Western Cape Government
Environmental Affairs & Development Planning

BETTER TOGETHER.

Feasibility Study:

Alternative and Sustainable Infrastructure Solutions for Human Settlements

Summary

March 2017

Feasibility Study

Alternative and Sustainable Infrastructure Solutions for Human Settlements

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BEING BETTER TOGETHER THROUGH SUSTAINABLE INFRASTRUCTURE ALTERNATIVES

Previous studies suggest that major problems and challenges within the delivery of Human Settlements are resource inefficiency, negative impacts on the natural environment, unsustainable practices regarding municipal infrastructure and community expectations regarding the type of services governments can supply.

The population of the Western Cape has grown from 4,5million to 5,8million people in the last decade, giving evidence of rapid change. Urbanisation comes with developmental advantages as well as serious challenges and problems. Among these advantages are the potential benefits for creating resource efficiency (infrastructure and services) and economies of scale. There are also multiple issues which arise along with urbanisation, including urbanisation of poverty, food insecurity and the proliferation of informal settlements.

It has often been questioned whether or not sustainable infrastructure could be implemented as a municipal standard without being prohibitively expensive or less effective. This feasibility study sought to investigate exactly this question and succeeds in making a case for sustainable infrastructure technologies over the business as usual infrastructure practices.

Project Phases

Site Selection:
The main difference between this project and current academic research surrounding “sustainability” lies in the practical application and concept development on a specific land parcel. This project is based in reality and this specific project phase evaluated and screened various candidate sites in both the Swartland and Mossel Bay Municipalities. A multi-criteria analysis approach was followed where criteria varied from land & legal to physical characteristics. Scaling opportunity for the successful site was also considered as a major driver towards selection.

Concept:
This project introduces two development concepts, one for each of the municipalities. These were the Sustainable Infrastructure and the Business as Usual concept. Both were developed through a design-led thinking process attempting to envision what a future could look like from a spatial and infrastructure response point of view.

Infrastructure Response:
Influencing and building on the concept, this project evaluated various alternative technologies that could be considered. Some technologies were not implementation ready, others are constantly evolving from an efficiency and affordability point of view. One of the biggest challenges was not only to select the best combination of technologies, but a combination of technologies. The impacts on existing service delivery options and infrastructure solutions were also considered.

Financial Lifecycle Analysis:
The infrastructure response options were considered from a practical as well as financial perspective. On the financial side, lifecycle cost analysis models were developed to quantify Capital Expenditure (CAPEX), Operational Expenditure (OPEX) and maintenance costs for each of the chosen technologies. The purpose of this modelling exercise was mainly aimed at quantifying and unpacking the cost implications of the infrastructure response options over a period.

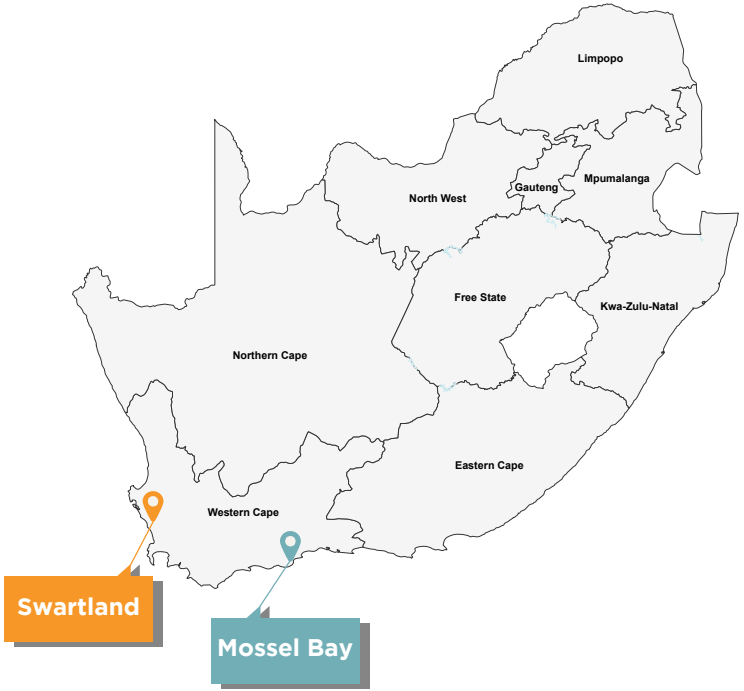
Economic Impact Assessment:
Using the financial model as a departure, this part of the project dealt with the wider economic opportunities and impacts of the infrastructure response options. Job creation, procurement, social and environmental gains were evaluated and compared.

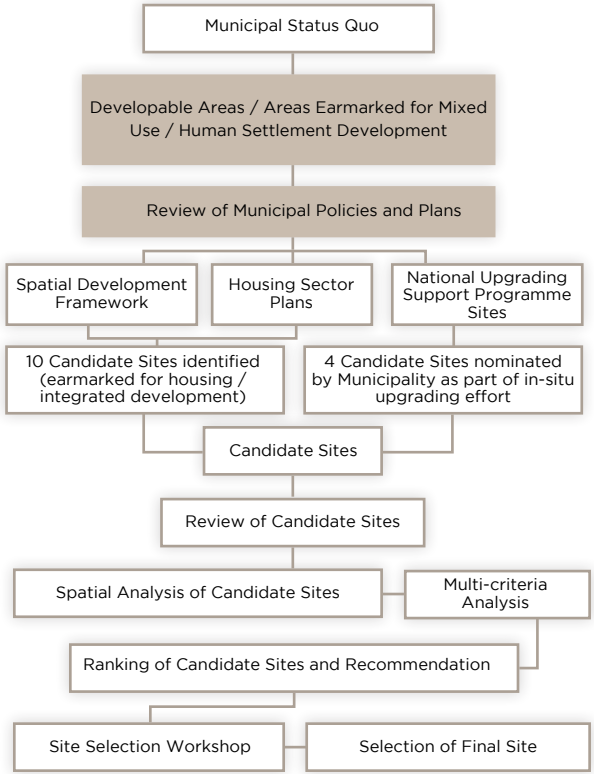
Cost-Benefit Analysis:
The infrastructure response options were compared through a cost-benefit-analysis model, where the Net Present Value (NPV) for both options at a specific discount rate were modelled.

Next Steps:
Where to from here? The study identified certain shortcomings and naturally could not address all the intricacies of designing a sustainable settlement. Key points and next actions are suggested, which could be dealt with in the future.

