REPORT No: P WMA 19/000/00/0507
Volume 2 of 7

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
Directorate: National Water Resource Planning

WESTERN CAPE WATER SUPPLY SYSTEM: RECONCILIATION STRATEGY STUDY

Determination of Future Water Requirements

FINAL

June 2007

CITY OF CAPE TOWN | ISIXEKO SASEKAPA | STAD KAAPSTAD

Submitted by:
Ninham Shand (Pty) Ltd in Association with
UWP Consulting (Pty) Ltd

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WESTERN CAPE RECONCILIATION STRATEGY STUDY

VOLUME NUMBER	REPORT TITLE	
1	Reconciliation Strategy	
2	**Determination of Future Water Requirements**	✓
3	Scenario Planning for Reconciliation of Water Supply and Requirement	
4	Overview of Water Conservation and Demand Management in the City of Cape Town	
5	Treatment of Effluent to Potable Standards for Supply from the Faure Water Treatment Plant	
6	Overview of Water Re-use Potential from Wastewater Treatment Plants	
7	Summary Report	

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Paul Rhode : City of Cape Town

THE WESTERN CAPE WATER SUPPLY SYSTEM RECONCILIATION STRATEGY

EXECUTIVE SUMMARY

The Department of Water Affairs and Forestry (DWAF) commissioned the Western Cape Reconciliation Strategy Study to facilitate the reconciliation of predicted future water requirements with supply from the Western Cape Water Supply System (WCWSS) for a 25 year planning horizon. The WCWSS serves the City of Cape Town (CCT), other urban users and irrigators and consists of infrastructure components owned and operated by both CCT and DWAF. The Study seeks to provide a decision support framework to facilitate timeous decisions regarding appropriate water resource interventions to ensure that the anticipated future water requirements can be met on a sustainable basis. As part of the overall study an analysis was undertaken to determine high and low future water requirement scenarios. These water requirement scenarios are then used as the basis from which more detailed scenario planning is undertaken.

The future water requirement study also provides information on the historic trends that underpin water demand patterns.

Historic trends
The historic trends that were analysed were:

- Water requirements for the City of Cape Town
- Population growth in the Greater Cape Town Area
- Economic growth in the Western Cape and Greater Cape Town Area

Historically, the annual requirements for water have generally increased consistently over time, with the exception of the restriction periods experienced post 2000.

Population growth rates were shown to decline with time (1972 to 2001) owing to the impact of HIV Aids, the out-migration of working-age residents and a decline in fertility rates.

The economic growth for the period 1996 to 2006 was shown to be higher than the National average, but lower than other Metropolitan Areas. The biggest contributor to the growth in the economy in the Greater Cape Town Area was the services industry, and in particular, the financial services industry.

For the period 1996 to 2006, the growth rate in water requirements was found to be lower than the economic growth rate, but higher than the population growth rate.

Forecasts
Two water requirement scenarios were forecasted using a model developed in Excel containing the parameters contained in the Table below. The results of the model in terms of the average growth in water demand for the forecast period is also contained in the Table.

Water requirement scenario	Average growth in water demand (%)	Population growth rate (% per annum)			Economic growth rate (% per annum)	
	2006 – 2030	2006-2011	2011-2016	2016-2030	2006-2010	2010-2030
High	3.09	1.12	1.38	1.74	4.5	6
Low	1.43	0.16	0.36	0.70	4	4

As illustrated in the table above, it is anticipated that the future growth in water requirement will be lower than the economic growth rate, but higher than the population growth rate.

Conclusions

Based on the assumptions used in the modelling, it is anticipated that the water requirements for the WCWSS will grow from 502 Mm^3/annum in 2006, to approximately 935 Mm^3/annum in 2030, for the High Growth Scenario and from 465 Mm^3/annum in 2006, to approximately 670 Mm^3/annum for the Low Growth Scenario.

It is recommended that :

a) The actual population and economic growth rates need to be monitored and the model updated when new information and projections become available.
b) The actual water use by user category should also be monitored, as these figures form the basis of future water requirement projections.
c) Due to the fact that restrictions are still in force, that the model be run on an annual basis to determine the impact of a change in base year demand.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
Directorate National Water Resource Planning
WESTERN CAPE WATER SUPPLY SYSTEM RECONCILIATION STRATEGY
Determination of Future Water Requirements

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ABBREVIATIONS AND ACRONYMS

AsgiSA	Accelerated Sustained Growth Initiative for South Africa
CCT	City of Cape Town
CMA	Cape Metropolitan Area
DWAF	Department of Water Affairs and Forestry
GDP	Gross Domestic Product
GGP	Gross Geographic Product
HIV/Aids	Human Immune Virus/Acquired Immune Deficiency Syndrome
IDP	Integrated Development Plan
IFR	Institute for Futures Research
UAW	Unaccounted for Water
WCWSS	Western Cape Water Supply System
WC/WDM	Water Conservation and Water Demand Management
WMA	Water Management Area

1. INTRODUCTION

The Department of Water Affairs and Forestry (DWAF) commissioned the Western Cape Reconciliation Strategy Study to facilitate the reconciliation of predicted future water demand scenarios with supply from the Western Cape Water Supply System (WCWSS) for a 25 year planning horizon. This report forms part of the Western Cape Reconciliation Strategy Study and describes the methodology for determination of the future water requirements for the Cape Metropolitan Area (CMA).

A further objective of the water requirement study was to develop a long-term forecasting model to be used for updating the future requirement scenarios. According to Baumann *et al*. (1988), the following general statements can be made about the water use forecasts that are typically performed for this purpose:

- The forecasts usually focus on aggregate water use including unaccounted-for water and not on a detailed breakdown of each category of water use.
- Only a single dimension of water use is forecast. This could be the average annual use or the maximum daily use or the maximum monthly use, depending on the requirements of the planning process. Typically, no further attention is given to seasonal variation in water use.
- The forecast methods chosen are likely to be simplistic.
- Long-term forecasts should be performed regularly, based on the best available information at the time.

Forecast methods are distinguished by the manner in which they explain past water use. In terms of complexity, this can range from a pencil line drawn on graph paper, to the most sophisticated econometric model.

The simplest method of forecasting is the time-extrapolation method. Water use is represented as a time series, with historic observations fitted to a smooth curve by graphical or mathematical curve-fitting methods. Once the curve is fitted, forecasting is simply done by extending the curve into the future.

After an analysis of the historic water use patterns, it was decided to use a bivariate forecast model, where the forecasted water use is a function of the historic per capita water usage and predetermined variables, such as population and economic growth rates.

It is essential to understand the historic trends in terms of water usage patterns, in order to determine factors that impact on future water requirements. Against this background, the report is presented in two sections. The first section reports on the historic trends with regards to population growth, economic growth and water usage. The second section presents the forecast in respect of population and economic growth and the water demand forecast results are given.

2. HISTORIC TRENDS

It is imperative to understand historic water use and the factors affecting it, before a forecast can be done. Based on the Review of the Long-Term Urban Water Demand study previously undertaken for the City of Cape Town in 2005, (City of Cape Town, 2005), it is assumed that future water demand growth is predominantly driven by population and economic growth. This section presents the historic trends with regards to water requirements and the historic population and economic growth, and proposes a relationship between these three variables.

2.1 Water requirements

For the purposes of understanding the historic water requirement patterns, an aggregate of total water consumption per annum was used and the average annual daily requirements were plotted as a function of time. The data for the period 1972 to 2006 is presented in **Figure 2.1**. Water requirements are calculated from July through to June, as this allows direct comparison with the economic and population growth rates.

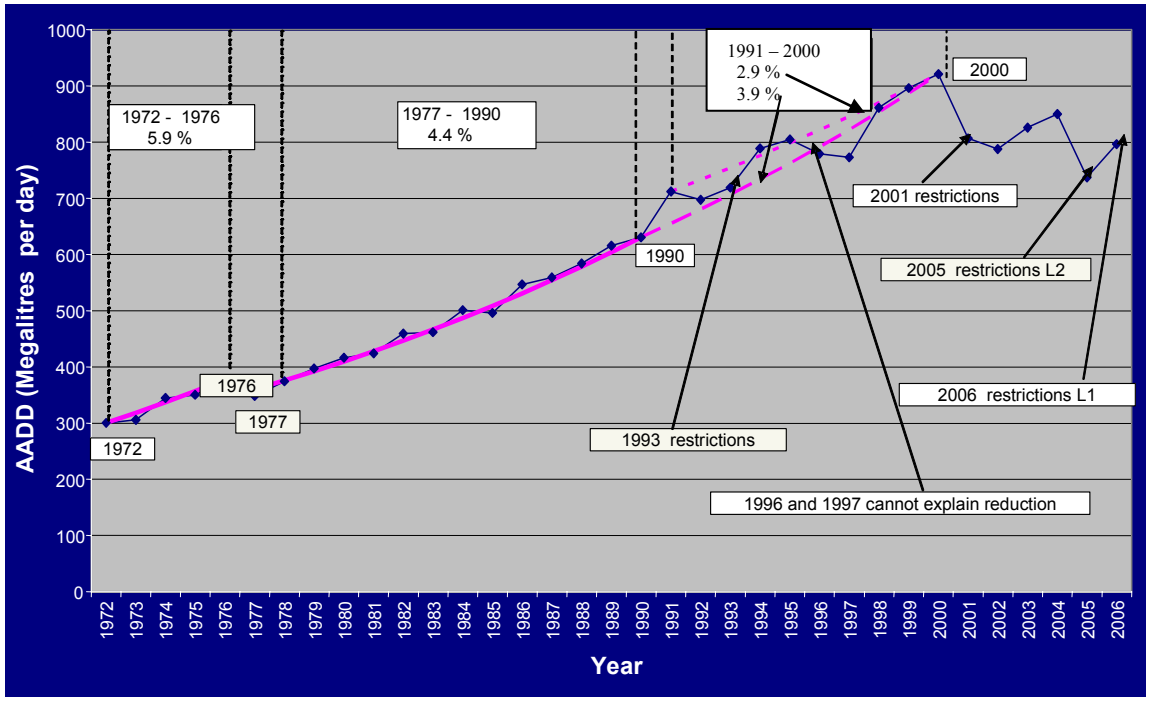

Figure 2.1 Water requirements for the period 1972 to 2006 (data received from the City of Cape Town) (L1 restriction is a 10% restriction level and L2 is a 20% restriction level)

There are three distinct periods of water requirements that are characterised by a similar year on year increase in water requirements (water requirement growth rate, %) these are:

Period	Water requirement growth rate (%)
1972 – 1976	5.9
1977 – 1990	4.4
1991 – 2000	2.9 – 3.9

Historically, the annual requirement for water has generally increased consistently over time, with the exception of the restriction periods experienced post 2000. The historic water requirements have also been marked by stepped declines between 1976 and 1977 and then again in 1991, 1995 and 1996. As part of the *Review of the Long-Term Urban Water Demand* study, the reason for these declines was investigated and the factors that were considered to influence water demand patterns were:

- climate,
- water restrictions, and
- user education.

The findings of the study were that:

- There is a strong seasonal pattern of water requirement coinciding with a winter rainfall regime (shown in **Figure 2.2**). However, the year on year changes in climate (rainfall and temperature) does not explain the structural drop in water requirement, which occurred from the summer of 2000/1. This period also coincided with the imposition of restrictions and a high-profile public-awareness campaign.
- There is soft evidence of a future possible structural shift back to the previous (pre-summer 2000/1) pattern in the summer of 2002/3. Restrictions (with the associated tariff increases), consumer education and water demand management initiatives, appear to have had a very significant impact on total daily water supplied to Cape Town, at least for the period between 2000 and 2005 (see **Figure 2.3**).

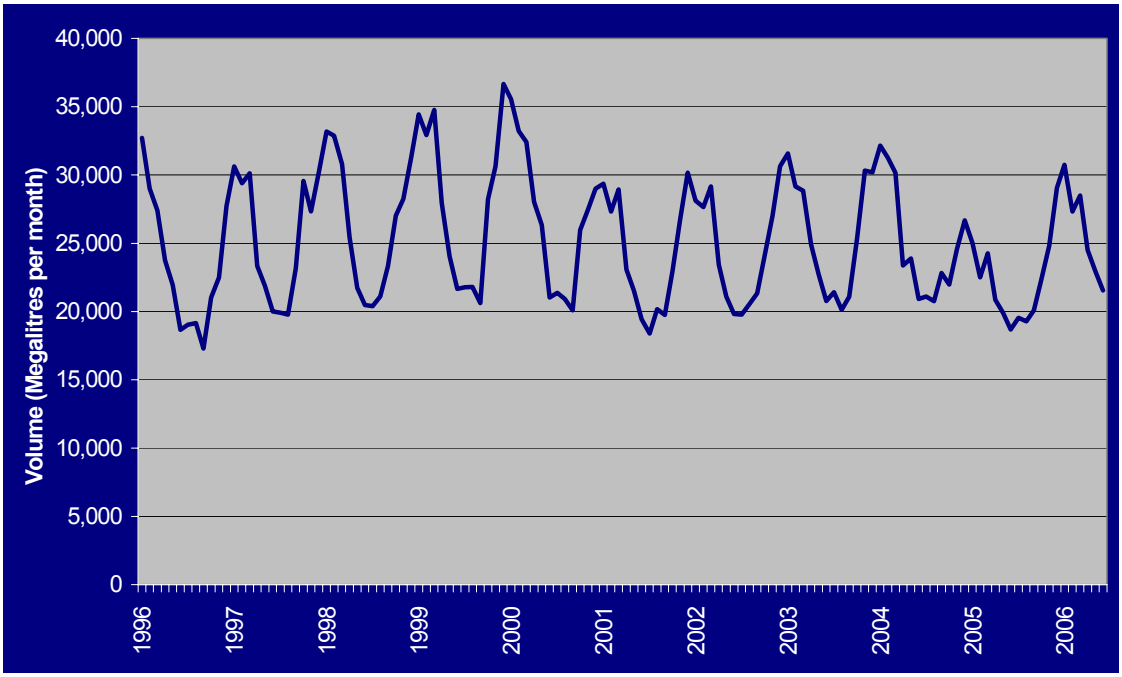

Figure 2.2 Seasonal water use patterns (data received from the City of Cape Town)

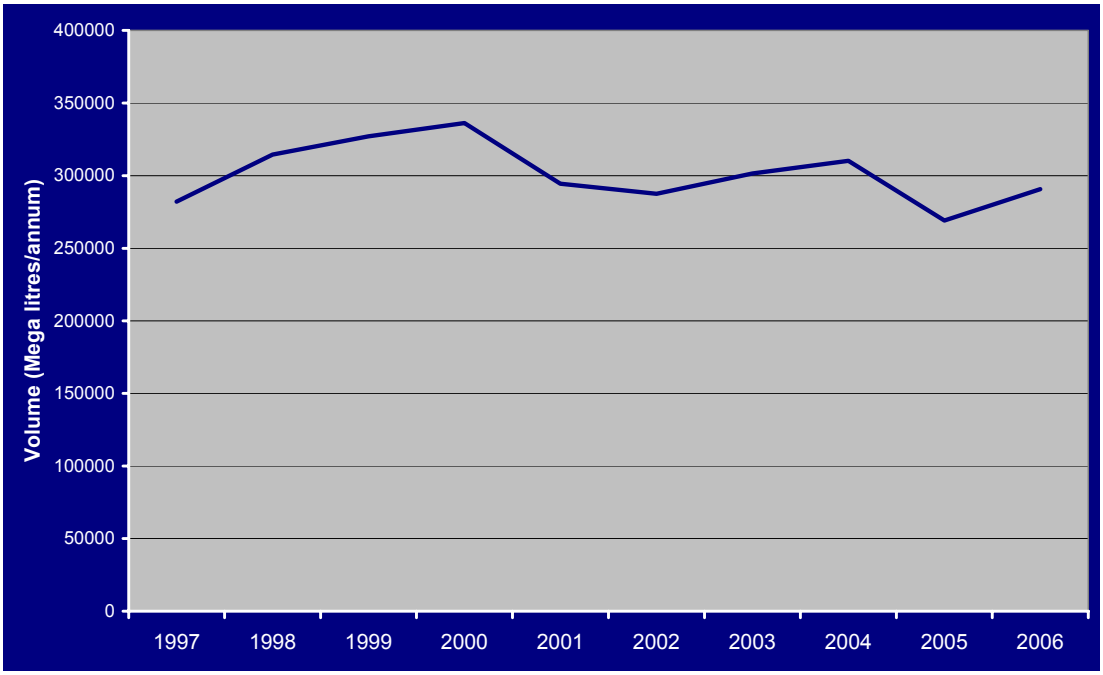

Figure 2.3 Bulk water supplied by the City of Cape Town (data received from the City of Cape Town)

2.2 Economic growth

For the period 1998 to 2002 (see **Figure 2.4**) the economic growth rates for the Greater Cape Town Area and the Western Cape followed a trend similar to the national average. In 2003, the Greater Cape Town Area showed a marked increase, reaching a Gross Geographic Product (GGP) (the regional equivalent of the national Gross Domestic Product (GDP) of 5.22 %, but this was followed by a decrease in the subsequent year to 4.01 % (lower than the Western Cape and national GDP).

According to the City of Cape Town's Integrated Development Plan (IDP) the economic performance of Cape Town over the past decade has been "totally inadequate to address the challenges of poverty". The rate of economic growth over the decade has been similar to the population growth rate resulting in a limited increase in the average per capita income. The unemployment rate is approximately 19.7% and is growing, with informal trading, which is mostly subsistence in nature, constituting some 10 to 20% of the economy.

Since 2000, the economic performance of Cape Town has been weak relative to other metropolitan areas. The performance prior to 2000 was higher than the national average owing to the structure of the national economy (low national growth, a declining rand and a big post democracy increase in tourism and agricultural exports). The growth in the economy of the Western Cape was due to the strong growth in the services industry while the growth of the manufacturing industry was disappointing. The improving national economy, the demand for resources by the Indian and Chinese economies and the growth of the national domestic market (concentrated in Gauteng) have had strong spin-offs for the Cape Town economy. However, in order to achieve a sustainable growth rate of 6% (as proposed by the Accelerated Sustained Growth Initiative for South Africa (AsgiSA)), a series of decisive interventions will be required by National, Provincial and Local Government.

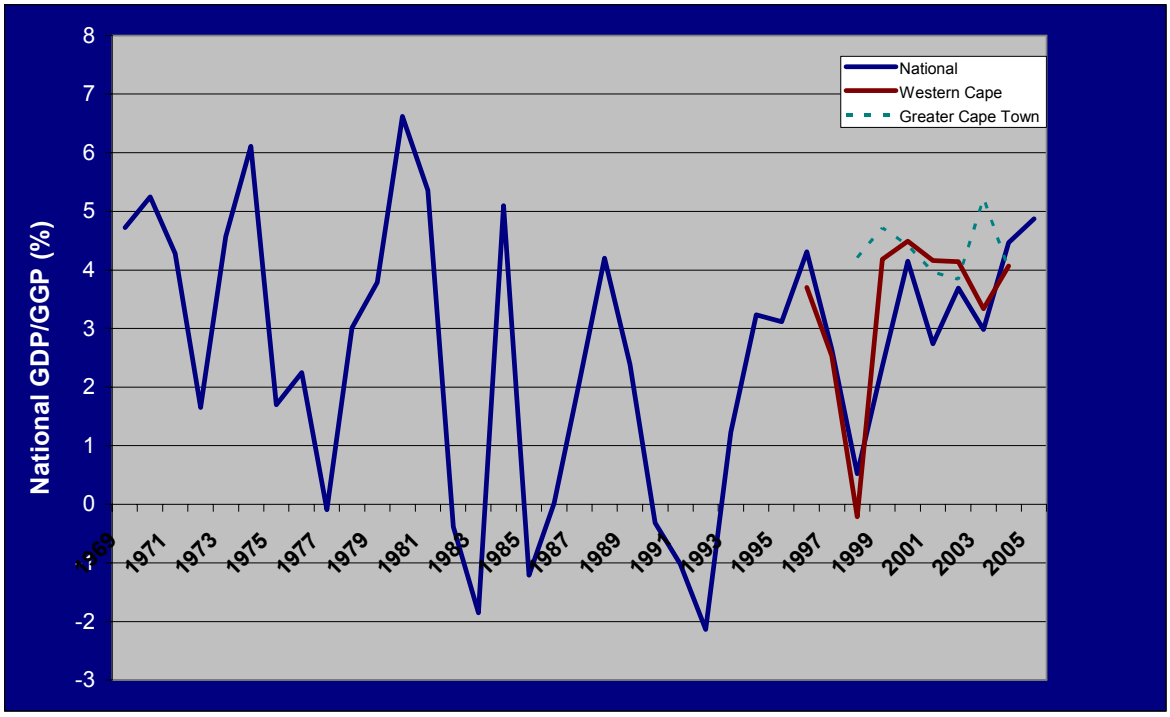

Figure 2.4 Economic growth rate for the period 1970 to 2006 (data from Stats SA, SA Reserve Bank and Wesgro)

For the purposes of correlating water requirements with economic growth (given in **Section 2.4**), a breakdown of the sectoral contributions to the GDP is given in **Table 2.1**. The most significant contributor to the expansion of the economy was the tertiary or services industry and in particular, the financial services industry. Traditionally, the services industry has not been a major consumer of water. These have been the primary and manufacturing industries.

Table 2.1 Sectoral Contributions to the Overall GDP Growth for the Western Cape for the Period 1995 to 2006 (data from the IFR and Wesgro)

Economic Sector	Percentage contribution
Total	**100**
Primary industries	**2.7**
Agriculture, forestry and mining	4.4
Mining and quarrying	-1.7
Secondary industries	**15.0**
Manufacturing	5.6
Electricity and manufacturing	3.9
Construction	5.4
Tertiary industries	**82.4**
Wholesale and retail trade, hotels and restaurants	14.5
Transport and communication	26.1
Finance, real estate and business services	41.3
Community social and other personal services	3.2
General government services	-2.7

2.3 Population growth

The historic population numbers presented are those obtained from Stats SA and Dorrington (2005). The numbers obtained from Dorrington (2005) are the Census numbers adjusted upwards for undercounting. During the review of the Census, *inter alia*, the following potential deficiencies within the results for the total population were identified (Statistics Council 2003):

- under-enumeration of the 0-4 year olds,
- too few foreigners identified,
- age mis-statement, particularly age exaggeration, particularly across the pension age for both males and females,
- too few male in-migrants and/or significant male undercount (relative to the number of females),
- an excess of teenagers,
- potentially significant undercount of the White population, and
- slightly greater than expected Coloured population.

