Vadose zone classification and aquifer vulnerability of the Molototsi and Middle Letaba Quaternary Catchments, Limpopo Province, South Africa

By

Olma Tsakani Makonto

Student No: 29709751

Course Code: IGL 890

A dissertation submitted to the Department of Geology in partial fulfilment for the Degree of Master of Sciences in Engineering and Environmental Geology

Department of Geology

School of Physical Sciences

University Pretoria

Supervisor : Mr M.A Dippenaar

Co-supervisor : Mr Y. Van Wyk

January 2013

Declaration

I, **Olma Tsakani Makonto** hereby declare that this dissertation for the *Magister Scientia* in Engineering and Environmental Geology (specialisation option: Hydrogeology) of the University of Pretoria, submitted by me has never been previously submitted for a degree at this or any other University, and that it is my own work, and that all reference materials contained herein have been duly acknowledged.

……………………........ ……………………….............

Signature Date

Abstract

The aquifer vulnerability of the Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments was assessed to determine the influence of the vadose zone on the groundwater regime. Anecdotal evidence indicated that the aquifers may be vulnerable to pollution. The aquifer vulnerability was assessed by developing a new method RDSS. The RDSS method was developed by combining relevant vulnerability parameters of DRASTIC, GOD, EPIK, SEEPAGE, COP and SINTACS. RDSS evaluates the vadose zone as a pathway for pollutants by using the following four parameters namely: **R**echarge, **D**epth to water table, **S**oil type and **S**lope. Recharge was estimated using the Chloride-mass balance method. Depth to water table was measured in the field using a dipmeter. For inaccessible boreholes, data was requested from Groundwater Project Consulting Company. The seepage behaviour (soil type) was determined using parameters such as hydraulic conductivity, infiltration and percolation. Percolation and hydraulic conductivity was determined by undertaking percolation tests in accordance with SABS 0252-2:1993. Infiltration was determined using the double ring infiltrometer. Slopes were determined from the digital elevation method using ArcGIS software. High recharge was revealed in the lower parts of both B81G and B82D. Shallow depth to water level was revealed on the upper part of B82D and extended towards the lower part of B81G. Soil type relates to saturated vertical hydraulic conductivity, which was rated to be high in the northeast of B81G. Gentle (high influence due to preferential infiltration to runoff) slopes extend from the south towards the northern parts of both B81G and B82D. The four parameters (recharge, depth to water table, soil type, and slope) were overlaid using Weighted Sum, Weighted Overlay and Raster Calculator to produce the final vulnerability map. When using Weighted Overlay and Weighted Sum, rasters were given different percentages of influence in different scenarios. The Weighted Overlay tool inputs multiple rasters and sets all weights equal to 100%. The Weighted Sum tool inputs multiple rasters and sets all weight equal to 1.0. When using the Raster Calculator, rasters were evaluated by being added together without multiplying by the percentage of influence. The results obtained are discussed in detail with reference to the degree of vulnerability of these two densely populated rural areas.

Acknowledgements

I am grateful to my supervisors Mr. M.A Dippenaar and Mr. Y. van Wyk lecturers of the Department of Geology, for their guidance and sharing with me their knowledge from the beginning of my work until the end. Their availability and teachings helped me to gain knowledge. I acknowledge Mr G. Chauke, Client Service Centre, University of Pretoria, for funds arrangements. I appreciate his support, advices and encouragements. I acknowledge the National Research Foundation (NRF) and the Water Research Commission (WRC) for funding this research. I acknowledge the South African Weather Service, Department of Water Affairs and Dr. E Van Wyk for granting me permission to use the data. I acknowledge the assistance of Mr S. Nevhutanda Limpopo Department of Agriculture and Mrs E. Pretorius Department of Geography, Geoinformatics and Meteorology for GIS analysis. I would also like to thank Mr M.S Mphahlele and Mr F. Maluleke for logistic support.

I want to thank my mother Mphephu Joyce Rikhotso for availability and support from the first day of my studies until the end. I would like to thank all members of Department of Geology for the love they showed me. I thank this department for assistance throughout the project. I would like to thank all my classmates for unity and support throughout the study. Above all things I thank God for the wisdom He gave me and leading to meet people who helped me to accomplish the purpose of my life.

Dedication

This project is dedicated to God Almighty to Him be all the glory.

Table of Contents

List of Figures

List of Tables

Acronyms and abbreviations

b	-	Vadose zone thickness
B81G	-	Molototsi quaternary catchment
B82D	-	Middle Letaba quaternary catchment
Clgw	-	Mean annual chloride from groundwater
CMB	-	Chloride-Mass Balance
COP	-	Flow concentrations, Overlying layers, Precipitation
DEM	-	Digital Elevation Method
DRASTIC	-	Depth to water table, Net recharge, Aquifer media, Soil media, Topography, Impact of vadose zone, Hydraulic conductivity
DRI	-	Double Ring Infiltrometer
DWA	-	Department of Water Affairs
E	-	Epikarst
EPIK	-	Epikarst, Protective cover, Infiltration, Karst network development
ESRI	-	Environmental Systems Research Institute
GIS	-	Geographic Information Systems
GOD	-	Groundwater occurrence, Lithology of overlying layers, Depth to groundwater (in unconfined or confined condition)
GPM	-	Groundwater Project Management Consulting Company
GRIP	-	Groundwater Resource Information Project.
h	-	Hour
$\Delta \mathbf{h}$	-	Change in head
$\Delta \mathbf{h}_i$	-	Distance of infiltration

I	-	Infiltration
K	-	Hydraulic Conductivity
MAP	-	Mean Annual Precipitation
mbgl	-	Metres Below Ground Level
mg/l	-	Milligram per litre
PI	-	Protective cover, Infiltration Condition
Q	-	Steady state flow rate
r	-	Radius
R_T	-	Total recharge
RDSS	-	Recharge, Depth to water table, Soil type and Slope
SINTACS	-	Soggiacenza (aquifer depth), Infiltrazione (Seepage water input), Non saturo (Unsaturated zone features; grain size, texture, mineral composition, faulting and karstification), Tipologia della copertura (Soil type), Acquifero (Hydro-geological characteristics of aquifer), Conducibilitá (Aquifer hydraulic conductivity), Superficie topografica (Roughness of land surface)
SEEPAGE	-	System for Early Evaluation of Pollution potential of Agricultural Ground-water Environments
t	-	Time
TD	-	Total atmospheric chloride deposition
WMA	-	Water Management Area

CHAPTER 1: INTRODUCTION

1.1 Background

The vadose zone is the portion of the geological profile above the groundwater (phreatic) surface (Poehls and Smith, 2009). It is often called the 'unsaturated zone' or 'zone of aeration'. According to Boulding and Ginn (2004), the vadose zone is also the significant reservoir for the capture, storage and release of contaminants.

According to Babiker *et al.*, (2005) vulnerability assessment has been recognised for its ability to delineate areas that are more likely than others to become contaminated as a result of anthropogenic activities. Once the areas susceptible to contamination are identified, it can be targeted for careful land-use planning, intensive monitoring and prevention of groundwater contamination.

The work contained in this dissertation forms part of the project funded by the Water Research Commission (WRC) of South Africa. The WRC granted the project to a group of researchers, entitled *Preliminary Vadose Zone Classification Methodology (Molototsi and Middle Letaba Quaternary Catchments).* The focus of this thesis within the framework is to look at classifying the vadose zone and determining its vulnerability to contaminants in the Molototsi and Middle Letaba Water Management Areas. Molototsi and Middle Letaba are located in Limpopo Province of South Africa.

1.2 Rationale

Ground-based sanitation systems, cemeteries and waste sites may cause groundwater contamination which result in poor groundwater quality. This was in accordance with the results found by Witthüser *et al.*, (2011) during the WRC project entitled *Determining Sustainable Yields of Potential Productive Well Fields in the Basement Aquifers of the Limpopo Province.* Protection of groundwater resources makes it important to classify vadose zone and determine the vulnerability of the aquifer to contamination. The aquifer vulnerability was assessed by developing a method RDSS by combining relevant parameters from aquifer vulnerability assessment methods such as DRASTIC, GOD, EPIK, SEEPAGE, COP and SINTACS. The vadose zone must be classified since it is the pathway for the transport of contaminants into the aquifer. Determining the vulnerability of the aquifer to contamination is important, since it helps in prevention of aquifer contamination, and thus serves as one of the groundwater management strategies.

Moreover, determining aquifer vulnerability is one of the crucial groundwater resource management techniques, since South Africa is a water scarce country (Perret, 2002). Many rural communities in South Africa depend on groundwater for survival. Therefore determining the vulnerability is a way to potentially prevent contamination and thereby ensuring safe sources of potable water.

1.3 Objectives

The objectives of this research are:

1. Assess the vadose zone as a pathway for contamination from surface (vulnerability)
2. Deduce a method for quantifying aquifer vulnerability to contamination.
3. Compare various GIS approaches to assess aquifer vulnerability.

1.4 Research Hypothesis

Aquifers are vulnerable to contamination by human activities. Classification of the vulnerability to contamination forms the basis of this research and may be a way to better reveal the extent to which different areas are more or less vulnerable than others. The method should also reveal why some areas are more vulnerable than others.

CHAPTER 2: LITERATURE REVIEW

2.1 Preamble

The main aim of this chapter is to review relevant literature on vadose zone classification and aquifer vulnerability. A review was done by examining published literature on vadose zone classification and aquifer vulnerability. Books, scientific journals, both private and government reports, and internet sources were used for this review. Information from these sources was extracted and used to compare the problem in the area of study and in the field of study with those in other areas (global, continental, national, regional, provincial and local).

2.2 Vadose Zone Classification

The subsurface occurrence of groundwater may be divided into the zones of aeration (vadose) and saturation (Todd and Mays, 2005). The vadose zone is the unsaturated subsurface region between the land surface and groundwater table (Flury and Wai, 2003). The vadose zone consists of voids occupied partially by liquids (water) and partially by gas (air). The vadose zone can further be divided into three major subdivisions which are the soil water or root zone, intermediate zone and capillary zone (Figure 1, Dippenaar *et al.*, 2005).

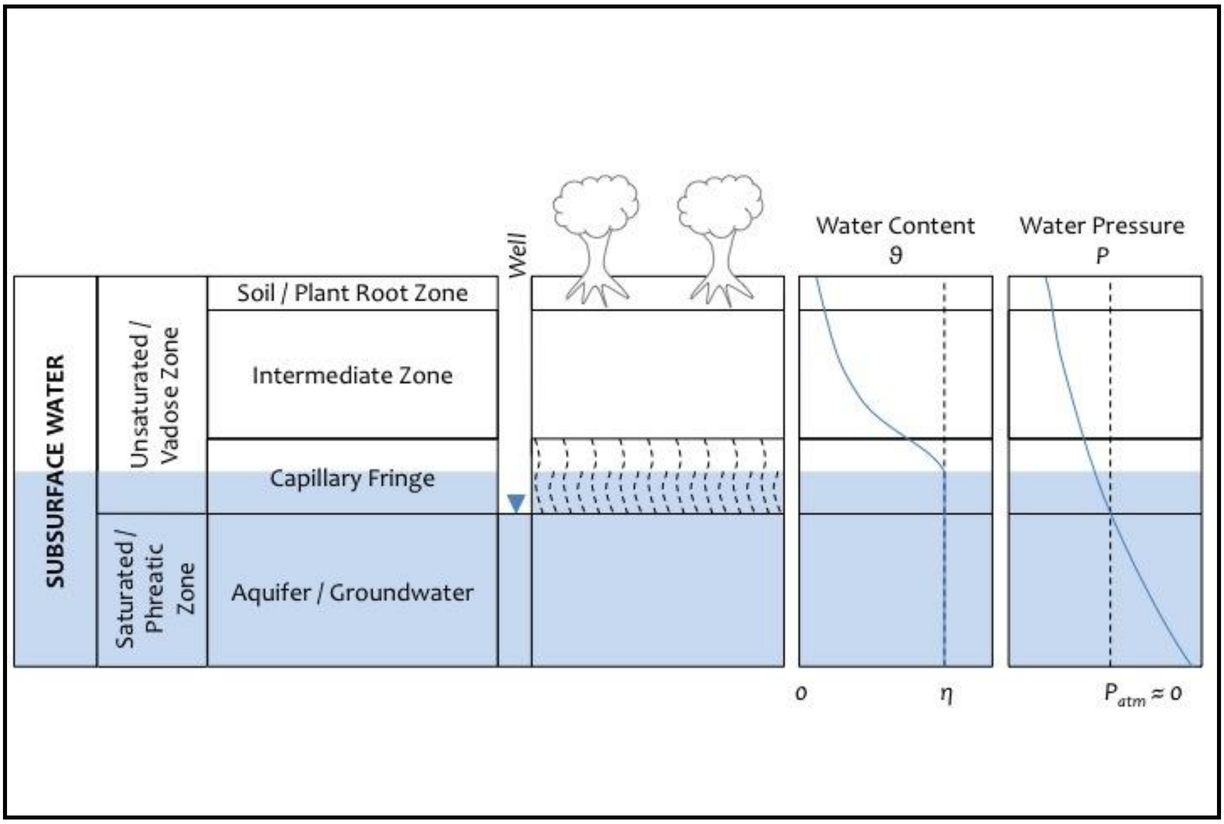

Figure 1: Vertical distribution of subsurface water (Dippenaar *et al.*, 2005).

2.2.1 Soil Water Zone / Root Zone

This zone lies between the ground surface and the maximum depth to which the roots penetrate (Boulding and Ginn, 2004). The quality and the quantity of moisture in this zone are dependant on the amount of water evapo-transpired with high evapotranspiration reducing soil moisture content (ratio of mass of water to mass of wet material) (Kraszewski *et.*, 1997). This zone is important for agriculture since the soil water supplies moisture to plant roots.

2.2.2 Intermediate Zone

The intermediate zone extends from the lower edge of the soil water zone to the upper limit of the capillary fringe (Todd and Mays, 2005). The pores in this zone are filled with air and water.

This zone contains residual moisture (referring to that water which is available in soil that will not contribute to liquid flow due to blockage in flow paths or strong adsorption onto solid phase) which is determined by the matric potential (Boulding and Ginn, 2004). Boulding and Ginn further indicated that the amount of water held by matric potential is low in course grained material (sand and gravel) and high in fine grained materials (clay).

2.2.3 Capillary Fringe

This zone marks the final transition between the vadose zone and the saturated zone (Boulding and Ginn, 2004). It extends from the water table upwards to the limit of the capillary rise of water (Todd and Mays, 2005). In the capillary zone voids are filled with air and water with matrix forces holding water in the soil due to the attractive forces of water to solids and the surface tension of water. The water fills the small pores, while the air fills the large pores in the soil (Van Schalkwyk and Vermaak, 2000).

2.3 Aquifer Vulnerability

2.3.1 Defining Vulnerability

According to Babiker *et al.,* (2005) the concept of aquifer vulnerability can be defined as the possibility of percolation and diffusion of contaminants from ground surface into the groundwater system. The contamination may be due to anthropogenic and natural impacts. Two types of vulnerability are recognised: intrinsic (or natural) and specific (integrated) vulnerability (Ibe *et al.*, 2001). Intrinsic vulnerability is the term used to define the vulnerability of groundwater to contaminants generated by human activities (Daly *et al.*, 2002). It takes account of the geological, hydrological, and hydrogeological characteristics of the area, but is independent of the nature of contaminants. Specific vulnerability is defined as the vulnerability of groundwater to a particular contaminant or group of contaminants (Daly *et al.*,

2002) and takes into account the properties of contaminants and their relationships with various components of intrinsic vulnerability.

Groundwater is gaining increasing attention as a source of water supply owing to its relatively low susceptibility to pollution in comparison to surface water and the relatively large storage capacity of the aquifers (Melloul and Collin, 1998). According to Babiker *et al.*, (2005) to ensure that the groundwater (aquifer) remains as a source of water for the area, it is necessary to estimate whether certain locations are more susceptible to receive and transmit pollution. The concept of aquifer vulnerability creates awareness of aquifer contamination and such vulnerability assessments can provide a screening tool to focus effort on prevention of groundwater contamination (Edet, 2004). According to Voss and Tesoriero (1997) identification of areas that are susceptible to contamination is an important tool for land use planners and environmental regulators since additional precautions can be taken in these areas to minimize groundwater contamination. Vulnerability assessments are also useful for water suppliers. Development of new supplies may be curtailed, and more frequent sampling of existing supplies may be required in risk areas.

The importance of aquifer vulnerability maps lies in its ability to be an effective preliminary tool for planning, policy and operational levels of decision-making (Baalousha, 2006). This helps planners to protect groundwater as an essential economic resource and to act as a foundation for the designation of protection zones (Robins *et al.,* 2007). Vulnerability assessments offer valuable information in development of groundwater protection strategies, identification of areas for land use restriction, assessment of the potential impact of land use alteration on groundwater contamination, establishment of priorities for groundwater monitoring and detailed studies, establishment of priorities for measures such as remediation, and public awareness campaigns to educate for instance on danger of agrochemical misuse in their water sources. The identified vulnerable areas may then be subjected to land use restriction or targeted for greater attention in order to protect the underlying groundwater (Metni *et al.*, 2004).

The concept of aquifer vulnerability is based on the assumption that the physical environment may provide some degree of protection of groundwater against natural impacts, especially with regard to contaminants entering the subsurface environment (El Naga, 2004). Vulnerability depends on the characteristics of the site and assumes that differing soil and hydrogeological conditions will give differing levels of vulnerability and afford different degrees of protection of the underlying aquifer (Worrall *et al.*, 2002). The intrinsic vulnerability concept is independent of the nature of pollutants; and is a function of the locality.

According to Edet (2004) the most important parameters affecting aquifer vulnerability to pollution include saturated thickness of the aquifer, depth to groundwater level, lateritic layer thickness and the aquifer media character. Due to a thin vadose zone, as well as preferential flow through regolith, cracks and macropores, contaminants can easily reach the groundwater (Chilton and Foster, 1995). Karst aquifers are generally considered to be vulnerable to pollution because of their unique heterogeneous structure and can be considered as a network of conduits of high permeability (Doerfliger *et al.*, 1999).

2.3.2 Methods of Assessing Vulnerability

According to Worral and Besien (2004) there are three approaches to vulnerability assessment; (i) index methods which combine specific characteristics that are taken as controlling vulnerability; (ii) modelling approaches using physically-based methods to approximate contaminant transport; and (iii) statistical methods that correlate contaminant occurrence with properties of the area. In this study index methods are chosen due to their simplicity (Aljazzar, 2010). Index methods have been developed because of the lack of monitoring data and due to the limitation to obtain more hydrogeological information. Modelling approaches are complex and require large datasets. However, the lack of physically-based and precise representation has also some drawbacks. Choosing a statistical approach is directly affected by data availability. According to Aljazzar (2010) the statistical significance of the results can be explicitly calculated. This provides a measure of uncertainty in the method. The disadvantage is that statistical methods are difficult to develop. There are different methods developed for aquifer vulnerability assessment which include: DRASTIC, GOD, EPIK, SEEPAGE, COP, PI and SINTACS (Table 1).

Table 1: Parameters involved in different selected methods of vulnerability assessment.

Method	Parameters included	References
DRASTIC	Depth to water table Net recharge Aquifer media Soil media Topography Impact of vadose zone Hydraulic conductivity	(Thirumalaivasan *et al*., 2003)
GOD	Groundwater occurrence Lithology of overlying layers Depth to groundwater (in unconfined or confined condition)	(Gogu and Dassargues, 2000a)
EPIK	Epikarst Protective cover Infiltration Karst network development	(Gogu and Dassargues, 2000b)
SEEPAGE	Soil slope Depth to water table Vadose zone material Aquifer material Soil depth Attenuation potential	(Muhammetoglu and Yardimci, 2006)
COP	Flow concentrations Overlying layers Precipitation	(Vías *et al*., 2006)
PI	Protective cover Infiltration condition	(Gogu and Dassargues, 2000a)
SINTACS	Soggiacenza (Aquifer depth) Infiltrazione (Seepage water input) Non saturo (Unsaturated zone features; grain size, texture, mineral composition, faulting and karstification) Tipologia della copertura (soil type) Acquifero (Hydrogeological characteristics of aquifer) Conducibilitá (aquifer hydraulic conductivity) Superficie topografica (Roughness of land surface)	(Civita and De Maio, 2004)

The DRASTIC Method

According to Lin *et al*., (1998) DRASTIC is one of the most widely used indices for aquifer vulnerability assessment. It is amongst the earliest to be used and it is still favoured by many state and local regulatory and planning agencies. The DRASTIC method has appeared to be a standardized system for evaluating aquifer vulnerability to contamination (Al-Hanbali and

Kondoh, 2008). The DRASTIC method employs a scoring system for aquifer susceptibility assessment (Voss and Tesoriero, 1997) and uses the parameter ratings and weightings to compute the DRASTIC index. Table 2 indicates the original and modified DRASTIC weight as applied by Panagopoulos *et al.*, (2006).

Table 2: Original and modified weights of DRASTIC factors (Panagopoulos *et al.*, 2006).

Parameter	Original Weight	Modified Weight
Depth to water table (D)	5	3
Net recharge (R)	4	1
Aquifer media (A)	3	5
Soil media (S)	2	_
Topography (T)	1	2
Impact of vadose zone (I)	5	2.5
Hydraulic conductivity (C)	3	_

The parameters are combined according to Equation 1 to obtain the final DRASTIC index (D_i), which can then be used to identify areas that are more prone to groundwater pollution relative to other areas (Leyland *et al.*, 2008).

$$D_i = D_r D_w + R_r R_w + A_r A_w + S_r S_w + T_r T_w + I_r I_w + C_r C_w$$ **Equation 1**

Where *r* represents the rating‘s value, and *w* the weight assigned to each parameter.

According to Babiker *et al.*, (2005) the DRASTIC method has certain advantages and limitations as indicated in Table 3.

Table 3: Advantages and disadvantages of DRASTIC method.

Advantages	Disadvantages
• DRASTIC uses a large number of parameters (seven) to compute vulnerability index, which ensures the best presentation of hydrogeological settings (Babiker *et al.*, 2005). • The numerical ratings and weights are well defined and are used worldwide (Babiker *et al.*, 2005). • DRASTIC allows the pollution of any hydrogeological setting to be systematically evaluated (Aller, 1987). • According to Neukum and Hötzl (2007) the DRASTIC method is independent of the aquifer type. • The DRASTIC method has the advantage of selecting the significant variables and their relative importance based on the occurrence of contaminants in groundwater in a given area (Voss, 1997). • Its main advantages also include prior experience since 1984 and the relatively accessible and available data it requires (Metni *et al.*, 2004). • It is applicable in humid as well as arid to semi-arid climates (Al-Hanbali and Kondohi, 2008).	• Although the method is good and used worldwide it also has demerits. To be effective DRASTIC requires calibration against real groundwater observation (Worrall and Besien, 2004). • The DRASTIC index provides only a relative evaluation tool and is not designed to provide absolute answers (Gogu and Dassargues, 2000a).

The GOD Method

According to Gogu and Dassargues (2000a) the GOD method is an empirical system for quick assessment of the aquifer vulnerability to pollution. It is best suited for large areas (used in land management) and it has a simple and pragmatic structure. Although the method has advantages it also has one disadvantage i.e. the overlying lithology parameter contribute to the vulnerability only in the case of unconfined aquifers.

The name of the method is based on three parameters: groundwater occurrence **(G),** overall lithology of aquifer or aquitard **(O)**, and depth to groundwater table **(D)**. The vulnerability index is calculated by the following formula (Draoui *et al.*, 2008):

$$I_{GOD} = I_G \times I_O \times I_D \qquad \textbf{Equation 2}$$

I_G, I_O and I_D represent the ratings of the three parameters used by the method and is indicated in Table 4.

Table 4: The rating values of vulnerability parameters for GOD method (Draoui *et al.*, 2008).

Parameter	Range/Rating					
G (groundwater occurrence)	Range Rating		Unconfined 1		Confined 0.6	
O (overall lithology of aquifer)	Range Rating	Gravels-pebbles 0.8	Sands 0.7	Loam sands 0.6	Marls and loams 0.5	Clays 0.4
D (depth to groundwater table)	Range (m) Rating	0-2 1	2-5 0.9	5-10 0.8	10-20 0.7	

The EPIK Method

Different methods for aquifer vulnerability assessment, including karst methods (although some parameters are irrelevant to non-karst vulnerability assessments), were reviewed in order to understand various methods used for aquifer vulnerability assessment in different hydrogeological environments. Karst aquifers and environments are highly vulnerable to contamination and to anthropogenic modification. The vulnerability of karst aquifers to contamination is due to particular characteristics such as thin soils and point of recharge in subsidence, shafts, and swallow holes (Polemio *et al.*, 2009). The EPIK method has been specifically created for the vulnerability assessment of karst aquifers (Andreo *et al.*, 2006). EPIK is an acronym for Epikarst **(E)**, Protective cover **(P)**, Infiltration conditions **(I)** and Karst network development **(K)** (Doerfliger *et al.*, 1999). A protection factor (F_P) is calculated by summing the values of the parameters E, P, I and K (each between 1 and 4) and applying a weight varying from 1 to 3 in Equation 3 (Vías *et al.*, 2005).

$$F_p = 3E + 1P + 3I + 2K$$ **Equation 3**

Table 5 indicates the rating values for the vulnerability parameters of EPIK method.

Table 5: The rating values of the vulnerability parameters for EPIK method (Vías *et al.*, 2005).

Parameter	Range/Rating			
E (epikarst)	Range Rating	Highly fractured in quarries and roads $E_1 = 1$		Rest of catchment area $E_3 = 4$
P (protection cover)	Range Rating	Leptosols and soils on quaries $P_1 = 1$	Regosols, anthrosols, calcisols $P_2 = 2$	Soils on layers that have very low hydraulic conductivity and thickness > 400 m $P_4 = 4$
I (infiltration)	Range (out of catchment area) Rating	Areas collecting runoff water (buffer 50 and 100 m) and slopes feeding those areas (slope higher than 10% for cultivated sectors and 25% for meadows and pastures) $I_3 = 3$	$I_4 = 4$	
K (karst network)	Range Rating	Triassic marbles $K_3 = 3$		

EPIK is a clear and original parameter-weighting and -rating method (Gogu and Dassargues, 2000b). The disadvantage of EPIK concerning scale is that the EPIK method needs a more detailed scale to obtain the E and I parameters, and it is advisable to use larger scale (1:25 000) to delimitate the karst landforms.

The SEEPAGE Method

According to Gogu and Dassargues (2000a) SEEPAGE is a **S**ystem for **E**arly **E**valuation of **P**ollution potential of the **A**gricultural **G**roundwater **E**nvironment and is a numerical ranking method analysing contamination potential from both concentrated and dispersed sources.

Various hydrogeological settings and soil physical properties that affect the aquifer vulnerability to pollution potential are considered: soil slope, depth to water table, vadose zone material, aquifer material, soil depth and attenuation potential. The attenuation potential further considers the following factors: texture of soil surface, texture of subsoil, surface layer, pH, organic matter content of the surface, soil drainage class and soil permeability (least permeable layer) (Muhammetoglu and Yardimci, 2006).

According to Gogu and Dassargues (2000a) a weight factor ranging from 1 to 50 is assigned to each parameter. A weight factor of 50 is assigned for the most significant parameter of the aquifer vulnerability and the weight factor of 1 is assigned for the least significant. Once the scores for the six parameters are obtained, these are summed to get the SEEPAGE Index Number (SIN). Table 6 indicates the classification of SEEPAGE Index Number (SIN) for pollution potential (Muhammetoglu and Yardimci, 2006).

Table 6: Classification of SEEPAGE Index Number (SIN) for pollution potential (Muhammetoglu and Yardimci, 2006).

SIN	**Low**	**Moderate**	**High**	**Very High**
Value	1-89	90-144	145-209	>210

The COP Method

The COP acronym comes from the three parameters of the European approach used: Flow **C**oncentration, **O**verlying layers and **P**recipitation (Polemio *et al.*, 2009). Vulnerability is assessed as the product of the three factors as shown in Equation 4 (Vías *et al.*, 2010).

$$COPIndex = C_{SCORE}.O_{SCORE}.P_{SCORE}$$ **Equation 4**

According to Vías *et al.*, (2006) the O-factor refers to the protection of the unsaturated zone of the aquifer against contaminants. It indicates the capability of the unsaturated zone to filter out contamination and thus reduce adverse effects (Andreo *et al.*, 2006). The C- and P- factors are used as modifiers that correct the degree provided by the overlying layer (O factor) (Polemio *et al.*, 2009). The C-factor takes into account the surface conditions that control water flowing towards zones of rapid infiltration, which have less capacity to attenuate contamination (Andreo *et al.*, 2006). Table 7 indicates the scores for C, O and P parameters (Vías *et al.*, 2010).

Table 7: Scores for C, O and P parameters (Vías *et al.*, 2010).

Parameter	Scores	Protection Value
C	0 - 0.2	Very High
	0.2 - 0.4	High
	0.4 - 0.6	Moderate
	0.6 - 0.8	Low
	0.8 - 1.0	Very Low
O	1	Very Low
	2	Low
	2 - 4	Moderate
	4 - 8	High
	8 - 15	Very High
P	0.4 - 0.5	Very High
	0.6	High
	0.7	Moderate
	0.8	Low
	0.9 - 1	Very Low

The COP method can be applied in different climatic conditions and different types of carbonate aquifers (diffuse and conduit flow system) and consider special hydrogeological properties of karst (Vías *et al.*, 2005). The COP method uses variables, parameters and factors in line with those proposed in the European Approach and can be applied using different levels of available data (Vías *et al.*, 2006). The COP method has since been adapted for South Africa (Leyland, 2008).

The PI Method

PI is an acronym for Protective cover **(P)** and Infiltration condition **(I)** and the vulnerability is assessed as the product of these two factors as shown in Equation 5 (Goldscheider, 2005):

$$\pi = P \times I$$ **Equation 5**

Where π is the protection factor.

The P-factor describes the protective function of all layers between the ground surface and the groundwater table: soil, sub-soil, non-karst rock and unsaturated karst rock. P = 1 for a very low degree of protection, and 5 for very thick protective overlying layers (Andreo *et al.*, 2006). The I-factor (Infiltration conditions) describes the degree to which the protective cover is bypassed as a result of surface and shallow subsurface flow in the catchment of swallow holes (Goldscheider, 2005). It takes into account the soil properties controlling runoff generation, the vegetation and the slope gradient. It ranges between 0 (swallow holes, sinking streams, and steep slopes generating surface runoff) and 1 (diffuse infiltration and percolation) (Andreo *et al.*, 2006). Table 8 indicates the common legend for the vulnerability map, the P-map and I-map (Mimi and Assi, 2009).

Table 8: Common legend for the vulnerability map, the P-map and I-map (Mimi and Assi, 2009).

	Vulnerability map vulnerability of groundwater		**P-Map protective function of overlaying layers**		**I-Map degree of bypassing**	
	Description	**π-Factor**	**Description**	**P Factor**	**Description**	**I Factor**
Red	Extreme	0-1	Very low	1	Very high	0.0-0.2
Orange	High	>1-2	Low	2	High	0.4
Yellow	Moderate	>2-3	Moderate	3	Moderate	0.6
Green	Low	>3-4	High	4	Low	0.8
Blue	Very low	>4-5	Very low	5	Very low	1.0

The PI method is applicable to all types of aquifer and provides specific methodological tools for karst (Andreo *et al.*, 2006). The PI method has the disadvantage of requiring detailed data and it classifies all areas made of bare karren fields as zones of very high vulnerability. It is applicable to areas of both autogenic and allogenic recharge.

The SINTACS Method

According to Civita (2010) the acronym SINTACS comes from the Italian names of the factors that are used, *i.e.* **S**oggiacenza (Aquifer depth), **I**nfiltrazione (Seepage water input), **N**on saturo (Unsaturated zone features; grain size, texture, mineral composition, faulting and karstification), **T**ipologia della copertura (soil type), **A**cquifero (Hydrogeological characteristics of aquifer), **C**onducibilitá (aquifer hydraulic conductivity) and **S**uperficie topografica (Roughness of land surface). The vulnerability index for each cell is computed as per Equation 6:

$$I_{SINTACS} = \sum_{i=1}^{7} P_j W_j \qquad \textbf{Equation 6}$$

Table 9 indicates SINTACS weights for different strings in accordance with Edet (2004).

Table 9: SINTACS weights for different strings (Edet, 2004).

Parameter	Normal I	Severe I	Seepage	Karst	Fissured	Nitrates
S	5	5	4	2	3	5
I	4	5	4	5	3	5
N	5	4	4	1	3	4
T	3	5	2	3	4	5
A	3	3	5	5	4	2
C	3	2	5	5	5	2
S	3	2	2	5	4	3

The SINTACS method is derived from the DRASTIC method and has been developed for vulnerability assessments and mapping requirements (medium and large-scale maps) (Civita and De Maio, 2004). SINTACS uses seven parameters like DRASTIC but the rating and weighting procedure is more flexible. It provides four weight classifications but it also allows creation of new ones. Having good precision and flexibility, the SINTACS method is much more effective in detailed studies. The SINTACS method is able to distinguish degrees of vulnerability at regional scales where different lithologies exist, but it is much less effective at assessing the vulnerability of carbonate aquifers as it does not take into account the peculiarities of karst (Vías *et al.*, 2006). Relatively simple methods could provide similar results to the complex ones. Thus, with the SINTACS method, which uses seven parameters, it is possible to obtain a vulnerability map similar or with even fewer classes than the one obtained by the GOD method, which only uses three variables (Vías *et al.,* 2005).

2.3.3 The Geographic Information System (GIS) in Vulnerability Assessment

Hydrogeological investigations and interpretation entered a new era with the advent of GIS. GIS is a computer-based system that is designed to capture, store, retrieve, manipulate and integrate spatial data (Aljazzar, 2010). Within the constraints of uncertainty, Geographic Information Systems (GIS) are commonly used in the application of vulnerability assessment due to their ability to handle both spatial and attribute data, and because it can interactively perform queries and associations (Metni *et al.*, 2004). According to Robins *et al.,* (2007) GIS allows different sets of data to be combined to produce vulnerability evaluations.

2.3.4 Vadose Zone Classification and Aquifer Vulnerability in Limpopo Province, South Africa and Globally

In South Africa, a study on the geotechnical and hydrogeological characterisation of residual soils in the vadose zone of Midrand in Gauteng was done by Vermaak (2000). This can be linked to vulnerability assessment as the characterisation of the vadose zone is in effect related to its ability to protect the phreatic zone from contamination. Similar studies – including an understanding of the vadose zone and aquifer vulnerability – are necessary in Limpopo Province due to the large number of boreholes being used for rural water supply purposes. This will increase knowledge about aquifer vulnerability and create awareness on the importance of aquifer vulnerability.

It is important to determine aquifer vulnerability before a known source of contamination can be investigated. This will assist decision makers to plan in advance how to protect aquifers from contamination. Globally, a lot of studies on aquifer vulnerability have been undertaken, but in most of the studies aquifer vulnerability was assessed when there was a known source of pollution. For example Stigter *et al.,* (2005) assessed aquifer vulnerability where there was known fertilizer pollution from agricultural areas.

Numerous studies were done, however methods such as DRASTIC, GOD, EPIK and SINTACS which were developed by Aller *et al.,* (1987); Foster (1987); Doerfliger and Zwahlen (1997) and Civita and De Maio (2004) were used. For example, Antonakos and Lambrakis (2007) researched the development and testing of the three hybrid methods for the assessment of aquifer vulnerability to nitrates, based on the DRASTIC method. Gogu and Dassargues (2000b) evaluated the sensitivity analysis for the EPIK method of vulnerability assessment in a small karstic aquifer in Southern Belgium.

CHAPTER 3: METHODOLOGY

3.1 Assessing the Vadose Zone as a Potential Pathway for groundwater Contamination

The possibility of contaminants moving through the vadose zone was determined by developing a new method, RDSS. It is important that new methods be developed when assessing aquifer vulnerability other than repeating the same methods which has been used by other authors because study areas differ with physical characteristics, and some methods will only be suitable for specific study areas. For example, EPIK is a method designed for karst aquifers only. This makes EPIK unsuitable for this area of study, since its geology is not comprised of karst aquifers. DRASTIC and SINTACS require a lot data which is not available in this study area, making these methods unsuitable for this study area. A new method has subsequently been developed with the selected parameters being readily available through field measurements and application of GIS, and as the other parameters may be redundant for this area of study. These parameters (**R**echarge, **D**epth to water table, **S**oil type and **S**lope) were presented using ArcGIS 9.3.1.

3.2 Parameters for Assessing Aquifer Vulnerability

3.2.1 Recharge

Recharge is the amount of water which penetrates the ground surface and reaches the water table (Babiker *et al.*, 2005). According to de Vries and Simmers (2002), recharge is defined as the downward flow of water reaching the water table, forming an addition to the groundwater reservoir. One mechanism is downward percolation by soil water in excess of soil moisture deficit and evapotranspiration (infiltration excess). Recharge can be broadly defined as the water that reaches an aquifer from any direction (down, up or laterally) (Scanlon *et al.*, 2002).

According to Sophocleous (2004) the sources of recharge to groundwater systems include both natural and human induced phenomena. Natural sources include recharge from precipitation, lakes, ponds, and rivers (including perennial, seasonal, and ephemeral flows), and from other aquifers. Human induced sources of recharge include irrigation losses from canals and fields, leaking water mains, sewers, septic tanks, and over irrigation of parks, gardens, and other public amenities. Recharge from these sources has been classified as direct recharge from percolation of precipitation and indirect recharge from runoff ponding. Other classifications include localized or focused recharge, preferential recharge, induced recharge, mountain front recharge, etc.

Direct or diffuse recharge is defined as water added to the groundwater reservoir in excess of soil moisture deficits and evapotranspiration, by direct vertical percolation of precipitation through the unsaturated zone i.e. recharge below the point of impact of the precipitation (Lerner, 2002). Indirect recharge results from percolation to the water table following runoff and localization in joints, as ponding in low-lying areas and lakes, or through the beds of surface water courses (DWAF, 2006). Localised or focused recharge is the recharge from horizontal surface concentration of water in the absence of well-defined channels, such as recharge through sloughs, and potholes (Sophocleous, 2004). Mountain front recharge involves complex processes of unsaturated and saturated flow in fractured rocks, as well as infiltration along channels flowing across alluvial fans (DWAF, 2006). Preferential recharge is the resulting recharge of the flow through macropores (Sophocleous, 2004).

According to Fetter (2001) the rate at which the water table recharges depends on the thickness of the vadose zone, topography and vegetation. Where the vadose zone is thinner, recharge can reach the water table quickly. Soil moisture percolating through the vadose zone beneath the upland areas takes longer to reach the water table than lowland areas. Recharge is much greater in vegetated than in non-vegetated regions and greater in areas of annual crops and grasses than in areas of trees and shrubs (Scanlon *et al.*, 2002). Figure 2 indicates the main factors controlling groundwater recharge (DWAF, 2006).

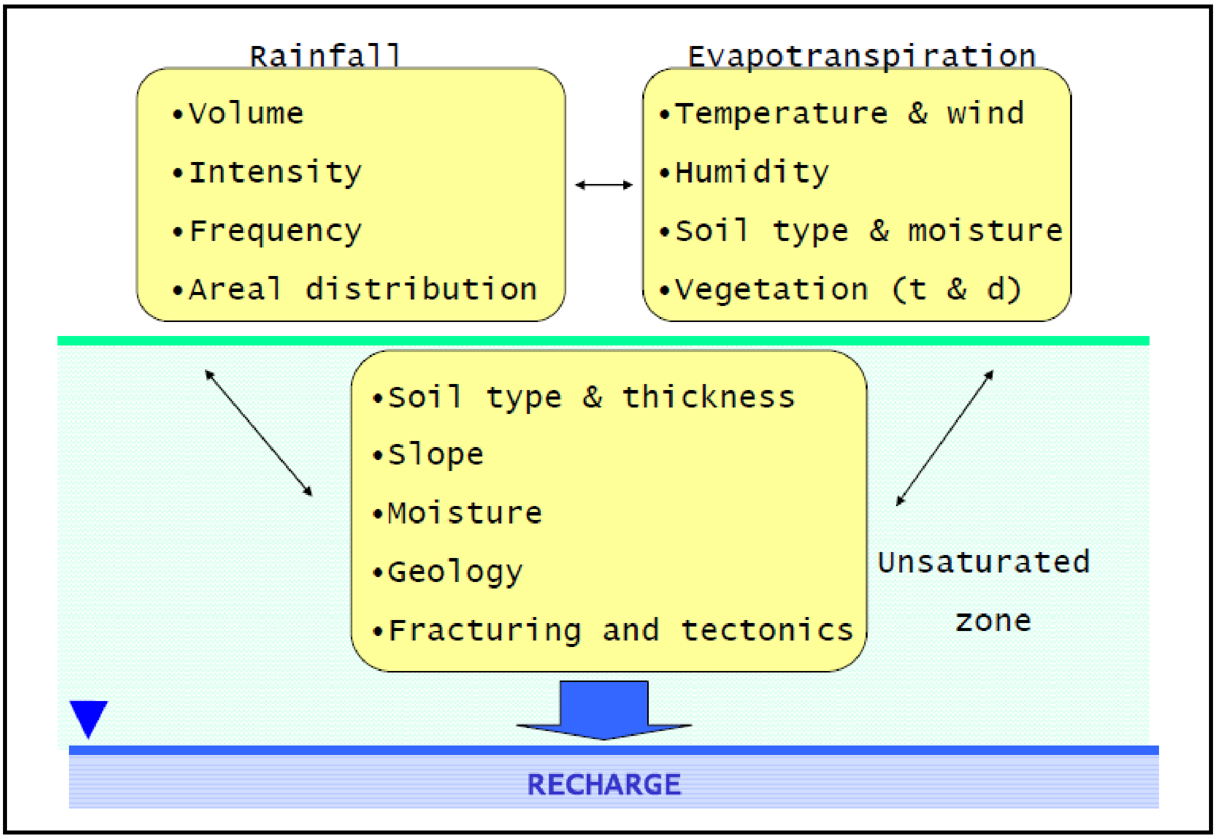

Figure 2: The main factors controlling groundwater recharge (DWAF, 2006).

Recharge water represent the vehicle for transporting pollutants (Babiker *et al.*, 2005). Recharge was chosen as a RDSS parameter since it determines the amount of water that reaches the aquifer. There are various methods for recharge estimation as shown in Table 10 (Sophocleous, 2004).

In this study, recharge was estimated using the Chloride Mass Balance (CMB) method because of the ready availability of the required input data. According to Wood (1999), CMB is based on the following assumptions:

- Chloride in groundwater originate from precipitation only and directly on the aquifer
- The chloride is conservative in the system.
- The chloride-mass flux is constant with time
- Chloride within the aquifer is not concentrated or recycled.

Table 10: Methods for recharge estimation (Sophocleous, 2004).

Method/Model	Category	Required input data		Calibration
		Climatic	Soil moisture and groundwater	
One-dimensional soil water flow model (SOIL)	Inflow	Precipitation, temperature, wind speed, relative humidity.	Soil water retention properties, hydraulic conductivity, groundwater outflow.	Measured groundwater levels.
Soil moisture budget model	Inflow	Precipitation, temperature, wind speed, relative humidity.	Size of soil moisture reservoir, soil moisture recharge relation.	Soil water flow model.
Chloride concentration	Aquifer response	Precipitation, wet and dry deposition of chloride.	Concentration of chloride in groundwater.	
Spring discharge	Out flow		Spring discharge, size of catchment area.	
Catchment area model (PULSE)	Outflow	Precipitation, temperature, potential, evapotranspiration.	Size of soil moisture reservoir, soil moisture recharge relation, outflow from the groundwater reservoir.	Spring discharge

Recharge can be calculated using the relationship shown in Equation 7 (e.g. Witthüser *et al.* 2011).

$$R_T = \frac{TD \times MAP}{Cl_{gw}}$$ **Equation 7**

Where: R_T = total recharge (mm/a)

TD = total atmospheric chloride deposition (mg/l)

MAP = mean annual precipitation (mm/a)

Cl_{gw} = mean annual chloride from groundwater (mg/l)

The total atmospheric chloride deposition (TD) data was requested from Dr. Eddie Van Wyk from the Department of Water Affairs (Van Wyk, 2010). Data for mean annual precipitation was requested from the South African Weather Service and data for mean annual chloride from groundwater was requested from the Department of Water Affairs.