Site Selection

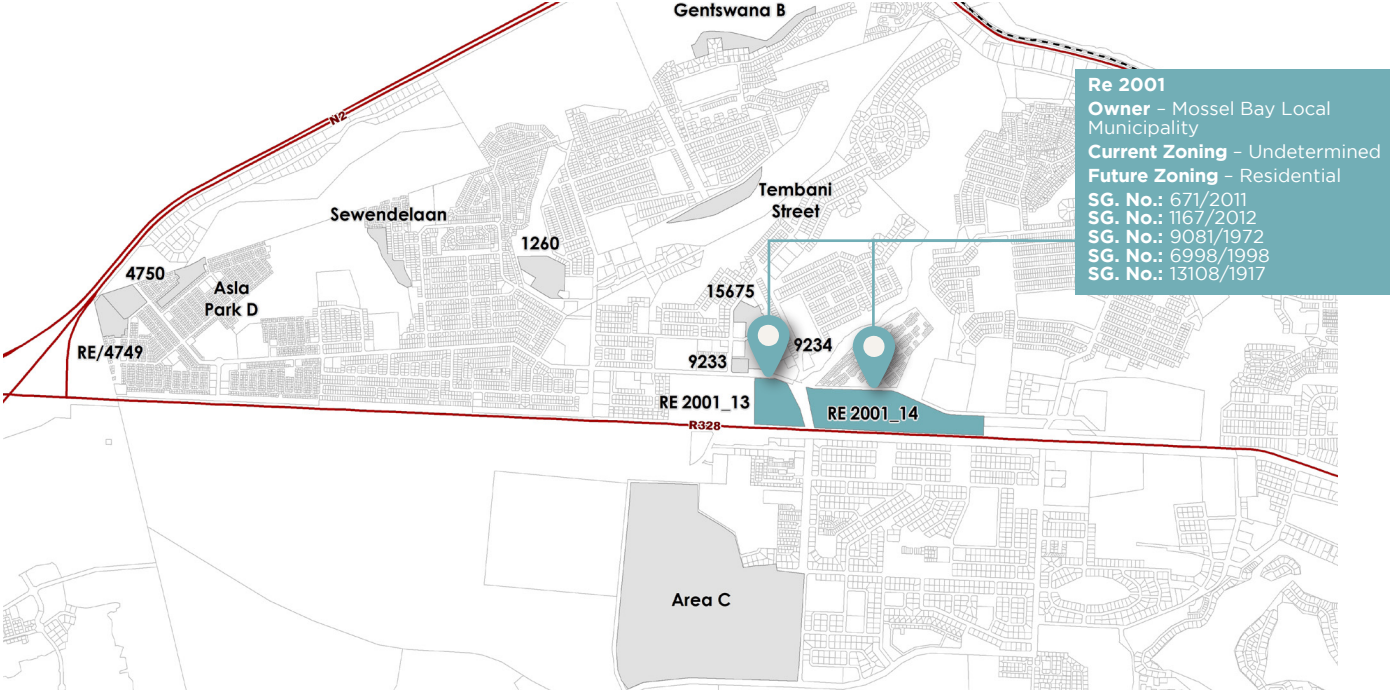
Site Selection





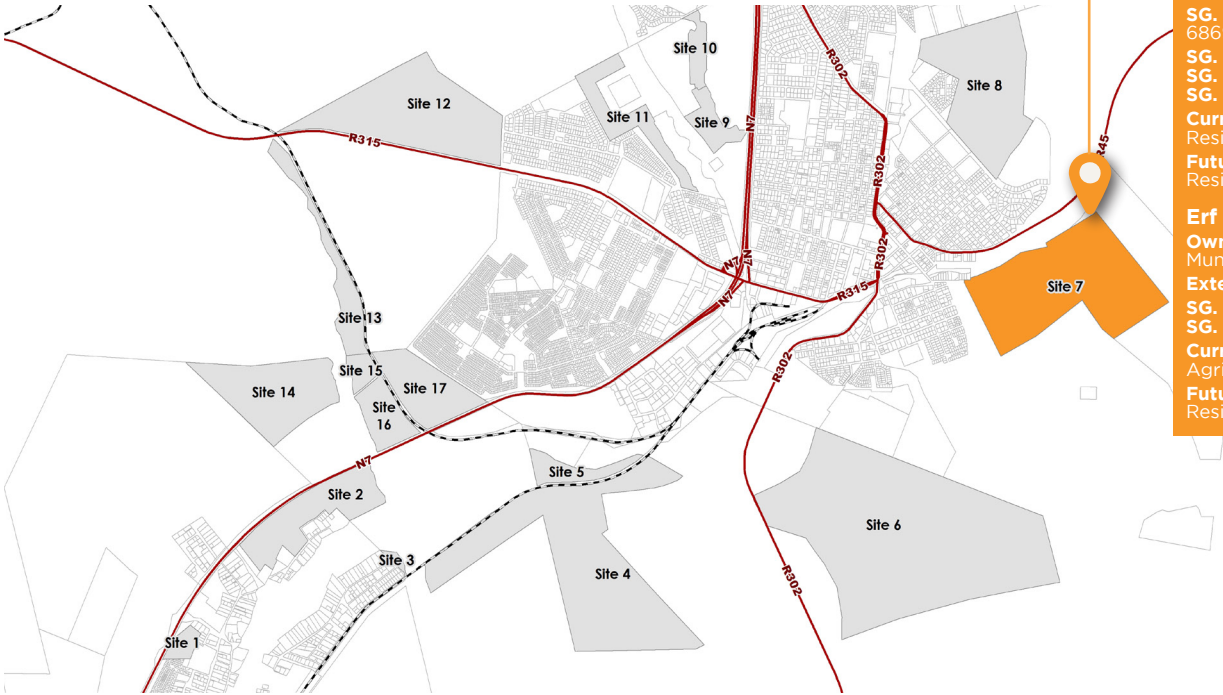
Mossel Bay

Selected Candidate Site



Swartland

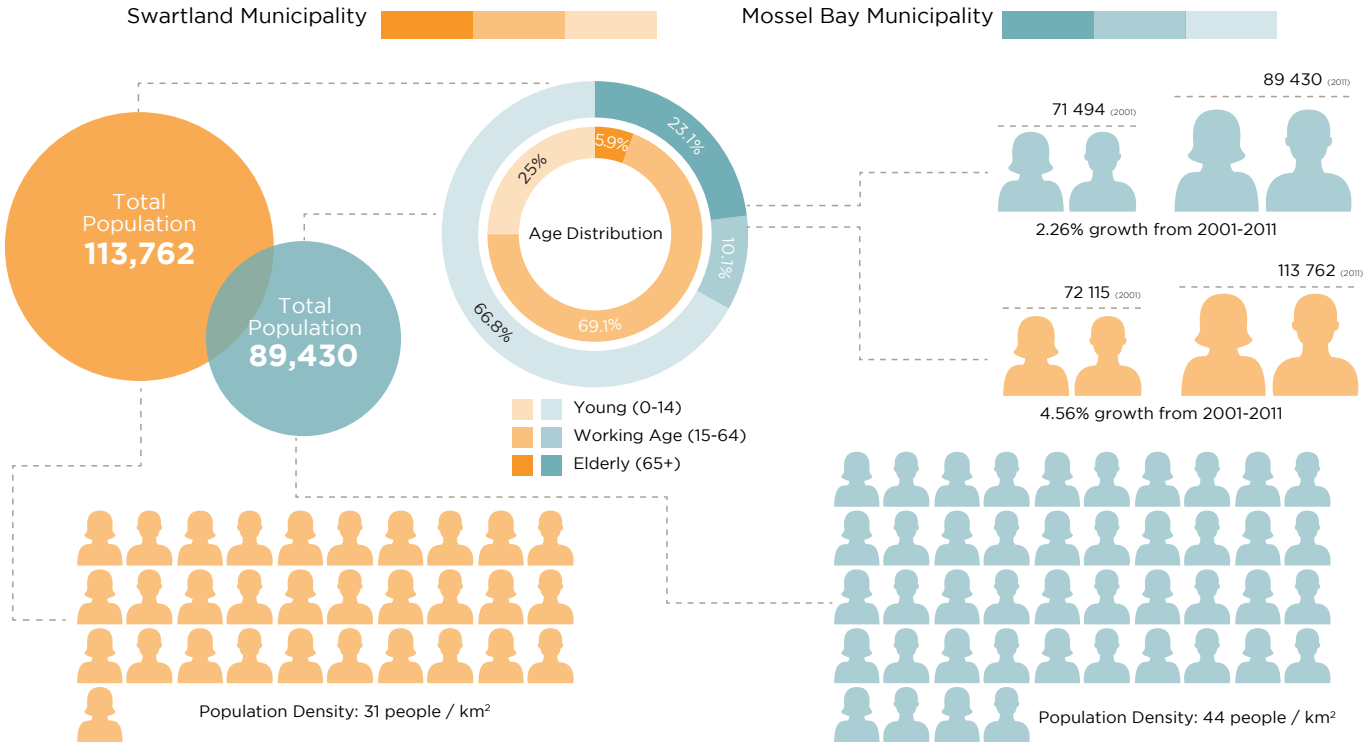
Selected Candidate Site

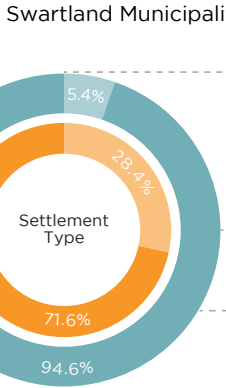


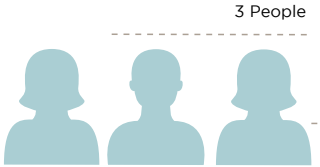
Erf 327
Owner – Swartland Municipality
Extent – 1184.1762ha
SG. No.: General Plan B 6869, 1917
SG. No.: 2837/77
SG. No.: 13081/1917
SG. No.: 3348/2003
Current zoning – Residential Zone 1
Future Zoning – Residential

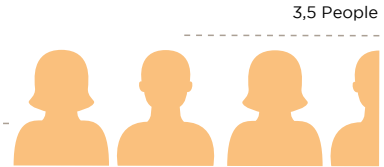
Erf 6491
Owner – Swartland Municipality
Extent –
SG. No.: 6954-94
SG. No.: 6869/1917
Current Zoning – Agricultural Zone 1
Future Zoning – Residential

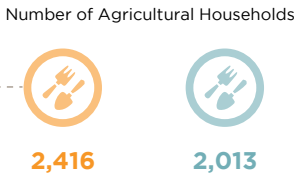
Municipal Characteristics



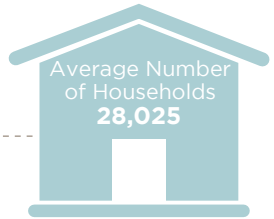

Swartland Municipality
5.4%
28.4%
Settlement Type
71.6%
94.6%
Urban Settlement
Farm Settlement

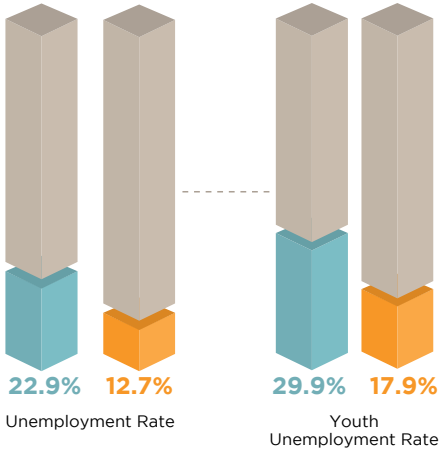

3 People
Average Household Size


Mossel Bay Municipality
3,5 People
Average Household Size


Number of Agricultural Households
