the majority of households seemed to transit from the 'no access' category to `rudimentary access' before getting into the 'basic access' category, especially for the more rural provinces. For instance, another reason why KwaZulu-Natal featured in Group B is the trend reflecting that a good proportion of the households in the province witnessed a direct improvement from `no access' in Phase I to 'basic access' in Phase II without having to pass through the rudimentary stage, implying better quality service delivery in KwaZulu-Natal than Eastern Cape, Limpopo and Mpumalanga.

Tables 8a to 8c provide a summary of average annual delivery, average annual change in backlog and average annual change in household number for all of the groups of provinces (A, B, C).

Table 8a
Delivery, backlog and access in Phases I and II, Group A

Parameter	Phase I	Phase II
Annual delivery	164 940	161 525
Annual change in backlog	-32 284	16 819
Annual change in HH	132 657	178 343
Piped HH	4 161 597	4 969 220
Total households (HH)	4 233 294	5 125 010

Source: Computed from Stats SA Household Surveys 95 - 05

Table 8b
Delivery, backlog and access in Phases I and II, Group B

Parameter	Phase I	Phase II
Annual delivery	187 299	105 895
Annual change in backlog	5 356	-8 378
Annual change in HH	187 655	97 517
Piped HH	2 533 096	3 062 572
Total households (HH)	3 245 774	3 733 360

Source: Computed from Stats SA Household Surveys 95

Table 8c
Delivery, backlog and access in Phases I and II, Group C

Parameter	Phase I	Phase II
Annual delivery	155 503	88 555
Annual change in backlog	26 919	18 092
Annual change in HH	182 423	106 648
Piped HH	2 327 513	2 770 290
Total households (HH)	3 335 757	3 868 996

Source: Computed from Stats SA Household Surveys 95

Table 8a shows that during Phase I, 1995-99, the initial base backlog for Group A was almost approaching elimination, implying that average annual delivery met annual additional demand and was enough to gradually reduce the initial base backlog. However, the second phase manifests an annual increase in backlogs. Table 8a shows an average annual decrease in backlog of about 30 000 per annum during the first phase. The second phase (1999-2005) shows an annual increase in backlog of almost 17 000 households per annum. Annual additional connections could be seen to be almost steady at about 160 000 per annum, while additional demand rose between Phases I and II from about 130 000 per annum to

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180 000 per annum. This explains the rising backlog during the second phase.

In Table 8b the Group B provinces show a different scenario: in Phase I the initial base backlog was rising at about 5 000 per annum while the second phase manifests an annual decrease of 8 000 in backlog, although annual additional connections were reduced from 180 000 during the first phase to about 100 000 in the second phase. The declining backlog could be as a result of declining annual additional demand, which has reduced considerably from almost 190 000 during the first phase to about 100 000 in the second phase.

As shown in Table 8c, Group C provinces witnessed a rising initial base backlog during Phase I of about 27 000 per annum. The second phase also manifests a rising trend in backlog although reduced to 18 000 per annum. Additional connections reduced from 155 000 per annum during the first phase to about 90 000 during the second phase. Although additional annual demand declined from about 180 000 to about 100 000 between the phases, it did not have the desired effect on the backlog. This could be as a result of the inability of the Group C provinces to deal with the initial base backlog.

In general, on a comparative basis, the initial condition is most favourable for Group A (Western Cape, Gauteng and Free State) provinces that started with a total backlog of 200 000 in 1995. This initial backlog was declining annually at 30 000 per annum during the first phase. The Group A provinces have also been consistent with additional delivery at 160 000 per annum. These provinces have also witnessed a rising trend in additional demand, which could easily be attributed to in-migration, as the results of the 2006 Community Survey show that Gauteng and the Western Cape are the biggest recipients of internal migrants in South Africa with migration at 43% and 23% of the population, respectively (Statistics South Africa, 2007). The Group C (Eastern Cape, Mpumalanga and Limpopo) provinces started with the most unfavourable initial conditions, with a backlog of 900 000 in 1995. Although the annual additional backlog decreased from 27 000 in 1995 to 18 000 in 2005, this cannot be attributed to accelerated delivery, but could be due to out-migration to the Group A provinces, as all of the provinces in this group reflected that more than 20% of the population had migrated from the provinces, according to the 2007 Community Survey (Statistics South Africa, 2007).