3.2.2 Depth to water table

The depth to water table is defined as the distance from the ground surface to the water table (Al-Zabet, 2002). Al-Zabet (2002) further indicates that the depth to the water table is important as it determines the thickness of the material through which contaminants travel before reaching the aquifer. The deeper the water table, the less the chance of contamination because contaminants will take a longer time to reach the water table (Babiker *et al.,* 2005). The depth to the water table is obtained by measuring the distance between the land surface and the phreatic surface in a borehole.

A dipmeter was used to determine the depth to the water table. The device consists of a two-wire coaxial cable that has an electrode separated by an air gap at the lower end (MacDonald *et al.*, 2005). When both electrodes are submerged it is indicated by a light or buzzer. In accordance with MacDonald *et al.*, (2005) the cable is graduated so that the depth to the water table can be read directly from the cable. Not all boreholes were accessible during the site visit as some boreholes are sealed. For inaccessible boreholes, the depth to water table data was requested from the Groundwater Project Management Consulting Company (GPM, 2010).

3.2.3 Soil Type

Soil typically represents the upper weathered portion of the vadose zone and controls the amount of water that can infiltrate downwards (Babiker *et al.*, 2005). Soil type refers to the grain size distribution (grading-related) in terms of clay, silt, sand and gravel content (Dippenaar *et al.*, 2010). The pollution potential of the soil is affected by the type of clay present, the shrinking/swell potential of the clay, grain size distribution of the soil and organic material present. Soil has a significant impact on the amount of recharge that can infiltrate into the ground. In general, the less the clays shrink and swell and the finer the grain size, the less likely contaminants will reach the water table (Aller *et al.*, 1987).

For the purpose of this research, soil type is referred to and is assessed by determining parameters such as infiltration, percolation and hydraulic conductivity as this directly relates to the soil texture and structure. According to Pfannkuch (1969), infiltration is the flow of water through the soil surface into the subsurface and percolation is the movement of water through unsaturated interior pore spaces.

In 1856, a French hydraulic engineer named Henry Darcy described an experiment designed to study the flow of water through porous media (Deming, 2002). From the experiment Darcy found that one dimensional flow of water through a pipe filled with sand was proportional to the cross-sectional area and the head loss along the pipe and inversely proportional to the flow length (Fetter, 2001). Darcy‘s experiment resulted in the formulation of a mathematical law which states that the rate of fluid flow through a porous medium is proportional to the potential energy gradient within that fluid (Deming, 2002). The constant of proportionality is the hydraulic conductivity.

According to Alyamani and Şen (1993) hydraulic conductivity is a measure of the ease with which fluid flows through a porous material. The hydraulic conductivity represents the ability of a porous medium to transmit water through its interconnected voids. It is a function of the medium and the fluid flowing through it (Boulding and Ginn, 2004).

Darcy‘s law and the interrelationship with hydraulic conductivity is shown in Equation 8. The hydraulic gradient is calculated as the change in hydraulic head, *dh*, over the change in distance, *dl*, between two points of observation.

$$Q = KiA$$ **Equation 8**

Therefore $K = \frac{Q}{A}.i = \frac{Q}{A}.\frac{dl}{dh}$

Where: $Q =$ Discharge [L^3 / T]

$K =$ Constant of proportionality = hydraulic conductivity [L / T]

$A =$ Cross-sectional through flow area [L^2]

dh = Change in hydraulic head over distance dl [L]

dl = Change in distance [L]

The hydraulic conductivity, a measure of the rate at which water moves through a medium, is therefore the defining parameter when relating soil type to hydrological processes.

The seepage behaviour was determined by means of field percolation and infiltration tests. A double ring infiltrometer (DRI) in accordance with the method of Jenn *et al.*, (2007) was used in order to determine infiltration. The DRI consists of a 100 cm diameter outer ring and a 30 cm diameter inner ring. At suitable sites the soil surface is prepared, by excavating 5-10 cm deep using a shovel and a spade. The outer ring is first positioned and thereafter the inner ring is centred. The rings are inserted into the ground (using a hammer) deep enough to prevent water in the ring from flowing laterally on surface. The tops of the outer and the inner rings were maintained at the same level using carpenter‘s level. A steel measuring tape is placed vertically inside the inner ring and the water from the mariotte bottles is poured into the two rings. Measurements are taken on the steel measuring tape at set time intervals. The measurements are continued until steady state condition is reached. According to Jenn *et al.*, (2007) the DRI assumes that Darcy’s law applies; flow is laminar; the aquifer is not affected by external energy; is homogeneous and isotropic, and quasi-infinite in area; is of uniform thickness; horizontal; and the well is fully penetrating.

Since infiltration is the rate at which soil is able to absorb water, the measurements taken from the steel measuring tape are divided by the time from the stop watch and gives infiltration as shown in Equation 9.

$$I = \frac{\Delta h}{t}$$ **Equation 9**

Where; Δh is change in vertical distance of water level in inner ring (mm)

t is time for this drop in water level to take place (s)

A percolation test in accordance with the South African National Standards (SANS) 10252-2:1993 was used in order to determine the percolation rate and hydraulic conductivity. In this method a vertical test hole of 150 mm diameter and 400 mm depth is excavated using an auger and shovel. The saturated condition is established by filling the hole with water. The water level is allowed to drop to 180 mm and time measurements are taken for the drop to 130 mm. The experiment is repeated until the percolation rates do not vary by more than 10% between the readings. The percolation rate (mm/h) as indicated in Equation 10 is determined by dividing the last drop in water level (mm) by the time taken for this drop (h). The units were converted to m/s.

$$\mathrm{P} = \frac{\Delta h_i}{t}$$ **Equation 10**

Where: Δh_i is the distance of infiltration (mm)

t is time in (s)

Darcy‘s law was used to determine hydraulic conductivity as shown in Equation 11 and assuming an unsaturated hydraulic gradient of one. This is because the hydraulic gradient is calculated as the change in hydraulic head, *dh*, over the change in distance, *dl*, between two points of observation (Deming, 2002).

$$\mathrm{K} = \frac{Q}{\Pi r^2} = {(dh)(A)}/{(dt)(A)} = {dh}/{dt}$$ **Equation 11**

Where: Q (m^3/s) is the steady state flow rate in the inner ring (assuming that the flow within the ring is essentially one dimensional downward at a unit hydraulic gradient).

r (m) is the radius of the inner ring.

3.2.4 Slope

Topography refers to the slope of the land surface, and indicates whether runoff will remain on the surface or whether it will infiltrate to allow contaminant infiltration to the saturated zone (Babiker *et al.*, 2005). A steeper topography provides lesser opportunity for pollutants to infiltrate (Kim and Hamm, 1999). According to Rahman (2008) areas with low gradients tend to retain water for longer periods of time. This allows for a greater infiltration or recharge of water and greater potential for contaminant migration.

The topographic slope can be determined by direct field mapping using the theorem mean value. A particular point on the ground is selected; a line orthogonal to contour is formed by two persons holding a tape measure between them. In accordance with Strahler (1956) one person sight to the partner with an Abney hand level, on which slope is directly read as tangent (per cent scale). The two trigonometric functions (tangent and sine) of the slope angle are used to determine slope. The tangent of slope is the ratio of vertical to horizontal distance.

Therefore $\tan\beta = \frac{\Delta y}{\Delta x}$ **Equation 12**

$= \frac{dy}{dx}$ at a chosen point.

However, in this investigation GIS methods were applied. The slope was generated from Digital Elevation Method (DEM) measurement on topographic map at a scale of 1:50 000 using ArcGIS 9.3.1 software (ESRI).

3.3 Combination of Parameters

The four parameters (recharge, depth to water table, soil type, and slope) were combined using overlay operations in ArcGIS 9.3.1. Overlays involve combining spatial and attribute data from two or more spatial data layers and are among the most common and powerful spatial data operations (Bolstad, 2005). An overlay operation requires that data layers use a common coordinate system. In this study South African standard for geographic coordinate system WGS 84 was used in all maps and was projected to WGS 84 Universal Transverse Mercator 36S. If the coordinate systems used in the various layers (recharge, depth to water table, soil type and slope) are not exactly the same, these features will not align correctly.

There are two methods for performing overlay analysis: raster overlay and feature/vector (points, lines and polygons) overlay (Gorr and Kukland, 2007). In this study the raster method was chosen. Polygon overlays often suffer when there are common features that are represented in both input data layers (Bolstad, 2005). According to Bernhardsen (1992) and Gorr and Kurland (2007) raster overlay is often more efficient than vector overlay. Raster overlay involves the cell-by-cell combination of two or more data layers. Data from one layer in one cell location correspond to a cell in another data layer (Bolstad, 2005). In this study the data for recharge, soil type, and depth to water level were in point format, therefore polygons for these three parameters were created by digitising in ArcGIS. Thereafter, polygon shapefiles were converted into raster using the conversion tool. The slope data was not converted to polygons because slope was analysed using DEM and DEM data is in raster format. The raster data were then reclassified using the reclassify tool in the spatial analyst tool. Raster reclassification assigns output values that depend on the specific set of input values (Bolstad, 2005).

There are three raster overlay methods, *viz*. Weighted Sum, Weighted Overlay and Raster Calculator. After reclassification, the four parameters (recharge, depth to water level, soil type, and slope) were evaluated in all of these overlay methods to produce the vulnerability maps for B81G and B82D.

3.3.1 Weighted Sum

According to Gorr and Kurland (2007) the Weighted Sum tool provides the ability to weight and combine multiple inputs to create an integrated analysis. It is similar to the Weighted Overlay tool in that multiple raster inputs, representing multiple factors, can be easily combined incorporating weights or relative importance. There are two major differences between Weighted Overlay and Weighted Sum:

- The Weighted Sum tool does not rescale the reclassified values back to an evaluation scale.

- The Weighted Sum tool allows floating-point and integer values, whereas the Weighted Overlay tool only accepts integer rasters as inputs. By not rescaling the reclassified values back to the evaluation scale, the analysis maintains its resolution. The values of rasters are grouped into categories. For example shallow water level, intermediate water level, and deep water level. The category assigned a reclass value identifying the preference for the class relative to a criterion in the overlay analysis. The Reclassified tool allows such rasters to be reclassified.

The Weighted Sum works by multiplying the designated field values for each input raster by the specified weight. It then sum (adds) all input rasters together to create an output raster. Each input raster can be weighted, or assigned a percentage of influence, based on its importance. Weighted Sum tool input multiple rasters and set all weight equal to 1.0.

3.3.2 Weighted Overlay

According to Gorr and Kurland (2007) Weighted Overlay is a technique for applying a common measurement scale of values to diverse and dissimilar inputs to create an integrated analysis. Weighted Overlay reclassifies values in the input rasters into common evaluation scale of suitability or preference, risk or some similarly unifying scale. Each input raster is weighted according to its importance or its percent of influence. The resulting cell values are added together to produce the output raster. The weight is a relative percentage, and the sum of the percent of influence must be equal to 100. Changing the evaluation scale or the percentage influences can change the results of the Weighted Overlay analysis.

3.3.3 Raster Calculator

The Raster Calculator tool allows you to create and execute Map Algebra expression in a tool (Gorr and Kurland, 2007). Map Algebra is the cell-by-cell combination of raster data (Bolstad, 2005). Raster Calculator is designed to execute a single-line algebraic expression using multiple tools and operators using the calculator tool interface. When multiple tools or operators are used in one expression, the performance of this equation will generally be faster than executing each of the operators or tools individually (Gorr and Kurland, 2007).

According to Gorr and Kurland (2007) the Raster Calculator tool is not intended to be used in scripting environments and is not available in the standard Spatial Analysist ArcPy module. The Raster Calculator is specifically designed to offer the following benefits:

- Implement single-line algebraic expressions.
- Support the use of variables in Map Algebra when in ModelBuilder.
- Apply Spatial Analyst operators on three or more inputs in a single expression.
- Use multiple Spatial Analyst tool in a single expression.

CHAPTER 4: SITE DESCRIPTION

4.1 Vadose Zone Classification and Aquifer Vulnerability in Molototsi and Middle Letaba Quaternary Catchments

In the Molototsi and Middle Letaba quaternary catchments, groundwater is extensively used as the source of water supply. There is no published data available on aquifer vulnerability. A study on the microbial and physico-chemical assessment of borehole water was done and the results obtained showed that the borehole water is of poor quality (Samie, 2011).

4.2 Characteristics of the Study Area

4.2.1 Location

The Molototsi quaternary catchment is located in the Groot Letaba River secondary catchment. The Groot Letaba River Catchments form part of the Luvuvhu/ Letaba Water Management Area (WMA2) (DWAF, 2004). The Molototsi study area is located between latitudes of (S23˚41'3.12" and S23˚21'44.41") and longitudes of (E30˚12'40.51" and E30˚31'36.74").

The Middle Letaba quaternary catchment is located in the Klein Letaba River secondary catchment. The Klein Letaba River Catchments also form part of the Luvuvhu/ Letaba Water Management Area (WMA2) (DWAF, 2004). The Middle Letaba study area is located between latitudes of (S23˚28'43.28" and S23˚15'53.26") and longitudes of (E29˚59'17.88" and E30˚23'30.14") as shown in Figure 3.

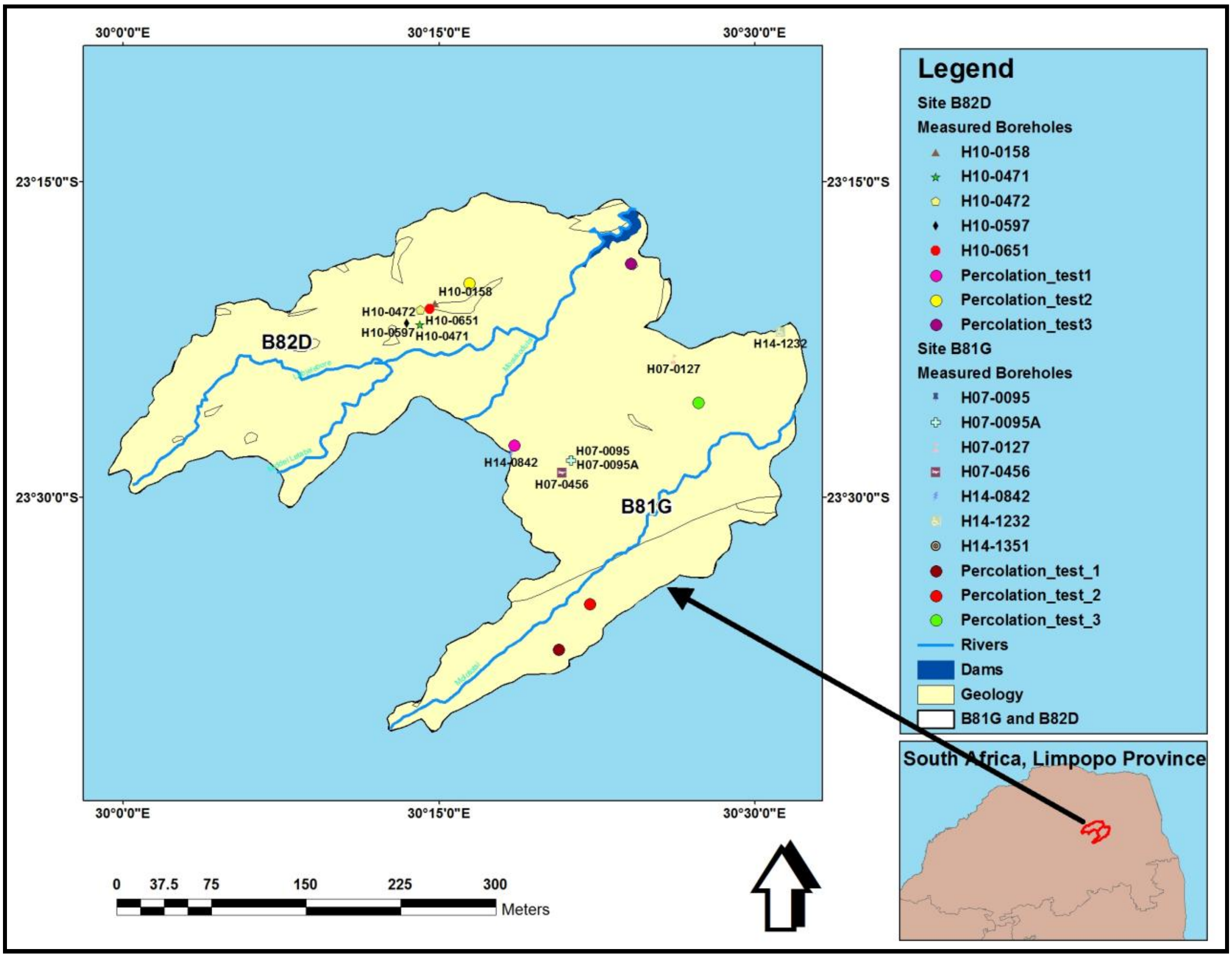

Figure 3: Locality of the Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

4.2.2 Climate

Both Molototsi and Middle Letaba quaternary catchments are characterised by warm, frost free and subtropical climate with summer rainfall. The mean annual temperature ranges from 18˚C to more than 28˚C, with an average of 25.5˚C (DWAF, 2004). The rainfall is seasonal and occurs mainly during summer months (i.e. October to March) (Van Vuuren *et al.*, 2003). The peak rainfall months are January and February. The dry season begins in April with rainfall decreasing dramatically with June being the driest month of the year. It is characterised by low rainfall and high potential evaporation figures of 400-600mm and 2100-2200mm per annum respectively (Nyabeze *et al.*, 2007).

4.2.3 Vegetation, Topography and Soil

Tropical Bush and Savannah dominate the area. Tropical trees and shrubs are common and the dominant grass is tall form of *Themeda trianda* (Van Vuuren *et al.,* 2003). Generally Mopani trees that give Mopani worms a major staple food for Shangaans dominate the area of study. The area is characterised by hills with steep to gentle slope. The average soil condition of the area of study consists of medium clay loam to sandy clay.

4.2.4 Geology

The main geology underlying both B82D and B81G is the Goudplaats-Hout River Gneiss with the exception of the southern part of B81G where Duivelskloof Leucogranite is developed as shown on Figure 4 (Robb *et al*. 2006). Giyani, Mothiba, Zandrivierspoort, Bandelierkop, Schiel Alkaline and Palmietfontein Granite cover a small portion of the study area. The Goudplaats-Hout River Gneiss forms the basement on which other existing lithologies were deposited and preserved (DWAF, 2006). The Goudplaats Gneiss is a medium to fine-grained rock, and consists of oligoclase, quartz, microcline, biotie, and some muscovite (Schutte, 1986). The colour varies from light to dark grey and exhibits a strong foliation in places where it is characterised by alternating bands of leucocratic and melanocratic material (banded gneiss). The Goudplaats-Hout River Gneiss is Palaeoarchean (3 600 – 3 200 million years) ranging from homogenous to strongly layered, leucocratic felsic to mafic minerals (Holland, 2011). It consists of biotite gneiss, migmatite and re-melted granitic mobilizate and underlay more than 50% of the catchment (DWAF, 2006). The gneisses are reported to be migmatitic showing stromatic structure (Brandl *et al.,* 2006). Non-migmatitic, homogenous gneisses seem to be less developed (Kröner *et al.*, 2000).

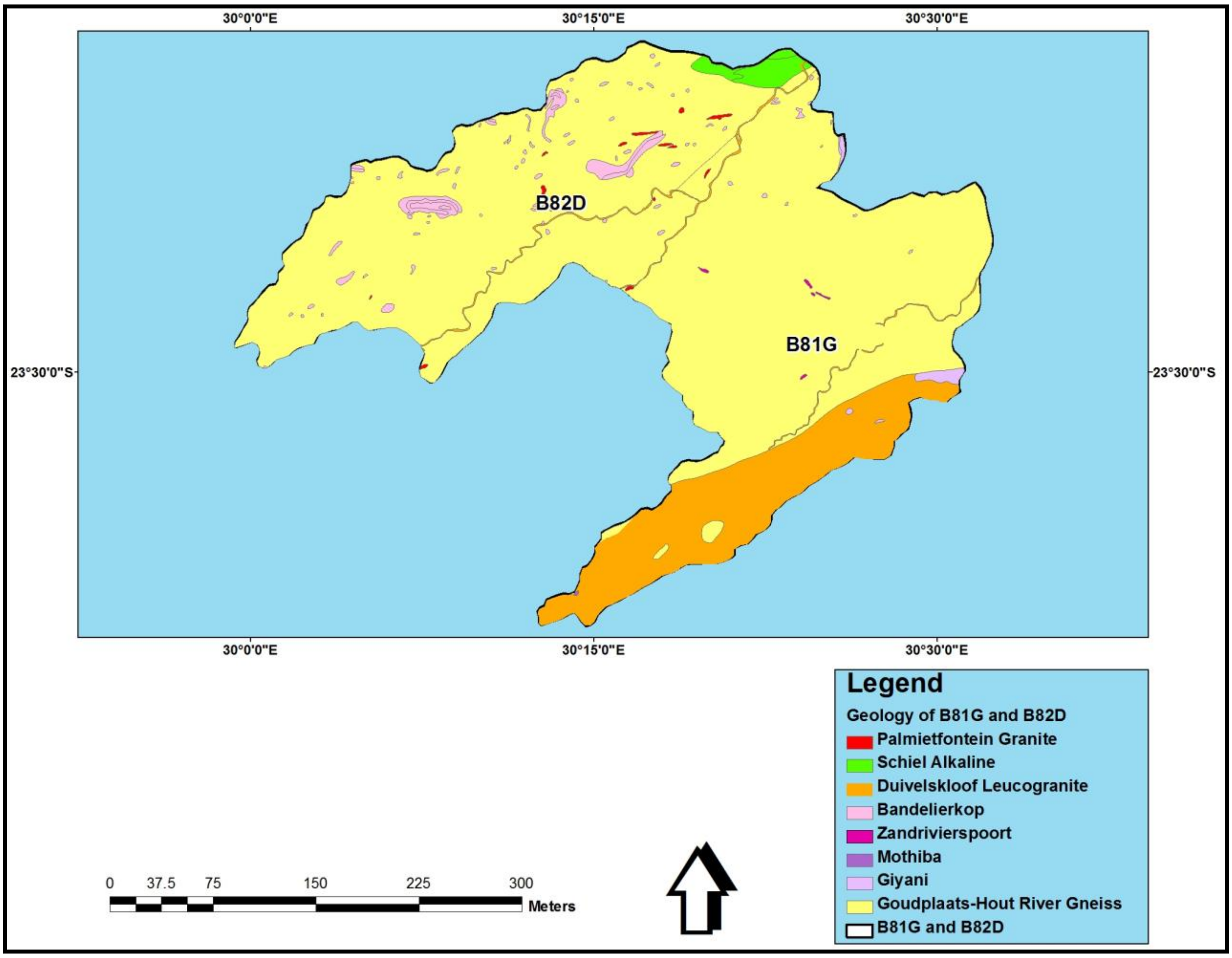

Figure 4: The geology of Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

4.2.5 Hydrogeology and Hydrology

Groundwater is used extensively as a source of water supply for rural communities in Middle Letaba sub-catchment. There is relatively large groundwater resource in this catchment, estimated to be about 30% of the utilisation in the subarea (DWAF, 2004). According to GRIP Limpopo (2010), the daily abstraction of groundwater ranges from 0.72 to 604.80 m^3/day. The contribution of groundwater to the available water in Middle Letaba quaternary catchments is estimated to be about 9 million m^3/a (Van Vuuren *et al.,* 2003). According to DWAF (2004) groundwater is used to supplement irrigation during times of drought in Middle Letaba quaternary catchment. Groundwater abstraction takes place close to the river and probably has a direct impact on the surface water flow. According to GRIP Limpopo (2010), moderate to good yields of between 0.05 to 8 ℓ/s are found in Middle Letaba quaternary catchment. GRIP Limpopo (2010) further showed that Middle Letaba quaternary catchment is characterised by shallow depth to water level ranging from 0.19 to 36.21 mbgℓ. The other major tributaries of the middle Letaba River include the Boontjies and Koedoes Rivers (DWAF, 2004).

The contribution of groundwater to the available water in Molototsi quaternary catchment is estimated to be about 12 million m^3/a (DWAF, 2004). According to GRIP Limpopo (2010), daily groundwater abstraction in the Molototsi quaternary catchment ranges from 0.72 to 777.60 m^3/day. Similarly, groundwater is used to supplement irrigation during times of drought in Molototsi quaternary catchment. Groundwater abstraction takes place close to the river and also appears to have a direct impact on the surface water flow. According to GRIP Limpopo (2010) moderate to good yields of between 0.01 to 9.0 ℓ/s are found in Molototsi quaternary catchments. GRIP Limpopo (2010) further indicated that depth to water level in Molototsi quaternary catchment ranges from 0.05 to 61.43 mbgℓ. The Molototsi River is the major tributary of Groot Letaba River (DWAF, 2004).

Figure 5 indicates the borehole localities of Molototsi and Middle Letaba Quaternary Catchments. The borehole data was accessed from GRIP/NGA data.

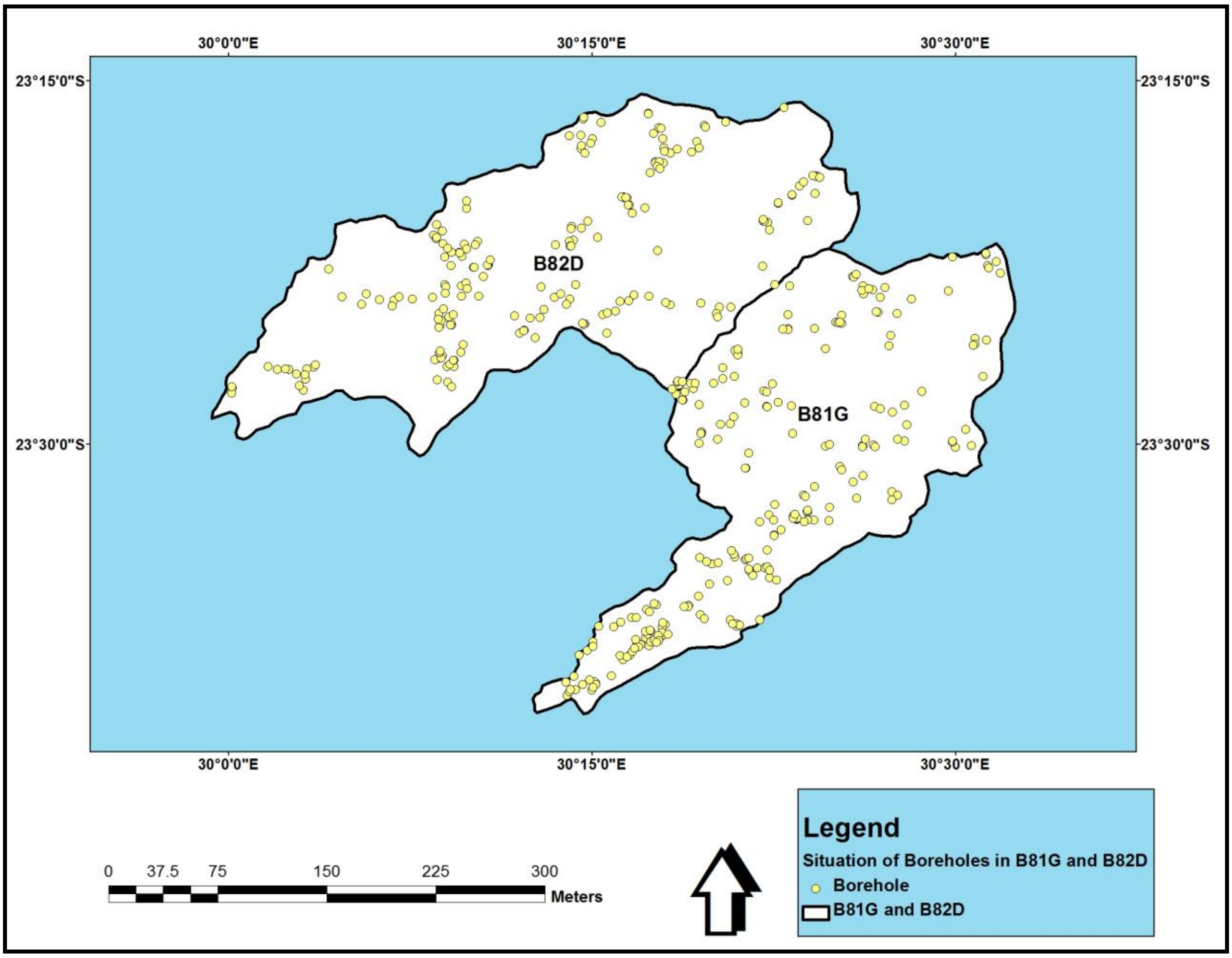

Figure 5: The borehole locations in the Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

CHAPTER 5: METHOD APPLICATIONS

5.1 Recharge

Recharge was calculated using Equation 7. Mean annual chloride from groundwater (Clgw) for Molototsi and Middle Letaba quaternary catchments was calculated from NGDB data (Table A-1 and A-2, Appendix A). NGDB is the National Groundwater Database data. The NGDB data set is probably the most comprehensive borehole data set in South Africa and incorporates an estimated 225 000 boreholes (DWAF, 2009). In 2001 GRIP in Limpopo underway, this data captured on to AquaBase and loaded into NGDB (DWAF, 2009). Mean annual precipitation (MAP) for Molototsi quaternary catchment was calculated using mean annual rainfall data for Belvedere, Letaba Distric and Tzaneen-Westfalia Estate rainfall stations (Figure 6 and Table A-3, Appendix A). There are no rainfall stations in Molototsi quaternary catchment, and subsequently Belvedere, Letaba Distric and Tzaneen-Westfalia Estate rainfall stations were chosen since they are the closest rainfall stations around B81G (Figure 6). MAP for Middle Letaba quaternary catchment was calculated using mean annual rainfall data for Kleinfontein, Setali and Voorspoed-Bos rainfall stations (Figure 7 and Table A-4, Appendix A). The total atmospheric chloride deposition for the catchments was calculated using rainwater chloride concentration from Taaiboschgroet rainfall station (Table A-5, Appendix A).

A cut-off value was implemented with the highest emperical value determined in recharge analysis being 103 mm/a. A value of 50 mm/a was therefore regarded as a suitable cut-off, since it is the half of 103 mm/a which is highest value for recharge. Any value < 25 mm/a was regarded as low recharge; 25 – 50 mm/a was regarded as intermediate; and > 50 mm/a was regarded as high. The results obtained show low recharge of < 25 mm/a in the upper part of Molototsi and Middle Letaba quaternary catchments. Intermediate recharge of between 25 – 50 mm/a was obtained in the lower part of Molototsi and Middle Letaba quaternary catchments. However, small portions in the upper part of both Molototsi and Middle Letaba quaternary catchments also showed intermediate recharge. High recharge of > 50 mm/a was obtained in the lower part of Molototsi quaternary catchment.

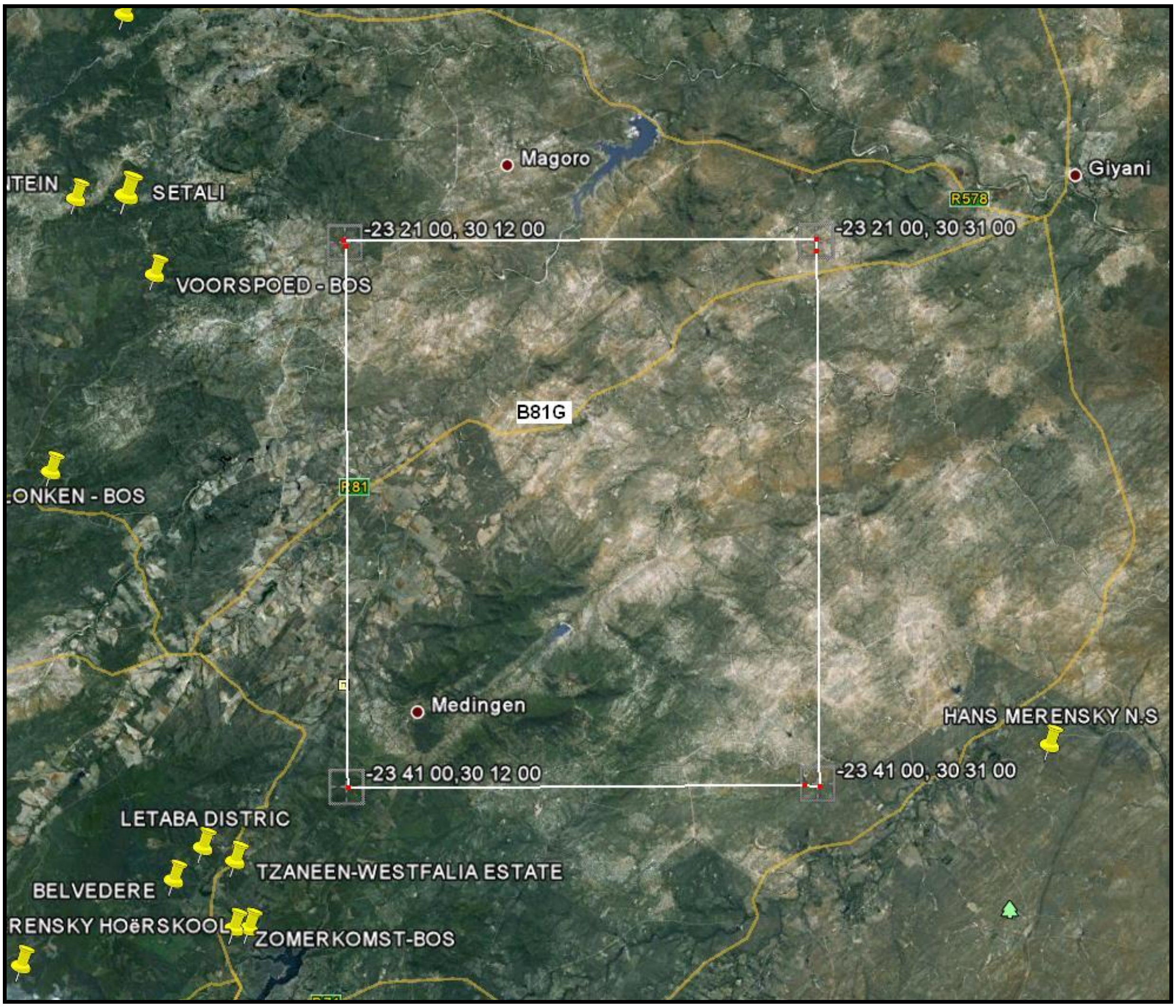

Figure 6: Rainfall stations in Molototsi quaternary catchment (B81G).

Figure 7: Rainfall stations in Middle Letaba quaternary catchment (B82D).

Aquifers in western part of Molototsi quaternary catchments may be vulnerable to pollution due to high recharge revealed. If the water which is recharging aquifers in the lower part of Molototsi quaternary catchments is contaminated, then the aquifers are vulnerable to pollution. The calculated recharge was analysed using ArcGIS (Figure 8).

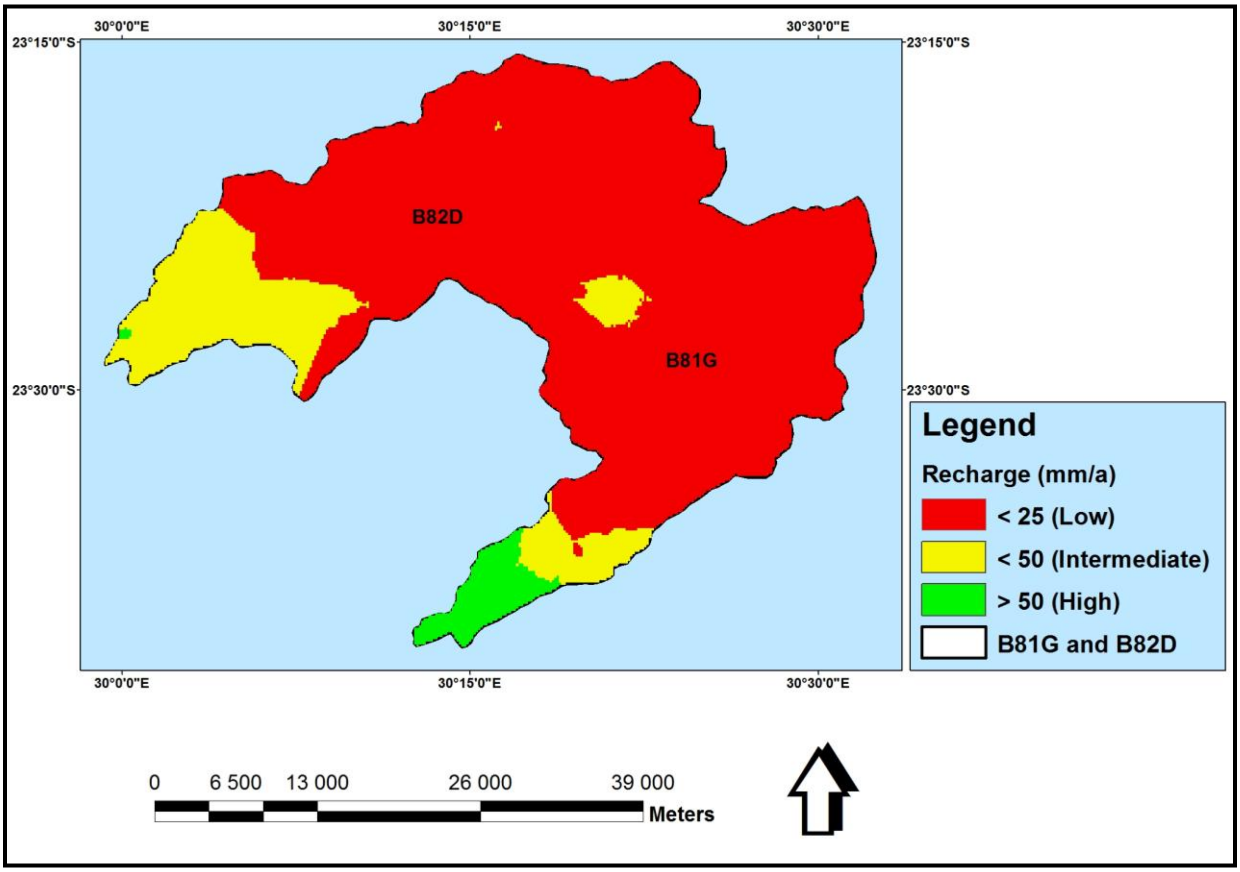

Figure 8: The recharge for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

The total recharge for Molototsi quaternary catchment is:

$$R_T = \frac{0.6 mg/l \times 1074.64 mm/a}{25.592 mg/l}$$

$$= 25.194 \ mm/a$$

Similarly the recharge for Middle Letaba quaternary catchment is:

$$R_T = \frac{0.6 mg/l \times 836.933 mm/a}{32.650 mg/l}$$

$$= 15.380 \ mm/a$$

5.2 Depth to Water Table

The depth to the water table for Molototsi and Middle Letaba quaternary catchments was measured in the field. For inaccessible (sealed) boreholes additional data was requested from GPM Consulting Company (Table A-8 and Table A-9, Appendix A). The data are represented in ArcGIS (Figure 9(a) and 9(b)).