2,416
2,013

Average Number of Households
29,324


Average Number of Households
28,025


22.9%
12.7%
Unemployment Rate
29.9%
17.9%
Youth Unemployment Rate

Concept

Sustainable Human Settlements Principles

Strategic Goal 1

Create opportunities for growth and jobs

Strategic Goal 2

Improve education outcomes and opportunities for youth development

Strategic Goal 3

Increase wellness, safety and tackle social skills

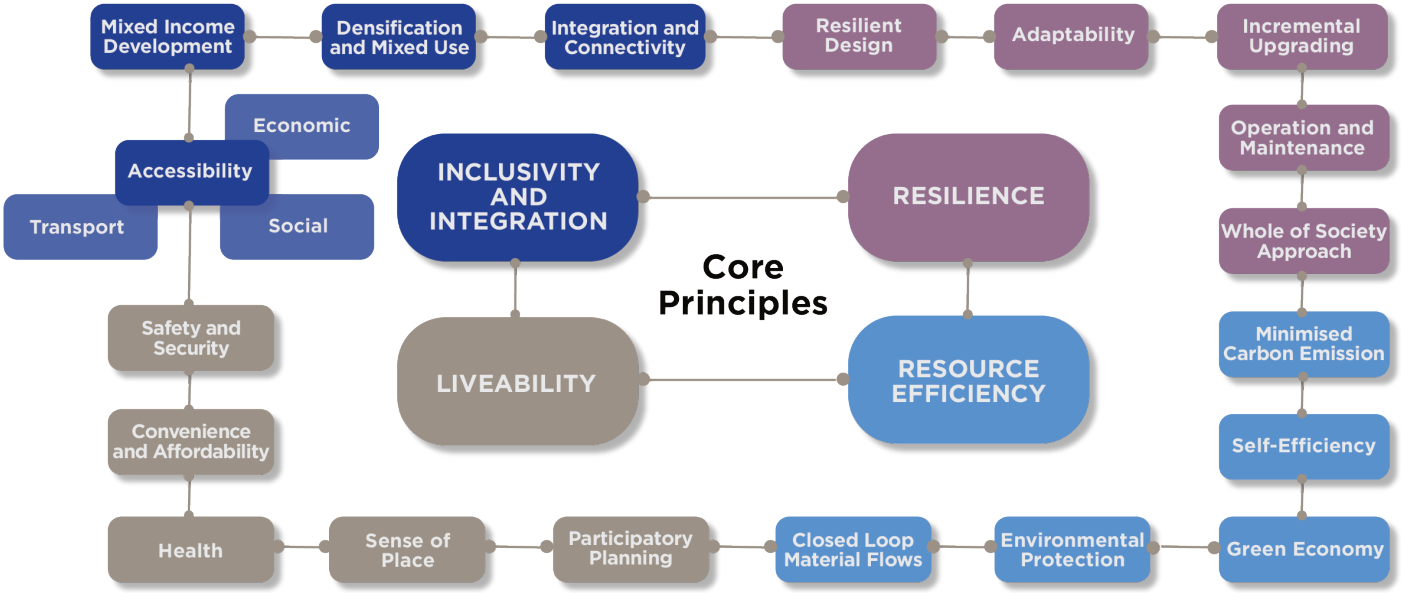
Strategic Goal 4

Enable a resilient, sustainable, quality and inclusive living environment

Strategic Goal 5

Embed good governance and integrated service delivery through partnerships and spatial alignment

A review of existing principles, policies and approaches surrounding sustainability provided significant evidence of key themes in the sustainable development space. These have been assimilated into the following chart which illustrates the principles that guide what sustainable human settlements should strive toward achieving or what strategic considerations settlements should contribute to.