Both the Stats SA and Dorrington projections are presented in **Figure 2.5**, and represent a typical population profile for a growing nation (i.e. an increase in numbers with time). The very low population numbers in the years prior to 1994 are as a result of not accounting for Black Africans.

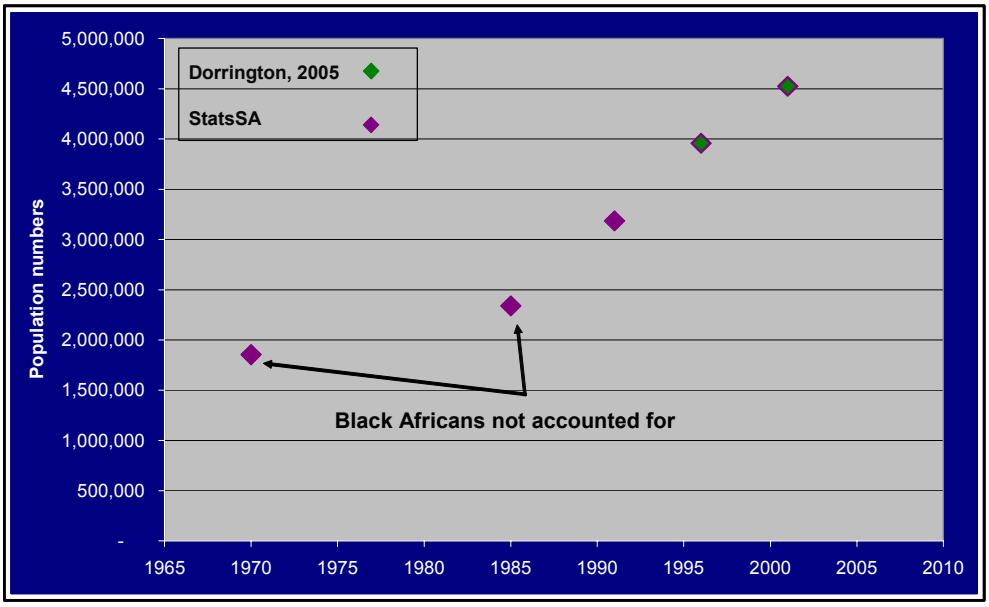

Figure 2.5 Discrete population numbers for the Greater Cape Town Area for the period 1970 to 2001 (data from Stats SA and Dorrington, 2005)

Based on the population numbers shown in **Figure 2.5** the population growth rates are shown in **Figure 2.6**. The initial increase is due to an adjustment being made for Black Africans who were not originally accounted for. The declining trend thereafter has been explained by Dorrington (2005) as being due to the impact of HIV Aids, a decline in fertility rates and an out migration of working age residents.

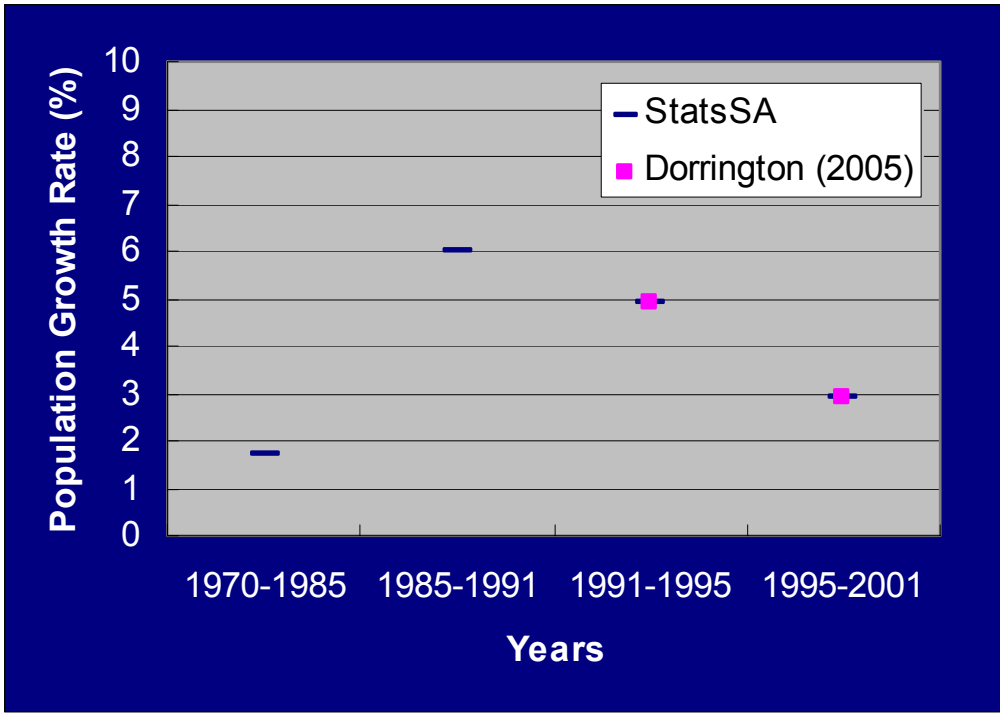

Figure 2.6 Economic growth rates (data from Stats SA and Dorrington, 2005)

2.4 Comparison of the water requirements, economic growth and population growth

In order to get an understanding of the relationship between water requirements and the economic and population growth rates, the three variables were plotted as a function of time in **Figure 2.7**. For the period pre-1996, where no actual economic data was available for the City of Cape Town, no clear trend is observable. However, the City of Cape Town's IDP does state that: *Since 1980, Cape Town's economic growth rate has, on average, exceeded the national growth rate by half a percentage point. For the City of Cape Town, economic growth between 1990 and 2000 averaged 2.6% per annum.* After 1996, it is evident from the actual data that the growth rate in water requirement is higher than the population growth rate, but lower than the economic growth rate (**Figure 2.8**). According to Baumann *et al* (1988) this is generally the case and consequently one can use the population and economic growth rates to forecast the water requirements using a bivariate method. The bivariate model calculates future water use based on the past water requirement and a variable, for example:

Water requirement in year (X+1) = Water requirement in year (X) + Water requirement in year (X) * (economic growth rate or population growth rate)

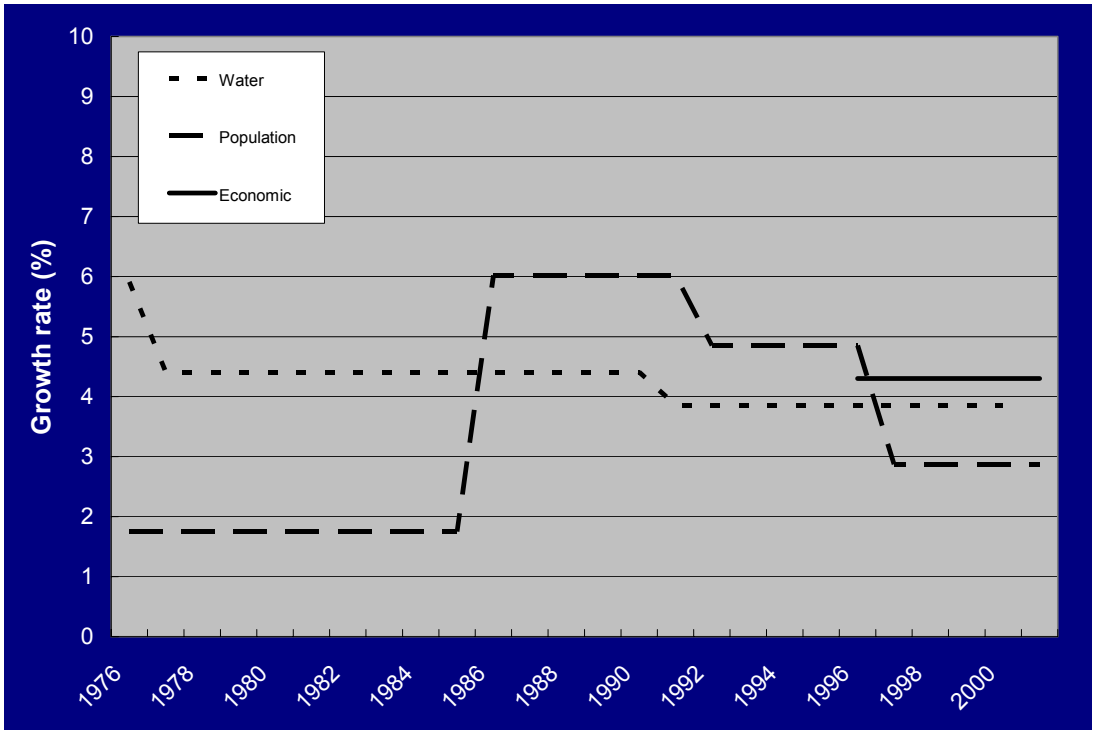

Figure 2.7 Comparison of water requirement, economic and population growth rates (data from the City of Cape Town, Stats SA, IFR and Dorrington, 2005)

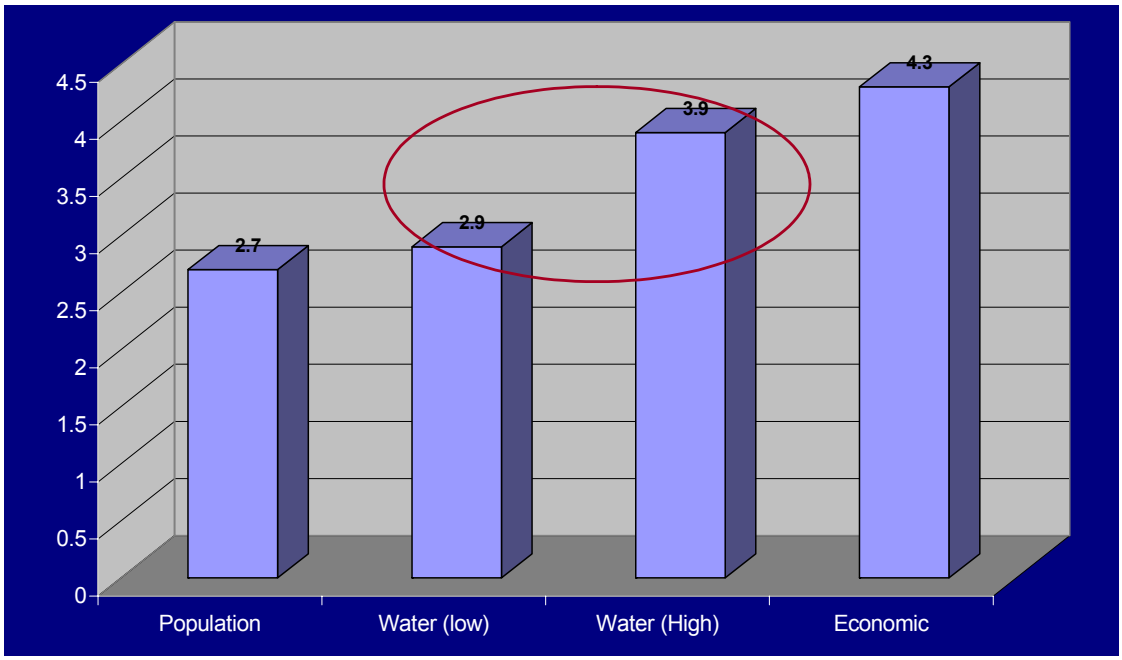

Figure 2.8 Average growth rates for the period 1995 to 2001

The water (low) and water (high) per annum growth rates shown in **Figure 2.8** depict the range of possible average historic growth rates of water requirements between 1991 and 2000. These per annum growth rates are illustrated graphically in **Figure 2.1**. The average population and economic growth rates also depict the historical growth rates for the period 1995 to 2001.

3. METHODOLOGY FOR WATER REQUIREMENT FORECASTS

With an understanding of the historic trends in terms of water requirements, population and economic growth rates a forecasting methodology was developed. The proposed methodology and forecasting results are discussed below.

3.1 Methodology adopted

An MS-Excel model was developed to model future water requirements in the Greater Cape Town Area over the next 25 years. The model was used to establish alternative scenarios for the future water requirements of the Western Cape Water Supply System (WCWSS). The alternative scenarios are considered to be dependent on the following main variables:

- Population growth rate
- Economic growth rate

The alternative scenarios can also be based on high and low population and economic growth rates, as well as various levels of water services and other variables.

3.2 Structure of model

A simplistic representation of the model is shown as **Figure 3.1**. The model can be divided into three sections, *viz*: inputs, calculations (engine) and outputs.

The key components on which the model is based are:

- Residential water requirements,
- Non-residential water requirements,
- Unaccounted-for Water (UAW), and
- Bulk sales.

These components were populated in the model during the development phase and are used to provide the future requirements. It forms part of the engine of the model (detailed below).

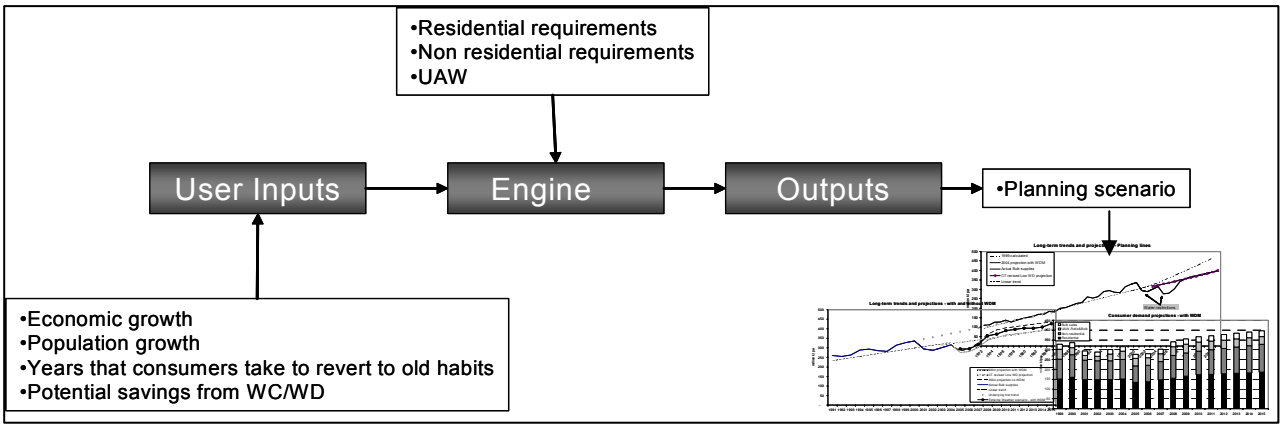

Figure 3.1 Graphical representation of the model

3.2.1 Input Data

The inputs are defined as those parameters that the user can enter before running the model. Default numbers are available in the model, but can be updated once better, more recent information becomes available. The input variables are:

- Economic growth projections.
- Population growth rate projections and rate of growth of households.
- Number of years to revert back to old habits – following water restrictions or an intensive Water Conservation/Water Demand Management (WC/WDM) media campaign. It normally takes a number of years for consumers to return to their previous habits. The number of years can be specified as an input variable in the model.
- Potential permanent savings – WC/WDM interventions can lead to permanent savings in water demand. These savings can be incorporated as an input variable in the model.

The selection of appropriate input data for this study is discussed in **Section 3.3**.

3.2.2 Calculations (engine)

The algorithm on which the model is based is included in the 'engine' module. The following parameters can be varied by the user in order to test the sensitivity on various water requirements planning scenarios.

- Residential requirements
- Non-residential requirements
- Unaccounted-for water, and
- Bulk water sales (use)

Residential water requirements

The prediction of future water requirements is based on the number of water connections and the average water requirements per connection. The number of water connections was obtained from the Census household data and the average water requirement per connection from historic water use data. The future water requirements of residential users was determined by initially escalating the number of connections by taking into consideration household growth rates, due to new connections as well as changes in requirements of existing users owing to migration to higher service level groups. The projected number of water users is then multiplied by the per-household consumption to give the projected water demand. This water requirement is then escalated/deflated by taking into account price elasticity and changes on tariffs. As a result of this, the total future water requirement by residential users is provided as an output.

Non-residential water requirement

In the non-residential element of the model the following users are accounted for:

- Commercial
- Schools and sportsfields
- Tourism
- Residential institutions
- Heavy industry
- Government and municipality

- Agricultural; and
- Small users

The determination of future non-residential water requirements is achieved by escalating the present water usage with either the economic or the population growth rate. Typically, the water usage for schools and sportsfields and residential institutions are escalated with the population growth rate, while the remaining users are escalated by the economic growth rate.

Unaccounted-for Water (UAW)

The baseline value for UAW is 13.6% as provided by the City of Cape Town (excluding bulk water UAW). The actual quantity of UAW is calculated by equating the sum of the residential, non residential and UAW to the bulk water requirement. Any restriction in UAW is seen as a water demand management intervention which will reduce the total water requirement for the City of Cape Town.

3.2.3 Outputs

The outputs that the model provides include:

- Future water requirements as a function of selected parameters, e.g. various planning scenarios, high and low water requirement scenarios, etc.
- Projected usage by consumer groups, including:
  - Domestic
  - Non-residential
  - External sales
- Predictions for UAW

3.3 Sources of information and assumptions made as input to the model

The forecasted water requirement scenarios are estimated for the following variable parameters :

1. Forecasted population growth rates
2. Forecasted economic growth rates, and
3. The base year.

3.3.1 Population Growth Rates

Two different projections for future population growth rates have been carried out for the City of Cape Town recently, namely a population projection by the IFR (2004) and by Dorrington (2005). Both of these use the 2001 Census data as the baseline from which the projections are made.

The IFR (2004) has migration as implicit in the model and has high and low population growth scenarios based on:

- No HIV/AIDS (high scenario)
- With HIV/AIDS (low scenario)

The Dorrington (2005) projection has HIV/AIDS as implicit and has a high, middle and low scenario based on migration patterns:

- The high scenario assumes that migration continues at the present rate
- The middle scenario assumes that migration reaches an equilibrium, and

- The low scenario assumes that the migration pool from the Eastern Cape has decreased significantly

The full report produced by Dorrington (2005) is included in Appendix A.

The forecasted population growth rates as defined by the IFR and Dorrington (2005) are shown in **Figure 3.2** and **Table 3.1**. For completeness, the historic trend is also included. From the analysis of historic (1996-2001) and projected (2001-2021) demographic trends in the City of Cape Town and adjacent municipalities, the following conclusions can be made that are important for water requirement/consumption analyses:

- The City of Cape Town, currently home to 64% of the Western Cape population, will continue to experience relatively high, though declining, population growth rates during the projection period, primarily as a result of continued in-migration to the City, particularly from the Eastern Cape Province.
- In absolute numbers, the population of the City of Cape Town is projected to increase by 44%, from 2.89 million in 2001 to 4.18 million by 2021, while the number of households is expected to increase by 56%, from 763 000 in 2001 to 1.19 million by 2021 (Dorrington, 2005). Such an increase will have significant impacts on the availability of, and requirement for, potable water in the City.
- However, because of the demographic impact of the HIV/AIDS epidemic (i.e. increasing mortality rates and declining life expectancies at birth) and declining fertility rates (as a result of urbanisation, higher educational attainment levels, improving living standards and increased use of contraceptives), the growth of the population of the City of Cape Town and the number of households is projected to be significantly smaller than in the absence of the AIDS epidemic.
- Although the Western Cape still has the lowest HIV prevalence rates in the country, the rates will increase significantly during the next decade, resulting in rising mortality rates and increasing numbers of AIDS-sick people in need of medical care and hospitalisation, which could increase the demand for water.
- The City of Cape Town is, and will continue to experience a net gain of migrants during the projection period, primarily from the Eastern Cape. This continued inflow of migrants to Cape Town will increase the demand for housing, educational facilities, health care facilities and infrastructure, and therefore also the demand for water and sanitation services.
- With regard to the five adjacent municipalities, the total population is also projected to continue to grow during the projection period in spite of declining fertility rates and increasing mortality rates as a result of HIV/AIDS. The projected population increase of 37% to 690 000 by 2021 is primarily as a result of continued in-migration, particularly into the Stellenbosch and Drakenstein Municipalities. The total number of households in the five municipalities is projected to increase from 129 654 in 2001 to 193 048 - an increase of 49%. Such an increase will also increase the requirement for potable water in the region.

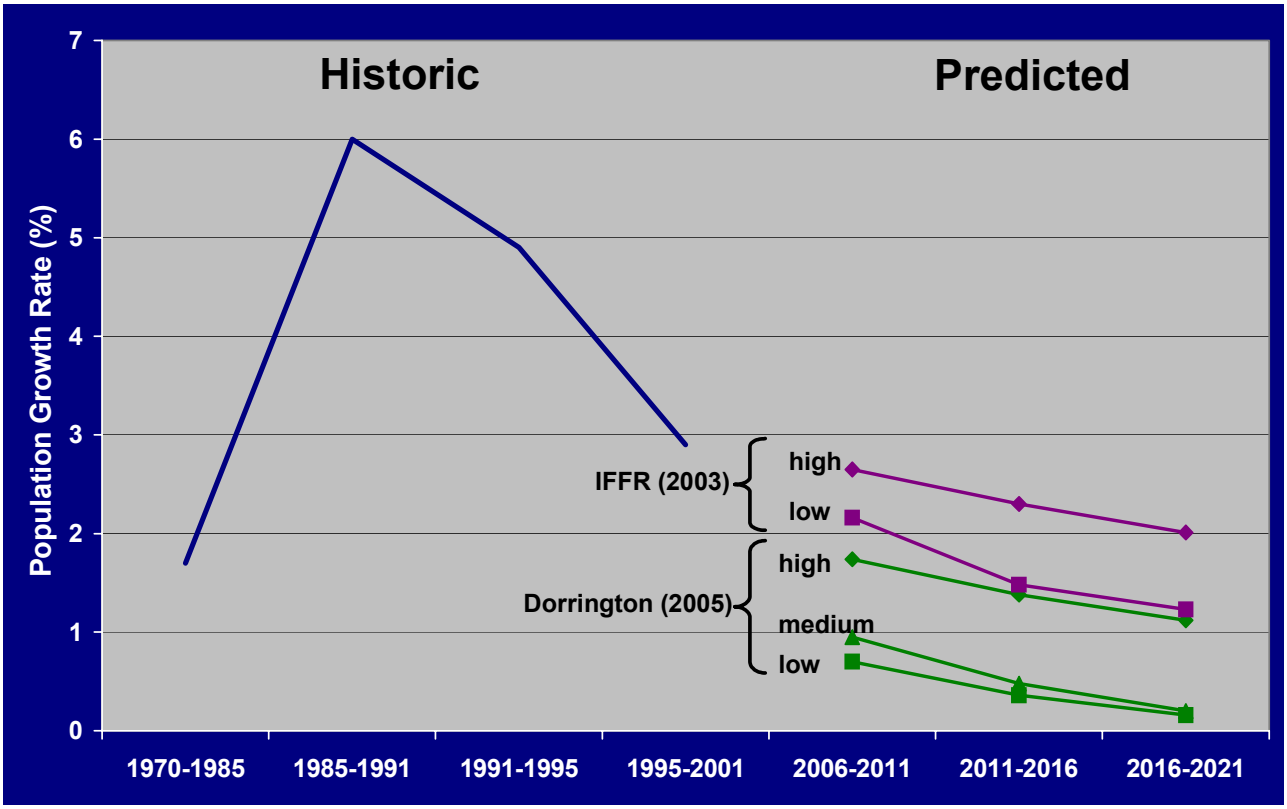

Figure 3.2 **Historic and forecasted population growth rates in the Greater Cape Town Area (data from the IFR and Dorrington, 2005)**

Table 3.1 **Population Growth Rates as Forecast by IFR (2003) and Dorrington (2005)**

Source	**Low (%per annum)**			**Medium (%per annum)**			**High (% per annum)**		
	Period			**Period**			**Period**		
	2006-2011	2011-2016	2016-2021	2006-2011	2011-2016	2016-2021	2006-2011	2011-2016	2016-2021
IFR (2003)	1.23	1.48	2.16				2.01	2.30	2.65
Dorrington (2005)	0.16	0.36	0.70	0.20	0.48	0.98	1.12	1.38	1.74

After numerous consultations, it was decided that Dorrington's (2005) high and low growth scenarios would be used for the forecasting scenarios, as this model has the impact of HIV/Aids as implicit, and the impact of migration as a variable. In addition, the Dorrington (2005) population projections are also the population projections that have been officially adopted by the City of Cape Town. Consequently, the following population growth rates were used for the purposes of this study:

Source	*Low (% per annum)*			*High (% per annum)*		
	Period			**Period**		
	2006-2011	2011-2016	2016-2021	2006-2011	2011-2016	2016-2021
Dorrington (2005)	0.16	0.36	0.70	1.12	1.38	1.74

3.3.2 Economic Growth Rate

Since 1980, Cape Town's economic growth rate has, on average, exceeded the national growth rate by half a percentage point. For the City of Cape Town, economic growth between 1990 and 2000 averaged 2.6% per annum (based on information provided in the City of Cape Town's IDP). Based on historical performance and future potential, Cape Town's economic growth rate between 2000 and 2010 could average between 4.0 and 4.5% per annum (**Figure 3.3**). In addition, it is assumed that a higher economic growth is accompanied by a gradual redistribution of income in favour of previously disadvantaged groups. There is also a drive to reach the AsgiSA target of 6%, which the City has subscribed to.

