



KAAP AGULHAS MUNISIPALITEIT
CAPE AGULHAS MUNICIPALITY
U MASIPALA WASECAPE AGULHAS

REPORT

ON

MASTER PLAN FOR THE MV (11kV) DISTRIBUTION NETWORK AT CAPE AGULHAS

REPORT NO: G/10264/E/R2B

Dated: 30 JUNE 2017

Prepared by:

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1.0 **INTRODUCTION**

This report has been compiled on the instruction of the Manager of the Electrical Department, Mr Steve Cooper, to prepare a master plan for the Medium Voltage (MV – 11kV) distribution network for Cape Agulhas.

The purpose of the master plan can be summarised as follows:

- 1.1 To identify the network components which need to be augmented to address immediate problems and to cater for long term load growth, i.e. 20 years, and new developments.
- 1.2 To serve as a basis for any new construction work so that it can be carried-out in a planned and phased manner, thus minimizing any abortive work due to a lack of insight into the future requirements.
- 1.3 To cost and programme the augmentation work to form part of a business plan for the implementation thereof.

The report contains sufficient information for forward planning to cater for full development of presently serviced areas and known new developments, which together, will generate a total load in the order of 1,9 MVA over the next ten (10) years.

It must be pointed out that load growth patterns will change and it is recommended that the window for the technical issues related to the master plan not be longer than two (2) years, but for financial planning it can be made up to five (5) years.

This report focusses more on the financial rather than the technical issues, which are depicted in detail on the master plan drawings and have previously been discussed and agreed with the Manager of the Electrical Department.

2.0 **BASIS OF REPORT**

The report is based on the following:

- (i) Information received from Mr Steve Cooper from the Municipality's Electrical Department and Mr Gerrit van Rooyen from Eskom during meetings and telephone conversations in 2017.
- (ii) Drawings of the existing municipal MV Network.
- (iii) Information received from the Municipality's Town Planning and Housing Departments regarding possible future developments in the area.

3.0 **DRAWINGS**

Reference should also be made to the following drawings, of which a copy of each is issued separately:

Existing Network

Drawing No. 10264/E2/01:	Struisbaai, Agulhas & Suiderstrand: Existing MV (11kV) Plan Layout No.1
Drawing No. 10264/E2/02:	Struisbaai, Agulhas & Suiderstrand: Existing MV (11kV) Plan Layout No.2
Drawing No. 10264/E2/03:	Struisbaai, Agulhas & Suiderstrand: Existing MV (11kV) Schematic Diagram

Master Plan Network

Drawing No. 10264/E2/04:	Struisbaai, Agulhas & Suiderstrand: Master MV (11kV) Plan Layout No.1
Drawing No. 10264/E2/05:	Struisbaai, Agulhas & Suiderstrand: Master MV (11kV) Plan Layout No.2
Drawing No. 10264/E2/06:	Struisbaai, Agulhas & Suiderstrand: Master MV (11kV) Schematic Diagram

The master plan drawings show the existing network in blue and the upgrading and extension measures required in red. This method has been adopted to avoid having to refer to two sets of drawings.

4.0 **LOAD, DESIGN CRITERIA AND 20 YEAR GROWTH FORECAST**

The load figures, i.e Town's peak kVA demand and the connected kVA load of the existing network (diversity factors ranging from 40% to 70% were used), and future load depicted on the master plan have been used to assess the loading in the various areas as a basis to evaluate the present and future capacity of the existing network components and to determine the upgrading and extension measures required.

The maximum voltage regulation is taken at $\pm 2,5\%$ in the MV networks, $\pm 2,5\%$ across distribution substations and $\pm 7\%$ across the LV network.

The Town's peak kVA demands over the last sixteen (16) years were obtained from Mr Steve Cooper, as measured at the Eskom Bulk Metering Point and included in Annexure A. This annexure also depicts the Town's load growth for the next twenty (20) years. Annexure B depicts a graph of a best fit exponential curve depicting the projected load growth.

The design of the system is based on the system being able to supply the full load demand in an area, or areas, after the loss of any one feeder while the voltage regulation remains within reasonable limits at the furthest point of the network. It is not considered necessary to base planning on the loss of more than one feeder at the same time.