Development Concept: What we want to see

Access to clean energy from low carbon sources by all

A resource efficient settlement

Walkable cities and places where NMT and Public Transport are the only modes of transport

An efficient pedestrian and NMT design

Flexible and adaptable urban farms that can support changing needs through densification and a focus on the public realm

High density multi-use buildings

Living environments where people of all ages feel safe and secure when navigating the city

Employment opportunities and safe, well-lit public spaces

Locally grown healthy food sources that support the local economy and promote healthy communities and food security

Urban agriculture, vertical farms

Inclusive and integration

Resilience

Liveability

Resource efficiency

Mossel Bay

Concept Design - Zoning Plan

Utility

Social housing and mix use

Residential Apartments
150 units / ha (60% coverage)

Commercial / Residential
150 units / ha (80% coverage)

Civic and Social
(20% coverage)

Residential Apartments
150 units / ha (60% coverage)

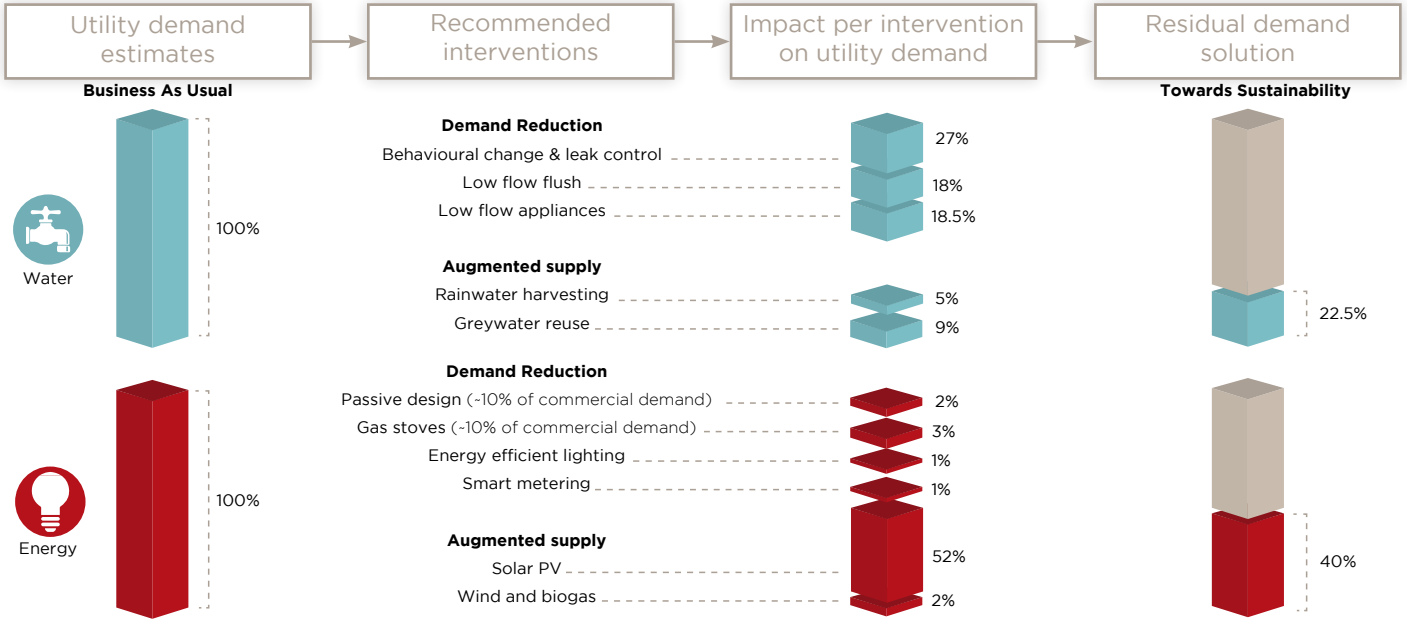
Swartland

Concept Design - Zoning Plan

Infrastructure Response

Infrastructure Response

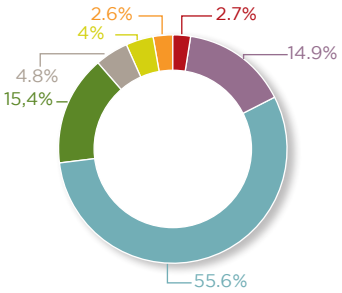
Fundamental design components and methodology



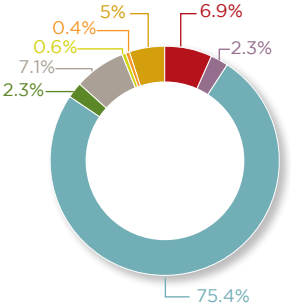
Financial Lifecycle Analysis

Cost Breakdown of Utilities (R'mil)

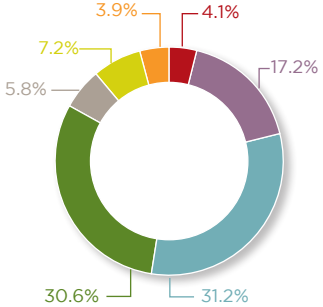
Mossel Bay Business as Usual



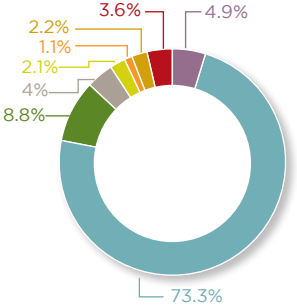
Mossel Bay Sustainable



Swartland Business as Usual



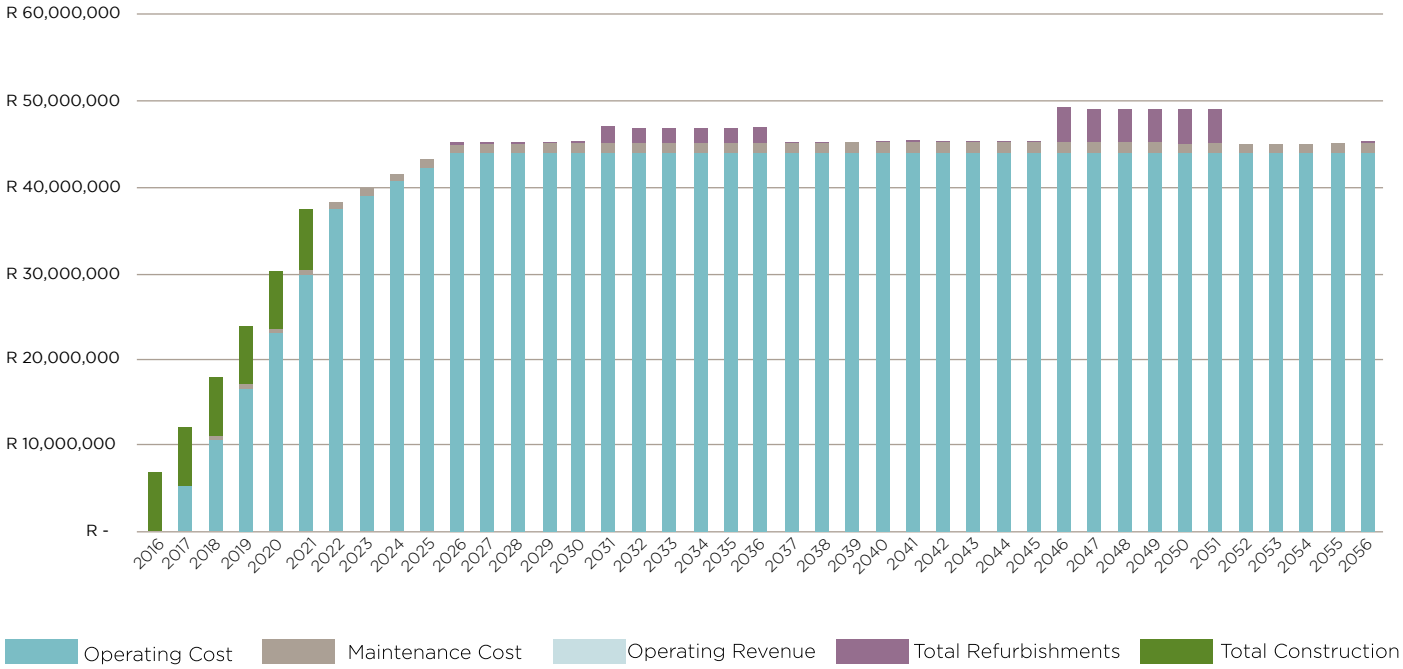
Swartland Sustainable



Water Supply
Earthworks
Electricity
Road Transport
Sanitation
Stormwater
Telecommunication
Waste Management

