Royal HaskoningDHV
*Enhancing Society Together*

# Knysna Stormwater Masterplan

## PCSWMM Network Modelling Report for CBD Sub-Catchment

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Knysna Municipality

# KNYSNA STORMWATER MASTERPLAN – PCSWMM NETWORK MODELLING REPORT

## TABLE OF CONTENTS



## LIST OF FIGURES AND TABLES

# 1. INTRODUCTION

Royal HaskoningDHV was tasked to identify and record the existing Knysna stormwater infrastructure and present the information in the form of a set of planbooks as part of the Knysna Stormwater Masterplan appointment. The main objective of the survey is to have an updated recording of all the existing infrastructure, which can referenced to and updated. Further included in the Masterplan, is the modelling of the existing stormwater infrastructure using the stormwater modelling software PCSWMM in order to identify which pipe sections currently operate under high capacity.

# 2. METHODOLOGY

## 2.1. Survey of Existing Infrastructure

VPM Town Planners and Surveyors were sub-contracted to survey the existing stormwater network for the town of Knysna. Suburbs within Knysna were subdivided and categorised into phases. The order of surveying was based on the severity of network flooding within the suburbs and from recommendations from the Knysna Municipality.

| PHASE 1 | STATUS |
|---|---|
| CENTRAL BUSINESS DISTRICT | COMPLETED |
| PHASE 2 | STATUS |
| NORTHERN AREAS | |
| WITLOKASIE / FLENTERS | SURVEY COMPLETED. AWAITING INFORMATION FROM VPM |
| XOLWENI / RHOBOLOLO | |
| JOODSE KAMP | |
| ETHEMBENI | |
| CONCORDIA | |
| BONGANI / KHAYALETHU | |
| EDAMENI | |
| DAM SE BOS | |
| NEKKIES | |
| PHASE 3 | STATUS |
| EASTFORD / SIMOLA / KANONKOP | NOT STARTED |
| RHEENENDAL / KARATARA | |
| PHASE 4 | STATUS |
| BELVIDERE / BRENTON | NOT STARTED |
| BUFFALO BAY | |
| PHASE 5 | STATUS |
| SEDGEFIELD | NOT STARTED |

**Table 1: Survey Schedule**

The Central Business District was identified as the first area to be modelled.