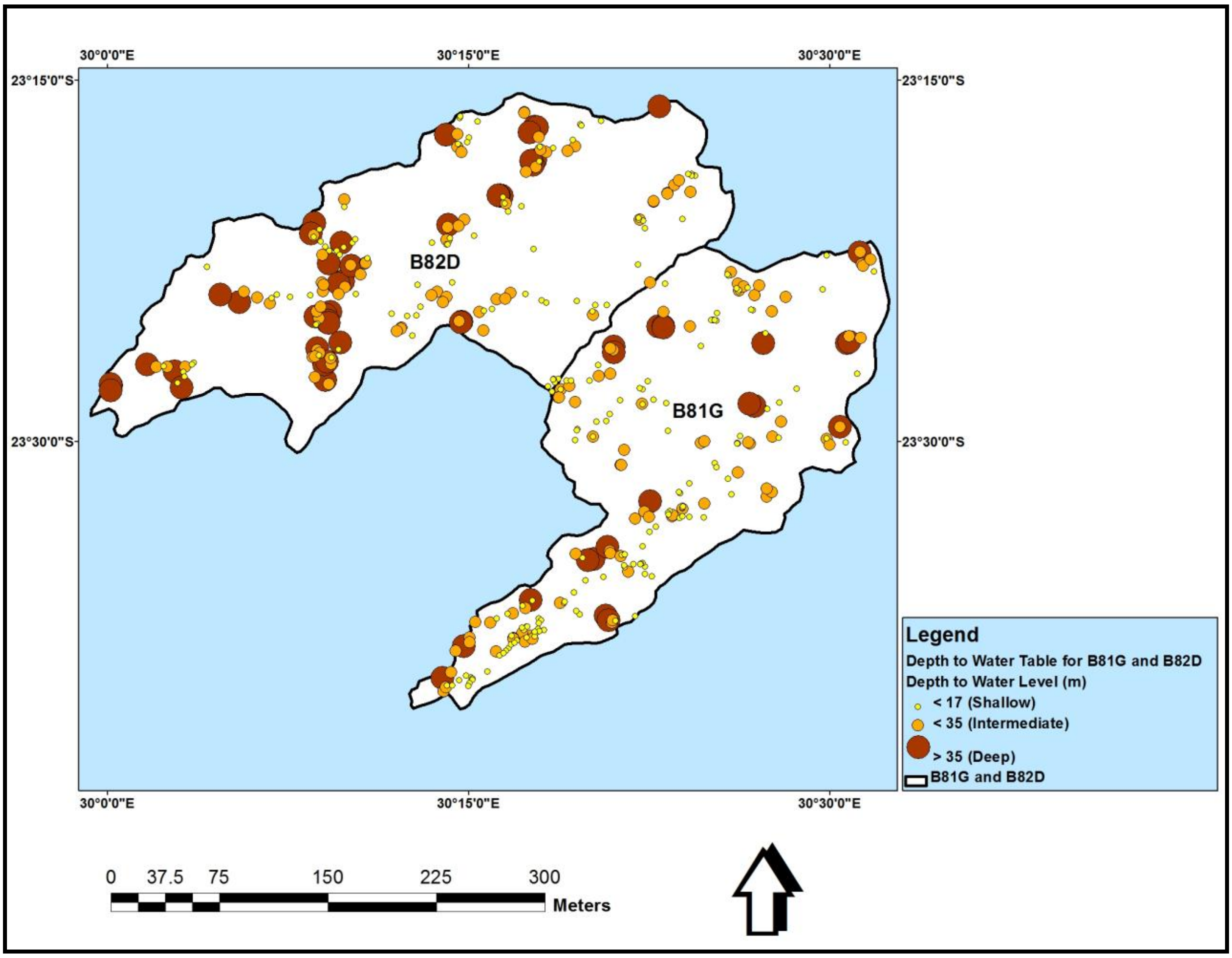

Figure 9(a): The depth to water level for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

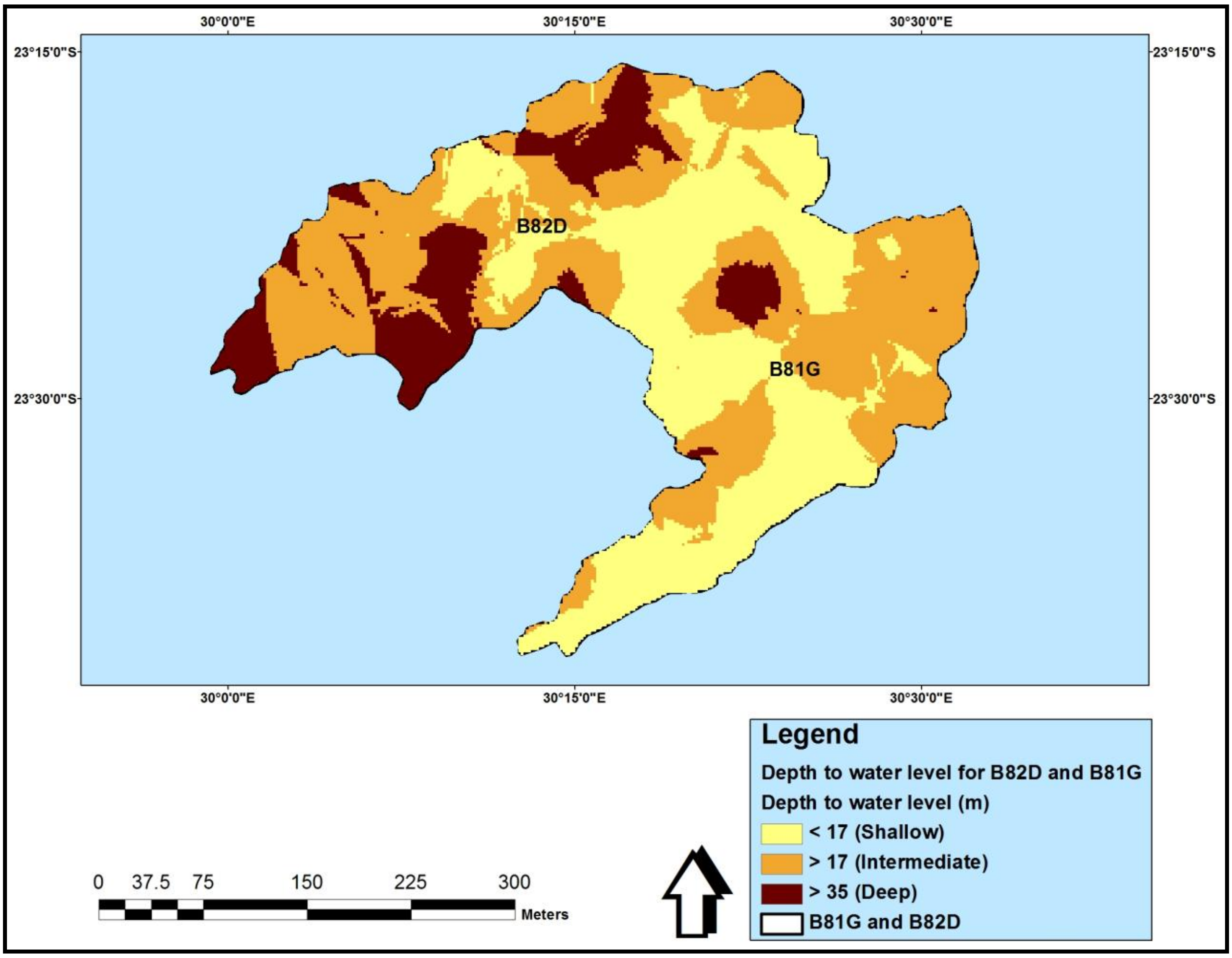

Figure 9(b): The depth to water level for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

A cut-off value was implemented and the highest emperical value determined in depth to water level analysis was 70.43 m. So a value of 35 m was regarded as a suitable cut-off. Any value < 17 m was regarded as shallow depth to water level. A value of between 17 to 30 m was regarded as intermediate depth to water level. A value of > 35 m was regarded as deep depth to water level. The results obtained show shallow depth to water level of < 17 m on the lower part of B81G and the upper part of both B82D and B81G. Intermediate depth to water level of between 17 - 35 m was revealed on the upper and small portion on the lower part of B81G. Similarly intermediate depth to water level of between 17 - 35 m was revealed on the lower and upper part of B82D. Deep depth to water level of > 35 m was revealed on the lower part of B82D, and the upper part of both B81G and B82D. Areas with shallow depth to water level (lower part of B81G and upper part of both B82D and B81G) may be vulnerable to pollution, because contaminants can quickly reach the aquifer due to shallow depth to water level.

5.3 Soil Type

5.3.1 Data Collection

Data were collected from infiltration and percolation tests during the wetting cycles, as well as under steady-state conditions when pre-wetting has been assumed and the system is considered saturated.

Infiltration under Pre-wetting and Saturated Conditions

The infiltration rates for Molototsi and Middle Letaba quaternary catchments were determined in the field using a double ring infiltrometer (Table A-10(a) and (b)). The data are represented in a graph (Figure 10). Within the constraints of uncertainty, the results obtained show a low infiltration rate for infiltration test 1. As the time was increased from 60 to 720 s the infiltration rate dropped from 6.67×10^{-5} to 5.0×10^{-5} m/s, and remained at a constant rate of 5.0×10^{-5} m/s throughout the test. Infiltration test 2 shows a high infiltration rate, and infiltration dropped from 1.83×10^{-4} to 1.14×10^{-4} m/s. Infiltration test 3 showed moderate infiltration rate. Infiltration dropped from 1.5×10^{-4} to 1.0×10^{-4} m/s with increase in time. Aquifers in areas with high infiltration rate might be vulnerable to pollution.

Equation trendlines were used to elaborate the accuracy of the data. In Figure 10 infiltration test 1 displayed an R^2 value of 0.71, which means that the data is 71% accurately represented. Infiltration test 2 displayed an R^2 value of 0.998, which means that the data is 99.8% accurately represented. Infiltration test 3 displayed an R^2 value of 0.990, which means that the data is 99% accurately represented.

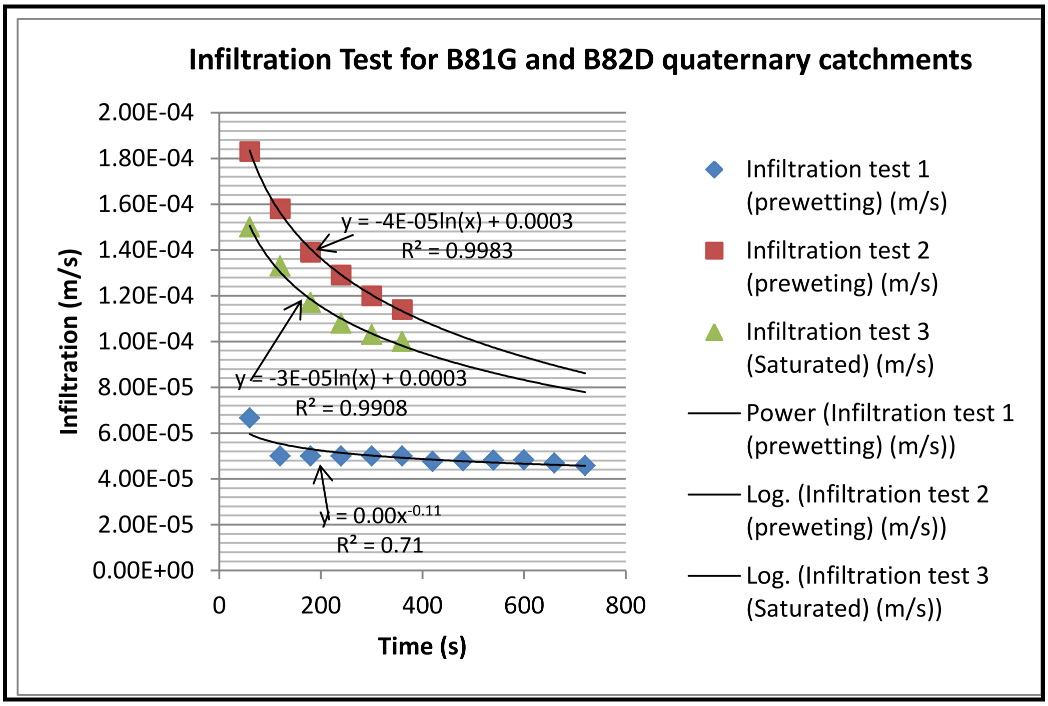

Figure 10: Infiltration tests for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

Percolation under Pre-wetting Conditions

Percolation was tested in the field by creating pre-wetting and saturated conditions (Table A-10(c), (d) and (e), Appendix A). From the percolation test results, hydraulic conductivity was calculated.

The data are represented in a graph (Figure 11). The results obtained for percolation test 1 shows low percolation rate. The percolation was at a constant rate of 2.348×10^{-5} m/s with increase in time from 332 to 1400 s. Percolation tests 2, 3, 4, 5 and 6 were moderate. Percolation slowed down with increase in time from 2.0×10^{-4} to 1.5×10^{-4} m/s for percolation test 2. Similarly percolation test 3 slowed down with increase in time from 1.25×10^{-4} to 1.12×10^{-4} m/s. For percolation test 4, percolation slowed down from 1.41×10^{-4} to 1.15×10^{-4}

m/s. For percolation test 5, percolation slowed down with increased in time from 1.2×10^{-4} to 1.1×10^{-4} m/s. For percolation test 6, percolation slowed down with increase in time from 2.94×10^{-4} to 2.75×10^{-4} m/s. This may result in low vulnerability of aquifer to pollution, due to slow movement of water between the pore spaces.

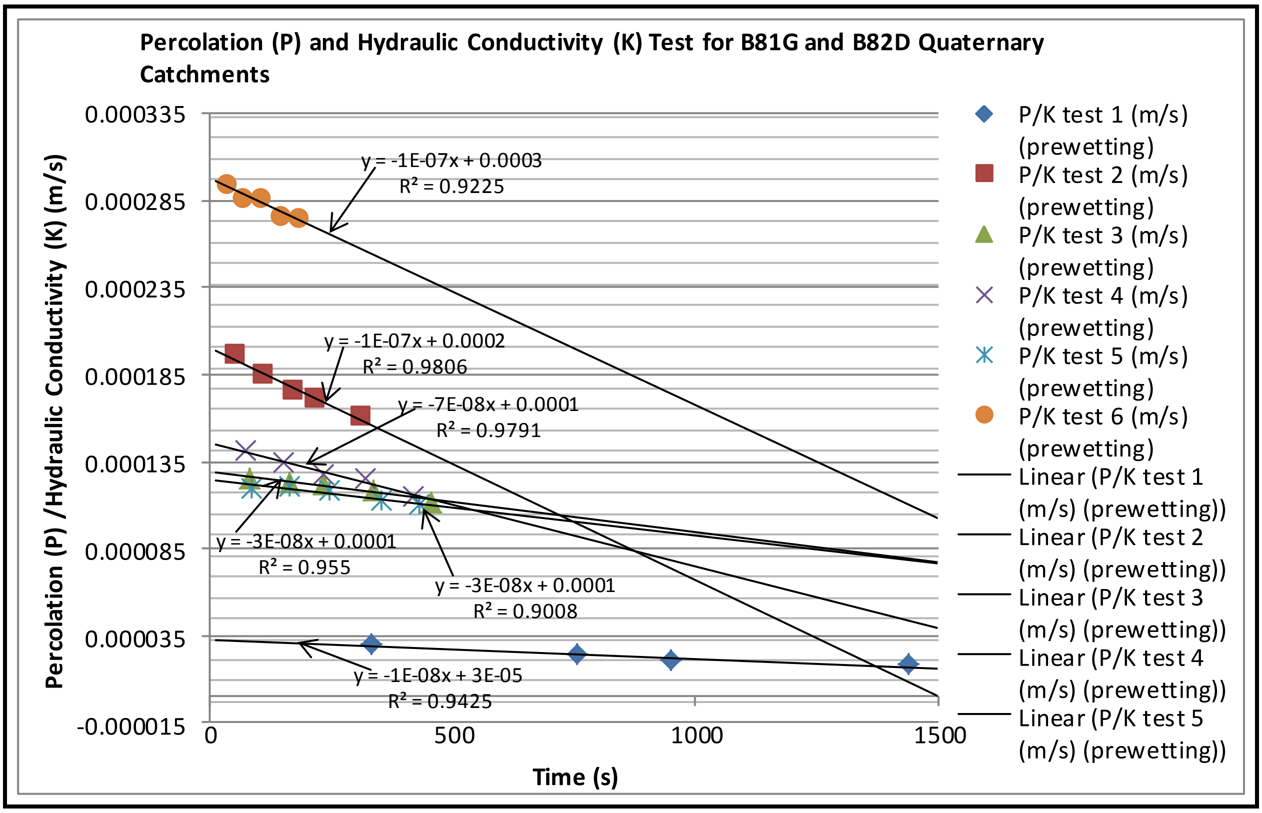

Figure 11: Percolation Test for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments under prewetting condition.

Darcy's law was used to determine hydraulic conductivity from the infiltration and percolation tests and assuming a hydraulic gradient of 1 (Equation 13).

$$K = \frac{Q}{A} i$$ **Equation 13**

The data are represented in a graph (Figure 11). The results obtained for hydraulic conductivity test 1 shows low hydraulic conductivity rate. The hydraulic conductivity was at a constant rate of 2.348×10^{-5} m/s with increase in time from 332 to 1400 s. The hydraulic conductivity for test 2, 3, 4, 5 and 6 was moderate. Hydraulic conductivity slowed down with increase in time from 2.0×10^{-4} to 1.5×10^{-4} m/s for hydraulic conductivity test 2. Similarly hydraulic conductivity test 3 slowed down with increase in time from 1.25×10^{-4} to 1.12×10^{-4} m/s. For hydraulic conductivity test 4, hydraulic conductivity slowed down from 1.41×10^{-4} to 1.15×10^{-4} m/s. For hydraulic conductivity test 5, hydraulic conductivity slowed down with increased in time from 1.2×10^{-4} to 1.1×10^{-4} m/s. For hydraulic conductivity test 6, hydraulic conductivity slowed down with increase in time from 2.94×10^{-4} to 2.75×10^{-4} m/s. This may result in low vulnerability of aquifer to pollution, due to slow movement of water between the pore spaces.

Equation trendlines were used to elaborate the accuracy of the data. In Figure 11 percolation or hydraulic conductivity test 1 displayed an R^2 value of 0.942 which means that the data is 94.2% accurately represented. Percolation or hydraulic conductivity test 2 displayed an R^2 value of 0.980, which means that the data is 98.0% accurately represented. Percolation or hydraulic conductivity test 3 displayed an R^2 value of 0.955, which means that the data is 95.5% accurately represented. Percolation or hydraulic conductivity test 4 displayed an R^2 value of 0.979, which means that the data is 97.90% accurately represented. Percolation or hydraulic conductivity test 5 displayed an R^2 value of 0.9008, which means that the data is 90.08% accurately represented. Percolation or hydraulic conductivity test 6 displayed an R^2 value of 0.922, which means that the data is 92.2% accurately represented.

Percolation under Prewetting and Saturated Condition

Similarly the data are represented in a graph (Figure 13(a) and (b)). Percolation test 1 (prewetting and saturated condition) shows high percolation rate. Under prewetting condition, percolation increased from 0 to 2.89×10^{-3} m/s with increase in time from 60 to 161 s. This is because under prewetting condition the soil is dry, so water percolates quickly. Under saturated conditions, percolation dropped from 1.0×10^{-3} to 7.94×10^{-4} m/s with increase in time from 10 to 63 s. This is because under saturated condition the soil is wet, as a results water percolate slowly. Percolation test 2 (prewetting and saturated) shows low percolation rate. Under prewetting condition, percolation was at constant rate of 9.59×10^{-5} m/s with increase in time from 92 to 527 s. Under saturated condition, percolation was at a constant rate of 9.48×10^{-5} m/s with increase in time from 172 to 952 s.

Percolation test 3 (prewetting and saturated condition) show moderate percolation rate. Under prewetting condition, percolation dropped from 4.0×10^{-4} to 3.4×10^{-4} m/s with increase in time from 34 to 147 s. Under saturated condition, percolation dropped from 2.0×10^{-3} to 1.0×10^{-3} m/s with increase in time from 48 to 258 s. Similarly percolation test 4 (prewetting and saturated condition) shows moderate percolation rate. Under prewetting condition, percolation dropped from 2.0×10^{-4} to 1.0×10^{-4} m/s with increase in time from 46 to 300 s. Under saturated condition, percolation was at a constant rate of 1.0×10^{-4} m/s with increase in time from 78 to 476 s. Aquifers in high percolation rate zone (Percolation test 1 (prewetting and saturated condition)) may be vulnerable to pollution. This is because the water is able to move easily between the pore spaces.

Darcy‘s law was used to determine hydraulic conductivity assuming an unsaturated hydraulic gradient of 1 (Equation 13). The data was represented in a form of a graph (Figure 12(a) and (b)). Hydraulic conductivity test 1 (prewetting and saturated condition) shows high hydraulic conductivity rate. Under prewetting condition, hydraulic conductivity increased from 0 to 2.89×10^{-3} m/s with increase in time from 60 to 161 s. This is because under prewetting condition the soil is dry, so water moves quickly. Under saturated conditions, hydraulic conductivity dropped from 1.0×10^{-3} to 7.94×10^{-4} m/s with increase in time from 10 to 63 s. This is because under saturated condition the soil is wet, as a result the water moves slowly. Hydraulic conductivity test 2 (prewetting and saturated) shows low hydraulic conductivity rate. Under prewetting condition, hydraulic conductivity was at constant rate of 9.59×10^{-5} m/s with increase in time from 92 to 527 s. Under saturated condition, hydraulic conductivity was at a constant rate of 9.48×10^{-5} m/s with increase in time from 172 to 952 s.

Hydraulic conductivity test 3 (prewetting and saturated condition) shows moderate hydraulic conductivity. Under prewetting condition, hydraulic conductivity dropped from 4.0×10^{-4} to 3.4×10^{-4} m/s with increase in time from 34 to 147 s. Under saturated condition, hydraulic conductivity dropped from 2.0×10^{-3} to 1.0×10^{-3} m/s with increase in time from 48 to 258 s. Similarly hydraulic conductivity test 4 (prewetting and saturated condition) shows moderate hydraulic conductivity rate. Under prewetting condition, hydraulic conductivity dropped from 2.0×10^{-4} to 1.0×10^{-4} m/s with increase in time from 46 to 300 s. Under saturated condition, hydraulic conductivity was at a constant rate of 1.0×10^{-4} m/s with increase in time from 78 to 476 s. Aquifers in high hydraulic conductivity rate zone (hydraulic conductivity test 1 (prewetting and saturated condition)) may be vulnerable to pollution. This is because the water is able to move easily between the pore spaces.

Equation trendlines were used to elaborate the accuracy of the data. In Figure 12(a) percolation or hydraulic conductivity test 1 under prewetting condition displayed an R^2 value of 0.947 which means that the data is 94.7% accurately represented. Percolation or hydraulic conductivity test 1 under saturated condition displayed an R^2 value of 0.960, which means that the data is 96.0% accurately represented. Percolation or hydraulic conductivity test 2 under prewetting condition displayed an R^2 value of 0.984 which means that the data is 98.4% accurately represented. Percolation or hydraulic conductivity test 2 under saturated condition displayed an R^2 value of 0.863, which means that the data is 86.3% accurately represented.

Equation trendlines were used to elaborate the accuracy of the data. In Figure 12(b) percolation or hydraulic conductivity test 3 under prewetting condition displayed an R^2 value of 0.941 which means that the data is 94.1% accurately represented. Percolation or hydraulic conductivity test 3 under saturated condition displayed an R^2 value of 0.944, which means that the data is 94.1% accurately represented. Percolation or hydraulic conductivity test 4 under prewetting condition displayed an R^2 value of 0.963 which means that the data is 96.3% accurately represented. Percolation or hydraulic conductivity test 4 under saturated condition displayed an R^2 value of 0.961, which means that the data is 96.1% accurately represented.

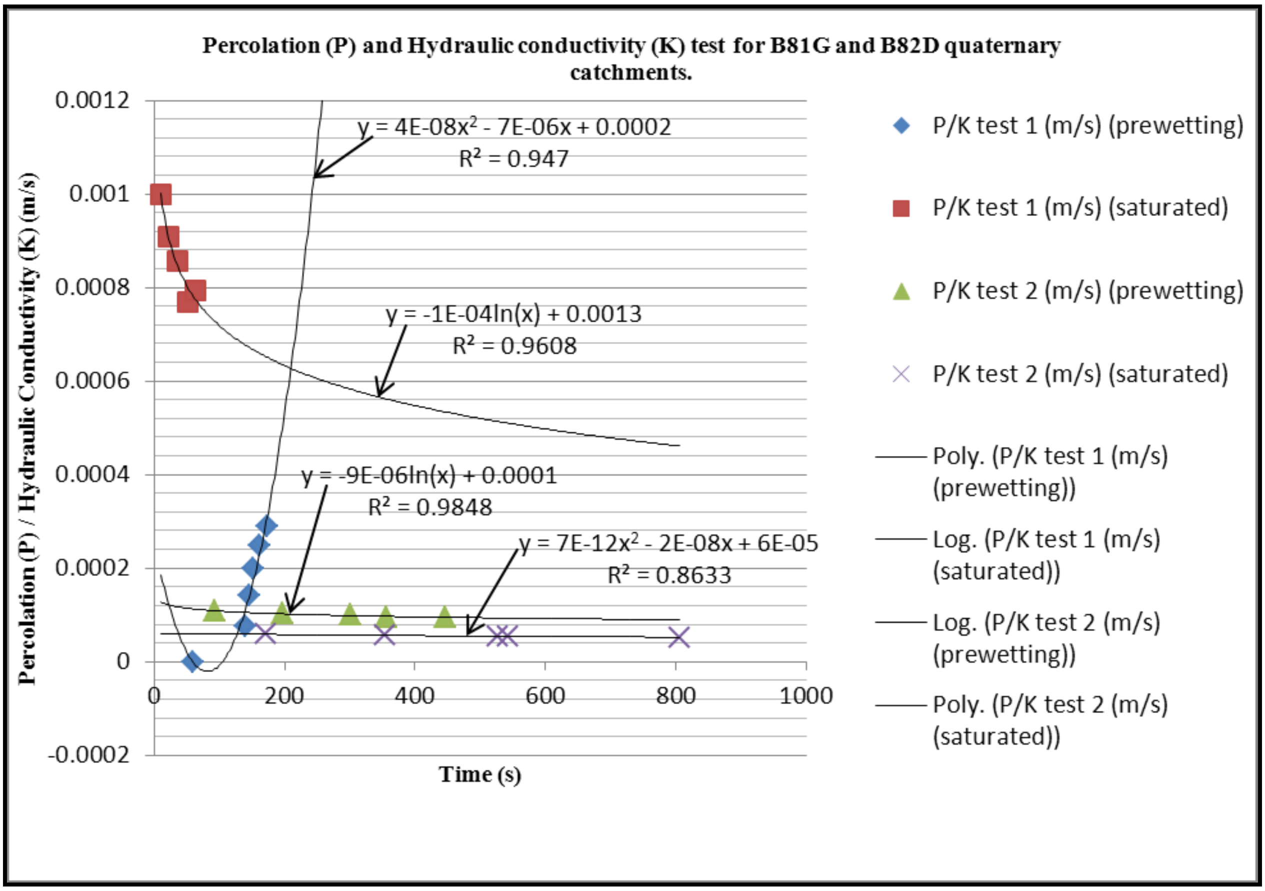

Figure 12(a): Percolation Test for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments under prewetting and saturated conditions.

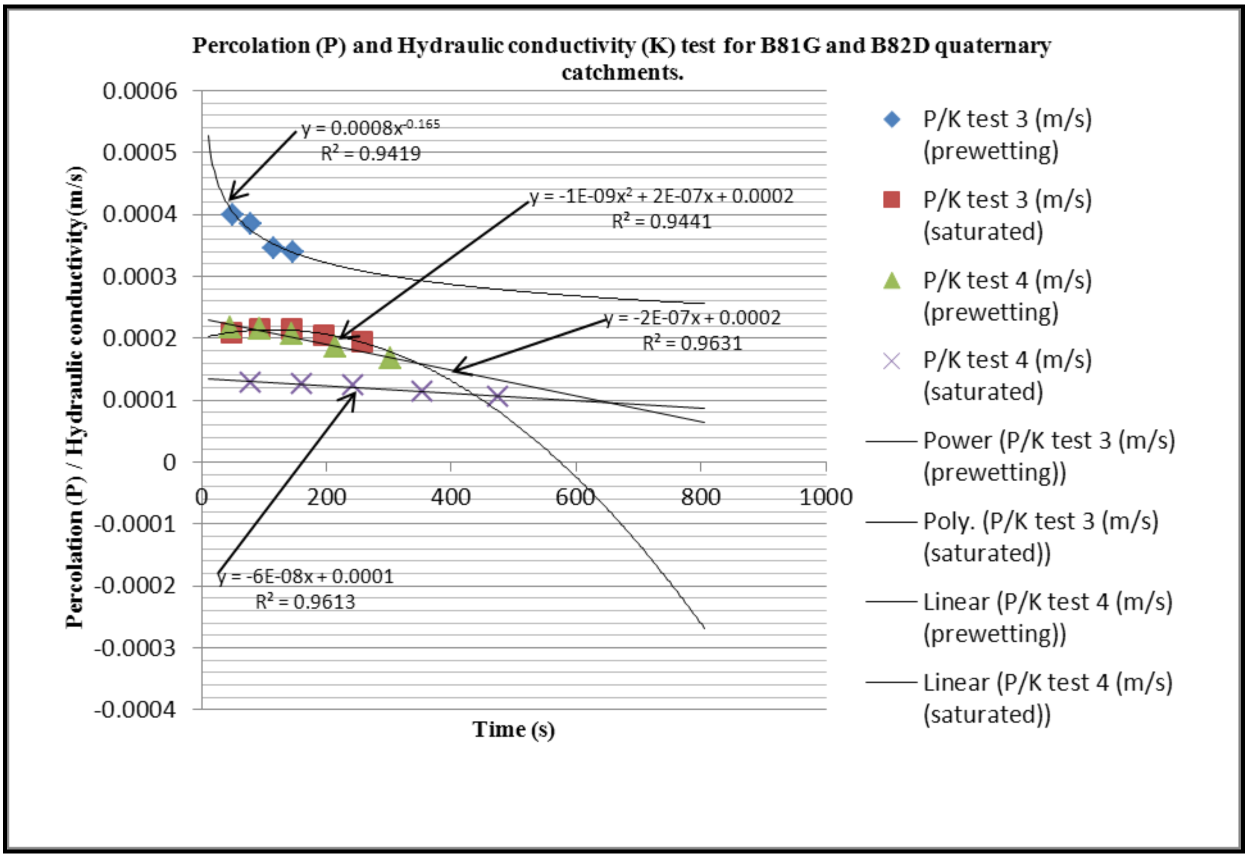

Figure 12(b): Percolation Test for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments under prewetting and saturated conditions.

Percolation under Saturated Condition

The results obtained show moderate percolation rate for percolation test 1, 2, 3, and 4. Percolation increased from 1.0×10^{-4} to 4.0×10^{-3} m/s with increase in time from 91 to 114 s for percolation test 1. Percolation increased from 1.45×10^{-4} to 6.0×10^{-4} m/s with increase in time from 69 to 89 s for percolation test 2. Percolation increased from 2.0×10^{-4} to 8.0×10^{-4} m/s with increase in time from 37 to 60 s for percolation test 3. Percolation increased from 2.0×10^{-4} to 6.0×10^{-4} m/s with increase in time from 43 to 85 s for percolation test 4. Percolation test 5 showed high percolation rate. Percolation increased from 2.0×10^{-4} to 1.64×10^{-3} m/s with increase in time from 32 to 43 s. Aquifers in areas with high percolation rate may be vulnerability to pollution.

Darcy's law was used to determine hydraulic conductivity assuming an unsaturated hydraulic gradient of 1 (Equation 13). The data are represented in a graph (Figure 13). The results obtained show moderate hydraulic conductivity rate for hydraulic conductivity tests 1, 2, 3, and 4. Hydraulic conductivity increased from 1.0×10^{-4} to 4.0×10^{-3} m/s with increase in time from 91 to 114 s for hydraulic conductivity test 1. Hydraulic conductivity increased from 1.45×10^{-4} to 6.0×10^{-4} m/s with increase in time from 69 to 89 s for hydraulic conductivity test 2. Hydraulic conductivity increased from 2.0×10^{-4} to 8.0×10^{-4} m/s with increase in time from 37 to 60 s for hydraulic conductivity test 3. Hydraulic conductivity increased from 2.0×10^{-4} to 6.0×10^{-4} m/s with increase in time from 43 to 85 s for hydraulic conductivity test 4. Hydraulic conductivity test 5 showed high hydraulic conductivity rate. Hydraulic conductivity increased from 2.0×10^{-4} to 1.64×10^{-3} m/s with increase in time from 32 to 43 s. Aquifers in areas with high hydraulic conductivity rate may be vulnerability to pollution.

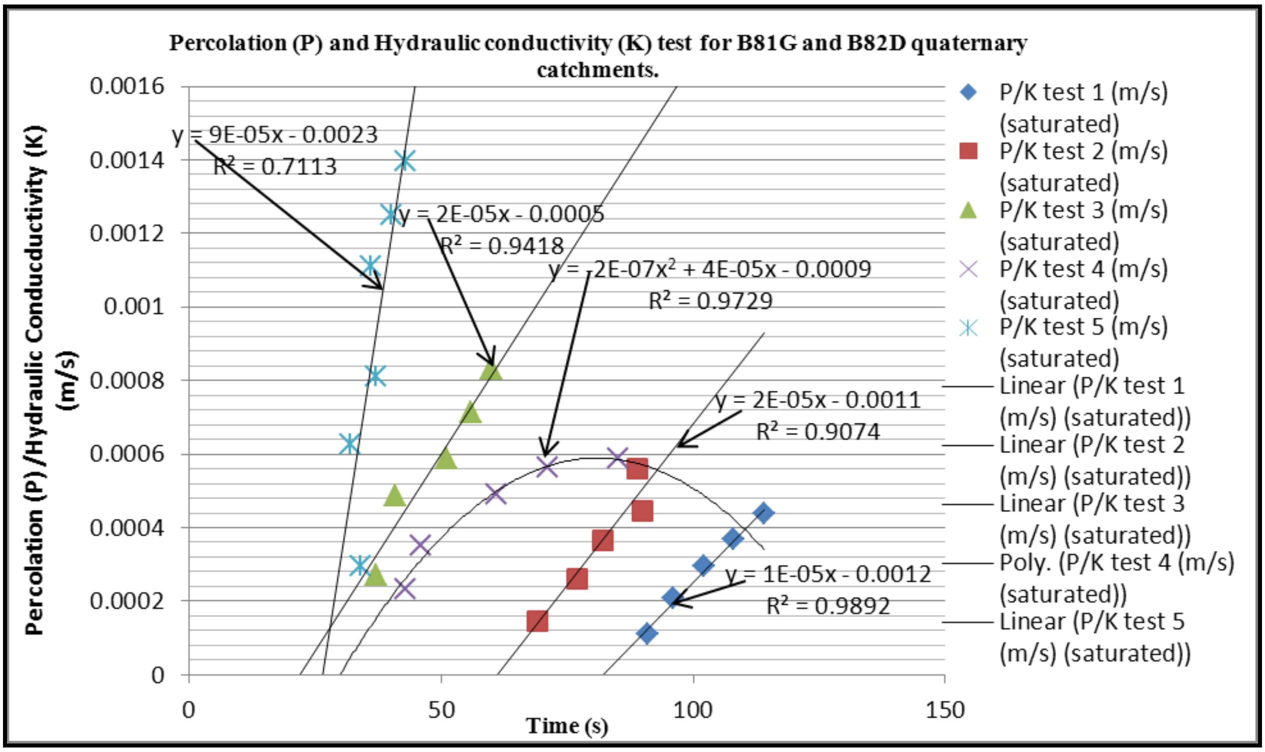

Figure 13: Percolation Test for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments under saturated condition.

Equation trendlines were used to elaborate the accuracy of the data. In Figure 13 percolation or hydraulic conductivity test 1 saturated condition displayed an R^2 value of 0.989 which means that the data is 98.9% accurately represented. Percolation or hydraulic conductivity test 2 under saturated condition displayed an R^2 value of 0.907, which means that the data is 90.7% accurately represented. Percolation or hydraulic conductivity test 3 under saturated condition displayed an R^2 value of 0.941 which means that the data is 94.1% accurately represented. Percolation or hydraulic conductivity test 4 under saturated condition displayed an R^2 value of 0.972, which means that the data is 97.2% accurately represented. Percolation or hydraulic conductivity test 5 under saturated condition displayed an R^2 value of 0.711, which means that the data is 71.1% accurately represented.

5.3.2 Soil Type Data Analysis

The seepage behaviour of water in the soil was determined by undertaking infiltration and percolation tests in the field. From the percolation tests results, hydraulic conductivity was calculated. The results obtained from these tests were represented in ArcGIS (Figure 14).

Cut-off value was implemented. The highest emperical value determined in soil type analysis was 3.23×10^{-4} m/s. A value of 1.62×10^{-4} m/s was, therefore, regarded as a suitable cut-off. Any value $< 8.07\times10^{-5}$ m/s was regarded as low conductivity; 8.07×10^{-5} to 1.62×10^{-4} m/s was regarded as intermediate , and > 1.62×10^{-4} m/s was regarded as high.

The results obtained shows that Middle Letaba quaternary catchment (B82D) is dominated by low infiltration, percolation or hydraulic conductivity rate of between 1.28×10^{-4} to 1.85×10^{-4} m/s. However intermediate infiltration, percolation or hydraulic conductivity of between 1.85×10^{-4} to 2.41×10^{-4} m/s is revealed towards the lower part of Middle Letaba quaternary catchments (B82D). In a nutshell the aquifers in Middle Letaba quaternary catchment might not be as vulnerable to pollution because the catchment is dominated by low and intermediate infiltration, percolation or hydraulic conductivity rate.

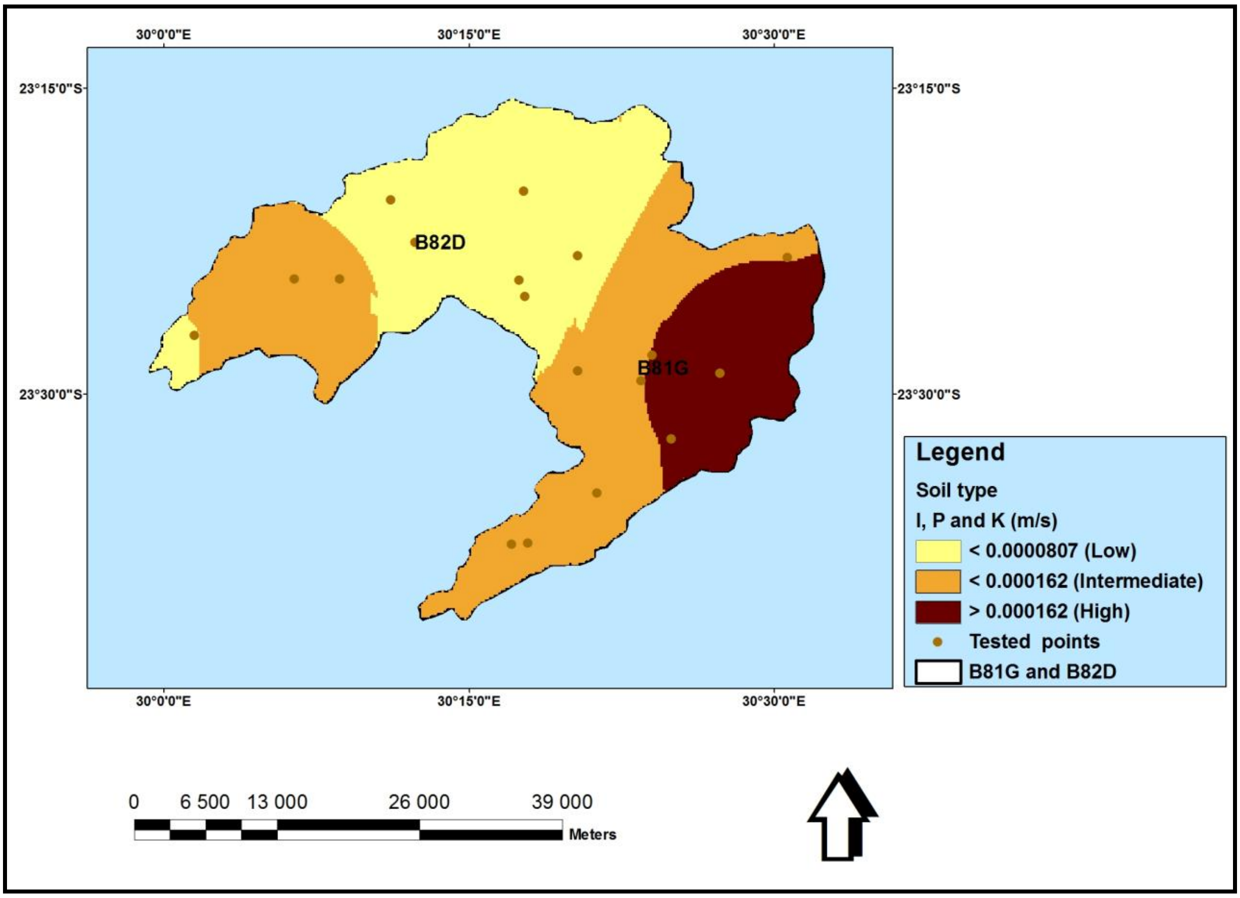

Figure 14: The soil type of Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

Similarly Molototsi quaternary catchment (B81G) is dominated by intermediate infiltration, percolation or hydraulic conductivity rate of between 1.85×10^{-4} to 2.41×10^{-4} m/s. However high hydraulic conductivity between 2.41×10^{-4} to 3.23×10^{-4} m/s is shown on the eastern part of Molototsi quaternary catchments (B81G). The aquifers in the area with high infiltration, percolation or hydraulic conductivity rate might be vulnerable to pollution.

5.4 Slope

The slope was analysed using ArcGIS (Figure 15). A cut-off value was implemented and the highest emperical value determined in slope analysis was 37º. So a value of 18º was regarded as a suitable cut-off. Any value < 9º was regarded as low slope. A value of between 9º to 18º was regarded as gentle slope. A value of > 18º was regarded as steep slope.

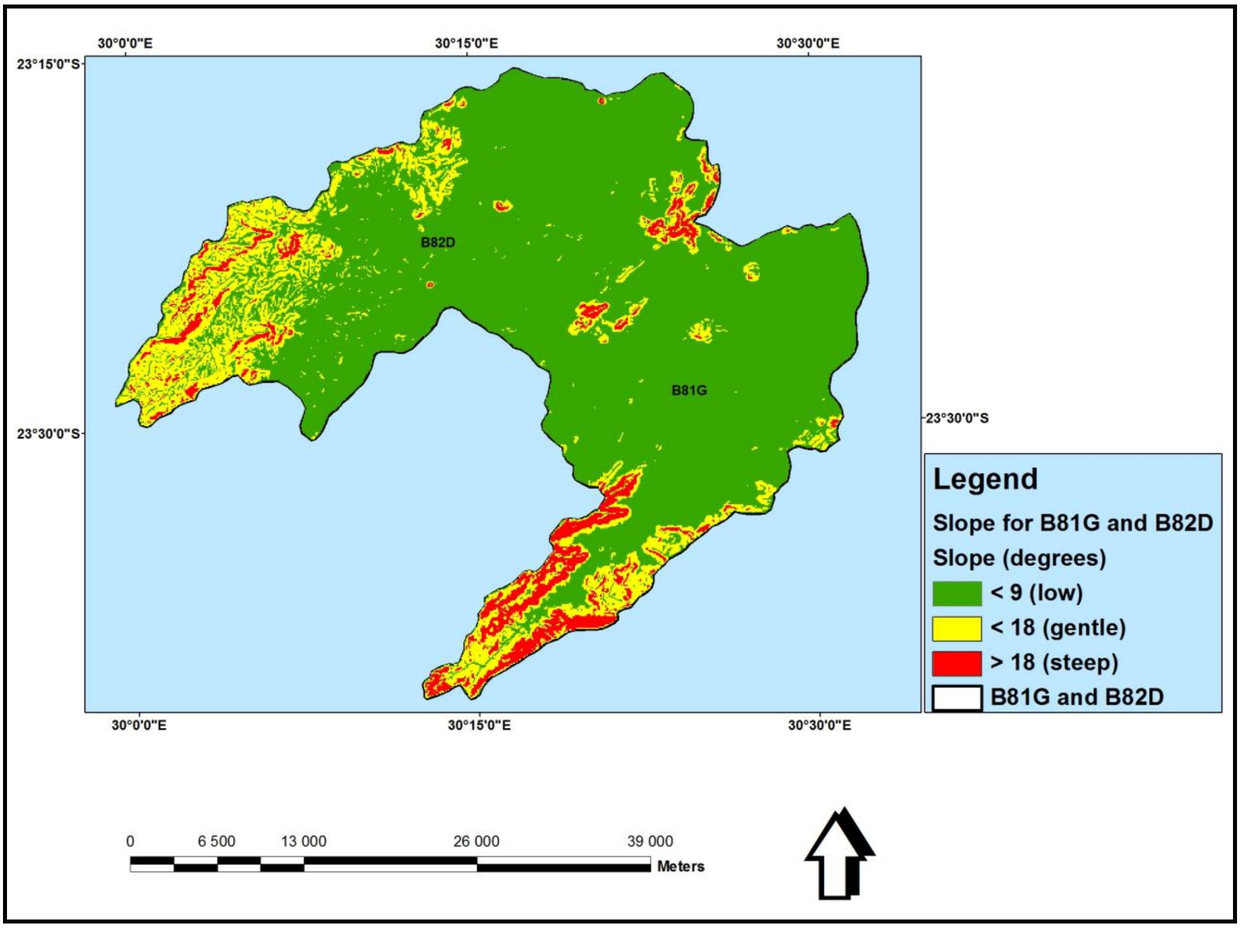

Figure 15: The slope of Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

The results obtained show that both B81G and B82D are dominated by low slope of < 9º. However steep slope of > 18º was revealed on the lower parts of both B81G and B82D. Similarly, gentle slope of between 9º to 18º was revealed on the lower parts of both B81G and B82D. Some portions on the upper parts of both B81G and B82D showed both steep and low slope. Water flows rapid on steep slopes, which may result in low vulnerability in the lower and some portions in the upper parts of both B81G and B82D. Low slopes retain water for a long period of time, and if the water infiltrating is containing contaminants, 65 % of both B81G and B82D may be vulnerable to pollution. This is because both catchments are dominated by low slope.

5.5 The Aquifer Vulnerability of Molototsi (B81G) and Middle Letaba (B82D) Quaternary Catchments

In order to analyse the aquifer vulnerability of B81G and B82D the raster data was first reclassified then analysed using the three overlay methods which are Weighted Sum, Weighted Overlay, and Raster Calculator. The rasters were reclassified as shown in Table 11.

Table 11: Reclassification of raster.