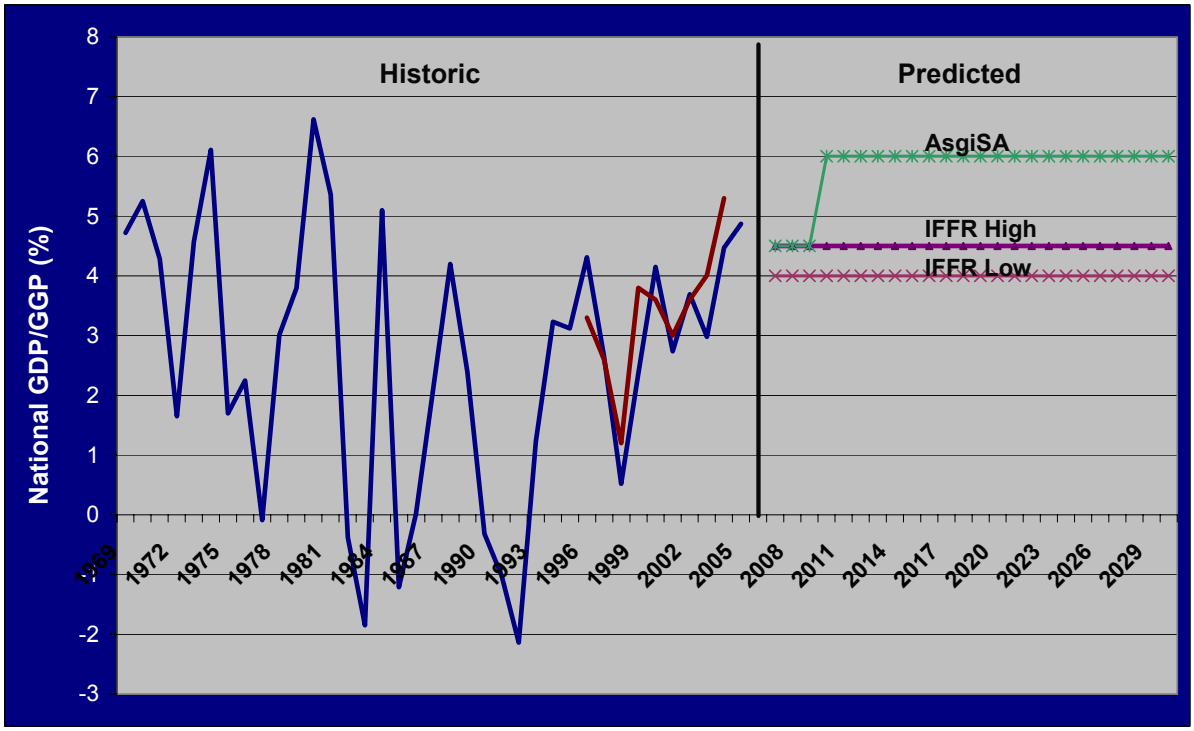

Figure 3.3 Historic and forecasted economic growth rate

In the modelling assumptions, it was decided to use the IFR low economic growth rate of 4% for the low economic growth scenario and the IFR high growth rate of 4.5% for the period 2006 to 2010. Beyond 2010, it was decided to use the AsgiSA 6% as the high economic growth rates.

3.3.3 The Base Year

From the historic data presented in **Section 2.3** it was not clear from which year the forecasting should commence. For the purposes of demonstration, 2003 and 2006 where used as the baselines from which to start the prediction, for each of these years a low water requirement, a low population and economic growth rate and a high water requirement scenarios, high population and economic growth rates where predicted (giving four scenarios). The predictions are shown in **Figure 3.4**, indicating the sensitivity of the forecast to the choice of base year. An understanding of the seasonal usage patterns, as shown in **Figure 3.5** is required to allow an informed decision about the base year to be made. The base demand as defined by the winter demand displays a levelling off from 1999 with an overall decline in summer demand from 1995 onwards (1999 and 2004 are the exceptions). The abovementioned trends lead to the conclusion that there has been an overall structural change in water use patterns in the City of Cape

Town. It was therefore considered appropriate to use 2003 as the base year for the high water requirement scenario and 2006 for the low water requirement scenario.

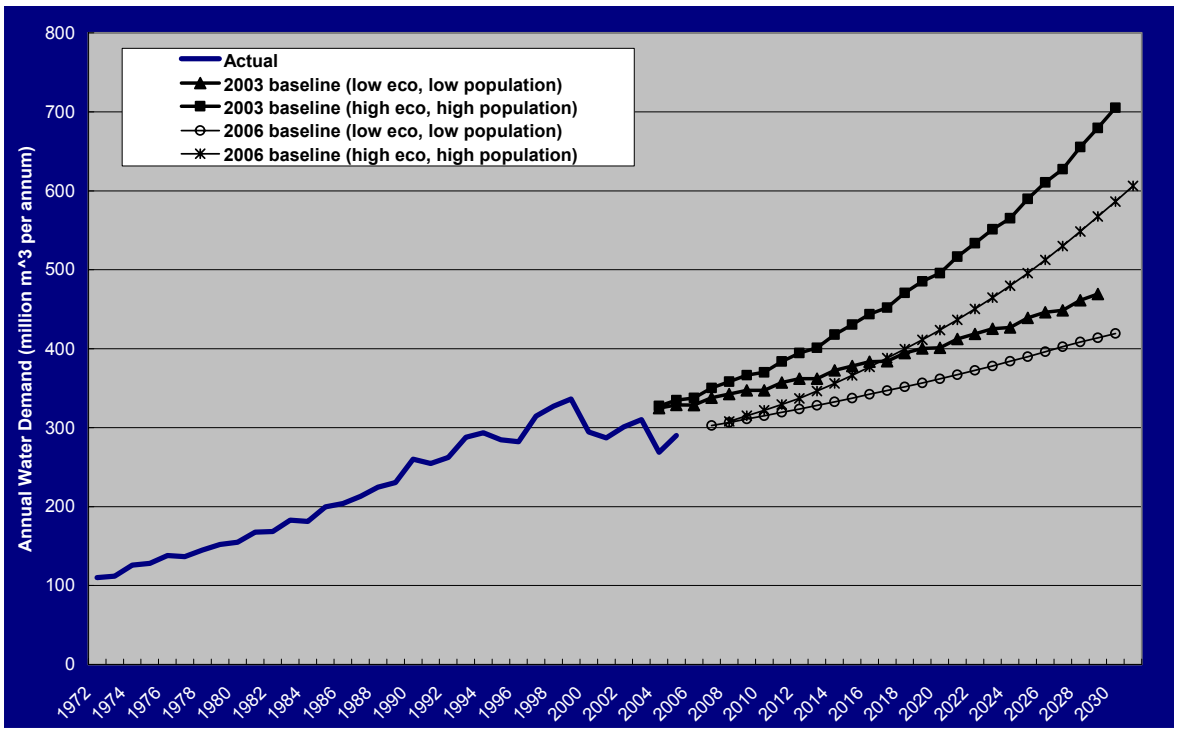

Figure 3.4 Sensitivity of the forecast to the choice of base year

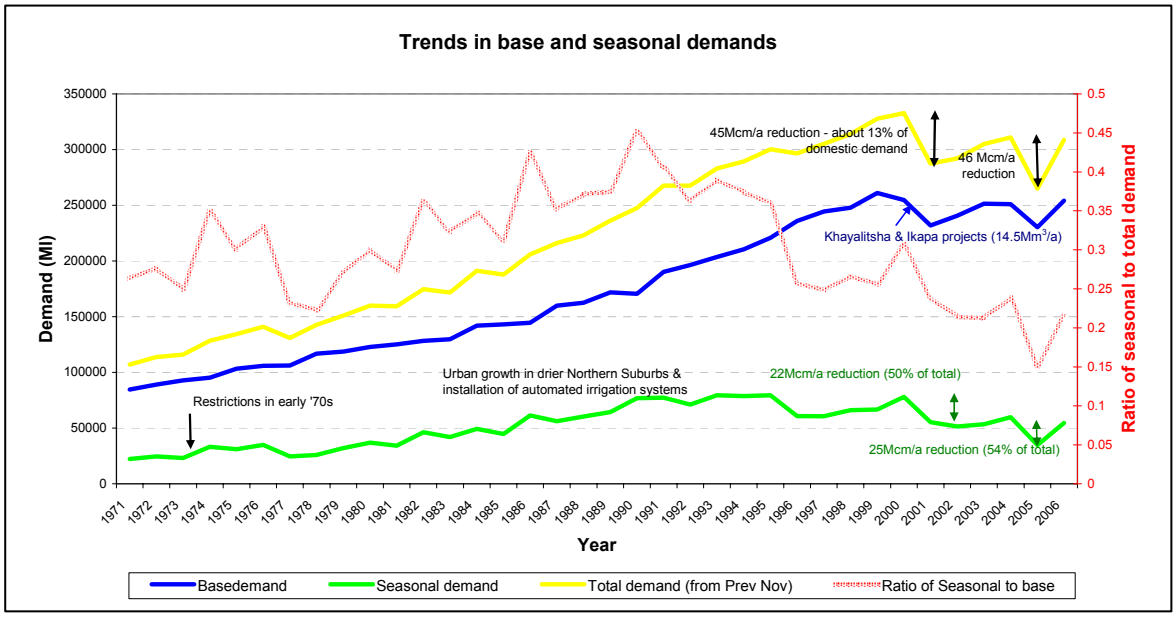

Figure 3.5 Trends in seasonal demand

It must be noted that predicting future water requirements from 1999/2000 is complicated by the fact that water restrictions were imposed in 2000/2001 and then again in 2003/2004. In parallel to this, the City continued to implement water demand management initiatives. Future water requirements should be monitored and the base year for projections revised when better data is available and the imposition of water restrictions lifted.

3.4 Water requirement forecast

Using the various base years, population and economic growth rates, as outlined above, two water requirement scenarios were developed, namely a high and a low water requirement scenario. These are summarised in **Table 3.2**. The data shown in this chapter reflects the projected bulk water requirements for the CCT as well as the bulk water supplied by the CCT to Drakenstein and Stellenbosch Municipalities.

Table 3.2 Data used to Determine High and Low Water Demand Scenarios

Water requirement scenario	Base year	Population growth rate (% per annum)			Economic growth rate (% per anum)	
		2006-2011	2011-2016	2016-2030	2006-2010	2010-2030
High	2003	1.12	1.38	1.74	4.5	6
Low	2006	0.16	0.36	0.70	4	4

Using the data shown in **Table 3.2** the model was run and the outputs are graphically presented in **Figure 3.6.**

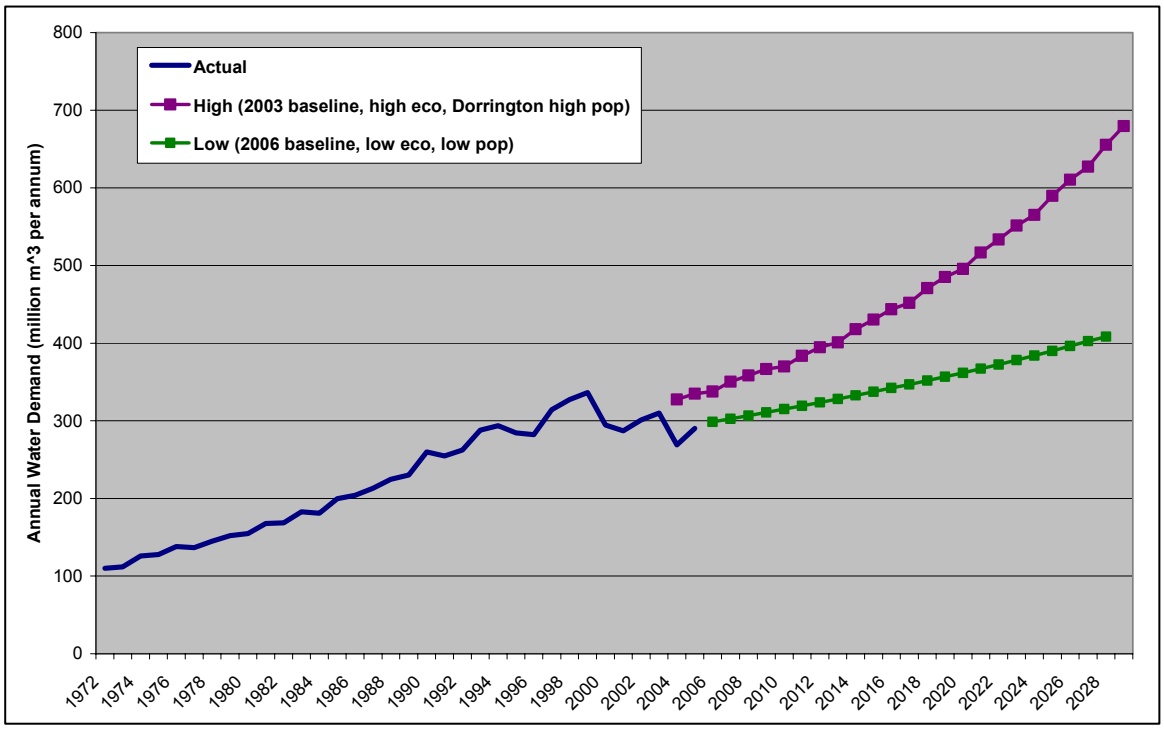

Figure 3.6 Actual and forecasted water requirement for the period 1972 to 2030 (CCT, Drakenstein and Stellenbosch)

It is evident that the range between the high and low water demand scenario is pronounced. The average growth in water demand for the high scenario is 3.09%/annum and for the low scenario is 1.43%/annum. The average of the two scenarios is approximately 2.26%/annum. A comparison of the average growth in water demand with the population and economic growth rates is given in **Table 3.3**. In

general, the average growth in water demand is lower than the economic growth rate and higher than the population growth rate. This has been shown to be the case with the historic data as well.

Table 3.3 Comparison of the Average Growth in Water Requirement with the Population and Economic Growth Rates

Average growth in water requirement (% per annum)	Population growth rate (% per annum)			Economic growth rate (% per annum)	
2006 - 2030	2006-2011	2011-2016	2016-2030	2006-2010	2010-2030
3.09	1.12	1.38	1.74	4.5	6
1.43	0.16	0.36	0.70	4	4

4. PRESENT AND FUTURE WATER REQUIREMENTS IN WCWSS

4.1 Present water requirements

The total present unrestricted water use within the WCWSS area is estimated at about 508 million m^3/a. The largest proportion of water (63% in 2004) is supplied to urban users (domestic and industrial) within the CCT. A much smaller proportion of water (5% in 2004) is supplied to the towns of Stellenbosch, Paarl and Wellington, as well as to towns on the West Coast and in the Swartland region. Some urban users in the Riviersonderend catchment, in the Breede Water Management Area (WMA) as well as rural users, also receive water from the system, for stock watering and domestic use.

In 2004, approximately 32% of the total volume of water supplied by the WCWSS was used by irrigators along the Berg and Eerste Rivers and along the Riviersonderend in the Breede WMA.

4.2 Future water requirements for the wcwss

The future water requirement projections, which were determined in **Section 3.4** applied only to the City of Cape Town (including bulk water supplied by the City of Cape Town to Drakenstein and Stellenbosch Municipalities). For the purposes of reconciling supply and requirement for the entire WCWSS, the following assumptions were made with regard to the other users of water from the WCWSS:

- Future irrigation requirements have been assumed to grow at a constant rate of 2%/annum up to the capping limit, which is defined by the current allocations. The actual growth in these requirements will, however, mainly depend on the Rand exchange rate and international markets.
- The forecast growth rate in urban water requirements for the West Coast and Swartland towns was assumed to be 6%/annum.

Figure 4.1 shows the high and low water requirement scenarios for the entire WCWSS.

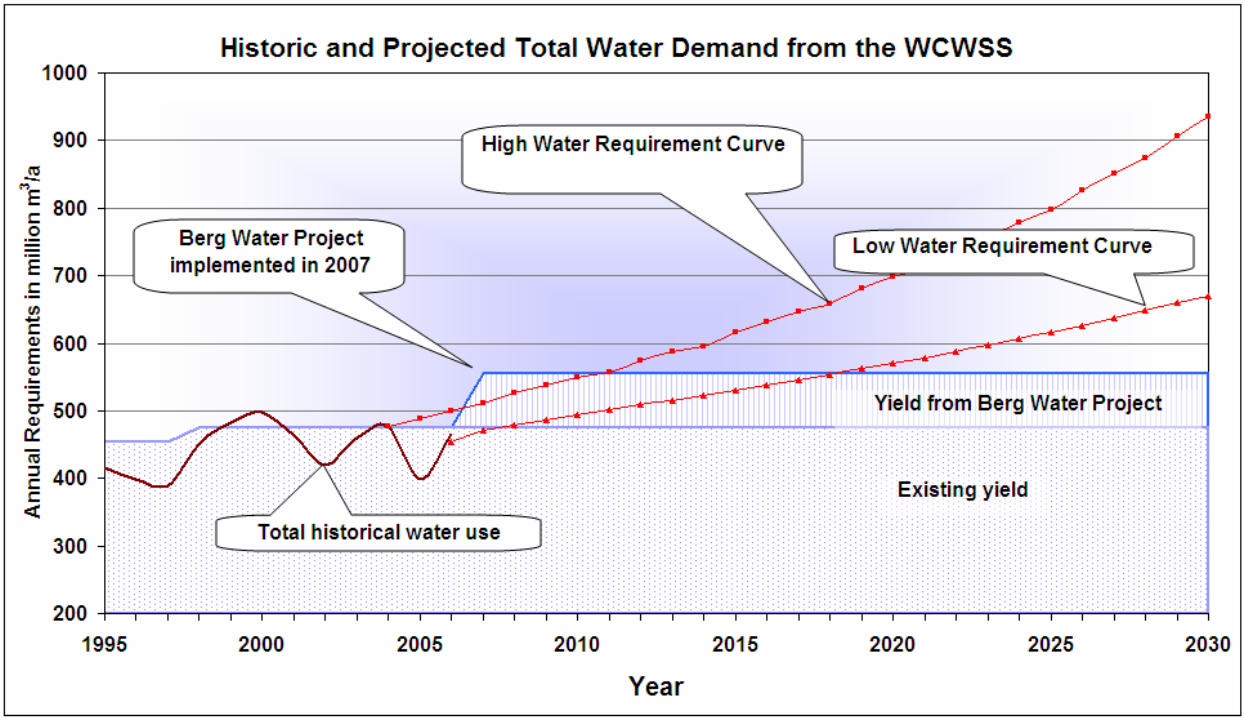

Figure 4.1 Projected future water requirements from the WCWSS

5. CONCLUSIONS

5.1 Limitations and assumptions

The result of this work has been the forecasting of a range of future water requirements ('window of water requirements') based on numerous assumptions. It is important that the scenarios be rerun as more relevant data becomes available. This should thus be seen as a dynamic process that will be used to inform numerous strategic objectives and as such is a tool that must be used with caution rather than be accepted as 'the answer'. Future water requirements should be monitored and the base year for projections revised when better data is available and the imposition of water restrictions lifted.

5.2 Conclusions

Based on the assumptions used in the modelling, it is anticipated that the water requirements for the WCWSS are predicted to grow from 502 Mm^3/annum in 2006 to approximately 935 Mm^3/annum in 2030, for the High Growth Scenario and from 465 Mm^3/annum in 2006, to approximately 670 Mm^3/annum for the Low Growth Scenario.

5.3 Recommendations

It is recommended that :

a) The actual population and economic growth rates need to be monitored, and the model updated when new information and projections become available.

b) The actual water use by user category should also be monitored, as these figures form the basis of future water requirement projections.

c) Due to the fact that restrictions are still in force, that the model be run on an annual basis to determine the impact of a change in base year demand.

6. REFERENCES

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City of Cape Town. 2005. *Review of the Long Term Urban Water Demand*. Prepared by Ninham Shand, Palmer Development Group and the Institute for Futures Research.

