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DEPARTMENT OF
WATER AFFAIRS
AND FORESTRY

Feasibility Study for the Raising of Clanwilliam Dam

Socio-economic Impact Assessment

Final
February 2009

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DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE OPTIONS ANALYSIS

FEASIBILITY STUDY FOR THE RAISING OF THE CLANWILLIAM DAM

SOCIO-ECONOMIC IMPACT ASSESSMENT

Final

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Department of Water Affairs and Forestry
Directorate Options Analysis

FEASIBILITY STUDY FOR THE RAISING OF THE CLANWILLIAM DAM

APPROVAL

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EXECUTIVE SUMMARY

Introduction

Urban-Econ was appointed to conduct a socio-economic impact assessment of the various Clanwilliam Dam raising options. Clanwilliam Dam is in need of remedial work in order to meet dam safety standards. This, combined with the need in the area for water, especially for irrigation farming, has presented an opportunity to raise the dam wall and increase its capacity.

There are a number of complexities involved, however, as some individuals and activities will benefit, while others will be either temporarily disrupted or permanently affected in a negative way. A socio-economic impact assessment was, thus, needed in order to analyse and weigh these affects against one another.

There are numerous alternatives for the project, all of which have been explained and assessed in the report. Alternatives deal with the shape of the wall and the raising height (5 m, 10 m and 15 m raising options), as well as how to manage and allocate the additional yield.

The report starts by describing the characteristics of the catchment area as a baseline against which impacts are assessed. The impacts on aquaculture, agriculture, tourism and the local municipalities are addressed. In addition, some ethical and sustainability issues are considered. Finally, recommendations are made for the raising of the Clanwilliam Dam wall.

Methodology

Due to the complexities of the alternatives being assessed, a combined qualitative-quantitative approach was used. Baseline information was gathered regarding the socio-economic profile of the study area. This entailed analysis of census and other socio-economic data in order to gain understanding of the economic structure and population demographics of the study area. Further, numerous existing reports on the proposed raisings were reviewed and incorporated as inputs into the study.

Due to the complexity of the project, development issues and sectors affected were assessed and reported on.

Recognised input-output modelling techniques were utilised to determine the direct and indirect impacts of the various alternatives in terms of employment, economic growth and economic opportunities created and lost by each alternative. As not all of the impacts could be quantified, qualitative discussions supplement the results of this modelling process.

Finally, the results of this work were framed within a national and regional policy context, as well as various international trends regarding sustainable and ethical development.

Location of the study area

The study area was determined by :

a) utilising Ninham Shand's mapping of study zones
b) mapping local municipalities and wards, and
c) assessing the Olifants-Doorn Water Management Area (WMA).

The study area was, thus, determined to be the Cederberg and Matzikama Local Municipalities, in the West Coast District, Western Cape. **Section 1** of the report provides more information and a map of the study area.

Socio-economic profile

The socio-economic profile of the study area is provided in **Section 2** of the report. Both the Cederberg and Matzikama Municipalities are characterised by vast, rural agricultural and conservation land, with small urban centres.

The chief economic activity is agriculture, contributing 28.65% of the Cederberg gross geographic product (GGP) and 19.08% of the Matzikama GGP and employing 58.44% and 48.89% of the employed populations of Cederberg and Matzikama, respectively. Other economic sectors are largely centred on serving agricultural sector and/or processing agri-products. Economic growth is positive, but slow at an average of 2.35% per annum over the past 11 years.

The combined populations for the study area was approximately 112 152 in 2006. This is largely dispersed over the rural areas. Unemployment for the area is comparatively low, at below 9%, but many of those classified as "employed" are working in elementary jobs, often seasonal or part-time work. Household incomes are, as a result, low, with more than 3/4 earning less than R 3 200/month. Education levels are low, with the area having a higher rate of no-schooling than the West Coast District. The implications are:

- Opportunities for semi-skilled work are essential to the livelihood of, particularly, the rural population;
- Access to education opportunities and awareness of the importance of education must be enhanced.

Access to services is also low (for example, only about 30% have access to a telephone in their dwelling), but is characteristic of rural South Africa. Many families reside on farms and are dependent on farms for employment, housing and access to transport.

Poverty is particularly high in the rural areas, where access to services is lower that the averages for the study area and vulnerability to economic changes high. The Ebenhaezer community is an example of this, with approximately 3 500 people almost solely dependent on subsistence activities.

Development issues

The Olifants-Doorn WMA is a dry area experiencing annual decreases in rainfall, yet has a strong agricultural sector on which the economy is centred. The Clanwilliam Dam is an important component of the WMA and is currently in need of extensive remedial work in order to meet dam safety requirements. Due to the strong relationships with water between tourism, agriculture, fishing and other sectors, the need for increased water availability has been identified. These relationships are explained in **Section 3** of the report.

Various alternatives for the Dam Raising have been identified. These include three height options (5 m, 10 m and 15 m raising), four design options (ogee and labyrinth shapes, existing or extended lengths) and two water-use options for the additional yield. The latter includes a full-use option, in which all additional yield is utilised for irrigation and an ecological water requirement (EWR) Reserve implementation option, in which ecological requirements are met and water is released to maintain the downstream-ecosystems and its dependents.

Impacts of these alternatives are both positive and negative. Negative affects include temporary and permanent losses of facilities, land and infrastructure as well as livelihoods for the Ebenhaezer community. These are presented and assessed in detail in **Sections 3, 4** and **5.**

Socio-economic impact

Recognised Input-Output modelling techniques were utilised to determine the economic impact of the raising alternatives in terms of new business sales, GGP and employment created and lost. It was determined that positive impacts far exceed the negative ones. Further, it was determined that the 15m raising option carried the best outcomes relative to costs.

Assuming that the EWR implementation option is selected, the findings for the construction period are summarised as follows:

Table E1 Summary of Impacts: CAPEX: Implementation Option 2

Type of Impact	Safety Work	Alternatives		
		5 m	10 m	15 m
Total NBS (R'000)	552,000	1,371,000	1,976,000	2,525,000
Total GGP (R'000)	102,000	294,000	432,000	564,000
Total Jobs	270	2,680	4,260	6,930

This includes the construction work on the dam wall, the realignment of roads, the mitigation of impacts on surrounding properties as well as the initial start-up of new agricultural land, in terms of irrigation infrastructure and first crops.

In terms of operation, both losses and gains are evident. These are summarised as follows:

Table E2 Summary of Impacts: OPEX: Implementation Option 2

Type of Impact	Alternatives		
	5 m	10 m	15 m
Total NBS Gains (R'000)	325,000	556,000	779,000
Total NBS Losses (R'000)	26,000	51,000	56,000
Total GGP Gains (R'000)	102,000	177,000	243,000
Total GGP Losses (R'000)	8,000	16,000	17,000
Total Job Gains	2,000	3,000	3,720
Total Job Losses	110	260	270
Rates & Taxes (R'000)	29,000	51,000	70,000

As can be seen, the permanent benefits far exceed the temporary losses.

Other considerations

Section 5 is dedicated to addressing the ethics of negatively affecting some members of society for the benefit of others. It is found that in the case of Clanwilliam, the benefits are wide and far stronger than the negative impacts. Thus, the displacement of some can be justified for the benefit of more.

Further, sustainability issues were addressed and recommendations for the implementation of efficient irrigation systems and other water-saving methods were provided.

Social benefits of the Clanwilliam Dam raising are important for the poverty alleviation strategies of the study area. Jobs, new sources of income and opportunities for economic advancement are all created. With adequate support in terms of access to transport, training and funding, the project could result in

significant improvements in the overall standard of living of the populations of the Cederberg and Matzikama Local Municipalities.

Concluding remarks

On the basis of our findings, Urban-Econ recommends that the 15m raising option, together with the EWR Reserve be recommended as the decision for the Clanwilliam Dam raising evaluation. Some specific recommendations to maximise the benefits and minimise the negative impacts can be provided:

- Enhance sustainability practices of all water users in the WMA through awareness campaigns, as well as other programmes or subsidies to advocate the use of water-efficient technologies (particularly irrigation systems);
- Train and assist farm managers to cope with expansion, especially where new partnerships and trusts have been formed;
- Include the Ebenhaezer and other disadvantaged and disenfranchised communities in participatory processes;
- Match the skills-levels of those temporarily and permanently negatively affected by the dam raising with those new opportunities created;
- Monitor the impact felt by the Ebenhaezer community and assist their management of livelihoods (agriculture and fishing activities) through appropriate programmes;
- Identify those families who will lose their homes and access to transport as a result of lost jobs. Prioritise these individuals for new agricultural land, trusts and BEE ventures;
- Develop a strong marketing campaign to bring old visitors back and attract new visitors to the Clanwilliam Dam Resort and other tourist facilities once the dam raising construction is completed.

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GLOSSARY AND ABBREVIATIONS

ASGISA	Accelerated and Shared Growth Initiative of South Africa
BEE	Black Economic Empowerment
CAPEX	Capital Expenditure
DWAF	Department Water Affairs and Forestry
EIA	Environmental Impact Assessment
EWR	Ecological Water Requirement
GDP	Gross Domestic Product
GGP	Gross Geographic Product
GPRS	General Packet Radio System
GVA	Gross Value Added
IDP	Integrated Development Plan
LED	Local Economic Development
MAR	Mean Annual Runoff
MEDS	Micro-Economic Development Strategy
NBS	New Business Sales
NEMA	National Environmental Management Act
ODCMA	Olifants-Doorn Catchment Management Area
OPEX	Operational Expenditure
PGDP	Provincial Growth and Development Plan
PGWC	Provincial Government of the Western Cape
RPF	resource-poor farmers
SMME	Small, Medium and Micro Enterprises
STATSA	Statistics South Africa
UNFAO	United Nations Food and Agriculture Organisation
WCPAS	West Coast Poverty Alleviation Strategy
WMA	Water Management Area

1. INTRODUCTION

1.1 Introduction

During a dam safety survey the Department of Water Affairs and Forestry (DWAF) found the Clanwilliam Dam to be lacking in some safety aspects, because it did not fully comply with dam safety legislation. Concurrent to the required dam safety remedial construction, the Clanwilliam Dam could potentially also be raised by up to a maximum of 15 m. The aim of the study is therefore to verify the technical, social, economic and financial viability of raising the Clanwilliam Dam, at feasibility level.

Urban-Econ was appointed to conduct a socio-economic impact assessment of the various Clanwilliam Dam raising options. The consideration of a Clanwilliam Dam wall raising involves inputs from numerous professionals, including an environmental impact assessment (EIA), heritage impact assessment, agricultural feasibility studies and engineer's reports. Urban-Econ's role has been to provide the macro socio-economic evaluation with the following objectives:

- To establish baseline information on the current socio-economic profile of the study area
- To identify and assess main sectors that use water and other ecosystem goods
- To describe how changes in the water yield and ecosystems will affect turnover and employment in these sectors
- To estimate impact on the local economy in terms of gross geographic product (GGP), new business sales and employment
- To describe affected communities and estimate the impact on their well-being
- To provide recommendations for the mitigation of negative impacts and the maximisation of positive impacts.

1.2 Methodology

Due to the complexities of the alternatives being assessed, a combined qualitative-quantitative approach was employed. Baseline information was gathered regarding the socio-economic profile of the study area, in order to provide a benchmark against which the impacts can be assessed. Further, numerous existing reports on the proposed raisings were reviewed and incorporated as inputs into the study. Recognised Input-Output modelling techniques were utilised to determine the direct and indirect impacts of the various alternatives in terms of employment, economic growth and economic opportunities created and lost by each alternative. All of this is framed within a national and regional policy context, as well as various international trends regarding sustainable and ethical development.

1.3 Location of the study area

Clanwilliam Dam is situated in the Cederberg Local Municipality, which falls within the West Coast District Municipality in the Western Cape. Clanwilliam Dam is located south of the town, Clanwilliam, and is visible from the N7. The dam, *inter alia*, provides water to the Matzikama and Cederberg Local Municipalities, and three irrigation areas, namely the immediate area below the

Dam, the area along the river between Clanwilliam Dam and the Bulshoek Weir and the area served by a canal system below the Bulshoek Weir (13 911 ha). The total land used for agricultural purposes in the study area is 37 253 ha, comprising of deciduous fruit, grapes (table and wine), citrus fruit, rooibos tea, some cattle and sheep, summer vegetables and lucerne. Hoodia is also grown in the area. **Figure 1.1** depicts the main catchment area, which is made up of:

- Cederberg Wards 1, 2, 3, 6
- Matzikama Wards 1, 2, 4, 5, 6

These wards comprise approximately 72% of the total populations of the Matzikama and Cederberg Local Municipalities. Matzikama and Cederberg Municipalities, therefore, comprise the central study areas, as any impact felt by this 72% will have knock-on effects for the remaining population. It must be noted, however, that the significant impact will be felt in the rural areas of the two municipalities, including the Ebenhaezer fishing community at the Olifants River mouth, and due attention is, thus, given to these impacts in particular.

The impacts of the potential Clanwilliam Dam raising extend beyond agriculture and tourism and include impacts on fishing activities, most notably the aquaculture activities on which the Ebenhaezer community rely. This community has a unique relationship with land, water, agriculture and fishing. For this reason, special attention is given to this community, which is located within the Matzikama Local Municipality, along the Olifants River, near to the river mouth (i.e. downstream of the dam). The location of Ebenhaezer is depicted in **Figure 1.2**.

1.4 Report outline

Section 2 is an overview and discussion of current economic and social characteristics of Cederberg and Matzikama Local Municipalities.

Section 3 provides an introduction to the main development issues, namely the main sectors to be affected as well as the various dam raising options.

Section 4 is a presentation of the findings of an Input-Output model, which determines the direct and indirect impacts of each alternative. The unique impacts on the fishing sector, particularly on small, rural fishing communities along the Olifants River are also discussed.

Section 5 presents a summary of benefits and dis-benefits alongside the arising ethical and sustainability considerations, with appropriate recommendations. Social impacts are also discussed here.

Finally, **Section 6** summarises the key findings and proposes technical and managerial recommendations for the raising of Clanwilliam Dam.

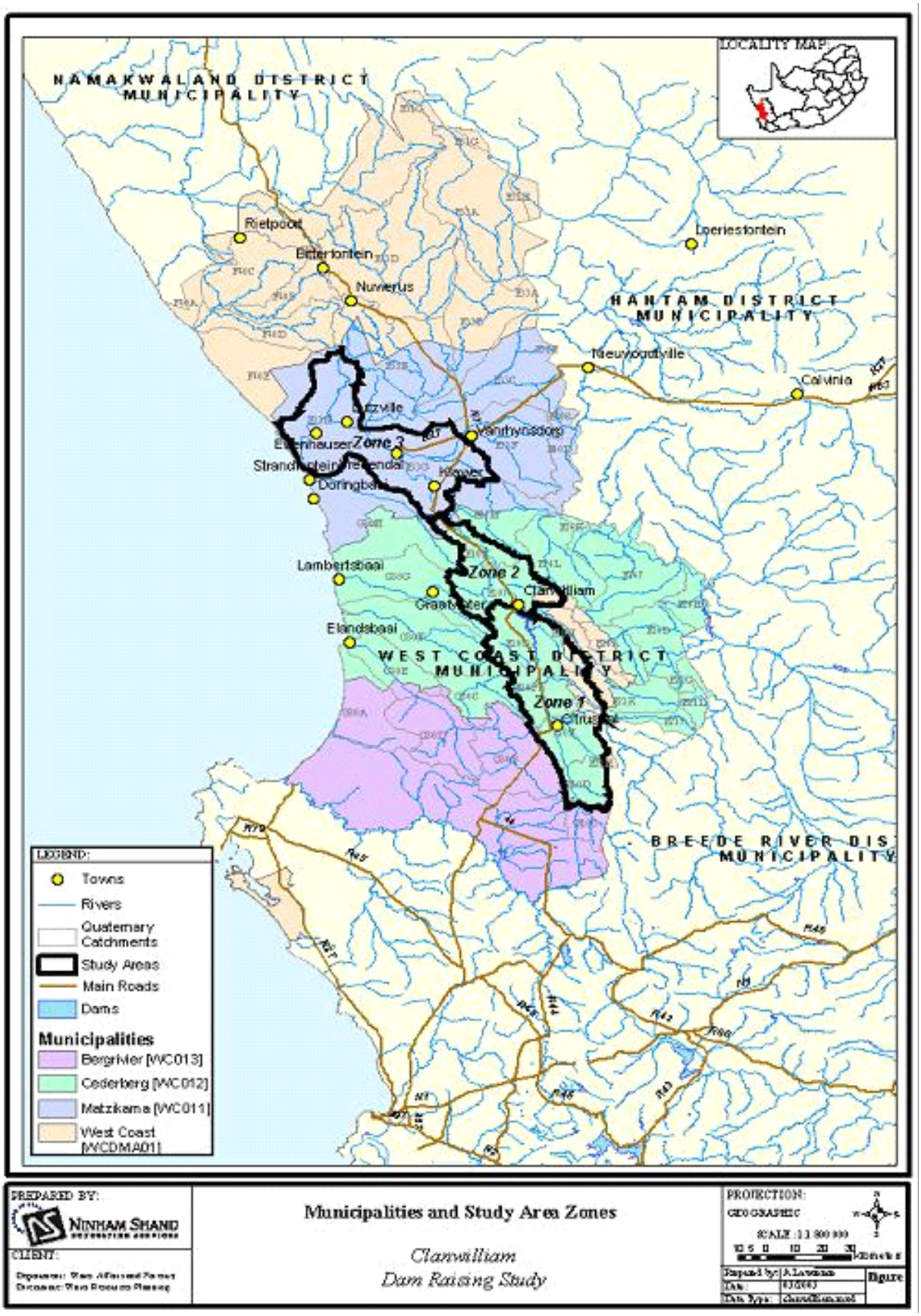

Figure 1.1 The study area

[Source: Google.maps]

Figure 1.2 The location of Ebenhaezer

1.5 Resources consulted

Numerous sources of information have been utilised in the preparation of this report. Numerous official policy and planning documents were used as the framework for guiding principles. These are summarised in **Section 2**. Baseline data was gained from the Quantec database, which presents Census and other regional data. Projections were made using recognised formulas.

Preliminary studies contracted by DWAF were reviewed, including:

- Anchor Environmental Consultants. 2006. *Olifants/Doring Catchment Ecological Water Requirements Study: Socio-economics Study.* Report V2.

This study dealt with social and economic consequences as part of a Reserve determination process.

- ASCH Professional Services and Ninham Shand (Pty) Ltd. 2007. *Feasibility Study for the Raising of the Clanwilliam Dam in the Western Cape: Impacts on Roads and Other Infrastructure (Draft).*

The impact on roads and other infrastructure were determined by this study and used as inputs in the determination of socio-economic impacts of the various dam raising alternatives.

- Barbour, T and Van der Merwe, S. 2005. *Social Impact Assessment: Raising of Clanwilliam Dam*.

This study provided valuable qualitative and quantitative information on those groups that could potentially be affected by the decision taking regarding the future of the Clanwilliam Dam.

These documents have all been published online, by Ninham Shand, the consulting engineers.

Further, in order to understand the financial needs and potential of agricultural activities, Prof. Laubscher's (2007) study, *Clanwilliam Dam Raising Feasibility Study: Financial Feasibility of Irrigation Farming*, was used. Prof. Laubscher was also consulted telephonically in order to gain the necessary clarification, as well as to confirm assumptions. Representatives from Ninham Shand were conferred with telephonically at various phases of the study in order to gain clarification, test assumptions and determine important impact areas.

A full list of references follows at the end of the report.

2. SOCIO-ECONOMIC PROFILE

2.1 Introduction

The purpose of this section is to provide some insight into the relative size and structure of the local economy and its manifestations in terms of social characteristics and quality of life in the study area. The evaluation of the local socio-economic profile will be used as the baseline against which the potential value of the dam expansion will be evaluated, in terms of impact on economic structures as well as household income and individual well-being. This section also includes a brief background to Clanwilliam Dam itself as well as the relevant policy environment.

2.2 Overview of the study area

In terms of the economic features of the study area, the analysis includes the regional, district and local municipal areas. The statistical data for the economic analysis delineated into smaller areas is not available through STATSA and, therefore, the majority of the economic information is discussed at the level of the two local municipalities most directly affected by the project, namely Cederberg and Matzikama Municipalities. The economic situation is discussed through an overview of the following:

- Economic Structure
- GGP Sectoral Contribution
- Sectoral Employment and Trends
- Sectoral Growth Profile

The social profile includes:

- Population Figures
- Geographic Distribution
- Age and Gender Profiles
- Occupation, Income and Education Profiles
- Dwelling Types, Mode of Transport and Access to Basic Services

2.2.1 Economic Structure

The economic structure of the area are presented and discussed in the following sections. The economic structure is discussed through an investigation into:

- The proportional contribution that the various sectors are making to the aggregate economies
- The growth rate of each sector in terms of GGP contributions

Based on previous and ongoing studies in the West Coast, Urban-Econ has developed an understanding of the District. Urban-Econ understands that the District area jurisdiction is characterised by a mix of urban and rural economies. This ranges from a relatively strong

economic performance to relatively isolated rural settlements with high levels of poverty. Important regional economic dynamics include:

- An economy based on agricultural, industrial and tourist activities.
- Numerous natural resources that include ecological diversity and rare biomes, agriculture and fishing, the coast and some of the most scenic regions in South Africa. As such the region has a diverse economic profile that comprises of a strong agricultural component, manufacturing as well as strong transport and communications sector. The construction industry is also experiencing a boom.
- The region is experiencing changes such as the increase in tourism, the high growth in the services sector and the strong demand in real estate. These changes are not occurring uniformly in space, but at specific locations, mostly along the coast. As such, the various nodes are developing at their own particular economic rate.
- The West Coast District Municipality stresses the importance of balancing equitable economic growth with sustainable human development and environmental integrity.

2.2.2 GGP Sectoral Contribution

Figure 2.1 illustrates the sectoral contributions to gross domestic product (GDP) in the Cederberg and Matzikama Local Municipalities.