Slope	Soil type	Recharge	Water level
0 (low) < 9.303	0 (low) < 0.0000807 m/s	0 (low) < 20 mm/a	0 (deep) > 35 m
1 (gentle) 9.303 - 18.606	1 (intermediate) 0.0000807 - 0.000162 m/s	1 (intermediate) 20 – 40 mm/a	1 (shallow) < 17 m
2 (steep) > 18.606	2 (high) > 0.000162 m/s	2 (high) > 40 mm/a	2 (intermediate) 17 – 35 m

5.5.1 The Weighted Sum Aquifer Vulnerability Results

In order to verify the accuracy for the results, the analysis was undertaken considering different scenarios. Different scenarios were considered in order to address the influence of different weights for different parameters on the final vulnerability map. Table 12 indicates scenarios for aquifer vulnerability using Weighted Sum tool.

Table 12: Scenarios for aquifer vulnerability using Weighted Sum.

Scenario	Percentage of influence = 1			
	Recharge	**Depth to water table**	**Soil type**	**Slope**
A	0.25	0.25	0.25	0.25
B	0.30	0.40	0.20	0.10
C	0.15	0.40	0.30	0.15
D	0.40	0.25	0.25	0.10

Figure 16 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario A (as per Table 12).

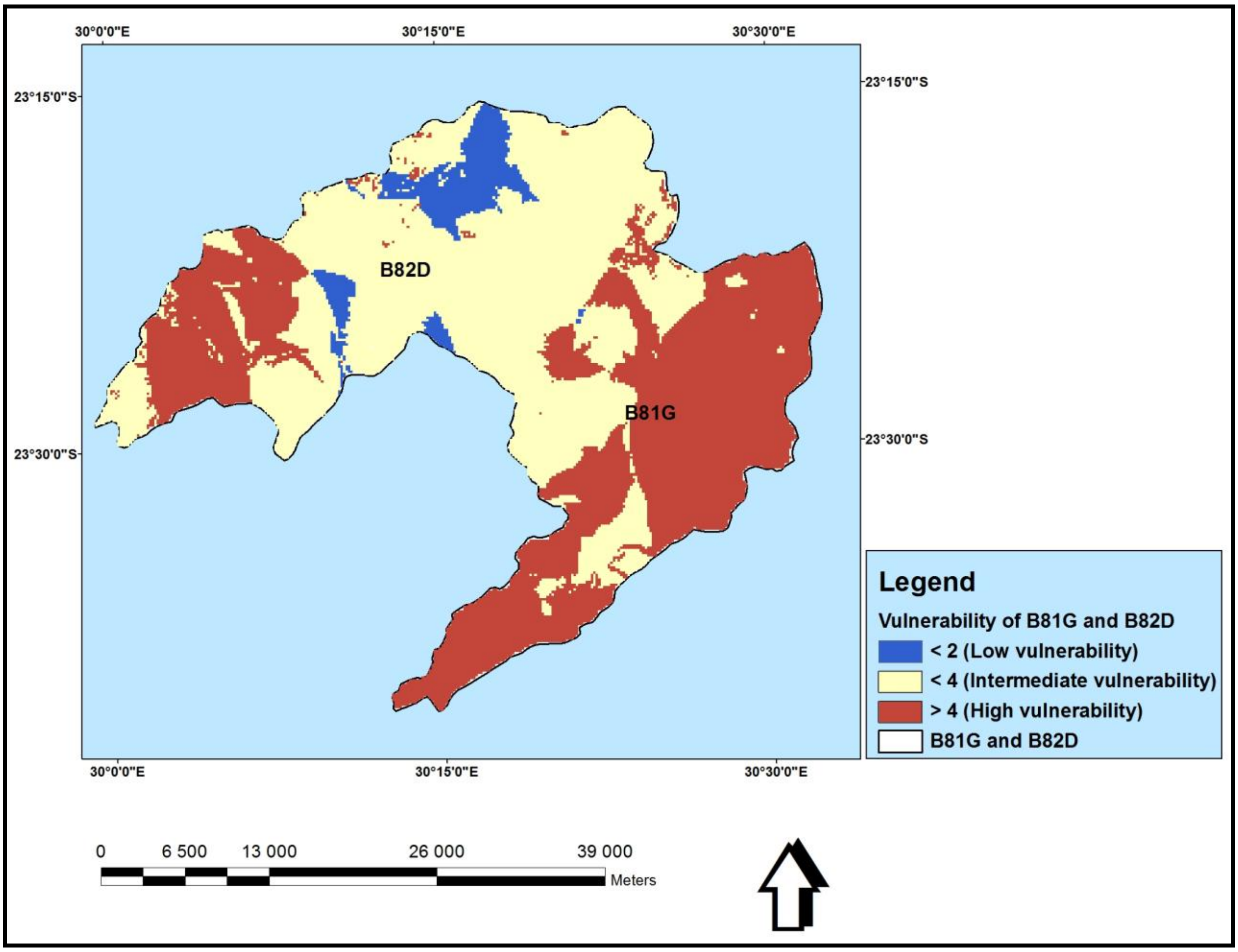

Figure 16: The aquifer vulnerability map for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments analysed using Weighted Sum (scenario A).

Figure 17 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario B (as per Table 12).

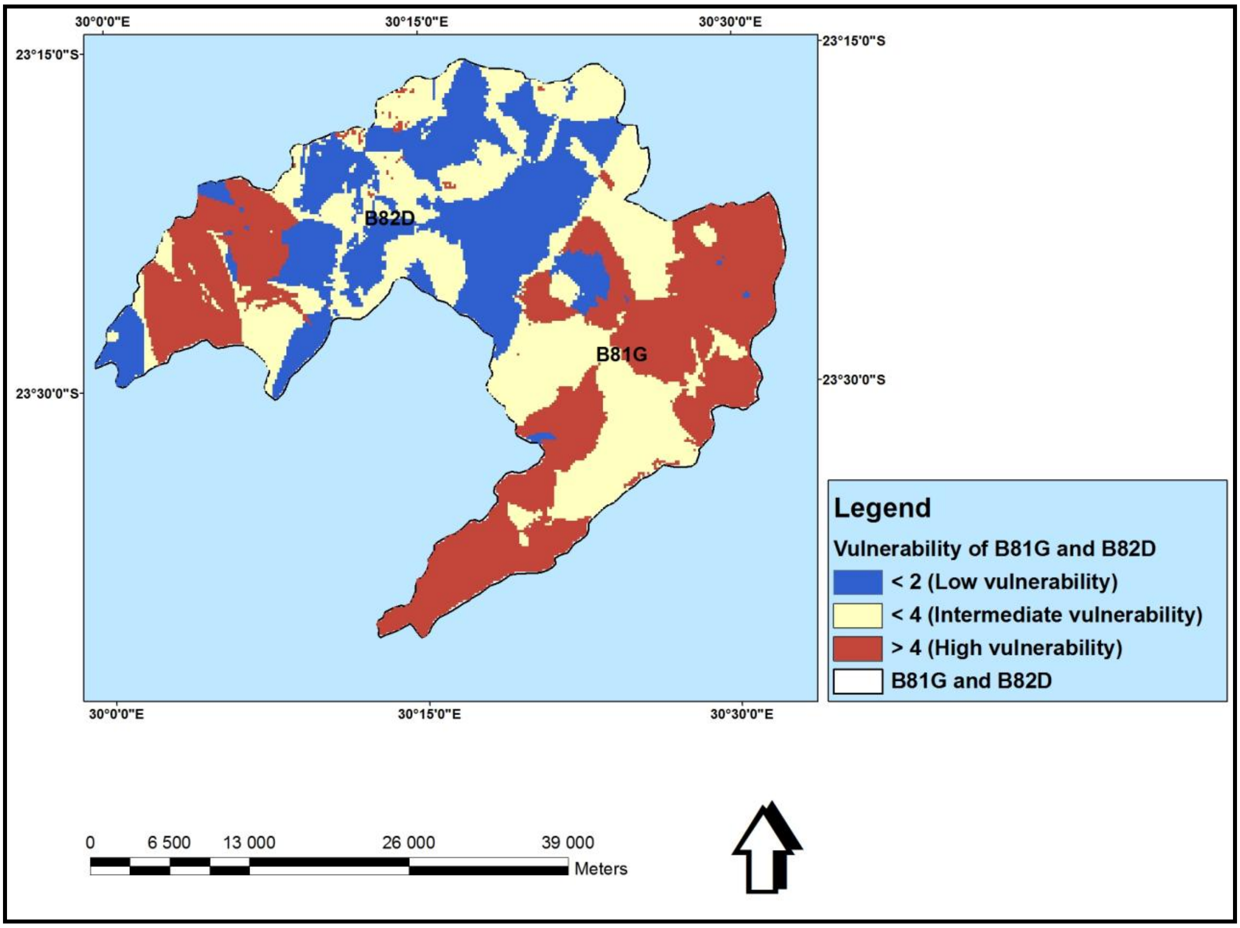

Figure 17: The aquifer vulnerability map for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments analysed using Weighted Sum (scenario B).

Figure 18 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario C (as per Table 12).

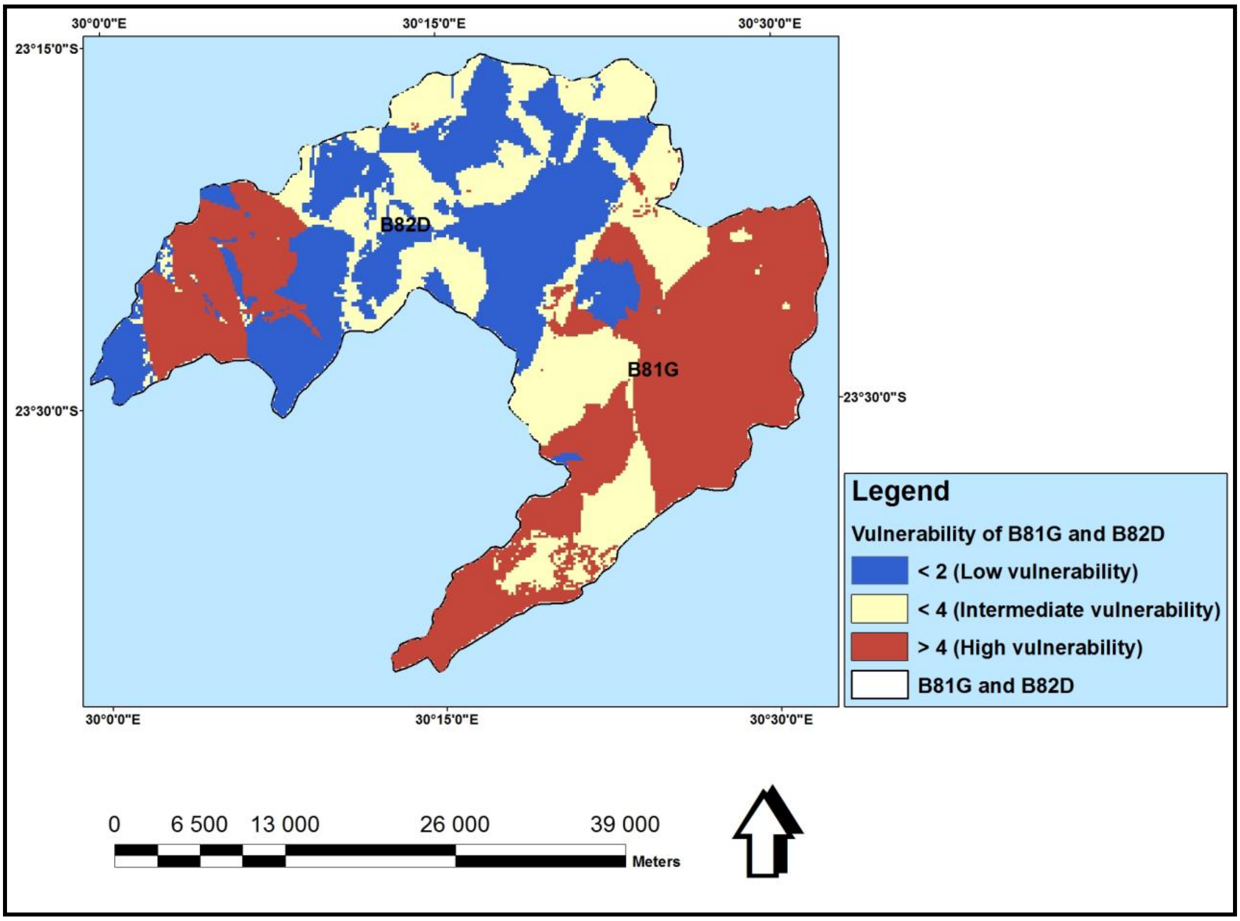

Figure 18: The aquifer vulnerability map for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments analysed using Weighted Sum (scenario C).

Figure 19 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario D (as per Table 12).

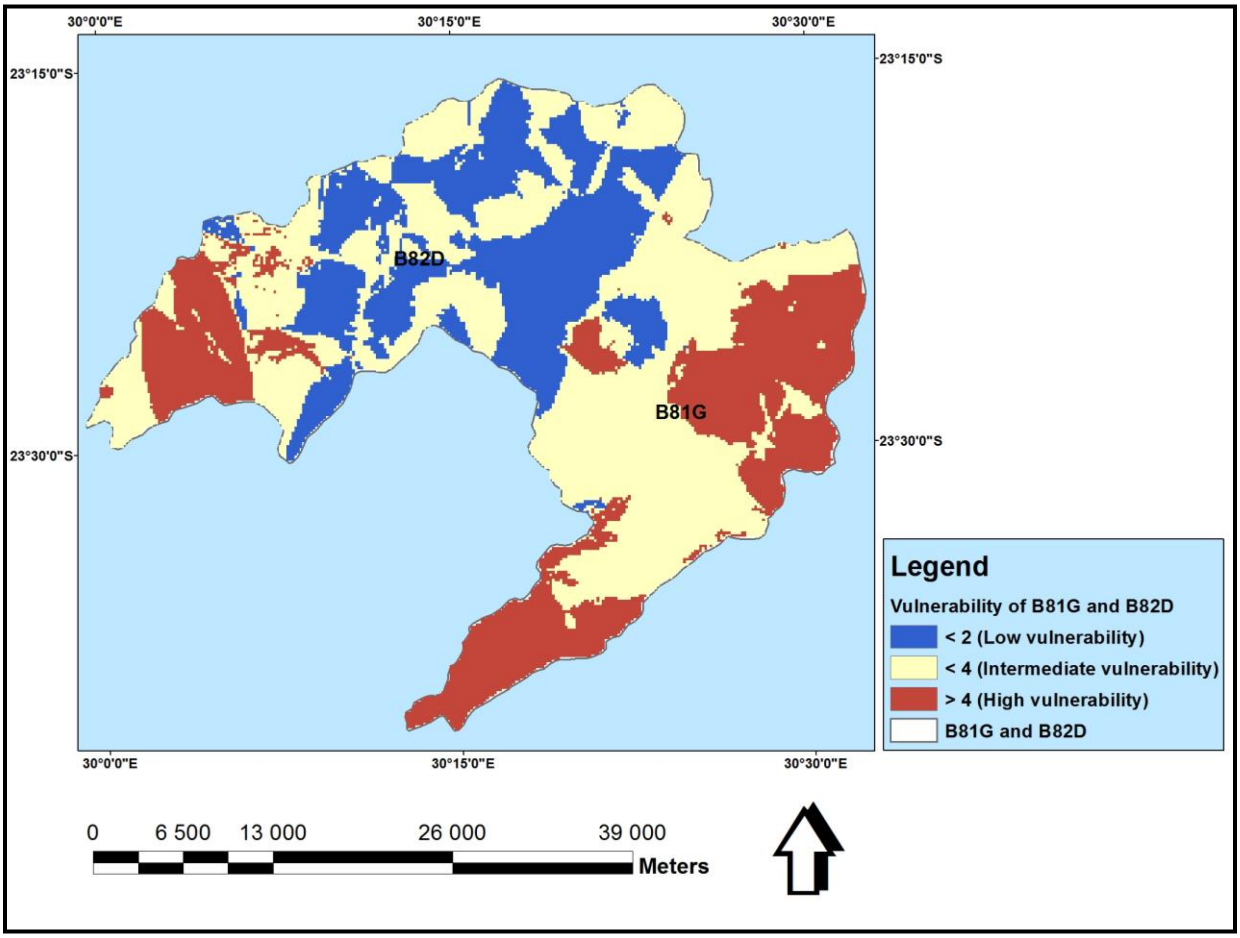

Figure 19: The aquifer vulnerability map for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments analysed using Weighted Sum (scenario D).

5.5.2 The Weighted Overlay Aquifer Vulnerability Results

As with Weighted Sum, Weighted Overlay tool was used to analyse the aquifer vulnerability of B81G and B82D. The analysis was undertaken in order to verify the accuracy of the results obtained when using weighted Sum. The analysis was undertaken considering different scenarios. Table 13 indicates scenarios for aquifer vulnerability using Weighted Overlay tool.

Table 13: Scenarios for aquifer vulnerability using Weighted Overlay.

Scenario	Percentage of influence = 100%				
	Recharge	**Depth to water table**	**Soil type**	**Slope**	**Scale**
A	25%	25%	25%	25%	1 to 5 by 1
B	30%	35%	20%	15%	1 to 5 by 1
C	15%	40%	30%	15%	1 to 5 by 1
D	10%	40%	40%	10%	1 to 5 by 1

Figure 20 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario A (as per Table 13) and influence was assigned in each raster within a scale of 1 to 5 by 1.

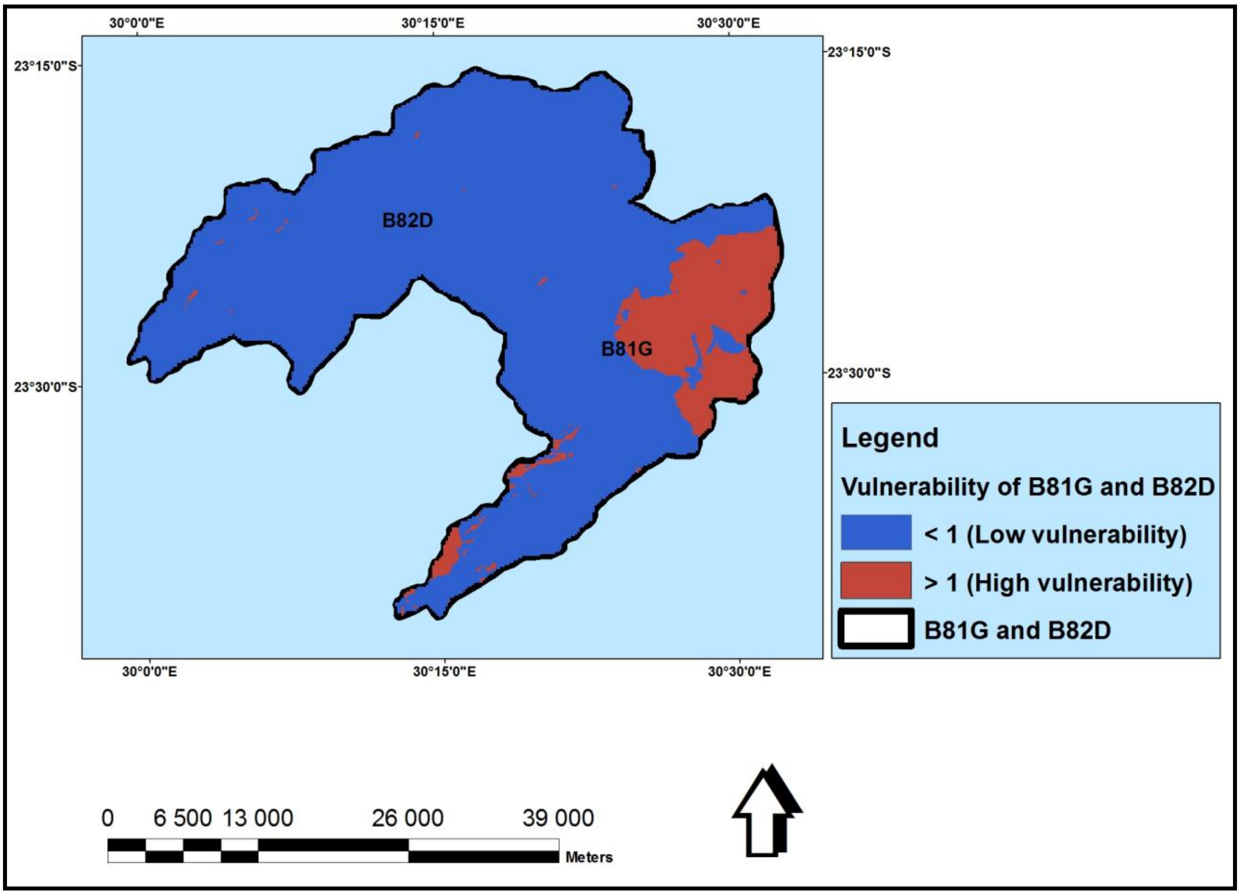

Figure 20: The aquifer vulnerability of Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments using Weighted Overlay (scenario A).

Figure 21 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario B (as per Table 13) and influence was assigned in each raster within a scale of 1 to 5 by 1.

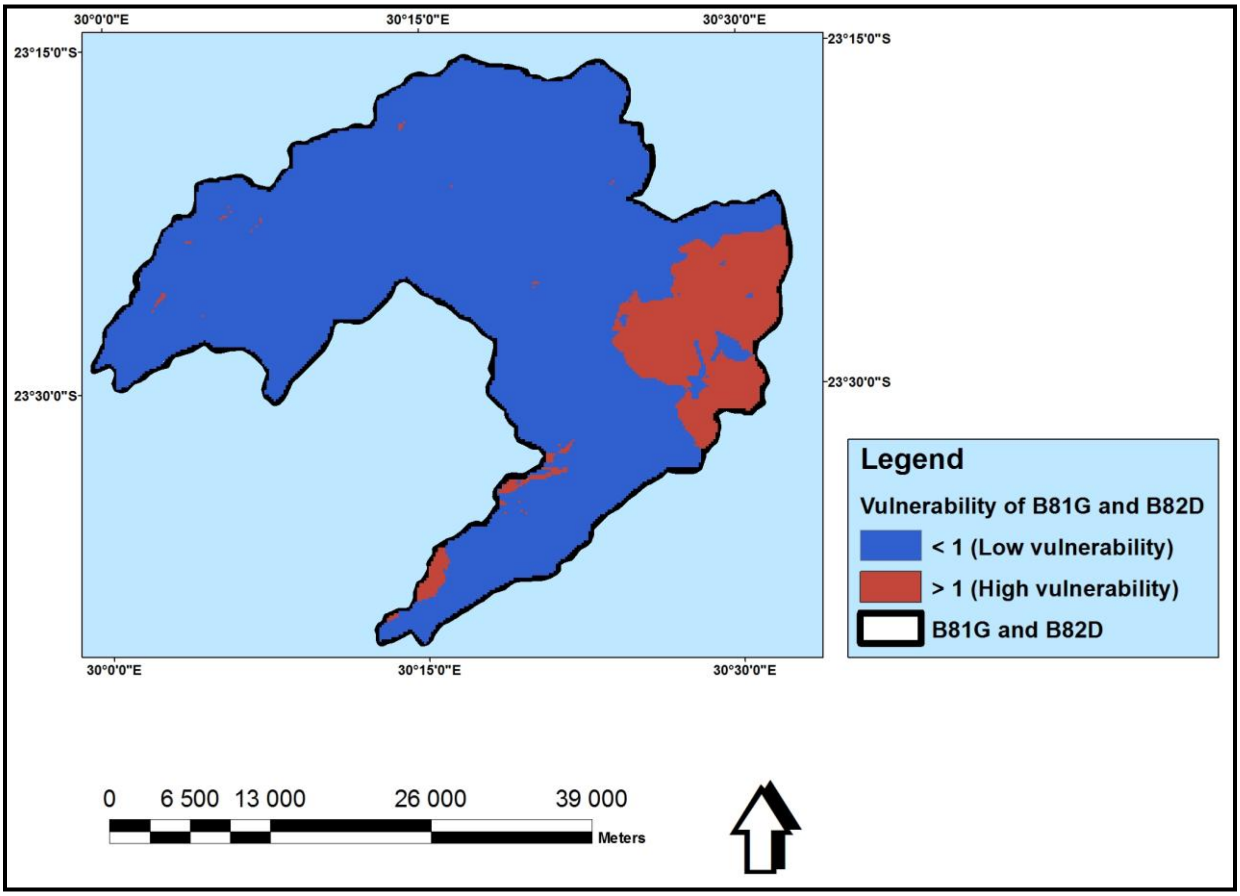

Figure 21: The aquifer vulnerability of Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments using Weighted Overlay (scenario B).

Figure 22 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario C (as per Table 13) and influence was assigned in each raster within a scale of 1 to 5 by 1.

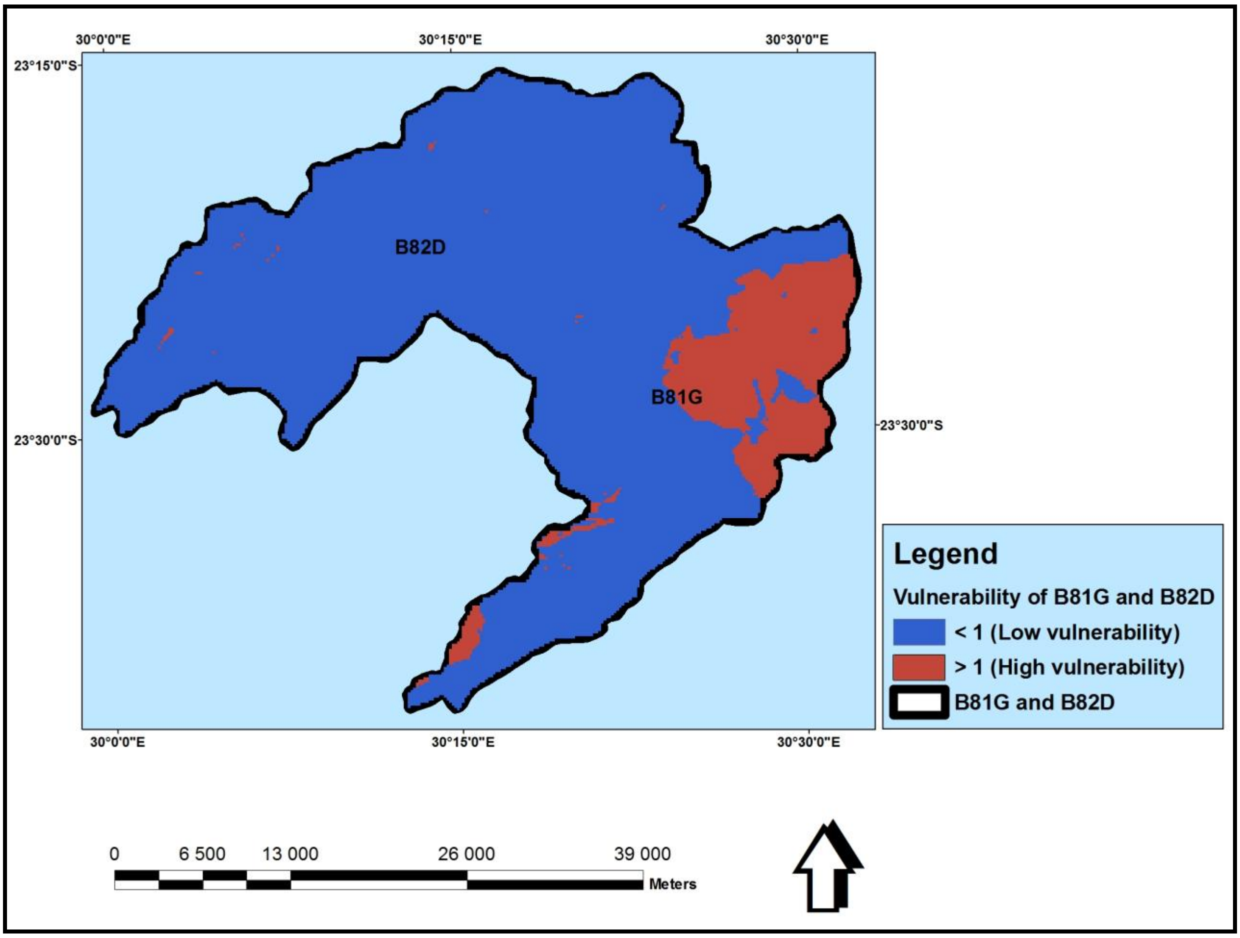

Figure 22: The aquifer vulnerability of Molotsi (B81G) and Middle Letaba (B82D) quaternary catchments using Weighted Overlay (scenario C).

Figure 23 shows the aquifer vulnerability in the catchments. The analysis was undertaken using Weighted Sum tool as per weightings for the Scenario D (as per Table 13) and influence was assigned in each raster within a scale of 1 to 5 by 1.

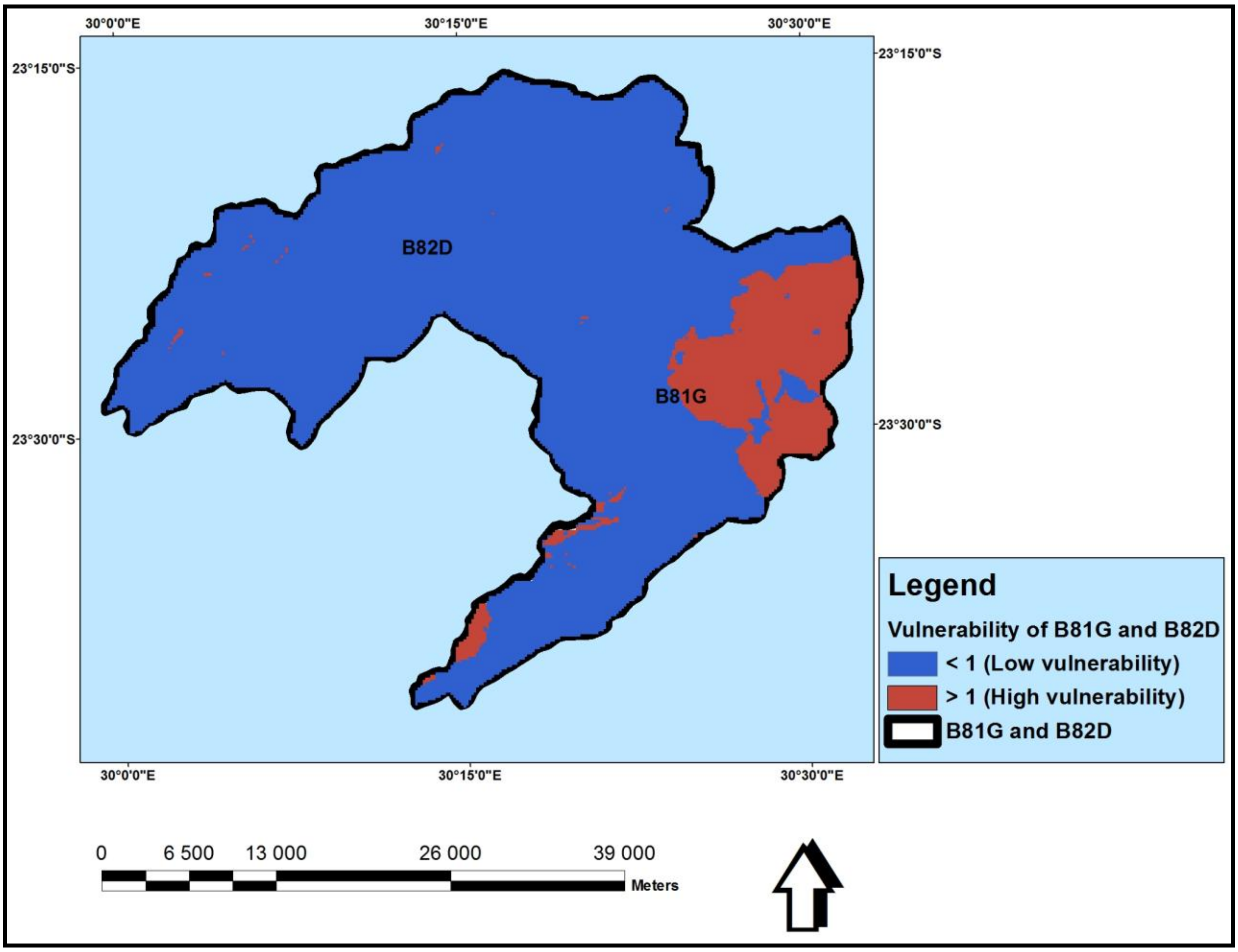

Figure 23: The aquifer vulnerability of Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments using Weighted Overlay (scenario D).

5.5.3 The Raster Calculator Aquifer Vulnerability Results

The map in Figure 24 reveals the degrees to which aquifers are vulnerable to pollution in the B81G and B82D. In order to verify the accuracy of the results obtained when using Weighted Overlay and Weighted Sum, Raster Calculator tool was used to perform the same task. The Map Algebra expression for recharge, depth to water level, soil type and slope was created by combining the rasters for recharge, depth to water level, soil type and slope to produce the output raster (Figure 24). Unlike Weighted Sum and Weighted Overlay, the Raster Calculator does not assign weights to parameters, it works by generating an equation. The vulnerability map was classified into low, intermediate, and high vulnerability. The low vulnerability is represented by blue colour, the intermediate vulnerability is represented by yellow colour, and the high vulnerability is represented by red colour.

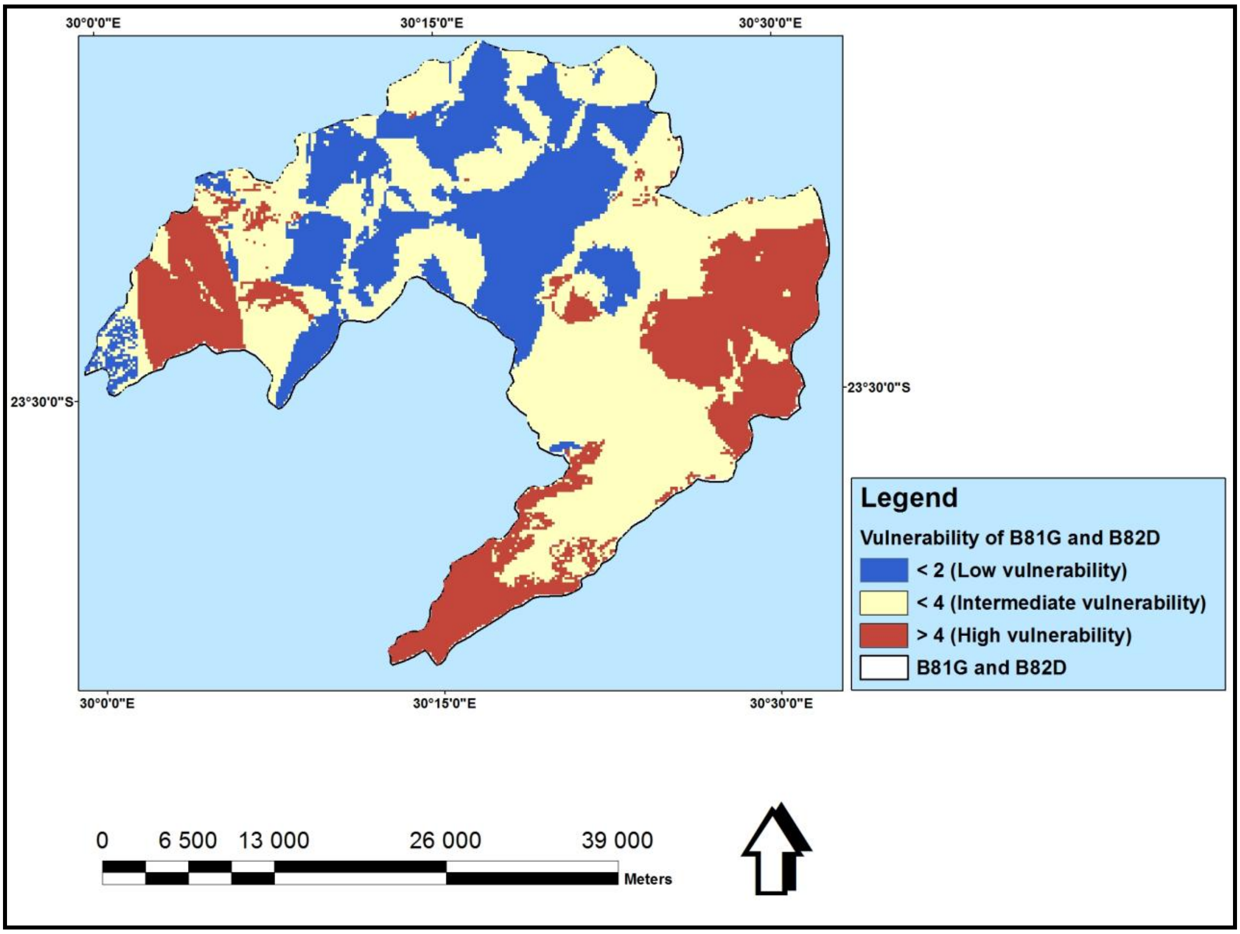

Figure 24: The aquifer vulnerability of Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments analysed using Raster Calculator.

5.6 Analysis

5.6.1 The Aquifer Vulnerability Analysis using Weighted Sum Tool

The results obtained from the four scenarios when using Weighted Sum were similar. High aquifer vulnerability was revealed from all scenarios on the lower parts of both Molototsi and

Middle Letaba quaternary catchments. For the entire scenarios high vulnerability was revealed on the upper right of Molototsi quaternary catchment. The tip part of Middle Letaba quaternary catchment showed intermediate vulnerability in scenario A and D, and low vulnerability in scenario B and C. In all the four scenarios intermediate vulnerability extended from the lower towards the upper part of Molototsi. Low vulnerability was revealed on the upper part of Middle Letaba quaternary catchments from all the scenarios.

Scenario B was chosen as the one which can best represent the aquifer vulnerability of Molototsi and Middle Letaba quaternary catchments. This scenario was chosen, because depth to water level is an important parameter in Molototsi and Middle Letaba quaternary catchment. Ground-based sanitation systems (pit latrines toilets) are located next to groundwater sources (boreholes). This makes depth to water level an important parameter. Scenario B assigned high weight to depth to water level, hence this scenario is regarded the one which can best represent the vulnerability of Molototsi and Middle Letaba quaternary catchment.

5.6.2 The Aquifer Vulnerability Analysis using Weighted Overlay Tool

From all the four scenarios high aquifer vulnerability was revealed on the lower part of Molototsi quaternary catchments. However, high vulnerability was also revealed on the upper right of Molototsi quaternary catchments. All the four scenarios showed that Molototsi and Middle Letaba are dominated by low vulnerability.

5.6.3 The Aquifer Vulnerability Analysis using Raster Calculator Tool

The results obtained when using Raster Calculator were similar to the results obtained when using Weighted Sum (scenario D). High aquifer vulnerability was revealed on the lower parts of both B81G and B82D. High vulnerability was also revealed on the upper right of B81G. B81G is dominated by intermediate vulnerability, the vulnerability extended from the lower towards the upper part of the quaternary catchment. However B82D showed intermediate vulnerability on the lower and some portions on the upper part of the quaternary catchment. B82D is dominated by low vulnerability. The vulnerability extended from the lower part of B82D towards the upper part of B81G.

High Aquifer Vulnerability

Considering the aquifer vulnerability map for Molototsi and Middle Letaba quaternary catchments analysed using Weighted Sum tool (scenario, B). The lower parts of both Molototsi and Middle Letaba quaternary catchments showed high vulnerability. However, high vulnerability was also revealed on the upper parts of both Molototsi and Middle Letaba quaternary catchments. This high level of vulnerability on the lower part of Molototsi quaternary catchment results mainly from the accumulated impacts of shallow and intermediate water level, high recharge, mixture of low, gentle and steep slope, and intermediate soil type. The high vulnerability on the lower part of Middle Letaba quaternary catchment results from the accumulated impacts of intermediate water level, mixture of high and intermediate recharge, mixture of low, gentle and steep slope, and intermediate soil type. High vulnerability on the upper east of Molototsi quaternary catchment is due to the accumulated impact of soil type, low slope, mixture of shallow and intermediate water level, and low recharge. High vulnerability on the upper west of Molototsi is due to the accumulated impact of intermediate soil type, mixture of intermediate and shallow water level, low slope, and low recharge. High aquifer vulnerability indicates that there is high likehood of contaminants to reach the aquifer. Therefore these areas need to be prioritize for regular groundwater monitoring.

Intermediate Aquifer Vulnerability

Similarly, considering the aquifer vulnerability map for Molototsi and Middle Letaba quaternary catchments analysed using Weighted Sum tool (scenario, B). Molototsi (B81G) quaternary catchment is dominated by intermediate vulnerability. The vulnerability extends from the upper towards the lower part of the catchment. Middle Letaba quaternary (B82D) catchment showed intermediate vulnerability on the lower and the upper part of the quaternary catchment. In the B81G the intermediate vulnerability is due to the accumulated impact of mixture of shallow and intermediate water level, low recharge, low slope and intermediate soil type. On the lower part of B82D the intermediate vulnerability is due to the accumulated impact of deep water level, intermediate recharge, low and intermediate soil type, and mixture of low, gentle and steep slope. On the upper part of B82D the intermediate vulnerability is due to the accumulated impact of mixture of shallow and intermediate water level, low recharge, low soil type, and low slope. Intermediate vulnerability means that the aquifers are in good condition, but if the physical environment deteriorates the condition can change to either high vulnerability.

Low Aquifer Vulnerability

Similarly, considering the aquifer vulnerability map for Molototsi and Middle Letaba quaternary catchments analysed using Weighted Sum tool (scenario, B). The lower and the upper part of Middle Letaba (B82D) quaternary catchment showed low aquifer vulnerability. However Molototsi quaternary catchment (B81G) also showed a small portion of low vulnerability at the upper part of the quaternary catchment. The low vulnerability in the B81G is due to the accumulated impact of intermediate recharge, intermediate soil type, mixture of low, gentle and steep slope, and deep water level. The low vulnerability in the lower part of B82D is due to the accumulated impact of deep water level, low recharge, intermediate and low soil type, and low slope. The low vulnerability in the upper left of B82D is due to low slope, deep water level, low recharge, and low soil type. The low vulnerability on the upper right of B82D is due to low soil type, low slope, low recharge, and shallow water level. Low vulnerability shows that aquifers are at low risk of contamination.

5.7 Evaluation of Parameters

The geology of Molototsi and Middle Letaba quaternary catchments is dominated by gneisses. Gneisses are a common and widely distributed type of rock formed by high-grade regional metamorphic processes from pre-existing formations that were originally igneous rocks. Gneissic rocks are usually medium to coarse grained, and largely recrystallized but do not carry large quantities of chlorite or other platy minerals (DEAT, 2009). The absence of chlorite in gneisses makes the method used for recharge estimation (Chloride Mass Balance method) suitable for this area of study. The chloride balance method assumes that there is no added chloride into the groundwater from the geology, .notably with the possible inclusion of chlorite minerals in greenstones.

Depth to water table is not static. According to Leduc *et al.*, (1997) depth to water level is variable (fluctuates) over time. According to Zhang and Schilling (2006) infiltration through the vadose zone, due to high rainfall causes rise in water table. Measuring depth to water level in the accessible boreholes gave the current data about the water level condition. This makes the data used for depth to water level analysis reliable.

According to Department of Environmental Protection (2006) infiltration and percolation tests should not be conducted in the rain or within 24 hours of significant rainfall events or when the temperature is below freezing. The infiltration, percolation, and hydraulic conductivity in the area of study were undertaken considering saturation which might be from rainfall. Considering the impact rainfall makes the data for infiltration, percolation, and hydraulic conductivity reliable.

According to Toutin (2002) the ability to carry out realistic terrain analyses is limited primarily by the quality of DEM applied in terms of the accuracy and distribution of the elevation point used to interpolate the DEM, the interpolation logarithm used to generate a continuous DEM, and the chosen grid cell size. According to Kjeldsen *et al.*, (2002) the larger the grid size, the more the DEM fail to represent steeper slopes. The smaller the grid size the higher is the catchment proportion of zero percent slope and steep slopes. According to Helmschrot (1999) the official DEM of South Africa has a grid size of 200 m, which is not sufficient for slope analysis on a regional scale. Hence a raster based DEM_{90} developed from Shuttle Radar Topography Mission (SRTM) with a grid size of 90 m x 90 m was used for slope analysis in

Molototsi and Middle Letaba quaternary catchments. Reducing the grid size makes the results obtained for slope analysis reliable.