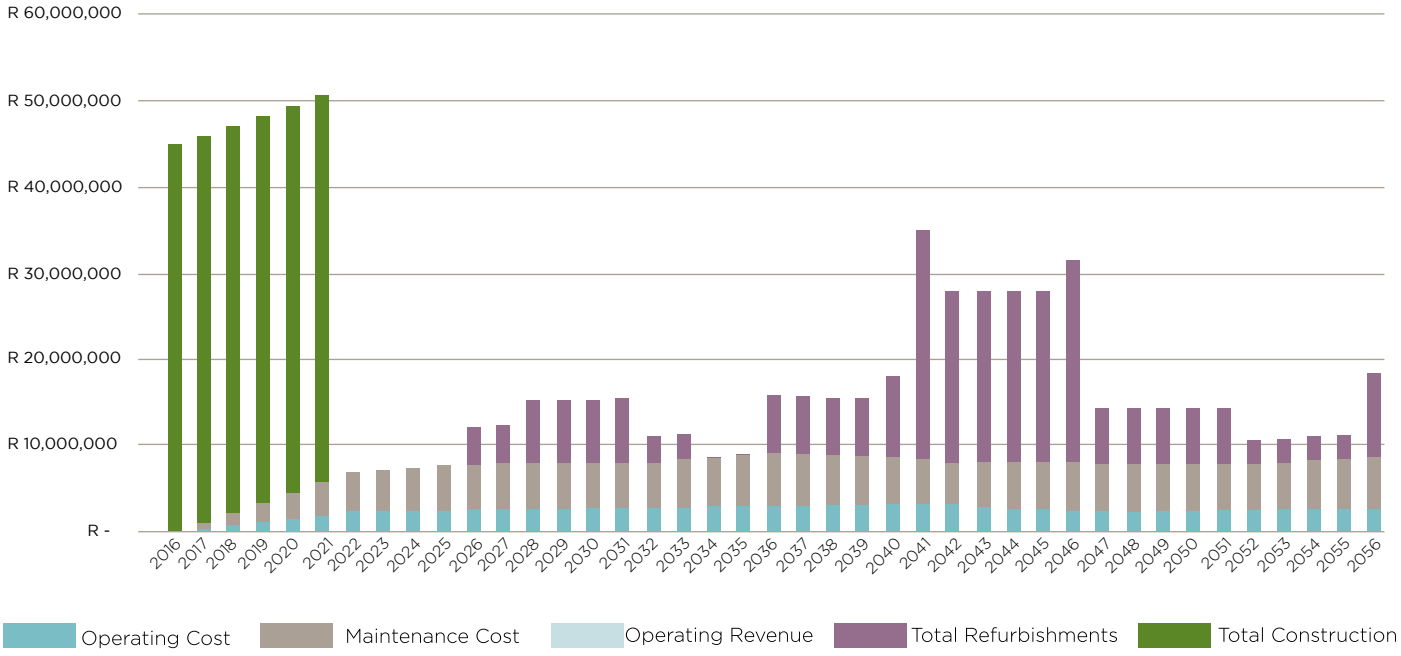
Mossel Bay

Business as Usual Total Cost



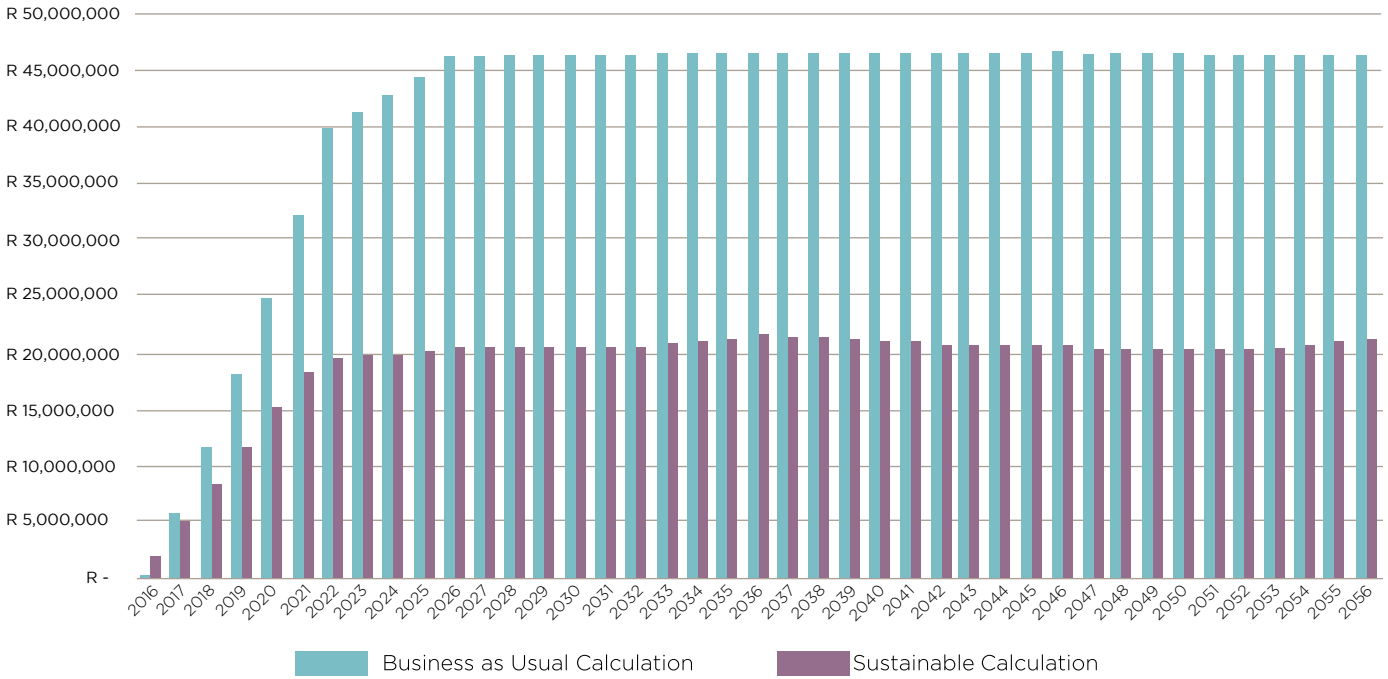
Mossel Bay

Sustainable Total Cost



Mossel Bay

Annual Depreciation and Operational Expenditure (OPEX)