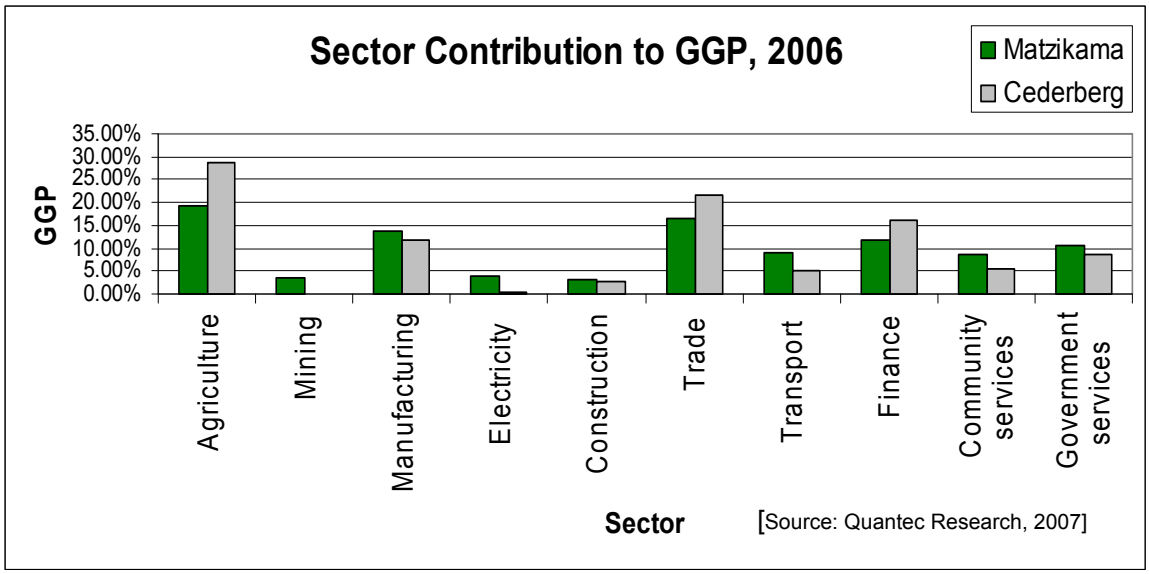

Figure 2.1 GGP contributions: Cederberg and Matzikama, 2006 (Constant Rand Values, 2005)

Figure 2.1 indicates that for both municipalities, agriculture, forestry and fishing and wholesale, retail, trade and catering and accommodation are the largest economic sectors. Agriculture, forestry and fishing contribute 28.65% to the Cederberg GGP and 19.08% to the Matzikama GGP. Wholesale, retail, trade and catering and accommodation contributes 21.56% of the Cederberg GGP and 16.62% of the Matzikama GGP. For the Cederberg, finance and business services is another important sector, contributing 15.93%, followed by manufacturing, which contributes 11.62%. For Matzikama, manufacturing contributes 13.65% of the GGP and finance and business services another 11.69%.

Figure 2.1 indicates that the study area economies are fairly diversified, which is a sign of strength in terms of economic resilience of the area to slumps in any particular sector. Much of

the manufacturing, wholesale and finance and business services are, however, directly linked to the agricultural activities of the area. Tourism also contributes to a variety of these sectors.

a. Comparative Advantage

Comparative advantage is an economic measure used to determine the sectoral competitiveness. The formula is as follows:

$$\text{Comparative advantage} = \frac{\%\text{ sector contribution to GDP}}{\%\text{ sector contribution to GGP}}$$

Any index above 1 indicates that that local sector has a comparative advantage over others and is, thus, an essential sector.

Taking the combined GGP of the study area (Cederberg and Matzikama), agriculture in these areas contributes 21.07% of their total GGP. For the West Coast, agriculture contributes 19.41% of the district's GGP and nationally, agriculture contributes only 2.81% of the GDP.

The comparative advantage indices are, thus, as follows:

- Study area over West Coast: 1.09
- West Coast over national: 6.9
- Study area over national: 7.49

These indices show that the West Coast region contributes significantly to the agriculture sector nationally and that the study area has a strong competitive advantage nationally. Economic activities related to agricultural sector should, therefore, be nurtured to enhance contribution to GDP and to improve international competitiveness.

2.2.3 Sectoral Employment Contribution

Figure 2.2 depicts sectoral contribution to employment for 2006.

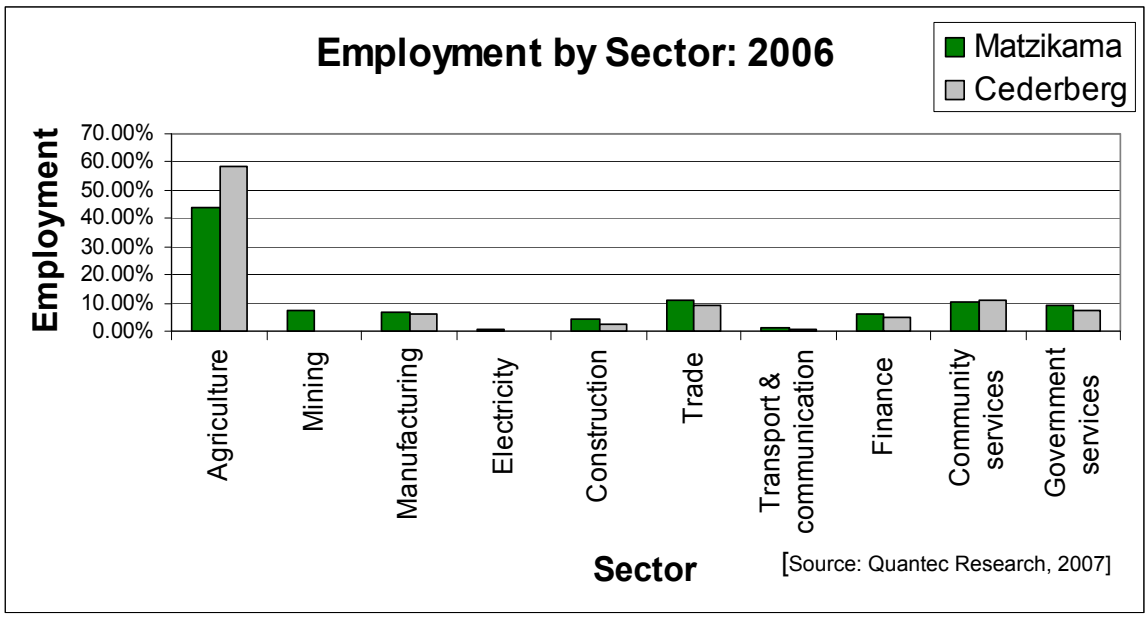

Figure 2.2 Sectoral employment contributions: Cederberg and Matzikama, 2006

Figure 2.2 indicates that agriculture, forestry and fishing is the biggest employment sector in the study area, employing 58.44% and 48.89% of the employed populations of Cederberg and Matzikama, respectively. Community, social and personal services are also a significant employment sector (11.05% and 10.49% for Cederberg and Matzikama, respectively). This is followed by wholesale, retail, trade and catering and accommodation (9.10% for Cederberg and 10.75% for Matzikama). General government services and finance and business services are the next biggest employers for the area, as well as mining for Matzikama.

The above confirms that agriculture is an essential industry in terms of contributions to both GGP and employment in the study area.

2.2.4 Economic Growth

Figure 2.3 depicts the total production levels at constant prices, which indicates an increase in total GGP for the West Coast District as a whole, as well as for the Cederberg and Matzikama municipal areas. The growth from 1995 to 2006 is depicted.

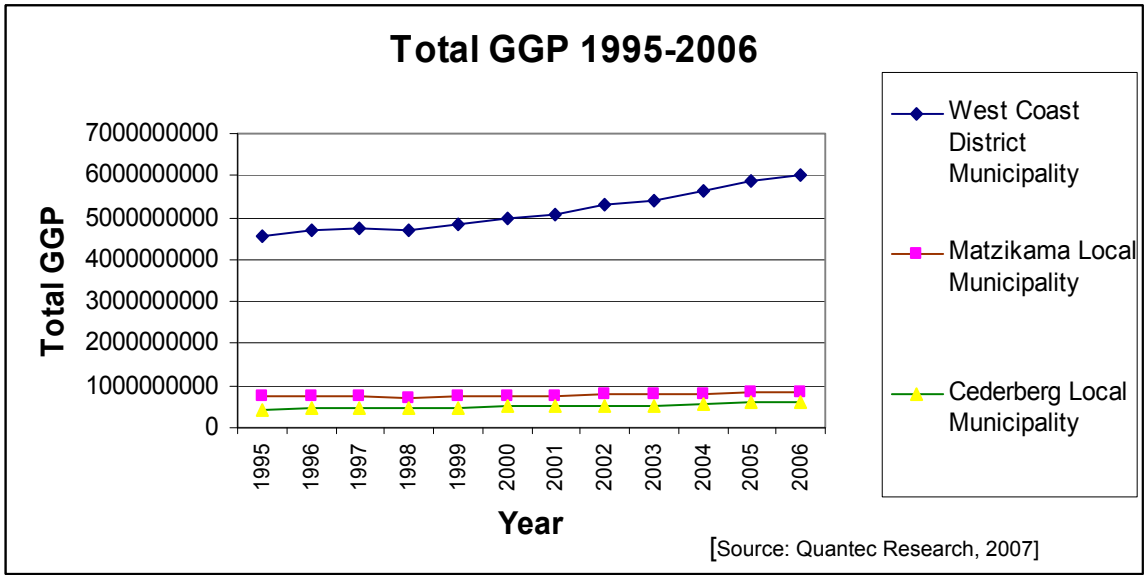

Figure 2.3 Total GDP, 1995-2006

Figure 2.3 illustrates a positive, but slow, growth rate for the West Coast (average of 2.35% per annum over an 11 year period), Cederberg (2.81%) and Matzikama (1.27%) between 1995 and 2006. As can be seen, the study area is not sharing in the rapid economic growth experienced in the district as a whole. This is largely due to an economic boom along the coast, attributable to increased manufacturing activities in areas such as Saldanha Bay. Economic activity in Ebenhaezer is declining, as fishing quotas and unpredictable rainfall patterns jeopardise local livelihoods, with no replacement opportunities forthcoming.

In order to meet national goals of poverty alleviation and broad-based economic upliftment, Accelerated and Shared Growth Initiative of South Africa (ASGISA) sets a target of 6% growth rate in GDP until 2014, and the Cederberg and Matzikama Local Municipalities are falling far short of this target. The West Coast Poverty Alleviation Strategy identifies lack of access to economic development opportunities as a major stumbling block that needs to be overcome in order to expand economic growth in the area. This must be done through educational and training programmes, expansion of small, medium and micro-enterprises (SMME) development

programmes, such as RED Door, as well as general increases in access to services and, particularly, to transport.

2.3 Socio-Economic Considerations

The purpose of this sub-section is to highlight the salient socio-economic features of the West Coast and specifically the Cederberg and Matzikama municipal areas. In so doing, a baseline is created against which impacts of the dam raising options will be assessed. The section is structured as follows:

- The salient demographic features are discussed
- Employment characteristics

Specific sub-headings are used to present a suitable indication of the different dimensions of the individual categories.

2.3.1 Salient Demographic Features

The salient demographic figures, which are mentioned in this sub-section, relates to the population totals, growth rates, population and gender structure.

a. Cederberg and Matzikama socio-economic profile

Based on Quantec research (using Census 1996 and 2001 data), population figures for the study area are estimated as follows for 2006:

- Cederberg: 48 786
- Matzikama: 63 366
- Total study area: 112 152

Annual population growth (based on 1996 and 2001 census data) is estimated at 4.4% for Cederberg and 4.76% for Matzikama, with a 4.6% average for the study area. According to DWAF (2005) a lack of strong economic stimulants and resulting emigration, as well as HIV/Aids will curb population growth, to see little growth in the total population up until 2025. They also note, however, that there is seasonal migration into the area, particularly of seasonal farm workers in the summer months. Population growth for the study area exceeds national (2.01%), Western Cape (provincial) (2.75%) and West Coast (district) (3.77%) growth rates for the same period. This has implications for the pace of service delivery, as well as economic growth rate required, both of which need to be increased in a purposeful, sustainable and timeous manner.

The Matzikama IDP (2007-2011) uses 2001 Census Data and recognises a population of 50 199 in 2001, with a growth rate of 4.76%. This is the same growth rate determined by Urban-Econ using Quantec data. If the integrated development plan (IDP) figure is projected up to 2006 using a 4.76% annual growth rate, the figure, 63 366 is obtained, indicating that Urban-Econ's population data is in line with the Matzikama IDP.

Comparisons with the Cederberg IDP (2006-2011) reflect some disparities. Using the Census 2001 population data, the Cederberg Local Municipality projects their population up to 2006 and gives a total figure of 42 138. This is approximately 6 000 people less than Urban-Econ's figure. The figure provided in the Cederberg IDP is manipulated by predicted decreases in the local

white population (negative growth rate of -0.30%), as well as a decline in the growth rate of local coloured populations to 1.3% by 2006. There is no source provided for these predictions, however, and thus Urban-Econ selected to use the recognised 1996 and 2001 Census figures for the purpose of baseline data.

The population is mostly rural and dispersed over a large area, with population concentration in towns such as Clanwilliam and Vredendal. The Ebenhaezer community is an example of a rural community that is particularly vulnerable to poverty. Due to their reliance on the Olifants River for subsistence livelihoods, special attention is given to this community. Census data for Ebenhaezer, Papendorp and Viswater cannot be extracted from sub-place tables, as even the sub-place tables cover a far vaster area. Information on these areas is extracted from Anchor Environmental Consultants' *Olifants/Doring Catchment Ecological Water Requirements Study* (2006) and Barbour and Van der Merwe's *Social Impact Assessment* (2005).

Ebenhaezer is described as a "small rural fishing village" that is "extremely poor". The total population is estimated at 3 500 people, mostly coloured, Afrikaans speaking descendants of the original Ebenhaezer families. Ebenhaezer consists of several districts along the Olifants River, including Papendorp, 10 km from Ebenhaezer. Papendorp is extremely isolated and essentially consists of two rows of RDP houses that overlook the estuary. Fishing is the main source of livelihood in Papendorp. **Figure 2.4** is a satellite image of Ebenhaezer, while **Figure 2.5** is a satellite image of Papendorp.

Figure 2.4 Satellite image of Ebenhaezer **[Source: Google.maps]**

Figure 2.5 Satellite image of Papendorp [Source: Google.maps]

As can be seen in the images, the areas are remote and dry (though the soil is considered to be of a good quality), with heavy reliance on the passing Olifants River and the Estuary. A recently constructed balancing dam has aided this situation, though management of agricultural activities remains weak.

Population Distribution and Gender and Age Profiles

Population distribution for the study area is depicted in **Figure 2.6** and the gender and age profile in **Figure 2.7**.

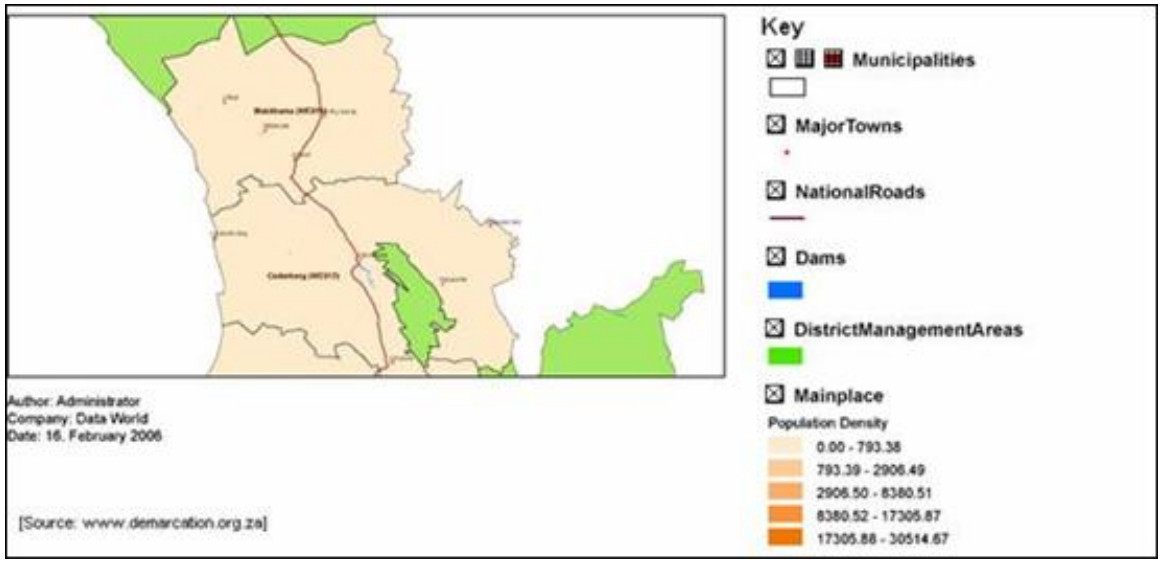

Figure 2.6 Population Distribution: Cederberg and Matzikama

The population of the study area is characteristically rural, as population density is low and urban centres dispersed. This has implications for community cohesion, as people living nearby to one another are inter-dependent, as well as for the importance of access to services and transport.

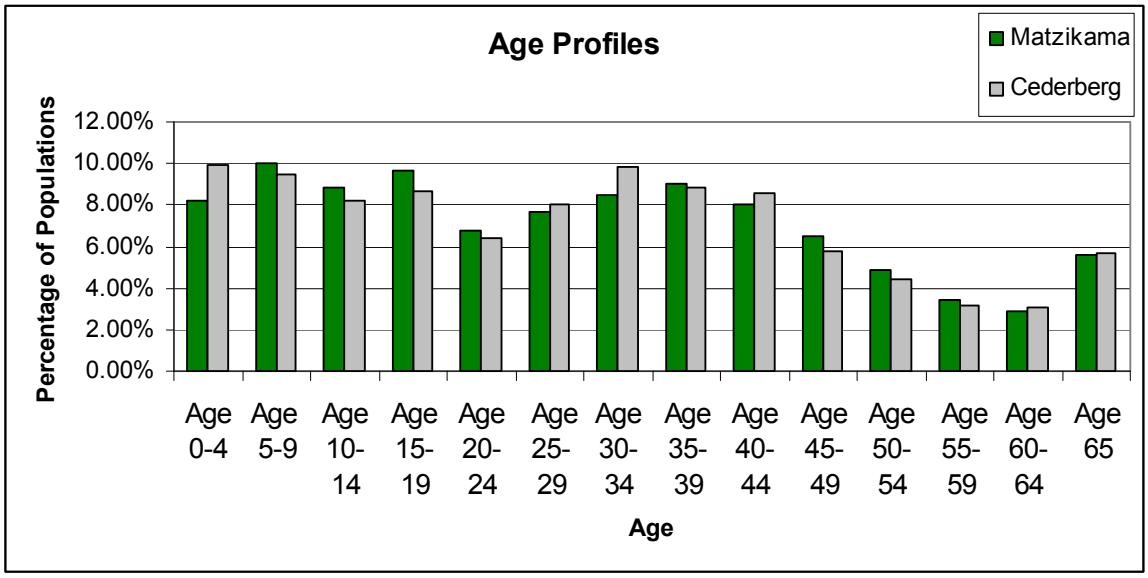

Figure 2.7 Age Profiles, 2006 [Source: Quantec Research, 2007]

Figure 2.7 depicts a relatively young population. There is growth in the young age groups, which has implications for education and health care facilities. The highest growth (annual growth rate of between 7% and 10%) has been in the 30 to 50 years age group indicating immigration of economically active and/or work-seeking adults. With the GGP growth rate remaining very low, but with population growth of economically active people, active efforts to enhance economic opportunities are needed in order to prevent increased vulnerability to poverty in the area.

With regard to the gender profile, there is an equal balance, with 50.86% of the Cederberg population being female, and 49.14% male. For Matzikama, 50.38% are female and 49.62% are male, resulting in an overall gender ratio for the study area of 50.60% female and 49.40% male.

b. Employment levels

Table 2.1 depicts employment levels for the study area for 2001. Census data for 1996 and 2001 bare discrepancies and, therefore, projections to 2006 could not be made. If the study area follows the general trend of the West Coast District, however, employment levels are likely to have risen since 2001.

Table 2.1 Employment Status, 2001

Status	Cederberg	Matzikama	Total Study Area
Employed	60.02%	56.87%	58.25%
Unemployed	6.85%	10.66%	8.99%
Not Economically Active	33.13%	32.47%	32.76%

[Source: Quantec Research, 2007]

Table 2.1 indicates that in 2001 unemployment was at 8.99% for the total study area, with an additional 32.76% being classified as not economically active. Unemployment is highest in the Matzikama area. The nature of the employment is also to be considered here, as much of the employed population are employed on a seasonal basis as casual farm labour (this is, summer

work only, earning an average of R50/day) (*Financial Viability of Irrigation Farming,* Laubscher, 2007). Occupations and incomes must, therefore, be considered alongside employment figures. Occupations are depicted in **Table 2.2**.

Table 2.2 Employment by Occupation 2006

Occupation	Matzikama	Cederberg	Total
Legislators senior official	3.85%	4.03%	3.93%
Professionals	1.25%	1.01%	1.14%
Technicians and associate professionals	10.66%	5.46%	8.32%
Clerks	8.20%	6.31%	7.35%
Service workers shop and market sales workers	5.76%	5.58%	5.68%
Skilled agricultural and fishery workers	4.91%	4.76%	4.84%
Craft and related trades workers	6.46%	3.94%	5.33%
Plant and machine operators	4.31%	4.31%	4.31%
Elementary occupations	54.61%	64.60%	59.10%

[Source: Quantec Research, 2007]

In terms of occupations, for the total study area, more than half of employed residents are working in elementary occupations, followed by technicians and associate professionals and clerks, respectively. The Matzikama also sees 6.46% of workers employed in craft and related trades work.

Interestingly, skilled agricultural and fishery workers make up only 4.84% of the employed population. This indicates that while the agriculture, forestry and fishing sector contributes significantly to employment; the majority of people employed in this sector are unskilled or semi-skilled workers.