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APPENDIX A

PROJECTION OF THE POPULATION OF THE CITY OF CAPE TOWN 2001 - 2021

PROJECTION OF THE POPULATION OF THE CITY OF CAPE TOWN 2001-2021

Prepared for: City of Cape Town

Prepared by: Professor R E Dorrington, Centre of Actuarial Research, University of Cape Town

December 2005

CHAPTER 1

INTRODUCTION

The previous report opened with the following lament (Dorrington 2000):

> "Estimating and projecting the South African population has never been an easy task because of the paucity of data and the heterogeneous nature of the population. Such work is an order of magnitude more difficult at a regional level where migration is far more significant and not documented at all, and where there may be poorly understood regional deviations in fertility and mortality.
>
> However, the task becomes almost impossible when the country is in the process of transformation. Not only the systems of record keeping change (or in some cases break down completely) but there is also a change in personnel usually leading to a loss in continuity.
>
> In addition to this the country is suffering what is likely to turn out to be the worst HIV/AIDS epidemic in the world and there is only limited understanding of how this will shape our demographic future.
>
> Indeed so huge were the uncertainties involved that it was necessary to re-estimate the national population before estimating the population in the CMA in order to get a better understanding of the pattern of undercount and recent changes in mortality and fertility."

Unfortunately on average things haven't improved much since then. Although one might have hoped that a second census would allow us to feel more confident about some of the previous results and assumptions, the known undercount (for which the actual count needed to be adjusted) was larger in 2001 than in 1996 and is of such a magnitude that one cannot place any reliance on the small area estimates arising out of either census. By way of example the annual growth rates for the health districts implied by a comparison of the numbers from the two censuses range from -2.3% for the Central district to 6% for the Eastern district. These appear to be implausible when compared with the annual growth rate for the provincial population as a whole of 2.7%.

However, on the positive side we have more data and a better understanding of the HIV/AIDS epidemic in the province which should improve the projections, although these now have to account for interventions and possible behaviour change which generally increase the level of uncertainty. In addition the 2001 census provides data on migration from 1996-2001 which allows us to derive more reliable estimates than was the case in the previous projection.

As was mentioned in the previous report demographers are careful to warn users of demographic projections that projections are not predictions but rather

vehicles for better understanding the way the population may change in future. This warning is particularly relevant to projections of regional populations within South Africa today.

This report describes efforts to estimate the current population in the City of Cape Town and to project the population forward to the year 2021 in accordance with the project proposal in Appendix 10.

There are two distinct, although interrelated, phases to the study. Only the first phase is covered here.

In particular, the population for the City[1], split by population group, sex and age in five-year age groups, has been projected from the base year of 2001 to the year 2021 at five yearly intervals, taking into account the possible impact of the HIV/AIDS epidemic and treatment and prevention interventions.

These numbers have been distributed between the eight Health Districts.

[1] The City of Cape Town consists of the following Health Districts: Central, Eastern, Khayalitsha, Klipfontein, Mitchell's Plain, Northern Panorama, Southern, and Tygerberg.

CHAPTER 2

THE BASE POPULATION AS AT OCTOBER 2001

Before we can project the population we obviously need to decide on a starting point. The 2001 Census (in the form of the Community Profile provided by Stats SA) is the obvious choice. Unfortunately a number of potential deficiencies with the overall census results have been identified by the Census Sub-committee of the Statistic Council (Statistics Council 2003) and the Census estimates for the for the City need to be investigated in this regard (and for any other deficiencies).

As was the case with the 1996 Census respondents self classified themselves into population groups. As a result some people were unclassified by population group. At the national level this amounted to less than 1% and hence is of little consequence, however, for the Western Cape and some health districts in particular, as was found in the previous census, the figures were higher. What is different in the case of the 2001 census was the fact that the data were edited and such cases were allocated a population group, and it is unlikely that one can do much better than accept these edits.

The editing of the 2001 census data also allocated ages to those without age (again less than 1% of all data) and again it is unlikely that one can improve on this process so these edits were accepted.

These data are presented in Table 1 (more detail in Appendix 1):

	Male	*Female*	*Total*
African	448	469	917
Coloured	662	730	1 393
Indian	21	21	41
White	259	284	543
Total	1 389	1 504	2 893

Table 1: 2001 Census results (thousands)

Thus, ignoring any minor changes to overall boundaries according to censuses the population has increased from 2,558 million to 2,893 million (an increase of some 12%), with the biggest increase being in the African population (258 thousand or 33%), followed by the Coloured population (95 thousand or 7%) and then the Indian population (5 thousand or 13%). In contrast the White population fell by some 21 thousand or 4%.

2. Deficiencies in the Census

During the review of the Census, *inter alia*, the following potential deficiencies with the results for the total population were identified (Statistics Council 2003):

1. under-enumeration of the 0-4 year olds
2. too few foreigners identified
3. age misstatement, particularly age exaggeration, particularly across the pension age for both males and females
4. too few male in-migrants and/or significant male undercount (relative to the number of females).
5. an excess of teenagers
6. potential significant undercount of the White population.
7. slightly greater than expected Coloured population.

Each of these deficiencies needs to be investigated when assessing the acceptability of the estimate of the population for the City.

3. Comparison of previous projection with the 2001 census estimates

The figures below compare the sex ratios and the numbers of females by age of the previous projection (Dorrington 2000) with the equivalent numbers from the 2001 census. Included on these figures as well are the results of a modified projection (New96proj) taking into account the lessons learnt from these comparisons and additional information which from Census 2001.

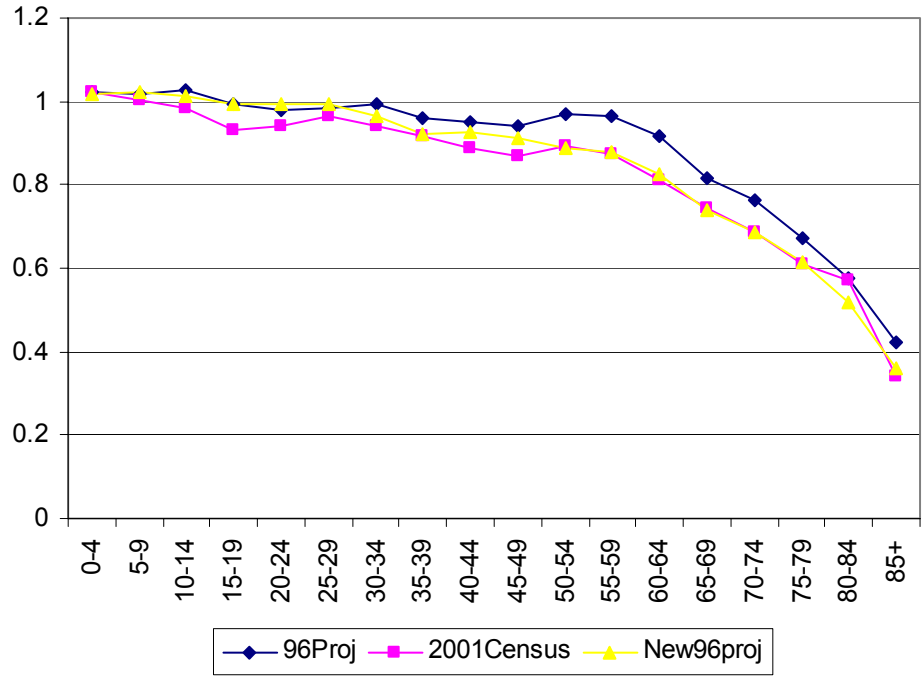


Figure 1: Male to female ratio: Total population of the City of Cape Town, 2001

The overall male to female ratio of the 2001 Census data is 92.4% whereas that of the previous projection are about 96.9% (suggesting an undercount of males relative that of the females of some 4.5%). The overall sex ratio in the previous census was 94%, which supports the conclusion that the 2001 census undercounted men relative women to a greater extent than the 1996 census. Analysis of the results by population group leads to the conclusion that in total the number of males needs to be some 2.1% higher than was estimated by the 2001 census.

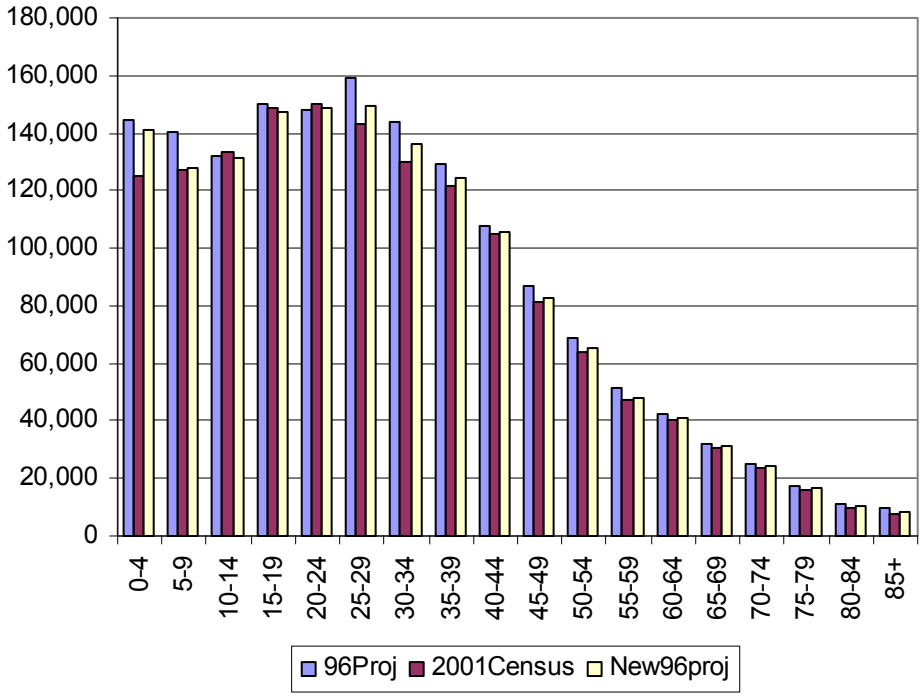


Figure 2: Female population of the City of Cape Town, 2001

The results of the previous projection are reasonably close to the census estimates with the exception of the 0-9 and 25-39 age range, although they are slightly higher for all ages above 39. In order to understand the numbers better and to decide on a basis for projecting the population forward we now consider each population group separately.

3.1 Coloured

From Figure 3 we see that the projected numbers from the previous projection exceed the census numbers on the 0-9 age range in particular. While some of this difference is due to undercounting in the census, it was decided that since the previous census seemed to count the children fairly well only some, maybe half of this difference, was due to undercount. Otherwise the estimates from the previous report were assumed to be accurate and these numbers projected forward on the basis described in the next chapter.

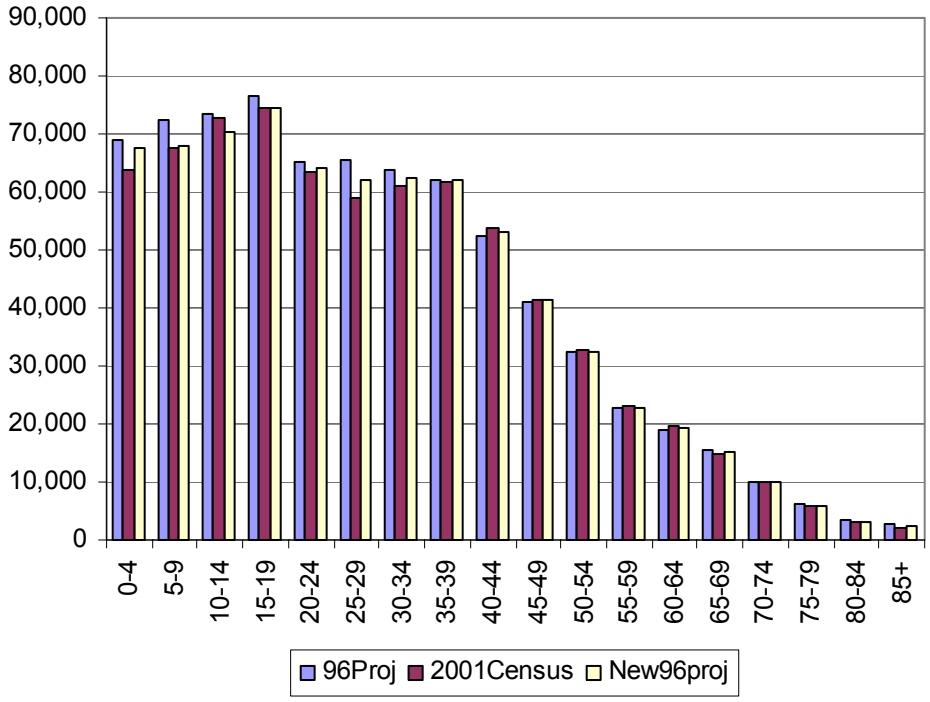


Figure 3: Number of Coloured females, 2001

The overall sex ratio from the previous projection was 93.2% compared to 90.7% implied by the numbers from the 2001 census (suggesting an undercount of males relative to females of some 2.5%). Given the assumed accuracy of the number of females and the fairly low implied sex ratio from the projection it was decided to accept the sex ratio projected from the 1996 base population using the projection basis outlined in the next chapter. According to the comparison in Figure 4 his implies an undercount in men aged 20-49 and over 75.

Although it is possible that adjusting the 1996 estimate so as to produce projected numbers that are an average of the census numbers and those projected from the 1996 base population might produce a better estimate, it was decided that the difference in numbers was too small to warrant the extra work involved in so doing.

The result of these changes is to add only about 27 000 lives (1.9%) to the 2001 census estimates (increasing males by 20 000 and decreasing females by 6 000).

The results appear in Appendix 3.

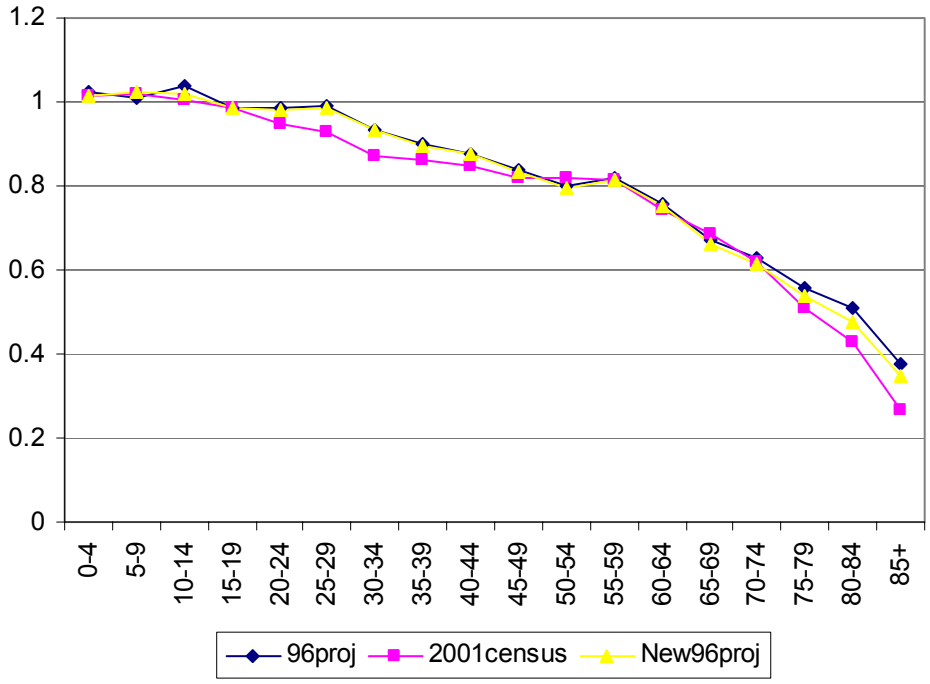


Figure 4: Male to female ratios: Coloureds, 2001

3.2 African

As can be seen from Figure 5 the previous projection appears to have exaggerated the numbers aged 0-9, underestimated the numbers 10-24 and exaggerated the numbers 25-39. After analysis it was decided to assume that difference in the 0-9 age range was due to an undercount in the census and the difference in the 10-19 age range was due to an exaggeration of the numbers in the 2001 census, both consistent with what was observed at the national level. In the absence of any information to the contrary it was decided to accept the census numbers in these age ranges and to attribute the difference to errors in the pattern and level of migration assumed in the previous projection. This implies 1 500 too few in-migrants in the 20-24 age range and 2 000, 6 000 and 2 000 too many in the next three age bands, 25-29, 30-34 and 35-39. These have been allowed for in the projection basis described in the next chapter.

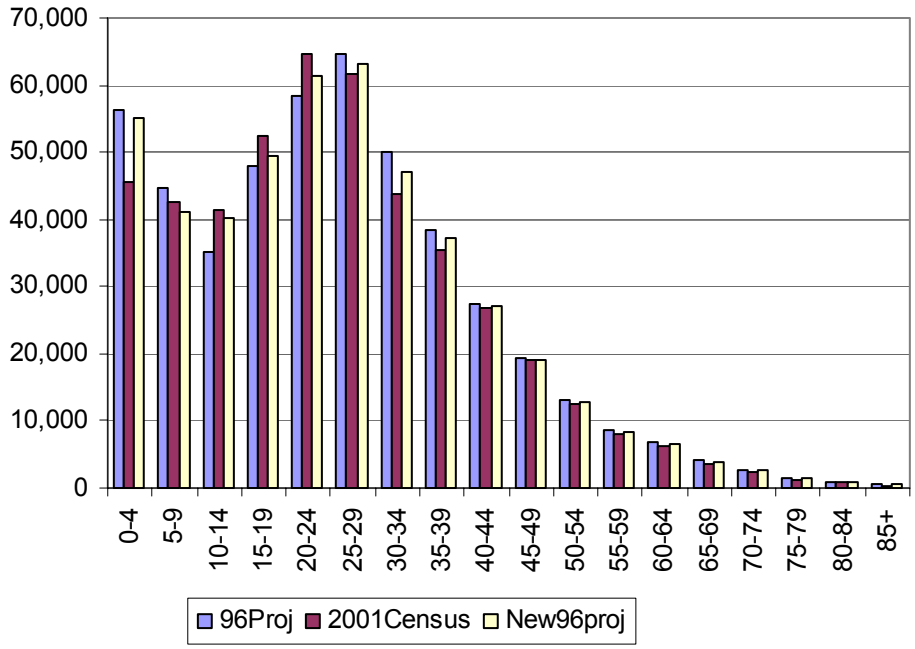


Figure 5: Number of African females, 2001

As noted in the previous report there was a significant difference between the projected sex ratios and those implied by the 1996 census estimates. In the absence of more information it was, at that time, decided to use a smoothed set of ratios based on previous projections. As can be seen from Figure 6, while these ratios are consistent with or more plausible than those derived from the 2001 census estimates up to the 20-29 year age group, the two sets of ratios again differ significantly, and it has to be said, implausibly, above that age. This time, however, given the consistency in ratios from the two censuses it is seems more appropriate to use a smoothed set of sex ratios that is broadly consistent with those found by the two censuses.

The effect of these adjustments was to add around 35 000 (3.7%) to the total African population, a little over 25 000 to males, and little over 9 000 to females.

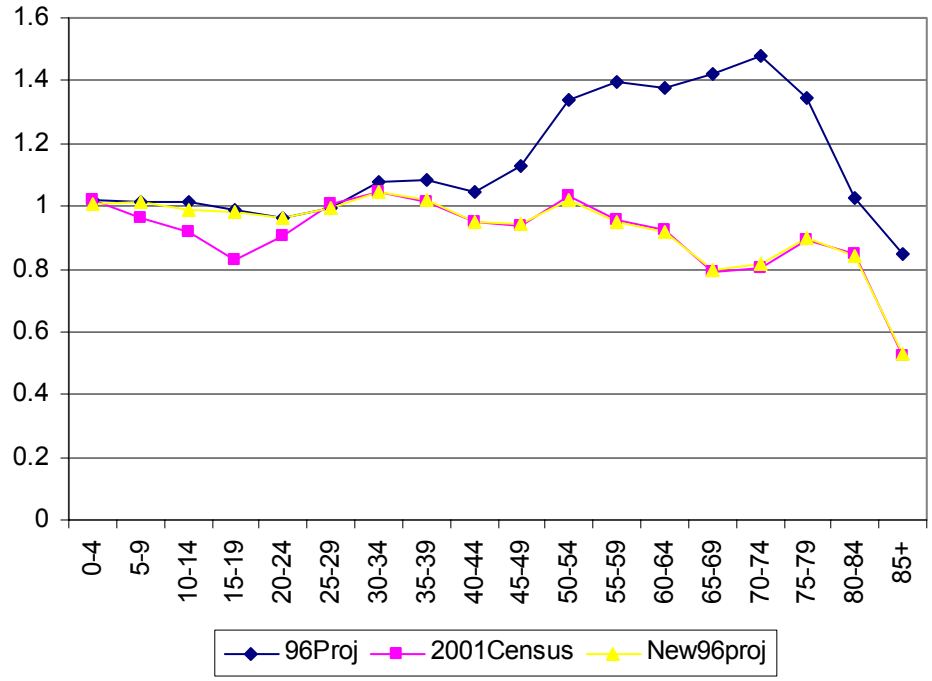


Figure 6: Male to female ratios: Africans, 2001

3.3 White

The previously projected population is much higher than the number estimated by the census. While some of this is likely to be due to an undercount in the 2001 census much of it is due to an underestimate of the emigration of Whites, particularly in the 20-29 age group in that projection. In addition to adjusting the emigration to be consistent with the levels estimated from the 2001 census and data from the main receiving countries, it was decided to assume an undercount of some 5% (which is a somewhat arbitrary allowance for undercount which is less than assumed previously). Although it is possible the undercount is bigger than accounted for in these figures it does not make sense to keep allowing for such a substantial undercount without further evidence as to its magnitude when two censuses have failed to identify it.