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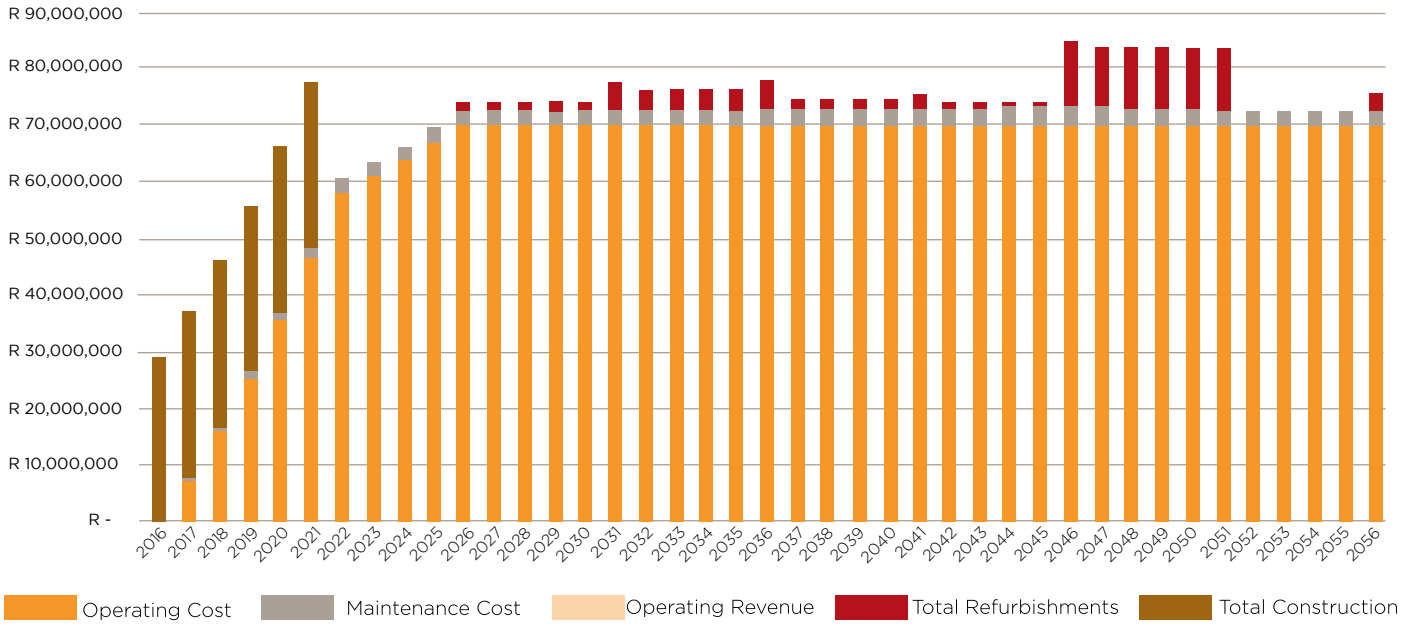
Business as Usual Total Cost



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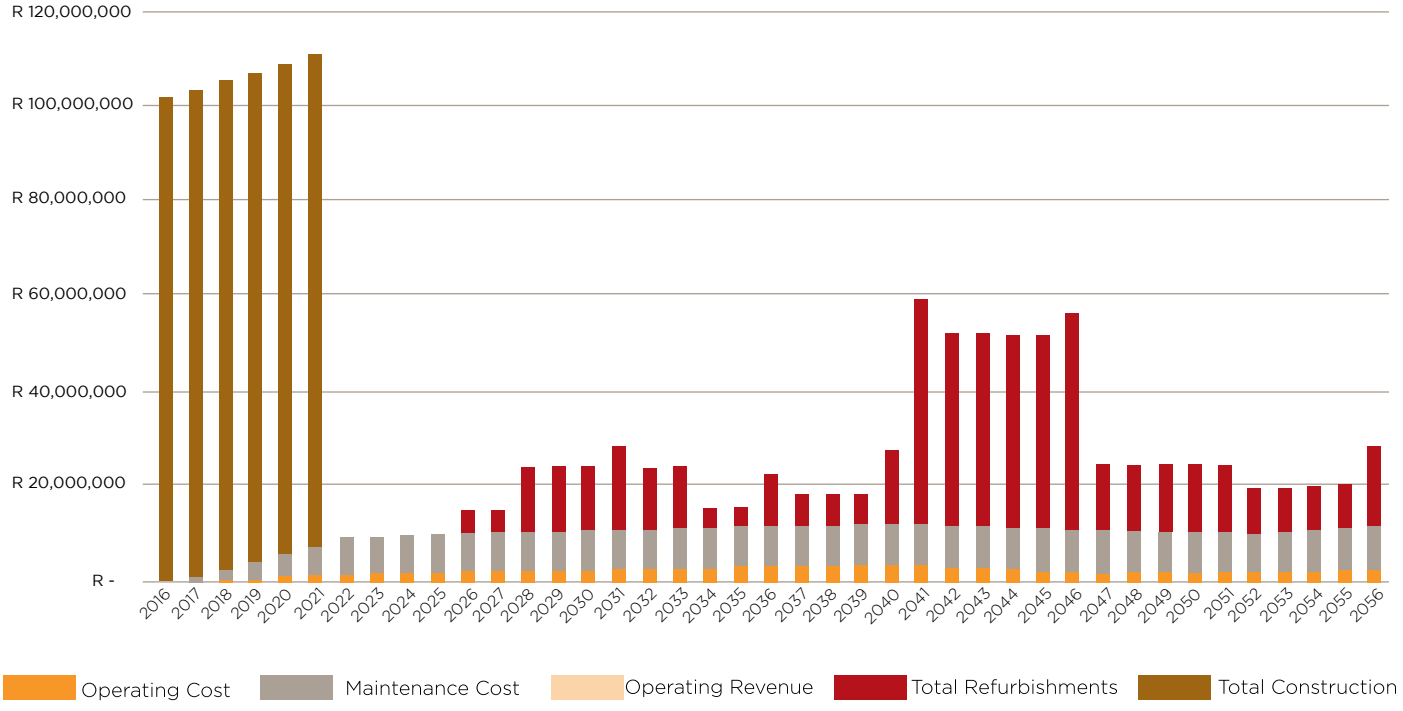
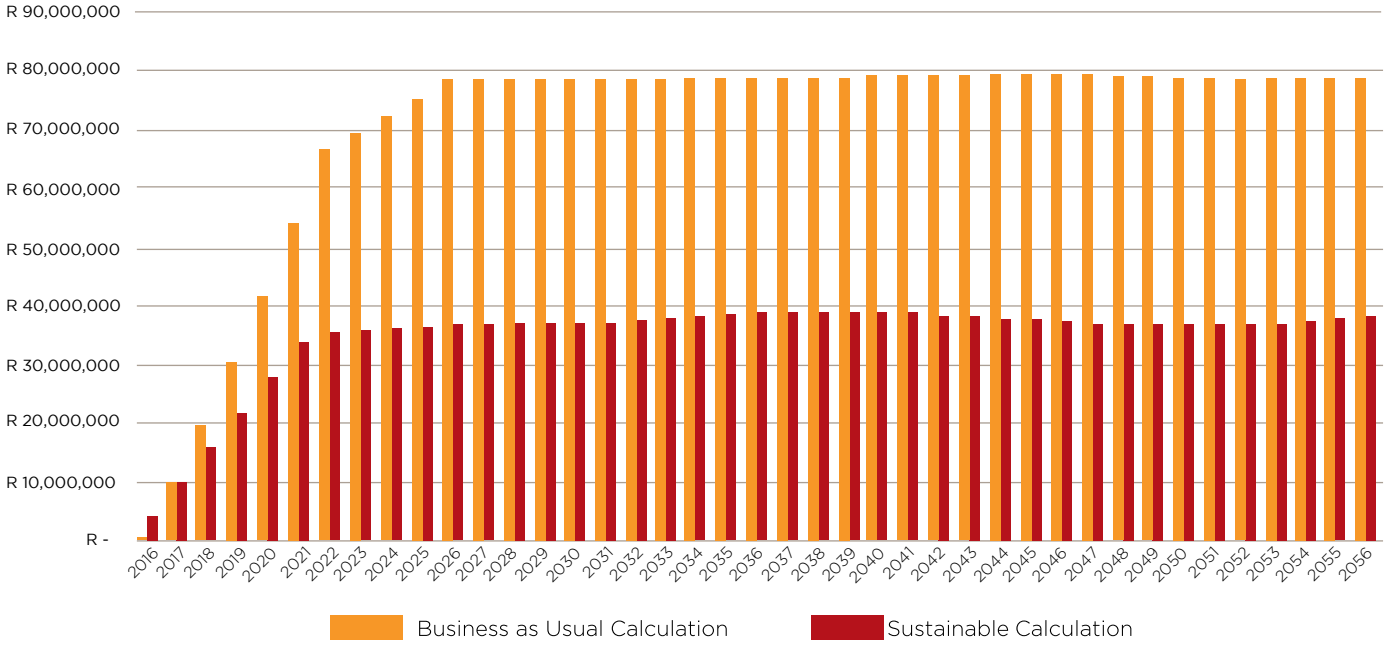
Sustainable Total Cost