The RDSS method involves the overlaying of the parameters recharge, depth to water level, soil type, and slope. When overlain, areas where high recharge, shallow water level, high soil type, and low slope coincide are considered as high vulnerable areas. This is because recharge is the principal vehicle for transporting contaminants to the water table. Increases in recharge increase the chances of contaminants reaching the water table. Depth to water level determines the depth of material through which contaminants must travel before reaching the aquifer. Deeper water level implies lesser chance of contamination to occur. Shallow water level is more conducive for contaminants to reach the groundwater as compared to deeper water level under similar surface condition. Soil type (the seepage behaviour of water) has a significant impact on the amount of recharge that can infiltrate into the ground. An increase in hydraulic conductivity, infiltration and percolation increase the vulnerability of the aquifer. Topography helps control the likehood that pollutants will runoff or remain long enough to infiltrate through the ground slope. In low slopes, pollutants remain long enough to infiltrate.

The four parameters (recharge, depth to water level, soil type, and slope) proved to have determined the aquifer vulnerability of B81G and B82D. Areas which were expected to be vulnerable to pollution due to shallow water level, high recharge, high soil type, and low slope were also found to be vulnerable when using the RDSS method.

CHAPTER 6: CONCLUSIONS

Various methods for assessing aquifer vulnerability such as DRASTIC, GOD, EPIK, SEEPAGE, COP and SINTACS were reviewed. A new method RDSS was deduced which is based on four parameters, namely: Recharge, Depth to water level, Soil type and Slope. The four parameters were combined using the overlay tool in ArcGIS 9.3.1. Three different overlay methods Weighted Sum, Weighted Overlay, and Raster Calculator, were used to do the analysis. The Weighted Sum scenario B with 0.30, 0.40, 0.20, and 0.10 weights for recharge, depth to water level, soil type, and slope was chosen as the one which best represent the vulnerability of the Molototsi and Middle Letaba quaternary catchments. This scenario was chosen because it emphasises the differences in vulnerability best with the greater weight towards the depth to water level parameter. The depth to water level is an important parameter in both catchments, since ground-based sanitation systems are located next to ground water sources in these catchments. The RDSS method also proved valuable in the application in densely populated rural areas due to the readiness with which parameters can be determined in the field and with the aid of GIS.

The first objective of this study was to assess the vadose zone as a pathway for contamination from the surface (vulnerability). Vulnerability assessment of the study area has been developed using the RDSS method.

The second objective was to quantify vulnerability using the assigned parameters which are conductivity (K), vadose zone thickness (b), slope and recharge. The objective has been achieved, since the recharge, depth to water level, soil type (hydraulic conductivity, infiltration, and percolation), and slope has been analysed. The four parameters were overlaid to generate the vulnerability map (Figure 16, 17, 18, 19, 20, 21, 22, 23 and 24). The vulnerability was classified into low, intermediate, and high vulnerability (Figure 17, scenario B).

Future research studies are recommended to validate the findings of this study, as well as the RDSS method.

REFERENCES

Al-Hanbali, A. and Kondoh, A. (2008). Aquifer vulnerability Assessment and Evaluation of Human Activities Impact (HAI) within the Dead Groundwater Basin, Jordan. *Hydrogeology Journal*, **16**, 499-510.

Aljazzar, T.H. (2010). Adjustment of DRASTIC Vulnerability Index to Assess Groundwater Vulnerability for Nitrate Pollution Using the Advection Diffusion Cell. PhD thesis (unpublished), RWTH Aachean University, Aachean, Germany, 28-31pp.

Aller, L., Bennett, T., Lehr, J.H., Petty, H.J. and Hackett, J. (1987). DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings, Environmental Protection Agency Report NO. EPA-600/2-87-035, National Water Well Association, 455-485pp.

Alyamani, M.S. and Şen, Z. (1993). Determination of Hydraulic Conductivity from Complete Grain-Size Distribution Curves. *Ground Water*, **31** (4), 551.

Al-Zabet, T. (2002). Evaluation of Aquifer Vulnerability to Contamination Potential Using DRASTIC Method. *Environmental Geology*, **43**, 203-208.

Andreo, B., Golderschelder, N., Vadillo, I., Vías, J.M., Neukum, C., Sinreich, M., Jiménez, P., Brechenmacher, J., Carrasco, F., Hötzl, H., Perles, M.J. and Zwahlen, f. (2006). Karst Groundwater Protection: First Application of Pan-European Approach to Vulnerability, Harzards and Risk Mapping in the Sierra de Libar (Southern Spain). *Science of the Total Environment*, **357**, 54-73.

Antonakos, A.K. and Lambrakis, N.J. (2007). Development and Testing of Three Hybrid Methods for the Assessment of Aquifer Vulnerability to Nitrates, Based on the DRASTIC Method, an Example from NE Korinthia, Greece. *Journal of Hydrology*, **333**, 288-304.

Baalousha, H. (2006). Vulnerability Assessment for the Gaza Strip Palestine Using DRASTIC. *Environmental Geology*, **50**, 405-414.

Babiker, I.S., Mohamed, M.A., Hiyama, T. and Kato, K. (2005). A GIS-based DRASTIC Method for Assessing Aquifer Vulnerability in Kakamigahara Height, Gifu Prefecture, Central Japan. *Science of the Total Environment*, **345**, 127-140.

Bernhardsen, T. (1992). GIS Tools. In: Geographic Information System. *Viak IT*, Norway, 191pp.

Boulding, J.R and Ginn, J.S. (2004). Soil, Vadose Zone, and Ground-water Contamination Assessment, Prevention and Remediation. 2nd edition. *Lewis Publishers*, London. 50pp.

Bolstad, P. (2005). Basic Spatial Analysis. In: GIS Fundamentals: A First Text on Geographic Information Systems. *Eider Press*, United States of America, 324, 325, 334, 355pp.

Brandl, G., Cloete, M. and Anhaeusser, C.R. (2006). Archaean Greenstone Belt. In: Johnson, M.R and Thomson, R.J (Editors), The Geology of South Africa. *Geological Society of South Africa*, Johannesburg/ *Council for Geoscience*, Pretoria, 31-36pp.

Civita, M. and De Maio, M. (2004). Assessing and Mapping Aquifer vulnerability to Contamination: The Italian "combined" Aproach. *Geofísica Internacional*, **43** (4), 513-532.

Civita, M.V. (2010). The Combined Approach When Assessing and Mapping Groundwater Vulnerability to Contamination. *Journal of Water Resource and Protection,* **2** (1), 14-28.

Chilton, P.J. and Foster, S.S.D. (1995). Hydrogeological Characterisation and Water-Supply Potential of Basement Aquifers in Tropical Africa. *Hydrogeology Journal,* **3** (1), 47.

Daly, D., Dassargues, A., Drew, D., Dunne, S., Goldscheider, N., Neale, S., Popescu, I.C. and Zwahlen, F. (2002). Main concept of the ‘‘European Approach’’ to Karst-groundwater-vulnerability Assessment and Mapping. *Hydrogeology Journal*, **10**, 340-345.

[DEAT] Department of Environmental Affairs and Tourism (2009). Environmental Management Framework for the Olifants and Letaba River Catchment Areas: Draft Report on the Status Quo, Opportunities, Constraints and the Desired State (version 1), Pretoria, South Africa, 12pp.

Deming, D. (2002). Introduction to Hydrogeology. In: Russian, R. (editor), Introduction to Hydrogeology. 1st edition. *McGraw-Hill,* New York, 31pp.

Department of Environmental Protection (2006). Pennsylvania Stormwater Best Management Practices Manual. *Bureau of Watershed Management,* **30** (20), 437-443.

de Vries, J.J. and Simmers, I. (2002). Groundwater Recharge: an Overview of Process and Challenges. *Hydrogeology Journal*, **10**, 5-17.

Dippenaar, M.A., Sole, M.D., Van Rooy, J.L., du Toit, G. J. and Reynecke, J.L. (2005). Determining Actual LNAL Plume Thickness: Review and Case Study in Fractured Aquifer. *Bulleting of Engineering Geology Environment,* **64**, 347-360.

Dippenaar, M.A., Van Rooy, J.L., Moyo, A., Freëse., R and Makonto, O.T. (2010). Preliminary Vadose Zone Classification Methodology (Molototsi and Middle Letaba Quaternary Catchments). Water Research Commission (South Africa) Project Number K8/876. 14pp.

Doerfliger, N. and Zwahlen, F. (1997). EPIK: Cartographic Method for Assessing the Vulnerability of Karst Aquifers for the Purpose of Delineating Protection Zones. International Symposium on Karst Waters and Environmental Impacts 1995, 1995 September 10-20, Balkema, Netherlands, 1995, 117-123.

Doerfliger, N., Jeannin, P.Y. and Zwahlen, F. (1999). Water Vulnerability Assessment in Karst Environments: A New Method of Defining Protection Areas Using a Multi-Attribute Approach and GIS Tools (EPIK Method). *Environmental Geology,* **39** (2), 165-176.

Draoui, M., Vías, J., Andreo, B., Targuisti, K. and Stitou El Messari, J. (2008). A comparative Study of Four Vulnerability Mapping Methods in a Detritic Aquifer Under Mediterranean Climatic Conditions.*Environmental Geology*, **54**, 455-463.

[DWAF] Department of Water Affairs and Forestry (2004). Internal Strategic Perspective: Luvuvhu/Letaba Water Management Area: Prepared by Goba Moahloli Keeve Steyn (Pty) Ltd in Association with Tlou and Matji, Golder Associates Africa and BKS on behalf of the Directorate: National Water Resource Planning. Department of Water Affairs and Forestry (South Africa), Report Number PWMA 02/000/00/0304. 1-18pp.

[DWAF] Department of Water Affairs and Forestry (2006). Groundwater Resource Assessment II – Task 3aE Recharge. Department of Water Affairs (South Africa), Tender NO 2003-150, Version 2.0., 10-48pp.

[DWAF] Department of Water Affairs and Forestry (2006). Letaba Catchment Reserve Determination Study Groundwater Report Final. Department of Water Affairs and Forestry (South Africa). Report No. RDM/B800/02/CON/COMP/0504, 5pp.

[DWA] Department of Water Affairs (2009). Strategy and Guideline Development for National Groundwater Planning Requirements: Review of GR1, GRA2 and International Assessment Methodologies. Department of Water Affairs (South Africa). Report No. PRSA 000/00/11609/6, 3-2,3pp.

Edet, A.E. (2004). Vulnerability Evaluation of a Coastal Plain Sand Aquifer with a Case Example from Calabar, Southeastern Nigeria. *Environmental Geology*, **45**, 1062-1070.

El Naga, A. (2004). Aquifer Vulnerability Assessment Using the DRASTIC Method at Russeifa Landfill, Norheast Jordan. *Environmental Geology*, **47**, 51-62.

Fetter, C.W. (2001). Soil Moisture and Groundwater Recharge. In: Lynch, P., Hale, S. and Sturla, B (Editors), Applied Hydrogeology. 4th edition. *Merril Publishing Company*. UK. 231-231pp.

Flury, M. and Wai, N.N. (2003). Dyes as Tracers for Vadose Zone Hydrology. *Reviews of Geophysics*, **41** (1), 2-37.

Foster, S.S.D. (1987). Fundamental Concepts in Aquifer Vulnerability, Pollution Risk and Protection Strategy. In: van Duijvanbooden, W. and van Waegeningh, H.G. (Editors), Vulnerability of Soil and Groundwater to Pollution. TNO Committee on Hydrological Research, The Hague., Proceeding Information, **38**, 69-86.

Gogu, R.C. and Dassargues, A. (2000a). Current Trends and Future Challenges in Aquifer vulnerability Assessment using Overlay and Index Methods. *Environmental Geology*, **39(6)**, 549-559.

Gogu, R.C. and Dassargues, A. (2000b). Sensitivity Analysis for the EPIK Method of Vulnerability Assessment in Small Karstic Aquifer, Southern Belgium. *Hydrogeology Journal*, **8**, 337-345.

Goldscheider, N. (2005). Karst Aquifer vulnerability Mapping Application of a New Method in the Swabian AIb, Germany. *Hydrogeology Journal*,**13**, 555-564.

Gorr, W.L. and Kurland, K.S. (2007). ArcGIS 9 (ArcEditor 9.3.1 and Extensions), Help function (software). ESRI, 380 New York Street, USA. Available from: http:// www.esri.com.

[GPM] Groundwater Project Management Consulting Company (2010). Depth to Water Table Data. Polokwane, South Africa. http://www.griplimpopo.co.za.

[GRIP] Groundwater Resource Information Project Limpopo (2010). Limpopo GRIP Data, Mopani District Municipality, Greater Giyani and Greater Tzaneen Local Municipality. Department of Water Affairs (South Africa), Document 1. http://www.griplimpopo.co.za/home.php.

Helmschrot, J. (1999). Applications of Remote Sensing Data for Distributed Hydrological Modelling of Large Scale Afforested Areas in the Northern East Cape Province, South Africa. Session: Research and Management of Ecosystems and Natural Resources Including Forests, Deutscher Tropentag 1999 in Berlin, 1-8 pp.

Holland, M (2011). Hydrogeological Characterisation of Crystalline Basement Aquifers within the Limpopo Province, South Africa. PhD thesis (unpublished), University of Pretoria, South Africa, 66pp.

Ibe, K.M., Nwankwor, G.I. and Onyekuru, S.O. (2001). Assessment of Aquifer vulnerability and its Application to the Development of Protection Strategy for the Water Supply Aquifer in Owerri, Southeastern Nigeria. *Environmental Monitoring and Assessment*, **67** (3), 323-360.

Jenn, F., Knödel, K., Liese, M. and Voigt, H. (2007). Precipitation. In: Knödel, K., Lange, G. And Voigt, H.J. (editors), Environmental Geology: Handbook of Methods and Case Studies. *Springer. Heidelberg.*652-653pp.

Kim, Y.J. and Hamm, S. (1999). Assessment of the potential for Groundwater Contamination Using the DRASTIC/EGIS Technique, Cheongju Area, South Korea. *Hydrogeology Journal*, **7,** 227-235.

Kjeldsen, T.R., Smithers, J.C. and Schulze, R.E. (2002). Regional Flood Frequency Analysis in Kwazulu-Natal Province, South Africa, Using the Index-Flood Method. *Journal of Hydrology,* **225**, 194-211.

Kraszewski, A.W., Trabelsi, S. and Nelson, S.O. (1997). Moisture Content Determination in Grain by Measuring Microwave Parameters. *Measurement Science and Technology,* **8**, 857-863.

Kröner, A., Jaeckel, P. and Brandl, G. (2000). Single Zircon Ages for Felsic to Intermediate Rocks from the Pieterburg and Giyani Greenstone Belts and Bordering Granitoid Orthogneisses, Northern Kaapvaal Craton, South Africa. *Journal of African Earth Sciences*, **30** (4), 773-793.

Leduc, C., Bromley, J. and Schroeter, P. (1997). Water Table Fluctuation and Recharge in Semi-Arid Climate: Some Results of the HAPEX-Sahel Hydrodynamic Survey (Niger), *Journal of Hydrology*, **188** (189), 123-138.

Lerner, D.N. (2002). Identifying and Quantifying Urban Recharge: a Review. *Hydrogeology Journal*, **10**, 143-152.

Leyland, R.C. (2008). Vulnerability Mapping in Karst Terrains, Examplified in the Wider Cradle of Human Kind World Heritage Site. MSc thesis (unpublished), University of Pretoria, Pretoria, South Africa, 74-91pp.

Leyland, R.C., Witthüser, K.T and van Rooy, J.L. (2008). Vulnerability Mapping in the Karst Terrains, Examplified in the Wider Cradle of Humankind World Heritage Site. Water Research Commission (South Africa) Report No. KV 208/08. 33pp.

Lin, H.S., Scott, H.D., Steele, K.F. and Inyang, H.I. (1998). Agricultural Chemicals in the Alluvial Aquifer of a Typical Country in the Arkansas Delta. *Environmental Monitoring and Assessment*, **58**, 151-172.

MacDonald, A., Davies, J., Calow, R. and Chilton,J. (2005). Developing Groundwater: A Guide for Rural Water Supply. *ITDG Publishing*, UK, 215pp.

Melloul, A.J. and Collin, M. (1998). A Proposed Index for Aquifer Water Quality Assessment: the Case of Israel‘s Sharon Region. *Journal of Environmental Management*, **54**, 131-142.

Metni, M., El-Fadel, M., Sadej, S., Kayal, R. and EL Khoury, D.L. (2004). Groundwater Resources in Lebanon: A Vulnerability Assessment. *Water Resources Development*, **20** (4), 475-491.

Mimi, Z.A. and Assi, A. (2009). Intrinsic Vulnerability, Hazard and Risk Mapping for Karst Aquifers: A Case Study. *Journal of Hydrology*, **364**, 298-310.

Muhammetoglu, A. and Yardimci, A. (2006). A Fuzzy Logic Approach to Assess Groundwater Pollution Levels Below Agricultural Fields. *Environmental Monitoring and Assessment*, **118**, 337-354

Neukum, C. and Hötzl, H. (2007). Standardization of Vulnerability Maps. *Environmental Geology*, **51**, 689-694.

Nyabeze, W.R., Mallory S., Hallowes J., Mwaka B. and Sinha, P. (2007). Determining Operating Rules for the Letaba River System in South Africa Using three Methods. *Physical and chemistry of the Earth*, **32** (15-18), 1040-1049.

Panagopoulos, G.P., Antonakos, A.K. and Lambrakis, N.J. (2006). Optimization of DRASTIC Method for Aquifer vulnerability Assessment Via the Use of Simple Statistical Methods and GIS, *Hydrogeology Journal*,**14**, 894-911.

Perret, S. (2009). Water Policies and Smallholding Irrigation Schemes in South Africa: A History and New Institutional Challenges. *Journal of Water Policy*, **4** (3), 283-300.

Pfannkuch, H. and Paul, S. (1969). Elsevier‘s Dictionary of Hydrogeology. *Elsevier Publishing Company*, U.S.A. 60,83pp.

Poehls, D.J. and Smith, G.J (2009). Encyclopedic Dictionary of Hydrogeology. Ganus, W.J., Hurst, R.W. and Smith, L. 1st edition. *Elsevier Publishing Company*, UK. 358pp.

Polemio, M., Casarano, D. and Limoni, P.P. (2009). Karstic Aquifer Vulnerability Assessment Methods and Results at a Test Site (A Pulia, Southern Italy). *Natural Hazards and Earth System Sciences*, **9**, 1461-1470.

Rahman, A. (2008). A GIS Based DRASTIC Method for Assessing Aquifer vulnerability in Shallow Aquifer in Aligarh, India. *Applied Geography*, **28** (1), 32-53.

Robb, L.J., Brandl, G., Anhaeusser, C.R. and Pouljol, M. (2006). Archaean Granitoid Intrusions. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. (editors), The Geology of South Africa, *Geological Society of South Africa*, Johannesburg/*Council for Geoscience*, Pretoria, 70-73pp.

Robins, N.S., Chilton, P.J. and Cobbing, J.E. (2007). Adapting Existing Experience with Aquifer Vulnerability and Groundwater Protection for Africa. *Journal of African Earth Science*, **47** (1), 30-38.

Samie, A., Makonto, O.T., Odiyo, J., Ouaboi-Egbenni, P.O., Mojapelo, P., and Bessong, P.O (2011). Microbial Quality, Diversity and Antibiotic Susceptibility Profiles of Bacterial Isolates from Borehole Water Used by Schools in Greater Giyani Municipality, Mopani District, South Africa. *Journal of Microbiology Research*, **5** (3), 198-210.

Scanlon, B.R., Healy, R.W. and Cook, P.G. (2002). Choosing Appropriate Techniques for Quantifying Groundwater Recharge. *Hydrogeology Journal*, **10**, 18-39.

Schutte, I.C (1986). The General Geology of the Kruger National Park. *Geological Survey of South Africa*, Koedoe (**29**), 16.

Sophocleous, M. (2004). Groundwater Recharge. In: Silveira L., Wohnlich S., Usunoff E.J. (Editors), In Encyclopedia of Life Support System [EOLSS], Developed under the Auspices of the UNESCO. *EOLSS Publishers*, Oxford, UK [http://eolss.net].

South African National Standards. (1993) Code of practice: Water supply and drainage for buildings. Part 2: drainage installations for buildings. SABS 10252-2:1993.

Stigter, T.Y., Ribeiro, L. and Carvalho Dill, A.M. (2005). Evaluation of an Intrinsic and Specific Vulnerability Assessment Method in Comparison with Groundwater Salinisation and Nitrate Contamination Levels in two Agricultural Regions in the South Portugal. *Hydrogeology Journal*, **14**, 79-99.

Strahler, A.N. (1956). Quantitative Slope Analysis. *Geological Society of America*, **67**, 571-596.

Thirumalaivasan, D., Karmegam, M. and Venugopal, K. (2003). AHP-DRASTIC: Software for Specific Aquifer Vulnerability Assessment Using DRASTIC Method and GIS. *Environmental Methodling and Software*, **18**, 645-656

Todd, D.K and Mays, L.W. (2005). Occurrence of Groundwater. In: Zobrist, B., Welter, J., Vargas, V.A. and Kulesa, T, Groundwater Hydrology. 3rd edition. *Agrosy Publishing*. U.S.A.- 45-48pp.

Toutin, T. (2002). Review Article: Geometric Processing of Remote Sensing Images: Models, Algorithms and Methods. *International Journal of Remote Sensing*, **25** (10), 1893-1924.

Van Schalkwyk, A. and Vermaak, J.J.G. (2000). The Relationship between Geotechnical and Hydrogeological Properties of Residual Soils and Rocks in the Vadose Zone, Water Research Commission (South Africa), Report NO.701/1/11/,1-261pp.

Van Vuuren, A.J., Jordaan, H., Van Der Walt, E. and Vanjaarveld, S. (2003). Luvuvhu and Letaba Water Management Area: Water Resource Situation Assessment. Department of Water Affairs and Forestry (South Africa), Report Number P/02000/00/0101. 2-3pp.

Van Wyk, E. (2010). Estimation of Episodic Groundwater Recharge in Semi-Arid Fractured Hard Rock Aquifers. PhD thesis (unpublished), University of the Free State, Bloemfontein, South Africa, 132pp.

Vermaak, J.J.G (2000). Geotechnical and Hydrogeological Characterization of Residual Soil in the Vadose Zone. PhD thesis (unpublished), University of Pretoria, Pretoria, South Africa, 2-5pp.

Vías, J.M., Andreo, B., Perles, M.J. and Carrasco, F. (2005). A Comparative Study of Four Schemes for Aquifer vulnerability Mapping in a Diffuse Flow Carbonate Aquifer under Mediterranean Climatic Conditions. *Environmental Geology*, **47**,586-595.

Vías, J.M., Andreo, B., Perles, M.J., Carrasco, F., Vadillo, I. and Jiménez, P. (2006). Proposed Method for Aquifer vulnerability Mapping in Carbonate (karstic) aquifers: the COP method: Application in two Pilot Sites in Southern Spain. *Hydrogeology Journal*, **14**, 912-925.

Vías, J.M., Andreo, B., Ravbar, N. and Hötzl, H. (2010). Mapping the Vulnerability of Groundwater to the Contamination of Four Carbonate Aquifers in Europe. *Journal of Environmental Management*, **91**, 1500-1510.

Voss, F.D. and Tesoriero, A.J. (1997). Predicting the Probability of Elevated Nitrate Concentrations in the Puget Sound Basin: Implication for Aquifer Susceptibility and Vulnerability. *Groundwater*, **35** (6), 1029-1039.

Witthüser, K.T., Holland, M., Rossouw, T.G., Rambau, E., Bumby,A.J., Petzer,K.J., Dennis, I., Beekman, H., van Rooy, J.L., Dippenaar, M. and de Wit, M.(2011). Determining Sustainable Yields of Potential Productive Well Fields in the Basement Aquifers of the Limpopo Province With Special Emphasis on the Limpopo (WMA a) and Luvuvhu/Letaba (WMA 2) Water Management Areas. Water Research Commission (South Africa) Project Number K5/1693/1, 5pp.

Wood, W.W. (1999). Use and Misuse of the Chloride-Mass Balance Method in Estimating Groundwater Recharge. *Groundwater,* **37** (1), 2-3.

Worrall, F., Besien, T. And Kolpin, D.W. (2002). Aquifer vulnerability: Interactions of Chemical and Site Properties. *The Science of the Total Environment,* **299**, 131-143.

Worrall, F. and Besien, T. (2004). The Vulnerability of Groundwater to Pesticide Contamination Estimated Directly from Observations of Presence or Absence in Wells. *Journal of Hydrology*, **303**, 92-107.

Zhang, Y.K. and Schilling, K.E (2006). Effects of Land Cover on Water Table, Soil Moisture, Evapotranspiration, and Groundwater Recharge: A Field Observation and Analysis, *Journal of Hydrology*, **319**, 328-338.

APPENDIX A: DATA

The following are included on the companion CD:

Table A-1: Mean annual chloride from groundwater data for Molototsi quaternary catchment (B81G).

Table A-2: Mean annual chloride from groundwater data for Middle Letaba quaternary catchment (B82D).

Table A-3: Mean annual rainfall data for Molototsi quaternary catchment (B81G).

Table A-4: Mean annual rainfall data for Middle Letaba quaternary catchment (B82D).

Table A-5: Total atmospheric chloride deposition for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

Table A-6: Recharge for Molototsi quaternary catchment (B81G).

Table A-7: Recharge for Middle Letaba quaternary catchment (B82D).

Table A-8: Depth to water table data for Molototsi quaternary catchment (B81G).

Table A-9: Depth to water table data for Middle Letaba quaternary catchment (B82D).

Table A-10(a): Indicate infiltration test for B81G and B82D using Double Ring Infiltrometer of 15 cm radius under unsaturated condition.

Table A-10(b): Indicate infiltration test for B81G and B82D using Double Ring Infiltrometer of 15 cm radius under unsaturated and saturated condition.

Table A-10(c): Indicate percolation test for B81G and B82D using an Auger of 7.5 cm radius under prewetting condition.

Table A-10(d): Indicate percolation test for B81G and B82D using an Auger of 7.5 cm radius under prewetting and saturated condition.

Table A-10(e): Indicate percolation test for B81G and B82D using an Auger of 7.5 cm radius under saturated condition.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table A-1: Mean annual chloride from groundwater data for Molototsi (B81G) quaternary catchment (NGDB data, from DWA).

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1996/06/06	NONE	SAMPLE	6.000		3.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1996/12/11	NONE	SAMPLE	4.900		3.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1997/05/29	NONE	SAMPLE	4.900		3.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1997/09/17	NONE	SAMPLE	9.000		3.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1998/05/26	NONE	SAMPLE	5.400		3.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1998/10/15	NONE	SAMPLE	8.300		3.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1999/05/05	NONE	SAMPLE	8.600		3.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1999/09/29	NONE	SAMPLE	5.000		10.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2000/05/08	NONE	SAMPLE	11.134		10.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2001/04/25	NONE	SAMPLE	11.748		10.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2001/10/11	NONE	SAMPLE	14.076		10.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2002/09/04	NONE	SAMPLE	17.005		10.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2003/05/08	NONE	SAMPLE	15.107		
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2003/08/27	NONE	SAMPLE	14.545		10.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2004/04/21	NONE	SAMPLE	15.004		5.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2004/10/26	NONE	SAMPLE	18.773		5.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2005/04/25	NONE	SAMPLE	16.129		4.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2005/10/25	NONE	SAMPLE	15.031		4.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2006/06/20	NONE	SAMPLE	11.234		4.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2006/10/17	NONE	SAMPLE	16.109		4.0
ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.63556	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	2007/05/22	NONE	SAMPLE	17.696		4.0
HARMONIC MEAN ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767							9.530	9.530	
2330CB00052 MOJADJE'S LOCATION PTN. MAKURUPETJE	-23.645	30.273889	MAKURUPETJE MOJADJES	1995/02/01	NONE	SAMPLE	4.700		3.0
2330CB00052 MOJADJE'S LOCATION PTN. MAKURUPETJE	-23.645	30.273889	MAKURUPETJE MOJADJES	1995/05/05	NONE	SAMPLE	7.900		3.0
HARMONIC MEAN MOJADJE'S LOCATION PTN. MAKURUPETJE							5.894	5.894	
KROMRIVIERFONTEIN (DUP NAME 5682)	-23.54444	30.397778	KROMRIVIERFONTEIN (DUPL NAME 4)	1995/02/10	NONE	SAMPLE	64.000	64.000	3.0
KROMRIVIERFONTEIN (DUP NAME 5683)	-23.54417	30.397778	KROMRIVIERFONTEIN (DUPL NAME 5)	1995/02/13	NONE	SAMPLE	57.600	57.600	3.0
KROMRIVIERFONTEIN (DUP NAME 5684)	-23.54361	30.398056	KROMRIVIERFONTEIN (DUPL NAME 6)	1995/02/12	NONE	SAMPLE	13.000		
KROMRIVIERFONTEIN (DUP NAME 5684)	-23.54361	30.398056	KROMRIVIERFONTEIN (DUPL NAME 6)	1995/04/30	NONE	SAMPLE	15.000		3.0
HARMONIC MEAN KROMRIVIERFONTEIN (DUP NAME 5684								13.928	13.928
2330CB00050 MUDUBUNG MOJADJES	-23.63306	30.2925	2330CB00050 MUDUBUNG MOJADJES	1995/02/09	NONE	SAMPLE	28.400	28.400	3.0
2330CB00059 MOJADJE'S LOCATION PTN. SETALENG	-23.60806	30.314722	SETALENG MOJADJES	1995/02/13	NONE	SAMPLE	38.600	38.600	3.0
2330CB00054 MODJADJE'S PTN. MADUMELENG	-23.61333	30.330278	MADUMELENG	1995/02/15	NONE	SAMPLE	33.200	33.200	3.0
2330AD0065 STATELAND PTN. REFILWE	-23.395	30.436667	REFILWE	1995/05/11	NONE	SAMPLE	50.100	50.100	3.0
JAMELA (DUP NAME 5765)	-23.43944	30.348611	JAMELA (DUPL NAME 1)	1995/04/26	NONE	SAMPLE	6.400		3.0
JAMELA (DUP NAME 5765)	-23.43944	30.348611	JAMELA (DUPL NAME 1)	1995/05/23	NONE	SAMPLE	5.500		3.0
HARMONIC MEAN JAMELA (DUP NAME 5765)							5.916	5.916	
GA MOLAI	-23.54611	30.399167	GA MOLAI	1995/04/11	NONE	SAMPLE	36.000	36.000	3.0
JAMELA (DUP NAME 5766)	-23.44028	30.348889	JAMELA (DUPL NAME 2)	1995/04/25	NONE	SAMPLE	23.300		3.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
JAMELA (DUP NAME 5766)	-23.44028	30.348889	JAMELA (DUPL NAME 2)	1995/05/21	NONE	SAMPLE	13.100		3.0
HARMONIC MEAN JAMELA (DUP NAME 5766)							16.771	16.771	
2330AD00067 STATELAND PTN. NAKAMPE H07-1058	-23.39861	30.468333	2330AD00067 NAKAMPE H07-1058	1995/05/29	NONE	SAMPLE	163.300		3.0
2330AD00067 STATELAND PTN. NAKAMPE H07-1058	-23.39861	30.468333	2330AD00067 NAKAMPE H07-1058	2005/04/12	NONE	SAMPLE	50.838		4.0
2330AD00057 STATELAND PTN. MAMAILLA	-23.41222	30.458611	MAMAILLA (DUPL NAME 3)	1995/05/30	NONE	SAMPLE	92.200	92.200	3.0
2330AD00067 STATELAND PTN. NAKAMPE H07-1058	-23.39861	30.468333	2330AD00067 NAKAMPE H07-1058	1995/05/29	NONE	SAMPLE	163.300		3.0
2330AD00067 STATELAND PTN. NAKAMPE H07-1058	-23.39861	30.468333	2330AD00067 NAKAMPE H07-1058	2005/04/12	NONE	SAMPLE	50.838		4.0
HARMONIC MEAN 2330AD00067 STATELAND PTN. NAKAMPE H07-1058							77.537	77.537	
2330AD00056 STATELAND PTN. MAMAILLA	-23.4125	30.459167	MAMAILLA (DUPL NAME 1)	1995/05/29	NONE	SAMPLE	70.100	70.100	3.0
2330CB00306 MODUBUNG	-23.63694	30.28917	2330CB00306 MODUBUNG	1995/07/19	NONE	SAMPLE	1.500	1.500	3.0
SENAKWE	-23.56194	30.411944	SENAKWE	1995/07/19	NONE	SAMPLE	194.000	194.000	3.0
2330CB00458 MODJADJE'S LOCATION PTN. MODUBUNG	-23.63639	30.294167	MODJADJES (DUPL NAME 23)	1997/07/13	NONE	SAMPLE	34.400	34.400	3.0
2330CA00042 MEIDINGEN H07-0009	-23.64139	30.246667	MEIDINGEN (DUPL NAME 6)	1997/07/21	NONE	SAMPLE	5.600		3.0
2330CA00042 MEIDINGEN H07-0009	-23.64139	30.246667	MEIDINGEN (DUPL NAME 6)	2007/09/16	NONE	SAMPLE	100.500		
HARMINIC MEAN 2330CA00042 MEIDINGEN H07-0009							10.609	10.609	
2330CA00052 MEIDINGEN PTN. RAKWADU - H07-1025	-23.66444	30.243333	MEIDINGEN (DUPL NAME 7)	1997/07/11	NONE	SAMPLE	5.900	5.900	3.0
2330CB00367 MEIDINGEN - H07-0566	-23.63778	30.250556	MEIDINGEN (DUPL NAME 8)	1997/08/01	NONE	SAMPLE	5.400	5.400	3.0
2330CB00384 MODJADJE'S PTN. BOSHAKGE - H07-0899	-23.59694	30.331111	MODJADJES (DUPL NAME 24)	1997/08/05	NONE	SAMPLE	46.900		3.0
2330CB00384 MODJADJE'S PTN. BOSHAKGE - H07-0899	-23.59694	30.331111	MODJADJES (DUPL NAME 24)	2005/04/01	NONE	SAMPLE	48.747		4.0
2330CB00384 MODJADJE'S PTN. BOSHAKGE - H07-0899	-23.59694	30.331111	MODJADJES (DUPL NAME 24)	2008/02/01	NONE	SAMPLE	49.852		4.0
HARMONIC MEAN 2330CB00384 MODJADJE'S PTN. BOSHAKGE - H07-0899							48.469	48.469	
2330CB00201 MODJADJE'S LOCATION PTN. MALEMATSA	-23.60806	30.2925	MODJADJES (DUPL NAME 25)	1997/08/04	NONE	SAMPLE	8.800	8.800	3.0
2330CB00353 MODJADJES	-23.60889	30.295556	MODJADJES (DUPL NAME 26)	1997/08/01	NONE	SAMPLE	13.200	13.200	3.0
2330CB00360 MODJADJE'S PTN. TLATSA - H07-0636	-23.58194	30.335	MODJADJES (DUPL NAME 27)	1997/08/06	NONE	SAMPLE	45.900	45.900	3.0
2330CB00504 MODJADJE'S LOCATION PTN. MALEMATSA H07-0974	-23.61889	30.275	MODJADJES (DUPL NAME 68)	1997/07/27	NONE	SAMPLE	7.600		3.0
2330CB00504 MODJADJE'S LOCATION PTN. MALEMATSA H07-0974	-23.61889	30.275	MODJADJES (DUPL NAME 68)	2005/04/01	NONE	SAMPLE	12.077		4.0
HARMONIC MEAN 2330CB00504 MODJADJE'S LOCATION PTN. MALEMATSA H07-0974							9.329	9.329	
2330CB00431 MEIDINGEN PTN. RABOTHATA H07-0976	-23.62639	30.259167	MEIDINGEN (DUPL NAME 20)	1997/07/26	NONE	SAMPLE	10.400		3.0
2330CB00431 MEIDINGEN PTN. RABOTHATA H07-0976	-23.62639	30.259167	MEIDINGEN (DUPL NAME 20)	2005/04/01	NONE	SAMPLE	15.003		4.0
HARMONIC MEAN 2330CB00431 MEIDINGEN PTN. RABOTHATA H07-0976							12.285	12.284	
2330CB00366 MODJADJE'S LOCATION PTN. MALEMATHA - H07-0685	-23.61222	30.288056	MODJADJES (DUPL NAME 69)	1997/07/28	NONE	SAMPLE	16.200	16.200	3.0
2330CB00370 MODJADJE'S LOCATION PTN. MADUMELANA - H07-0687	-23.62167	30.269167	MODJADJES (DUPL NAME 70)	1997/07/26	NONE	SAMPLE	7.700	7.700	
2330CB00430 MODJADJE'S LOCATION PTN MADUMELANA	-23.62139	30.269444	MODJADJES (DUPL NAME 71)	1997/07/31	NONE	SAMPLE	10.700	10.700	3.0
2330CB00336 MODJADJE'S PTN. MADUMELANA - H07-0268	-23.61139	30.315833	MODJADJES (DUPL NAME 72)	1997/08/10	NONE	SAMPLE	17.200	17.200	3.0
2330CB00305 MODJADJES	-23.66167	30.251389	MODJADJES (DUPL NAME 73)	1997/08/07	NONE	SAMPLE	6.900	6.900	3.0
2330CB00350 MODJADJE'S LOCATION - H07-0422	-23.62306	30.351667	MODJADJES (DUPL NAME 31)	1997/08/19	NONE	SAMPLE	16.300	16.300	3.0
2330CB00352 MODJADJE'S LOCATION PTN. BOSHAKGE	-23.60278	30.322778	MODJADJES (DUPL NAME 77)	1997/08/19	NONE	SAMPLE	20.200	20.200	3.0
2330CB00401 MODJADJES	-23.63361	30.280278	MODJADJES (DUPL NAME 79)	1997/08/18	NONE	SAMPLE	21.600	21.600	3.0
2330CB00306 MODJADJES H070014	-23.63694	30.289167	MODJADJES (DUPL NAME 80)	1997/08/16	NONE	SAMPLE	31.800		3.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330CB00306 MODJADJES H070014	-23.63694	30.289167	MODJADJES (DUPL NAME 80)	2002/12/19	NONE	SAMPLE	39.145		10.0
HARMONIC MEAN 2330CB00306 MODJADJES H070014							35.092	35.092	
2330CB00307 MODJADJE'S LOCATION - H07-0015	-23.61944	30.344167	MODJADJES (DUPL NAME 81)	1997/08/14	NONE	SAMPLE	21.800	21.800	3.0
2330CB00308 MODJADJES	-23.62389	30.349444	MODJADJES (DUPL NAME 38)	1997/09/04	NONE	SAMPLE	10.400	10.400	3.0
2330CB00309 MODJADJES	-23.62194	30.349444	MODJADJES (DUPL NAME 40)	1997/09/06	NONE	SAMPLE	12.300	12.300	3.0
KROMRIVIERFONTEIN (DUP NAME 7303)	-23.545	30.398333	KROMRIVIERFONTEIN (DUPL NAME 3)	1997/09/09	NONE	SAMPLE	27.000	27.000	3.0
2330CB00328 MODJADJES - H07-0071	-23.55222	30.4025	MODJADJES (DUPL NAME 42)	1997/09/09	NONE	SAMPLE	387.800	387.800	3.0
2330CB00437 MODJADJE'S LOCATION PTN. MAKWASELA	-23.64556	30.268056	MODJADJES (DUPL NAME 86)	1997/09/04	NONE	SAMPLE	9.200	9.200	3.0
2330CB00387 SENOBELA - H07-0909	-23.5525	30.4125	SENOBELA (DUPL NAME 5)	1997/09/11	NONE	SAMPLE	147.200	147.200	3.0
2330CB00470 MODJADJE'S LOCATION PTN. KHEFOLWE	-23.6425	30.312222	MODJADJES (DUPL NAME 88)	1997/09/03	NONE	SAMPLE	4.800	4.800	3.0
MODJADJES (DUP NAME 7305)	-23.65833	30.263333	MODJADJES (DUPL NAME 43)	1997/09/01	NONE	SAMPLE	10.000	10.000	3.0
2330CB00379 MODJADJE'S LOCATION PTN. MORWASETLA - H07-0836	-23.61889	30.366111	MODJADJES (DUPL NAME 47)	1997/09/21	NONE	SAMPLE	7.900	7.900	3.0
2330AD00300 NORTHHAMPTON	-23.47333	30.466111	NORTHHAMPTON	1997/09/16	NONE	SAMPLE	257.200	257.200	3.0
2330CB00454 MODJADJES H071022	-23.63056	30.297778	MODJADJES (DUPL NAME 49)	1997/10/03	NONE	SAMPLE	22.000		
2330CB00454 MODJADJES H071022	-23.63056	30.297778	MODJADJES (DUPL NAME 49)	2002/12/19	NONE	SAMPLE	18.730		10.0
HARMONIC MEAN 2330CB00454 MODJADJES H071022							20.234	20.234	
2330AD00263 STATELAND PTN. MAPHALLE - H07-0102	-23.45778	30.321389	MAPHALLE STAATSGROND	1997/11/28	NONE	SAMPLE	180.700	180.700	3.0
STAATSGROND (DUP NAME 7539)	-23.45833	30.334444	STAATSGROND (DUPL NAME 31)	1997/11/04	NONE	SAMPLE	93.900	93.900	3.0
2330CB00270 STATELAND PTN. MAPHALLE - H07-0461	-23.45333	30.34	STAATSGROND (DUPL NAME 11)	1997/12/08	NONE	SAMPLE	123.100	123.100	3.0
MAPHELLE STAATSGROND	-23.45722	30.318056	MAPHELLE STAATSGROND	1997/12/10	NONE	SAMPLE	121.600	121.600	3.0
2330AD00295 STATELAND PTN. NAKAMPE - H07-0831	-23.40833	30.445556	STAATSGROND (DUPL NAME 32)	1998/02/02	NONE	SAMPLE	105.900	105.900	3.0
NWAMANKENA	-23.38056	30.530833	NWAMANKENA	1998/01/13	NONE	SAMPLE	1153.800	1153.800	3.0
2330AD00286 BELLEVUE PTN. MAUPA	-23.40944	30.384722	BELLEVUE MAUPA	1994/12/10	NONE	SAMPLE	64.800	64.800	3.0
MOROKA	-23.53111	30.456389	MOROKA	1994/12/03	NONE	SAMPLE	89.700	89.700	3.0
MAPHALLE	-23.45667	30.333889	MAPHALLE (DUPL NAME 2)	1994/12/09	NONE	SAMPLE	88.200	88.200	3.0
2330BC00165 KURANT A - H07-0198	-23.46	30.517222	KURANT A	1995/05/15	NONE	SAMPLE	77.600	77.600	3.0
BOTSHABELA	-23.38	30.509167	BOTSHABELA	1995/05/18	NONE	SAMPLE	209.300	209.300	3.0
2330AD00205 DITSHOSHING H07-0454	-23.49111	30.325	2330AD00205 DITSHOSHING H07-0454	1995/05/30	NONE	SAMPLE	207.000		3.0
2330AD00205 DITSHOSHING H07-0454	-23.49111	30.325	2330AD00205 DITSHOSHING H07-0454	2005/01/18	NONE	SAMPLE	505.243		4.0
2330AD00205 DITSHOSHING H07-0454	-23.49111	30.325	2330AD00205 DITSHOSHING H07-0454	2005/04/16	NONE	SAMPLE	250.787		4.0
HARMINIC MEAN 2330AD00205 DITSHOSHING H07-0454							277.839	277.839	
2330AD00259 DITSHOSHING	-23.46833	30.346389	DITSHOSHING (DUPL NAME 1)	1995/05/24	NONE	SAMPLE	101.400	101.400	3.0
DITSHOSHING	-23.48444	30.344722	DITSHOSHING (DUPL NAME 2)	1995/05/28	NONE	SAMPLE	73.400		3.0
DITSHOSHING	-23.48444	30.344722	DITSHOSHING (DUPL NAME 2)	1995/06/10	NONE	SAMPLE	69.700		3.0
HARMINIC MEAN DITSHOSHING							71.502	71.502	
2330AD00255 FEMANE	-23.49167	30.388056	FEMANE	1995/06/12	NONE	SAMPLE	142.200	142.200	
2330AD00296 NEBO	-23.40806	30.446389	NEBO (DUPL NAME 10)	1995/06/10	NONE	SAMPLE	102.600	102.600	3.0
MOROKO	-23.53556	30.450556	MOROKO	1995/07/19	NONE	SAMPLE	302.000	302.000	3.0
SENOBELLA-A-BOLEBEDU	-23.49333	30.461944	SENOBELLA-A-BOLEBEDU	1995/08/18	NONE	SAMPLE	342.200	342.200	3.0
2330BC00223 STATELAND PTN. MAEKGWE	-23.48944	30.510278	MAEKGWE (STAATSGROND)	1995/10/12	NONE	SAMPLE	44.100	44.100	3.0
2330CB00434 MOHOKONI/BOLOBEDU	-23.50083	30.435556	MOHOKONI/BOLOBEDU (DUPL NAME 1)	1996/09/19	NONE	SAMPLE	142.600	142.600	3.0
2330CB00434 WORCESTER PTN. MOHOKONI	-23.50167	30.43611	2330CB00434 MOHOKONI	1996/09/18	NONE	SAMPLE	133.300	133.300	3.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AD00292 WORCESTER PTN. MOHOKONI - H07-0747	-23.49528	30.4375	MOHOKONI/BOLOBEDU (DUPL NAME 2)	1996/09/18	NONE	SAMPLE	347.600	347.600	3.0
2330CB00205 WORCESTER PTN. MOHOKONI	-23.50694	30.441667	2330CB00205 MOHOKONI	1996/09/18	NONE	SAMPLE	411.000	411.000	3.0
2330AD00300 NORTHAMPTON	-23.47306	30.466667	NORTHAMPTON (DUPL NAME 7)	1996/09/28	NONE	SAMPLE	253.800	253.800	3.0
ELANDSFONTEIN (DUP NAME 30931)	-23.42722	30.521667	ELANDSFONTEIN (DUPL NAME 3)	1997/01/24	NONE	SAMPLE	368.200	368.200	3.0
2330CB00330 STATELAND PTN. RAMBEBE H07-0169	-23.53167	30.455833	RAMBEBE STAATSGROND	1997/01/26	NONE	SAMPLE	116.000	116.000	3.0
2330AD00258 STATELAND PTN. MOHLABANENG - H07-0089	-23.47389	30.372222	MOHLABANENG STAATSGROND	1997/01/18	NONE	SAMPLE	132.500	132.500	3.0
2330AD00296 STAATSGROND PTN. PHAPHADI - H07-0831A	-23.4075	30.446389	STAATSGROND REFILWE	1997/01/26	NONE	SAMPLE	158.300	158.300	3.0
2330AD00286 BELLEVUE	-23.40972	30.384167	BELLEVUE (DUPL NAME 16)	1997/01/16	NONE	SAMPLE	66.200	66.200	3.0
2330AD00284 STATELAND PTN. MAMOKHADE - H07 0548	-23.43111	30.453611	MAMOKHADE STAATSGROND	1997/01/25	NONE	SAMPLE	100.800	100.800	3.0
WORCESTER (DUP NAME 30933)	-23.50556	30.410556	WORCESTER (DUPL NAME 26)	1997/01/21	NONE	SAMPLE	215.900	215.900	3.0
2330AD00268 NAKAMPE STAATSGROND H070139	-23.40889	30.459444	NAKAMPE STAATSGROND	1997/01/22	NONE	SAMPLE	57.200		3.0
2330AD00268 NAKAMPE STAATSGROND H070139	-23.40889	30.459444	NAKAMPE STAATSGROND	2003/01/13	NONE	SAMPLE	71.199		10.0
HARMINIC MEAN 2330AD00268 NAKAMPE STAATSGROND H070139							63.436	63.436	
2330AD00259 SHAWELA STAATSGROND H070095	-23.46806	30.346667	SHAWELA STAATSGROND	1997/01/14	NONE	SAMPLE	91.500		3.0
2330AD00259 SHAWELA STAATSGROND H070095	-23.46806	30.346667	SHAWELA STAATSGROND	1997/04/15	NONE	SAMPLE	85.100		3.0
2330AD00259 SHAWELA STAATSGROND H070095	-23.46806	30.346667	SHAWELA STAATSGROND	2003/01/06	NONE	SAMPLE	137.085		
2330AD00259 SHAWELA STAATSGROND H070095	-23.46806	30.346667	SHAWELA STAATSGROND	2004/04/01	NONE	SAMPLE	124.258		5.0
HARMINIC MEAN 2330AD00259 SHAWELA STAATSGROND H070095							105.201	105.201	
2330AD00289 BELLEVUEPTN. MAUPA - H07-0704	-23.41944	30.384722	BELLEVUE (DUPL NAME 3)	1997/01/11	NONE	SAMPLE	52.600	52.600	3.0
GAMELA	-23.42167	30.520833	GAMELA (DUPL NAME 1)	1997/02/06	NONE	SAMPLE	302.100	302.100	3.0
2330AD00411 STAATSGROND MAMAILA H070848	-23.38333	30.429167	STAATSGROND MAMAILA	1997/01/18	NONE	SAMPLE	48.500		3.0
2330AD00411 STAATSGROND MAMAILA H070848	-23.38333	30.429167	STAATSGROND MAMAILA	2003/01/13	NONE	SAMPLE	75.192		10.0
2330AD00411 STAATSGROND MAMAILA H070848	-23.38333	30.429167	STAATSGROND MAMAILA	2004/06/13	NONE	SAMPLE	77.765		5.0
HARMINIC MEAN 2330AD00411 STAATSGROND MAMAILA H070848							64.134	64.134	
2330AD00267 STATELAND PTN. REFILWE H07-0127	-23.39028	30.436389	MAMAILA STAATSGROND	1997/01/22	NONE	SAMPLE	75.500	75.500	3.0
BELLEVUE (DUP NAME 30935)	-23.43583	30.349444	BELLEVUE (DUPL NAME 4)	1997/01/11	NONE	SAMPLE	12.100	12.100	3.0
2330AD00266 STAATSGROND BELLEVUE H070117	-23.41944	30.403333	STAATSGROND BELLEVUE	1997/01/15	NONE	SAMPLE	62.200		3.0
2330AD00266 STAATSGROND BELLEVUE H070117	-23.41944	30.403333	STAATSGROND BELLEVUE	2003/01/08	NONE	SAMPLE	47.070		10.0
HARMINIC MEAN 2330AD00266 STAATSGROND BELLEVUE H070117							53.588	53.588	
2330AD00020 STATELAND PTN. DITSHUSHING - H07-0705	-23.49556	30.336111	STAATSGROND DITSHUSHING	1997/01/15	NONE	SAMPLE	101.700		3.0
2330AD00020 STATELAND PTN. DITSHUSHING - H07-0705	-23.49556	30.336111	STAATSGROND DITSHUSHING	2003/07/04	NONE	SAMPLE	156.189		10.0
HARMINIC MEAN 2330AD00020 STATELAND PTN. DITSHUSHING - H07-0705							123.188	123.188	
2330CB00500 KROMRIVIERFONTEIN H070545	-23.51472	30.356111	KROMFONTEIN	1997/01/17	NONE	SAMPLE	57.200		3.0
2330CB00500 KROMRIVIERFONTEIN H070545	-23.51472	30.356111	KROMFONTEIN	2003/01/07	NONE	SAMPLE	57.986		10.0
HARMINIC MEAN 2330CB00500 KROMRIVIERFONTEIN H070545							57.590	57.590	
MAPHALELE STAATSGROND BELLEVUE	-23.46278	30.314167	MAPHALELE STAATSGROND BELLEVUE	1997/01/10	NONE	SAMPLE	364.200	364.200	3.0
2330CB00376 MODJADJE'S LOCATION PTN. RAMOTATA - H07-0798	-23.63639	30.283056	MODJADJES (DUPL NAME 51)	1997/02/16	NONE	SAMPLE	12.200	12.200	3.0
2330CB00304 MEIDINGEN H070011	-23.66333	30.2525	MEIDINGEN (DUPL NAME 10)	1997/02/12	NONE	SAMPLE	5.200		3.0
2330CB00304 MEIDINGEN H070011	-23.66333	30.2525	MEIDINGEN (DUPL NAME 10)	2002/12/18	NONE	SAMPLE	5.000		10.0
HARMINIC MEAN 2330CB00304 MEIDINGEN H070011							5.098	5.098	
2330CB00436 MODJADJES H070987	-23.64361	30.275278	MODJADJES (DUPL NAME 52)	1997/02/20	NONE	SAMPLE	6.200		3.0
2330CB00436 MODJADJES H070987	-23.64361	30.275278	MODJADJES (DUPL NAME 52)	2002/12/17	NONE	SAMPLE	10.702		
2330CB00436 MODJADJES H070987	-23.64361	30.275278	MODJADJES (DUPL NAME 52)	2007/09/15	NONE	SAMPLE	8.899		4.0
HARMINIC MEAN 2330CB00436 MODJADJES H070987							8.172	8.172	