Ebenhaezer residents are mostly unemployed, relying on subsistence farming and fishing. According to Anchor Environmental Consultants, approximately 33% of households are involved in subsistence farming, growing potatoes, sweet potatoes, beans, pumpkin, onions and seasonal garden vegetables. The remaining two thirds of households either do not have access to suitable land, or lack the capital and tools necessary for start-up. Approximately 18% of households have some form of livestock. Improved management of these activities is needed in order to realise the full potential of the area.

Regarding fishing at Ebenhaezer, there are approximately 45 permit holders, each one with an assistant. Due to the lack of alternative economic activities and the fishing history of the community, however, it is estimated that more than 200 households are involved in fishing activities.

c. Household income

Generally, household income levels are a basis for determining poverty levels in a community. Additionally, the income levels of a particular area provide some insight into the economic behaviour of a particular community, i.e. the buying power of that community, the potential poverty levels that a community might be experiencing and vulnerability to changes in the economy.

Income data from the Censuses of 1996 and 2001 utilises different values and, therefore, no projections could be made. **Figure 2.8** displays monthly income of households in 2001.

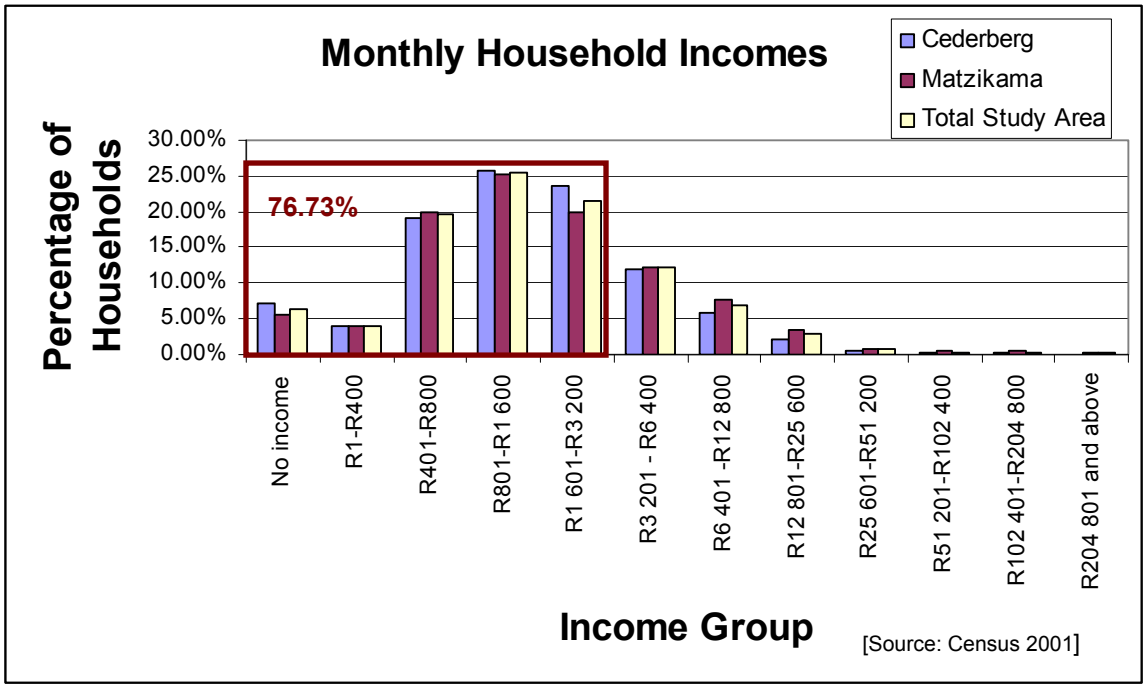

Figure 2.8 Monthly household incomes, 2001

As can be seen, household incomes are low, with the majority of households (76.73%) earning less than R3 200/month. These households experience transport, housing and service costs as being unaffordable. The percentage of households earning no income is 7.04% for the Cederberg, 5.66% for Matzikama and 6.25% for the total area. While this remains a concerning number of households, it is well below the West Coast District average of 34.3% (Urban-Econ, 2007).

The West Coast Poverty Alleviation Strategy (WCPAS) indicates that, on average, a poorer household cannot meet their monthly needs as their expenses exceed their income. The average household spends most of their monthly income on food and clothing as well as education followed by housing. A consequence of this is increasing dependency on the state. The WCPAS notes that there is an increasing amount of people receiving grants, and that the majority of these are old age grants and child-care grants. This means that economically active individuals are unable to meet the needs of their dependents. Opportunities to increase household incomes are, thus, vital to the immediate well-being of residents, as well as the long-term sustainability of the local economies.

Ebenhaezer families relying on fishing experience extreme rural poverty and are reliant mostly on subsistence fishing and farming. The average household income in Ebenhaezer is less than **R 500/month**, and this figure drops with seasonal changes, to as low as **R 100/month** in summer months.

d. Education Levels

The employability of the residents of the study area is based on an investigation of the overall education levels achieved by the individuals. A gap in the existing data, relating to non-formal education, implies that only formal educational qualifications are investigated. This limitation is acknowledged and the interpretations are undertaken with due cognisance of the potential

implications. The baseline data is presented in **Figure 2.9**, which illustrates the local education profiles for the West Coast District, Cederberg and Matzikama.

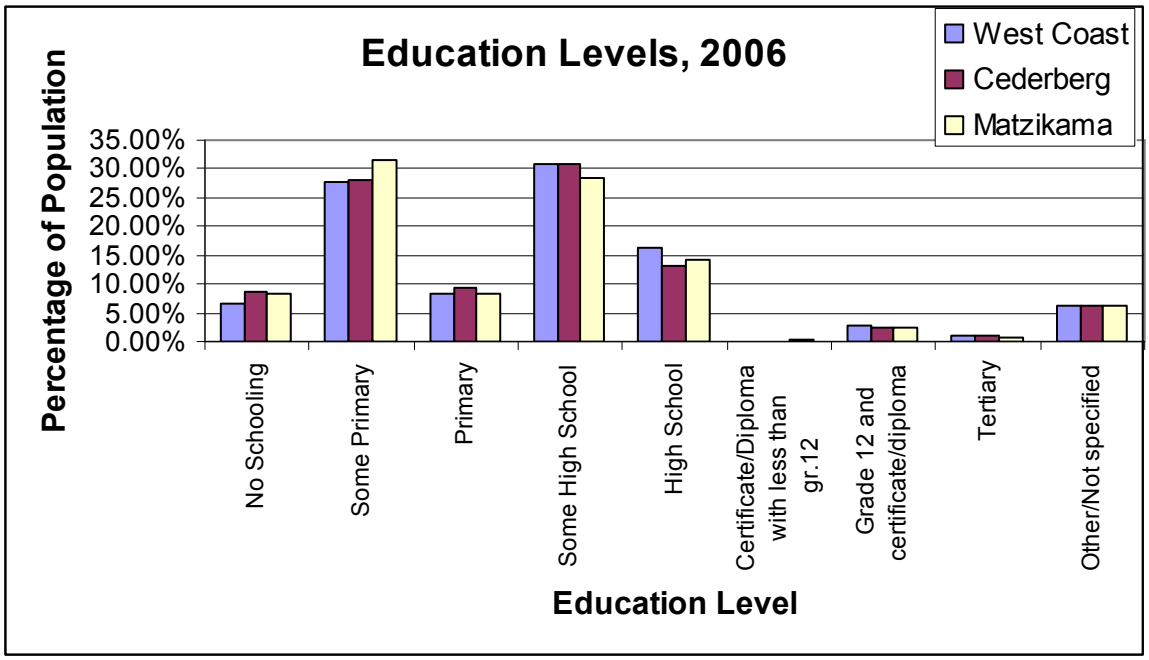

Figure 2.9 Levels of education, 2006 [Source: Quantec Research, 2007]

Figure 2.9 shows that there is a very low percentage of people with tertiary education in the study area, but that this is in line with the general trend in the West Coast District. The high percentage of population with partial or full secondary education is positive for the potential labour pool, in terms of skills levels. The Cederberg and Matzikama Municipalities have a higher percentage of people with no schooling, however, with 6.61% of the West Coast having no schooling, compared to 8.77% and 8.27% of the Cederberg and Matzikama Municipalities, respectively. There is also a rural-urban divide in education levels, with people with tertiary education residing mostly in urban centres. The implications of this information are two-fold:

- Opportunities for semi-skilled work are essential to the livelihood of, particularly, the rural population
- Access to education opportunities and awareness of the importance of education must be enhanced

For Ebenhaezer, according to Anchor Environmental Consultants, 19% of the local population have no schooling or primary education. Only, 59% have some secondary education, but no matric, 9% have a matric certificate and 14% have a diploma/certificate. No members of the community have tertiary qualifications.

e. Dwelling type

Dwelling type as well as tenure is used as an indicator of the development status of a particular area. There are an estimated total of 33 649 households in the total study area. **Table 2.3** depicts the percentage of household by dwelling type for the Cederberg and Matzikama.

Table 2.3 Percentage Population by Dwelling Type 2006

Dwelling Type	Cederberg	Matzikama
House on separate stand	91.65%	86.43%
Traditional dwelling	2.90%	6.81%
Town house, cluster, semi detached	0.75%	0.08%
Flat in block of flats	1.52%	0.97%
House/flat room in backyard	0.15%	0.10%
Informal dwelling shack in backyard	1.79%	1.35%
Informal dwelling shack elsewhere	0.98%	3.92%
Room flatlet on shared property	0.05%	0.07%
Caravan tent	0.21%	0.28%
Other	0.00%	0.00%

[Source: Quantec Research, 2007]

As can be seen, the majority of the population are housed in a permanent house or brick structure. This is a positive indicator in terms of the development levels and quality of life in the area. Much of this housing includes farm housing.

f. Mode of transport

Personal mobility is depicted in **Table 2.4** below.

Table 2.4 Transport Patterns to School and Work

Mode	Cederberg	Matzikama
On foot	66.17%	58.8%
Bicycle	0.67%	0.9%
Motorcycle	0.26%	0.3%
Car as a driver	6.42%	9.7%
Car passenger	11.00%	11.1%
Minibus/taxi	1.89%	5.1%
Bus	9.92%	9.7%
Train	0.12%	0.1%
Other	3.55%	4.3%

[Source: Census 2001]

According to census data from 2001, more than half of the study area population does not have access to transport and get to work or to school by foot (66.17% in the Cederberg and 58.8% in Matzikama). This is followed by "in a car as a passenger" (11% and 11.1%, respectively) and "by car as a driver" (8.0%).

At Ebenhaezer, there is no formal transport and most residents walk as their main mode of transport. There are two small convenience stores, apart from which the nearest retail centres are Lutzville (20 km from Ebenhaezer) and Vredendal (40 km). There are no shops or services in Papendorp and no formal public transport link with Ebenhaezer. According to Barbour and Van der Merwe, residents of Papendorp who need to access the shop, post office or clinic in Ebenhaezer either walk or wait for a lift on the side of the road. Access to a vehicle has direct implications for the ability of residents to transport fish and agri-products to neighbouring market. Access to a vehicle has, thus, become a source of elitism and exploitation.

The WCPAS identifies access to transport, particularly for the rural communities of the Cederberg and Matzikama areas, as a key aspect for local and provincial government to address. Due to the geographically dispersed nature of the communities, in combination with low household incomes, individuals cannot afford the use of taxis, and often have to walk long distances to get to the nearest taxi route.

This has implications for job creation. Generation of employment opportunities must either occur close to the residences of work-seekers (for example, farm work with farm housing) or must incorporate the transport needs of individuals into the planning processes.

g. Access to services in the study area

Here access to water, sanitation, electricity, refuse removal and telecommunications is discussed. This is not only used as an indicator of development level and quality of life, but also of existing backlog pressure on the local municipalities in terms of service provision. The data on Cederberg and Matzikama is combined in this section to give an overall image of the population that will be affected by a Clanwilliam Dam raising project.

With regard to Ebenhaezer, access to services is limited, with only basic water, electricity, sanitation (83% have flush toilets), housing and education services and a community health care programme operating from the local primary school.

Water

Fresh water is scarce in the area, which has low annual rainfall, and water needs are vast for agricultural activities, in addition to the normative human usage. Access to water facilities in the study area is depicted in **Figure 2.10** below.

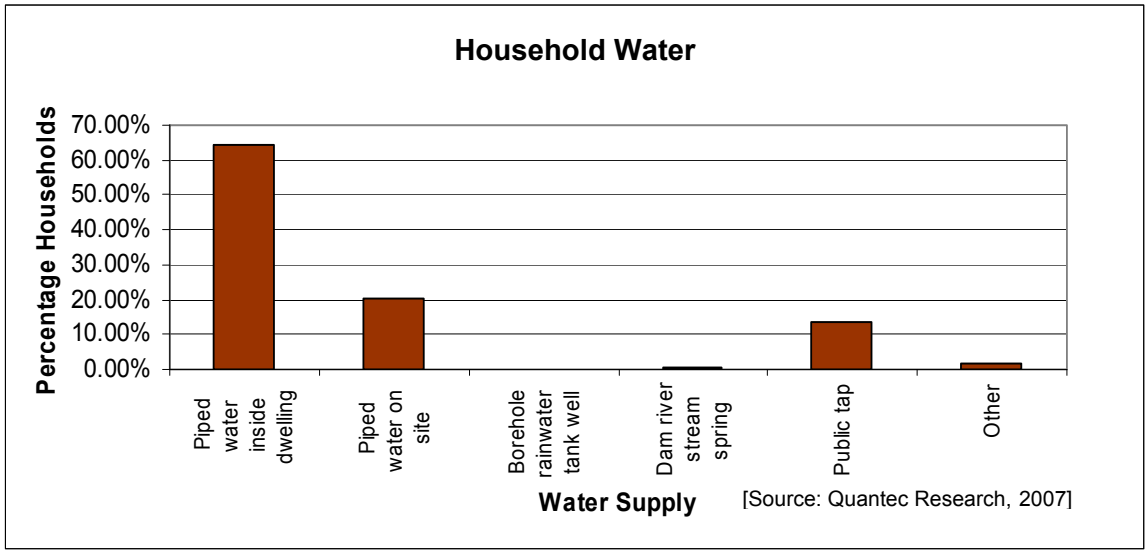

Figure 2.10 Household Water Facility 2006

As can be seen, access to piped water in the study area can be improved, as only 65.15% of households have access to piped water inside their dwellings. Remembering that between 86% and 91% of residents live in brick houses, the lack of piped water indicates that many of these houses are likely to be old, under-serviced farm houses (labour accommodation). Twenty percent (20%) of households have piped water on site and 13.39% share public taps.

Water is supplied to Ebenhaezer households and/or community taps via pipelines directly from the Olifants River. Papendorp, according to Sowmen *et al* (2000), does not have any piped water and use buckets to collect water from the river. Both of these systems are unreliable and pose health hazards.

Sanitation

Table 2.5 below represents household sanitation in the study area.

Table 2.5 Sanitation, Cederberg and Matzikama, 2006

Form of Sanitation	Percentage of Households
Flush or chemical toilet	82.81%
Pit latrine	1.75%
Bucket latrine	1.16%
Other/Unspecified	14.28%

[Source: Quantec Research, 2007]

Few conclusions can be drawn from the data represented in **Table 2.5** due to the high percentage classified as "other/unspecified".

Electricity

Household energy sources for the study area are depicted in **Table 2.6**.

Table 2.6 Household Energy, Cederberg and Matzikama, 2006

Energy Source	Percentage of Households
Electricity	88.14%
Gas	0.23%
Paraffin	1.53%
Candles	9.99%
Other	0.11%

[Source: Quantec Research, 2007]

The majority of households (88.14%) do have access to electricity, while a significant number (9.99%) rely on candles and fires.

Refuse Removal

Table 2.7 depicts household access to refuse removal services for the study area.

Table 2.7 Refuse Removal, Cederberg and Matzikama, 2006

Refuse Service	Percentage of Households
Removed by local authority at least weekly	55.18%
Removed by local authority less often	0.71%
Communal refuse dump	1.84%
Own refuse dump	41.74%
No rubbish disposal	0.54%

[Source: Quantec Research, 2007]

Table 2.7 indicates that 55.18% of households have their refuse removed weekly by the local authority, while 41.74% have their own refuse dump. This likely reflects the rural-urban dynamic of the area, with many farms managing their own waste.

Telecommunications

In terms of cellular phone coverage, the area is covered for voice and data, limited GPRS, but not for 3G. Regarding telephones, **Table 2.8** indicates household access to telephones in 2006. As can be seen, only 30% of households have access to a telephone in the home.

Table 2.8 Telephones, Cederberg and Matzikama, 2006

Access to Telephone	Percentage of Households
Telephone in dwelling and cell-phone	14.88%
Telephone in dwelling only	17.13%
Cell-phone only	10.14%
At a neighbour nearby	12.42%
At a public telephone nearby	30.18%
At another location nearby	5.15%
At another location; not nearby	5.69%
No access to a telephone	4.41%

[Source: Quantec Research, 2007]

Table 2.8 shows that access to telephones is very low in the study area, with only 14.88% having both a household telephone and cell phone and 17.13% having a telephone in the home. Over 52% of households only have access to a neighbour's or public telephone, while 4.41% have no access to telephones.

The above data does not reflect the disparities that exist between the rural and urban populations of the study area. The WCPAS indicates that in Ebenhaezer, only 3.4% of the population have access to a telephone and for rural Cederberg, this is approximately 17.9%.

Access to communication technology is increasingly relevant as a poverty indicator. For rural communities especially, access to communication technology is essential to avoid social and economic isolation. The social implications of extreme isolation are hunger, malnutrition, under-education as well as domestic problems such as neglect, abuse and substance abuse. All of

these are counter-productive in terms of enhancing overall economic and social well-being and the ability to contribute to the local economy and community.

2.4 Background to Clanwilliam Dam

The Clanwilliam Dam was built between 1932 and 1935, with an original wall height of 38 metres. In 1966, the capacity was increased by 30% by raising the wall 6 metres (3 metres concrete and 3 metres crest gates). The capacity of the dam is now 122 million m^2 of water. As with any dam, regular maintenance work is needed. The dam is currently in need of remedial work to meet dam safety requirements and, in the face of water needs in the area; the opportunity to simultaneously raise the dam wall (and, thus, increase capacity) has been identified.

The dam, which has a lake-like appearance (see **Figure 2.11**) and a surface area of 11,04 km^2 supports approximately 13 214 ha of agricultural land and is also a valuable tourism asset, as it is a popular camping, skiing and fishing destination.

Figure 2.11 Photograph of Clanwilliam Dam
[Source: www.clanwilliam.info]

Details on the various raising options follow in **Section 3**: Dam Raising Options. Information regarding the social and economic sectors reliant on the dam will be provided in the relevant impact chapters.

2.5 Policy environment

As with any development activity, there is a policy context in which decisions must be made. The relevant policies for the proposed Clanwilliam Dam raising include:

- Accelerated and Shared Growth Initiative of South Africa (ASGISA)
- Micro-Economic Development Strategy for the Western Cape (MEDS)
- West Coast Integrated Development Plan (IDP)

- Cederberg IDP
- Matzikama IDP (2005)
- Strategic Framework for Sustainable Development in South Africa (Department Environment and Tourism)
- National Environmental Management Act (107 of 1998) (NEMA)
- National Water Act (36 of 1998)
- Conservation of Agricultural Resources Act (43 of 1983)
- National Water Resources Strategy
- Western Cape Department of Agriculture Strategic Plan, 2005-2010
- Western Cape Department of Environmental Affairs and Development Planning Strategic and Performance Plan, 2005-2009
- West Coast Poverty Alleviation Strategy, 2006
- West Coast Local Economic Development (LED) (Draft, 2007)

Table 2.9 illustrates the various policies and possible implications thereof.

Table 2.9 Policy Implications

Policies	Description	Implications
Accelerated and Shared Growth Initiative of South Africa (ASGISA)	The Accelerated and Shared Growth Initiative of South Africa is a shared growth initiative which is focused on a development path which is vigorous and ensures that the economy is inclusive where products and services are diverse, more value is added to the products and services which are offered, costs of production and distribution are reduced, labour is readily absorbed into sustainable employment, and new businesses proliferate and expand.	The implications are that the development goals of each city, town and settlement are becoming focused on ensuring that developmental aspects are aligned to an inclusive economy. There is the target of between 4.5 and 6% annual growth rate in terms of GDP. Any development, including a Clanwilliam Dam Raising should, thus, contribute to an increased GGP, more jobs and a more diversified economy.
Micro-Economic Development Strategy (MEDS) for the Western Cape (2005)	The MEDS will provide certainty on the 10-year economic development view of Government. It will provide a firm platform for launching co-ordinated meaningful cost-efficient interventions in the economy by all social partners. It will be the authoritative reference point for all-important views by Provincial Government of Western Cape (PGWC) on matters economic for planners, analysts and investors.	Any development project will be analysed in-depth prior to gaining support from the Province. Agri-business falls into the second priority group identified by MEDS and is also listed for sector support, within the "resource beneficiation industry cluster", which includes agri-processing, aquatic industries and new potential industries, such as food processing. Tourism, is, however, prioritised over agriculture.
West Coast Integrated Development Plan (IDP)	This document sets out guidelines for the local IDP processes. Further, it sets out guiding principles of sustainability, holism, participation, empowerment, environmental awareness and information management. Poverty alleviation through equitable economic development, infrastructural development, environmental management and accessible services are the main foci.	A Clanwilliam Dam raising is seen as an infrastructural investment. The option selected must be environmentally, economically and socially sustainable.