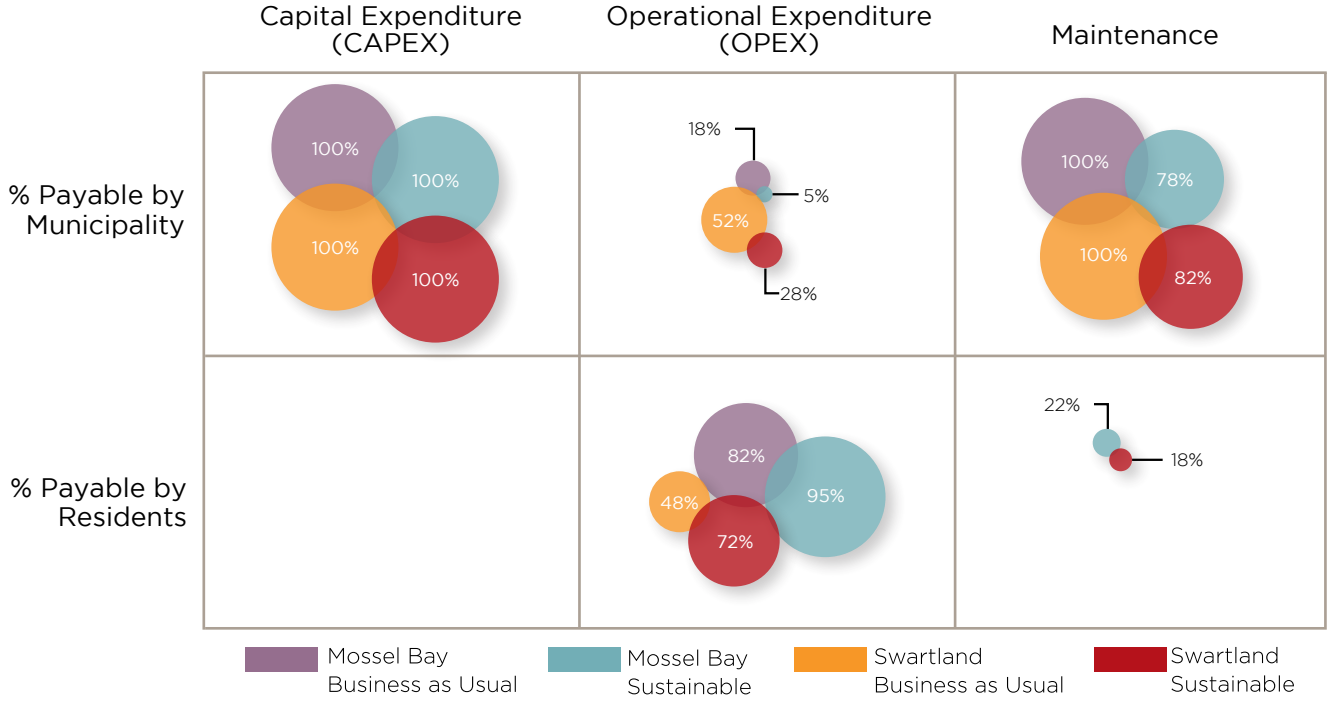


Swartland

Annual Depreciation and Operational Expenditure (OPEX)



Accumulated Cost

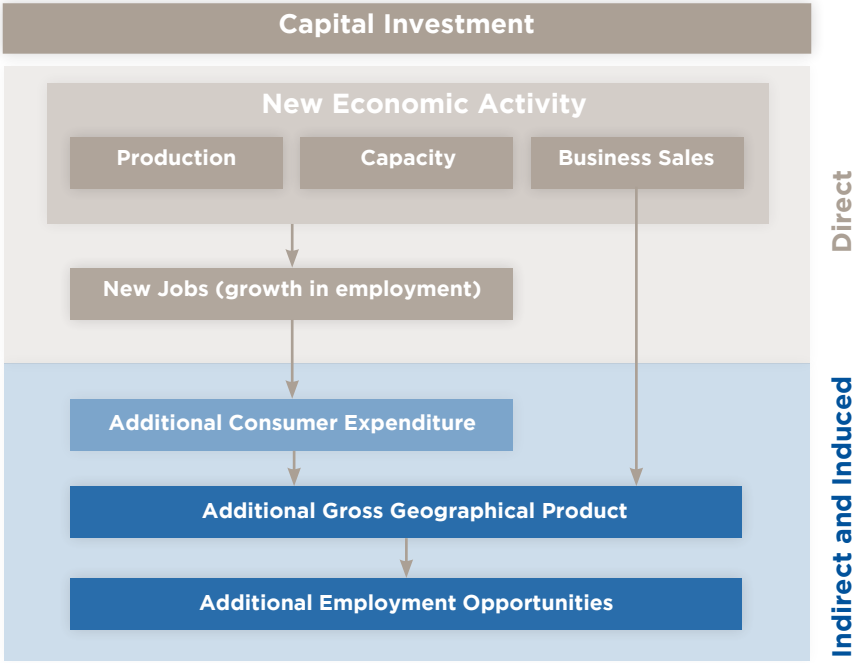


Residents pay more for OPEX in the sustainable scenario – this is for solar panel maintenance. But it's still less than the savings/ benefits for those households (Swartland is less dense so higher costs).

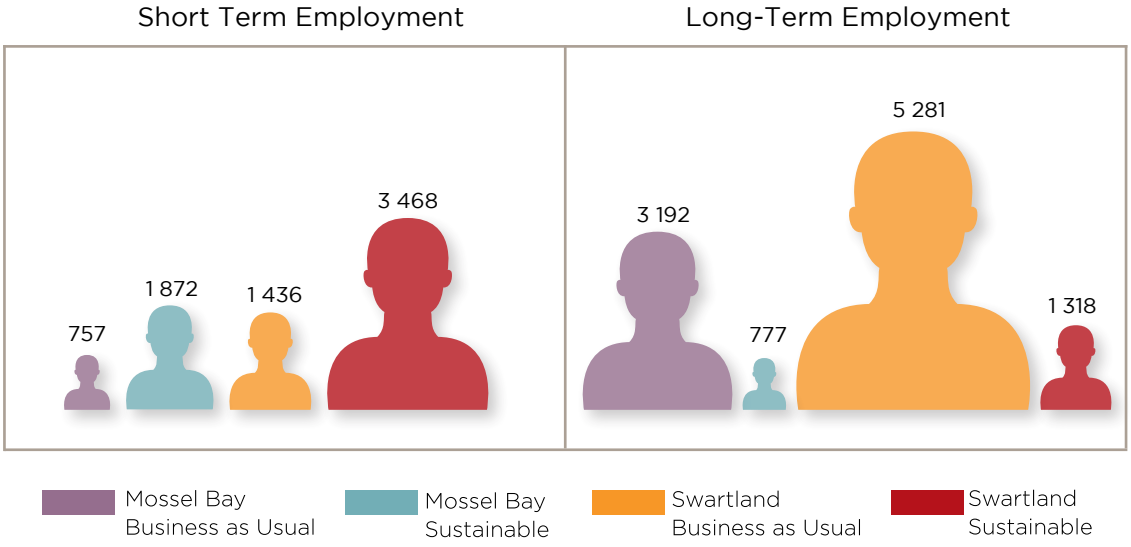
Economic Impact Assessment

Capital Investment

The following flow process explains the methodology used to calculate direct and indirect economic impacts for both business as usual and sustainable alternatives.