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330CB00334 MODJADJES H070267	-23.63528	30.280556	MODJADJES (DUPL NAME 53)	1997/02/17	NONE	SAMPLE	7.200		3.0
2330CB00334 MODJADJES H070267	-23.63528	30.280556	MODJADJES (DUPL NAME 53)	1997/04/13	NONE	SAMPLE	4.300		3.0
2330CB00334 MODJADJES H070267	-23.63528	30.280556	MODJADJES (DUPL NAME 53)	2002/12/08	NONE	SAMPLE	11.696		10.0
HARMINIC MEAN 2330CB00334 MODJADJES H070267							6.565	6.565	
2330CB00371 MODJADJE'S LOCATION PTN. MARAKA - H07-0729	-23.63167	30.286667	MODJADJES (DUPL NAME 54)	1997/02/18	NONE	SAMPLE	12.000	12.000	3.0
2330CB00345 MODJADJES H070387	-23.57278	30.346667	MODJADJES (DUPL NAME 1)	1997/02/19	NONE	SAMPLE	29.000		3.0
2330CB00345 MODJADJES H070387	-23.57278	30.346667	MODJADJES (DUPL NAME 1)	2003/01/08	NONE	SAMPLE	41.645		10.0
HARMINIC MEAN 2330CB00345 MODJADJES H070387							34.191	34.191	
2330CB00476 MODJADJE'S PTN MABULANA	-23.57639	30.3475	MODJADJI	1997/02/15	NONE	SAMPLE	38.100	38.100	3.0
2330CB00180 MEIDINGEN	-23.66417	30.2525	MEIDINGEN (DUPL NAME 1)	1997/02/16	NONE	SAMPLE	4.700	4.700	3.0
2330CB00439 MODJADJE'S LOCATION PTN. MADIBONG	-23.63389	30.2925	MODJADJES (DUPL NAME 2)	1997/02/20	NONE	SAMPLE	18.100	18.100	3.0
2330CB00497 MEIDINGEN	-23.66389	30.251944	MEIDINGEN (DUPL NAME 2)	1997/02/26	NONE	SAMPLE	4.600	4.600	3.0
2330AC00377 VLAKFONTEIN PTN. MOTHOBEKI - H07-0799	-23.54	30.375556	VLAKFONTEIN (DUPL NAME 10)	1997/02/23	NONE	SAMPLE	93.700	93.700	3.0
2330CB00454 MODJADJES	-23.62472	30.298056	MODJADJES (DUPL NAME 3)	1997/03/04	NONE	SAMPLE	14.700		3.0
2330CB00454 MODJADJES	-23.62472	30.298056	MODJADJES (DUPL NAME 3)	1997/03/21	NONE	SAMPLE	13.200		3.0
HARMINIC MEAN 2330CB00454 MODJADJES							13.910	13.910	
2330CB00361 MODJAJE'S LOCATION PTN. IKETLENG - H07-0654	-23.6225	30.298889	MODJAJES	1997/03/05	NONE	SAMPLE	16.100		3.0
2330CB00361 MODJAJE'S LOCATION PTN. IKETLENG - H07-0654	-23.6225	30.298889	MODJAJES	1997/04/16	NONE	SAMPLE	9.800		3.0
HARMINIC MEAN 2330CB00361 MODJAJE'S LOCATION PTN. IKETLENG - H07-0654							12.184	12.184	
2330CB00477 MODJADJES	-23.57694	30.323889	MODJADJES (DUPL NAME 4)	1997/02/21	NONE	SAMPLE	48.100	48.100	
2330CA00019 SCHOONGELEGEN PTN. MEIDINGEN / MPHAKANE - H07-1409	-23.66722	30.25	MEIDINGEN (DUPL NAME 4)	1997/02/20	NONE	SAMPLE	6.300		3.0
2330CA00019 SCHOONGELEGEN PTN. MEIDINGEN / MPHAKANE - H07-1409	-23.66722	30.25	MEIDINGEN (DUPL NAME 4)	2006/04/05	NONE	SAMPLE	13.370		4.0
HARMINIC MEAN 2330CA00019 SCHOONGELEGEN PTN. MEIDINGEN / MPHAKANE - H07-1409							8.564	8.564	
2330CB00475 MODJADJES H070993	-23.61083	30.313333	MODJADJES (DUPL NAME 5)	1997/03/07	NONE	SAMPLE	40.100		3.0
2330CB00475 MODJADJES H070993	-23.61083	30.313333	MODJADJES (DUPL NAME 5)	2003/01/13	NONE	SAMPLE	41.493		10.0
HARMINIC MEAN 2330CB00475 MODJADJES H070993							40.785	40.785	
2330CB00372 MODJADJES H070754	-23.64722	30.271667	MODJADJES (DUPL NAME 6)	1997/02/25	NONE	SAMPLE	9.500		3.0
2330CB00372 MODJADJES H070754	-23.64722	30.271667	MODJADJES (DUPL NAME 6)	1997/03/21	NONE	SAMPLE	10.300		3.0
2330CB00372 MODJADJES H070754	-23.64722	30.271667	MODJADJES (DUPL NAME 6)	2002/12/18	NONE	SAMPLE	13.689		10.0
HARMINIC MEAN 2330CB00372 MODJADJES H070754							10.893	10.893	
2330CB00438 MODJADJES H070989	-23.6275	30.286667	MODJADJES (DUPL NAME 7)	1997/02/18	NONE	SAMPLE	34.000		3.0
2330CB00438 MODJADJES H070989	-23.6275	30.286667	MODJADJES (DUPL NAME 7)	2002/12/19	NONE	SAMPLE	41.469		10.0
HARMINIC MEAN 2330CB00438 MODJADJES H070989							37.365	37.365	
VLAKFONTEIN (DUP NAME 30978)	-23.56167	30.377778	VLAKFONTEIN (DUPL NAME 53)	1997/03/10	NONE	SAMPLE	143.500	143.500	3.0
VLAKFONTEIN (DUP NAME 30979)	-23.55056	30.390556	VLAKFONTEIN (DUPL NAME 54)	1997/03/08	NONE	SAMPLE	451.200	451.200	3.0
2330CB00332 MODJADJE'S LOCATION PTN. SETALENG - H07-0264	-23.60972	30.316389	MODJADJES (DUPL NAME 55)	1997/03/07	NONE	SAMPLE	35.000	35.000	3.0
VLAKFONTEIN (DUP NAME 30985)	-23.55	30.390556	VLAKFONTEIN (DUPL NAME 12)	1997/03/12	NONE	SAMPLE	294.600		
VLAKFONTEIN (DUP NAME 30985)	-23.55	30.390556	VLAKFONTEIN (DUPL NAME 12)	1997/03/24	NONE	SAMPLE	284.100		3.0
HARMINIC MEAN VLAKFONTEIN (DUP NAME 30985)							289.255	289.255	
MODJADJES (DUP NAME 30993)	-23.41944	30.357778	MODJADJES (DUPL NAME 56)	1997/03/17	NONE	SAMPLE	63.700	63.700	3.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330CB00186 MODJADJE'S PTN. MATSWE	-23.57806	30.355833	MODJADJES (DUPL NAME 57)	1997/03/16	NONE	SAMPLE	24.600	24.600	3.0
2330CB00187 MODJADJE'S PTN. GA-MATSWE	-23.58333	30.3675	MODJADJES (DUPL NAME 58)	1997/03/13	NONE	SAMPLE	33.700	33.700	3.0
2330CB00435 WORCESTER	-23.50055	30.44305	2330CB00435 WORCESTER	1997/04/08	NONE	SAMPLE	244.700	244.700	3.0
VLAKFONTEIN (DUP NAME 31011)	-23.54861	30.388889	VLAKFONTEIN (DUPL NAME 13)	1997/04/04	NONE	SAMPLE	54.000	54.000	3.0
VLAKFONTEIN (DUP NAME 31012)	-23.54806	30.388611	VLAKFONTEIN (DUPL NAME 14)	1997/04/05	NONE	SAMPLE	18.100	18.100	3.0
MODJADJES (DUP NAME 31013)	-23.64472	30.274167	MODJADJES (DUPL NAME 8)	1997/04/09	NONE	SAMPLE	26.300	26.300	3.0
2330CB00185 MODJADJE'S PTN. GA-MATSWE	-23.57833	30.355278	MODJADJES (DUPL NAME 9)	1997/04/15	NONE	SAMPLE	57.200	57.200	3.0
2330CB00443 MODJADJE'S PTN. MATSWE	-23.57722	30.3575	MODJADJES (DUPL NAME 10)	1997/04/16	NONE	SAMPLE	33.000	33.000	3.0
2330CB00498 MODJADJES	-23.58972	30.371944	MODJADJES (DUPL NAME 11)	1997/04/24	NONE	SAMPLE	106.300	106.300	3.0
2330CB00499 MODJADJES	-23.58333	30.363611	MODJADJES (DUPL NAME 12)	1997/04/18	NONE	SAMPLE	97.900	97.900	3.0
2330CB00374 MODJADJE'S LOCATION PTN. MORWATSHEHLA - H07-0760	-23.59194	30.376667	MODJADJES (DUPL NAME 13)	1997/04/26	NONE	SAMPLE	33.600	33.600	3.0
KROMRIVIERFONTEIN (DUP NAME 31025)	-23.54639	30.397778	KROMRIVIERFONTEIN (DUPL NAME 1)	1997/05/01	NONE	SAMPLE	145.900	145.900	3.0
2330CB00323 MODJADJES	-23.58278	30.368889	MODJADJES (DUPL NAME 14)	1997/04/24	NONE	SAMPLE	31.100	31.100	3.0
2330CB00322 MODJADJE'S PTN. GA-MATSWE - H07-0050	-23.58944	30.360278	MODJADJES (DUPL NAME 15)	1997/04/22	NONE	SAMPLE	55.600	55.600	3.0
2330CB00373 MODJADJE'S LOCATION PTN. MATSWE - H07-0757	-23.58556	30.371667	MODJADJES (DUPL NAME 17)	1997/04/25	NONE	SAMPLE	74.800	74.800	3.0
BELLEVUE (DUP NAME 31026)	-23.43583	30.349722	BELLEVUE (DUPL NAME 17)	1997/04/23	NONE	SAMPLE	9.600	9.600	3.0
SENOBELA (DUP NAME 31033)	-23.54306	30.412778	SENOBELA (DUPL NAME 2)	1997/05/11	NONE	SAMPLE	366.200		3.0
SENOBELA (DUP NAME 31033)	-23.54306	30.412778	SENOBELA (DUPL NAME 2)	1997/05/11	NONE	SAMPLE	7.300		3.0
HARMINIC MEAN SENOBELA (DUP NAME 31033)							14.315	14.315	
KROMRIVIERFONTEIN (DUP NAME 31034)	-23.54528	30.398056	KROMRIVIERFONTEIN (DUPL NAME 2)	1997/05/05	NONE	SAMPLE	14.500	14.500	3.0
2330CB00394 MODJADJES H071001	-23.63861	30.281667	MODJADJES (DUPL NAME 19)	1997/05/10	NONE	SAMPLE	7.400		3.0
2330CB00394 MODJADJES H071001	-23.63861	30.281667	MODJADJES (DUPL NAME 19)	2002/12/18	NONE	SAMPLE	14.183		10.0
HARMINIC MEAN 2330CB00394 MODJADJES H071001							9.726	9.726	
MODJADJES (DUP NAME 31051)	-23.63111	30.295278	MODJADJES (DUPL NAME 61)	1997/05/23	NONE	SAMPLE	25.500	25.500	3.0
2330CB00455 MODJADJE'S PTN. SOTONG	-23.62972	30.302222	MODJADJES (DUPL NAME 62)	1997/05/24	NONE	SAMPLE	16.600	16.600	3.0
2330CB00419 MODJADJE'S H07-1074	-23.63028	30.299167	2330CB00419 MODJADJES H07-1074	1997/05/17	NONE	SAMPLE	22.500		3.0
2330CB00419 MODJADJE'S H07-1074	-23.63028	30.299167	2330CB00419 MODJADJES H07-1074	2005/08/26	NONE	SAMPLE	31.738		4.0
HARMINIC MEAN 2330CB00419 MODJADJE'S H07-1074							26.332	26.332	
2330CA00043 MEIDINGEN - H07-0010	-23.63556	30.249167	MEIDINGEN (DUPL NAME 11)	1997/05/14	NONE	SAMPLE	9.200	9.200	3.0
WORCESTER (DUP NAME 31052)	-23.39194	30.387778	WORCESTER (DUPL NAME 28)	1997/05/16	NONE	SAMPLE	141.700	141.700	3.0
2330CB00456 MODJADJE'S LOCATION PTN. SHOTONG	-23.63361	30.296111	MODJADJES (DUPL NAME 20)	1997/05/25	NONE	SAMPLE	15.100	15.100	3.0
2330CB00400 MODJADJES LOCATION PTN. TLATSA	-23.57972	30.33	MODJADJES (DUPL NAME 21)	1997/06/13	NONE	SAMPLE	67.700	67.700	3.0
2330CB00342 MODJADJE'S PTN. SEKOTI - H07-0379	-23.58083	30.331389	MODJADJES (DUPL NAME 65)	1997/06/18	NONE	SAMPLE	49.700	49.700	3.0
2330CB00342 MODJADJE'S PTN. SEKOTI - H07-0379	-23.58083	30.331389	MODJADJES (DUPL NAME 65)	2008/01/31	NONE	SAMPLE	62.488	62.488	4.0
2330CA00047 MEIDINGEN - H07-0567	-23.64389	30.241111	MEIDINGEN (DUPL NAME 12)	1997/06/08	NONE	SAMPLE	14.100	14.100	3.0
2330CA00046 MEIDINGEN PTN. MAPANA - H07-0562	-23.65889	30.237222	MEIDINGEN (DUPL NAME 18)	1997/06/25	NONE	SAMPLE	6.300	6.300	3.0
2330AD00245 STATE LAND PTN. BELLEVUE - H07-0621	-23.41056	30.421389	2330AD00245 STATE LAND - BELLEVUE	2000/01/27	NONE	SAMPLE	246.543	246.543	10.0
2330CB00294 STATE LAND - SENOBELA	-23.55083	30.398056	2330CB00294 STATE LAND - SENOBELA	2000/01/29	NONE	SAMPLE	102.226	102.226	10.0
2330AD00247 STATEGROUND H07-0586	-23.46306	30.36778	2330AD00247 STATEGROUND H070586	2001/07/28	NONE	SAMPLE	171.453	171.453	10.0
2330BC00205 STATELAND H07-1133	-23.47639	30.5025	2330BC00205 STATELAND H071133	2002/01/15	NONE	SAMPLE	250.778	250.778	10.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330CC00055 MOHLABAS LOCATION H08-1322	-23.92933	30.23947	2330CC00055 MOHLABAS LOCATION H081322	2002/06/28	NONE	SAMPLE	51.937	51.937	
2330AD00250 NDENGEZA CLINIC H14-0856	-23.3153	30.40646	2330AD00250 NDENGEZA CLINIC H140856	2002/07/03	NONE	SAMPLE	304.239		10.0
2330AD00250 NDENGEZA CLINIC H14-0856	-23.3153	30.40646	2330AD00250 NDENGEZA CLINIC H140856	2002/07/11	NONE	SAMPLE	537.595		10.0
HARMINIC MEAN 2330AD00250 NDENGEZA CLINIC H14-0856							388.574	388.574	
2330AD00251 ZONNEBLOEM H10-0629	-23.29583	30.30861	2330AD00251 ZONNEBLOEM H100629	2002/08/28	NONE	SAMPLE	100.743	100.743	10.0
2330AD00297 STATELAND H07-0841	-23.45833	30.33444	2330AD00297 STATELAND H070841	2002/10/11	NONE	SAMPLE	891.682	891.682	10.0
2330BC00219 KORANTA H07-0200	-23.46555	30.51955	2330BC00219 KORANTA H07-0200	2002/10/21	NONE	SAMPLE	116.133		10.0
2330BC00219 KORANTA H07-0200	-23.46555	30.51955	2330BC00219 KORANTA H07-0200	2005/11/14	NONE	SAMPLE	187.428		4.0
HARMINIC MEAN 2330BC00219 KORANTA H07-0200							143.408	143.408	
2330BC00387 STATELAND H07-0512	-23.49483	30.51111	2330BC00387 STATELAND H070512	2002/10/22	NONE	SAMPLE	81.693	81.693	10.0
2330CB00488 STATELAND H22-0472	-23.58291	30.48583	2330CB00488 STATELAND H220472	2002/11/02	NONE	SAMPLE	97.323	97.323	10.0
2330AD00409 STATELAND H07-0458	-23.435	30.34832	2330AD00409 STATELAND H070458	2002/11/10	NONE	SAMPLE	43.555		10.0
2330AD00409 STATELAND H07-0458	-23.435	30.34832	2330AD00409 STATELAND H070458	2003/01/09	NONE	SAMPLE	41.920		10.0
HARMINIC MEAN 2330AD00409 STATELAND H07-0458							42.722	42.722	
2330AD00248 BELLEVUE PORTION MAUPA - H070713	-23.41916	30.38443	2330AD00248 BELLEVUE PORTION MAUPA - H070713	2002/01/28	NONE	SAMPLE	55.857		10.0
2330AD00248 BELLEVUE PORTION MAUPA - H07-0713	-23.41916	30.38443	2330AD00248 BELLEVUE PORTION MAUPA - H070713	2002/07/21	NONE	SAMPLE	75.354		10.0
HARMINIC MEAN 2330AD00248 BELLEVUE PORTION MAUPA - H07-0713							64.157	64.157	
2330CB00305 MEIDINGEN PTN. RAKWADU - H07-0012	-23.66213	30.25155	2330CB00305 MEIDINGEN H070012	2002/12/18	NONE	SAMPLE	11.656	11.656	10.0
2330CB00497 MEIDINGEN H07-0498	-23.66397	30.25236	2330CB00497 MEIDINGEN H070498	2002/12/18	NONE	SAMPLE	5.000	5.000	10.0
2330CB00478 MEIDINGEN H071000	-23.66616	30.2508	2330CB00478 MEIDINGEN H071000	2002/12/18	NONE	SAMPLE	5.000	5.000	10.0
2330CB00395 MODJADJES H071003	-23.62719	30.29033	2330CB00395 MODJADJES H071003	2002/12/19	NONE	SAMPLE	11.015	11.015	10.0
2330CB00401 MODJADJES H071051	-23.63466	30.27983	2330CB00401 MODJADJES H071051	2002/12/18	NONE	SAMPLE	21.778		10.0
2330CB00323 MODJADJES H070051	-23.58358	30.36913	2330CB00323 MODJADJES H070051	2003/01/09	NONE	SAMPLE	28.985		10.0
2330CB00323 MODJADJES H070051	-23.58358	30.36913	2330CB00323 MODJADJES H070051	2008/01/24	NONE	SAMPLE	50.009		4.0
HARMINIC MEAN 2330CB00323 MODJADJES H070051							29.876	29.876	
2330AD00007 VLAKFONTEIN H070408	-23.55247	30.36519	2330AD00007 VLAKFONTEIN H070408	2003/01/07	NONE	SAMPLE	144.673		10.0
2330AD00007 VLAKFONTEIN H070408	-23.55247	30.36519	2330AD00007 VLAKFONTEIN H070408	2005/04/01	NONE	SAMPLE	121.858		4.0
2330AD00007 VLAKFONTEIN H070408	-23.55247	30.36519	2330AD00007 VLAKFONTEIN H070408	2008/01/28	NONE	SAMPLE	87.478		4.0
HARMINIC MEAN 2330AD00007 VLAKFONTEIN H070408							112.995	112.995	
2330CB00498 MODJADJES H070502	-23.59075	30.372	2330CB00498 MODJADJES H070502	2003/01/09	NONE	SAMPLE	77.730		10.0
2330CB00498 MODJADJES H070502	-23.59075	30.372	2330CB00498 MODJADJES H070502	2008/01/22	NONE	SAMPLE	123.877		4.0
HARMINIC MEAN 2330CB00498 MODJADJES H070502							95.522	95.522	
2330CB00499 MOJADJES H070519	-23.58377	30.3638	2330CB00499 MOJADJES H070519	2003/01/13	NONE	SAMPLE	133.560		10.0
2330CB00499 MOJADJES H070519	-23.58377	30.3638	2330CB00499 MOJADJES H070519	2008/01/26	NONE	SAMPLE	110.859		4.0
HARMINIC MEAN 2330CB00499 MOJADJES H070519							121.155	121.155	
2330CB00501 KROMRIVIERFONTEIN H070698	-23.53394	30.39538	2330CB00501 KROMRIVIERFONTEIN H070698	2003/01/08	NONE	SAMPLE	135.488		10.0
2330CB00501 KROMRIVIERFONTEIN H070698	-23.53394	30.39538	2330CB00501 KROMRIVIERFONTEIN H070698	2005/04/01	NONE	SAMPLE	122.139		4.0
HARMINIC MEAN 2330CB00501 KROMRIVIERFONTEIN H070698							128.468	128.468	
2330AD00410 STATELAND H070806	-23.42108	30.40302	2330AD00410 STATELAND H070806	2003/01/08	NONE	SAMPLE	11.979	11.979	10.0
2330CB00477 MODJADJES H070995	-23.57702	30.32405	2330CB00477 MODJADJES H070995	2003/01/08	NONE	SAMPLE	48.163	48.163	
2330AD00412 STATELAND H070111	-23.39158	30.38597	2330AD00412 STATELAND H070111	2003/01/15	NONE	SAMPLE	101.366	101.366	10.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AD00414 STATELAND H070627	-23.39275	30.44302	2330AD00414 STATELAND H070627	2003/01/13	NONE	SAMPLE	115.792		10.0
2330AD00414 STATELAND H070627	-23.39275	30.44302	2330AD00414 STATELAND H070627	2008/01/20	NONE	SAMPLE	120.675		4.0
HARMINIC MEAN 2330AD00414 STATELAND H070627							118.183	118.183	
2330AD00415 BELLEVUE H070861	-23.41947	30.38122	2330AD00415 BELLEVUE H070861	2003/03/22	NONE	SAMPLE	81.708		10.0
2330AD00415 BELLEVUE H070861	-23.41947	30.38122	2330AD00415 BELLEVUE H070861	2004/06/20	NONE	SAMPLE	78.075		5.0
HARMINIC MEAN 2330AD00415 BELLEVUE H070861							79.850	79.850	
2330CB00502 SENOBELA H070659	-23.53572	30.43186	2330CB00502 SENOBELA H070659	2003/07/30	NONE	SAMPLE	85.587		10.0
2330CB00502 SENOBELA H070659	-23.53572	30.43186	2330CB00502 SENOBELA H070659	2005/04/06	NONE	SAMPLE	74.031		4.0
HARMINIC MEAN 2330CB00502 SENOBELA H070659							79.391	79.391	
2330CB00353 MODJADJES H070683	-23.60936	30.29444	2330CB00353 MODJADJES H070683	2003/07/29	NONE	SAMPLE	18.657	18.657	10.0
2330CB00366 MODJADJES H070685	-23.61258	30.28738	2330CB00366 MODJADJES H070685	2003/07/29	NONE	SAMPLE	14.778	14.778	10.0
2330CB00374 MODJADJES H07-0760	-23.59213	30.37672	2330CB00374 MODJADJES H070760	2003/07/24	NONE	SAMPLE	60.434	60.434	10.0
MODJADJES H07-0974	-23.61816	30.277	2330CB00504 MODJADJES H070974	2003/07/29	NONE	SAMPLE	5.000	5.000	10.0
2330AD00418 WORSHESTER H07-0983	-23.49958	30.44327	2330AD00418 WORSHESTER H070983	2003/07/29	NONE	SAMPLE	213.311	213.311	10.0
2330AD00261 STATELAND H07-0098	-23.46277	30.31416	2330AD00261 STATELAND H070098	2003/07/10	NONE	SAMPLE	260.600	260.600	4.0
2330AD00416 NORTHAMPTON H07-0710	-23.46255	30.47658	2330AD00416 NORTHAMPTON H07-0710	2003/07/09	NONE	SAMPLE	423.655		
2330AD00416 NORTHAMPTON H07-0710	-23.46255	30.47658	2330AD00416 NORTHAMPTON H07-0710	2005/08/09	NONE	SAMPLE	672.786		10.0
HARMINIC MEAN 2330AD00416 NORTHAMPTON H07-0710							519.917	519.917	5.0
2330AD00300 NORTHAMPTON H07-0984	-23.47197	30.46497	2330AD00300 NORTHAMPTON H070984	2003/07/09	NONE	SAMPLE	266.045	266.045	5.0
2330AD00417 STATELAND H07-1181	-23.4628	30.31336	2330AD00417 STATELAND H071181	2003/07/07	NONE	SAMPLE	355.680	355.680	5.0
2330CB00308 MODJADJES H07-0016	-23.6243	30.3493	2330CB00308 MODJADJES H070016	2003/10/29	NONE	SAMPLE	40.775	40.775	5.0
2330CB00309 MODJADJES H07-0017	-23.62255	30.34958	2330CB00309 MODJADJES H070017	2003/10/29	NONE	SAMPLE	20.480	20.480	5.0
2330AD00283 MAMAILE A H070539	-23.38361	30.42897	2330AD00283 MAMAILE A H070539	2003/10/26	NONE	SAMPLE	65.128	65.128	5.0
2330CB00505 MODJADJES H071081	-23.62259	30.34655	2330CB00505 MODJADJES H071081	2003/10/08	NONE	SAMPLE	129.665	129.665	5.0
2330CB00506 AKANANI PRIMARY SCHOOL/MAMITWASKOP H07-0819	-23.72497	30.36852	2330CB00506 AKANANI PRIMARY SCHOOL/MAMITWASKOP H07-0819	2003/12/24	NONE	SAMPLE	81.538	81.538	5.0
2330CB00378 TUMEDI PRIMARY SCHOOL/MODJADJES H07-0834	-23.61705	30.37949	2330CB00378 TUMEDI PRIMARY SCHOOL/MODJADJES H07-0834	2003/12/17	NONE	SAMPLE	20.729	20.729	5.0
2330CB00358 SHOTONG PRIMARY SCHOOLE H07-0633	-23.63111	30.29727	2330CB00358 SHOTONG PRIMARY SCHOOLE H07-0633	2003/12/15	NONE	SAMPLE	34.897	34.897	5.0
2330CB00359 MODIPE HIGH SCHOOL H07-0634	-23.63866	30.38963	2330CB00359 MODIPE HIGH SCHOOL H07-0634	2003/12/16	NONE	SAMPLE	18.134	18.134	5.0
2330CB00507 KHEOPENG SCHOOL H07-1195	-23.63869	30.36088	2330CB00507 KHEOPENG SCHOOL H07-1195	2004/01/20	NONE	SAMPLE	6.602	6.602	5.0
2330CB00508 MODJADJES/PJAPJAMELA SCHOOL H07-1271	-23.62877	30.3985	2330CB00508 MODJADJES/PJAPJAMELA SCHOOL H07-1271	2004/01/18	NONE	SAMPLE	17.795	17.795	5.0
2330BC00410 MEIDINGEN/RAJEKO H07-1198	-23.48897	30.50711	2330BC00410 MEIDINGEN/RAJEKO H07-1198	2004/01/10	NONE	SAMPLE	65.238	65.238	5.0
2330CB00509 MOHLOTI SCHOOL H07-1299	-23.69227	30.35066	2330CB00509 MOHLOTI SCHOOL H071299	2004/02/22	NONE	SAMPLE	20.516	20.516	5.0
2330AD00008 SHAWELA H07-0455	-23.48486	30.34505	2330AD00008 SHAWELA H07-0455	2004/03/30	NONE	SAMPLE	240.174	240.174	5.0
2330AD00012 SHAWELA H07-0456	-23.47999	30.34735	2330AD00012 SHAWELA H070456	2004/04/03	NONE	SAMPLE	187.988	187.988	5.0
2330CB00329 GAFAMANE H07-0079	-23.5003	30.41058	2330CB00329 GAFAMANE H070079	2004/05/04	NONE	SAMPLE	288.803	288.803	5.0
2330AD00255 FEMANE H07-0082	-23.49169	30.38802	2330AD00255 FEMANE H070082	2004/05/06	NONE	SAMPLE	150.884	150.884	
2330AD00256 GA NTATA H07-0083	-23.47661	30.45672	2330AD00256 GA NTATA H070083	2004/05/12	NONE	SAMPLE	169.221	169.221	