Policies	Description	Implications
Cederberg IDP	The Cederberg IDP focuses on "people, not places" and is made up of numerous sectoral plans, including a LED, a SDF and Water Service Development Plan (currently being formulated). Economic development is hoped to stem from growth in agricultural, industrial, retail and tourism activities.	LED is seen not as a thing the municipality does, but as a way in which all activities are conducted. The IDP emphasises both "hard" and "soft" interventions for economic growth, including skills development, and infrastructural investments, respectively. This includes significant investment in the local water network (boreholes, reservoirs and pump stations).
Matzikama IDP (2005)	The Matzikama IDP envisages sustainable economic and social development for the area, through coordinated investments in infrastructure, human resources and the natural environment. The IDP calls for the establishment of water management plans, as well as water-use management that promotes sustainable, effective and affordable use.	Coordination with the Department of Agriculture is promoted by the IDP. Further, the IDP sets out 22 priorities, including researching and enhancing water sources and to promote and support new small farmers in the area. Thus, a Clanwilliam Dam raising option must be decided on after consideration of impact on emerging farmers. Further, all potential water sources and sustainable use thereof must be investigated.
Strategic Framework for Sustainable Development in South Africa (Department Environment and Tourism)	This framework seeks to meet the Millennium Development Goal of integrating the principles of sustainable development with all policies and programmes. It seeks to promote balance between "people, planet, prosperity". Collaborative efforts to secure resources for use by future generations are sought. Agriculture is seen as an essential sector in terms of economic and social contributions, but is also seen as a risk sector, in that it draws heavily on natural resources, including water, and South Africa is defined as a "water-stressed" country as consumption currently outweighs capacity.	Long-term water quantity and quality must be considered in all planning processes and should be accompanied by comprehensive programmes to reduce consumption. The impacts of global warming and inefficient water-use patterns must be included in long-term water planning.
National Environmental Management Act (107 of 1998, amended 2004) (NEMA)	The act sets out institutions for environmental management as well as generic principles of sustainability, a people-centred approach and equitable resource utilisation.	Sustainability must be considered in all decisions relating to the environment and/or a natural resource.
National Water Act (36 of 1998)	The act recognises water as a scarce and essential resource and seeks to promote the integrated, sustainable and equitable management of water resources.	The Clanwilliam Dam must comply with dam safety regulations as laid out in the act. Further, EIAs and participatory procedures must be followed for any dam work.
Conservation of Agricultural Resources Act (43 of 1983)	This act provides control mechanisms for the use of a natural land, soil, water and vegetation, as well as for the eradication of alien vegetation and weeds.	The dam raising and agricultural activities it stimulates must not contravene any functions of this act. The dam raising should be combined with water-saving initiatives, such as the eradication of water-draining alien vegetation and weeds.

Policies	Description	Implications
National Water Resource Strategy (2004)	The strategy aims to ensure that water use is justified, sustainable, effective and efficient. There must be a balance between water availability and utilisation for optimal social and economic benefits.	Clanwilliam Dam falls under the Olifants River Water Management area, where water runoff from irrigation and fertilisation must be reduced. The dam raising must consider impacts on water quality and provide for mitigation measures for negative affects, such as increased salination levels.
Western Cape Department of Agriculture Strategic Plan, 2005-2010	This document sets out four strategic areas, namely land reform, research and development, enhancing the competitiveness of agricultural products and managing available water. They envision an agricultural sector that enjoys global success, and is competitive, inclusive, socially responsive and in balance with nature. This will be done through various support programmes, including support for local governments, agric-businesses, new farmers as well as through the provision of technological and research information that promotes sustainable resource usage.	Promoting more efficient use of water is seen as the "key challenge" to the department. Irrigation of agricultural land currently constitutes 43% of all water used in the Western Cape and this is seen to be unsustainable due to climate change and population factors. Water-related planning is therefore prioritised with a focus on efficient-use technologies. This is discussed in detail in the section dedicated to sustainable development.
Western Cape Department of Environmental Affairs and Development Planning Strategic and Performance Plan, 2005-2009	This document sets out strategic goals and processes for the Department. It prioritises sustainable use of natural resources, people-centred development planning and equitable access to land and other natural resources.	Decision-making regarding developments that affect natural resources and/or productive agricultural land must be based on rational, strategic and long-term factors as well as principles of equity and sustainability.
West Coast Poverty Alleviation Strategy 2006 (WCPAS)	This document aims to supply information and plans to "address the daunting challenge of comprehensively addressing poverty as a multi-dimensional threat to sustained prosperity and well being in the West Coast region as well as the province and country as a whole".	The key areas identified for to alleviate poverty are education (including a learner transport plan), LED (including SMME development, training and subsidies), increasing access to communication technologies, social development, health and basic services.
West Coast LED (Draft: 2007)	This document will form the framework from which all activities with an economic impact must be framed. It is a supportive document for the IDP, as well as a specification of how economic development should be done.	The objectives of the LED are to improve the business environment (enabling environment), to retain existing jobs and grow existing businesses, to attract investments and funding and to share the benefits of growth. Expansion of the agricultural sector, and sharing the benefits thereof, are, thus important for the Clanwilliam Dam project.

In addition, the November 2000 World Commission on Dams Report (*Dams and Development: A New Framework for Decision-making*) forms the global policy framework. This framework argues that, while dams are necessary for economic activity, the development of dams often comes at great human, social and environmental costs and that benefits of dams should be equitable to those affected by their development. It further states that the benefits of dams are often over-

estimated and they usually produce less irrigation and/or energy than anticipated, at a higher social and environmental cost than anticipated. Dam developments should, therefore, be publicly accepted, environmentally sustainable and benefits should be shared. Any negative impacts on livelihoods should also be mitigated by appropriate programmes. It also puts forward that all options should be assessed prior to building or extending a dam. Assessments of options must address both supply and demand side factors, such as:

- The real need for water
- Potential benefits and risks of alternatives
- The performance and productivity of existing irrigation systems and their alternatives
- Various sources of water (rivers, desalination, rain-seeding)

This is to be done through a five-phase process:

a) Needs assessment: validating the needs for water and energy
b) Selecting alternatives and identifying the preferred development plan (this includes investigative studies)
c) Development plans (participatory, including plans for mitigation measures and monitoring and evaluation)
d) Project implementation
e) Project operation (flexibility to changing circumstances is important)

Finally, the "Water Law Principles" of 1996 has relevance. There are 21 principles laid out, relating to ownership and management of South Africa's water resources. A systems approach that recognises all ecological and human factors impacting on water quality and availability is advocated. Further, all of the principles aim to "achieve optimum, long term, environmentally sustainable social and economic benefit for society" from the use of water resources (Water Law Principles of 1996).

The remainder of this report will measure compliance with the above policies and provide recommendations regarding the Clanwilliam Dam raising (Phase 2 of the above process).

2.6 Concluding remarks

This section showed that the area that would be affected by the Clanwilliam Dam consists mostly of commercial agricultural land. Agriculture is seen as a core economic activity, which provides employment, income and even housing to much of the population. Agriculture contributes 28.65% of the Cederberg GGP and 19.08% of the Matzikama GGP, while employing 58.44% and 48.89% of employed individuals, respectively. The maintenance of this sector, which will directly benefit from increased water yield, is essential to the economic and social stability of the study area.

Economic growth in the area is slow, however, and requires conscious efforts to raise it to the ASGISA target level of 6%. Despite weak economic growth, employment in the area is above average nationally, with only 8.99% unemployment rate. Occupations are largely elementary, however, resulting in more than three quarters of the local population remaining poor (households earning under R 3 200/month).

Population growth for the study area (4.6%) is higher than the national, provincial and district averages and also exceeds the local economic growth rate. This has implications for education, service provision and job creation. Advances in economic and social activities must occur faster to meet the needs of a growing population and prevent increases in unemployment and associated dependencies.

Access to services is another important focal area for local governments, with people in the study area suffering a lack of access to services such as piped water, telecommunications and transport. In order to take advantage of economic growth, for example of growth in the agricultural sector, the population needs to be empowered with the education and skills to take advantage of the opportunities for increased income as well as access to basic services to improve the ability to be productive. Access to transport and telecommunications are also essential improvement points that will directly impact the population's ability to take advantage of economic opportunities.

Section 3 introduces the reader to the main development issues, namely the structures of key sectors affected by changes in water yield, the proposed dam raising alternatives and the direct implications of these on the specified sectors.

3. DEVELOPMENT ISSUES

3.1 Introduction

This section presents information on the current situation in terms of the need for repairs to the existing dam wall, the increasing need for water and the relationships between various sectors and the environment, particularly water. Finally, a description of dam raising alternatives is provided.

3.2 Current situation

The Water Management Area (WMA) of the Olifants-Doorn Catchment Area is the second largest WMA in South Africa, covering a total area of 4 906 600 hectares or 49 066km^2. Half of the area falls in the Western Cape, and half in the Northern Cape. There are numerous sectors relying on this WMA, with use currently lower than yield, though exceeding ecological reserve requirements. The National Water Act requires consideration of the Ecological Water Requirement (EWR) or Reserve in administering water-use licences. For this reason, options for increasing yield in the catchment area have been investigated, with the raising of Clanwilliam Dam deemed the most viable in terms of environmental impacts (Anchor Environmental Consultants, 2006).

The Olifants-Doorn WMA is generally arid, with an average rainfall of less than 300 mm/annum (1 500 mm in mountainous regions of the Western Cape and less than 100 mm in the more northern parts). About 90% of the catchment area is used for conservation of natural vegetation, tourism and low-intensity livestock grazing. The remainder consists mostly of irrigable farming land, some dryland farming, tree plantations and limited mining activities, as well as small urban centres (Anchor Environmental Consultants, 2006).

The Olifants River is the main river of the WMA, with the Doring as its primary tributary. The area is divided into six management units, as follows:

- Knersvlakte (Northern part)
- Lower Olifants (North Western component, including Ebenhaezer and Vredendal)
- Sandveld (Western coastal stretch, including Lamberts Bay and Sandbaai)
- Doring (South Eastern edge)
- Upper Olifants (Western edge of Olifants River, upstream of Clanwilliam Dam)
- Koue Bokkeveld (Eastern edge of Olifants River, upstream of Clanwilliam Dam)

WESGRO (www.wesgro.org.za) identifies the main growth areas for the WMA as fishing, tourism and citrus, wine, deciduous fruit and Rooibos farming.

The remainder of this section provides basic information on the existing structure and dependencies related to the Olifants-Doorn WMA.

3.2.1 Existing dam infrastructure

The current structure consists of a non-overspill crest, with an approximate length of 250 m. It is a concrete gravity dam, with an ogee shaped spillway, controlled by 13 vertical spillway gates, supported by piers. Two outlet pipes discharge water into the river, while a third channels water to the hydropower plant and irrigation canal.

The need for repairs to the dam wall to adhere to dam safety standards is evident. The existing 43 m wall is in need of repairs and the existing spillway gates are to be replaced by a fixed concrete spillway. This remedial work will not alter the storage capacity of the Dam, but it does provide the opportunity to simultaneously make other structural changes, and the potential raising of the Dam is, therefore, under investigation.

Repairs are needed for three main reasons. Firstly, there is a build up of alkaline residue on the wall, which compromises the quality of the concrete in an "alkali-aggregate reaction". Secondly, the shear-stressed cables are losing their resistance, compromising the stability and safety of the wall. Thirdly, the quartzitic sandstone foundation is fractured, compromising elasticity. These changes all require significant capital investment as well as civil engineering activities. Raising the Dam wall during the same project would enhance cost-effectiveness while increasing the capacity of the Dam, with resultant benefits for irrigated agricultural activities (DWAF Dam Design Report).

3.2.2 Relationships and needs

According to the Western Cape Department of Economic Development and Tourism (2006), the primary economic activities of agriculture and fishing in the WMA are essential contributors to the Western Cape's economy, especially as fruit, wine and fish products are the three largest export products for the Province. Thus, the WMA has indirect impacts on other sectors, creating jobs and income in transport, logistics and export industries. Tourism is also important for the Province, contributing approximately 10% in value added and employment. The West Coast is utilised by the Province in marketing tourism activities, as an "undiscovered" theme is ascribed to the area. There are various social and economic activities in the study area that are dependent on or influenced by the local ecosystem, particularly the water systems. These include:

- Agriculture
- Fishing
- Tourism
- Municipal Activities and Sources of Income
- Mining and Industries

These will each be briefly described in terms of their relationship with water and their contributions to GGP and employment.

a. Agriculture

Section 2 provided data on the economic and social value of Agriculture in the study area. Agriculture provides not only significantly to the GGP, but even more so to employment and livelihoods. It also has considerable competitive advantage as a food-supplier nationally. According to the Western Cape Provincial Development Council (2005), the Western Cape has just over 12% of agricultural land (hectares), but contributes "well over 50% of agri-exports" for South Africa.

Agriculture in the Olifants-Doorn WMA consists mostly of dryland agriculture and irrigated farming, though tree plantations (997 ha) and low-intensity livestock grazing are also evident.

Dryland Farming

Dryland farming varies year-to-year, based on rainfall. According to an Olifants/Doorn Water Management Area Strategic Framework (DWAF, 2005), rainfall in the area is currently decreasing, as the West of South Africa is gradually becoming hotter and dryer, while the East is

receiving increasing annual rainfall – DWAF (2005) further predict that over the next 50-100 years, rainfall in the WMA will decrease by 15%. In 2005 the Matzikama, along with other areas in the West Coast and Central Karoo, was declared a disaster area as a result of persistent drought (WC Department of Agriculture, 2005).

According to Anchor Environmental Consultants (2006), there is a total of 219 000 ha (4% of the WMA) available for dryland farming, but DWAF estimated in 2002 that only about 100 000 ha of this is used due to rainfall patterns. Wheat and Rooibos tea are the predominant crops, with hoodia being the latest addition to agricultural activities in the area. According to WESGRO, the Olifants River Valley, particularly Clanwilliam, is the only place in the world where Rooibos tea is commercially cultivated and produced.

Rooibos Farming

WESGRO has identified Rooibos farming as an important investment sector, and is currently promoting multi-million Rand BEE deals to advance the sector. According to WESGRO (2007), the annual turnover of Rooibos farms is R 460 million, with the production of between 6 500 and 10 000 tons annually. Approximately 6 300 tons are exported each year, about 600 - 800 of which is pre-packaged as tea, while the remainder is unprocessed. The expansion of Rooibos products into body products as well as juices is increasing the demand for Rooibos, as well as the growth in international recognition of its health properties. This provides opportunities for the study area, both in terms of farming as well as enterprises built on Rooibos-products.

Irrigation Farming

Irrigation agriculture includes citrus, deciduous fruits, grapes, potatoes and summer vegetables. Estimates for total land under irrigation vary, but are in the region of 46 000 ha, with the potential for a further 134 500 ha to be irrigated. The actual area of land under irrigation each year varies with water availability. Approximately 97% of current irrigated land falls in the Western Cape half of the WMA (Anchor Environmental Consultants, 2006). **Figure 3.1** depicts vineyards near Vanrhynsdorp.

Figure 3.1 Vineyards near Vanrhynsdorp **[Source: Urban-Econ]**

Citrus farming in the area is important nationally, as it is the biggest citrus-growing area in South Africa and contributes to the Western Cape's international exports (WESGRO). Similarly, the

area has developed a brand image for its wine, generally known as "Goue Vallei", which is growing in popularity internationally (WESGRO).

Tree plantations, mostly pine, are found in the high-rainfall areas of the Cederberg (385 ha) and Koue Bokkeveld mountains (232 ha) and along the headwaters of the Olifants River (380 ha). According to DWAF (2005) the total water usage of these plantations is **1 million m^3/a**, considered negligible for the area.

In terms of livestock, exact numbers are unavailable, though DWAF estimates that there are a total of 11 780 large stock (cattle), 336 00 small stock (sheep and goats) and 10 930 pigs in the WMA.

Approximately 40 000 ha of crops are harvested annually, with agriculture contributing around 45% of the GDP for the total WMA. The latest figure for agriculture in the total WMA was **R1.9 billion in 1997**, which is the lowest of any WMA in South Africa, but still incredibly significant for the area, which lacks activity in other economic sectors (DWAF, 2005).

An extensive land use determination exercise recently produced the following updated data:

- Total cash crops: 8 152 ha
- Total permanent crops: 27 250 ha
- Total fallow land: 1 485 ha

Relationship with Water

More than 90% of water use in the WMA is in summer, for irrigation. For this reason, storage of water is essential (Anchor Environmental consultants, 2006). According to DWAF (2005), about 95% of the total annual requirement is taken up by agriculture. This current demand will not be met when new Ecological Water Requirements (EWR) or Reserve requirements are implemented, placing limitations on the growth of the agricultural sector (DWAF, 2005). On average, irrigation farms require between 9 000 m^3/ha (mixed use) and 13 500 m^3/ha (grapes) of water (Laubscher, 2007).

The *Water Management Plan for the Olifants-Doorn Catchment Management Area*, compiled by S J de Wet, showed that drip irrigation is the preferred method of irrigation for permanent crops in the study area. **Table 3.1** represents a summary of these findings.

Table 3.1 ODCMA Irrigation methods percentage

Sub-Area	Total developed area (ha)	Drip Irrigation (%)	Centre Pivot (%)	Sprinkler and Flood Irrigation (%)	Micro-jet Irrigation (%)
Witzenberg Area	1 257			100	
Boschkloof	1 075			100	
Citrusdal (Estimated)	11 155	15	0	2	83
Clanwilliam WUA	9 855	15	20	35	30
LORWUA	13 911	80	0	15	5
TOTAL	**37 253**				

The efficiency factors of the various irrigation systems/methods are:

- Sprinkler: drip irrigation 95%
- Center Pivot 85%
- Flood basin and sprinkler: dragline 75%
- Sprinkler: micro-jet 90%

According to the *Water Management Plan for the Olifants-Doorn Catchment Management Area*, compiled by S J de Wet, Ebenhaezer is the only area where flood irrigation is still being used, while flood irrigation has been phased out in the rest of the study area.

Agriculture draws largely from the Clanwilliam Dam and the connected Bulshoek Weir/Canal system. The Oudebaaskraal Dam (34 million m^3/a) on the Tankwa River also lies within the WMA, but is privately owned and used for irrigation.

In addition, there are a number of smaller farm dams as well as abstraction activities directly from the river. These are largely unmonitored and, together with unlawful abstractions, cause considerable damage to the natural ecosystem, particularly affecting flows in the summer months (Anchor Environmental Consultants, 2006). DWAF (2005) identified these abstraction activities as a threat to water management initiatives and is currently undertaking studies regarding possible reserves, restrictions and licensing procedures.

Raising the Clanwilliam Dam wall is seen to be the most viable option in terms of reconciling development needs and ecological requirements (DWAF, 2005).

The views of local farmers vary widely on the potential benefit of raising the Dam wall. While all acknowledge the need for increased yield, not all are convinced that raising the Dam wall will achieve this, as water is most needed in the summer months, when the Dam dries up significantly (Barbour and Van de Merwe's 2005 *Social Impact Assessment*). Improved dissemination of information regarding the benefits and risks of raising the Dam wall is needed. The recent public participation processes have, according to Ninham Shand staff, addressed some uncertainties, and shown increased public commitment to the value of increasing the Clanwilliam Dam capacity.

b. Fishing

According to a UCT study on South African Coasts, the commercial fishing industry in South Africa is worth about R 1.7 billion, annually, employing close to 27 000 people. The West Coast is the centre of this, contributing about 70% of the industry's GGP contribution and jobs. An estimated 3.6 million South Africans depend on fish as a source of subsistence food, with a total value of around R 1 billion annually for subsistence fishing. Recreational fishing activities are estimated at R1.3 billion a year.

Aquaculture in the Clanwilliam Dam area as well as the lower Olifants-Doorn region is important in terms of recreational activities, subsistence fishing and West Coast Fisheries gill-net fishing. While the macro-economic contribution of these localised activities is minimal, the socio-economic value for specific communities is high. The relationships and impacts are fairly complex, and for this reason significant attention is paid to these communities.

Background to Ebenhaezer

Ebenhaezer was originally established in the 1800s on fertile agricultural land near Lutzville, as a missionary station. The Ebenhaezer families owned much of the arable land, but 1925 saw the removal of the families to the current location, further down the Olifants River near the estuary, via the enforcement of the Ebenhaezer Exchange of Land Act (No 14 of 1925). The community

recently won a breakthrough land claim to the value of R 100 million, involving 53 private owners (Business Report, March 17, 2005). The claim is to be awarded over a period of five years, in terms of a development plan, which was to be formulated during 2006.

According to the socio-economics study conducted by Anchor Environmental Consultants (2006), the new location of 1925 did not enjoy the same agricultural potential due to soil characteristics. Nonetheless, 260 ha of irrigable land was divided among the then 150 residents. These divided plots were too small for commercial agriculture and, with time, and increased salinisation levels, farming activities have ceased, apart from a few small subsistence farming activities. Today, the communities of Ebenhaezer, Papendorp and Viswater rely mostly on fishing activities along the Olifants River (Anchor Environmental Consultants, 2006).

A recent study on soil characteristics, however, showed that Ebenhaezer has good soil, as well as an adequate water supply. Jan Lambrechts of the University of Stellenbosch has conducted studies in the area and notes that the soil is of a similar quality to that on which the surrounding irrigation farmers are irrigating, and management of the irrigation systems at Ebenhaezer may be need improvement. Better agricultural and community management is needed to realise the full social and economic potential of the area.

The Olifants Estuary

As the mouth of the Olifants River is permanently open, a tidal influence of up to 36 km upstream (during spring tides) feeds the Olifants River estuary, which has the highest botanical rating of all South African estuaries (DWAF, 2005). Salinity increases in summer, when river flow is low. The productivity of the estuary is, thus, particularly sensitive to decreases in river flow, flood frequency and water quality (DWAF, 2005). Together with the Berg and Orange River Estuaries, the Olifants River estuary is one of three permanent estuaries along the West Coast. It supports approximately 45 species, many of which are partly or entirely estuarine-dependent, meaning that degradation of the estuary has significant impacts for West Coast fish. It also supports approximately 86 bird species and plays an important role in bird migration (DWAF, 2005).

Relationship with Water

Subsistence farming and fishing are the main economic activities in the area. The methods are elementary, with locals using wooden rowing boats and gill-nets to catch a South African mullet fish called "harder" (*Liza richardsonii*). Limited amounts of fish can be caught from the estuary, and the remainder of the catch, mostly used as a source of protein (not income), comes from the Olifants River.

There are approximately 45 permit holders, each one with an assistant. Due to the lack of alternative economic activities and the fishing history of the community, however, it is estimated that more than 200 households are involved in fishing activities. According to Barbour and Van der Merwe (2005), Marine and Coastal Management has approved a policy to phase out gill-net harder fishing in the Olifants River over a ten year period, but have not indicated when that ten year period will commence, or what economic development programmes will be implemented in order to counteract the negative socio-economic impact that this would have on the local community. This policy is called the "Netfish Policy" of 2005.