It is to be noted that the proposed network improvement is a concept design only and should not be considered as a final detailed planning. It provides a concept to guide actual detail planning and also acts as a guide to such planning to ensure general compliance with the spirit of the overall network master plan, without dictating rigid adherence to the order of priority given. The development within an area may occur earlier or later than is presently envisaged requiring a re-allocation of the order of the work.

5.0 **IMPACT OF RENEWABLES ON THE MASTER PLAN**

Renewable energy is energy that is generated from natural processes that are continuously replenished. This includes sunlight, geothermal heat, wind, tides, water, and various forms of biomass. This energy cannot be exhausted and is constantly renewed. Since it is not possible to exactly determine the extent of the afore-mentioned natural processes in the area it has been decided not to take the impact of any renewable technologies in consideration in the electricity master planning for the town.

6.0 **EXISTING NETWORK AND PROPOSED CHANGES**

The layout and schematic diagram of the existing MV network are shown on Drawing No.'s 10264/E2/01 & 02 and 10264/E2/01 & 02 respectively.

6.1 Eskom Supply:

The supply is provided from a 66/11kV Eskom substation via an 11kV overhead radial line (no firm supply) and underground cable with capacities of 7,3MVA and 2,28MVA respectively to the main intake substation, i.e. "SS Agulhas Links 1", situated on the Northern side of Cape Agulhas.

The current notified maximum demand with Eskom is 2 000 kVA and the maximum actual kVA demand was measured in January 2011 at 2 072 kVA. From the graph under Annexure B it can be seen that the load requirement for the last five years, however, varied between 1,2 MVA and 1,28 MVA (January 2017).

The estimated maximum demand in the next 10 years is about 1,9 MVA, which means that the existing supply cable, overhead line will be sufficient to cater for the expected load requirements. No increase of the current notified demand is expected.

Should the development on the western side of town proceed and more information is available on same, discussions must immediately proceed with Eskom to inform them of the possible rapid increase of the town's notified demand in future.

6.2 MV Feeders:

The main supply to Cape Agulhas is from the aforementioned "SS Agulhas Links 1" Substation, but supply can be taken from Struisbaai via the 35mm² Cu underground cable link between ring main unit "RMU Cornwallis" and miniature substation "MS 25A" in Struisbaai. Should the load requirement in Cape Agulhas exceed the load capacity of the aforementioned cable, i.e. 2,29 MVA, same must be upgraded. It is, however, not expected to happen in the next ten (10) years.

The existing main MV reticulation network consists mostly of bare overhead lines, ABC overhead lines and underground cables feeding from "SS Agulhas Links 1". The lines and cables are connected to a various number of ground mounted transformer substations, miniature substations, switching stations and ring main units forming part of a ring system. The loads on the system conductors are well within the current capacities of the conductors. It is further indicated on the drawings that all ABC overhead lines must be replaced with underground cables.

The Squirrel overhead line, between "SS Agulhas Links 1" and "SS School Str", however, needs to be upgraded to Oak.

As depicted on the drawings provision has been made for a third major ring from "SS Agulhas Links 1", should new developments proceed on the western side of town.

CBD and Town Areas:

The CBD and Town Areas are presently fed by means of 35/50mm² ABC overhead lines and 50/70mm² Cu underground cables. We recommended that all radial feeds be connected to as shown on the drawings to ensure that all transformer substations and miniature substations are connected to a ring feed supply.

6.3 Substations:

A number of ground mounted transformer substations, which are fed from overhead lines via radial underground cables, or underground cables, must be replaced with miniature substations equipped with ring main units as depicted on the master plan drawings. Provision has been made for additional miniature substations within the urban edge where new developments are planned to cater for the future load and to ensure that the voltage regulation on the LV networks is within the allowable limits.

Provision has been made for the upgrade of switching station "SS T33" and ring main unit "RMU Cornwallis". "RMU Cornwallis" must be upgraded when the load requirement of the town reaches 2,38 MVA, i.e. the load capacity of the fuse switch in said ring main unit.

From our inspection it was noted that some of the ring main units were wrongly labeled. We propose that all switchgear and equipment be labeled according to the drawings.

6.4 Condition:

The ground mounted transformer substation "GMT Rasperlaan" is 31 years old and need to be tested to ensure that all components are working safely.

7.0 **UPGRADING OF THE MV NETWORK**

In order to overcome the immediate and ten year load growth problems, the systematic strengthening of the internal reticulation system is recommended. An ongoing commitment to regular maintenance is also a pre-requisite to the provision of a quality supply to the town's consumers.