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330BC00161 BOTSHABELO H07-0142	-23.42727	30.52124	2330BC00161 BOTSHABELO H070142	2004/05/08	NONE	SAMPLE	488.346	488.346	4.0
2330AD00274 GA NTATA H07-0474	-23.47305	30.44413	2330AD00274 GA NTATA H070474	2004/05/09	NONE	SAMPLE	194.020	194.020	5.0
2330AD00285 MAPHALE H07-0464	-23.45686	30.31777	2330AD00285 MAPHALE H070464	2004/06/20	NONE	SAMPLE	117.328	117.328	5.0
2330BC00243 SIKHIMING H07-0530	-23.42667	30.15305	2330BC00243 SIKHIMING H070530	2004/04/28	NONE	SAMPLE	216.268	216.268	5.0
2330CA00074 KGAPANE H07-1204	-23.65866	30.2376	2330CA00074 KGAPANE H071204	2004/05/17	NONE	SAMPLE	15.139	15.139	5.0
2330CB00514 MAVELE H07-1300	-23.67594	30.41805	2330CB00514 MAVELE H071300	2004/04/20	NONE	SAMPLE	80.223	80.223	5.0
2330CB00512 VHULAKANJANI SCHOOL H07-1304	-23.73611	30.48602	2330CB00512 VHULAKANJANI SCHOOL H071304	2004/05/18	NONE	SAMPLE	134.342	134.342	5.0
2330CB00511 MAVELE PRIMARY SCHOOL H07-1305	-23.67502	30.41955	2330CB00511 MAVELE PRIMARY SCHOOL H071305	2004/04/20	NONE	SAMPLE	56.268	56.268	5.0
2330DA00049 UKUTHULA SCHOOL H14-1064	-23.54908	30.71141	2330DA00049 UKUTHULA SCHOOL H141064	2004/04/22	NONE	SAMPLE	171.512	171.512	5.0
2330AD00291 MAPHALLA H07-1179	-23.4568	30.32085	2330AD00291 MAPHALLA H071179	2004/06/24	NONE	SAMPLE	115.630	115.630	5.0
2330AD00293 MAMAILA A H07-0951	-23.39427	30.43702	2330AD00293 MAMAILA A H070951	2004/06/24	NONE	SAMPLE	95.438	95.438	5.0
2330CA00077 MANDELA PARK H07-1308	-23.6618	30.248	2330CA00077 MANDELA PARK H071308	2004/07/26	NONE	SAMPLE	8.449	8.449	4.0
2330AD00175 MAPHALLE H07-1309	-23.47169	30.32352	2330AD00175 MAPHALLE H071309	2004/07/29	NONE	SAMPLE	135.649	135.649	
2330AD00176 MAMAILA H07-1310	-23.39536	30.4365	2330AD00176 MAMAILA H071310	2004/08/04	NONE	SAMPLE	57.082		4.0
2330AD00176 MAMAILA H07-1310	-23.39536	30.4365	2330AD00176 MAMAILA H071310	2007/09/14	NONE	SAMPLE	111.122		4.0
HARMINIC MEAN 2330AD00176 MAMAILA H07-1310							75.421	75.421	4.0
2330AD00211 MAKGAKGAPTSE H07-0137	-23.37086	30.49759	2330AD00211 MAKGAKGAPTSE H07-0137	2005/04/08	NONE	SAMPLE	146.712	146.712	4.0
2330AD00212 MAKGAKGAPASTA H07-0646	-23.39363	30.495	2330AD00212 MAKGAKGAPASTA H07-0646	2005/04/12	NONE	SAMPLE	89.572	89.572	4.0
2330CB00157 POLASENG H07-0745	-23.53571	30.3962	2330CB00157 POLASENG H07-0745	2005/04/01	NONE	SAMPLE	156.562	156.562	4.0
2330CB00158 MOTHOBEKI H07-0797	-23.55679	30.37717	2330CB00158 MOTHOBEKI H07-0797	2005/04/01	NONE	SAMPLE	30.682	30.682	
2330CB00161 WORCESTER H07-0827	-23.52684	30.42889	2330CB00161 WORCESTER H07-0827	2005/04/02	NONE	SAMPLE	107.908	107.908	4.0
2330CB00162 MOTHOBEKI H07-0843	-23.54772	30.37161	2330CB00162 MOTHOBEKI H07-0843	2005/04/01	NONE	SAMPLE	96.382	96.382	4.0
2330AD00213 MAHLABONENG H07-0845	-23.47261	30.38653	2330AD00213 MAHLABONENG H07-0845	2005/04/10	NONE	SAMPLE	151.547	151.547	4.0
2330CB00164 SENOPELWA H07-0999	-23.56295	30.37444	2330CB00164 SENOPELWA H07-0999	2005/04/01	NONE	SAMPLE	464.804	464.804	4.0
2330AD00217 THAKO H07-1359	-23.49638	30.30897	2330AD00217 THAKO H07-1359	2005/04/01	NONE	SAMPLE	10.602	10.602	4.0
2330BC00175 RATJEKE H07-0233	-23.50193	30.49956	2330BC00175 RATJEKE H07-0233	2005/04/16	NONE	SAMPLE	58.454	58.454	4.0
2330AD00224 SEDIBENE H07-0110	-23.39047	30.38572	2330AD00224 SEDIBENE H07-0110	2005/04/27	NONE	SAMPLE	158.524	158.524	4.0
2330AD00226 MAMOKGADI H07-0118	-23.42491	30.45511	2330AD00226 MAMOKGADI H07-0118	2005/04/22	NONE	SAMPLE	195.409	195.409	4.0
2330AD00227 SEAPHOLE H07-0522	-23.49796	30.46417	2330AD00227 SEAPHOLE H07-0522	2005/04/12	NONE	SAMPLE	1202.030	1202.026	4.0
2330AD00228 JAMELA H07-0526	-23.44771	30.33919	2330AD00228 JAMELA H07-0526	2005/04/15	NONE	SAMPLE	91.768	91.768	4.0
2330CB00169 RAMAROKA SOUTH H07-0542	-23.51587	30.35531	2330CB00169 RAMAROKA SOUTH H07-0542	2005/04/13	NONE	SAMPLE	44.640	44.640	4.0
2330DA00092 MAEKGWE H07-0569	-23.50102	30.51056	2330DA00092 MAEKGWE H07-0569	2005/04/09	NONE	SAMPLE	103.062	103.062	4.0
2330AD00229 LEBAKA H07-0728	-23.47399	30.37025	2330AD00229 LEBAKA H07-0728	2005/04/18	NONE	SAMPLE	287.503	287.503	4.0
2330BC00164 KORANTA H07-0202	-23.45302	30.51845	2330BC00164 KORANTA H07-0202	2005/05/12	NONE	SAMPLE	184.801	184.801	4.0
2330AD00223 NAKAMPE H07-1222	-23.39875	30.44775	2330AD00223 NAKAMPE H07-1222	2005/05/18	NONE	SAMPLE	56.672	56.672	4.0
2330AD00209 DITSHONENG H07-1368	-23.49883	30.32333	2330AD00209 DITSHONENG H07-1368	2005/07/25	NONE	SAMPLE	208.570	208.570	4.0
2330AD00210 DITSHONENG H07-1369	-23.49211	30.32461	2330AD00210 DITSHOSENG H07-1369	2005/07/26	NONE	SAMPLE	211.664	211.664	4.0
2330AD00277 MOHLABANENG H07-0447	-23.47088	30.37752	2330AD00277 MOHLABANENG H07-0447	2005/08/08	NONE	SAMPLE	289.420	289.420	4.0
2330CB00048 MODJADJES H07-0918	-23.57177	30.37019	2330CB00048 MODJADJES H07-0918	2005/08/21	NONE	SAMPLE	3863.410	3863.412	4.0
2330AD00312 SEAPHOLE H07-1147	-23.48605	30.466	2330AD00312 SEAPHOLE H07-1147	2005/09/12	NONE	SAMPLE	122.988	122.988	4.0
2330AD00313 SEOPOLE H07-1148	-23.49685	30.45973	2330AD00313 SEOPOLE H07-1148	2005/08/23	NONE	SAMPLE	135.415	135.415	4.0
2330AD00231 SEFOFOTSE H07-0116	-23.434	30.4103	SEFOFOTSE H07-0116	2005/08/06	NONE	SAMPLE	134.992	134.992	
2330CB00170 KROMRIVIERFONTEIN H07-0724	-23.52863	30.40261	KROMRIVIERFONTEIN H07-0724	2005/08/18	NONE	SAMPLE	437.242	437.242	4.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AD00232 BELLEVUE H07-0822	-23.39802	30.37547	BELLEVUE H07-0822	2005/08/04	NONE	SAMPLE	100.082	100.082	4.0
2430BA00067 BISMARCK H08-1297	-23.39802	30.37547	BISMARCK H08-1297	2005/08/05	NONE	SAMPLE	184.296	184.296	4.0
2330BC00225 ELANDSFONTEIN H07-1080	-23.43085	30.51306	2330BC00225 ELANDSFONTEIN H07-1080	2005/08/27	NONE	SAMPLE	326.415	326.415	4.0
2330AD00207 BELLEVUE H07-1389	-23.43425	30.35	2330AD00207 BELLEVUE H07-1389	2005/11/18	NONE	SAMPLE	45.398	45.398	4.0
2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	-23.46369	30.36994	2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	2006/03/28	NONE	SAMPLE	168.171	168.171	4.0
2330AD00235 STATELAND PTN. MAMAILA - H07-1408	-23.39372	30.43511	2330AD00235 STATELAND PTN. MAMAILA - H07-1408	2006/03/30	NONE	SAMPLE	67.590	67.590	4.0
2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	-23.55266	30.39552	2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	2006/03/25	NONE	SAMPLE	345.713	345.713	4.0
2330AD00276 NORTHAMPTON PTN. GA-NTATA - H07-0476	-23.47521	30.44773	2330AD00276 NORTHAMPTON PTN. GA-NTATA - H07-0476	2006/07/06	NONE	SAMPLE	363.658	363.658	4.0
2330AD00231 SEFOFOTSE H07-0116	-23.434	30.4103	SEFOFOTSE H07-0116	2005/08/06	NONE	SAMPLE	134.992	134.992	4.0
2330CB00170 KROMRIVIERFONTEIN H07-0724	-23.5286	30.40261	KROMRIVIERFONTEIN H07-0724	2005/08/18	NONE	SAMPLE	437.242	437.242	4.0
2330AD00232 BELLEVUE H07-0822	-23.398	30.37547	BELLEVUE H07-0822	2005/08/04	NONE	SAMPLE	100.082	100.082	4.0
2430BA00067 BISMARCK H08-1297	-23.398	30.37547	BISMARCK H08-1297	2005/08/05	NONE	SAMPLE	184.296	184.296	4.0
2330BC00225 ELANDSFONTEIN H07-1080	-23.4309	30.51306	2330BC00225 ELANDSFONTEIN H07-1080	2005/08/27	NONE	SAMPLE	326.415	326.415	4.0
2330AD00207 BELLEVUE H07-1389	-23.4343	30.35	2330AD00207 BELLEVUE H07-1389	2005/11/18	NONE	SAMPLE	45.398	45.398	4.0
2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	-23.4637	30.36994	2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	2006/03/28	NONE	SAMPLE	168.171	168.171	4.0
2330AD00235 STATELAND PTN. MAMAILA - H07-1408	-23.3937	30.43511	2330AD00235 STATELAND PTN. MAMAILA - H07-1408	2006/03/30	NONE	SAMPLE	67.59	67.59	4.0
2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	-23.5527	30.39552	2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	2006/03/25	NONE	SAMPLE	345.713	345.713	4.0
2330CB00321 MODJADJE PTN. MATSWE - H07-0047	-23.58676	30.3575	2330CB00321 MODJADJE PTN. MATSWE - H07-0047	2006/07/07	NONE	SAMPLE	132.882	132.882	4.0
2330CB00420 MODJADJES PTN. MATSHWE - H07-1075	-23.58559	30.3572	2330CB00420 MODJADJES PTN. MATSHWE - H07-1075	2006/10/09	NONE	SAMPLE	45.918	45.918	4.0
2330AD00308 WORCESTER PTN. FEMANE - H07-0081	-23.49979	30.41298	2330AD00308 WORCESTER PTN. FEMANE - H07-0081	2007/09/16	NONE	SAMPLE	1764.780	1764.776	4.0
J2330AD00315 BELLEVUE PTN.AMELA - H07-0814	-23.43824	30.35005	2330AD00315 BELLEVUE PTN. JAMELA - H07-0814	2007/09/12	NONE	SAMPLE	73.771	73.771	4.0
2330AD00336 STATELAND PTN. MAMAILA - H07-0852	-23.38324	30.43195	2330AD00336 STATELAND PTN. MAMAILA - H07-0852	2007/09/15	NONE	SAMPLE	76.099	76.099	4.0
2330AD00180 STATELAND PTN. BELLEVUE - H07-0622	-23.41577	30.41739	2330AD00180 STATELAND PTN. BELLEVUE - H07-0622	2007/09/13	NONE	SAMPLE	69.220	69.220	4.0
2330CB00203 DJADJES PTN. MATSWE - H07-0756	-23.5794	30.36589	2330CB00203 MODJADJES PTN. MATSWE - H07-0756	2008/01/23	NONE	SAMPLE	53.885	53.885	4.0
2330CB00207 ODJADJES LOC. PTN. BOSHAGE - H07-1472	-23.5728	30.34563	2330CB00207 MODJADJES PTN. BOSHAGE - H07-1472	2008/01/29	NONE	SAMPLE	65.392	65.392	4.0
2330CA00051 MNGEN PTN. RAPITSI - H07-0783	-23.66322	30.23166	2330CA00051 MEIDINGEN PTN. RAPITSI - H07-0783	2008/02/07	NONE	SAMPLE	9.924	9.924	4.0
2330CA00032 SCHOONGELEGEN PTN. RAPITSI - H07-1482	-23.67245	30.23246	2330CA00032 SCHOONGELEGEN PTN. RAPITSI - H07-1482	2008/02/19	NONE	SAMPLE	7.311	7.311	4.0

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330CA00036 SCHOONGELEGEN PTN. RAPITSI - H07-1498	-23.66986	30.23401	2330CA00036 SCHOONGELEGEN PTN. RAPITSI - H07-1498	2008/02/17	NONE	SAMPLE	9.140	9.140	4.0
2330CA00078 SLEGEN PTN. GA-RAPITSI - H07-1499	-23.66855	30.23463	2330CA00078 SCHOONGELEGEN PTN. GA-RAPITSI - H07-1499	2008/02/20	NONE	SAMPLE	8.606	8.606	4.0
2330CB00211 JADJES PTN. SEKHUTENG - H07-1516	-23.61964	30.32668	2330CB00211 MODJADJES PTN. SEKHUTENG - H07-1516	2008/05/22	NONE	SAMPLE	59.877	59.877	4.0
HARMONIC MEAN FOR CHLORIDE IN GROUNDWATER FOR QUATERNARY CATCHMENT B81G								**25.592**	

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table A-2: Mean annual chloride from groundwater data for Middle Letaba (B82D) quaternary catchment (NGDB data, DWA).

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AC00119 VAALWATER	-23.4189	30.143611	VAALWATER (DUPL NAME 5)	1995/11/13	NONE	SAMPLE	24.700	24.700	3.0
2330AC00118 ROERFONTEIN	-23.3878	30.1625	ROERFONTEIN (DUPL NAME 4)	1995/11/15	NONE	SAMPLE	13.900		3.0
2330AC00118 ROERFONTEIN	-23.3878	30.1625	ROERFONTEIN (DUPL NAME 4)	1995/12/10	NONE	SAMPLE	15.800		3.0
HARMONIC MEAN 2330AC00118 ROERFONTEIN							14.789	14.789	
2330AC00237 ROERFONTEIN	-23.3881	30.163056	ROERFONTEIN (DUPL NAME 5)	1995/11/17	NONE	SAMPLE	14.000		3.0
2330AC00237 ROERFONTEIN	-23.3881	30.163056	ROERFONTEIN (DUPL NAME 5)	1995/12/11	NONE	SAMPLE	15.900		3.0
HARMONIC MEAN 2330AC00237 ROERFONTEIN							14.890	14.890	
2330AC00237 ROERFONTEIN	-23.3881	30.163056	ROERFONTEIN (DUPL NAME 5)	1995/12/13	NONE	SAMPLE	27.200		3.0
2330AC00237 ROERFONTEIN	-23.3881	30.163056	ROERFONTEIN (DUPL NAME 5)	1998/05/19	NONE	SAMPLE	19.200		3.0
HARMONIC MEAN 2330AC00237 ROERFONTEIN							22.510	22.510	
2330AC00115 ZOETFONTEIN	-23.3767	30.18	ZOETFONTEIN (DUPL NAME 3)	1995/11/28	NONE	SAMPLE	36.300	36.300	3.0
2330AC00116 ROERFONTEIN	-23.3936	30.161111	ROERFONTEIN (DUPL NAME 1)	1995/11/24	NONE	SAMPLE	20.000	20.000	3.0
LEMONDOKOP (DUP NAME 7177)	-23.4411	30.155	LEMONDOKOP (DUPL NAME 2)	1997/07/09	NONE	SAMPLE	14.900	14.900	3.0
GROOTFONTEIN (DUP NAME 7180)	-23.2978	30.318333	GROOTFONTEIN (DUPL NAME 58)	1997/07/13	NONE	SAMPLE	364.700	364.700	3.0
ZONNEBLOEM (DUP NAME 7183)	-23.2986	30.303611	ZONNEBLOEM (DUPL NAME 5)	1997/07/18	NONE	SAMPLE	33.900	33.900	3.0
ZONNEBLOEM (DUP NAME 7186)	-23.2958	30.308611	ZONNEBLOEM (DUPL NAME 3)	1997/07/20	NONE	SAMPLE	53.100	53.100	3.0
LEMONDOKOP (DUP NAME 7187)	-23.4406	30.141111	LEMONDOKOP (DUPL NAME 1)	1997/07/07	NONE	SAMPLE	7.400	7.400	3.0
2330AC00227 KLIPKRAAL PTN. THAKGALANE - H10-0213	-23.4472	30.053611	KLIPKRAAL (DUPL NAME 1)	1997/07/11	NONE	SAMPLE	10.900	10.900	3.0
GROOTFONTEIN (DUP NAME 7189)	-23.2906	30.321944	GROOTFONTEIN (DUPL NAME 7)	1997/07/15	NONE	SAMPLE	60.900	60.900	3.0
KWAGGAFONTEIN (DUP NAME 7196)	-23.2797	30.327222	KWAGGAFONTEIN (DUPL NAME 1)	1997/07/16	NONE	SAMPLE	41.700	41.700	3.0
UITSPAN (DUP NAME 7225)	-23.4636	30.001944	UITSPAN (DUPL NAME 3)	1997/07/24	NONE	SAMPLE	61.600	61.600	3.0
2330AC00231 UITSPAN H100624	-23.4594	30.001944	UITSPAN (DUPL NAME 4)	1997/07/30	NONE	SAMPLE	4.500		3.0
2330AC00231 UITSPAN H100624	-23.4594	30.001944	UITSPAN (DUPL NAME 4)	2002/10/04	NONE	SAMPLE	5.000		10.0
HARMONIC MEAN 2330AC00231 UITSPAN H100624							4.737	4.737	
UITSPAN (DUP NAME 7226)	-23.4603	30.0025	UITSPAN (DUPL NAME 5)	1997/07/21	NONE	SAMPLE	5.500	5.500	3.0
2330AC00225 BLINKWATER	-23.4456	30.058889	BLINKWATER (DUPL NAME 5)	1997/07/25	NONE	SAMPLE	12.200	12.200	3.0
2330AC00226 BLINKWATER PTN. THAKGALANE - H10-0617	-23.4444	30.059722	BLINKWATER (DUPL NAME 6)	1997/07/29	NONE	SAMPLE	10.200		3.0
2330AC00226 BLINKWATER PTN. THAKGALANE - H10-0617	-23.4444	30.059722	BLINKWATER (DUPL NAME 6)	2002/10/04	NONE	SAMPLE	11.167		10.0
HARMONIC MEAN 2330AC00226 BLINKWATER PTN. THAKGALANE - H10-0617							10.662	10.662	
UITSPAN (DUP NAME 7227)	-23.4603	30.001944	UITSPAN (DUPL NAME 2)	1997/08/02	NONE	SAMPLE	5.500	5.500	3.0
ZONNEBLOEM (DUP NAME 7235)	-23.3044	30.296111	ZONNEBLOEM (DUPL NAME 6)	1997/08/02	NONE	SAMPLE	45.900	45.900	3.0
ZONNEBLOEM (DUP NAME 7239)	-23.2972	30.299722	ZONNEBLOEM (DUPL NAME 4)	1997/08/05	NONE	SAMPLE	21.500		3.0
ZONNEBLOEM (DUP NAME 7239)	-23.2972	30.299722	ZONNEBLOEM (DUPL NAME 4)	2002/08/27	NONE	SAMPLE	32.849		10.0
HARMONIC MEAN ZONNEBLOEM (DUP NAME 7239)							25.990	25.990	
2330AC00206 VAALWATER - H10-0196	-23.4183	30.144444	VAALWATER (DUPL NAME 1)	1997/08/15	NONE	SAMPLE	20.000	20.000	3.0
2330AC00205 VAALWATER - H10-0194	-23.4172	30.145833	VAALWATER (DUPL NAME 2)	1997/08/14	NONE	SAMPLE	20.000		3.0
2330AC00205 VAALWATER - H10-0194	-23.4172	30.145833	VAALWATER (DUPL NAME 2)	2002/08/30	NONE	SAMPLE	38.164		10.0
2330AC00205 VAALWATER - H10-0194	-23.4172	30.145833	VAALWATER (DUPL NAME 2)	2008/01/15	NONE	SAMPLE	34.418		4.0
HARMONIC MEAN 2330AC00205 VAALWATER - H10-0194							28.502	28.502	
2330AC00204 VAALWATER - H10-0191	-23.4156	30.153611	VAALWATER (DUPL NAME 3)	1997/08/12	NONE	SAMPLE	29.000		3.0
2330AC00204 VAALWATER - H10-0191	-23.4156	30.153611	VAALWATER (DUPL NAME 3)	2002/08/30	NONE	SAMPLE	100.622		10.0
HARMONIC MEAN 2330AC00204 VAALWATER - H10-0191							45.024	45.024	
2330AD00171 BLINKWATER - H10-0005	-23.4042	30.3375	2330AD00171 BLINKWATER	1997/09/08	NONE	SAMPLE	209.100	209.100	3.0

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AC00207 VAALWATER - H10-0198	-23.4139	30.146111	VAALWATER (DUPL NAME 4)	1997/08/19	NONE	SAMPLE	77.500	77.500	3.0
AMSTERDAM (DUP NAME 7306)	-23.3967	30.289722	AMSTERDAM (DUPL NAME 7)	1997/09/02	NONE	SAMPLE	96.300	96.300	3.0
2330AC00188 ROTTERDAM - H100013	-23.4158	30.244722	ROTTERDAM (DUPL NAME 4)	1997/09/05	NONE	SAMPLE	62.600		3.0
2330AC00188 ROTTERDAM - H100013	-23.4158	30.244722	ROTTERDAM (DUPL NAME 4)	2002/10/08	NONE	SAMPLE	70.320		10.0
2330AC00188 ROTTERDAM - H100013	-23.4158	30.244722	ROTTERDAM (DUPL NAME 4)	2004/06/08	NONE	SAMPLE	59.003		5.0
HARMONIC MEAN 2330AC00188 ROTTERDAM - H100013							63.636	63.636	
2330AD00322 ROTTERDAM - H10-0012	-23.4072	30.265833	ROTTERDAM (DUPL NAME 5)	1997/09/02	NONE	SAMPLE	194.100	194.100	3.0
2330AD00325 ROTTERDAM - H10-0011	-23.4006	30.268889	AMSTERDAM (DUPL NAME 8)	1997/09/09	NONE	SAMPLE	252.800		3.0
2330AD00325 ROTTERDAM - H10-0011	-23.4006	30.268889	AMSTERDAM (DUPL NAME 8)	2004/06/16	NONE	SAMPLE	277.403		4.0
HARMONIC MEAN 2330AD00325 ROTTERDAM - H10-0011							264.531	264.531	
AMSTERDAM (DUP NAME 7361)	-23.4017	30.301389	AMSTERDAM (DUPL NAME 24)	1997/09/14	NONE	SAMPLE	93.600	93.600	3.0
2330AD00170 BLINKWATER	-23.4097	30.335556	2330AD00170 BLINKWATER	1997/09/15	NONE	SAMPLE	147.600	147.600	3.0
OLIFANTSHOEK (DUP NAME 7362)	-23.3297	30.273889	OLIFANTSHOEK (DUPL NAME 8)	1997/09/22	NONE	SAMPLE	28.700	28.700	3.0
OLIFANTSHOEK (DUP NAME 7363)	-23.3292	30.273056	OLIFANTSHOEK (DUPL NAME 9)	1997/09/18	NONE	SAMPLE	9.800	9.800	3.0
2330AD00318 AMSTERDAM - H10-0008	-23.4033	30.304722	AMSTERDAM (DUPL NAME 25)	1997/09/22	NONE	SAMPLE	305.400	305.400	3.0
2330AD00172 BLINKWATER - H10-0007	-23.4022	30.324444	2330AD00172 BLINKWATER	1997/09/09	NONE	SAMPLE	204.100	204.100	3.0
2330AD00096 STATELAND PTN. NDEGEZA A	-23.3117	30.403889	NDEGEZA A (HOOFKRAAL	1997/09/19	NONE	SAMPLE	91.300	91.300	3.0
OLIFANTSHOEK (DUP NAME 7415)	-23.3289	30.270556	OLIFANTSHOEK (DUPL NAME 1)	1997/10/20	NONE	SAMPLE	23.000	23.000	3.0
2330AC00193 ROERFONTEIN - H10-0029	-23.3756	30.178056	ROERFONTEIN (DUPL NAME 2)	1997/11/04	NONE	SAMPLE	57.700		3.0
2330AC00193 ROERFONTEIN - H10-0029	-23.3756	30.178056	ROERFONTEIN (DUPL NAME 2)	2002/08/29	NONE	SAMPLE	49.533		10.0
HARMONIC MEAN 2330AC00193 ROERFONTEIN - H10-0029							53.305	53.305	
2330AC00191 ROERFONTEIN - H10-0024	-23.3753	30.178611	ROERFONTEIN (DUPL NAME 3)	1997/11/01	NONE	SAMPLE	39.200	39.200	3.0
2330AD00128 STATELAND PTN. XIMAWUSA - H10-0002	-23.4044	30.345556	BLINKWATER (DUPL NAME 7)	1997/10/24	NONE	SAMPLE	24.500	24.500	3.0
2330AC00317 ROTTERDAM	-23.4228	30.259722	ROTTERDAM (DUPL NAME 6)	1997/10/18	NONE	SAMPLE	117.400	117.400	3.0
OLIFANTSHOEK (DUP NAME 7416)	-23.3289	30.271667	OLIFANTSHOEK (DUPL NAME 2)	1997/10/11	NONE	SAMPLE	29.400	29.400	3.0
OLIFANTSHOEK (DUP NAME 7417)	-23.3289	30.270833	OLIFANTSHOEK (DUPL NAME 3)	1997/10/19	NONE	SAMPLE	13.100	13.100	3.0
OLIFANTSHOEK (DUP NAME 7418)	-23.3289	30.270278	OLIFANTSHOEK (DUPL NAME 4)	1997/10/16	NONE	SAMPLE	32.000	32.000	3.0
ROTTERDAM (DUP NAME 7419)	-23.4156	30.243889	ROTTERDAM (DUPL NAME 7)	1997/10/18	NONE	SAMPLE	59.400	59.400	3.0
OLIFANTSHOEK (DUP NAME 7420)	-23.3361	30.286389	OLIFANTSHOEK (DUPL NAME 5)	1997/10/12	NONE	SAMPLE	62.700		3.0
OLIFANTSHOEK (DUP NAME 7420)	-23.3361	30.286389	OLIFANTSHOEK (DUPL NAME 5)	2002/10/08	NONE	SAMPLE	86.603		10.0
HARMONIC MEAN OLIFANTSHOEK (DUP NAME 7420)							72.738	72.738	
2330AD00149 MAGORO - MAGR11	-23.2881	30.327778	MAGORO (DUPL NAME 1)	1997/10/28	NONE	SAMPLE	302.000	302.000	3.0
2330AD00152 MAGORO - MAGR22	-23.2933	30.315833	MAGORO (DUPL NAME 2)	1997/10/28	NONE	SAMPLE	73.500	73.500	3.0
2330AC00192 ROERFONTEIN - H10-0028	-23.3836	30.175	ROERFONTEIN (DUPL NAME 7)	1997/10/30	NONE	SAMPLE	27.500		3.0
2330AC00192 ROERFONTEIN - H10-0028	-23.3836	30.175	ROERFONTEIN (DUPL NAME 7)	2002/08/29	NONE	SAMPLE	31.922		10.0
HARMONIC MEAN 2330AC00192 ROERFONTEIN - H10-0028							29.546	29.546	
2330AD00116 STATELAND PTN. NOBLEHOEK PTN. MAHLAHLANDELA	-23.3511	30.370833	NOBLEHOEK MAHLAHLANDELA	1997/10/30	NONE	SAMPLE	131.700	131.700	3.0
2330AD00262 STATELAND PTN. MAPHALLE - H07-0101	-23.4578	30.309167	MARHALLE STAATSGROND	1997/11/28	NONE	SAMPLE	271.000	271.000	3.0
2330AD00298 STATELAND PTN. MAPHALLE - H07-0865	-23.4611	30.304722	STAATSGROND (DUPL NAME 30)	1997/11/01	NONE	SAMPLE	693.000	693.000	3.0
2330AD00271 STATELAND PTN. MAPHALLE - H07-0462	-23.4561	30.308611	STAATSGROND (DUPL NAME 10)	1997/12/07	NONE	SAMPLE	346.800	346.800	3.0
2330AD00397 HERDERWATER PTN. RIBUNGWANI	-23.2714	30.288056	RIBUNGWANI (DUPL NAME 3)	1997/12/02	NONE	SAMPLE	20.000	20.000	3.0
2330AC00315 HARTE BEEST FONTEIN PTN. REMBULUWANI - H17-0279	-23.2986	30.244167	RIBUNGWANI (DUPL NAME 1)	1997/12/10	NONE	SAMPLE	96.800	96.800	3.0
2330AD00088 STATELAND PTN. NDENGEZA	-23.315	30.404722	NDENGEZA (DUPL NAME 1)	1997/10/17	NONE	SAMPLE	83.300		3.0
2330AD00088 STATELAND PTN. NDENGEZA	-23.315	30.404722	NDENGEZA (DUPL NAME 1)	1997/12/15	NONE	SAMPLE	791.000		3.0
HARMONIC MEAN 2330AD00088 STATELAND PTN. NDENGEZA							150.727	150.727	
NDENGEZA	-23.2969	30.405556	NDENGEZA (DUPL NAME 2)	1997/12/08	NONE	SAMPLE	138.700	138.700	3.0

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AD00360 STATELAND PTN. NDENGEZA	-23.3139	30.401944	NDENGEZA (DUPL NAME 3)	1997/11/12	NONE	SAMPLE	46.600	46.600	3.0
STAATSGROND (DUP NAME 7647)	-23.2881	30.291667	STAATSGROND (DUPL NAME 12)	1997/11/20	NONE	SAMPLE	28.400	28.400	3.0
2330AD00406 HELDER WATER PTN. RIBUNGWANI	-23.2717	30.288611	RIBUNGWANI (DUPL NAME 2)	1998/01/21	NONE	SAMPLE	29.000	29.000	3.0
2330AD00398 HELDERWATER PTN. RIBUNGWANI	-23.2714	30.288611	RIBUNGWANI (DUPL NAME 4)	1998/01/21	NONE	SAMPLE	29.900	29.900	3.0
2330AD00362 STATE LAND PTN. NDENGEZA	-23.3136	30.404444	STATE LAND (DUPL NAME 8)	1998/02/02	NONE	SAMPLE	79.200	79.200	3.0
2330AD00369 STATELAND PTN. NOBLEHOEK PTN. MUHL	-23.3456	30.367778	STATELAND (DUPL NAME 13)	1998/02/15	NONE	SAMPLE	115.300		3.0
2330AD00369 STATELAND PTN. NOBLEHOEK PTN. MUHL	-23.3456	30.367778	STATELAND (DUPL NAME 13)	1998/05/01	NONE	SAMPLE	67.800		3.0
HARMONIC MEAN 2330AD00369 STATELAND PTN. NOBLEHOEK PTN. MUHL							85.389	85.389	
2330AD00367 STATELAND PTN. NOBLEHOEK PTN. MUHL	-23.3328	30.376944	STATELAND (DUPL NAME 1)	1998/02/09	NONE	SAMPLE	145.200	145.200	3.0
HELDERWATER (DUP NAME 8000)	-23.2878	30.270556	HELDERWATER (DUPL NAME 1)	1998/02/13	NONE	SAMPLE	16.200	16.200	3.0
STATELAND (DUP NAME 8019)	-23.3264	30.413611	STATELAND (DUPL NAME 4)	1998/02/14	NONE	SAMPLE	101.300	101.300	3.0
2330AD00370 STATELAND PTN. NOBLEHOEK PTN. MUKL	-23.3294	30.376944	STATELAND (DUPL NAME 5)	1998/02/10	NONE	SAMPLE	112.200	112.200	3.0
STATELAND (DUP NAME 8020)	-23.3428	30.371389	STATELAND (DUPL NAME 6)	1998/02/11	NONE	SAMPLE	66.200	66.200	3.0
2330AD00160 HELDERWATER PTN. RIBUNGWANI - H17-0113	-23.2647	30.288056	HELDERWATER (DUPL NAME 2)	1998/05/14	NONE	SAMPLE	20.300	20.300	3.0
HELDERWATER (DUP NAME 8066)	-23.285	30.292222	HELDERWATER (DUPL NAME 3)	1998/05/23	NONE	SAMPLE	25.300	25.300	3.0
2330AC00238 KLIPKRAAL H100215	-23.4533	30.052778	KLIPKRAAL (DUPL NAME 18)	1998/05/17	NONE	SAMPLE	16.700		3.0
2330AC00238 KLIPKRAAL H100215	-23.4533	30.052778	KLIPKRAAL (DUPL NAME 18)	2002/10/03	NONE	SAMPLE	23.167		10.0
HARMONIC MEAN 2330AC00238 KLIPKRAAL H100215							19.409	19.409	
2330AC00232 KLIPKRAAL PTN. THAGALANE - H10-0213	-23.4617	30.051111	KLIPKRAAL (DUPL NAME 2)	1998/05/08	NONE	SAMPLE	17.800		3.0
2330AC00232 KLIPKRAAL PTN. THAGALANE - H10-0213	-23.4617	30.051111	KLIPKRAAL (DUPL NAME 2)	2008/02/25	NONE	SAMPLE	24.638		4.0
HARMONIC MEAN 2330AC00232 KLIPKRAAL PTN. THAGALANE - H10-0213							20.668	20.668	
2330AC00233 KLIPKRAAL H100214	-23.4581	30.048056	KLIPKRAAL (DUPL NAME 3)	1998/05/10	NONE	SAMPLE	15.000		3.0
2330AC00233 KLIPKRAAL H100214	-23.4581	30.048056	KLIPKRAAL (DUPL NAME 3)	2002/10/04	NONE	SAMPLE	20.084		10.0
2330AC00233 KLIPKRAAL H100214	-23.4581	30.048056	KLIPKRAAL (DUPL NAME 3)	2004/06/03	NONE	SAMPLE	20.556		5.0
HARMONIC MEAN 2330AC00233 KLIPKRAAL H100214							18.170	18.170	
HARTEBEESFONTEIN (DUP NAME 8082)	-23.275	30.243611	HARTEBEESFONTEIN (DUPL NAME 18)	1998/05/28	NONE	SAMPLE	192.300	192.300	3.0
2330AC00317 HARTEBEESTFONTEIN PTN MASAKONA-NEWSTAN - H17-0280	-23.2864	30.242222	HARTEBEESFONTEIN (DUPL NAME 7)	1998/05/19	NONE	SAMPLE	67.400	67.400	3.0
MIDDAGZON 524LS	-23.4539	29.998611	MIDDAGZON 524LS	1979/04/19	NONE	SAMPLE	27.700	27.700	3.0
2330AD00262 MAPHALLE	-23.4575	30.309444	MAPHALLE (DUPL NAME 1)	1995/07/19	NONE	SAMPLE	241.000	241.000	3.0
MALEKWA	-23.2978	30.2975	MALEKWA	1996/05/04	NONE	SAMPLE	96.700	96.700	3.0
MIDDELWATER (DUP NAME 30795)	-23.3986	30.224444	MIDDELWATER (DUPL NAME 3)	1996/10/29	NONE	SAMPLE	247.900		3.0
MIDDELWATER (DUP NAME 30795)	-23.3986	30.224444	MIDDELWATER (DUPL NAME 3)	2008/01/18	NONE	SAMPLE	393.660		4.0
HARMONIC MEAN MIDDELWATER (DUP NAME 30795)							304.222	304.222	
2330AC00142 ZEEKOEFONTEIN PTN. MIDDELWATER - H10-0169	-23.3906	30.214722	MIDDELWATER (DUPL NAME 4)	1996/10/28	NONE	SAMPLE	31.800	31.800	3.0
2330AC00196 HARTEBEESTFONTEIN PTN. GA-MAMAILA - H10-0158	-23.3456	30.246944	GA-MAMAILA (DUPL NAME 1)	1996/10/20	NONE	SAMPLE	69.100	69.100	3.0
2330AC00198 HARTEBEESTFONTEIN PTN. GA-MAMAILA	-23.3594	30.234444	GA-MAMAILA (DUPL NAME 2)	1996/10/26	NONE	SAMPLE	110.500	110.500	3.0
2330AC00197 HARTEBEESTFONTEIN PTN. MAMAILA - H10-0165	-23.3583	30.236944	HARTEBEESFFONTEIN	1996/10/24	NONE	SAMPLE	76.300	76.300	3.0
2330AC00210 ZEEKOEWATER PTN. MIDDELWATER - H10-0183	-23.4203	30.203333	ZEEKOEIWATER (DUPL NAME 1)	1996/11/01	NONE	SAMPLE	53.400	53.400	3.0
2330AC00203 ZEEKOEWATER PTN. MIDDELWATER - H10-0181	-23.4225	30.200278	ZEEKOEIWATER (DUPL NAME 2)	1996/11/08	NONE	SAMPLE	18.600	18.600	3.0
ZEEKOEIWATER	-23.4192	30.2025	ZEEKOEIWATER (DUPL NAME 3)	1996/11/02	NONE	SAMPLE	50.500	50.500	3.0
2330AC00067 MIDDELWATER H100442	-23.3953	30.228333	2330AC00067 MIDDELWATER H100442	1996/11/06	NONE	SAMPLE	124.500		3.0

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AC00067 MIDDELWATER H100442	-23.3953	30.228333	2330AC00067 MIDDELWATER H100442	2004/08/03	NONE	SAMPLE	110.946		5.0
HARMONIC MEAN 2330AC00067 MIDDELWATER H100442							117.333	117.333	
MIDDELWATER (DUP NAME 30848)	-23.3989	30.234722	MIDDELWATER (DUPL NAME 5)	1996/11/03	NONE	SAMPLE	59.800	59.800	3.0
MIDDELWATER (DUP NAME 30849)	-23.4025	30.232222	MIDDELWATER (DUPL NAME 6)	1996/10/31	NONE	SAMPLE	101.500	101.500	3.0
2330AC00201 HARTEBEESTFONTEIN PTN. MAMAILA - H10-0171	-23.3625	30.234722	GA-MAMAILE	1996/10/30	NONE	SAMPLE	54.200	54.200	3.0
2330AC00071 HARTEBEESFONTEIN - H10-0472	-23.3506	30.235556	HARTEBEESFONTEIN (DUPL NAME 5)	1996/10/25	NONE	SAMPLE	157.700	157.700	3.0
HARTEBEESFONTEIN (DUP NAME 30850)	-23.3589	30.224722	HARTEBEESFONTEIN (DUPL NAME 6)	1996/11/08	NONE	SAMPLE	27.100		3.0
HARTEBEESFONTEIN (DUP NAME 30850)	-23.3589	30.224722	HARTEBEESFONTEIN (DUPL NAME 6)	1996/11/09	NONE	SAMPLE	61.600		3.0
HARMONIC MEAN HARTEBEESFONTEIN (DUP NAME 30850)							37.641	37.641	
2330AC00283 BONTFONTEIN PTN. GA-PHOOKO - H10-0342	-23.3758	30.153056	ZOETFONTEIN (DUPL NAME 19)	1996/11/16	NONE	SAMPLE	32.400	32.400	3.0
2330AC00217 ZOETFONTEIN PTN. GA-PHOOKO - H10-0598	-23.3669	30.158611	ZOETFONTEIN (DUPL NAME 20)	1996/11/11	NONE	SAMPLE	43.100		3.0
2330AC00217 ZOETFONTEIN PTN. GA-PHOOKO - H10-0598	-23.3669	30.158611	ZOETFONTEIN (DUPL NAME 20)	2002/08/30	NONE	SAMPLE	73.323		10.0
HARMONIC MEAN 2330AC00217 ZOETFONTEIN PTN. GA-PHOOKO - H10-0598							54.289	54.289	
2330AC00195 BONTFONTEIN PTN. GA-PHAAKO - H10-0151	-23.37	30.148611	BONTFONTEIN (DUPL NAME 2)	1996/12/02	NONE	SAMPLE	26.400	26.400	3.0
2330AC00218 BONTFONTEIN PTN. GA-PHOOKO - H10-0431	-23.3614	30.144722	BONTFONTEIN (DUPL NAME 3)	1996/11/25	NONE	SAMPLE	49.300		3.0
2330AC00218 BONTFONTEIN PTN. GA-PHOOKO - H10-0431	-23.3614	30.144722	BONTFONTEIN (DUPL NAME 3)	1996/11/25	NONE	SAMPLE	24.400		3.0
2330AC00218 BONTFONTEIN PTN. GA-PHOOKO - H10-0431	-23.3614	30.144722	BONTFONTEIN (DUPL NAME 3)	2005/01/19	NONE	SAMPLE	81.364		4.0
HARMONIC MEAN 2330AC00218 BONTFONTEIN PTN. GA-PHOOKO - H10-0431							40.784	40.784	
2330AC00220 ROERFONTEIN PTN. GA- PHOOKO - H10-0601	-23.38	30.168611	ROERFONTEIN (DUPL NAME 6)	1996/12/10	NONE	SAMPLE	67.700	67.700	3.0
2330AC00135 ZOETFONTEIN	-23.3775	30.16889	2330AC00135 ZOETFONTEIN	1996/11/02	NONE	SAMPLE	61.900	61.900	3.0
ZOETFONTEIN (DUP NAME 30908)	-23.3647	30.150556	ZOETFONTEIN (DUPL NAME 21)	1996/12/07	NONE	SAMPLE	20.300	20.300	3.0
BONTFONTEIN (DUP NAME 30909)	-23.3817	30.142778	BONTFONTEIN (DUPL NAME 4)	1996/12/04	NONE	SAMPLE	15.400	15.400	3.0
ZOETFONTEIN (DUP NAME 30910)	-23.3661	30.165833	ZOETFONTEIN (DUPL NAME 22)	1996/12/10	NONE	SAMPLE	47.800	47.800	3.0
ZOETFONTEIN (DUP NAME 30911)	-23.3697	30.160556	ZOETFONTEIN (DUPL NAME 4)	1996/11/29	NONE	SAMPLE	118.900	118.900	3.0
ZOETFONTEIN (DUP NAME 30912)	-23.3364	30.153333	ZOETFONTEIN (DUPL NAME 5)	1996/11/25	NONE	SAMPLE	35.500	35.500	3.0
BONTFONTEIN (DUP NAME 30914)	-23.3575	30.1475	BONTFONTEIN (DUPL NAME 1)	1996/11/19	NONE	SAMPLE	33.400	33.400	3.0
2330AC00199 ARTEBEESFONTEIN PTN. MIDDELWATER - H10-0167	-23.3492	30.235833	MIDDELWATER (DUPL NAME 7)	1996/10/25	NONE	SAMPLE	45.200	45.200	3.0
WORCESTER (DUP NAME 30932)	-23.3472	30.42	WORCESTER (DUPL NAME 25)	1997/01/21	NONE	SAMPLE	71.900	71.900	3.0
ZONNEBLOEM (DUP NAME 31054)	-23.3047	30.293333	ZONNEBLOEM (DUPL NAME 1)	1997/06/14	NONE	SAMPLE	31.300		3.0
ZONNEBLOEM (DUP NAME 31054)	-23.3047	30.293333	ZONNEBLOEM (DUPL NAME 1)	2002/08/27	NONE	SAMPLE	33.927		10.0
HARMONIC MEAN ZONNEBLOEM (DUP NAME 31054)							32.561	32.561	
2330AC00175 LEMONDOKOP H10-0579	-23.4397	30.141944	2330AC00175 LEMONDOKOP H10-0579	1997/06/22	NONE	SAMPLE	7.900		3.0
2330AC00175 LEMONDOKOP H10-0579	-23.4397	30.141944	2330AC00175 LEMONDOKOP H10-0579	2002/08/30	NONE	SAMPLE	16.009		10.0
HARMONIC MEAN 2330AC00175 LEMONDOKOP H10-0579							10.579	10.579	
HARTEBEESFONTEIN (DUP NAME 31055)	-23.3511	30.235278	HARTEBEESFONTEIN (DUPL NAME 17)	1997/06/16	NONE	SAMPLE	163.400	163.400	3.0
ZONNEBLOM	-23.3053	30.293333	ZONNEBLOM	1997/06/19	NONE	SAMPLE	20.200		3.0
ZONNEBLOM	-23.3053	30.293333	ZONNEBLOM	2002/08/27	NONE	SAMPLE	66.898		10.0
HARMONIC MEAN ZONNEBLOM							31.030	31.030	
ZONNEBLOEM (DUP NAME 31066)	-23.2953	30.299167	ZONNEBLOEM (DUPL NAME 2)	1997/06/20	NONE	SAMPLE	35.100	35.100	3.0
2330AD00246 HELDERWATER - HELDERWATER CLINIC	-23.2811	30.29583	2330AD00246 HELDERWATER - HELDERWATER CLINIC	2000/02/03	NONE	SAMPLE	30.223	30.223	10.0
2330AC00147 LEMONDOKOP - H100657	-23.4394	30.1461	2330AC00147 LEMONDOKOP	2000/06/01	NONE	SAMPLE	5.000		10.0
2330AC00147 LEMONDOKOP - H100657	-23.4394	30.1461	2330AC00147 LEMONDOKOP	2002/08/30	NONE	SAMPLE	11.656		10.0
HARMONIC MEAN 2330AC00147 LEMONDOKOP - H100657							6.998	6.998	
2330AC00345 MORGENZON H17-0415	-23.2739	30.24416	2330AC00345 MORGENZON H17-0415	2001/05/08	NONE	SAMPLE	99.930		10.0
2330AC00345 MORGENZON H17-0415	-23.2739	30.24416	2330AC00345 MORGENZON H17-0415	2002/08/28	NONE	SAMPLE	101.238		10.0