It could be noted from Tables 8a to 8c that, although average annual delivery was almost stable for Group A for Phase I and II, annual delivery decreased marginally by 2%. On the other hand, Groups B (Northern Cape, Kwazulu-Natal and North West) and C both show a substantial decline of about 43% in average annual delivery from Phase I to Phase II. Backlog was declining annually in Phase I for Group A and an increasing backlog in Phase II is evident for the same group. For Group A the annual change in household numbers increased from Phase I to II by about 34%. On the other hand, Groups B and C show a decline in annual change in household number between Phases I and II.

For Group A, percentage access rose from 95% in 1995 to 98% in 1999 and maintained the percentage access at 98% till 2005. This pattern of access could be noted where percentage access rose from the initial base of 94% in 1995 to 98% in 1999 and remained steady at 98% till 2005, irrespective of average annual delivery of over 160 000 in the Group A provinces. The inhibiting factor for reaching the 100% access mark could be attributed to in-migration from the Group B and C provinces (Statistics South Africa, 2007). Tables 8b and 8c show that annual additions to household numbers have been on the decrease among the provinces in Groups B and C but on the increase for Group A. This implies that people could be out-migrating from B and C to Group A and thus the resultant effect is the persistent backlog in the Group A provinces at about 2%. For Group B, an increase in percentage access from 72% in 1995 to 80% in 1999 and 83% in 2005 is noted. Although delivery slowed, percentage access increased as a result of a decreasing number of additional households over the years. This group of provinces could be said to be passing through the rapid rate of growth in percentage access. For Group C provinces, Tables 8c indicates that they started with the lowest access, at about 66%, in 1995. Although percentage access increased from 66% in 1995 to 69% in 1999 and to 71% in 2005, delivery declined significantly and additional household numbers also declined.

The proportion of households with basic access for Group A could be described using the logistic model, as in Eq. (1). Available data show that Group A had completed the movement on the logistic line having reached the limiting steady state at 98% as shown in Fig. 4. Group B could be described as being in the rapid advancement stage following an exponential function (Eq. (2)). The model predicts that, all things being equal, the Group B provinces could achieve 100% access in about 2015 at the current rate of delivery and demographic change. A boost in delivery could make a huge difference in enabling these provinces to approach 100% access, as these provinces are favoured by out-migration. We observed the Group C provinces to be at the slow stage of growth following a linear model (Eq. (3)). Though these provinces are also favoured by out-migration, lack of sustained delivery and improved capacity are major issues of concern and delivery dropped quite remarkably.

The models that describe the patterns of access among the provincial groups are given in Eqs. (1) to (3) below:

$$A(t) = \frac{K}{1 + \left(\frac{K}{A_0} - 1\right) \exp\left(-r_0 t\right)} \quad (1)$$

$$B(t) = B_0 exp^{rt} \quad (2)$$

$$C(t) = C_0 + rt \quad (3)$$

These patterns of growth are represented graphically for the respective provincial groups in Fig. 4.

A notable inference from the numerical outcomes and graphics presented so far is the important issue of development of delivery capacity in the various provinces. The Group A provinces could be noted to have made remarkable progress in terms of sustaining levels of delivery and even improving on delivery figures, from 660 000 delivered in Phase I to 800 000

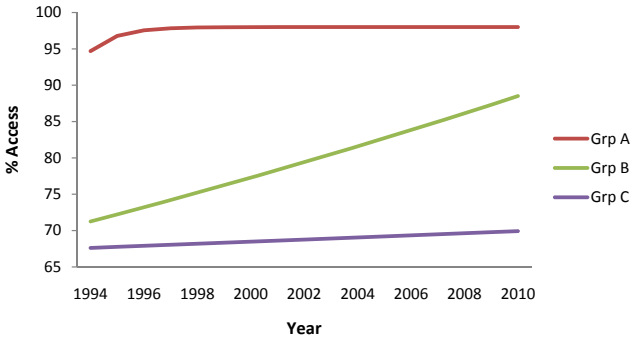

Figure 4
Pattern of access among the provincial groups

delivered in Phase II. However, Groups B and C show decline in delivery over the phases, where Group B was down from 700 000 to 500 000, and Group C from 600 000 to 400 000 from Phase I to Phase II. This highlights issues and questions around capacity and capacity building in these provinces, i.e., the ability of the provinces to at least sustain a steady delivery thrust and gradually improve on it.