According to a report compiled by Sowmen *et al* in 2000 for the World Fish Centre (whose objective it is to "reduce poverty and hunger by improving fishing and aquaculture"), there were 72 licenses in 1998, indicating that there has already been a decrease in permits available in the period between 1998 and 2005. According to Martin (1999), licences are awarded to individuals, but not more than one person per household may hold a license. Martin speculates that poor participation in fish management procedures is hindering fish management in the area. This is

supported by Sowmen *et al* (2000), who argue that the community's history of forced-removal during apartheid feeds feelings of disempowerment and mistrust in these processes. They further note that, while a co-management initiative exists, 40% of residents have not even heard of this forum. Baring in mind the size of the community, this is likely due to a lack of implementation of the initiative.

Fish caught is used as a source of income for some families, though this is inconsistent and catch is particularly low in the winter months. The average household will earn less than **R 500/month** from fishing in the winter months (Barbour and Van der Merwe, 2005). Anchor Environmental Consultants estimate the value of the estuary fishing activities to be around **R 500 000/annum**.

Catch is sold to locals as well as to farmers and farm workers in the nearest towns, though this is limited to those who have access to transport. Access to a 'bakkie' becomes a source of elitism and locals are often exploited, with high rental rates for the use of a vehicle to transport fish to Lutzville, Doornbaai or Vredendal (Barbour and Van der Merwe, 2005).

Sowmen *et al* (2000) suggest that over the 1990s the area has become more subsistence-focused, with household incomes decreasing rapidly (according to these authors, some households earn less than R 100/month) and reliance on subsistence fishing and farming is increasing as a result.

As can be seen, the "livelihoods" of Ebenhaezer families are directly linked to the Olifants River. A livelihood consists of assets, activities and entitlements, while sustainable livelihoods deal with how people cope with risks and environmental changes (UCT Coastal Resources). For the Ebenhaezer community, assets include the natural resources as well as the indigenous knowledge and skills of the people. The strong sense of community is also an asset. Assets that are lacking are access to transport, roads, services and employment opportunities. The livelihood activities include fishing, farming and trading in nearby towns. A recent study on *resource poor farmers* (Ninham Shand, 2007, for DWAF) found that due to reliance of communities such as Ebenhaezer on fish stock "water for the Reserve …. has an important equity component".

c. Tourism

Tourism is one of ASGISA's top priority sectors. According to the June 2007 budget vote speech made by Marthinus van Schalkwyk, Minister of Environmental Affairs and Tourism, the tourism sector's total GDP contribution for 2006 is estimated at 8.3%, with contribution to national employment at 7.5%.

Tourism in the study area is largely based on the landscape: rugged and mountainous in the Cederberg and wide arid plains to the north-west. Interestingly, agricultural activities contribute to the scenic quality of the area – as a tourist, one cannot help but be struck by the magnificent contrast between the dry, arid natural land and the green, irrigated vineyards of the West Coast Wine Route. **Figure 3.2** depicts vineyards to be seen surrounding the town of Vredendal, while **Figure 3.3** depicts the vast, dry landscape that can be seen when descending down Vanrhyn's Pass from Vredendal to the Coast.

The water canals serving these wine lands can be seen in **Figure 3.2**.

Wild flowers, rivers and Clanwilliam Dam are specific tourist attractions. The Cederberg Mountains also offer adventure tourism, with established hiking and sky-diving tourism enterprises. Citrusdal is considered a national leader in eco-tourism facilities and activities (WESGRO).

Figure 3.2 Photograph of vineyards near Vredendal
Source: www.olifantsriverwineroute.com]

Clanwilliam Dam is surrounded by holiday homes, lodges and the Clanwilliam Dam Resort. The Clanwilliam Dam Resort is a popular weekend and summer holiday destination for South African and some foreign families. The resort consists of 400 camp sites, two large ablution blocks and nine chalets. According to an Urban-Econ interview with a bookings employee, the resort enjoys full use in the summer season (80% full over weekends September to Easter (March/April) and 100% use over December and January). Bookings for the December/January school holiday period occur one year in advance. In winter, however, the camp sites are mostly vacant, occasionally used as accommodation for labourers working on projects in the area. The chalets are 80-90% full on weekends, winter and summer. Rates vary, as follows:

- May to July: 1-4 people, R65/night per site; 5-6 people, R90/night per site
- August to April: 1-4 people, R92/night per site; 5-6 people, R120/night per site
- Chalets: year-round, 1-4 people, R460/night per chalet; 5-6 people, R580/night per chalet

The dam is considered an attractive holiday destination due to the lake-like nature of the dam offering space for water sports, as well as fishing and good weather. The Clanwilliam area is also considered safe, child-friendly and hospitable (www.clanwilliam.org.za).

Anchor Development Consultants (2006) note that the Olifants Estuary is largely untapped as a tourism resource. The Olifants River is known for river-rafting, bird-watching and food-and-wine based tourism. The area also offers 4x4 trails, historical sites and the world's largest succulent nursery (http://www.olifantsriverwineroute.com).

Lamberts Bay is the WMA's fishing industry centre and has combined this with natural assets to create a popular and very successful holiday resort (WESGRO).

Figure 3.3 View from Vanrhyn's Pass

[Source: http://blogs.warwick.ac.za]

Relationship with Water

While urban centres have experienced significant growth in tourist numbers in recent years, water shortages in other areas and coastal towns restrict tourism developments, especially as the water shortage periods coincide with the summer tourist season (Anchor Environmental Consultants, 2005).

Clanwilliam Dam itself is a significant tourism attraction, as a popular skiing, fishing and camping venue. The Dam has the municipality-owned Clanwilliam Dam Resort (camping facilities) on its edge as well as a number of lodges, inns and bungalows. Temporary and permanent impacts on these facilities are addressed in **Section 3.4**.

Comments on a website (www.clanwilliam.org.za) dedicated to frequenters of the Clanwilliam Dam Resort indicate that they are sceptical about the wall raising, anticipating changes in the environment as well as changes in water temperature and quality, impacting on recreational boating, skiing, swimming and fishing, and the overall attractiveness of the dam as a holiday venue. Anchor Environmental Consultants (2006), however, argue that "increased lake area behind the raised Dam wall could enhance the attraction of the area for water sports, recreational fishing and resort development". A public participation process hosted in Clanwilliam showed support for the latter view.

d. Municipal activities and sources of income

As mentioned, the Clanwilliam Dam Resort is municipality-owned. The 400-site, 9-chalet venue is an important source of municipal income. Based on an Urban-Econ interview with a bookings employee at the resort, annual turnover can be estimated at **R 4 million**. Precise implications of a dam wall raising are discussed in **Section 3.4**. **Figure 3.4** depicts various scenes at Clanwilliam Dam Resort.

Figure 3.4 Clanwilliam Dam Resort
[Source: Urban-Econ]

The local municipalities within the WMA are also responsible for maintaining other water services and infrastructure, much of which is ageing and in need of repair/replacement. According to DWAF (2005), better maintenance and management of these systems would result in significant cost savings in the long-term. According to Anchor Environmental Consultants (2006), most urban centres and rural communities rely on a combination of groundwater supplies and abstractions from the canal systems and Olifants River for household usage.

e. Mining and industries

While mining is not a major sector in the area, a few small mining activities do take place, including gypsum, salt, sand and diamonds (offshore dredging). The industrial sector is small, and largely centred on agri-products processing and packaging. An estimated **3 million m^3/a** of water is used by the mining and industrial sectors combined (DWAF, 2005). **Figure 3.5** is an image of sand mining activities near the Olifants River Mouth.

Figure 3.5 Satellite view of sand mining, Olifants River Mouth
[Source: Google.maps]

3.3 Dam raising alternatives

There are four alternatives for raising the Dam wall, namely no raising, a 5 m raising, 10 m raising and 15 m raising. Each of these is described briefly here.

The "0 m" or "no raising" option entails simply completing the remedial work required to meet dam safety standards. This will have no impact on the volume capacity of the Dam. This work would take approximately 24 months.

The "5 m raising" option entails raising the dam wall by 5 m, to increase capacity to 186 million m^3 (an increase of 50%). Completing the necessary remedial works and raising the wall by 5 m would take approximately 30 months.

The "10 m raising" option is a raising of 10 m to increase capacity to 266 million m^3 (an increase of 114.5%). Completing the necessary remedial works and raising the wall by 10 m would take approximately 36 months.

The "15 m raising" option is the most significant option, entailing an increase in height of 15 m and an increase in capacity to 364 million m^3 (a 193.5% increase). Completing the necessary remedial works and raising the wall by 15 m would take approximately 42 months.

The times indicated above include 6 months preparation/site establishment work and 3 months post-construction site rehabilitation.

In addition to the above options, DWAF has investigated different shapes for the Dam wall. Two main shapes are investigated, each with different options for width (current width or extended width). All of these alternatives are assessed in the impact modelling process, results of which are presented in **Section 4**. **Figure 3.5** depicts a labyrinth shape and **Figure 3.6** depicts an ogee shape.

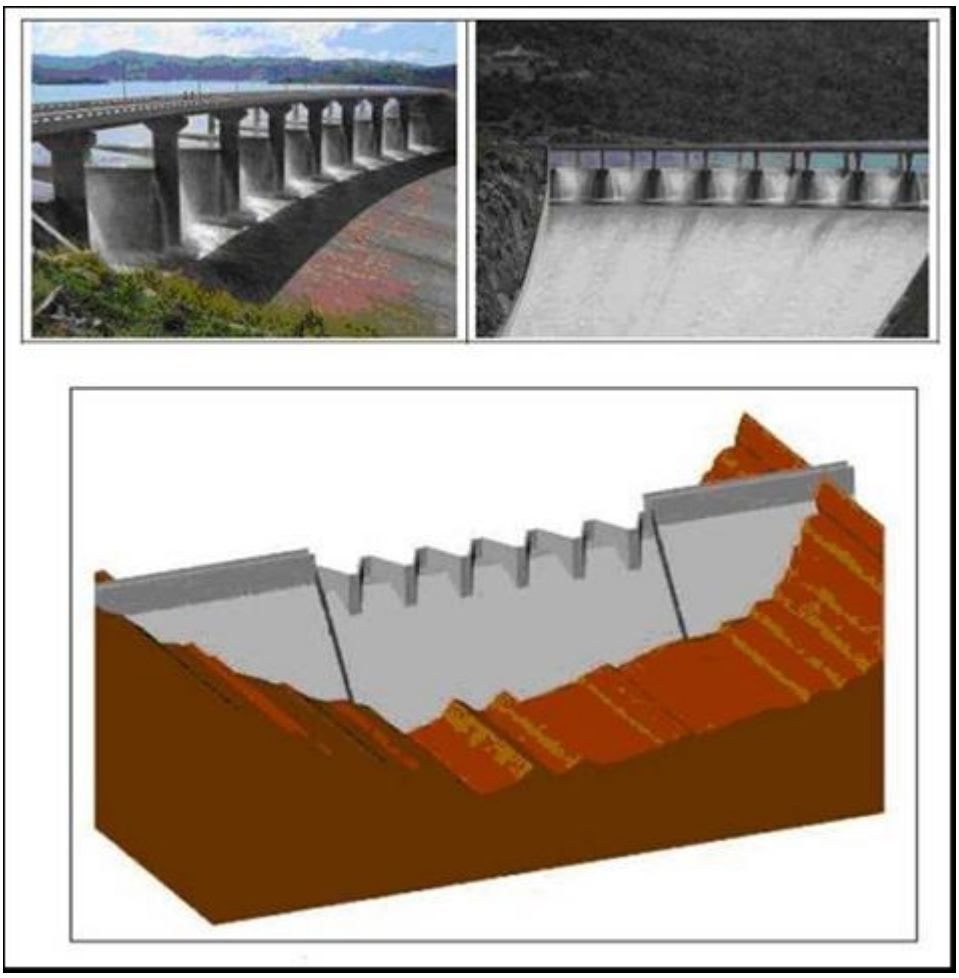

Figure 3.6 A labyrinth shaped dam wall [Source: DWAF Dam Design Report]

Figure 3.6 depicts a labyrinth-shaped wall at Maguga Dam in Swaziland and DWAF's model of a labyrinth shape.

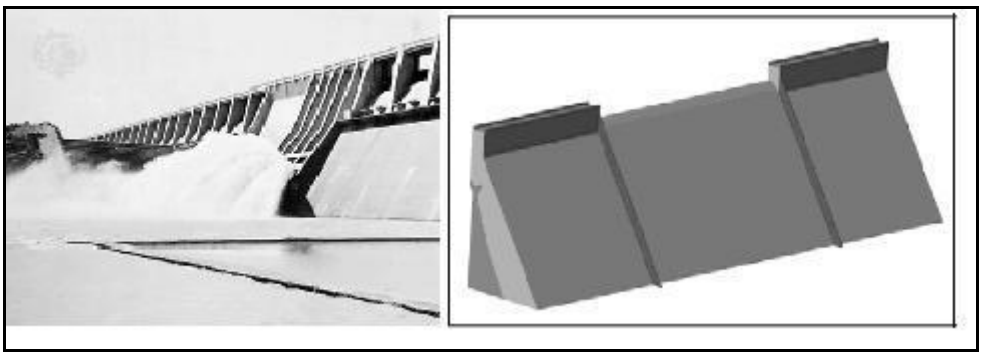

Figure 3.7 An ogee shaped dam wall
[Sources: www.britannica.com/ebi/art-14988; DWAF, 2006]

Figure 3.7 depicts the ogee-shaped wall of the Vaal Dam, and DWAF's model of an ogee wall.

In addition to the shape, the outlet structure was investigated. The current structure is a "bottom release outlet structure", where water is released from the bottom of the Dam only. The alternative, "multi-level outlet works" is considered more sophisticated and more viable in terms of meeting ecological water quality requirements. This entails having release structures at various levels, allowing water from different depths (and therefore different temperatures, salinity and so on) to mix in an attempt to meet downstream water quality requirements. No decision on this has yet been taken, though the EIA recommends the "multi-level" option, for the three raising options, for stated reasons.

During construction, these alternatives have implications for:

- The establishment of a construction site
- Realigning existing and building new (temporary and permanent) roads
- Mitigating impacts on other infrastructure
- Quarrying activities: additional roads, quarrying and stockpiling of materials to be used in construction

These impacts are presented in more detail in various engineers' reports as well as the EIA. The capital implications are used as inputs in modelling the economic impact, the results of which are presented in **Section 4**.

Finally, alternatives exist for the allocation of additional yield, should the raising go ahead. There is a lack of agreement on different scenarios for water allocation, but two broad alternatives were assessed for the purposes of this report. The first option (Option 1) is that all additional yield be allocated for irrigation, while the second option (Option 2) (considered to be the more likely option) is that an ecological reserve will be implemented. The first option would allow for approximately 4 220 ha, 6 110 ha and 7 780 ha of additional irrigation for the 5 m, 10 m and 15 m options, respectively. The second/reserve option would allow for approximately 1 700 ha, 2 960 ha and 4 070 ha of additional irrigation for the three options, respectively.

Option 2: Distribution of EWR

The Option 2 that is assessed throughout the remainder of the report, entails the Reserve option discussed at a public meeting held in Clanwilliam in April 2007. It entails the scenario of implementation of the Ecological Reserve in a distributive manner, such that the reduction in use (4% for each user) is spread across the entire Olifants River, as opposed to singularly penalising the downstream users. This is reflected in all calculations regarding Option 2, as well as the forecasted distribution of new agricultural land (**Table 3.2**).

3.4 Implications of the alternatives

This section provides details as to the specific impacts on:

- Agriculture
- Fishing

- Tourism
- Municipal Activities and Sources of Income
- Mining and Industry
- Residential Impacts

Other impacts, such as impacts on heritage sites and environmental impacts, are assessed in separate sub-studies.

The direct costs of expropriating land and replacing and/or reimbursing infrastructure have been included in the CAPEX component of **Section 4**, when the impacts are assessed in economic terms (GGP, new business sales and employment). The following is simply a breakdown of the tangible impacts, for clarity regarding the impacts of construction and later operation.

The data in this section is drawn from the *Feasibility Study for the Raising of the Clanwilliam Dam in the Western Cape: Impacts on Roads and Other Infrastructure (Draft)*, prepared for DWAF by ASCH Professional Services and Ninham Shand Consulting Services (2007), as well as the *Olifants/Doring Catchment Ecological Water Requirements Study: Socio-economics Study* conducted by Anchor Environmental Consultants (2006). The former provide information as to the activities and infrastructure falling within the potential new purchase lines, while the latter held interviews with affected parties and compiled inventories of foreseeable impacts.

3.4.1 Agriculture

Agricultural impacts are vast and varied. In the immediate vicinity of the dam, permanent losses in land and temporary losses in infrastructure, as well as temporary access problems, will be experienced by farmers. **Table 3.2** summarises these impacts. In the WMA as a whole, however, impacts for agriculture are positive. This is reflected in the additional irrigation activities which can be supported. **Table 3.3** summarises additional agricultural activities for the various options.

Table 3.2 Impacts on Agricultural Infrastructure and Land

Impact on	5m	10m	15m
Crops (ha)	0.5 ha mangoes, 15.3 ha citrus. 6 ha summer vegetables and grazing land for 55 cattle and 400 sheep.	3 ha mangoes, 44.8 ha citrus, 18 ha summer vegetables and grazing land for 55 cattle and 400 sheep.	6 ha mangoes, 128 ha citrus, 18 ha summer vegetables and grazing land for 55 cattle and 400 sheep.
Irrigation Infrastructure	7 pump houses, 5 bore-holes, 9 pipelines, 2 dams, 1 fountain	8 pump houses, 5 bore-holes, 10 pipelines, 4 dams, 1 fountain	10 pump houses, 5 bore-holes, 11 pipelines, 5 dams, 1 fountain
Other infrastructure	Access, or ease of access, may be affected during construction	One farm shed Access, or ease of access, may be affected during construction	Two farm sheds and 1 farm stall (closed). Access, or ease of access, may be affected during construction

[Source: Extracted from ASCH & Ninham Shand and Anchor]

The impacts presented in **Table 3.2** are significant for the owners and workers of the 14 farms affected. Compared to the total regional hectares for farming, however, the impact is negligible. In addition to the above, Renbaan Farm has irrigation rights for 50 ha of land, but has not yet

begun agricultural activities. All 50 ha will be lost with the 5 m, 10 m and 15 m options and is viewed as an opportunity cost.

The impacts on farm houses and labourer's accommodations are included in the discussion on residential impacts below (**Table 3.7**).

Table 3.3 Additional Agricultural Activities (new irrigation)

	5 m	10 m	15 m
Option 1: Full Use of Additional Yield			
Citrusdal citrus	211 ha	305.5 ha	389 ha
Clanwilliam citrus	1 688 ha	2 444 ha	3 112 ha
Melkboom/Trawal mixed	844 ha	1 222 ha	1 556 ha
Melkboom/Trawal table grapes	1 055 ha	1 527.5 ha	1 945 ha
Klawer/Vredendal mixed	211 ha	305.5 ha	389 ha
Klawer/Vredendal table grapes	211 ha	305.5 ha	389 ha
Total	**4 220 ha**	**6 110 ha**	**7 780 ha**
Option 2: Implementation of Ecological Reserve			
Citrusdal citrus	85 ha	148 ha	203.5 ha
Clanwilliam citrus	680 ha	1 184 ha	1628 ha
Melkboom/Trawal mixed	340 ha	592 ha	814 ha
Melkboom/Trawal table grapes	425 ha	740 ha	1017.5 ha
Klawer/Vredendal mixed	85 ha	148 ha	203.5 ha
Klawer/Vredendal table grapes	85 ha	148 ha	203.5 ha
Total	**1 700 ha**	**2 960 ha**	**4 070 ha**

[Source: Extracted from ASCH & Ninham Shand, Anchor, Laubscher and discussions with Ninham Shand's Staff]

As can be seen from **Table 3.3**, additional agricultural land will mostly be located downstream of Clanwilliam Dam. The difference between the full-yield and reserve options in terms of additional irrigable hectares is significant, though the implementation of the reserve has an important role in terms of the long-term sustainability of the local environment, as well as the sustainability of the river and river mouth.

Even with the implementation of an Ecological Reserve, the additional irrigable land catered for by the extra yield (**Table 3.3**) far exceeds the land lost by raising the dam wall (**Table 3.2**)

3.4.2 Fishing

The Ebenhaezer communities are extremely dependent on the Olifants River for subsistence fish as well as for household water and irrigation of subsistence farming. Their livelihood literally depends on the Olifants River. Any impacts on the River will, therefore, impact on the Ebenhaezer community. This section entails an assessment of these possible impacts.

Barbour and Van der Merwe (2005) hosted discussions with members of the community and present certain issues or concerns raised by the Ebenhaezer community. These are summarised in **Table 3.4**.

Table 3.4 Concerns Raised by the Ebenhaezer Community

Issue	Description	Implication
Closure of the River mouth	Fresh water is needed to keep the river mouth open (this occurs through regular flow as well as from winter floods). Keeping the mouth open is essential for the life-cycles of harders.	Raising the dam wall may reduce the amount of flow as well as the intensity and frequency of winter floods.
Up-stream farming Activities	Farmers upstream of Ebenhaezer, but downstream of Clanwilliam Dam, are known for extracting unmonitored amounts of water from the river and storing this in farm dams.	This activity may increase with the raising of the dam wall. The result is twofold: firstly, there is an impact on flow and the maintenance of the river mouth and secondly, young harder are often pumped out of the river into the dams, reducing procreation in the estuary and subsequent catch.
Subsistence Farming	If flow is reduced due to the above reasons, salinity levels of soil will increase, negatively affecting subsistence farming.	The Ebenhaezer community does not have access to sophisticated soil monitoring and irrigation systems and will be negatively affected by increased salinity.
Water Quality	The use of pesticides upstream of Ebenhaezer impacts on water quality and fish quantities. The Ebenhaezer residents have reported illegal activities (irrigation runoff and empty pesticide canisters being pumped directly into the river) but have seen no subsequent action.	Increased yield for irrigation and increased hectares of irrigated land will exacerbate these affects if action is not taken by the relevant authorities.
Discrimination	A history of disempowerment as well as ongoing racism among farmers and authorities has left the community feeling unable to voice concerns and participate actively.	Proactive measures to enhance participation and strengthen LED programmes in the area is needed to ensure that the Ebenhaezer community is not abandoned in the water and agricultural management processes.
River Flow	Being able to predict the river flow is essential to fishing activities.	The community fears that they will not know when the dam will release water and will not be able to plan accordingly. Further, high river flow is most needed in dry, summer months, when the dam is likely to be holding back the most water.
Access to information	The community, due to geographical and educational reasons, has a lack of access to information regarding the construction and operation of the dam	A lack of access to information is hindering the ability of the community to plan ahead and may hamper their inherent capacity to mitigate any negative impacts that the dam raising may have.