Total Job Creation



There is more short-term employment for the sustainable option, but the long-term employment is much smaller. This would be higher if there is local production and maintenance of solar products (PV and SWHs etc.)

Cost Benefit Analysis

Mossel Bay

Economic Cost Benefit Analysis Results: Comparative Analysis

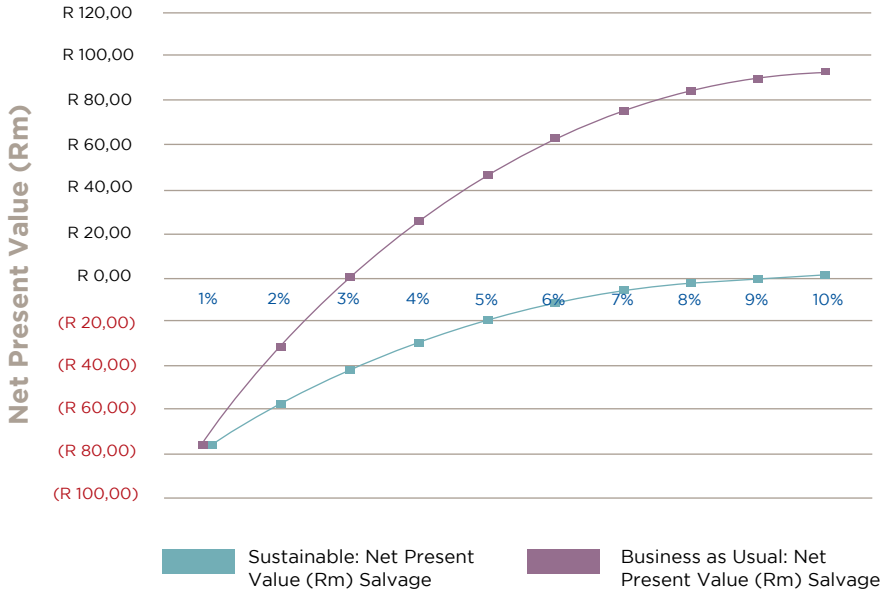
Discount Rate:	1%		5%		10%	
Development Option	Business as Usual	Sustainable	Business as Usual	Sustainable	Business as Usual	Sustainable
Net Present Value (Rm)	R -77,26	R -80,22	R -21,19	R -46,95	R 1,92	R 92,09
BCR	R 0,94	R 0,89	R 0,97	R 1,11	R 1,01	R 1,31

The table illustrates a Net Present Value (NPV) and Benefit-Cost Ratio (BCR) for discount rates of 1%, 5% and 10%. The discount rate refers to the interest tate used in a discounted cash flow analysis to determine the present value of future cash flows.

From this table it is apparent that the sustainable option achieves a positive BCR and NPV following a discount rate of 5%. Hence, for every R1 spent, a return of R1.11 will be achieved.

Mossel Bay

Economic Cost Benefit Analysis: Business as Usual vs Sustainable



Salvage Rate – time value of money

Net Present Value greater for Sustainable option – greater returns per R1 million spent

Positive BCR at 3% discount rate (cost of capital)

Business as Usual option – Positive returns at 9% discount rate

Non-monetary benefits

Returns for both Mossel Bay and Swartland are over 40 years

Swartland

Economic Cost Benefit Analysis Results: Comparative Analysis

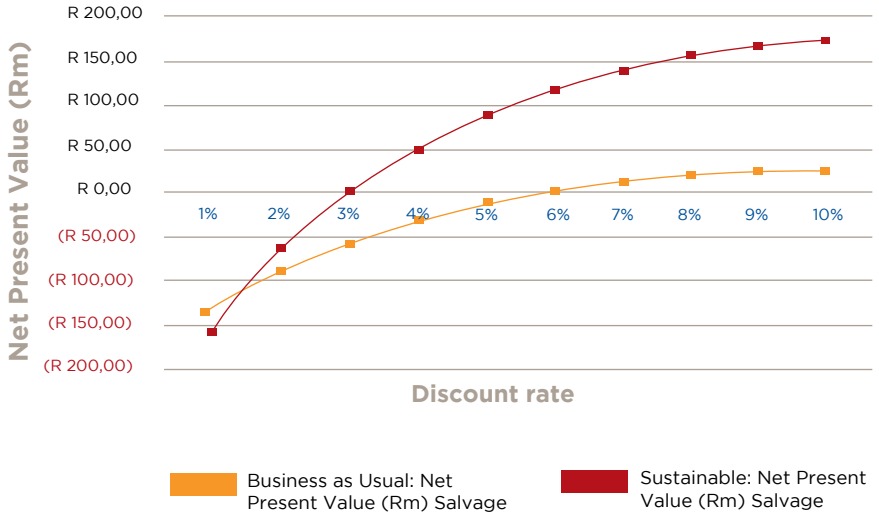
Discount Rate:	1%		5%		10%	
Development Option	Business as Usual	Sustainable	Business as Usual	Sustainable	Business as Usual	Sustainable
Net Present Value (Rm)	R -130,70	R -159,97	R -16,50	R -88,87	R 28,47	R 176,45
BCR	R 0,95	R 0,88	R 0,99	R 1,10	R 1,04	R 1,28

The table illustrates a Net Present Value (NPV) and Benefit-Cost Ratio (BCR) for discount rates of 1%, 5% and 10%. The discount rate refers to the interest tate used in a discounted cash flow analysis to determine the present value of future cash flows.

From this table it is apparent that the sustainable option achieves a positive BCR and NPV following a discount rate of 5%. Hence, for every R1 spent, a return of R1.10 will be achieved.

Swartland

Economic Cost Benefit Analysis: Business as Usual vs Sustainable



Salvage Rate – time value of money

Net Present Value greater for Sustainable option – greater returns per R1 million spent

Positive BCR at 3% discount rate (cost of capital)

Business as Usual option – Positive returns at 6% discount rate

Non-monetary benefits

Next Steps

Summary of Findings

This feasibility study reflects that operational costs are significantly less expensive than conventional “business as usual” costs.

It supports the growing evidence that sustainable developments hold financial rewards for building owners, operators (municipalities) and occupants alike. Also, the study is indicative of the fact that typically, sustainable settlements have lower energy, water, maintenance and operating costs. These reduced operational costs do not need to come at the expense of higher first capital costs, as a local business, for example, can own and render the infrastructure as a service at a premium over a 20 - 40 year service contract. Through an integrated design process and the innovative use of sustainable materials and equipment, the first cost of a sustainable building can be equivalent to, or lower than that of a traditional building.

Albeit, some sustainable design features do incur a higher first cost. For this study, the initial cost of energy generating infrastructure, i.e. solar photo-voltaic panels, is high but the payback period for the incremental investment is often short - with a lower life-cycle cost compared to more traditional buildings. In addition, the cost of sustainable technologies is continuously dropping as they are developed and improved upon. The sustainable settlement option is better for the province, the municipality, the household, the economy and the environment. This proves that through innovative thinking, we can become **BETTER TOGETHER**.

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Environmental Affairs and Development Planning