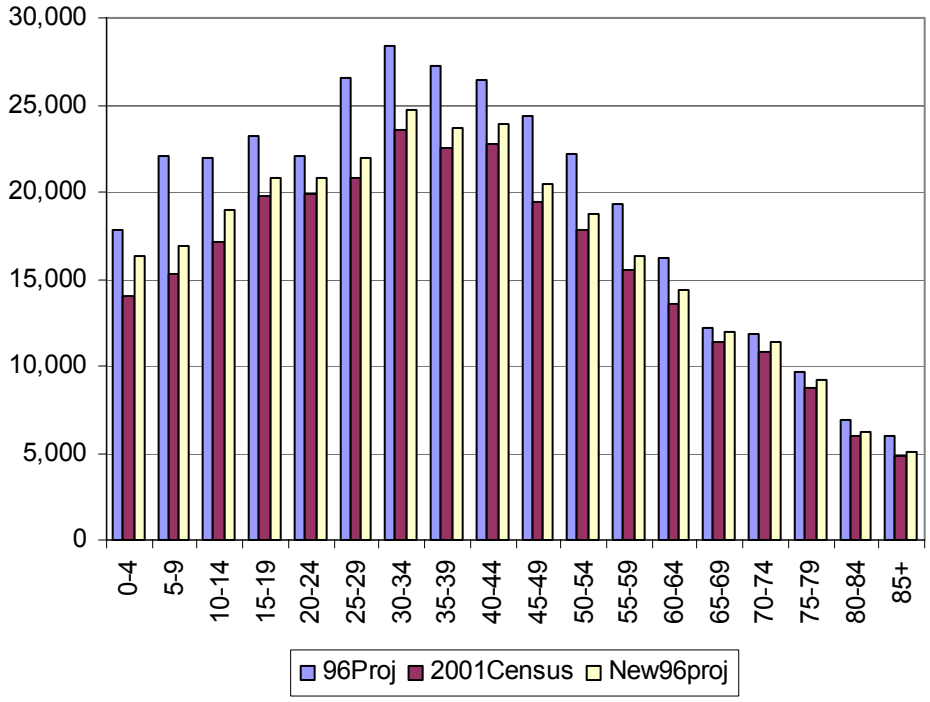


Figure 7: Number of White females, 2001

The sex ratios (Figure 8) of the projected population were accepted as being more reasonable than those from the 2001 census on the grounds of arguments in the previous report, with the exception of the 25-29 year age group where it is assumed that there has been significantly higher emigration of young men than women, in line with the picture at the national and provincial levels.

The net effect of these changes is to add a total of about 36 000 (6.3%) to the number of Whites, 19 000 males and 18 000 males.

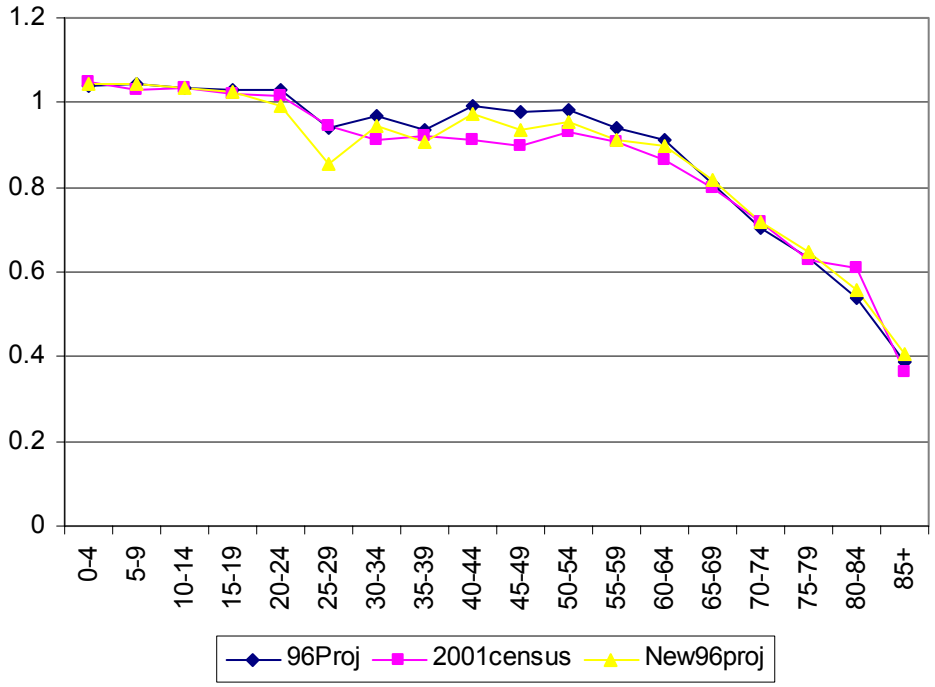


Figure 8: Male to female ratios: Whites, 2001

3.4 Indian

The Indian population in the City is very small, in fact too small for one to be able to rely on the estimates from the census, given the level of adjustment they contain (as can be seen by the difference between the projected numbers from 1996 and the 2001 census. Although such small numbers do not warrant detailed analysis the figures have been included for completeness.

Given the unreliability of the censuses it was decided to adjust the 1996 base population such that the projected numbers over age 4 were an average of the 2001 census numbers and the projected numbers before adjustment. In addition the sex ratios were smoothed to produce a more plausible sequence by age. The net effect of this change is to increase the population by 3 200 (7.1%), equally split between males and females.

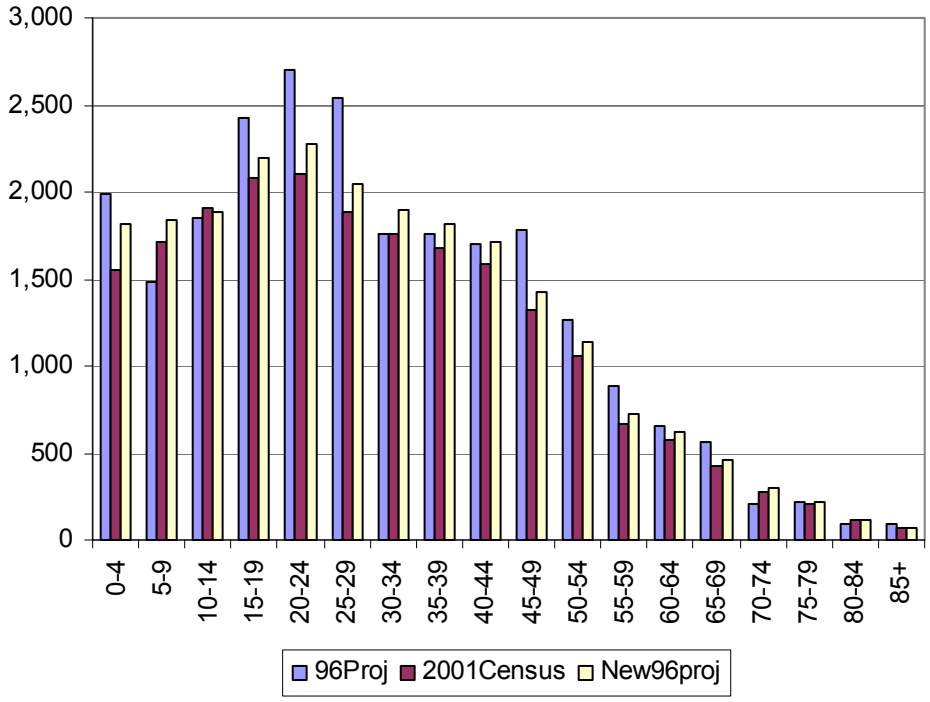


Figure 9: Number of Indian females, 2001

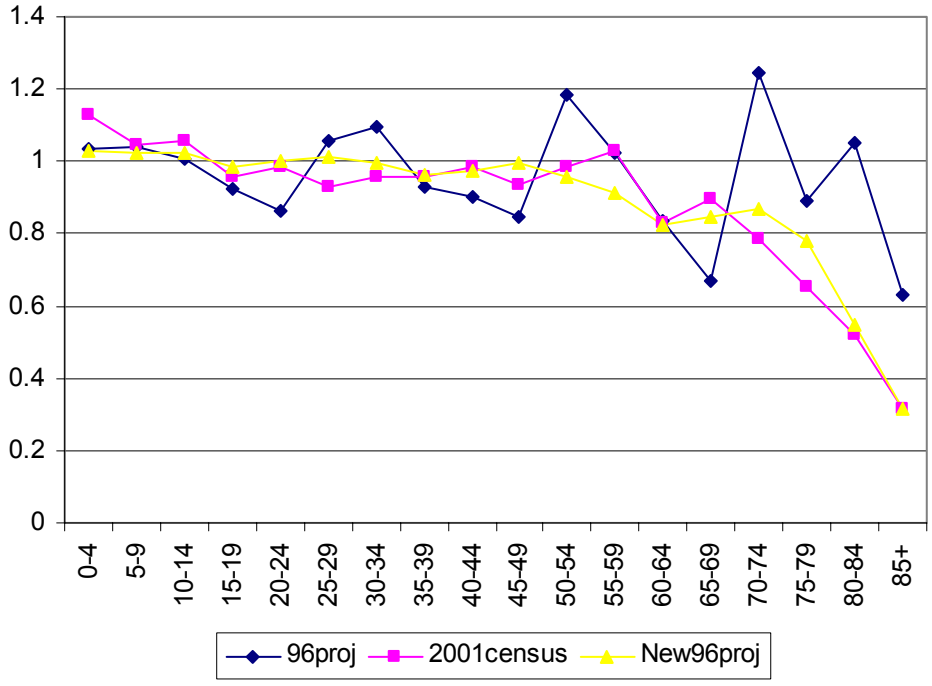


Figure 10: Male to female ratios: Indians, 2001

3.5 Total

The overall effect of all these changes is to add some 102 000 (3.4%) to the total population of the City as of the date of the census in 2001, to give the following totals (details in Appendix 3):

	Male	*Female*	*Total*
African	473	478	951
Coloured	683	737	1 420
Indian	22	23	45
White	277	302	579
Total	1 455	1 540	2 995

Table 2: Numbers in the City of Cape Town as at mid-year in 2001 (thousands)

4. Distribution by health district

Unfortunately, as mentioned in the introduction, the extent to which the censuses needs to be adjusted for undercount on the basis of a very small post-enumeration survey is such as to undermine completely any confidence one might have in estimates of small populations. Although it would appear that the provincial estimates are consistent from one census to the next it is not clear, at this stage, what minimum size of population/area in the Western Cape is needed in order to be able to rely on the census estimates. As can be seen from the growth rates implied by a comparison of the numbers by health district in each census shown in Table 3[2] one can't rely on numbers for populations this small.

	1996	*2001*	*Growth*
Central	323 761	288 410	-2.3%
Eastern	295 590	398 050	6.0%
Khayalitsha	255 693	329 000	5.0%
Klipfontein	332 279	344 486	0.7%
MP	338 010	401 092	3.4%
Northern Panorama	362 191	419 153	2.9%
Southern	294 429	310 810	1.1%
Tygerberg	387 289	400 876	0.7%
City	**2 589 242**	**2 891 877**	**2.2%**
Western Cape	3 957 317	4 524 335	2.7%
CT/WC	65%	64%	

Table 3: Growth rates by health district implied by 1996 and 2001 census results

[2] Data supplied by Janet Gie.

The numbers of people living in the various health districts (HDs) was determined by applying the population group-sex-age correction factors implied by the estimates derived in section 3 to each population group-age-sex combination within each health district.

The detailed results of these calculations appear in Appendix 3. These can be summarised as follows:

	Health District								
	Central	Eastern	Khaya.	Klipf.	MP	NP	South.	Tyger.	Total
Total	326 373	378 060	315 769	361 782	400 145	458 178	326 895	427 577	2 994 779

Table 4: Adjusted 2001 Census results by health district

5. Distribution of the underestimate

The percentage additional undercount implied by the above estimates is as follows:

	Male	*Female*	*Total*
African	5%	2%	4%
Coloured	3%	1%	2%
Indian	5%	7%	8%
White	7%	6%	6%
Total	5%	2%	3%

Table 6: Percentage additional undercount in the 2001 Census for the City

	Health District								
	Central	Eastern	Khaya.	Klipf.	MP	NP	South.	Tyger.	Total
Total	12%	-5%	-4%	5%	0%	9%	5%	6%	3%

Table 7: Undercount by health district

CHAPTER 3

POPULATION PROJECTIONS

In order to project the population we need to make assumptions about:

- Fertility (including the impact of HIV on fertility)
- Mortality (including the impact of HIV on mortality)
- Migration
- The prevalence patterns and future spread of HIV and AIDS, taking into account possible interventions.

1. Fertility

In all cases the total fertility rates (TFRs) were kept the same as those used in the previous projection Dorrington (2000) to project from the base population to 2001. Since, for the purpose of the projections in this report, it was decided to start all projections from 1985 to allow fully for the historical impact of the HIV/AIDS epidemic, TFRs were needed going back in time. These earlier TFRs were derived by extrapolating the recent TFRs back in time in such a way as to reproduce the base population for the cohort born since 1985.

Age-specific fertility rates (ASFRs) were derived by scaling the provincial age-specific fertility rates to sum to the TFRs for the City for each of the population groups.

The fertility rates are summarised in Appendix 2.

2. Mortality

Non-HIV:

In the absence of estimates of mortality specific to the city provincial mortality rates were used for each of the population groups. Explanations of the derivation of these rates can be found in Dorrington, Moultrie and Timæus (2004) and the meta data report for the ASSA2003 model which is due to be released at the end of November.

HIV:

The impact of HIV on mortality was modelled using the ASSA2003 AIDS and Demographic model (see meta data report of the model to be released at end of November) calibrated as described below.

The mortality rates are summarised in Appendix 2.

3. Migration

Migration is undoubtedly the most difficult demographic variable to predict and thus it was decided to carry out projections on three migration assumptions corresponding with those made in the previous projection. The numbers of migration 1996-01 by sex and age are given in Appendix 4. By and large the level of net migration appears to have been very low for all but the African population group where it is around 3.5% per annum. The child migration numbers for the Coloured population group are the result of assuming the same pattern of migration for the City as for the province, however, in all likelihood these should be negligible and the fertility of the population in the City should probably be a little lower to account for this difference. However, the net effect on the projections is negligible.

High: The migration experience over the 1996-01 period for the African, Coloured and Indian populations, is assumed to continue in the future in absolute terms (i.e. numbers), while the White net emigration is assumed to cease from 2001.

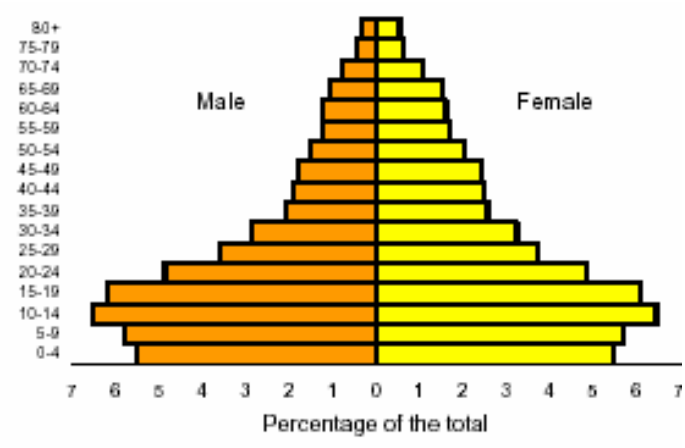
Low: Migration falls from the 1996-01 levels to zero over a 15-year projection period for the African, Coloured and Indian populations, and to rise over 30 years for the White population.

Middle: Migration falls from the 1996-01 levels to zero over a 30-year projection period. This is the assumption used for the detailed projections.

These scenarios produce lower migration than was the case in the previous projection which may well call their reasonableness into question. However, it was decided to stick with these scenarios for the following reasons:

1. There is a diminishing pool of potential migrants. Most in-migrants to the Western Cape (and hence to a lesser extent Cape Town) come from the Eastern Cape. The Eastern Cape has experienced very high out-migration over the recent past and as can be seen from Figure 11 this has now distorted the population pyramid to the point that one must start to question the likelihood of seeing significant numbers of migrants among the older adults.

In addition much of provincial in-migration is to the towns, particularly places along the coast like George, Mossel Bay, Knysna and Plettenberg Bay.



Source: Statistics SA (2005): 21

Figure 11: Mid-2005 population pyramid for the Eastern Cape

2. Although the number of in-migrants net of out-migrants for the province estimated by Stats SA for the period 2001-2006 is more than double the number that would be consistent with the middle projections, their mid-2005 estimate of the population in the province is some 6% (285 000) lower than the provincial estimate that is consistent with the middle projection for the City. The two populations are compared in Figure 12.

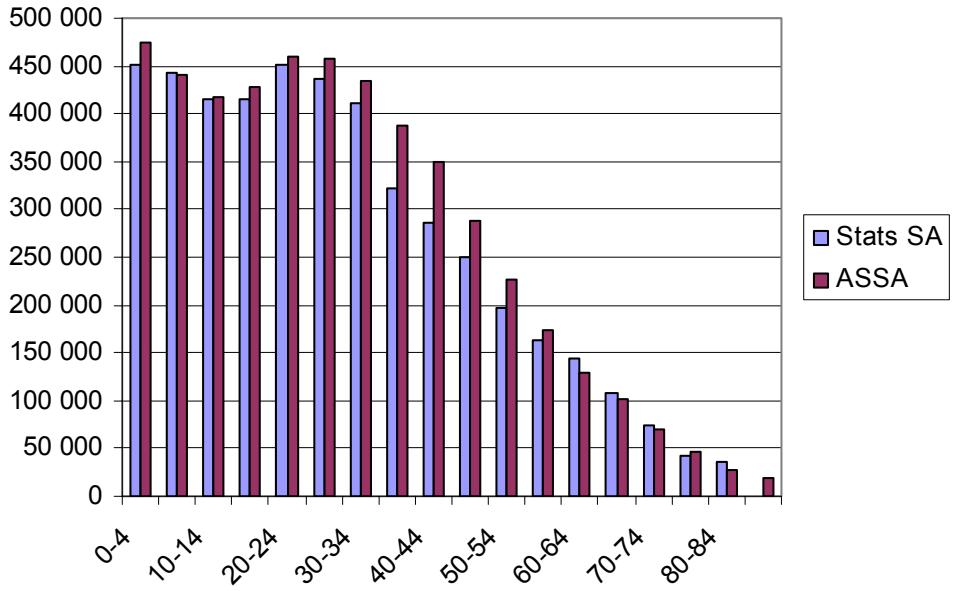


Figure 12: Comparison of the estimated population for the province with that from Stats SA mid-2005 estimate

4. HIV/AIDS

The impact of HIV/AIDS was allowed by using the ASSA2003 AIDS and Demographic model (Actuarial Society of South Africa, 2005) calibrated to fit the ante-natal survey results for the Western Cape. In order to do this it was

necessary, by a process of iteration, to find the starting population which, when projected forward to 2001 would, more-or-less, reproduce the base population arrived at earlier. The model also allows for the roll out of ART and other interventions to province-specific levels. In the absence of better estimates of the likely level of roll-out of interventions for the city the projections in this report assume the same level of roll-out as for the province as a whole.

5. RESULTS

The results of these projections appear in Appendices 4 to 6, and are shown graphically in Figure 13.

Details by population group, age and sex for the middle projection are given in Appendix 4, showing that the total population would, on these assumptions, grow from 3 million in 2001 to some 3.4 million by the year 2031.

Appendix 6 compares the total population estimates based on the high and low migration assumptions with those based on the middle migration assumptions. From this comparison we can see that the population in the City in 2021 could range, on these assumptions, between a low of 3.4 million and a high of 4.1 million.[3]

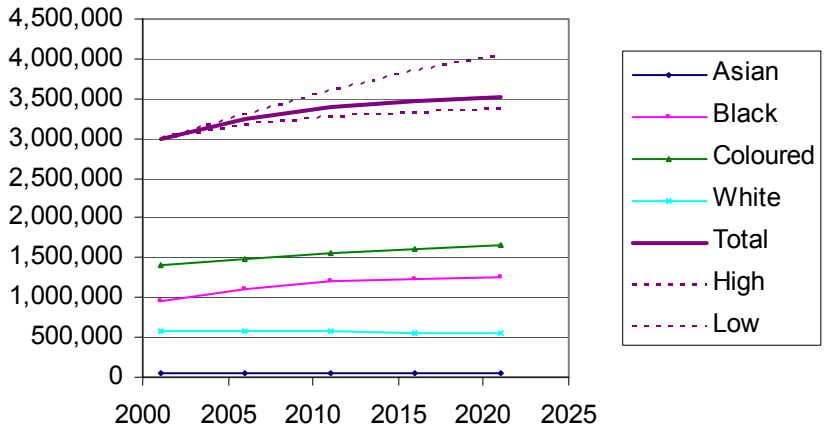


Figure 13: Total population projections

In order to estimate the population by health district the ratio method (Shryock and Siegal, 1976) was employed. However, given the unreliability of the census estimates at this level it was decided to estimate the population in the health districts to be the average of the 1996 and 2001 census estimates at the point half way between the censuses. In order to estimate the population numbers as at the census dates it is necessary to decide on the likely growth rates for the districts. As a first pass the populations were assumed to have grown at rates that were roughly comparable with those of the previously demarked MLCs (Metropolitan Local Councils) into which the health districts fell, as shown in Table 8. These estimates were then presented to experts from the city from which arose as second set of estimates. These two sets of estimates were combined along with a third set based on the growth in the

[3] This represents a 20% margin of confidence which compares very favourably with, for example, that of Haldenwang's (1999) high and low national estimates when one bears in mind the uncertainties associated with regional projections.

numbers of housing plans approved to produce the final estimates shown in Table 8.

Health District	*Growth rate from censuses*	*Previous MLCs*	*Range of growth rates*	*Growth rate assumed for health district*
Central	-2.3%	Cape Town	2.5%	2.2%
Eastern	6.0%	Oostenberg, Helderberg	3.0-4.5%	3.4%
Khayalitsha	5.0%	Tygerberg, Oostenberg	3.0-3.5%	2.9%
Klipfontein	0.7%	Tygerberg?, Cape Town	2.5-3.0%	2.2%
Mitchell's Plain	3.4%	Tygerberg	3.4%	2.9%
Northern	2.9%	Blaauberg	7.7%	6.0%
Panorama				
Southern	1.1%	Southern Peninsula	3.1%	2.6%
Tygerberg	0.7%	Tygerberg	3.4%	2.8%

Table 8: Health district population growth rates, 1996-2001

The results of these calculations are shown graphically in Figure 14. A comparison of the high, middle and low projections appears in Appendix 6.

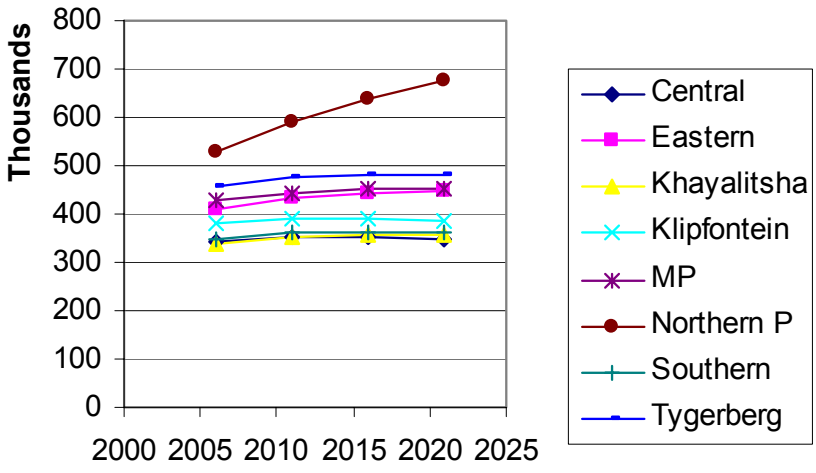


Figure 14: Projections of the health districts

It is important to note that the above is a simple model which extrapolates the trend between 1996 and 2001 on the assumption that the rate of change in the various proportions will disappear over a suitably long period (60 years was chosen in this case). Where people will actually live in future depends on the

complex interaction of a number of factors, not least of which is town and regional development. Thus the major use of these numbers is to give some idea of the "pressure points" for development.