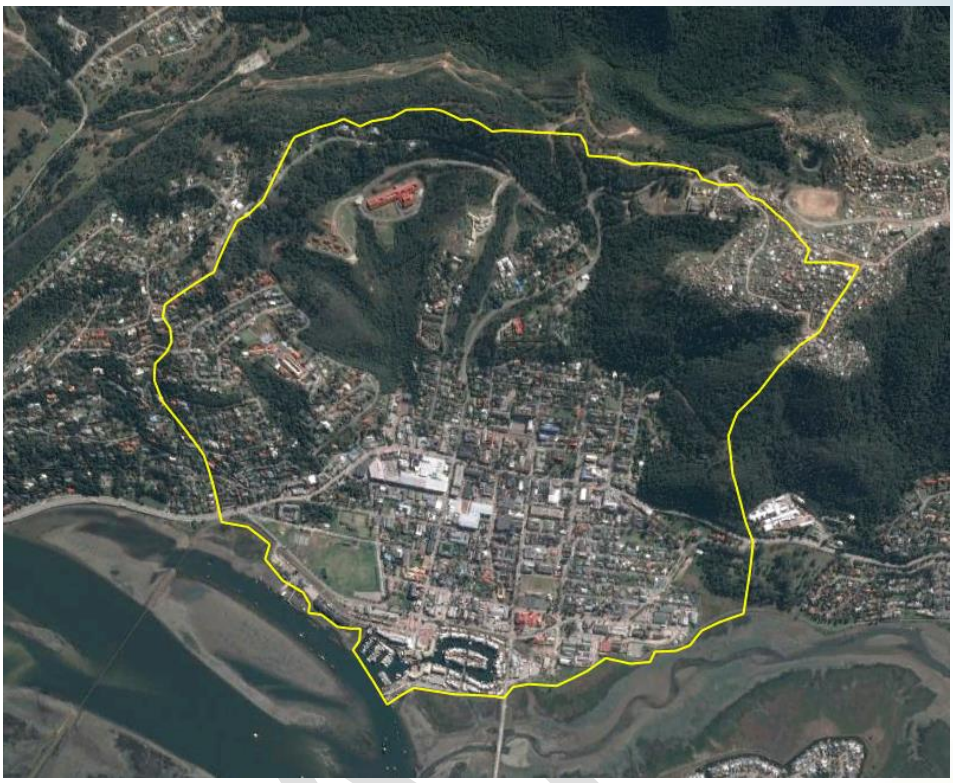

**Figure 1: CBD Catchment Area**

The catchment under consideration lies along the southern coastline of South Africa and has a Mean Annual Precipitation (MAP) of 754 mm. Due to the nature of the survey done by VPM, parts of Westhill and Heuwelkruin were included in the model, even though they do not fall under the Central Business District.

## 2.2. GIS Conversion

The information attained from the survey was then converted and migrated over to a Geographic Information System (GIS). Within this system, the location all the surveyed manholes along with their invert and cover levels, connecting pipes diameters and lengths were presented in a map format.

It was from the GIS information that the planbooks, showing the location of all the picked up existing stormwater infrastructures, were created.

## 2.3. PCSWMM Modelling

Using the GIS information, the manhole and pipe location and data were imported into the stormwater modelling software; PCSWMM.

Once the layout was set, the hydrology, sub-catchment, soil infiltration, outfall tidal restrictions, pipe roughness and pipe entry and exit loss coefficients were added to the system in order to be able to accurately run the model.

| Calculation Element | Inputs |
|---|---|
| Hydrology | South Africa SCS 24h Type 1 82.9mm design storm, total rainfall = 82.9 mm, rain interval = 5 minutes, rain units = mm/hr. |
| Sub - Catchments | Slope % = 1<br>Impervious % = 85<br>N Impervious = 0.011<br>N Pervious = 0.15<br>Depression Storage Imper (mm) = 1.27<br>Depression Storage Per (mm) = 2.54<br>Percentage Routed = 95% |
| Infiltration | Curve Number method used<br>Drying Time (days) = 2<br>Conductivity (mm/hr) = 1.27<br>Curve Number = 94 |
| Outfall | Tide Gate effected |
| Grid inlet sizing | N/A |
| Pipe sizing calculations | Concrete pipes were selected. A roughness of 0.015 used for all pipes. Exit loss coefficients based on bends used. |

**Table 2: Model Inputs**

### 2.3.1. Modelling Results

The results of the model are represented in an aerial image, attached as Appendix A. The surveyed network is highlighted in green and the pipe sections that experience high surcharge volumes are highlighted in red. The pipe diameters and max flows through the red pipe sections are presented above the pipes. The details of all the flow values of the entire model are attached as Appendix B.

## 3. CONCLUSION

The model shows there are a number of pipes, approximately 340, within the Knysna CBD that experience a high level of surcharging and node flooding. This was expected as a number of pipe sections identified in the survey, consist of small pipe diameters in downstream sections of the catchment which experience the higher stormwater flows.

## 4. RECOMMENDATIONS

Based on the model, a number of pipe sections would have to be redesigned by either adjusting the slope or upsizing the pipe diameters or both. In order to accurately determine the quantity of new larger pipes required, the current stormwater network would have to be redesigned.

## 5. COSTS

Based on a rough estimate of the number of larger pipes needed and the current local Southern Cape services contractors, the cost to construct the new stormwater pipes will be **Rxxx.xxxx (EXCL. VAT)**

**DOCUMENT CONTROL SHEET**

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# 6. APPENDIX A

# 7. APPENDIX B