Variations on level of access and delivery over time could be noted when all of the provinces are considered separately. When the provinces are grouped according to some matching criteria, the wide variations are spread across the provinces and less fluctuation could be noted. Delivery slowed in Groups B and C from Phase I to Phase II (95-99 to 00-05), whereas the Group A provinces maintained the delivery thrust between the phases and also had a marginal increase in delivery. While demographic factors such as household fragmentation and internal migration could have played a contributing explanatory role in the access dynamics seen among the provincial groups, the water services national information system (DWA, 2011) outlined factors that may have direct impacts on water backlogs in the provinces. These factors include water infrastructure problems, operational /maintenance issues, water resource problems and housing problems. Infrastructural problems are seemingly spread across the provinces; KwaZulu-Natal is the province with the highest number of cases of no water infrastructure (40%), followed by Limpopo at 20%. Eastern Cape and Mpumalanga contribute 13% and 12% of cases of no water infrastructure, respectively (DWA, 2011). Operation/maintenance problems seem to be a setback peculiar to the Group C provinces; Limpopo accounts for 70% of cases of operational maintenance issues while Mpumalanga accounts for 29% (DWA, 2011). South Africa is a semi-arid country; available fresh water reserves should be treasured and managed country-wide as a collective effort. However, the water services national information system reports show that Limpopo accounts for 39% of backlog issues related to water resource problems, with KwaZulu-Natal contributing 30% and the North West and Mpumalanga contributing 20% and 10%, respectively (DWA, 2011). Backlogs due to housing problems featured most prominently for the Group A provinces; Gauteng contributes 45% in this category and the Western Cape 36% (DWA, 2011). This could be as a result of high in-migration into these provinces, especially with regard to unskilled and poor migrants as they increase the population and household numbers in the informal settlements.

Conclusion

This research attempted to evaluate the process of attaining universal access to adequate water in the post-1994 era. An outstanding characteristic of the evaluation process was the very diverse initial conditions of access to basic water services at the dawn of the new South Africa in 1994/95. It was observed from the possible interplay of water infrastructural problems, water resources, demographic factors and delivery capacity (that is, the ability to sustain the delivery thrust) that the declining trend of water service delivery in later years is only applicable to the provinces in Groups B (Northern Cape, KwaZulu-Natal and North West) and C (Eastern Cape, Mpumalanga and Limpopo). The Group A (Western Cape, Gauteng and Free State) provinces show evidence of sustainability of delivery levels and achieved an improvement on additional delivery from 660 000 in Phase I to 808 000 in Phase II.

The investigation of the dynamics of change in numbers of households and the interaction with demand and access rates of the provincial groups shows that, where the existing service base is low, with a relatively high level of out-migration leading to a decrease in household numbers, the annual rate of delivery is lower than in other provinces and the percentage access rises marginally. In the provinces where the existing service base was higher and there is a relatively lower level of emigration, there is a marginal change in household numbers, the annual rate of delivery is faster and the percentage access rises significantly. In the provinces with the most favourable initial conditions, i.e., those in which the existing service base was the highest, there is remarkable change in household numbers as a result of immigration and the annual rate of delivery is quite sustainable. Percentage access rises at an early stage and remains stable at the limiting value.

In fitting the advancement in access for the provinces to various equations it was observed that the provinces in Group A have progressed along the logistic line, having reached the limiting steady state. Group B could be described as being in the rapid advancement stage. The model predicts that, all things being equal, the Group B provinces could achieve 100% access in about 2015 if the current rate of delivery and demographic change are maintained. A boost in delivery could make huge differences in enabling delivery levels to approach 100% access, as these provinces are favoured by out-migration. Group C provinces were found to be at the slow stage of growth, though these provinces are also favoured by out-migration. Lack of capacity is a major issue of concern and delivery dropped quite remarkably. The Group A provinces would require only a small boost in delivery and utilisation at maximum capacity in order to overcome their current limiting tendency to achieve 100% access, in a year or two, through strategic planning and good understanding of the impact of demographic factors.

The results imply that in as much as service delivery programmes and policies should focus on the formerly disadvantaged poor and rural communities, adequate provision should also be made for the surge of internal and international migrants into urban areas. The slowed rate of delivery in the Group C (Eastern Cape, Mpumalanga and Limpopo) provinces and the in-migration into Group A (Western Cape, Gauteng and Free State) provinces might hinder the attainment of the water target of the millennium development goals in South Africa if the current trend continues.

Future research would entail the extension of this analysis using the 2010 rounds of national household data, as they become available, in order to observe the most recent trends and the changes that may have occurred over the period 2005 to 2010 (Phase III).

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