The immediate urgent elements which must be attended to:

- (a) Replace overhead line between "SS-Agulhas Links 1" and "SS School" with Oak conductor.
- (b) Replace the ABC overhead lines with underground cables.
- (c) Commence / proceed with a maintenance programme.

The vision for the town in future is a ring main overhead / underground line / cable system which connects the new "SS Agulhas Links" with all the existing & future miniature substations, including the replacement of all the ABC overhead lines with underground cables.

The proposed improvements and extensions have been divided into three phases. Phase 1 covers the most urgent work which should be carried out within the period from present (2018) to 2019, followed by Phase 2 and Phase 3 each of four year work periods, i.e. 2020 to 2023 and 2024 to 2027. Phase 3 encompasses some items of work for which it is not practical to set a time period, as certain items may be required at any time between 2020 to 2027, depending on the rate of development.

7.1 Phase 1 - (2018 to 2019):

7.1.1 SS-Agulhas Links 1: Replace the Squirrel overhead line between "SS Agulhas Links 1" and "SS School" with Oak conductor.

7.1.1 General: Inspect and test equipment mentioned under Sub-Clause 6.4 of Clause 6.0 and replace with new or refurbish existing.

7.2 Phase 2 - 2020 to 2023:

- 7.2.1 GMT T28: Replace the 50mm² ABC overhead conductor between “GMT T28” and “MS 29” with a 50mm² Cu underground cable.
- 7.2.2 MS 29: Replace the 50mm² ABC overhead conductor between “MS 29” and “GMT T30” with a 50mm² Cu underground cable.
- 7.2.3 MS 32: Replace the 50mm² ABC overhead conductor between “MS 32” and “SS T33” with a 50mm² Cu underground cable.
- 7.2.4 SS T3: Replace the 50mm² ABC overhead conductor between “SS T3” and “GMT T35” with a 50mm² Cu underground cable

7.3 Phase 3 - (2024 to 2027):

- 7.3.1 SS T3: Replace three way ring main unit, “RMU SS T3” with a five way switch.
- 7.3.2 RMU Cornwallis: Replace three way ring main unit, “RMU Cornwallis” with a three way switch, i.e. two isolators and one breaker.
- 7.3.3 SS T3: Install 50mm² Cu underground cable between “SS T33” and “GMT 35”.
- 7.3.4 General Item: Ground Mounted Transformer Substations: Replace ground mounted transformer substation with miniature substation, incl., ring main unit.
- 7.3.5 MS Zoetendal No. 1: New miniature substation, incl., ring main unit, and 70mm² Cu underground cable between “SS Zoetendal” and “SS Rasperlaan”.
- 7.3.6 MS Zoetendal No. 2: New miniature substation, incl., ring main unit.

Note that the new infrastructure required for new developments, i.e. the development on the western side of town, i.e. miniature substations “MS A”, “MS B”, “MS C”, “MS D” and “MS E” have not been priced, since it has been assumed that said infrastructure will be financed by the respective developers.

8.0 **PROPOSED CHANGES TOGETHER WITH COST ESTIMATES**

The proposed upgrading and extensions to the MV network, together with the cost estimates & proposed order of priority, is given hereafter.

It is to be noted that the cost estimates exclude VAT, escalation and planning fees. Escalation can be added at approximately 1,25% per month. The cost estimates are order of magnitude values and must be refined the year before implementation after a more detailed design has been carried-out.

8.1 Phase 1 - (2018 to 2019):

- 8.1.1 SS-Agulhas Links 1: Replace the Squirrel overhead line between “SS Agulhas Links 1” and “SS School” with Oak conductor. R 225 000
- 8.1.2 General: Inspect and test equipment mentioned under Sub-Clause 5.4 of Clause 5.0 and replace with new or refurbish existing. R 100 000 R 325 000