[Source: Barbour and Van der Merwe, 2005: adapted]

Anchor Environmental Consultants present information on the possible impacts on the river and Estuary. A summary of predicted losses for different scenarios is presented in **Table 3.5**. The scenarios presented are those scenarios deemed most likely by Anchor Environmental Consultants, and do not include the 5 m and 10 m options.

Table 3.5 Impacts of Various Dam Raising and Water Management Options on Gill-net Fishing

Scenario	Changes in MAR*	Changes in Catches	Changes in Value
No raising; 4% Reserve	+11.93%	-11.25%	-11.25%
15m Raising; 4% Reserve	+3.7%	-11.25%	-11.25%
15m Raising, selective implementation of Reserve (5/8 EWR**)	-15.29%	-2.83%	-2.83%
15m Raising, additional abstraction weirs, selective implementation of Reserve (4/8 EWR)	-25.97%	-17.92%	-17.92%
15m Raising, additional abstraction weirs, no Reserve	-40.77%	-15.16%	-15.16%

[Source: Adapted from Anchor Environmental Consultants, 2006]
* MAR: Mean Annual Runoff
** EWR: Ecological Water Requirement

As can be seen, implementing the full recommended Ecological Reserve will help to minimise negative impacts downstream of the dam.

The scenario's shaded grey in **Table 3.5** have already been discarded, based on the findings of the Ecological Reserve study, amongst others, conducted for DWAF.

In terms of socio-economic impact, the above changes will have impacts on the Ebenhaezer community, as well as West Coast Fisheries. These impacts are elaborated in turn below.

Ebenhaezer Community

As has been discussed above, the Ebenhaezer community is heavily reliant on fishing activities for both income and nutrition. All scenarios represented in **Table 3.5** imply a negative affect for the livelihoods of the Ebenhaezer community. In terms of GGP, however, the implications are almost negligible (between 0.04% and 0.27% decrease), especially when compared to the vast contributions to GGP presented in **Section 4**. Thus, the impacts are low in terms of economics, but high in terms of the livelihoods of a rural community.

Adequate community planning and programmes to mitigate the impacts on livelihoods, can, however, ensure the sustainability of this community. Sustainable livelihoods must be promoted in order to mitigate the risks. Should this not occur, the impacts on the Ebenhaezer community will have subsequent social impacts on other areas, as migration to seek work in growth-hubs of the West Coast (such as Saldanha Bay), may increase. The people of Ebenhaezer must be mobilised to cope with the short-term stress related to this project, as well as the long-term changes they may face.

West Coast Fisheries

West Coast Fisheries make use of line-fish caught near the mouth of the Olifants River. Approximately 2 700 people are employed in these activities, with an additional 268 illegal line-fisherman and approximately 26 000 recreational fisherman (annual) catching fish in this area.

The Estuary at Ebenhaezer is utilised as a nursery for various line-fish and is valued by West Coast Fisheries at R 3.45 million/annum. Losses in the most developed scenario will amount to R 760 000/annum, as well as impacts on jobs and household incomes. This is loss in comparison to current activities. Opportunity costs are not included, for example if a development near the estuary where to be established, tourism and residential activities would be impacted.

3.4.3 Tourism

Impacts on tourism can be both positive and negative. Direct negative impacts include the impacts on those tourism activities directly linked to the Dam – the Clanwilliam Dam resort and other facilities that will be either temporarily or permanently lost due to their positioning within the new purchase lines. **Table 3.6** summarises the impacts on tourist facilities. Holiday homes (some of which are rented out to tourists) are discussed as residential facilities (**Table 3.8**).

Table 3.6 Impacts on Tourist Facilities

Facility	5 m	10 m	15 m
Clanwilliam Municipal Dam Resort (20 employees)	300 serviced sites, one ablution block, two sewer pump stations	400 serviced sites, two ablution blocks, two sewer pump stations, 3 chalets	400 serviced sites, two ablution blocks, two sewer pump stations, 9 chalets
Clanwilliam Aquatic Club	Clubhouse and slipway	Clubhouse and slipway	Clubhouse and slipway
Cedar Inn (6 salaried employees, 25 wage workers)	-	12 motel rooms, one Total Garage (petrol station, restaurant, bar and shop), 18 boat houses	12 motel rooms, one Total garage (filling station and shop), 18 boat houses

[Source: Extracted from ASCH and Anchor]

It is intended that all of the above facilities will be redeveloped higher above the new flood line, thus impacts are temporary. In addition to the above, Rondegat Farm has a B&B which has an annual turnover of approximately R30 000, which will be impacted temporarily while access roads are realigned, and likely for the duration of construction as this will detract from the attraction of the area as a holiday destination.

Whether these venues will be less or more popular after completion of the project will depend on the strength of a marketing strategy to bring back regular visitors and attract new-comers to an "improved" destination.

A potential positive impact of the dam raising relates to Kransvlei Golf Estate. Kransvlei has been approved for development above the 15 m line (though its access road is below the 5 m option and would require re-alignment). The estate will consist of a 9-hole golf course and

340 residential erven. The developers are in favour of the Dam raising, as they feel that raising the water level to be closer to their estate will boost the ambiance and attractiveness of the venue and, in turn, enhance the financial success of the development.

3.4.4 Municipal activities and sources of income

The most direct impact for the municipalities relates to the impact on the Clanwilliam Dam Resort, as discussed above. There are also, however, various opportunity costs to be considered. There is a significant number of undeveloped, but appropriately zoned and serviced erven that will be lost by the various alternatives. These are summarised in **Table 3.7**.

Table 3.7 Impacts on Undeveloped Residential Erven

Undeveloped erven	5 m	10 m	15 m
Caleta Cove	3 erven	15 erven	15 erven
Nooitgedacht Nature Reserve	-	8 erven	16 erven
Sederview	-	20 erven	20 erven
Total	**3 erven**	**43 erven**	**51 erven**

[Source: Extracted from ASCH and Anchor]

The opportunity cost here relates to the loss of the potential revenue which could be derived should the dam wall not be raised and these erven developed as residential (permanent or holiday) properties. **Figure 3.8** is a photograph of Nooitgedacht Nature Reserve.

Figure 3.8 Nooitgedacht Nature Reserve [Source: ASCH Professional Services, 2007]

Section 4 elaborates on economic impacts for the local municipalities.

3.4.5 Mining and industry

There are no foreseeable negative impacts on mining activities as a result of any of the dam raising alternatives. A short-term benefit will be felt during quarrying activities to supply materials for the new wall. This is incorporated into the CAPEX component of **Section 4**.

A commercial activity that will be temporarily disturbed is that of the N7 Total Complex, or "Cedar Inn". In addition to the tourism-related activities presented in **Table 3.6**, there is a commercial premises and workshop, used by a tow-in and mechanics company that will be affected. The entire complex will be moved to suitable land further along the N7, so impacts will be temporary. The 20 Cedar Inn staff and 3 mechanics-shop workers will need to be supported during the construction, however, as 24 - 42 months is a long time to go without a salary. A temporary workshop could be set up, for example, while alternative employment, possibly linked to the Dam-raising activities, will be needed for the Cedar Inn employees.

3.4.6 Residential impacts

The new purchase lines for each of the raising options have implications for existing residential properties. These include holiday homes and some permanent homes surrounding the Dam, farm houses and labourers accommodations on those farms surrounding the Dam, as well as Cedar Inn, which is along the N7 realignment component and consists of a flat with three permanent residents. **Table 3.8** depicts affected residential properties, while **Table 3.9** presents impacts on agricultural residences.

Table 3.8 Impacts on Developed Residential Erven

Developed Erven	5 m	10 m	15 m
Caleta Cove	-	6 second homes, 1 permanent residence	10 second homes, 3 permanent residences
Nooitgedacht Nature Reserve	6 second homes	6 second homes	7 second homes
Sederview	2 second homes	3 second homes	3 second homes
Cedar Inn	-	1 apartment (permanent residents)	1 apartment (permanent residents)
Total	**8 second homes**	**15 second homes, 2 permanent residence**	**20 second homes, 4 permanent residences**

[Source: Extracted from ASCH and Anchor]

Table 3.9 Impacts on Agricultural Residences

Agricultural Residences	5 m	10 m	15 m
Houses	1	4	10
Staff Accommodation*	0	14	17
Total	**1**	18	27

[Source: Extracted from ASCH and Anchor]
* The size and quality of these vary.

Figure 3.9 View of Caleta Cove
[Source: ASCH Professional Services, 2007]

The costs of expropriation are incorporated into the Input-Output model, **Section 4**.

3.5 Conclusion

This section has provided an overview of the Olifants-Doorn WMA and shows that the agricultural sector relies heavily on the resources of the WMA, utilising between 90 and 95% of water in the area. The introduction of an Ecological Reserve will restrict growth and development in the agricultural sector and DWAF has deemed the raising of the Clanwilliam Dam the most viable option for dealing with this. Various alternatives in terms of height and design, as well as allocation of additional yield, are under consideration.

Direct impacts in terms of infrastructural losses were summarised to provide a background to all of the factors considered in the Input-Output model used to determine direct and indirect economic impacts.

As was illustrated, the raising of the Dam wall will not exclusively affect agriculture. Other sectors are reliant on water resources, land and infrastructure in the area. The following section presents the results of an input-output model applied to each alternative to inform the analysis of socio-economic impacts on the area as a whole, as well as on specific industries.

4. SOCIO-ECONOMIC IMPACT ANALYSIS

4.1 Introduction

The purpose of this section is to develop a better understanding of the potential economic impact of the proposed Clanwilliam Dam raising options.

Economic impact refers to the effect on the level of economic activity in a given area as a result of some form of external intervention in the economy. In the case of this study, the local impacts will affect the West Coast District Municipality, and specifically the study area which includes the Cederberg and Matzikama Local Municipalities. These impacts are measured as a result of a capital investment in each of the raising alternatives.

The analysis focuses on the changes that could be expected in the two local municipal economies and communities and can best be estimated by using a technique called the I-O modelling. The Input-Output model translates the anticipated structural change in the economy as a consequence of the proposed development into direct and multiplicative (i.e. indirect and induced effects) in the economy. This technique is a generally accepted approach in an attempt to understand and quantify the potential effects of an exogenous change in the economy.

There are various measures which can determine the impact of such actions on the local residents, and these include the following:

- **Impact on employment numbers**, i.e. the number of additional jobs created or jobs lost as a result of the change in the economic growth of the local economy. This is the most popular measure of economic impact because it is easier to comprehend than large, abstract Rand figures.
- **Value Added** (which is normally equivalent to Gross Geographical Product) is a broader impact of the full income effect. This measure essentially reflects the sum of wage income and corporate profit generated in the region.
- Impact on **household incomes** in the study area increases as pay levels rise or additional workers are hired.
- **The impact on Business Output** (also referred to as revenue or sales volume) is the broadest measure or economic activity, as it generates the largest numbers. It includes the gross level of business revenue, which pays for cost of materials and cost of labour, as well as generating net business income profits.
- **Impacts** on the number of persons residing in the study area, who are living in poverty.

The net economic impact is usually viewed as the expansion or contraction of an area's economy, resulting from changes in (i.e., opening, closing, expansion or contraction of) a facility, project or programme. In the case of the Clanwilliam Dam, this is complex, as it involves not only the raising of the wall, but also the closing (in some cases temporary and in others permanent) of tourist facilities and agricultural land, while simultaneously creating new opportunities as a result of increased dam capacity.

The following impacts can usually be quantified:

- Direct impact: The direct impact is calculated from macro-economic aggregates occurring as a direct result of the project. The initial impact on GGP for example is taken from the financial information and equals the value added generated by a specific scenario.

- The multiplicative effects can be grouped into two distinct effects: indirect and induced.
  - Indirect impact: Indirect impacts are calculated from the activities of suppliers through application of the model. For purposes of this study, indirect suppliers include those industries who deliver goods and services to the activity under discussion (first round suppliers) including suppliers who on their part deliver goods and services to the first mentioned indirect suppliers.
  - Induced impacts: These impacts are the impacts on the demand for goods and services due to the project. Examples include the income of employees and shareholders of the project as well as the income arising through the backward linkages of this spending in the economy. The impact is sometimes confused with the forward linkages of a project.

In order to simplify the impact assessment, households have been incorporated in the input/output model as a productive sector because they provide inputs in the form of labour and their reward (i.e. income) is spent in the economy. Thus, by closing the input/output model with respect to households, the direct and indirect multipliers are higher in order to accommodate the induced effects of household expenditure in the economy.

Finally, a discussion of the social implications of the identified economic impacts for the Cederberg and Matzikama Municipalities follow.

4.2 Understanding the input/output model

While there are many methods of regional economic impact analysis, the I-O modelling approach has proven to be a particularly effective method for evaluating the implications of introducing an exogenous change to the economy.

The Input-Output Table forms the nucleus of the I/O model. Essentially, the Input-Output Table is nothing more than an extension of the National Accounts of a country, i.e. desegregating it into the various sectors of the economy. Therefore, the Input-Output Table is a quantified and summarised version of all transactions that took place between the main economic stakeholders in a particular year. For this reason, Input-Output Tables are compiled and published by Statistics South Africa (SSA), using primarily South African Reserve Bank Accounts data. These sectoral figures are therefore strictly compatible with the macro national accounting data published by the South African Reserve Bank and STATS SA on a regular basis.

The Input-Output modelling approach is recognised and accepted both **nationally** and **internationally.** The model utilised as part of this report was based on the national model and it has been adapted to reflect local economic dynamics and local forward and backward linkages.

The Input-Output Table makes provision for two kinds of transactions at a sectoral level, namely the purchase of intermediate and primary inputs on the one side, and the supply of intermediate and final outputs on the other side. In order to arrive at proper multipliers for the different sectors, household income expenditure has been included in the inter-industry section of the Input-Output Table. This implies that household income is treated as being spent within the economic system and is generating further economic activity.

It is also important to note that the main economic decision-makers who are responsible for the transaction activities contained in the Input-Output Table are entrepreneurs, workers, households and government (all three levels).

Importantly, it is the matrices that can be derived from the I/O model that are used as instruments for economic analysis. This is done by means of the so-called technical input coefficient matrix and the Leontief Inverse matrix. The fundamental assumptions with regard to the I/O model, as well as the use of this model for analytical purposes, are:

- Production activities in the economy are grouped in homogeneous sectors.
- The mutual interdependence of sectors is expressed in meaningful input functions.
- Each sector's inputs are only a function of the specific sector's production.
- The production by different sectors is equal to the sum of the separate sectors' of production.
- The technical coefficients remain constant for the period over which the projections are made.
- There will be no major change in technology.

It should also be noted that:

- All the Rand values in this report represent 2007 Rand values (cost excluding 14% VAT).
- The different measures of economic impact (jobs, GGP and new business sales) cannot be added together and should be interpreted as separate economic impacts.
- The model quantifies direct and indirect economic impacts for a specific amount of time (e.g. 5 years). Therefore, the estimates that are derived do not refer to gradual impacts over time.

4.3 Defining economic impact

Economic impacts can be defined as the effects (positive or negative) on the level of economic activity in a given area(s). The net economic impact is usually measured as the expansion or contraction of an area's economy, resulting from the changes in (i.e. opening, closing, expansion or contraction of) a facility, project or program. Importantly, the net economic impact is ultimately informed by the exogenous change to a particularly defined geographical area/entity.

The net economic impact of an exogenous change in the economy will be translated according to various direct and indirect economic effects, as are defined below:

Direct economic impacts are the changes in local business activity occurring as a direct consequence of public or private business decision, or public programmes and policies. Furthermore, increased user benefits lead to monetary benefits for some users and non-users (individuals and businesses) within the geographical area:

- For affected businesses, there may be economic efficiency benefits in terms of product cost, product quality or product availability, stemming from changes in labour market access, cost of obtaining production inputs and/or cost of supplying finished products to customers.

- For affected residents, benefits may include reduced costs for obtaining goods and services, increased income from selling goods and services to outsiders, and/or increased variety of work and recreational opportunities associated with greater location accessibility.

Indirect and induced impacts: Ultimately, the direct benefits to business and the residents of communities and regions may also have broader impacts, including:

- Indirect business impacts – business growth for suppliers to the directly- affected businesses.
- Induced business impacts – business growth as the additional workers (created by direct and indirect economic impacts/effects) spend their income on food, clothing, shelter and other local goods and services. This business growth will also have implications for potential municipal income due to raised taxes and service levies.
- Dynamic economic effects – shifts in broader population and business location patterns, land use and resulting land value patterns, which may also affect government costs and revenues. These changes will ultimately affect income, wealth and/or well-being.

The subsequent paragraphs discuss the direct and indirect (including induced) impacts of the proposed raising alternatives. The findings of the I/O modelling within subsequent paragraphs, propose to illustrate the impact that this capital injection will have on the local economies for each of the alternatives.

4.4 Capital expenditure (CAPEX)

This subsection focuses on the potential economic impacts of the proposed Clanwilliam Dam raising. For the purpose of this analysis, it is important to note that the estimated impacts are for the duration of the construction and development process, including potential leverage effects. This implies that the impact during the construction phase will fade away once development has been completed. However the sustainability of the effect of the proposed development will be experienced once the development is fully operational. The initial impacts will be discussed as part of this section.

The key for the tables used in this section is as follows:

- Safety Work: the required remedial work to meet dam safety requirements, no raising
- Alternative 1: Ogee shape, existing length
- Alternative 2: Ogee shape, extended length
- Alternative 3: Labyrinth shape, existing length
- Alternative 4: Labyrinth shape, extended length
- Roads: realignment work on minor roads and the N7
- Other Infrastructure: costs of expropriation and/or replacement of land and infrastructure affected (as summarised in **Section 3**)
- Agricultural start up: costs of initial expansion, including irrigation infrastructure and first crops
    - Option 1: Full use of additional water yield
    - Option 2: Implementation of Ecological Reserve

The above are assessed for all raising options, namely 5 m, 10 m and 15 m. Should a decision be taken not to raise the wall, the remedial work would still be completed, and this is assessed as the fourth option, where there would usually be a “no go” option.

The following were utilised to ensure accurate inputs for the model:

- Anchor Environmental Consultants. 2006. *Olifants/Doring Catchment Ecological Water Requirements Study: Socio-economics Study.* Report V2. Prepared for DWAF.
- ASCH Professional Services and Ninham Shand Consulting Services Pty (Ltd). 2007. *Feasibility Study for the Raising of the Clanwilliam Dam in the Western Cape: Impacts on Roads and Other Infrastructure (Draft).* Prepared for DWAF.
- DWAF. 2006. *Clanwilliam Dam Feasibility Design of Raising*.
- Laubscher, J. 2007. *Clanwilliam Dam Study: Raising of Storage Capacity. Financial Viability of Irrigation Farming (Draft)*.
- Discussions with representatives from Ninham Shand Staff.
- Calculating and costing files supplied compiled by ASCH Professional Services and Ninham Shand Consulting Services

Capital Expenditure

Table 4.1 Capital Expenditure (R'000)

Capital Expenditure	Safety Work	5 m	10 m	15 m
Dam				
Alternative 1	166,000	213,000	266,000	344,000
Alternative 2	-	227,000	277,000	343,000
Alternative 3	186,000	231,000	279,000	344,000
Alternative 4	-	238,000	288,000	354,000
Roads	-	101,000	132,000	154,000
Other Infrastructure	-	25,000	60,000	90,000
Salaries and Accommodation	37,000	47,000	56,000	66,000
Agricultural Start Up				
Option 1	-	398,000	986,000	734,000
Option 2	-	160,000	279,000	384,000

As can be seen, the differences in expenditure by wall design/shape are minor, while the differences by height are more significant. The differences in expenditure for Options 1 and 2 for agricultural start-up are due to the difference in total hectares on new irrigable land.

Depending on the combination of alternatives selected, Total Capital Expenditure will vary between **R 166 million** (safety work, alternative 1 or 2) and **R 1.2 billion** (15 m raising, alternative 4, usage option 1).

Based on the above estimated capital expenditure (CAPEX), the effects on the local and regional economies were modelled in terms of the impacts on, for example:

- Additional new business sales (additional production/output generated by the Clanwilliam project).
- Additional GGP.
- Additional employment (direct and indirect).

The following sub-section highlights the effects on the above variables.

4.4.1 New business sales

The construction work on the Dam wall, roads and other infrastructure will lead to the expansion of business sales for existing businesses located within the area, as well as the broader Western Cape region. For example, materials used in the construction process such as bricks, concrete, building sand and materials, and so on will be purchased, as well as particular services such as engineers and other specialists. These changes are measured in terms of new business sales, i.e. new sales that will be generated in the economy as a direct result of the capital investment in the Clanwilliam Dam project. The additional business sales that will be generated, both as a result of capital investment by the developers, and the private sector (i.e. agricultural land), are illustrated in **Table 4.2**.