CHAPTER 4

IMPLICATIONS OF THE PROJECTIONS

The population in the City is expected to grow by nearly 17% over the 15 year projection period. By the end of the period the black African population is expected to about 75% of the Coloured population which will be approximately 47% of the total population of the City.

Northern Panarama will continue to remain by far the largest health district, followed by Tygerberg with a population of about 71% of the size by 2021. The smallest health district by 2021 is expected to be the Central district with a population of about half the size of that of the Northern Panarama.

1. Number and size of households

The average household size in future is very much dependent on the number of houses that are built. Table 9 summarises two possible scenarios:

(a) assuming that the proportion of the population by age and sex who are heads of households remains the same over the years, and
(b) assuming that the average household size per head of household by age and sex remains the same over the years.

In both cases it is further assumed that by the year 2021 five percent of the population would be staying in institutions[4].

	1991	1996	2001	2021 (a)	2021 (b)
Asian	-	4.1	4.0	3.1	4.1
Black	3.2	3.6	3.6	3.0	3.9
Coloured	3.9	4.4	4.3	3.6	4.5
White	2.7	2.7	2.6	2.3	2.6
Total	3.7	3.6	3.6	3.2	3.9
No. of houses	-	681 000	760 000	1 057 000	864 000

Table 9: Average household size and number of houses in the City

[4] In 1996 an average of about 2% of the population appear to be staying in institutions with a high of about 4% for the White population.

Thus under scenario (a) there would be a doubling of the number of houses over the 35-year period while the average household size would fall by between 15% and 25%. Under scenario (b) the average household size remains largely unchanged but the number of households increases by some 57% over the 35-year period.

The number of households under each scenario by health district is shown in Table 10.

Scenario		2001*	% increase	
(a)	(b)		(a)	(b)
114 000	95 000	89 000	28%	7%
130 000	106 000	104 000	25%	2%
122 000	95 000	98 000	24%	-3%
114 000	91 000	88 000	30%	3%
123 000	98 000	69 000	78%	42%
218 000	184 000	129 000	69%	43%
102 000	84 000	80 000	28%	5%
134 000	111 000	103 000	30%	8%

* (approx.) dist. adjusted for the undercount but total kept as per census

Table 10: The number of households in 2021 by health district

2. HIV/AIDS

As was mentioned earlier the projections were carried out using the ASSA2003 model adapted to model the epidemic in the Western Cape. This model is hugely more sophisticated than the adaptation of the ASSA600 model used to allow for the impact of HIV/AIDS on the projections used in the previous projection. Apart from calibrating the model to fit the epidemic to each population group it allows for the impact of interventions on the epidemic.

2.1 Deaths

By the year 2013 deaths due to AIDS in the City are expected to be about half the number of deaths from all other causes. Figure 15 illustrates the impact of the epidemic on the expected number of deaths in future.

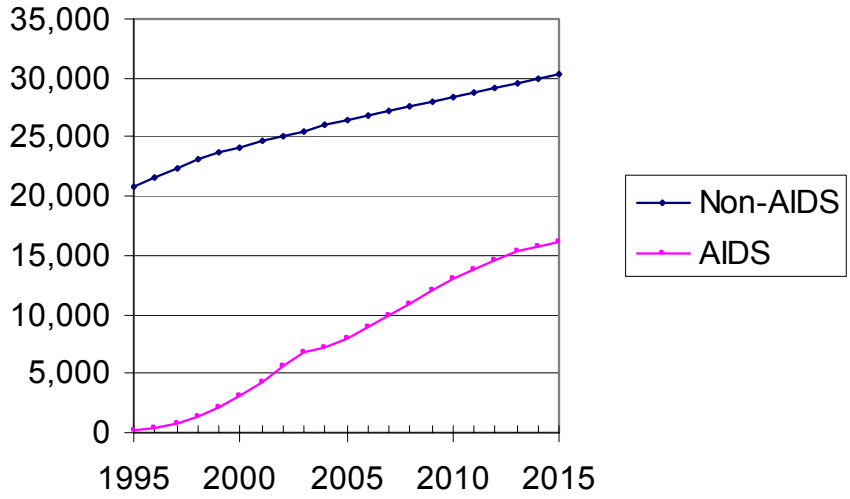


Figure 15: The number of deaths due to AIDS compared to those due to other causes.

2.2 Life Expectancy

Figure 16 illustrates the impact of the epidemic on life expectancies at birth on the two groups which are generally expected to suffer the biggest impact. Over the next 10 years the life expectancy at birth of the Coloured population is expected to remain fairly constant with that for females falling slightly while that of male could increase slightly. However, over the same period the life expectancy at birth of the African population group is expected to fall by some 10 to 15 years.

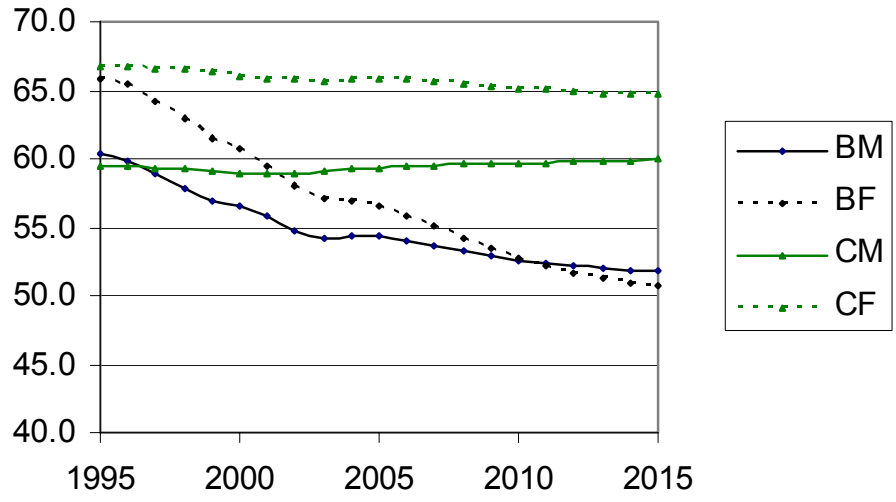


Figure 16: Life expectancy at birth for Black and Coloured males and females.

2.3 Population pyramids

Finally the impact of HIV on the population as a whole is illustrated by the difference in the population pyramids in 2021 (Figure 17).

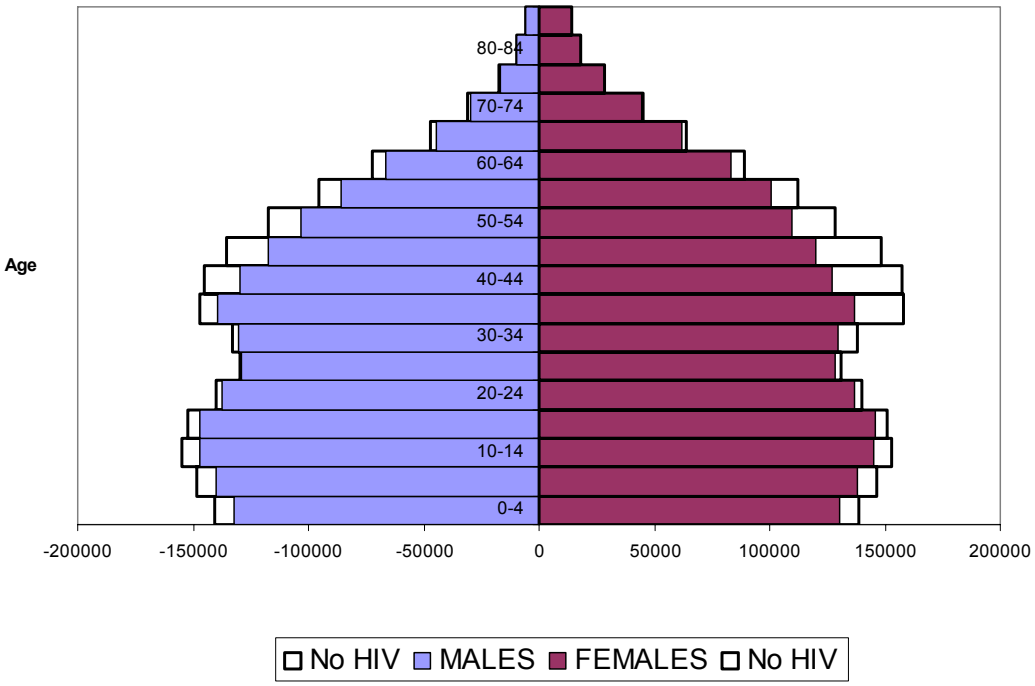


Figure 17: Population pyramids with and without HIV, 2021

As can be seen from these pyramids the impact is mainly in the working and very young age-groups with perhaps a greater (and younger) impact among females.

APPENDIX 1: POPULATION ACCORDING TO CENSUS 2001

CENTRAL	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									8 824	8 573
5-9									8 543	8 531
10-14									9 329	9 103
15-19									11 717	12 598
20-24									15 698	16 116
25-29									14 200	14 597
30-34									11 749	12 189
35-39									9 940	11 164
40-44									8 855	10 536
45-49									7 243	9 173
50-54									7 213	8 463
55-59									5 710	6 930
60-64									4 814	5 902
65-69									3 708	5 062
70-74									3 304	4 660
75-79									2 229	3 828
80-84									1 854	2 735
85+									841	2 487
									135 771	152 647
									288 418	

EASTERN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									19 430	19 184
5-9									19 843	19 506
10-14									20 069	19 835
15-19									19 198	20 205
20-24									17 011	18 250
25-29									17 138	18 400
30-34									17 003	18 419
35-39									17 025	18 542
40-44									13 947	14 881
45-49									9 424	10 310
50-54									6 804	7 346
55-59									4 818	5 289
60-64									3 929	4 490
65-69									2 760	3 276
70-74									1 936	2 862
75-79									1 294	2 072
80-84									788	1 393
85+									363	983
									192 780	205 243
									398 023	

KHAYALITSHA	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									16 901	16 609
5-9									15 578	16 060
10-14									15 431	16 733
15-19									16 605	20 069
20-24									19 138	21 824
25-29									19 671	21 514
30-34									15 113	16 145
35-39									12 986	13 737
40-44									9 631	10 516
45-49									6 727	7 035
50-54									4 469	4 120
55-59									2 481	2 513
60-64									1 713	1 929
65-69									763	990
70-74									467	542
75-79									237	273
80-84									162	167
85+									45	105
									158 118	170 881
									328 999	

KLIPFONTEIN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									15 139	14 820
5-9									15 528	15 354
10-14									16 250	16 673
15-19									16 906	18 383
20-24									16 173	18 141
25-29									15 773	16 926
30-34									13 472	14 692
35-39									12 132	13 896
40-44									9 848	11 728
45-49									7 738	9 770
50-54									6 539	8 086
55-59									5 111	6 195
60-64									4 191	5 748
65-69									3 054	4 701
70-74									2 034	3 398
75-79									1 321	2 054
80-84									588	1 166
85+									233	708
									162 030	182 439
									344 469	

MITCHELL'S PLAIN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									20 272	20 088
5-9									19 384	19 929
10-14									20 061	20 759
15-19									21 388	23 790
20-24									21 366	23 426
25-29									20 716	20 828
30-34									16 065	16 492
35-39									14 389	15 354
40-44									12 034	14 317
45-49									9 747	11 220
50-54									7 436	7 969
55-59									4 567	4 964
60-64									3 006	3 661
65-69									1 618	2 175
70-74									939	1 274
75-79									354	677
80-84									162	368
85+									66	231
									193 570	207 522
									401 092	

NORTHERN PANORAMA	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									17 802	16 943
5-9									17 287	17 034
10-14									17 354	17 460
15-19									18 084	18 874
20-24									18 476	18 726
25-29									20 052	20 503
30-34									19 462	20 691
35-39									17 669	18 633
40-44									15 610	16 739
45-49									11 760	12 788
50-54									9 520	10 168
55-59									7 003	7 665
60-64									5 391	6 222
65-69									3 707	4 446
70-74									2 580	3 380
75-79									1 612	2 348
80-84									765	1 279
85+									314	899
									204 448	214 798
									419 246	

SOUTHERN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									13 067	12 674
5-9									13 553	13 339
10-14									14 015	14 007
15-19									15 226	14 006
20-24									14 465	13 133
25-29									14 082	13 366
30-34									13 638	13 692
35-39									12 785	13 384
40-44									10 684	11 648
45-49									7 800	8 864
50-54									6 635	7 555
55-59									5 102	5 978
60-64									4 379	5 129
65-69									3 033	3 977
70-74									2 135	3 127
75-79									1 335	1 929
80-84									655	1 211
85+									303	892
									152 892	157 911
									310 803	

TYGERBERG	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4									16 316	16 110
5-9									17 415	17 265
10-14									18 434	18 557
15-19									19 674	20 467
20-24									18 257	20 149
25-29									16 699	17 488
30-34									15 326	17 464
35-39									14 689	16 771
40-44									12 792	14 692
45-49									9 962	12 052
50-54									8 483	10 355
55-59									6 370	7 838
60-64									5 304	7 108
65-69									4 007	5 790
70-74									2 624	4 284
75-79									1 518	2 691
80-84									769	1 609
85+									327	1 230
									188 966	211 920
									400 886	

CITY OF CAPE TOWN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4	46 466	45 648	64 782	63 788	1 744	1 548	14 773	14 077	127 765	125 061
5-9	40 870	42 467	68 661	67 493	1 788	1 714	15 763	15 274	127 082	126 948
10-14	38 014	41 502	73 198	72 736	2 024	1 911	17 669	17 112	130 905	133 260
15-19	43 267	52 333	73 225	74 435	1 990	2 076	20 226	19 802	138 707	148 646
20-24	58 553	64 656	59 963	63 309	2 080	2 107	20 123	19 848	140 719	149 919
25-29	62 191	61 744	54 890	58 991	1 762	1 890	19 664	20 856	138 507	143 482
30-34	45 713	43 731	53 160	60 877	1 676	1 754	21 411	23 525	121 961	129 887
35-39	36 093	35 581	53 273	61 873	1 608	1 677	20 766	22 498	111 740	121 630
40-44	25 484	26 867	45 698	53 865	1 565	1 586	20 774	22 785	93 521	105 103
45-49	17 851	18 989	33 955	41 451	1 238	1 324	17 470	19 413	70 514	81 176
50-54	12 869	12 465	26 681	32 611	1 046	1 060	16 568	17 825	57 164	63 962
55-59	7 750	8 104	18 811	23 034	691	670	14 050	15 511	41 302	47 319
60-64	5 716	6 177	14 672	19 808	480	578	11 763	13 606	32 631	40 168
65-69	2 883	3 642	10 259	14 962	382	425	9 088	11 407	22 612	30 435
70-74	1 935	2 401	6 200	10 040	221	281	7 769	10 835	16 125	23 556
75-79	1 174	1 319	2 966	5 814	134	205	5 479	8 716	9 753	16 054
80-84	655	774	1 327	3 082	58	111	3 644	5 990	5 684	9 957
85+	219	417	582	2 186	21	67	1 728	4 773	2 550	7 443
	447 704	468 817	662 301	730 355	20 508	20 982	258 728	283 852	1 389 241	1 504 006
	916 520		1 392 656		41 490		542 580		2 893 247	

The numbers for the health districts do not sum to those for the City exactly because the numbers for the health districts needed to be approximated from the numbers by Enumeration Area (EA) where the boundaries of health districts passed through EAs.

APPENDIX 2: DEMOGRAPHIC ASSUMPTIONS

Projections were carried out using a variation of the ASSA2003 AIDS and Demographic model (Actuarial Society of South Africa, 2005) which projects the population by individual ages and by individual years. The tables below are average fertility and survival rates extracted from the variation of the model used for this project to give an idea of the bases assumed.

FERTILITY (Age specific and total fertility rates):

African:

	2001-2006	2006-2011	2011-2016	2016-2021
15-19	0.045	0.041	0.038	0.036
20-24	0.088	0.086	0.084	0.081
25-29	0.109	0.110	0.111	0.112
30-34	0.093	0.094	0.093	0.094
35-39	0.056	0.050	0.046	0.043
40-44	0.023	0.019	0.017	0.015
45-49	0.006	0.004	0.003	0.003
TFR	2.090	2.013	1.946	1.904

Coloured:

	2001-2006	2006-2011	2011-2016	2016-2021
15-19	0.054	0.050	0.047	0.044
20-24	0.105	0.101	0.097	0.094
25-29	0.114	0.114	0.114	0.114
30-34	0.092	0.097	0.098	0.099
35-39	0.045	0.044	0.043	0.043
40-44	0.015	0.014	0.014	0.014
45-49	0.003	0.003	0.003	0.003
TFR	2.127	2.107	2.072	2.038

Indian:

	2001-2006	2006-2011	2011-2016	2016-2021
15-19	0.024	0.025	0.026	0.027
20-24	0.100	0.104	0.107	0.109
25-29	0.128	0.115	0.106	0.101
30-34	0.070	0.055	0.050	0.047
35-39	0.031	0.026	0.024	0.022
40-44	0.008	0.006	0.005	0.004
45-49	0.001	0.000	0.000	0.000
TFR	1.792	1.644	1.578	1.550

White:

	2001-2006	2006-2011	2011-2016	2016-2021
15-19	0.011	0.012	0.013	0.014
20-24	0.062	0.069	0.075	0.081
25-29	0.099	0.099	0.098	0.098
30-34	0.062	0.051	0.047	0.045
35-39	0.024	0.021	0.019	0.018
40-44	0.005	0.004	0.003	0.003
45-49	0.001	0.000	0.000	0.000
TFR	1.318	1.274	1.274	1.293

MORTALITY (five-year survival factors and life expectancy):

African:

	2001-2006		2006-2011		2011-2016		2016-2021	
	Male	Female	Male	Female	Male	Female	Male	Female
PB	0.9543	0.9578	0.9587	0.9619	0.9600	0.9629	0.9614	0.9641
0-4	0.9842	0.9856	0.9815	0.9829	0.9790	0.9802	0.9784	0.9796
5-9	0.9963	0.9973	0.9899	0.9909	0.9839	0.9849	0.9815	0.9824
10-14	0.9953	0.9966	0.9949	0.9964	0.9920	0.9935	0.9895	0.9911
15-19	0.9883	0.9882	0.9886	0.9888	0.9889	0.9892	0.9883	0.9887
20-24	0.9733	0.9590	0.9760	0.9575	0.9767	0.9550	0.9772	0.9554
25-29	0.9509	0.9356	0.9469	0.9124	0.9492	0.8988	0.9495	0.8966
30-34	0.9303	0.9341	0.9195	0.9035	0.9100	0.8731	0.9117	0.8645
35-39	0.9174	0.9370	0.9035	0.9084	0.8913	0.8814	0.8875	0.8707
40-44	0.9089	0.9435	0.8946	0.9176	0.8834	0.8944	0.8815	0.8877
45-49	0.8991	0.9461	0.8842	0.9294	0.8755	0.9088	0.8756	0.9038
50-54	0.8824	0.9333	0.8687	0.9282	0.8613	0.9155	0.8646	0.9106
55-59	0.8601	0.9049	0.8495	0.9087	0.8418	0.9064	0.8467	0.9041
60-64	0.8194	0.8650	0.8113	0.8712	0.8048	0.8776	0.8091	0.8813
65-69	0.7356	0.7953	0.7417	0.8097	0.7322	0.8146	0.7316	0.8229
70-74	0.6363	0.7063	0.6318	0.7080	0.6372	0.7182	0.6288	0.7167
75-79	0.5147	0.5883	0.5130	0.5886	0.5079	0.5851	0.5162	0.5916
80+	0.3505	0.4037	0.3388	0.3949	0.3371	0.4048	0.3231	0.3997
e_0	54.8	58.0	53.9	55.5	52.6	52.4	52.5	51.6

Coloured:

	2001-2006		2006-2011		2011-2016		2016-2021	
	Male	Female	Male	Female	Male	Female	Male	Female
PB	0.9649	0.9690	0.9721	0.9754	0.9771	0.9798	0.9810	0.9832
0-4	0.9907	0.9927	0.9912	0.9931	0.9913	0.9930	0.9919	0.9934
5-9	0.9971	0.9977	0.9964	0.9970	0.9950	0.9957	0.9940	0.9948
10-14	0.9928	0.9964	0.9930	0.9966	0.9929	0.9964	0.9925	0.9959
15-19	0.9826	0.9932	0.9832	0.9936	0.9838	0.9940	0.9842	0.9942
20-24	0.9740	0.9875	0.9746	0.9868	0.9752	0.9866	0.9759	0.9869
25-29	0.9689	0.9808	0.9689	0.9764	0.9691	0.9725	0.9699	0.9716
30-34	0.9623	0.9743	0.9609	0.9677	0.9597	0.9602	0.9600	0.9576
35-39	0.9509	0.9646	0.9491	0.9574	0.9469	0.9492	0.9465	0.9469
40-44	0.9360	0.9544	0.9349	0.9471	0.9336	0.9388	0.9337	0.9371
45-49	0.9135	0.9432	0.9128	0.9380	0.9126	0.9308	0.9136	0.9292
50-54	0.8834	0.9275	0.8830	0.9262	0.8829	0.9222	0.8845	0.9211
55-59	0.8464	0.9029	0.8476	0.9038	0.8488	0.9026	0.8518	0.9024
60-64	0.7972	0.8729	0.8016	0.8769	0.8035	0.8787	0.8072	0.8808
65-69	0.7370	0.8268	0.7427	0.8338	0.7483	0.8413	0.7520	0.8467
70-74	0.6685	0.7637	0.6731	0.7732	0.6794	0.7817	0.6862	0.7910
75-79	0.6111	0.7054	0.6150	0.7140	0.6168	0.7206	0.6199	0.7264
80+	0.4707	0.5072	0.4726	0.5137	0.4739	0.5168	0.4724	0.5194
e_0	59.0	65.7	59.6	65.6	59.8	64.8	60.2	64.8

Indian:

	2001-2006		2006-2011		2011-2016		2016-2021	
	Male	Female	Male	Female	Male	Female	Male	Female
PB	0.9856	0.9878	0.9865	0.9884	0.9873	0.9890	0.9884	0.9899
0-4	0.9959	0.9963	0.9953	0.9957	0.9943	0.9946	0.9940	0.9943
5-9	0.9985	0.9982	0.9981	0.9979	0.9968	0.9966	0.9955	0.9954
10-14	0.9952	0.9973	0.9954	0.9977	0.9953	0.9977	0.9948	0.9973
15-19	0.9887	0.9958	0.9886	0.9963	0.9884	0.9967	0.9880	0.9969
20-24	0.9851	0.9939	0.9845	0.9934	0.9840	0.9932	0.9835	0.9934
25-29	0.9839	0.9902	0.9832	0.9866	0.9827	0.9825	0.9828	0.9814
30-34	0.9779	0.9862	0.9755	0.9788	0.9728	0.9695	0.9718	0.9647
35-39	0.9649	0.9814	0.9614	0.9725	0.9569	0.9604	0.9547	0.9543
40-44	0.9502	0.9754	0.9471	0.9682	0.9433	0.9563	0.9418	0.9506
45-49	0.9312	0.9647	0.9288	0.9620	0.9262	0.9536	0.9262	0.9492
50-54	0.8987	0.9417	0.8977	0.9441	0.8956	0.9417	0.8972	0.9401
55-59	0.8563	0.9080	0.8603	0.9164	0.8614	0.9204	0.8651	0.9233
60-64	0.8020	0.8612	0.8099	0.8764	0.8143	0.8870	0.8184	0.8947
65-69	0.7383	0.8059	0.7479	0.8274	0.7570	0.8459	0.7639	0.8602
70-74	0.6736	0.7466	0.6843	0.7714	0.6947	0.7932	0.7051	0.8131
75-79	0.5997	0.6754	0.6111	0.7002	0.6195	0.7176	0.6277	0.7331
80+	0.4952	0.5468	0.4893	0.5435	0.4759	0.5375	0.4882	0.5686
e_0	63.8	69.9	63.7	69.9	63.3	68.8	63.3	68.5

White:

	2001-2006		2006-2011		2011-2016		2016-2021	
	Male	Female	Male	Female	Male	Female	Male	Female
PB	0.9898	0.9922	0.9905	0.9925	0.9909	0.9927	0.9914	0.9930
0-4	0.9960	0.9970	0.9952	0.9961	0.9943	0.9953	0.9942	0.9951
5-9	0.9984	0.9988	0.9980	0.9983	0.9968	0.9971	0.9959	0.9963
10-14	0.9954	0.9979	0.9956	0.9980	0.9955	0.9978	0.9950	0.9973
15-19	0.9894	0.9966	0.9899	0.9968	0.9902	0.9969	0.9904	0.9970
20-24	0.9870	0.9951	0.9871	0.9950	0.9871	0.9949	0.9871	0.9949
25-29	0.9871	0.9923	0.9868	0.9900	0.9865	0.9880	0.9864	0.9874
30-34	0.9849	0.9891	0.9841	0.9836	0.9832	0.9775	0.9829	0.9750
35-39	0.9801	0.9857	0.9795	0.9791	0.9777	0.9697	0.9769	0.9652
40-44	0.9719	0.9808	0.9714	0.9749	0.9699	0.9657	0.9685	0.9605
45-49	0.9574	0.9738	0.9577	0.9702	0.9566	0.9629	0.9560	0.9584
50-54	0.9331	0.9631	0.9344	0.9628	0.9348	0.9583	0.9349	0.9548
55-59	0.8983	0.9442	0.8999	0.9444	0.9015	0.9433	0.9035	0.9407
60-64	0.8515	0.9175	0.8557	0.9193	0.8582	0.9196	0.8620	0.9202
65-69	0.7904	0.8809	0.7981	0.8862	0.8039	0.8891	0.8081	0.8906
70-74	0.7067	0.8210	0.7147	0.8259	0.7229	0.8334	0.7291	0.8378
75-79	0.6133	0.7314	0.6212	0.7384	0.6279	0.7430	0.6352	0.7514
80+	0.4032	0.4852	0.3980	0.4847	0.4000	0.4904	0.4028	0.4845
e_0	68.0	74.4	68.2	73.7	68.0	72.4	68.1	71.7

APPENDIX 3: ESTIMATE OF THE POPULATION AS AT OCTOBER 2001

CENTRAL	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
									326	373

EASTERN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
									378 060	

KHAYALITSHA	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
										315 769

KLIPFONTEIN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
										361 782

MITCHELL'S PLAIN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
									400	145

NORTHERN PANORAMA	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
									458	178

SOUTHERN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
									326 895	

TYGERBERG	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4										
5-9										
10-14										
15-19										
20-24										
25-29										
30-34										
35-39										
40-44										
45-49										
50-54										
55-59										
60-64										
65-69										
70-74										
75-79										
80-84										
85+										
									427	577

CITY OF CAPE TOWN	AFRICAN		COLOURED		INDIAN		WHITE		TOTAL	
AGE	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM	MALE	FEM
0-4	55,578	55,235	68,557	67,508	1,854	1,817	17,072	16,340	143,062	140,900
5-9	41,712	41,058	69,158	67,945	1,861	1,836	17,555	16,852	130,287	127,690
10-14	39,501	40,072	71,490	70,422	1,937	1,889	19,653	18,998	132,580	131,380
15-19	48,547	49,491	73,301	74,524	2,132	2,190	21,310	20,797	145,290	147,002
20-24	59,330	61,436	62,943	64,269	2,229	2,275	20,722	20,841	145,224	148,822
25-29	62,888	63,202	61,296	62,183	2,043	2,041	18,741	21,906	144,967	149,332
30-34	49,273	47,191	58,156	62,332	1,887	1,893	23,344	24,714	132,660	136,129
35-39	37,951	37,279	55,575	61,977	1,742	1,811	21,457	23,674	116,724	124,740
40-44	25,736	27,110	46,477	53,066	1,680	1,711	23,294	23,952	97,187	105,839
45-49	18,131	19,190	34,443	41,311	1,430	1,429	19,126	20,467	73,130	82,397
50-54	13,097	12,808	25,891	32,489	1,088	1,143	17,880	18,770	57,956	65,210
55-59	7,898	8,319	18,682	22,858	664	722	14,895	16,327	42,139	48,226
60-64	5,978	6,522	14,697	19,445	535	622	12,815	14,314	34,026	40,903
65-69	3,070	3,854	10,132	15,213	418	457	9,766	11,959	23,386	31,483
70-74	2,103	2,572	6,206	10,014	290	301	8,181	11,372	16,780	24,259
75-79	1,265	1,405	3,262	5,974	201	219	5,912	9,151	10,640	16,749
80-84	768	909	1,551	3,185	80	119	3,475	6,242	5,873	10,455
85+	294	553	879	2,477	28	70	2,034	5,012	3,235	8,113
	473,122	478,205	682,695	737,194	22,098	22,544	277,233	301,687	1,455,149	1,539,630
	951,327		1,419,889		44,642		578,921		2,994,779	

APPENDIX 4: MIGRATION IMPLIED BY THE 1996 AND 2001 POPULATION ESTIMATES

INDIAN

AGE	AGE	Net migration to City MALE	Net migration to City FEM	Average rate p.a. MALE	Average rate p.a. FEM
0	0	-107	-91	-1.1%	-1.0%
5	5	-70	-42	-0.7%	-0.4%
10	10	91	96	0.9%	1.0%
15	15	168	163	1.6%	1.5%
20	20	258	243	2.6%	2.4%
25	25	168	96	1.8%	1.0%
30	30	96	68	1.1%	0.8%
35	35	118	112	1.4%	1.3%
40	40	98	61	1.3%	0.8%
45	45	22	10	0.3%	0.2%
50	50	-23	12	-0.5%	0.3%
55	55	-19	9	-0.6%	0.3%
60	60	22	17	0.9%	0.6%
65	65	46	0	2.4%	0.0%
70	70	24	16	1.6%	1.1%
75	75	5	1	0.6%	0.1%
80	80	-6	2	-1.7%	0.3%
85+	85+	-4	3	-8.3%	1.6%
		888	776	0.8%	0.7%

AFRICAN

AGE	AGE	Net migration to City MALE	Net migration to City FEM	Average rate p.a. MALE	Average rate p.a. FEM
0	0	1345	1366	0.6%	0.6%
5	5	4100	4216	2.2%	2.3%
10	10	3024	3919	1.5%	1.9%
15	15	8289	10345	3.5%	4.4%
20	20	25617	27521	10.6%	11.1%
25	25	19305	18165	7.9%	7.5%
30	30	5619	4652	2.7%	2.3%
35	35	1996	1754	1.3%	1.1%
40	40	1431	1343	1.4%	1.2%
45	45	792	780	1.0%	1.0%
50	50	343	380	0.7%	0.8%
55	55	101	238	0.3%	0.6%
60	60	-49	104	-0.2%	0.4%
65	65	-93	35	-0.7%	0.2%
70	70	-35	33	-0.3%	0.3%
75	75	24	28	0.3%	0.4%
80	80	14	24	0.4%	0.5%
85+	85+	6	16	0.6%	0.6%
		71829	74918	3.5%	3.7%

CLOURED

AGE	AGE	Net migration to City MALE	FEM	Average rate p.a. MALE	FEM
0	0	-1903	-1766	-0.5%	-0.5%
5	5	-3202	-2924	-0.9%	-0.8%
10	10	-711	-552	-0.2%	-0.2%
15	15	660	815	0.2%	0.2%
20	20	840	950	0.3%	0.3%
25	25	801	758	0.3%	0.2%
30	30	736	612	0.3%	0.2%
35	35	522	524	0.2%	0.2%
40	40	361	396	0.2%	0.2%
45	45	245	247	0.2%	0.1%
50	50	172	166	0.2%	0.1%
55	55	109	120	0.1%	0.1%
60	60	79	91	0.1%	0.1%
65	65	70	64	0.2%	0.1%
70	70	38	58	0.1%	0.1%
75	75	20	34	0.1%	0.1%
80	80	20	25	0.3%	0.2%
85+	85+	15	18	0.4%	0.2%
		-1128	-364	0.0%	0.0%

* They out-migration of children is a result of the methodology used and is more likely to be accounted for by a small reduction in the fertility rate.

WHITE

AGE	AGE	Net migration to City MALE	FEM	Average rate p.a. MALE	FEM
0	0	-1903	-4502	-2.0%	-4.9%
5	5	-3202	-1478	-3.3%	-1.6%
10	10	-711	891	-0.7%	0.9%
15	15	660	1683	0.6%	1.7%
20	20	840	-281	0.8%	-0.3%
25	25	801	-1332	0.7%	-1.1%
30	30	736	726	0.7%	0.6%
35	35	522	1426	0.5%	1.2%
40	40	361	1356	0.4%	1.3%
45	45	245	1077	0.3%	1.1%
50	50	172	1079	0.2%	1.3%
55	55	109	1318	0.2%	1.8%
60	60	79	1397	0.1%	2.2%
65	65	70	928	0.1%	1.5%
70	70	38	470	0.1%	0.8%
75	75	20	287	0.1%	0.7%
80	80	20	107	0.1%	0.4%
85+	85+	15	64	0.2%	0.3%
		-1128	-364	-0.1%	0.0%

APPENDIX 5: PROJECTIONS ON THE BASIS OF THE MIDDLE MIGRATION ASSUMPTION

AFRICAN

AGE	2006		2011		2016		2021	
	Males	Females	Males	Females	Males	Females	Males	Females
0-4	66,910	66,473	65,286	64,844	56,640	56,243	50,117	49,755
5-9	56,033	55,873	66,218	65,915	64,086	63,746	55,498	55,177
10-14	44,004	43,541	56,434	56,383	65,457	65,241	62,920	62,653
15-19	42,123	43,595	44,923	44,809	56,409	56,536	64,890	64,807
20-24	57,369	59,328	44,739	46,471	45,448	45,423	56,072	56,243
25-29	70,576	71,365	59,950	60,272	44,940	45,427	44,812	43,773
30-34	65,839	64,227	68,823	66,218	57,384	54,082	42,854	40,670
35-39	47,515	45,466	60,944	58,137	62,636	57,288	52,085	46,262
40-44	35,813	35,858	43,286	41,594	54,260	51,043	55,306	49,262
45-49	24,036	26,225	32,308	33,166	38,357	37,286	47,657	45,050
50-54	16,631	18,521	21,412	24,546	28,391	30,241	33,603	33,692
55-59	11,683	12,166	14,512	17,312	18,503	22,543	24,577	27,575
60-64	6,795	7,656	9,916	11,137	12,221	15,743	15,680	20,412
65-69	4,821	5,673	5,468	6,707	7,953	9,798	9,873	13,889
70-74	2,230	3,100	3,529	4,597	3,988	5,486	5,807	8,079
75-79	1,340	1,836	1,427	2,221	2,240	3,295	2,515	3,950
80-84	661	841	695	1,090	744	1,318	1,153	1,942
85+	360	583	333	562	338	664	361	799
	554,738	562,325	600,202	605,983	619,994	621,403	625,779	623,990
Total	1,117,063		1,206,185		1,241,396		1,249,769	

COLOURED

AGE	2006		2011		2016		2021	
	Males	Females	Males	Females	Males	Females	Males	Females
0-4	68,284	67,251	70,152	69,019	70,325	69,139	68,709	67,514
5-9	66,814	65,985	67,212	66,342	69,350	68,353	69,680	68,611
10-14	68,653	67,514	66,429	65,657	66,811	65,995	68,905	67,967
15-19	71,229	70,457	68,312	67,437	66,029	65,498	66,346	65,760
20-24	72,353	74,404	70,205	70,204	67,288	67,127	65,027	65,161
25-29	61,655	63,825	70,696	73,601	68,557	69,350	65,704	66,281
30-34	59,718	61,283	59,908	62,466	68,593	71,638	66,526	67,406
35-39	56,236	60,976	57,536	59,442	57,572	60,056	65,870	68,608
40-44	53,038	59,990	53,484	58,490	54,556	56,514	54,522	56,895
45-49	43,642	50,792	49,665	56,893	49,993	54,981	50,975	53,006
50-54	31,568	39,066	39,896	47,698	45,370	53,006	45,695	51,119
55-59	22,948	30,214	27,921	36,230	35,257	44,021	40,147	48,841
60-64	15,857	20,694	19,485	27,346	23,723	32,729	30,043	39,740
65-69	11,761	17,020	12,735	18,173	15,677	24,050	19,162	28,839
70-74	7,501	12,619	8,759	14,219	9,539	15,298	11,799	20,374
75-79	4,160	7,671	5,061	9,778	5,959	11,129	6,546	12,103
80-84	2,006	4,233	2,566	5,484	3,129	7,058	3,699	8,092
85+	1,151	2,876	1,498	3,660	1,930	4,732	2,391	6,123
	718,575	776,870	751,521	812,139	779,658	840,674	801,746	862,441
Total	1,495,445		1,563,661		1,620,331		1,664,187	

INDIAN

AGE	2006		2011		2016		2021	
	Males	Females	Males	Females	Males	Females	Males	Females
0-4	1,750	1,705	1,714	1,669	1,610	1,566	1,508	1,466
5-9	1,785	1,766	1,702	1,668	1,680	1,640	1,587	1,547
10-14	1,901	1,882	1,809	1,795	1,713	1,682	1,681	1,643
15-19	2,002	1,955	1,941	1,925	1,830	1,819	1,720	1,692
20-24	2,230	2,301	2,054	2,022	1,961	1,961	1,829	1,834
25-29	2,314	2,355	2,268	2,345	2,064	2,042	1,950	1,965
30-34	2,079	2,060	2,320	2,349	2,256	2,319	2,042	2,011
35-39	1,909	1,926	2,070	2,055	2,281	2,299	2,204	2,245
40-44	1,748	1,831	1,879	1,909	2,007	1,995	2,189	2,200
45-49	1,631	1,687	1,679	1,785	1,788	1,834	1,897	1,900
50-54	1,326	1,386	1,511	1,629	1,553	1,707	1,654	1,743
55-59	962	1,084	1,178	1,314	1,346	1,538	1,388	1,607
60-64	571	666	829	1,001	1,016	1,215	1,165	1,423
65-69	453	540	479	587	686	890	839	1,089
70-74	329	374	354	451	373	500	530	767
75-79	202	230	230	293	249	361	265	408
80-84	119	147	122	160	142	210	156	264
85+	50	105	81	138	96	163	114	207
	23,361	24,000	24,222	25,094	24,651	25,740	24,718	26,012
Total	47,361		49,315		50,390		50,730	

WHITE

AGE	2006		2011		2016		2021	
	Males	Females	Males	Females	Males	Females	Males	Females
0-4	15,109	14,500	14,092	13,553	13,342	12,841	12,009	11,562
5-9	14,560	13,851	14,006	13,415	13,583	13,060	13,092	12,607
10-14	16,915	16,172	14,231	13,510	13,814	13,224	13,459	12,940
15-19	20,374	19,857	17,241	16,577	14,361	13,687	13,833	13,279
20-24	20,948	21,248	20,109	20,053	17,047	16,653	14,215	13,706
25-29	18,691	19,951	19,892	20,744	19,507	19,755	16,685	16,478
30-34	17,800	21,531	18,123	19,642	19,478	20,427	19,177	19,465
35-39	23,772	25,285	17,906	21,571	18,010	19,383	19,231	19,979
40-44	21,800	24,258	23,663	25,165	17,685	21,077	17,680	18,775
45-49	23,329	24,309	21,529	24,041	23,105	24,427	17,190	20,268
50-54	18,940	20,640	22,669	23,948	20,755	23,305	22,138	23,420
55-59	17,470	18,885	18,094	20,277	21,381	23,145	19,486	22,319
60-64	14,288	16,332	16,177	18,294	16,529	19,344	19,411	21,870
65-69	11,712	13,900	12,626	15,405	14,086	17,021	14,340	17,889
70-74	8,227	10,979	9,615	12,554	10,286	13,822	11,458	15,232
75-79	6,016	9,579	6,024	9,227	7,026	10,539	7,536	11,620
80-84	3,809	6,830	3,842	7,152	3,848	6,919	4,493	7,937
85+	2,404	5,632	2,625	6,265	2,678	6,754	2,696	6,874
	276,163	303,736	272,464	301,391	266,522	295,385	258,128	286,219
Total	579,900		573,856		561,906		544,348	

TOTAL CITY POPULATION

AGE	2006		2011		2016		2021	
	Males	Females	Males	Females	Males	Females	Males	Females
0-4	152,054	149,929	151,245	149,085	141,916	139,789	132,343	130,297
5-9	139,191	137,475	149,137	147,340	148,699	146,799	139,857	137,941
10-14	131,472	129,109	138,904	137,345	147,795	146,141	146,964	145,202
15-19	135,728	135,863	132,418	130,748	138,630	137,540	146,789	145,539
20-24	152,901	157,281	137,107	138,750	131,744	131,163	137,143	136,944
25-29	153,236	157,497	152,807	156,963	135,066	136,574	129,152	128,497
30-34	145,437	149,101	149,175	150,675	147,710	148,466	130,599	129,552
35-39	129,431	133,653	138,455	141,205	140,499	139,026	139,390	137,094
40-44	112,399	121,936	122,311	127,158	128,508	130,629	129,697	127,132
45-49	92,637	103,013	105,182	115,884	113,243	118,528	117,719	120,223
50-54	68,464	79,613	85,488	97,821	96,069	108,258	103,089	109,974
55-59	53,063	62,348	61,705	75,133	76,487	91,248	85,598	100,341
60-64	37,511	45,347	46,406	57,778	53,490	69,030	66,299	83,446
65-69	28,749	37,132	31,309	40,871	38,402	51,760	44,214	61,705
70-74	18,286	27,071	22,256	31,820	24,186	35,106	29,595	44,453
75-79	11,717	19,314	12,742	21,519	15,474	25,324	16,862	28,082
80-84	6,594	12,051	7,225	13,886	7,862	15,505	9,500	18,235
85+	3,966	9,196	4,537	10,625	5,043	12,313	5,562	14,003
	1,572,837	1,666,931	1,648,409	1,744,607	1,690,824	1,783,200	1,710,371	1,798,662
Total	3,239,768		3,393,017		3,474,025		3,509,033	

APPENDIX 6: COMPARISON OF HIGH MIDDLE AND LOW PROJECTIONS

MIDDLE

	2006	2011	2016	2021
Asian	47,361	49,315	50,390	50,730
Black	1,117,063	1,206,185	1,241,396	1,249,769
Coloured	1,495,445	1,563,661	1,620,331	1,664,187
White	579,900	573,856	561,906	544,348
Total	3,239,768	3,393,017	3,474,025	3,509,033

HIGH

	2006	2011	2016	2021
Asian	48,079	51,201	53,786	55,840
Black	1,185,260	1,410,265	1,613,154	1,800,786
Coloured	1,493,191	1,559,570	1,614,300	1,655,132
White	577,742	570,758	559,011	543,462
Total	3,304,272	3,591,794	3,840,252	4,055,219

LOW

	2006	2011	2016	2021
Asian	46,902	48,293	48,810	48,664
Black	1,038,422	1,086,086	1,101,117	1,102,571
Coloured	1,495,244	1,562,352	1,617,835	1,661,048
White	579,900	573,856	561,906	544,348
Total	3,160,467	3,270,587	3,329,668	3,356,631

APPENDIX 7: PROJECT PROPOSAL

TERMS OF REFERENCE FOR UNDERTAKING THE POPULATION PROJECTION OF THE CITY OF CAPE TOWN AS A WHOLE

Objective

To produce a report estimating the current population in the City of Cape Town and projecting the population forward to the year 2021 in accordance with the project proposal attached.

The report is to include a description of the methods used as well as all assumptions made in deriving the estimates and a review of the accuracy of the previous (1999) projection.

Operation

1. In the first instance the consultant will be engaged to work on Phase 1 but in the light of this work may be retained to form part of the team to undertake Phase 2.
2. The City of Cape Town will provide a staff member from Strategic Information to work closely with the consultant in order to assist with the project and to gain an understanding of the projection process and its requirements.
3. The consultant will meet with the Steering Committee to ensure that the brief is clearly understood and that all needs are catered for.
4. In addition the consultant may need to meet with City officials from time to time to tap their expertise.

Time Frame

1. The report (1st phase) is to be completed within three months from the date of signing of the contract and receipt of the first instalment of payment. However, the consultant will report monthly on progress and the City reserves the right to cancel the appointment if progress is deemed to be unsatisfactory.

29 March 2004

PROJECT PROPOSAL

Population Projection of the City of Cape Town

Introduction

1. The need for an acceptable estimate of the current and future size and composition of the population of the City, over and above the analysis of data derived from the census, has been identified. This information is necessary to inform a wide range of planning initiatives presently being undertaken, or under discussion, in the City. The estimate of future population and its characteristics are crucial in determining:

    - The need and effective demand for housing and infrastructure development.
    - The need for health facilities.
    - The rate and growth of the supply of labour.
    - An assessment of need and resources.