8.2 Phase 2 - 2020 to 2023:

8.2.1	<u>GMT T28</u> : Replace the 50mm ² ABC overhead conductor between “GMT T28” and “MS 29” with a 50mm ² Cu underground cable.	R 470 000	
8.2.2	<u>MS 29</u> : Replace the 50mm ² ABC overhead conductor between “MS 29” and “GMT T30” with a 50mm ² Cu underground cable.	R 400 000	
8.2.3	<u>MS 32</u> : Replace the 50mm ² ABC overhead conductor between “MS 32” and “SS T33” with a 50mm ² Cu underground cable.	R 255 000	
8.2.4	Replace the 50mm ² ABC overhead conductor between “SS T3” and “GMT T35” with a 50mm ² Cu underground cable.	<u>R 372 000</u>	R1 497 000

8.3 Phase 3 - (2024 to 2027):

8.3.1	<u>SS T3</u> : Replace three way ring main unit, “RMU SS T3” with a five way switch.	R 450 000	
8.3.2	<u>RMU Cornwallis</u> : Replace three way ring main unit, “RMU Cornwallis” with a three way switch, i.e. two isolators and one breaker.	R 290 000	
8.3.3	<u>SS T3</u> : Install 50mm ² Cu underground cable between “SS T33” and “GMT 35”.	R 470 000	
8.3.4	<u>General Item: Ground Mounted Transformer Substations</u> : Replace ground mounted transformer substation with miniature substation, incl., ring main unit. (Say replace two transformers, i.e. 2 x R 600 000-00/each)	R1 200 000	
8.3.5	<u>MS Zoetendal No. 1</u> : New miniature substation, incl., ring main unit, and 70mm ² Cu underground cable between “SS Zoetendal” and “SS Rasperlaan”.	R 995 000	
8.3.6	<u>MS Zoetendal No. 2</u> : New miniature substation, incl., ring main unit.	<u>R 600 000</u>	<u>R4 005 000</u>
	Total, excl. VAT		R5 827 000

9.0 **FUNDING**

It is only viable to implement the capital expenditure proposed under Clause 8.0 if suitable income sources can be found to fund such expenditure. These income sources can be as follows:

- (i) A portion of the income from the sales of electricity to fund External Loans.
- (ii) Contribution by developers in the form of:
 - (a) Augmentation Levies that will become Internal Funds.
 - (b) Direct payments for the supply and installation of external or main MV network components necessary to supply specific new developments.
- (iii) Grants from example the Department of Energy (DoE) for the electrification of sub-economy housing, schools, etc, and MIG funding from Provincial Government for mainly streetlighting projects.

It is recognised that in the case of External Loans, although it could be financially justified and increased year by year in relation to the increased income from electricity sales, there are other considerations in terms of the Municipality's overall budget, the availability of loans, etc, that finally determines the value thereof. The income from this source should therefore be determined by the Municipality's treasury department in consultation with the electrical department.

10.0 **CONCLUSION**

It is recommended that adequate financial provision be made in the budgets for ongoing upgrading to the network as set out above. We would recommend that at least R 600 000-00 to R 800 000-00 per year be budgeted for upgrading of the network.

It is believed that the terms of reference have been covered, but we hold ourselves available if clarification is required on any of the items or points raised within this report, and to possibly assist with the discussions with the treasury department to determine the allocation of the expenditure in terms of the Municipality's overall budget.

11.0 **ACKNOWLEDGEMENT**

The assistance of Mr Steve Cooper is gratefully acknowledged and we would like to thank the Municipality for entrusting this commission to us.

We present our report for your consideration and await your further instructions.