Table 4.2 Estimated Additional Business Sales during the Construction Period (CAPEX)

Component	Direct Additional New Business Sales (R'000)	Indirect Additional New Business Sales (R'000)	Total Additional New Business Sales (R'000)
Safety Work			
Alternative 1	193,000	329,000	**522,000**
Alternative 2	192,000	327,000	**519,000**
Alternative 3	213,000	364,000	**577,000**
Alternative 4	213,000	363,000	**576,000**
Roads	-	-	**-**
Accommodation	2,000	2,000	**4,000**
Other Infrastructure	-	-	**-**
Agri-startup Option 1	-	-	**-**
Agri-startup Option 2	-	-	**-**
5 m			
Alternative 1	247,000	421,000	**668,000**
Alternative 2	262,000	448,000	**710,000**
Alternative 3	265,000	453,000	**718,000**
Alternative 4	273,000	465,000	**738,000**
Roads	104,000	177,000	**281,000**
Accommodation	2,000	3,000	**6,000**
Other Infrastructure	21,000	36,000	**57,000**
Agri-startup Option 1	353,000	452,000	**805,000**
Agri-startup Option 2	142,000	182,000	**324,000**
10 m			
Alternative 1	311,000	531,000	**842,000**
Alternative 2	322,000	550,000	**872,000**
Alternative 3	323,000	551,000	**874,000**
Alternative 4	333,000	569,000	**902,000**
Roads	136,000	232,000	**368,000**
Accommodation	3,000	4,000	**7,000**
Other Infrastructure	54,000	91,000	**145,000**
Agri-startup Option 1	511,000	655,000	**1,166,000**
Agri-startup Option 2	248,000	317,000	**565,000**

Component	Direct Additional New Business Sales (R'000)	Indirect Additional New Business Sales (R'000)	Total Additional New Business Sales (R'000)
15m			
Alternative 1	401,000	684,000	**1,085,000**
Alternative 2	400,000	682,000	**1,082,000**
Alternative 3	400,000	682,000	**1,082,000**
Alternative 4	410,000	699,000	**1,109,000**
Roads	157,000	269,000	**426,000**
Accommodation	4,000	4,000	**8,000**
Other Infrastructure	81,000	137,000	**218,000**
Agri-startup Option 1	658,000	834,000	**1,482,000**
Agri-startup Option 2	340,000	436,000	**776,000**

The total new business sales will vary by the combination of options selected. Should the 15m raising option be selected and the Reserve implementation option (Option 2) implemented, total new business sales will be approximately **R 2.5 billion**, with slight variations by design alternative.

4.4.2 Additional GGP

One of the most important indicators used to indicate economic growth and value is the GGP. The GGP measures the value of all final goods and services produced/provided within one year of the area's economy. The net effect of the construction and establishment of all activities related to the Clanwilliam Dam project on additional GGP is illustrated in **Table 4.3** (construction phase).

Table 4.3 Estimated Additional GGP Generated during the Construction Phase, including Leverage Potential

Component	Direct Additional GGP (R'000)	Indirect Additional GGP (R'000)	Total Additional GGP (R'000)
Safety Work			
Alternative 1	26,000	69,**000**	**95,000**
Alternative 2	26,000	69,000	**95,000**
Alternative 3	29,000	76,000	**105,000**
Alternative 4	29,000	76,000	**105,000**
Roads	-	-	**-**
Accommodation	1,000	300	**1,300**
Other Infrastructure	-	-	**-**
Agri-startup Option 1	-	-	**-**
Agri-startup Option 2	-	-	**-**
5m			
Alternative 1	34,000	**88,000**	**122,000**
Alternative 2	36,000	**94,000**	**130,000**
Alternative 3	36,000	**95,000**	**131,000**
Alternative 4	37,000	**98,000**	**135,000**
Roads	14,000	**37,000**	**51,000**
Accommodation	1,000	**500**	**1,500**
Other Infrastructure	3,000	**8,000**	**10,000**
Agri-startup Option 1	158,000	**93,000**	**251,000**

Component	Direct Additional GGP (R'000)	Indirect Additional GGP (R'000)	Total Additional GGP (R'000)
Agri-startup Option 2	64,000	**38,000**	**102,000**
10m			
Alternative 1	43,000	**111,000**	**154,000**
Alternative 2	44,000	**116,000**	**160,000**
Alternative 3	44,000	**116,000**	**160,000**
Alternative 4	46,000	**119,000**	**165,000**
Roads	19,000	**49,000**	**68,000**
Accommodation	2,000	**600**	**2,600**
Other Infrastructure	8,000	**19,000**	**27,000**
Agri-startup Option 1	229,000	**135,000**	**364,000**
Agri-startup Option 2	111,000	**65,000**	**176,000**
15m			
Alternative 1	55,000	**144,000**	**199,000**
Alternative 2	55,000	**143,000**	**198,000**
Alternative 3	55,000	**143,000**	**198,000**
Alternative 4	56,000	**147,000**	**203,000**
Roads	22,000	**56,000**	**78,000**
Accommodation	2,000	**800**	**2,800**
Other Infrastructure	12,000	**29,000**	**41,000**
Agri-startup Option 1	291,000	**172,000**	**433,000**
Agri-startup Option 2	152,000	**90,000**	**242,000**

Again, the total GGP will be determined by the combination of alternatives selected. Should the 15 m raising option be selected and the Reserve implementation option (Option 2) implemented, total additional GGP will be approximately **R 564 million**, with slight variations by design alternative.

4.4.3 Generation of Employment

Constructing the raised dam wall and mitigating effects on other infrastructure, as well as establishing new irrigation fields, will result in direct jobs being created on site and in other directly related sectors such as transport, construction and manufacturing sectors. Indirect jobs are also created due to the multiplier effect in the economy. For example, an additional amount of goods used in the construction sector will be required from businesses and industries related to the construction sector. This could lead to an increased number of jobs being created in these businesses, i.e. in order to increase the output of these businesses.

The number of jobs created during the development phase per Alternative, is illustrated in **Table 4.4**.

A reminder of the duration of each alternative is relevant here:

- Safety Work: 24 Months
- 5 m Raising: 30 Months
- 10 m Raising: 36 Months
- 15 m Raising: 42 Months

Table 4.4 Estimated Total Additional Employment Opportunities Generated during the Construction Phase

Component	Direct Additional Jobs	Indirect Additional Jobs	Total Additional Jobs
Safety Work			
Alternative 1	150	110	**260**
Alternative 2	150	110	**260**
Alternative 3	150	110	**260**
Alternative 4	150	110	**260**
Roads	-	-	**-**
Accommodation	5	5	**10**
Other Infrastructure	-	-	**-**
Agri-startup Option 1	-	-	**-**
Agri-startup Option 2	-	-	**-**
5 m			
Alternative 1	165	120	**285**
Alternative 2	165	120	**285**
Alternative 3	165	120	**285**
Alternative 4	165	120	**285**
Roads	445	330	**775**
Accommodation	5	5	**10**
Other Infrastructure	90	70	**160**
Agri-startup Option 1	2,760	830	**3,590**
Agri-startup Option 2	1,100	330	**1,400**
10 m			
Alternative 1	180	130	**310**
Alternative 2	180	130	**310**
Alternative 3	180	130	**310**
Alternative 4	180	130	**310**
Roads	580	430	**1,010**
Accommodation	8	7	**15**
Other Infrastructure	230	170	**400**
Agri-startup Option 1	3,990	1,200	**5,000**
Agri-startup Option 2	1,935	580	**2,515**
15 m			
Alternative 1	195	130	**325**
Alternative 2	195	130	**325**
Alternative 3	195	130	**325**
Alternative 4	195	130	**325**
Roads	675	500	**1,175**
Accommodation	9	8	**17**
Other Infrastructure	344	256	**600**
Agri-startup Option 1	7,660	1,530	**9,190**
Agri-startup Option 2	4,000	800	**4,800**

The total employment created will, again, be determined by the combination of alternatives selected. Should the 15 m raising option be selected and the Reserve option (Option 2) implemented, total additional employment will be **6 930.**

It must be noted, however, that these figures are the totals for all phases and components of the proposed development and will, in reality, likely *not occur concurrently*. For example, those

workers employed in the dam safety work will remain on site to complete the raising work, and even also be employed on road works.

4.4.4 Summary: Capital Expenditure

Due to the number of design and water use/implementation alternatives, various totals could exist. Based on the DWAF's current position, however, it is most likely that Option 2 will be selected. Further, the differences in impacts by design alternative are minor. Averages for the different design alternatives were used in compiling the totals presented in **Table 4.5**.

Table 4.5 Summary of Impacts: CAPEX: Implementation Option 2

Type of Impact	Safety Work	Alternatives		
		5m	10m	15m
Total NBS (R'000)	552,000	1,371,0000	1,976,000	2,525,000
Total GGP (R'000)	102,000	294,000	432,000	564,334
Total Jobs	270	2,680	4,260	6,930

4.5 Operational expenditure (OPEX)

It is generally known that after the construction of a development or facility, ongoing economic impacts (expenditure, output and job creation) will be sustained following the commencement of the economic activities on site. This expenditure expands the markets for goods and services, increases the labour market and serves as an impetus for new commercial development. In the case of Clanwilliam, numerous opportunities are created by the increased water capacity, particularly for agriculture, while impacts for tourism and fishing are more complex.

The sectors addressed here are tourism, residential and agricultural (all experiencing some losses and some gains). Neither the dam safety work, nor the particular dam design has impact on these, however. Thus, the 5 m, 10 m and 15 m options, as well as the two water use/implementation options are assessed here.

The economic impact is determined by the level of economic activity generated or lost as a result of the raising of the wall. In the case of Clanwilliam, it is largely due to increased hectares of irrigated agricultural land that requires ongoing operational and maintenance activities, but also addressing the impact of losing existing infrastructure, homes and agricultural land.

Again, the *Feasibility Study for the Raising of the Clanwilliam Dam in the Western Cape: Impacts on Roads and Other Infrastructure (Draft)* (prepared for DWAF by ASCH Professional Services and Ninham Shand Consulting Services) and the *Olifants/Doring Catchment Ecological Water Requirements Study: Socio-economics Study* (Anchor Environmental Consultants) were utilised, together with supplied calculation and costing files and Prof Laubscher's report on the *Financial Viability of Irrigation Farming (Draft)*.

Various assumptions are made, as follows:

- It is assumed that people from the study area will fill most of the direct employment opportunities and that the leakage factor will be determined by the supply of, and demand for specific skill requirements.

- The impacts derived from the operational phase are measured per annum.
- All the Rand values represent 2007 current prices.
- Losses include opportunity costs, i.e. the value of an opportunity lost, for example, to develop undeveloped land.

4.5.1 New Business Sales (NBS)

Table 4.6 Estimated Impact on Business Sales, per annum

Activity	Direct Turnover (R'000)	Indirect Turnover (R'000)	Total Turnover (R'000)
5 m			
LOSSES			
Tourism	8,000	8,000	16,000
Residential	200	300	500
Agricultural	4,000	5,000	9,000
Total	**12,000**	14,000	26,000
GAINS			
Agricultural: Option 1	354,000	454,000	898,000
Agricultural Option 2	143,000	183,000	326,000
10 m			
LOSSES			
Tourism	12,000	13,000	25,000
Residential	2,000	2,000	4,000
Agricultural	10,000	13,000	23,000
Total	24,000	28,000	52,000
GAINS			
Agricultural: Option 1	512,000	657,000	1,169,000
Agricultural Option 2	248,000	318,000	566,000
15 m			
LOSSES			
Tourism	12,000	14,000	26,000
Residential	2,000	3,000	5,000
Agricultural	11,000	14,000	25,000
Total	26,000	30,000	56,000
GAINS			
Agricultural: Option 1	652,000	836,000	1,489,000
Agricultural Option 2	341,000	437,000	778,000

* Gains for Option one are based on the assumption that all farmers will take measures to increase assurance of supply, to mitigate losses in drought periods.

Table 4.6 can be interpreted as follows:

Total NBS temporary losses for the 5m option are approximately **R 26 million**, while total permanent gains for implementation Option 1 is **R 898 million**, and for Option 2, **R 326 million**. Net Gain is, thus:

- Option 1: **R 872 million**
- Option 2: **R 300 million**

Total NBS temporary losses for the 10m option are approximately **R 52 million**, while total permanent gains for implementation Option 1 is **R 1. 17 billion**, and for Option 2, **R 556 million**. Net Gain is, thus:

- Option 1: **R 1.1 billion**
- Option 2: **R 504 million**

Total NBS temporary losses for the 15 m option are approximately **R 55 million**, while total permanent gains for implementation Option 1 is **R 1.5 billion** and for Option 2, **R 778 million**. Net Gain is, thus:

- Option 1: **R 1.4 billion**
- Option 2: **R 723 million**

As can be seen, the losses felt have a minor, if not negligible, effect on overall potential for new business sales, for all three raising options.

In the most developed scenario (15 m raising, with Option 1 implemented), losses in fishing will be R 500 000/annum for Ebenhaezer and R 760 000/annum for West Coast Fisheries. If this is not mitigated by appropriate intervention programmes, the impact on the Net Gain for the 15 m raising, Option 1 will be a decrease from R 1 489 billion to R 1.487 billion – a negligible loss.

It must be noted here, however, that the environmental impact of each alternative must be considered in addition to these figures. The value of these figures should also be evaluated within the context of opportunities lost in terms of other land-use options or the land expropriated for the dam raising, as well as the new irrigable fields.

4.5.2 Additional GGP

The generation of additional business sales and employment opportunities will initiate an ongoing ripple effect through the sub-region, resulting in an increase in product and service value (measured in GGP). The potential impact of the operation of the various the Alternatives are shown in **Table 4.7**.

Table 4.7 Estimated Impact on GGP per annum

Activity	Direct GGP (R'000)	Indirect GGP (R'000)	Total GGP (R'000)
5 m			
LOSSES			
Tourism	3,000	2,000	**5,000**
Residential	90	50	**140**
Agricultural	2, 000	1,000	**3,000**
Total	**5,000**	**3,000**	**8,000**
GAINS			
Agricultural: Option 1	158,000	94,000	**252,000**
Agricultural Option 2	64,000	38,000	**102,000**

Activity	Direct GGP (R'000)	Indirect GGP (R'000)	Total GGP (R'000)
10 m LOSSES			
Tourism	5 000	2 000	**7 000**
Residential	600	300	**900**
Agricultural	4 000	3 000	**7 000**
Total	**10 000**	**5 000**	**15 000**
GAINS			
Agricultural: Option 1	229 000	136 000	**365 000**
Agricultural Option 2	111 000	66 000	**177 000**
15 m LOSSES			
Tourism	5 000	2 000	**7 000**
Residential	1 000	500	**1 500**
Agricultural	5 000	3 000	**8 000**
Total	**11 000**	**6 000**	**17 000**
GAINS			
Agricultural: Option 1	292 000	173 000	**465 000**
Agricultural Option 2	153 000	90 000	**243 000**

Total GGP temporary losses for the 5 m option are approximately **R 8 million**, while the permanent GGP benefits are approximately **R 252 million** for Option 1 and **R 102 million** for Option 2. Net Value Added is, thus:

- Option 1: **R 244 million**
- Option 2: **R 94 million**

Total GGP temporary losses for the 10 m option are approximately **R 15 million**, while the permanent GGP benefits are approximately **R 365 million** for Option 1 and **R 177 million** for Option 2. Net Value Added is, thus:

- Option 1: **R 350 million**
- Option 2: **R 162 million**

Total GGP temporary losses for the 15 m option are approximately **R 17 million**, while the permanent GGP benefits are approximately **R 464 million** for Option 1 and **R 243 million** for Option 2. Net Value Added is, thus:

- Option 1: **R 447 million**
- Option 2: **R 226 million**

Again, the losses felt have a minor, if not negligible, effect on overall additional GGP, for all three raising options. The losses experienced by the Ebenhaezer community translate into minor, if not negligible, losses (between 0.04% and 0.27% decrease in GGP of the study area).

4.5.3 Generation of Employment

As a result of the new activities generated by the development, namely the new agricultural land, it can be estimated that the study area will be able to eventually sustain a substantial number of new employment opportunities for each alternative, as indicated in **Table 4.8**. These new jobs must be weighed against the negative impacts on downstream subsistence livelihoods, discussed below.

Table 4.8 Estimated Impact on Employment

Activity	Direct Additional Jobs	Indirect Additional Jobs	Total Additional Jobs
5 m			
LOSSES			
Tourism	30	10	**40**
Residential	5	2	**7**
Agricultural	50	10	**60**
Total	**85**	**22**	**107**
GAINS			
Agricultural: Option 1	4 160	830	**4 990**
Agricultural Option 2	1 680	335	**2 015**
10 m			
LOSSES			
Tourism	50	25	**75**
Residential	9	5	**14**
Agricultural	145	20	**165**
Total	**204**	**50**	**254**
GAINS			
Agricultural: Option 1	5 100	1 200	**6 300**
Agricultural Option 2	2 665	590	**3 255**
15 m			
LOSSES			
Tourism	60	25	**85**
Residential	10	5	**15**
Agricultural	150	25	**175**
Total	**220**	**55**	**275**
GAINS			
Agricultural: Option 1	6 000	1 500	**7 500**
Agricultural Option 2	3 000	800	**3 800**

Total temporary job losses for the 15 m option are approximately **275**, while the permanent employment gains are **7 500** for Option 1 and **3 800** for Option 2. Losses in fishing employment, in the most developed scenario (15 m raising and Option 1) are 200 for Ebenhaezer and 590 for West Coast Fisheries, a total of **790**.

Net employment gains can be summarised as follows:

5 m raising

- Option 1: **4 680**
- Option 2: **1 710**

10 m raising

- Option 1: **5 845**
- Option 2: **2 800**

15 m raising

- Option 1: **6 435**
- Option 2: **3 010**

The employment opportunities, which will be generated, will be sustainable jobs. Prof Laubscher (2007) conducted a viability study on irrigation farming and determined that it will be more profitable to expand existing farms than to establish new ones. Further, "joint ventures" (business trusts between farm owners and labourers) were deemed to be the most feasible option for the economic empowerment of previously disadvantaged groups.

The *Opportunities for the Supply of Water to Resource Poor Farmers* report (Ninham Shand for DWAF, 2007) provides a different set of conclusions, however. These recommendations include a suite of implementation options, including:

- Ensuring the protection of the Reserve.
- Allocation of additional water to the municipalities.
- Allocation of water to ensure availability for municipal commonage schemes.
- Establishment of a development company (DEVCO) to co-ordinate the development of a sustainable broad based black economic empowerment agricultural project.
- Support for Joint Ventures between existing commercial farmers and resource-poor farmers (RPFs).
- Encourage black commercial farmers and investors.
- Encourage existing commercial farmers to provide sufficient land and water to existing farm workers.
- Use allocation of additional water as an incentive to make land available for land reform.
- Retain water "in trust" for future allocation.

4.5.4 Municipal Rates and Taxes

Additional rates accumulated will depend on whether Option 1 or 2 water use is selected, as rates will be impacted by the m^2 of new agricultural land. **Table 4.9** depicts possible additional property rates for the Cederberg and Matzikama Municipalities combined.

Table 4.9 Additional Municipal Revenue

R'000	R'000	R'000	R'000
Safety Work	**5 m**	**10 m**	**15 m**
Option 1			
-	72,000	105,000	133,000
Option 2			
-	29,000	52,000	70, 000

Water tariffs will be an additional income. Figures for this could not be calculated, however, due to municipalities entering into special tariff arrangements with farmers in their jurisdiction. Further, some farmers will supplement their irrigation with water from private dams and exact amounts of water used from their dams vary.

4.5.5 Summary: Operational Expenditure

As the favoured implementation option is Option 2, **Table 4.10** summarises the impacts for this option.

Table 4.10 Summary of Impacts: OPEX: Implementation Option 2

Type of Impact	Alternatives		
	5 m	10 m	15 m
Total NBS Gains (R'000)	325,000	556,000	779,000
Total NBS Losses (R'000)	26,000	51,000	56,000
Total GGP Gains (R'000)	102,000	177,000	243,000
Total GGP Losses (R'000)	8,000	16,000	17,000
Total Job Gains	2,000	3,000	3,720
Total Job Losses	110	260	270
Rates & Taxes (R'000)	29,000	51,000	70,000

As can be seen, the agricultural gains far outweigh the losses in other sectors. The ethical considerations of a bias toward the agricultural sector, should the raising go ahead, are discussed in **Section 5**. Recommendations for mitigating the losses, which will affect specific individuals, are provided in **Section 6**.

The above indicates ***temporary losses*** and ***permanent gains***. Gains in terms of NBS, GGP and employment generated from re-constructing the lost facilities were represented in the CAPEX component, as "other infrastructure".

4.6 Conclusion

The implications of the above findings are important for quality-of-life in the broader Matzikama and Cederberg areas. Generally, new business sales and GGP growth is good for the overall functioning of the economy. Specifically, job creation for the low-skilled population will enhance household incomes, which in turn increases access to educational and economic opportunities.

The Dam raising will, however, have temporary negative impacts on certain activities, as well as impose long-term threats on the fishing sector. The Ebenhaezer community is a small, rural and disenfranchised community, whose livelihoods are heavily dependent on the Olifants River. This community, as well as West Coast Fisheries, will be negatively affected by the raising of the Dam wall, due to changes in flow and water quality impacting on fish stocks. The impacts are, in economic terms, minimal in comparison to the broader benefits of increased yield. The social impacts are, however, potentially devastating for households dependent on fishing activities for

income and nutrition. These social impacts can, however, be partly mitigated by the implementation of a Reserve option, as well as the implementation of recommendations supplied in the Resource Poor Farmers report. Partnership measures to uplift the community in terms of infrastructure and access to alternative economic activities are, thus, suggested. Recommendations as to how the potential benefits presented in this section can be enhanced are provided in the final section, **Section 6**. **Section 5** follows, with a discussion of ethical and sustainability considerations, as well as broad social impacts.

5. BENEFITS AND DIS-BENEFITS

5.1 Introduction

As can be seen from the impacts analysis, there are numerous advantages and disadvantages linked to the raising options. These disproportionably affect residential, tourist, fishing and agricultural groups, as well as the environment. This section includes a discussion of the ethical issues to be considered, as well as pertinent sustainability factors.

5.2 Social implications

The impacts presented in **Section 4** are expressed in terms of new business sales, additional GGP and employment. These, in turn, have implications for the quality of life of the populations of the Cederberg and Matzikama Local Municipalities. These include:

- Impact on Employment and Income Levels
- Impact on Authorities
- Impact on Communities

These are discussed, in turn, below. Recommendations for the maximisation of these benefits, and the mitigation of negative affects are presented in **Section 6**.