Operation

There are two distinct, although interrelated, phases to the study. These are:

1. The initial projection of the population of the City of Cape Town subdivided by population group (African, Coloured, Indian and White), age and sex.
2. In addition to these totals past patterns as to the distribution of the population will be used to produce estimates by broad geographic subdivision (on the assumption that HIV prevalence data can be provided for these populations), socio-economic group and household size.

This project proposal is concerned with the first phase of the project.

Phase 1: Projection of the population for the City as a whole

The population for the City of Cape Town will be projected from the base year of 2001 to the year 2021 at five yearly intervals. The projected population will be divided by sex, and age in five-year age groups. Such a projection will take into account the possible impact of the HIV/AIDS epidemic.

In addition these numbers need to be distributed between the sub-regions giving some ideas as to household size and type. This will be based on an extrapolation of past trends taking into account any expected future developments in the area.

The projection will involve at least seven sub-projects as outlined in Annexure 1. As it is probable that the results of most of these projects (in particular AIDS, population distribution and socio-economic make up of the population, migration) will be improved if the data is analysed by population group (African, Coloured, Indian and White) separately, the projections will be carried out for each population group separately.

A model will be produced which could be used by planners to consider the impact of alternative scenarios, in particular the impact of interventions.

Phase 2: Spatial distribution of the population increase within the City

The population in each sub-district will be projected from the base year of 2001 to the year 2021 at five yearly intervals. The projected population will be divided by sex, and age in five-year age groups. Such projections will take into account the possible impact of the HIV/AIDS epidemic and extrapolations of past trends taking into account any expected future developments in the area.

The projection will involve at least two further sub-projects as outlined in Annexure 1. As it is probable that the results of most of these projects (in particular AIDS, population distribution and socio-economic make up of the population, migration) will be improved if the data is analysed by population group (African, Coloured, Indian and White) separately, the projections will be carried out for each population group separately.

Essentially this stage would involve examining the migration, particularly at the sub-district level derived in Phase 1 on the basis of past patterns to see if it is consistent with known development plans as well as capacities of certain areas.

Required inputs

Annexure 2 provides preliminary details of data needed from the City in order to carry out the projection. As the project progresses other items may be added to the list.

29 March 2004

APPENDIX 8: ADDITIONAL SLIDES PRODUCED FOR PRESENTATIONAL PURPOSES

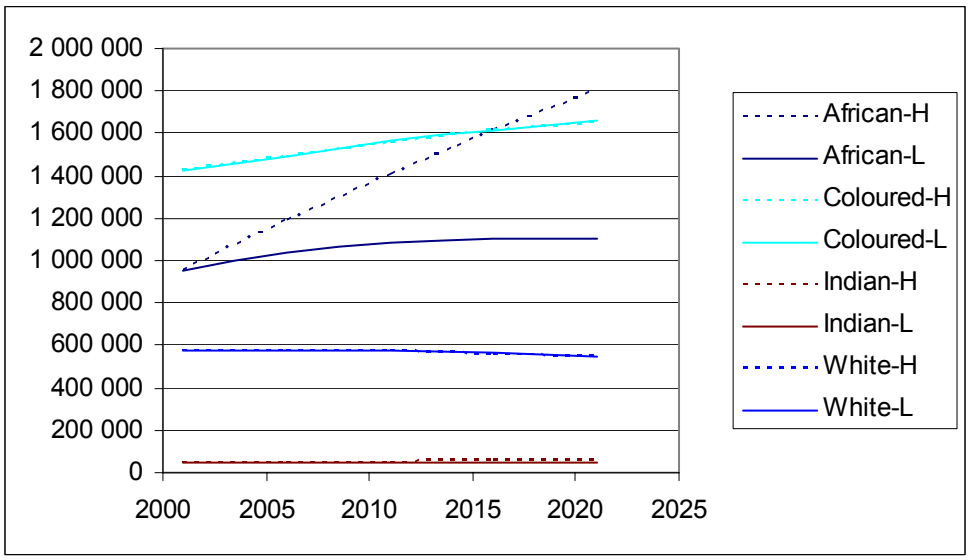


Figure 1 High and low projections by population group for the City of Cape Town

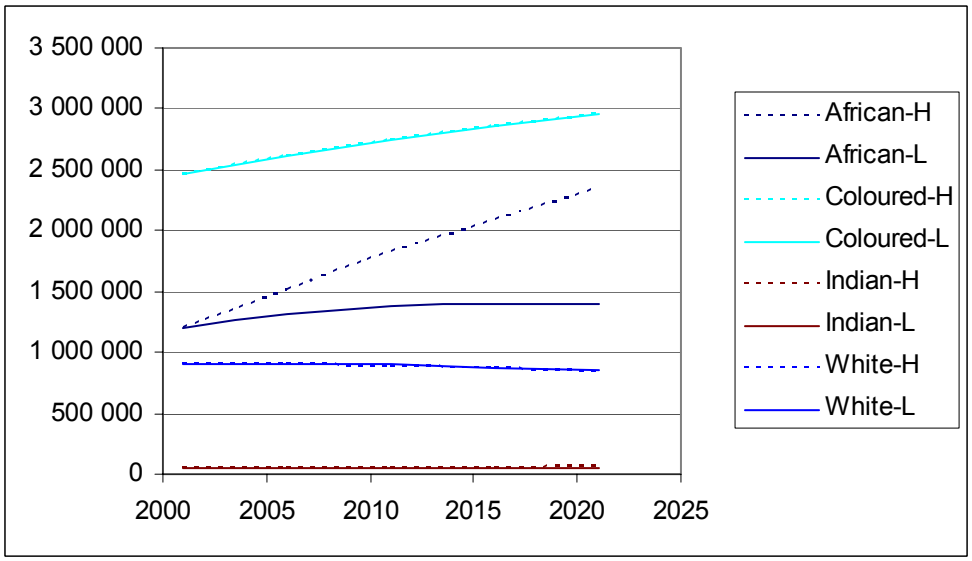


Figure 2 High and low projections by population group for the Western Cape

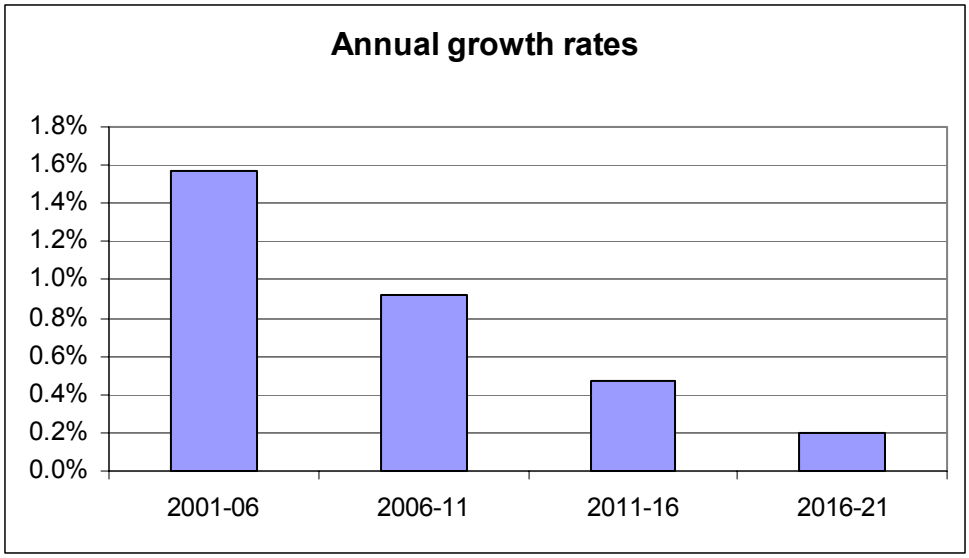


Figure 3 Annual growth rate of the population of the City of Cape Town

Table 4: Key indicator rates

	Annual rates			
	2001-06	**2006-11**	**2011-16**	**2016-21**
National				
Birth rate	2.1%	1.9%	1.7%	1.5%
Death rate	1.0%	1.2%	1.3%	1.4%
Natural increase	1.0%	0.7%	0.4%	0.2%
Net migration rate	0.5%	0.2%	0.1%	0.0%
Growth rate	1.5%	0.9%	0.5%	0.2%
African				
Birth rate	2.7%	2.3%	1.9%	1.7%
Death rate	1.1%	1.3%	1.5%	1.6%
Natural increase	1.6%	1.0%	0.4%	0.1%
Net migration rate	1.5%	0.5%	0.2%	0.1%
Growth rate	3.1%	1.5%	0.6%	0.1%
Coloured				
Birth rate	1.9%	1.9%	1.8%	1.7%
Death rate	0.9%	1.0%	1.1%	1.2%
Natural increase	1.0%	0.9%	0.7%	0.5%
Net migration rate	0.0%	0.0%	0.0%	0.0%
Growth rate	1.0%	0.9%	0.7%	0.5%
Indian				
Birth rate	1.6%	1.4%	1.3%	1.2%
Death rate	0.8%	0.9%	1.0%	1.1%
Natural increase	0.8%	0.5%	0.3%	0.1%
Net migration rate	0.4%	0.3%	0.2%	0.1%
Growth rate	1.2%	0.8%	0.4%	0.1%
White				
Birth rate	1.1%	1.0%	0.9%	0.9%
Death rate	1.2%	1.3%	1.4%	1.5%
Natural increase	-0.1%	-0.3%	-0.5%	-0.7%
Net migration rate	0.1%	0.1%	0.1%	0.0%
Growth rate	0.0%	-0.2%	-0.4%	-0.6%

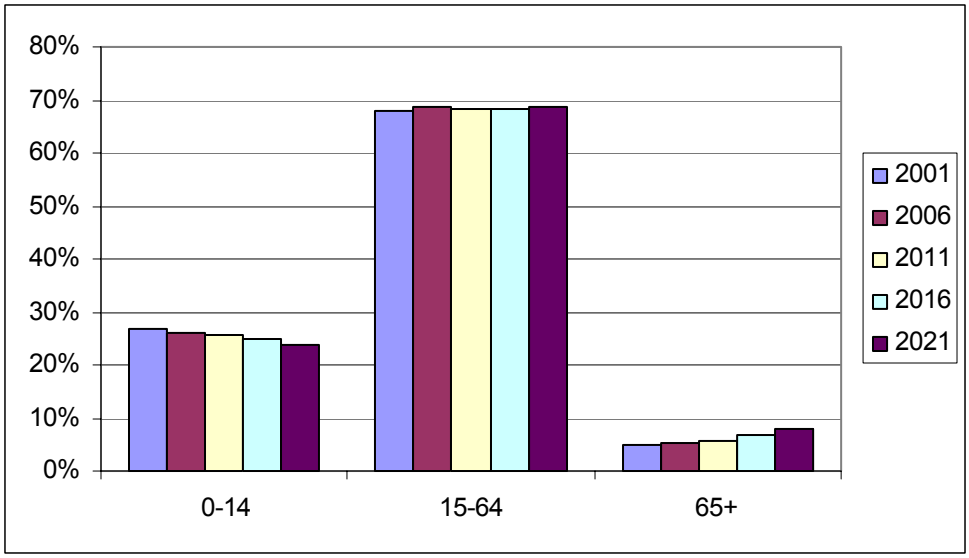


Figure 5 Population distribution by age group at five-yearly intervals

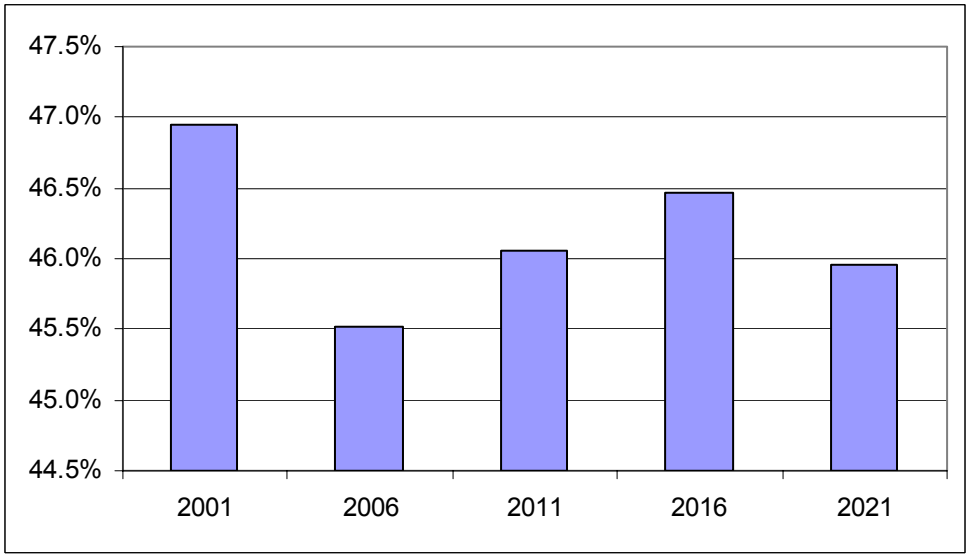


Figure 6 Dependency ratio at five-yearly intervals

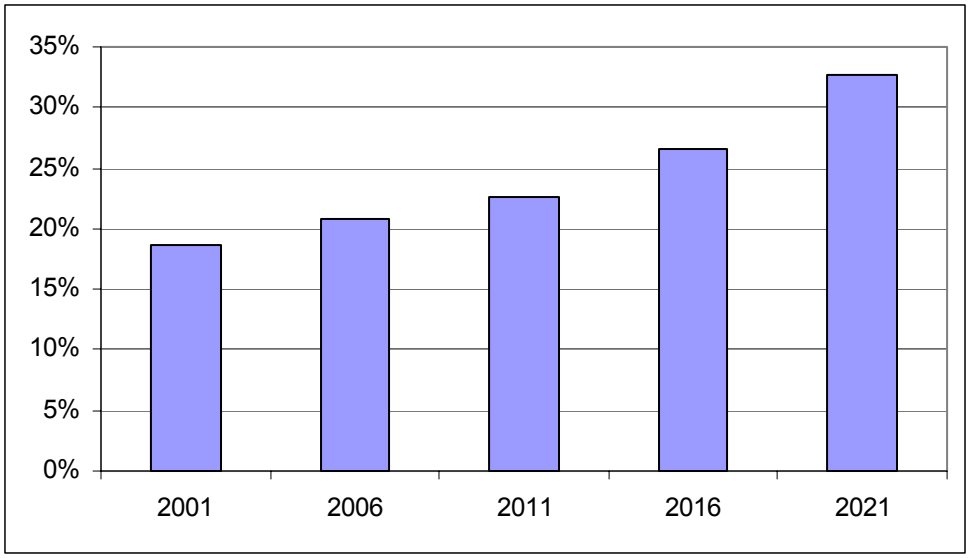


Figure 7 Ageing index

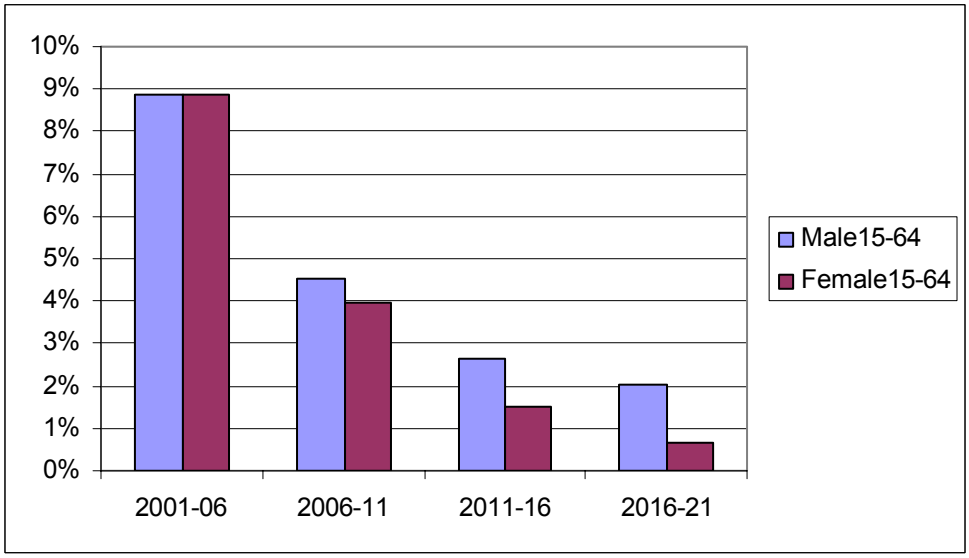


Figure 8 Five-yearly growth rates for population aged 15-64

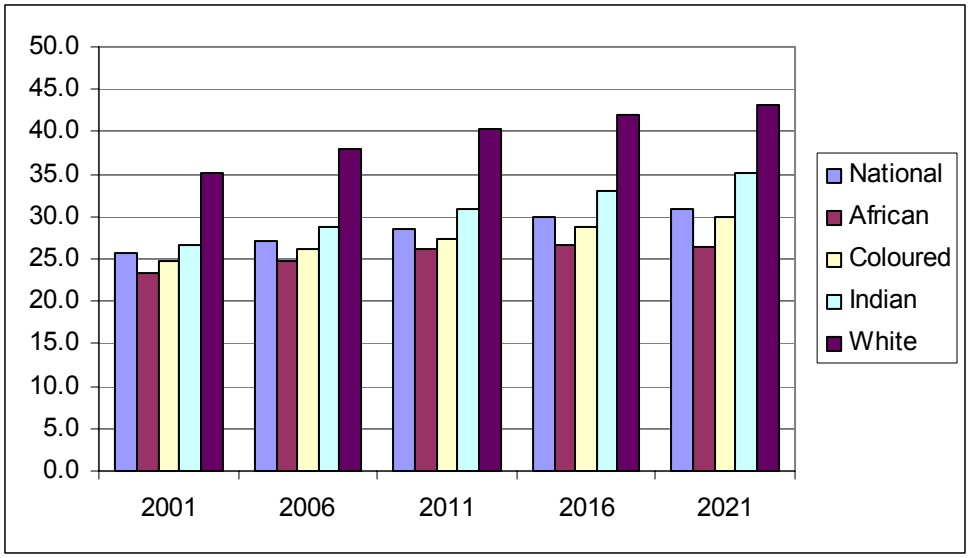


Figure 9 Median age (that age below which 50% of the population are aged) by population group at five-yearly intervals

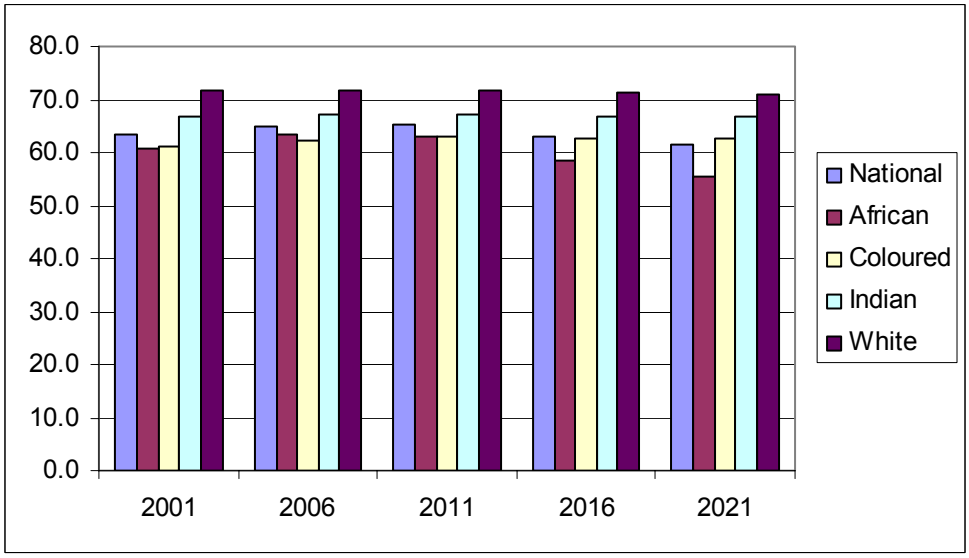


Figure 10 Life expectancy at birth by population group at five-yearly age intervals

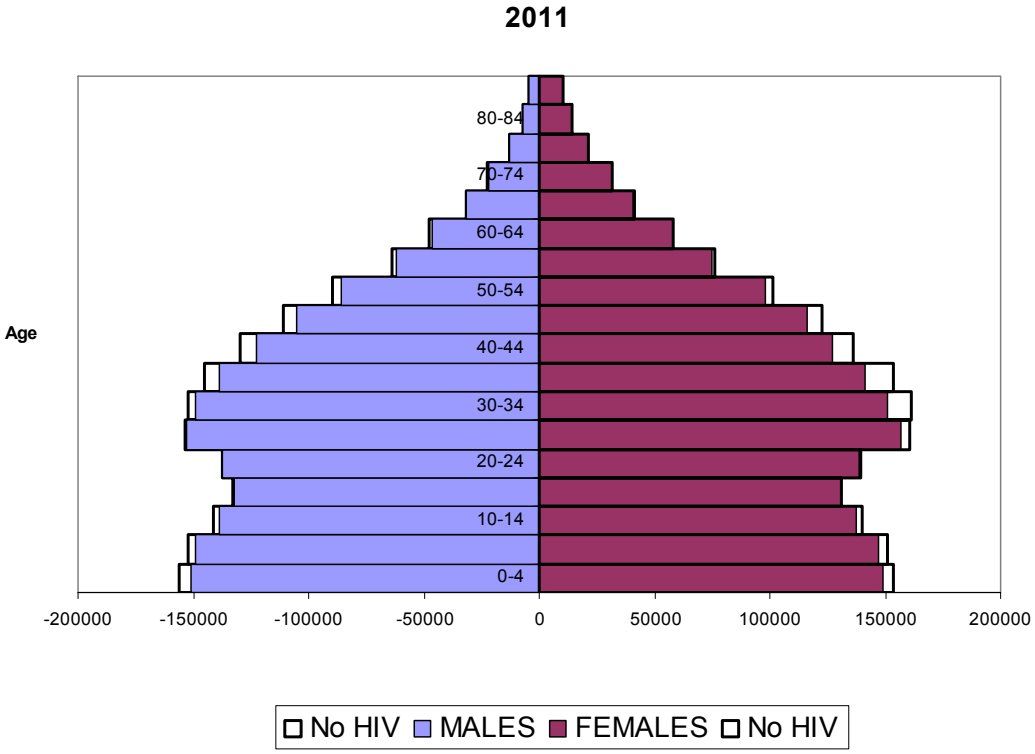


Figure 11 Population pyramid at 2011 (with and without an HIV epidemic)

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