J.S. de Villiers Pr Tech Eng
CLINKSCALES MAUGHAN-BROWN

June 2017

ANNEXURE A

LOAD FIGURES

SCHEDULE A

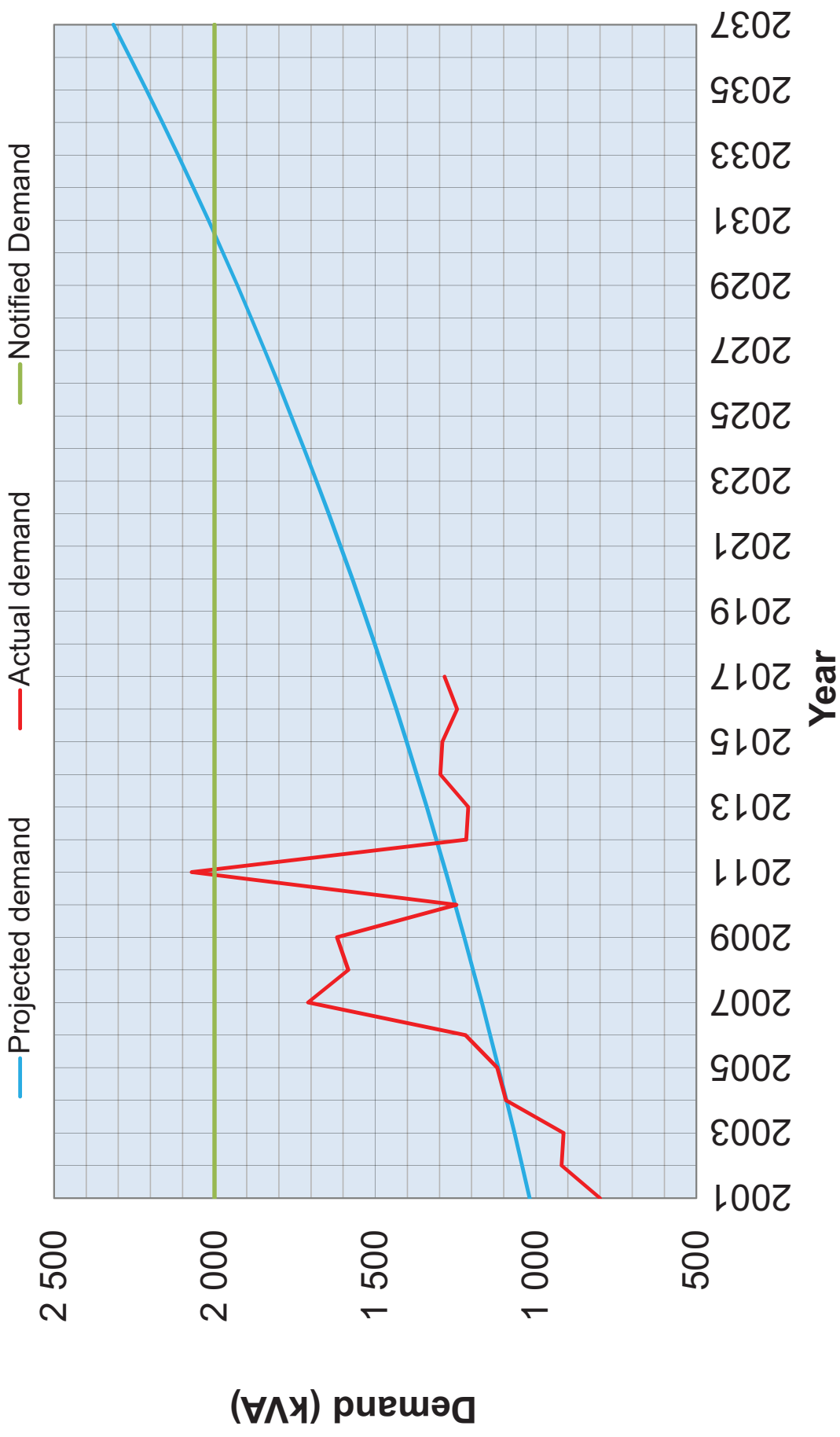
CAPE L'AGULHAS'S PEAK DEMAND (kVA) SINCE 2001 AND PROJECTED LOAD GROWTH FOR THE NEXT 20 YEARS

Year	Actual Peak kVA	Actual % Growth	Approx Projected Peak kVA
2001	800		
2002	920	15,00	
2003	914	-0,70	
2004	1 093	19,65	
2005	1 120	2,47	
2006	1 219	8,84	
2007	1 709	40,20	
2008	1 584	-7,31	
2009	1 619	2,21	
2010	1 247	-22,98	
2011	2 072	66,16	
2012	1 217	-41,26	
2013	1 210	-0,58	
2014	1 297	7,19	
2015	1 291	-0,46	
2016	1 245	-3,56	
2017	1 284	3,13	
2018			1 501
2019			1 536
2020			1 571
2021			1 608
2022			1 645
2023			1 683
2024			1 722
2025			1 761
2026			1 802
2027			1 843
2028			1 886
2029			1 929
2030			1 974
2031			2 019
2032			2 066
2033			2 144
2034			2 162
2035			2 212
2036			2 263
2037			2 315

ANNEXURE B

PROJECTED GROWTH GRAPH

L'Agulhas: Projected Load Growth



ANNEXURE C

DRAWINGS