5.2.1 Impact on Employment and Income Levels

Section 2 indicated that while employment statistics indicate a relatively low unemployment level (8.99%), underemployment (seasonal or part-time, low wage work) is high and household incomes are low. The socio-economic profile presented an area with very high poverty levels and extreme dependence on agriculture and subsistence activities.

The generation of up to 6 930 temporary jobs and 3 800 permanent jobs will greatly enhance the economic well-being of many households. Further, the extra yield allows for new irrigation fields to be established, which opens opportunities for previously disadvantaged communities and individuals to become involved in commercial agricultural activities, either through land-reform and subsidised start-ups, or through the establishment of partnerships and trusts with existing commercial farmers. This epitomises South Africa's vision of social upliftment and equality in economic opportunities.

Growth in agricultural activities will result in additional demand for agri-product processing and packaging, which can be done within the study area itself, thus reducing leakage and enhancing opportunities for employment and businesses in the manufacturing sector.

With a strong marketing strategy, tourism opportunities can also be expanded in the study area. This can include agri-tourism, such as wine and food-routes, as well as expansion of water-sports activities on the Clanwilliam Dam itself. Should the Ecological Reserve option be implemented, the Olifants River can be used as an eco-tourism route. All of these will provide work and SMME opportunities, while simultaneously boosting the local economy.

Overall increases in employment and incomes results in increased spending power and further injections into the local economy. Dependence on state grants will also be reduced.

Issues related to skills levels, access to transport and access to communication technologies will need to be enhanced in order to ensure that the population is able to take advantage of these opportunities. The implementation of the WCPAS is, thus, essential.

5.2.2 Impacts on Authorities

The temporary impact on Cederberg Municipality is mixed, with temporary losses in revenue from the Clanwilliam Dam Resort, but an overall boom in GGP from construction activities and the accommodation of outside site workers.

The permanent impact is, however, very positive for both the Matzikama and Cederberg Local Municipalities. Firstly, taxes generated from the new agricultural activities will strengthen the local budgets and enhance the capacity to deliver services. Improved service delivery enhances the well-being and productivity of the population, which in turn generates more tax revenue as well as decreasing dependency. Overall, the GGP growth that results from increased agricultural activities will enhance the capacity of the West Coast District Municipality to meet its objectives of social upliftment and poverty alleviation, which are already supported by the generation of employment opportunities and increased household incomes stemming from the raising of Clanwilliam Dam.

The generation of new employment necessitates attention to issues such as access to transport, education, skills training and communication technology. This has implications for the local authorities in terms of implementing poverty alleviation and service delivery strategies, the rate of which must be increased.

5.2.3 Impact on the Economy

Section 4 showed that both short-term and long-term impacts will be felt in the local and district economies. The combination of the 15 m raising, with the implementation of an Ecological Reserve (Option 2) will result in significant economic benefits, while mitigating the harmful effects on the environment and the livelihoods of downstream users. In terms of productivity, the construction phase of this option could contribute an additional **R 2.5 billion** in NBS and **R 564 million** in GGP. After construction is completed, this will be sustained as **R 723 million** in additional annual productivity and **R 226 million** in additional annual GGP.

5.2.4 Impact on Communities

The impact on communities is, again, mixed. The impacts for the Ebenhaezer community are potentially devastating, but can be managed in such a way as to prevent this, and even improve on the current situation. It is, therefore, recommended that measures be taken to alleviate the pressure on the Ebenhaezer community and West Coast Fisheries. These measures should be jointly undertaken by DWAF and those who are benefiting directly from the dam wall raising, namely local farm owners.

Recommendations include:

- DWAF should monitor and regulate abstractions from the system to ensure that impacts are not exacerbated by illegal abuses of the additional yield.
- Measures to monitor water quality at various points along the river should be implemented

- The ecological Reserve should be implemented.
- Information on changes made, Reserve release schedules and water quality should be made available to the Ebenhaezer community in due time for them to plan their activities.
- Alternative sources of income and nutrition need to be generated. The most obvious alternative is agriculture, and residents should gain access to the land and tools needed to pursue further subsistence farming as well as broader commercial activities, such as the production of hoodia products.
- West Coast Fisheries must be aided in planning for the impacts on the estuary and ensuring that losses are either minimised or alternative jobs and incomes are generated in the area.

The history of the Ebenhaezer community provides both opportunities and threats to the above recommendations. Based on the failure of attempts to establish a co-management committee, it is suggested that community workers/change agents be identified to facilitate the early communication processes. Change agents should possess the following characteristics:

- Fluency in Afrikaans
- Capable of building relationships with low-income community members, wealthier farmers and relevant authorities
- Communication, planning and facilitative skills
- Integrity

In addition, enhancing access to services such as piped water and transport may enhance well-being and access to economic opportunities.

Overall, however, impacts on communities are expected to be very positive, with increased employment and household income for a significant number of people.

The fast-tracking of poverty alleviation and service delivery programmes will have broad-based benefits for the local communities, in terms of general access to services, transport, education and training and communication technologies. This will increase the general capacity of communities to take advantage of, and create, economic opportunities.

Another potential benefit arises from the realignment and infrastructural replacements in those areas in the immediate vicinity of the Dam. New infrastructure and roads will likely be an improvement on those existing, thus improving the general environment in terms of ease of movement, quality and efficiency of infrastructure and the attractiveness of the area for tourists.

5.3 Ethical considerations

According to Prof Chris de Wet of Rhodes University, worldwide development of dams, irrigation schemes, w ter supply systems, energy generation and mining projects, among others, displace up to 15 million people annually. This is known as "development induced displacement" and it bears certain ethical considerations. These are briefly discussed here.

5.3.1 Displacement dilemma

Development induced displacement proposes a dilemma in that it is both "rights-affirming" (the development aims to meet basic human rights, such as access to water) and "rights-violating" (forced resettlement is seen as a violation of human rights) (De Wet, 2006).

The only way, in which this dilemma can be overcome, is if the development justifiably violates rights. In other words, the development must produce public benefits that will reach a significant number of people, particularly the poor. It cannot be justified if it promotes "limited sectional interest", i.e. benefits to an elite few.

The socio-economic effects of resettlement are often severe and include:

- Major stress and hardship during and for a few years after the period of resettlement, often resulting in an increase in illness and even death.
- Impoverishment: landlessness and joblessness can lead to further marginalisation, food insecurity and loss of access to resources.
- A loss of one's "social geometry" (socially constructed spatial-temporal personal frameworks) resulting in changes in cultural, social and economic support networks.

The above risks are particularly severe for those who are already living on a low-income, such as farm workers and fisherman, in the study area, as presented in **Section 3**. This includes the Ebenhaezer community, of approximately 3 500 people, as well as those working and living on surrounding farms, namely:

- The twenty employees of Clanwilliam Dam Resort.
- Those workers working on the 14 farms within the new purchase lines (totalling over 450 permanent and temporary workers, though not all will be affected, particularly where crops are relocated to new fields).
- Those workers and their families living in the 27 labourers' cottages that will be affected by a raising of 15 m (only 1 for 5 m and 18 for the 10 m option).

Despite these ethical concerns, development projects must take place and the range of options is often slim. De Wet (2006) notes that "it is not possible to avoid large dams – the world relies increasingly on irrigation to feed itself [and] small dams would not necessarily lessen displacement". Further, the Clanwilliam Dam raising will impact far fewer people than many development projects world-wide and is preferable to (a) neglecting the need for water, which will have long-term negative effects in terms of a gradual decline in the local economy and the well-being of the local populations, or (b) attempting to build smaller dams along the river, which will be more costly and environmentally disruptive, while likely also resulting the displacement of some.

The raising of the Clanwilliam Dam produce significant public benefits to justify the resettlement of the communities identified in prior sections. **Section 4** shows that up to 6 930 temporary jobs and 3 800 permanent jobs can be created by the 15 m raising and implementation of Option 2 water use (EWR). This far outweighs those jobs lost. Further, the impacts on infrastructure and access are temporary, whereas the overall GGP and NBS benefits are permanent. **Section 6.4** below will elaborate on the broad social benefits of raising the Dam wall, which outweigh, and therefore, justify the impact on a minority of people.

5.3.2 Ethics guidelines

This section provides suggestions regarding the mitigation of negative affects often seen in resettlement processes.

A job lost by one individual, or in the case of Ebenhaezer, a livelihood affected for one family, is not mitigated by a job created for another. For this reason, it is recommended that those individuals to be directly affected must be identified and their skills-level matched with the new employment opportunities. For example, a cleaner at the Clanwilliam Dam Resort can be temporarily employed at the manager's rented residences until the Resort is re-opened. Similarly, an employee of a farm losing land should be prioritised for employment on new agricultural land.

Rather than simply condoning the resettlement, active steps can be taken to make it beneficial to all:

- Market-related compensation of land, crops, infrastructure and buildings
- Benefit sharing to compensate sentimental losses as well as to mitigate potential socio-cultural and economic degradation. This is done by making identified parties beneficiaries of the project, i.e. in terms of subsidies to irrigate new land or though the establishment of trusts
- Adequate assessment of options for the development
- Enrolment of the Ebenhaezer community members in SMME development programmes, perhaps tourism oriented. **Figure 5.1** depicts tourists walking along the Olifants River, near Papendorp, a tourism enterprise resource for the Ebenhaezer community.

Figure 5.1 Tourists walking along the Olifants River
[Source: http://blogs24.com]

5.4 Sustainability considerations

This section looks at issues of sustainable development that surround the proposed raising of the Clanwilliam Dam wall. Included in the policies identified in **Section 2** were policies relating to environmental issues. These were:

- Strategic Framework for Sustainable Development in South Africa (Department Environment and Tourism)
- National Environmental Management Act (107 of 1998) (NEMA)
- National Water Act (36 of 1998)
- Conservation of Agricultural Resources Act (43 of 1983)
- Western Cape Department of Agriculture Strategic Plan, 2005-2010
- Western Cape Department of Environmental Affairs and Development Planning Strategic and Performance Plan, 2005-2009
- The Water Principles of 2006

In addition, the various IDPs all stress environmental, economic and social aspects of development. Sustainable development is most commonly defined using the definition from the World Commission on Environment and Development's (WCED) 1987 "Brundtland Report", which defined sustainable development as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". "Sustainability" is defined by environmental economists in terms of non-depletion of natural capital (Dresner, 2002).

Traditionally, economic growth is coupled with resource consumption and increasing pressure on the environment. With advances in efficiency-increasing technologies, over-consumption of resources is no longer necessary for economic growth or employment (Dresner, 2002). This section will identify the key sustainability factors to be considered, and provides recommendations for enhancing the sustainability of water utilisation in the study area.

Sustainable agriculture can be defined as:

"[a]gri-food systems that are economically viable, and meet society's need for safe and nutritious food, while conserving or enhancing…natural resources and the quality of the environment for future generations"

The objectives of sustainable agriculture are, thus:

a) "To conserve and enhance the natural resources that agriculture uses and shares
b) To be compatible with other environmental resources that are affected by agriculture
c) To be proactive in protecting the agri-food sector from the environmental impacts caused by other sectors and factors external to agriculture"

(Wilson and Tyrchniewicz, 1995)

In order to meet the above objectives of sustainable agriculture, technology and management techniques that work with the whole system are needed. This includes addressing irrigation technology, protecting soil quality, controlling alien vegetation and weeds and minimising waste.

5.4.1 Water as a resource

"Water is a critical resource that can constrain the development and management of energy, land, agriculture and the environment".

(Columbia Water Centre)

There is no questioning the value of water as a development resource. The West Coast region, and particularly the study area, is dependent on a strong agricultural sector. Economically, it makes sense to diversify this economy to reduce dependence and the vulnerability that goes with it. Regardless of efforts to diversify the economic base, agricultural activities are an essential component not only of the local GGP and employment sector, but also in terms of food production nationally. For this reason, the long-term sustainability of agricultural activities is non-negotiable. Due to the low rainfall of the area, irrigation is essential for agricultural yields. Thus, water becomes a key resource for the livelihoods and development of the Cederberg and Matzikama areas.

Water in the region, however, is scarce and global climate change is worsening seasonal extremes. **Figure 5.2** depicts Clanwilliam Dam in winter, while **Figure 5.3** depicts the Dam in summer.

Figure 5.2 Clanwilliam Dam in winter
[Source: www.clanwilliam.org.za]

Figure 5.3 Clanwilliam Dam in Summer
[Source: www.clanwilliam.org.za]

Using the tree on the left as a marker, a clear difference in water levels is visible. This is because 85% of total river flow occurs in winter, while 60% of the annual urban demand and 90% of the annual irrigation demand occurs in summer. This puts great pressure on farmers, who face the threat of crop failure each summer (The Water Wheel, 2006).

Water Affairs Minister, Lindiwe Hendricks, recently made a statement that water wastage in South Africa is "unacceptably high" (News24, 2007). The Department aims to institute water-wise and efficient uses, and will target the agricultural sector in particular, as the largest user of water. According to the News24 report, approximately 60% of all water used in South Africa is used for agricultural irrigation. South Africa's annual rainfall is 502 mm, compared to a global average of 860 mm (Water Institute of South Africa).

5.4.2 Efficient and effective water usage

As water is such a fundamental resource for social, economic and ecological activities, saving water can bring benefits in each of these realms. The United Nations Food and Agriculture Organisation (FAO) calls for technical, physical and administrative measures to be taken to enhance efficient resource use, such as water used for irrigation. According to their studies on irrigation systems, larger farms have more irrigation options (in terms of feasibility) than do small or micro farming activities. This links to issues around farm ownership and reform – trusts and joint ownership of larger farms is more sustainable than numerous micro-agricultural enterprises.

Various options for efficient water use exist, as well as alternative water sources. Fog harvesting is an example of an alternative water source that could be possible along the West Coast (feasibility studies are currently inconclusive). An example of efficient irrigation system is "drip irrigation". Viable options for small farms do exist, such as the labour intensive treadle-pump and bucket-drip systems.

The UN FAO has, further, identified underground irrigation and drip irrigation as the main technologies likely to be used in developing countries, where labour is normally abundant but capital scarce. Both technologies depend on the frequent application of small amounts of water as directly as possible to the roots of crops. A major advantage of water-saving technologies, particularly drip irrigation, is that as well as saving water they can increase yields and reduce the rate of salinisation.

According to the UN FAO research, farmers who switch from spitter/sprinkler-irrigation to drip-irrigation will save between 30 and 60% of their usual water usage.

Some underground irrigation systems do not require costly equipment but are labour intensive. These methods include the age-old method of placing porous clay jars in the soil around fruit trees and along crop rows, or the use of porous or perforated pipes buried underground and used to irrigate two rows of crops, one on either side of the pipe.

These irrigation options should be investigated, as more efficient water use will enhance the benefits of raising the Dam wall, thus making the original investment more worthwhile, while simultaneously enhancing the sustainability of project outcomes.

DWAF (2005) in their *Olifants/Doorn Water Management Area: Internal Strategic Perspective*, note that significant water losses occur in the current canal system. They estimate that through improved maintenance and refurbishment, losses can be reduced by 15% (or more, though possibly only through uneconomical means). Further, although urban uses of water are

comparatively small, savings can be made in urban and industrial uses, too. For example, DWAF (2005) identifies purification works at Vredendal, Elandsbaai and Clanwilliam as industrial activities to be monitored, as incurred losses are suspected due to poor management and aging infrastructure.

5.5 Conclusion

The social implications of the Dam raising were addressed. These include overall positive impacts for employment, incomes, the local authorities and communities as a whole. Recommendations for enhancing these impacts, and mitigating negative ones, follow in **Section 6**.

Ethical considerations are relevant to the Clanwilliam Dam raising project as negative impacts on some must occur for benefits to be felt by others. The positive impacts in terms of GGP, NBS and employment creation far out-weigh the negative impacts and, thus, the raising is ethically justifiable. Attending to the needs of and providing opportunities for those directly negatively affected will mitigate the impacts on poor families and enhance the overall long-term outcomes of the project.

Sustainability issues were also addressed. Environmental impacts, such as impacts on aquatic life, erosion and so on are beyond the scope and capacity of Urban-Econ's work. It is recommended that environmental assessments are read in combination with this report. What can be recommended on the basis of this section, however, is that any investment into water resources in the area should include assessments of sustainability issues. The Dam raising involves significant capital and human investment and, thus, warrants actions taken to enhance the efficient use of the additional yield created. Any additional yield should be prioritised for those farms which make use of modern, efficient and effective irrigation infrastructure.

Should efficient irrigation technologies be installed, the m^3/ha water needed will be reduced. This means that either more land can be farmed, resulting in more jobs and a higher contribution to the GGP, or water can be saved for other uses or future need. In the context of Clanwilliam, saving water may positively affect downstream users, such as the Ebenhaezer fishing community.

It is, therefore, recommended that the Clanwilliam Dam raising be just one component of a more integrated approach to sustainable water use in the region. Investment in modern irrigation systems, as well as education of farmers and farm workers regarding water-saving techniques will enhance the benefits of a Dam raising. Management of other infrastructure (i.e. the canal system) and uses (industrial) will only support efficient water management.

6. RECOMMENDATIONS AND CONCLUSIONS

6.1 Introduction

This section concludes the report with a brief summary and Urban-Econ recommendations.

6.2 Findings and recommendations

Section 2 showed that the population of the study area is rural and poor and heavily dependent on agriculture for employment as well as other services. **Section 3** showed that dependence on water is high, despite the semi-arid nature of the area.

Various options for the Dam raising exists, including non raising (safety work only), a 5 m raising, 10 m and 15 m raising options. Further, four design alternatives exist and two water usage/implementation options have been assessed. All of the above were assessed through an input-output mode, the results of which are presented in **Section 4.**

Based on sustainability issues, the impact on the Olifants River and its dependents (the Ebenhaezer community), as well as existing and proposed water use policies, it is most likely that Option 2, or a similar option, will be implemented, that is, an EWR Reserve will be applied (benefits of which are presented below).

The benefits of the 15 m option are far stronger than those of the 5 m and 10 m options, especially when considered in relation to the costs and losses in other sectors. The following is the breakdown of additional agricultural land that could be irrigated with the 15 m raising option:

Full-yield use (Option 1):

- Citrusdal citrus 389ha
- Clanwilliam citrus 3 112ha
- Melkboom/Trawal mixed 1 556ha
- Melkboom/Trawal table grapes 1 945ha
- Klawer/Vredendal mixed 389ha
- Klawer/Vredendal table grapes 389ha

EWR Reserve (Option 2):

- Citrusdal citrus 203.5ha
- Clanwilliam citrus 1628ha
- Melkboom/Trawal mixed 814ha
- Melkboom/Trawal table grapes 1 017.5ha
- Klawer/Vredendal mixed 203.5ha
- Klawer/Vredendal table grapes 203.5ha

While the full-use option does generate water to irrigate significantly more agricultural land, the EWR option is in-line with policies and is considered to be more ecological sustainable, and therefore, more long-lasting. The 15 m option, together with a Reserve implementation, will

provide significant long-term benefits, including over 3 000 new jobs and over R 200 million in additional GGP. Urban-Econ, therefore, recommends that the 15 m raising option, together with the EWR Reserve, be taken as the decision for the Clanwilliam Dam project. Some specific recommendations to maximise the benefits and minimise the negative impacts can be provided:

- Enhance sustainability practices of all water users in the WMA through awareness campaigns, as well as other programmes or subsidies to advocate the use of water-efficient technologies (particularly irrigation systems).
- Train and assist farm managers to cope with expansion, especially where new partnerships and trusts have been formed.
- Include the Ebenhaezer and other disadvantaged and disenfranchised communities in participatory processes.
- Match the skills-levels of those temporarily and permanently negatively affected by the dam raising with those new opportunities created.
- Develop an SMME or similar programme in Ebenhaezer. This can be aimed at enhancing the management of agricultural activities and/or expanding on tourism ventures.
- Identify those families who will lose their homes and access to transport as a result of lost jobs. Priorities these individuals for new agricultural land, trusts and BEE ventures.
- Develop a strong marketing campaign to bring old visitors back and attract new visitors to the Clanwilliam Dam Resort and other tourist facilities once the dam raising construction is completed.

6.3 Conclusion

There are numerous human and economic complexities involved in the proposed Clanwilliam Dam raising. Urban-Econ has attended to each of these as thoroughly as was possible with available information. Based on the in-depth understanding of these complexities gained, Urban-Econ recommends that the 15 m raising option, together with the EWR Reserve be recommended as the decision for the Clanwilliam Dam raising evaluation.

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FEASIBILITY STUDY FOR THE RAISING OF CLANWILLIAM DAM

Study Reports

No	Report name	DWAF Report numbers	NS Report numbers
1	Inception	No report number	4414
2	Screening of Options	P WMA 17/E10/00/0405	4415
3	Water Quality	P WMA 17/E10/00/0506	4416
4	System Analysis	P WMA 17/E10/00/0607	4417
5	Groundwater Resources	P WMA 17/E10/00/0707	4418
6	Environmental Scoping	P WMA 17/E10/00/0805	4419
7	Environmental Impact	P WMA 17/E10/00/0907	4420
8	Soils, Water Requirements and Crops	P WMA 17/E10/00/1106	4422
9	Water Management Plan for the Olifants-Doorn Catchment Management Area	P WMA 17/E10/00/1207	4423
10	Opportunities for the Supply of Water to Resource-poor Farmers	P WMA 17/E10/00/1307	4424
11	Irrigation Development and Water Distribution Options	P WMA 17/E10/00/1407	4425
12	Impacts on Roads and other Infrastructure	P WMA 17/E10/00/1507	4426
13	Financial Viability of Irrigation Farming	P WMA 17/E10/00/1607	4427
14	Socio-economic Impact Assessment	P WMA 17/E10/00/1707	4428
15	Financial Evaluation	P WMA 17/E10/00/1807	4455
16	Main	P WMA 17/E10/00/1907	4429

No	Reports by DWAF	DWAF Report numbers	NS Report numbers
17	Feasibility Design of Raising (Engineering Design) and Design Report Addendum	-	4430
18	First Engineering Geological Materials Report (Course Aggregate) For Proposed Raising (Council for Geoscience)	-	4431
19	Farm Dams (Options Analysis): include under Report 4 as Appendix	-	4432