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AC00345 MORGENZON H17-0415	-23.2739	30.24416	2330AC00345 MORGENZON H17-0415	2007/07/12	NONE	SAMPLE	87.941		4.0
HARMONIC MEAN 2330AC00345 MORGENZON H17-0415							95.982	95.982	
2330AC00150 VOORSPOED (PLANTATION) - H100662	-23.3783	30.068889	2330AC00150 VOORSPOED (PLANTATION) - H100662	2001/06/08	NONE	SAMPLE	19.687	19.687	10.0
2330AC00152 VAALWATER H100580	-23.4543	30.05049	2330AC00152 VAALWATER H100580	2001/08/26	NONE	SAMPLE	5.000	5.000	10.0
2330AC00153 VAALWATER H100461	-23.4362	30.15955	2330AC00153 VAALWATER H100461	2001/08/31	NONE	SAMPLE	19.864		10.0
2330AC00153 VAALWATER H100461	-23.4362	30.15955	2330AC00153 VAALWATER H100461	2002/11/02	NONE	SAMPLE	30.837		10.0
HARMONIC MEAN 2330AC00153 VAALWATER H100461							24.163	24.163	
2330AC00055 VAALWATER H100479	-23.3914	30.14921	2330AC00055 VAALWATER H100479	2001/09/20	NONE	SAMPLE	85.680		10.0
2330AC00055 VAALWATER H100479	-23.3914	30.14921	2330AC00055 VAALWATER H100479	2002/09/26	NONE	SAMPLE	76.577		10.0
HARMONIC MEAN 2330AC00055 VAALWATER H100479							80.873	80.873	
2330AC00154 VAALWATER H100086	-23.4004	30.11351	2330AC00154 VAALWATER H100086	2001/09/05	NONE	SAMPLE	38.001		10.0
2330AC00154 VAALWATER H100086	-23.4004	30.11351	2330AC00154 VAALWATER H100086	2002/09/26	NONE	SAMPLE	49.510		10.0
2330AC00154 VAALWATER H100086	-23.4004	30.11351	2330AC00154 VAALWATER H100086	2008/02/22	NONE	SAMPLE	60.833		4.0
2330AC00057 VAALWATER H100436	-23.3899	30.14808	2330AC00057 VAALWATER H100436	2001/09/08	NONE	SAMPLE	29.953		10.0
HARMONIC MEAN 2330AC00057 VAALWATER H100436							41.521	41.521	
2330AD00249 AMSTERDAM H100646	-23.401	30.27491	2330AD00249 AMSTERDAM H100646	2002/05/25	NONE	SAMPLE	177.311	177.311	10.0
2330AD00250 NDENGEZA CLINIC H140856	-23.3153	30.40646	2330AD00250 NDENGEZA CLINIC H140856	2002/07/03	NONE	SAMPLE	304.239		10.0
2330AD00250 NDENGEZA CLINIC H140856	-23.3153	30.40646	2330AD00250 NDENGEZA CLINIC H140856	2002/07/11	NONE	SAMPLE	537.595		10.0
HARMONIC MEAN 2330AD00250 NDENGEZA CLINIC H140856							388.574	388.574	
2330AD00251 ZONNEBLOEM H100629	-23.2958	30.30861	2330AD00251 ZONNEBLOEM H100629	2002/08/28	NONE	SAMPLE	100.743	100.743	10.0
2330AC00169 ROERFONTEIN H100024	-23.4753	30.17861	2330AC00169 ROERFONTEIN H100024	2002/08/29	NONE	SAMPLE	48.262	48.262	10.0
2330AC00171 HARTEBEESFONTEIN H100158	-23.3454	30.24597	2330AC00171 HARTEBEESFONTEIN H100158	2002/08/28	NONE	SAMPLE	81.260	81.260	10.0
2330AC00172 HARTEBEESFONTEIN H100165	-23.3584	30.23763	2330AC00172 HARTEBEESFONTEIN H100165	2002/08/28	NONE	SAMPLE	70.936	70.936	10.0
2330AC00143 HARTEBEESFONTEIN H100167	-23.3494	30.23627	2330AC00143 HARTEBEESFONTEIN H100167	2002/08/28	NONE	SAMPLE	68.236	68.236	10.0
2330AC00176 ZEEKOEIWATER H100593	-23.4111	30.21327	2330AC00176 ZEEKOEIWATER H100593	2002/08/29	NONE	SAMPLE	147.062	147.062	10.0
2330AD00156 ZONNEBLOEM H100633	-23.304	30.29594	2330AD00156 ZONNEBLOEM H100633	2002/08/27	NONE	SAMPLE	70.791	70.791	10.0
2330AD00252 GROOTFONTEIN H100743	-23.2865	30.3233	2330AD00252 GROOTFONTEIN H100743	2002/08/31	NONE	SAMPLE	39.923	39.923	10.0
2330AD00253 STATELAND H140330	-23.3267	30.387	2330AD00253 STATELAND H140330	2002/08/29	NONE	SAMPLE	70.540	70.540	10.0
2330AD00254 STATELAND PTN. MUHLAHLANDLELA - H14-0801	-23.3449	30.37002	2330AD00254 STATELAND H140801	2002/08/30	NONE	SAMPLE	31.220		10.0
2330AD00254 STATELAND PTN. MUHLAHLANDLELA - H14-0801	-23.3449	30.37002	2330AD00254 STATELAND H140801	2006/07/03	NONE	SAMPLE	106.004		4.0
HARMONIC MEAN 2330AD00254 STATELAND PTN. MUHLAHLANDLELA - H14-0801							48.234	48.234	
2330AC00179 ZOETFONTEIN H100154	-23.375	30.16916	2330AC00179 ZOETFONTEIN H100154	2002/09/02	NONE	SAMPLE	78.709	78.709	10.0
2330AC00180 LEMONDOKOP H100186	-23.4603	30.15333	2330AC00180 LEMONDOKOP H100186	2002/09/02	NONE	SAMPLE	42.403	42.403	10.0
2330AC00181 LEMONDOKOP H100188	-23.4389	30.15305	2330AC00181 LEMONDOKOP H100188	2002/09/02	NONE	SAMPLE	13.212		10.0
2330AC00186 HOPEFUL H170358	-23.2609	30.21002	2330AC00186 HOPEFUL H170358	2002/08/28	NONE	SAMPLE	71.392		10.0
2330AC00186 HOPEFUL H170358	-23.2609	30.21002	2330AC00186 HOPEFUL H170358	2002/10/22	NONE	SAMPLE	62.474		10.0
HARMONIC MEAN 2330AC00186 HOPEFUL H170358							66.636	66.636	
2330AC00347 LEMONDOKOP H100034	-23.4467	30.16244	2330AC00347 LEMONDOKOP H100034	2002/09/10	NONE	SAMPLE	44.516	44.516	10.0
2330AC00348 ZOETFONTEIN H100038	-23.3683	30.16175	2330AC00348 ZOETFONTEIN H100038	2002/09/02	NONE	SAMPLE	144.240	144.240	10.0
2330AC00146 BONTFONTEIN H100151	-23.6167	30.14875	2330AC00146 BONTFONTEIN H100151	2002/09/10	NONE	SAMPLE	32.093	32.093	10.0
2330AC00349 ZOETFONTEIN H100604	-23.3666	30.15366	2330AC00349 ZOETFONTEIN H100604	2002/09/10	NONE	SAMPLE	26.482	26.482	10.0
2330AC00350 ZOETFONTEIN H100611	-23.3616	30.16963	2330AC00350 ZOETFONTEIN H100611	2002/09/11	NONE	SAMPLE	60.701	60.701	10.0
2330AC00351 VAALWATER PTN. WENWAMOKGOPE - H10-0748	-23.4114	30.15113	2330AC00351 VAALWATER H100748	2002/09/12	NONE	SAMPLE	166.526		10.0

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AC00351 VAALWATER PTN. WENWAMOKGOPE - H10-0748	-23.4114	30.15113	2330AC00351 VAALWATER H100748	2006/07/23	NONE	SAMPLE	148.115		4.0
HARMONIC MEAN 2330AC00351 VAALWATER PTN. WENWAMOKGOPE - H10-0748							156.782	156.782	
2330AD00407 MORGENZON H170578	-23.2777	30.25597	2330AD00407 MORGENZON H170578	2002/08/29	NONE	SAMPLE	124.379	124.379	10.0
2330AD00408 MORGENZON H170119	-23.262	30.25562	2330AD00408 MORGENZON H170119	2002/08/28	NONE	SAMPLE	67.638		10.0
2330AD00408 MORGENZON H170119	-23.262	30.25562	2330AD00408 MORGENZON H170119	2007/08/07	NONE	SAMPLE	63.687		4.0
HARMONIC MEAN 2330AD00408 MORGENZON H170119							65.603	65.603	
2330AC00033 MOSTERTHOEK H100423	-23.4036	30.11233	2330AC00033 MOSTERTHOEK H10-0423	2002/09/26	NONE	SAMPLE	24.998		10.0
2330AC00033 MOSTERTHOEK H100423	-23.4036	30.11233	2330AC00033 MOSTERTHOEK H10-0423	2004/12/03	NONE	SAMPLE	27.765		5.0
HARMONIC MEAN 2330AC00033 MOSTERTHOEK H100423							26.309	26.309	
2330AD00297 STATELAND H070841	-23.4583	30.33444	2330AD00297 STATELAND H070841	2002/10/11	NONE	SAMPLE	891.682	891.682	10.0
2330AD00323 OLIFANTSHOEK H100015	-23.3291	30.27155	2330AD00323 OLIFANTSHOEK H100015	2002/10/07	NONE	SAMPLE	52.745	52.745	10.0
2330AD00330 OLIFANTSHOEK H100022	-23.3294	30.27291	2330AD00330 OLIFANTSHOEK H100022	2002/10/07	NONE	SAMPLE	26.136	26.136	10.0
2330AC00235 MOPANI H100421	-23.4479	30.03905	2330AC00235 MOPANI H100421	2002/10/04	NONE	SAMPLE	14.642		10.0
2330AC00235 MOPANI H100421	-23.4479	30.03905	2330AC00235 MOPANI H100421	2004/06/10	NONE	SAMPLE	15.368		5.0
HARMONIC MEAN 2330AC00235 MOPANI H100421							14.996	14.996	
2330AC00352 MOPANI H100636	-23.3606	30.04511	2330AC00352 MOPANI H100636	2002/10/04	NONE	SAMPLE	10.666	10.666	10.0
2330AC00355 MOSTERTHOEKPOORT H100752	-23.4051	30.10833	2330AC00355 MOSTERTHOEKPOORT H100752	2002/09/26	NONE	SAMPLE	40.674	40.674	10.0
2330AC00356 LEMONDOKOP H100580	-23.4378	30.1468	2330AC00356 LEMONDOKOP H100580	2002/11/03	NONE	SAMPLE	5.000	5.000	10.0
2330AC00358 BOSCHBOKHOEK H100755	-23.4475	30.03352	2330AC00358 BOSCHBOKHOEK H100755	2002/11/06	NONE	SAMPLE	18.061	18.061	10.0
2330AD00168 HELDERWATER H170116	-23.2773	30.28428	2330AD00168 HELDERWATER H170116	2002/11/18	NONE	SAMPLE	56.275	56.275	10.0
2330AC00359 HARTEBEESFONTEIN H100766	-23.37	30.21083	2330AC00359 HARTEBEESFONTEIN H100766	2003/03/01	NONE	SAMPLE	24.490	24.490	10.0
2330AC00360 MIDDELWATER H100767	-23.4058	30.21666	2330AC00360 MIDDELWATER H100767	2003/03/03	NONE	SAMPLE	84.579	84.579	10.0
2330AC00362 MOSTERTHOEK H100747	-23.3994	30.10372	2330AC00362 MOSTERTHOEK H100747	2003/03/20	NONE	SAMPLE	74.997	74.997	10.0
2330AC00315 HARTEBEESFONTEIN H170279	-23.2986	30.24483	2330AC00315 HARTEBEESFONTEIN H170279	2003/07/15	NONE	SAMPLE	70.630	70.630	10.0
2330AD00419 OLIFANTSHOEK H100664	-23.3397	30.27744	2330AD00419 OLIFANTSHOEK H10066423.	2003/10/06	NONE	SAMPLE	153.463	153.463	5.0
2330AC00376 BONTFONTEIN MOTSOKOTSA SCHOOL H100669	-23.3565	30.14287	2330AC00376 BONTFONTEIN MOTSOKOTSA SCHOOL H100669	2004/02/16	NONE	SAMPLE	56.568	56.568	5.0
2330AC00377 LEMONDOKOP H100670	-23.4564	30.15051	2330AC00377 LEMONDOKOP H100670	2004/02/13	NONE	SAMPLE	126.605	126.605	5.0
2330AC00378 MIDDELWATER H100671	-23.3889	30.23844	2330AC00378 MIDDELWATER H100671	2004/02/14	NONE	SAMPLE	308.944	308.944	5.0
2330AC00225 THAKGALANE 2 H100616	-23.4457	30.05824	2330AC00225 THAKGALANE 2 H100616	2004/06/07	NONE	SAMPLE	17.943	17.943	5.0
2330BC00243 SIKHIMING H070530	-23.4267	30.15305	2330BC00243 SIKHIMING H070530	2004/04/28	NONE	SAMPLE	216.268	216.268	4.0
2330AC00124 ROTTERDAM H100209	-23.4291	30.2358	2330AC00124 ROTTERDAM H100209	2004/06/12	NONE	SAMPLE	20.833	20.833	5.0
2330AD00203 PFUMELANG H10-0668	-23.3535	30.28977	2330AD00203 PFUMELANG H10-0668	2004/12/01	NONE	SAMPLE	131.003	131.003	4.0
2330AC00151 NANAKWE H10-0672	-23.4464	30.16969	2330AC00151 NANAKWE H10-0672	2004/12/01	NONE	SAMPLE	23.220	23.220	4.0
2330AD00204 MSENGI H10-0673	-23.4121	30.3358	2330AD00204 MSENGI H10-0673	2004/12/01	NONE	SAMPLE	81.136	81.136	4.0
2330AC00170 TSHABELANE EAST H10-0675	-23.3978	30.15972	2330AC00170 TSHABELANE EAST H10-0675	2004/12/01	NONE	SAMPLE	23.391	23.391	4.0
2330AC00266 ITIELENE H10-0084	-23.4034	30.09108	2330AC00266 ITIELENE H10-0084	2004/11/29	NONE	SAMPLE	16.849	16.849	4.0
2330AC00173 LEMONDOKOP H10-0100	-23.4548	30.14419	2330AC00173 LEMONDOKOP H10-0100	2004/12/05	NONE	SAMPLE	27.495	27.495	4.0
2330AC00290 OLIFANTSHOEK H10-0205	-23.3658	30.29497	2330AC00290 OLIFANTSHOEK H10-0205	2004/12/10	NONE	SAMPLE	41.592	41.592	4.0
2330AC00269 PHOOKO H10-0554	-23.3366	30.16369	2330AC00269 PHOOKO H10-0554	2004/12/06	NONE	SAMPLE	30.218	30.218	4.0
2330AC00263 ITIELENE H10-0645	-23.396	30.09408	2330AC00263 ITIELENE H10-0645	2004/11/29	NONE	SAMPLE	13.978	13.978	4.0
2330AC00261 PHOOKHO H10-0713	-23.3313	30.16372	2330AC00261 PHOOKHO H10-0713	2004/12/09	NONE	SAMPLE	31.438	31.438	4.0
2330AC00174 ITIELENE H10-0753	-23.3981	30.07758	2330AC00174 ITIELENE H10-0753	2004/12/01	NONE	SAMPLE	25.938	25.938	4.0

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AC00177 THAKGALANE H10-0754	-23.4456	30.02722	2330AC00177 THAKGALANE H10-0754	2005/01/05	NONE	SAMPLE	13.576	13.576	4.0
2330AD00068 MAMAILA H10-0519	-23.3566	30.25388	2330AD00068 MAMAILA H10-0519	2005/01/05	NONE	SAMPLE	97.533	97.533	4.0
2330AC00178 PHOOKO H10-0143	-23.3558	30.14052	2330AC00178 PHOOKO H10-0143	2005/01/23	NONE	SAMPLE	43.451	43.451	4.0
2330AC00074 RAPHAHLELO H10-0429	-23.3705	30.16028	2330AC00074 RAPHAHLELO H10-0429	2005/01/26	NONE	SAMPLE	173.056	173.056	4.0
2330AD00206 MUKHLAHLANDELA H14-1099	-23.3456	30.36976	2330AD00206 MUKHLAHLANDELA H14-1099	2005/01/24	NONE	SAMPLE	539.937	539.937	4.0
2330AD00219 NDENGEZA H17-0961	-23.2681	30.3818	2330AD00219 NDENGEZA H17-0961	2005/04/01	NONE	SAMPLE	87.741	87.741	4.0
2330AD00119 XIMAUSA H14-0323	-23.3772	30.36703	2330AD00119 XIMAUSA H14-0323	2005/05/01	NONE	SAMPLE	113.569	113.569	4.0
2330AC00187 PAARDEDOOD H10-0682	-23.4534	30.16388	PAARDEDOOD H10-0682	2005/08/05	NONE	SAMPLE	37.648	37.648	4.0
2330AC00189 PAARDEDOOD H10-0683	-23.4534	30.16452	PAARDEDOOD H10-0683	2005/08/03	NONE	SAMPLE	42.068	42.068	4.0
2330AC00200 PAARDEDOOD H10-0776	-23.4544	30.16286	PAARDEDOOD H10-0776	2005/08/07	NONE	SAMPLE	37.661	37.661	4.0
2330AC00219 ZOETFONTEIN PTN. GA-PHOCKO - H10-0600	-23.3623	30.16141	2330AC00219 ZOETFONTEIN H10-0600	2005/08/29	NONE	SAMPLE	76.779		4.0
2330AC00219 ZOETFONTEIN PTN. GA-PHOCKO - H10-0600	-23.3623	30.16141	2330AC00219 ZOETFONTEIN H10-0600	2006/10/12	NONE	SAMPLE	77.340		4.0
HARMONIC MEAN 2330AC00219 ZOETFONTEIN PTN. GA-PHOCKO - H10-0600							32.067	32.067	
2330AC00202 VAALWATER H10-0777	-23.4097	30.14433	VAALWATER H10-0777	2005/09/14	NONE	SAMPLE	56.342	56.342	4.0
2330AC00294 HARTEBEESFONTEIN PTN. MAMAILA CLINIC - H10-0651	-23.3508	30.2425	2330AC00294 HARTEBEESFONTEIN PTN. MAMAILA CLINIC - H10-0651	2006/03/18	NONE	SAMPLE	99.345	99.345	4.0
2330AC00209 ZOETFONTEIN PTN. RAPHAHLELO - H10-0778	-23.3653	30.16316	2330AC00209 ZOETFONTEIN PTN. RAPHAHLELO - H10-0778	2006/03/05	NONE	SAMPLE	89.977	89.977	4.0
2330AC00267 ZEEKOEIFONTEIN PTN. MIDDELWATER - H10-0076	-23.4113	30.19636	2330CD00251 MOHLABA'S LOC. PTN. MOHLABA HEAD KRAAL - H08-1584	2006/07/25	NONE	SAMPLE	238.927	238.927	4.0
2330AD00236 ZONNEBLOEM PTN. MAGORO / HLANGANANI - H10-0681	-23.3063	30.29738	2330AD00236 ZONNEBLOEM PTN. MAGORO - H10-0681	2006/07/10	NONE	SAMPLE	81.694	81.694	4.0
2330AD00238 KWAGGAFONTEIN PTN. MAGORO - H10-0740	-23.2813	30.32777	2330AD00238 KWAGGAFONTEIN PTN. MAGORO - H10-0740	2006/07/23	NONE	SAMPLE	23.735	23.735	4.0
2330AD00239 ZONNEBLOEM PTN. MAGORO / HLANGANANI - H10-0780	-30	30.2973	2330AD00239 ZONNEBLOEM PTN. MAGORO - H10-0780	2006/07/08	NONE	SAMPLE	183.332		4.0
2330AD00239 ZONNEBLOEM PTN. MAGORO / HLANGANANI - H10-0780	-30	30.2973	2330AD00239 ZONNEBLOEM PTN. MAGORO - H10-0780	2008/01/14	NONE	SAMPLE	199.011		4.0
HARMONIC MEAN 2330AD00239 ZONNEBLOEM PTN. MAGORO / HLANGANANI - H10-0780							190.850	190.850	
2330AC00211 VAALWATER PTN. SENWAMOKGOPE - H10-0783	-23.4128	30.14405	2330AC00211 VAALWATER PTN. WENWAMOKGOPE - H10-0783	2006/06/03	NONE	SAMPLE	46.456	46.456	4.0
2330AD00241 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0606	-23.3351	30.2753	2330AD00241 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0606	2006/06/30	NONE	SAMPLE	171.943	171.943	4.0
2330AD00166 HELDERWATER PTN. RIBUNGWANI / HELDERWATER CLINIC - H17-1063	-23.2815	30.29727	2330AD00166 HELDERWATER PTN. RIBUNGWANI / HELDERWATER CLINIC - H17-1063	2006/08/09	NONE	SAMPLE	73.142	73.142	4.0
2330AD00242 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0784	-23.3349	30.27456	2330CD00260 GLADSTONE PTN. GLADSTONE - H09-0187	2006/10/27	NONE	SAMPLE	128.134	128.134	4.0
2330AC00221 VAALWATER PTN. SENWAMOKGOPE - H10-0785	-23.4103	30.15419	2330AD00242 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0784	2006/10/11	NONE	SAMPLE	235.387	235.387	4.0
2330AC00223 LEMONDOKOP PTN. LEMONDOKOP - H10-0792	-23.4366	30.14475	2330AC00223 LEMONDOKOP PTN. LEMONDOKOP - H10-0792	2006/12/10	NONE	SAMPLE	10.556	10.556	4.0
2330AC00236 ROTTERDAM PTN. ROTTERDAM - H10-0789	-23.4164	30.24322	2330AC00236 ROTTERDAM PTN. ROTTERDAM - H10-0789	2006/12/04	NONE	SAMPLE	47.603	47.603	4.0

MONITORING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	Cl-DISS-WATER-RESULT	HARMONIC MEAN FOR Cl DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT
2330AD00243 ROTTERDAM PTN. ROTTERDAM - H10-0787	-23.4094	30.26019	2330AD00243 ROTTERDAM PTN. ROTTERDAM - H10-0787	2006/12/08	NONE	SAMPLE	281.850	281.850	4.0
2330AC00240 LEMONDOKOP PTN. LEMONDOKOP - H10-0793	-23.4354	30.14497	2330AC00240 LEMONDOKOP PTN. LEMONDOKOP - H10-0793	2006/12/13	NONE	SAMPLE	10.651	10.651	4.0
2330AC00298 KLIPKRAAL PTN. THAGHALANE - H10-0656	-23.4513	30.0461	2330AC00298 KLIPKRAAL PTN. THAGALANE - H10-0656	2007/02/04	NONE	SAMPLE	12.956	12.956	4.0
2330AD00304 GROOTFONTEIN PTN. MAGORO - H10-0798	-23.2957	30.32325	2330AD00304 GROOTFONTEIN PTN. MAGORO - H10-0798	2007/03/30	NONE	SAMPLE	101.128	101.128	4.0
2330AC00249 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1101	-23.2941	30.24222	2330AC00249 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1101	2007/08/03	NONE	SAMPLE	144.919	144.919	4.0
2330AD00307 MORGENZON PTN. MASAKONA - H17-1100	-23.2783	30.2558	2330AD00307 MORGENZON PTN. MASAKONA - H17-1100	2007/08/05	NONE	SAMPLE	168.042	168.042	4.0
2330AC00279 VAALWATER PTN. TSHABALANE WEST - H10-0760	-23.3957	30.14866	2330AC00279 VAALWATER PTN. TSHABALANE WEST - H10-0760	2008/01/16	NONE	SAMPLE	161.387	161.387	4.0
2330AC00222 BONTFONTEIN PTN. PHOOKO - H10-0609	-23.3485	30.14285	2330AC00222 BONTFONTEIN PTN. PHOOKO - H10-0609	2008/02/15	NONE	SAMPLE	38.948	38.948	4.0
2330AC00280 SCHOONUITZICHT PTN. MASAKONA - H17-0282	-23.2875	30.23383	2330AC00280 SCHOONUITZICHT PTN. MASAKONA - H17-0282	2008/03/02	NONE	SAMPLE	107.304	107.304	4.0
2330AC00326 ZOETFONTEIN PTN. RAPHAHLELO - H10-0801	-23.3679	30.15841	2330AC00326 ZOETFONTEIN PTN. RAPHAHHLELO - H10-0801	2008/04/06	NONE	SAMPLE	54.779	54.779	4.0
2330AC00337 VAALWATER PTN. SENWAMOKGOPE - H10-0802	-23.4067	30.14735	2330AC00337 VAALWATER PTN. SENWAMOKGOPE - H10-0802	2008/04/10	NONE	SAMPLE	69.069	69.069	4.0
2330AC00363 MOSTERDHOEK PTN. IIIELENE - H10-0818	-23.3999	30.12618	2330AC00363 MOSTERDHOEK PTN. IIIELENE - H10-0818	2008/04/07	NONE	SAMPLE	39.166	39.166	4.0
2330AC00364 ZOETFONTEIN PTN. RAPHALELO - H10-0820	-23.3753	30.17857	2330AC00364 ZOETFONTEIN PTN. RAPHALELO - H10-0820	2008/04/13	NONE	SAMPLE	87.105	87.105	4.0
2330AC00379 LEMONDOKOP PTN. LEMONDOKOP - H10-0814	-23.46	30.15285	2330AC00379 LEMONDOKOP PTN. LEMONDOKOP - H10-0814	2008/04/11	NONE	SAMPLE	34.302	34.302	4.0
2330AC00380 VAALWATER PTN. SENWAMOKGOPE - H10-0816	-23.4185	30.15202	2330AC00380 VAALWATER PTN. SENWAMOKGOPE - H10-0816	2008/04/04	NONE	SAMPLE	69.301	69.301	4.0
2330AC00381 LEMONDOKOP PTN. LEMONDOKOP - H10-0831	-23.441	30.15278	2330AC00381 LEMONDOKOP PTN. LOEMONDOKOP - H10-0831	2008/04/17	NONE	SAMPLE	17.031	17.031	4.0
2330AC00385 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1137	-23.2926	30.2486	2330AC00385 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1137	2008/06/15	NONE	SAMPLE	49.828	49.828	4.0
HARMONIC MEAN FOR CHLORIDE FROM GROUNDWATER FOR QUTERNARY CATCHMENT B82D								**32.650**	

Table A-3: Mean annual rainfall data for Molototsi (B81G) quaternary catchment.

Rainfall Station 1.

0679135 3	**BELVEDERE**	**Lat:**	**-23.75**	**Long:**	**30.08**	**Height: 975 m**

Station Number	Station Name	Year	Rainfall	Record Count
0679135 3	BELVEDERE	1960	1261.7	363
0679135 3	BELVEDERE	1961	1116.7	365
0679135 3	BELVEDERE	1962	1025.8	365
0679135 3	BELVEDERE	1963	839.0	365
0679135 3	BELVEDERE	1964	1243.5	366
0679135 3	BELVEDERE	1965	918.2	365
0679135 3	BELVEDERE	1966	1117.0	365
0679135 3	BELVEDERE	1967	1244.6	365
0679135 3	BELVEDERE	1968	1013.1	366
0679135 3	BELVEDERE	1969	1149.5	365
0679135 3	BELVEDERE	1970	754.4	365
0679135 3	BELVEDERE	1971	1053.7	365
0679135 3	BELVEDERE	1972	1606.7	366
0679135 3	BELVEDERE	1973	1297.8	365
0679135 3	BELVEDERE	1974	1203.3	243
0679135 3	BELVEDERE	1975	569.0	275
0679135 3	BELVEDERE	1976	1591.5	366
0679135 3	BELVEDERE	1977	1913.8	365
0679135 3	BELVEDERE	1978	1636.8	365
0679135 3	BELVEDERE	1979	1077.8	365
0679135 3	BELVEDERE	1980	1594.0	366
0679135 3	BELVEDERE	1981	1694.0	365
0679135 3	BELVEDERE	1982	834.0	365
0679135 3	BELVEDERE	1983	849.9	365
0679135 3	BELVEDERE	1984	1081.8	366
0679135 3	BELVEDERE	1985	1206.0	365
0679135 3	BELVEDERE	1986	1509.3	365
0679135 3	BELVEDERE	1987	1298.5	365
0679135 3	BELVEDERE	1988	1880.0	366
0679135 3	BELVEDERE	1989	983.0	365
0679135 3	BELVEDERE	1990	1214.5	365
0679135 3	BELVEDERE	1991	1055.0	365
0679135 3	BELVEDERE	1992	453.9	337
0679135 3	BELVEDERE	1993	892.0	365
0679135 3	BELVEDERE	1994	800.5	365
0679135 3	BELVEDERE	1995	1297.8	365
0679135 3	BELVEDERE	1996	1947.7	366
0679135 3	BELVEDERE	1997	1771.2	365
0679135 3	BELVEDERE	1998	1383.1	365

Station Number	Station Name	Year	Rainfall	Record Count
0679135 3	BELVEDERE	1999	1353.8	365
0679135 3	BELVEDERE	2000	2993.5	366
0679135 3	BELVEDERE	2001	983.8	365
0679135 3	BELVEDERE	2002	613.0	365
0679135 3	BELVEDERE	2003	721.0	365
0679135 3	BELVEDERE	2004	1417.5	366
0679135 3	BELVEDERE	2005	847.3	365
0679135 3	BELVEDERE	2006	1722.6	365
0679135 3	BELVEDERE	2007	947.9	365
0679135 3	BELVEDERE	2008	1027.1	366
0679135 3	BELVEDERE	2009	1490.2	365
Mean			**1230.0**	

Rainfall station 2.

0679164 3	**LETABA DISTRIC**	**Lat:**	**-23.73**	**Long:**	**30.10**	**Height: 945 m**

Station Number	Station Name	Year	Rainfall	Record Count
0679164 3	LETABA DISTRIC	1960	1255.7	366
0679164 3	LETABA DISTRIC	1961	989.6	365
0679164 3	LETABA DISTRIC	1962	988.8	365
0679164 3	LETABA DISTRIC	1963	660.4	365
0679164 3	LETABA DISTRIC	1964	1111.1	366
0679164 3	LETABA DISTRIC	1965	879.1	365
0679164 3	LETABA DISTRIC	1966	1139.6	365
0679164 3	LETABA DISTRIC	1967	1174.9	365
0679164 3	LETABA DISTRIC	1968	967.6	366
0679164 3	LETABA DISTRIC	1969	1189.1	365
0679164 3	LETABA DISTRIC	1970	729.1	365
0679164 3	LETABA DISTRIC	1971	904.5	365
0679164 3	LETABA DISTRIC	1972	1542.2	366
0679164 3	LETABA DISTRIC	1973	1109.9	365
0679164 3	LETABA DISTRIC	1974	1587.2	365
0679164 3	LETABA DISTRIC	1975	1283.5	365
0679164 3	LETABA DISTRIC	1976	1464.4	366
0679164 3	LETABA DISTRIC	1977	1833.9	365
0679164 3	LETABA DISTRIC	1978	1586.6	365
0679164 3	LETABA DISTRIC	1979	988.4	365
0679164 3	LETABA DISTRIC	1980	1375.1	366
0679164 3	LETABA DISTRIC	1981	1611.5	365
0679164 3	LETABA DISTRIC	1982	691.1	365
0679164 3	LETABA DISTRIC	1983	734.5	365
0679164 3	LETABA DISTRIC	1984	1070.7	366
0679164 3	LETABA DISTRIC	1985	1295.8	361
0679164 3	LETABA DISTRIC	1986	1244.3	362

Station Number	Station Name	Year	Rainfall	Record Count
0679164 3	LETABA DISTRIC	1987	1008.3	364
0679164 3	LETABA DISTRIC	1988	1635.6	365
0679164 3	LETABA DISTRIC	1989	875.6	365
0679164 3	LETABA DISTRIC	1990	876.0	365
0679164 3	LETABA DISTRIC	1991	797.8	365
0679164 3	LETABA DISTRIC	1992	396.0	366
0679164 3	LETABA DISTRIC	1993	726.1	365
0679164 3	LETABA DISTRIC	1994	702.3	365
0679164 3	LETABA DISTRIC	1995	988.7	365
0679164 3	LETABA DISTRIC	1996	1742.4	366
0679164 3	LETABA DISTRIC	1997	1291.7	365
0679164 3	LETABA DISTRIC	1998	1097.3	365
0679164 3	LETABA DISTRIC	1999	1535.9	365
0679164 3	LETABA DISTRIC	2000	2778.9	366
0679164 3	LETABA DISTRIC	2001	1154.0	365
0679164 3	LETABA DISTRIC	2002	477.7	365
0679164 3	LETABA DISTRIC	2003	673.7	365
0679164 3	LETABA DISTRIC	2004	1314.9	366
0679164 3	LETABA DISTRIC	2005	804.5	365
0679164 3	LETABA DISTRIC	2006	1577.6	365
0679164 3	LETABA DISTRIC	2007	974.1	365
0679164 3	LETABA DISTRIC	2008	1007.9	366
0679164 3	LETABA DISTRIC	2009	1296.1	365
Mean			**1142.8**	

Rainfall Station 3

0679194 5	**TZANEEN-WESTFALIA ESTATE**	**Lat:**	**-23.74**	**Long:**	**30.12**	**Height: 840 m**

Station Number	Station Name	Year	Rainfall	Record Count
0679194 5	TZANEEN-WESTFALIA ESTATE	2007	771.6	335
0679194 5	TZANEEN-WESTFALIA ESTATE	2008	719.8	349
0679194 5	TZANEEN-WESTFALIA ESTATE	2009	1062.0	354
Mean			**851.133**	

$$MAP \ \ for \ B81G$$

$$= \frac{MAP \ \ for \ Belvedere + MAP \ \ for \ Letaba \ Distric + MAP \ \ for \ Tzaneen - Westfalia \, Estate}{3}$$

$$= \frac{1230.0 + 1142.8 + 851.33}{3}$$

$$= 1074.64 \ mm / a$$

Table A-4: Mean annual rainfall data for Middle Letaba (B82D) quaternary catchment.

Rainfall station 1.

0723020 0	KLEINFONTEIN	Lat:-23.32	Long:30.0303	Height: 1,065 m

Station Number	Station Name	Year	Rainfall	Record Count
0723020 0	KLEINFONTEIN	1972	1415.9	366
0723020 0	KLEINFONTEIN	1973	986.5	365
0723020 0	KLEINFONTEIN	1974	1245.3	365
0723020 0	KLEINFONTEIN	1975	1004.3	365
0723020 0	KLEINFONTEIN	1976	1237.6	366
0723020 0	KLEINFONTEIN	1977	1543.4	365
0723020 0	KLEINFONTEIN	1978	1466.8	365
0723020 0	KLEINFONTEIN	1979	858.5	365
0723020 0	KLEINFONTEIN	1980	955.9	366
0723020 0	KLEINFONTEIN	1981	1492.1	364
0723020 0	KLEINFONTEIN	1982	609.5	363
0723020 0	KLEINFONTEIN	1983	556.5	365
0723020 0	KLEINFONTEIN	1984	834.8	366
0723020 0	KLEINFONTEIN	1985	997.7	364
0723020 0	KLEINFONTEIN	1986	813.8	365
0723020 0	KLEINFONTEIN	1987	547.1	365
0723020 0	KLEINFONTEIN	1988	1078.6	366
0723020 0	KLEINFONTEIN	1989	765.4	365
0723020 0	KLEINFONTEIN	1990	752.2	335
0723020 0	KLEINFONTEIN	1991	881.0	365
0723020 0	KLEINFONTEIN	1992	594.1	337
0723020 0	KLEINFONTEIN	1993	802.0	365
0723020 0	KLEINFONTEIN	1994	497.8	365
0723020 0	KLEINFONTEIN	1995	709.7	365
0723020 0	KLEINFONTEIN	1996	1161.5	366
0723020 0	KLEINFONTEIN	1997	968.7	365
0723020 0	KLEINFONTEIN	1998	730.1	365
0723020 0	KLEINFONTEIN	1999	863.4	365
0723020 0	KLEINFONTEIN	2000	2640.1	366
0723020 0	KLEINFONTEIN	2001	1009.0	365
0723020 0	KLEINFONTEIN	2002	538.5	365
0723020 0	KLEINFONTEIN	2003	495.9	365
0723020 0	KLEINFONTEIN	2004	802.4	366
0723020 0	KLEINFONTEIN	2005	607.2	365
0723020 0	KLEINFONTEIN	2006	881.8	365
0723020 0	KLEINFONTEIN	2007	763.5	365
0723020 0	KLEINFONTEIN	2008	579.3	366
0723020 0	KLEINFONTEIN	2009	842.1	365
Mean			**935.0**	

Rainfall station 2.

0723080 4	SETALI	Lat:-23.33	Long:30.04	Height: 884 m

Station Number	Station Name	Year	Rainfall	Record Count
0723080 4	SETALI	1960	738.7	366
0723080 4	SETALI	1961	735.4	365
0723080 4	SETALI	1962	673.1	365
0723080 4	SETALI	1963	434.6	365
0723080 4	SETALI	1964	752.1	366
0723080 4	SETALI	1965	482.0	365
0723080 4	SETALI	1966	571.1	365
0723080 4	SETALI	1967	756.9	365
0723080 4	SETALI	1968	643.7	366
0723080 4	SETALI	1969	688.3	365
0723080 4	SETALI	1970	519.7	365
0723080 4	SETALI	1971	723.6	365
0723080 4	SETALI	1972	1116.1	366
0723080 4	SETALI	1973	806.7	365
0723080 4	SETALI	1974	1183.0	365
0723080 4	SETALI	1975	833.0	365
0723080 4	SETALI	1976	1154.6	366
0723080 4	SETALI	1977	1324.7	365
0723080 4	SETALI	1978	1067.8	362
0723080 4	SETALI	1979	567.4	363
0723080 4	SETALI	1980	742.3	365
0723080 4	SETALI	1981	868.8	365
0723080 4	SETALI	1982	351.7	363
0723080 4	SETALI	1983	373.2	364
0723080 4	SETALI	1984	516.5	366
0723080 4	SETALI	1985	755.0	363
0723080 4	SETALI	1986	766.5	365
0723080 4	SETALI	1987	866.9	365
0723080 4	SETALI	1988	1067.4	366
0723080 4	SETALI	1989	736.2	365
0723080 4	SETALI	1990	594.9	365
0723080 4	SETALI	1991	720.9	365
0723080 4	SETALI	1992	604.8	366
0723080 4	SETALI	1993	621.3	365
0723080 4	SETALI	1994	448.3	365
0723080 4	SETALI	1995	604.8	365
0723080 4	SETALI	1996	950.4	305
0723080 4	SETALI	1997	258.8	122
0723080 4	SETALI	1998	587.0	365
0723080 4	SETALI	1999	927.5	365
0723080 4	SETALI	2000	1925.8	366
0723080 4	SETALI	2001	1012.4	365

Station Number	Station Name	Year	Rainfall	Record Count
0723080 4	SETALI	2002	273.2	365
0723080 4	SETALI	2003	413.8	365
0723080 4	SETALI	2004	792.1	366
0723080 4	SETALI	2005	315.8	365
0723080 4	SETALI	2006	618.2	356
0723080 4	SETALI	2007	745.1	365
0723080 4	SETALI	2008	506.4	366
Mean			**729.4**	

Rainfall station 3.

0723113 7	**VOORSPOED - BOS**	**Lat:-23.38**	**Long:30.07**	**Height: 1,065 m**

Station Number	Station Name	Year	Rainfall	Record Count
0723113 7	VOORSPOED - BOS	1960	809.6	366
0723113 7	VOORSPOED - BOS	1961	909.7	365
0723113 7	VOORSPOED - BOS	1962	676.0	365
0723113 7	VOORSPOED - BOS	1963	487.9	365
0723113 7	VOORSPOED - BOS	1964	714.1	366
0723113 7	VOORSPOED - BOS	1965	514.0	365
0723113 7	VOORSPOED - BOS	1966	741.5	365
0723113 7	VOORSPOED - BOS	1967	894.2	365
0723113 7	VOORSPOED - BOS	1968	733.1	366
0723113 7	VOORSPOED - BOS	1969	848.0	365
0723113 7	VOORSPOED - BOS	1970	438.0	365
0723113 7	VOORSPOED - BOS	1971	831.7	365
0723113 7	VOORSPOED - BOS	1972	718.3	366
0723113 7	VOORSPOED - BOS	1973	842.0	365
0723113 7	VOORSPOED - BOS	1974	1254.9	365
0723113 7	VOORSPOED - BOS	1975	956.7	365
0723113 7	VOORSPOED - BOS	1976	1251.3	366
0723113 7	VOORSPOED - BOS	1977	1668.9	365
0723113 7	VOORSPOED - BOS	1978	1393.8	362
0723113 7	VOORSPOED - BOS	1979	847.0	365
0723113 7	VOORSPOED - BOS	1980	874.1	364
0723113 7	VOORSPOED - BOS	1981	1541.0	365
0723113 7	VOORSPOED - BOS	1982	410.6	363
0723113 7	VOORSPOED - BOS	1983	600.1	365
0723113 7	VOORSPOED - BOS	1984	768.0	365
0723113 7	VOORSPOED - BOS	1985	974.0	365
0723113 7	VOORSPOED - BOS	1986	828.1	365
0723113 7	VOORSPOED - BOS	1987	950.0	360
0723113 7	VOORSPOED - BOS	1988	1005.5	365
0723113 7	VOORSPOED - BOS	1989	719.4	365

Station Number	Station Name	Year	Rainfall	Record Count
0723113 7	VOORSPOED - BOS	1990	684.1	243
0723113 7	VOORSPOED - BOS	1991	908.7	305
0723113 7	VOORSPOED - BOS	1992	517.3	366
0723113 7	VOORSPOED - BOS	1993	832.8	365
0723113 7	VOORSPOED - BOS	1994	484.5	365
0723113 7	VOORSPOED - BOS	1995	704.1	365
0723113 7	VOORSPOED - BOS	1996	1267.7	335
0723113 7	VOORSPOED - BOS	1997	1071.1	365
0723113 7	VOORSPOED - BOS	1998	938.1	365
0723113 7	VOORSPOED - BOS	1999	887.1	365
0723113 7	VOORSPOED - BOS	2000	1972.4	366
0723113 7	VOORSPOED - BOS	2001	875.5	365
0723113 7	VOORSPOED - BOS	2002	330.5	365
0723113 7	VOORSPOED - BOS	2003	453.5	365
0723113 7	VOORSPOED - BOS	2004	1043.7	366
0723113 7	VOORSPOED - BOS	2005	443.4	365
0723113 7	VOORSPOED - BOS	2006	899.0	365
0723113 7	VOORSPOED - BOS	2007	604.0	365
0723113 7	VOORSPOED - BOS	2008	651.0	366
0723113 7	VOORSPOED - BOS	2009	551.4	365
Mean			**846.4**	

$$MAP\ \ for\ B82D = \frac{MAP\ \ for\ Kle\inf otein\ +\ MAP\ \ for\ Setali\ +\ MAP\ \ for\ Voorspoed - Bos}{3}$$

$$= \frac{935.0 + 729.4 + 846.4}{3}$$

$$= 836.933\ \ mm/a$$

Table A-5: Total atmospheric chloride deposition for Molototsi (B81G) and Middle Letaba (B82D) quaternary catchments.

Taaiboschgroet Rainfall Station.

Rainwater chloride concentration in summer (S) and winter (W) seasons.

Collected over a three tier interval as follows:

Seasons	Concentration (mg/l)
Early (S:Oct $_{n}$ - Dec $_{n}$); (W: Apr $_{n+1}$ - Jun $_{n+1}$)	1.1
Peak (S:Jan $_{n+1}$ - Mar $_{n+1}$); (W: Jul $_{n+1}$ - Sep $_{n+1}$)	0.6
Dry (S:Apr $_{n+1}$ - Sep $_{n+1}$); (W: Oct $_{n+1}$ - Mar $_{n+1}$)	1.9

Table A-6: Recharge for Molototsi (B81G) quaternary catchment.

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
HARMONIC MEAN ZQMTOY2 2330CB00079 GA-MODJADJI (GA MOKWASELE) - H070767	-23.6356	30.281667	ZQMTOY2 GA-MODJADJI (GA MOKWASELE)	1996/06/06 to 2007/05/22	NONE	SAMPLE	9.530	3.0	0.6	1074.64	67.658
HARMONIC MEAN MOJADJE'S LOCATION PTN. MAKURUPETJE	-23.645	30.273889	MAKURUPETJE MOJADJES	1995/02/01 to 1995/05/05	NONE	SAMPLE	5.894	3.0	0.6	1074.64	109.397
KROMRIVIERFONTEIN (DUP NAME 5682)	-23.5444	30.397778	KROMRIVIERFONTEIN (DUPL NAME 4)	1995/02/10	NONE	SAMPLE	64.000	3.0	0.6	1074.64	10.075
KROMRIVIERFONTEIN (DUP NAME 5683)	-23.5442	30.397778	KROMRIVIERFONTEIN (DUPL NAME 5)	1995/02/13	NONE	SAMPLE	57.600	3.0	0.6	1074.64	11.194
HARMONIC MEAN KROMRIVIERFONTEIN (DUP NAME 5684	-23.5436	30.398056	KROMRIVIERFONTEIN (DUPL NAME 6)	1995/02/12 to 1995/04/30	NONE	SAMPLE	13.929	3.0	0.6	1074.64	46.291
2330CB00050 MUDUBUNG MOJADJES	-23.6331	30.2925	2330CB00050 MUDUBUNG MOJADJES	1995/02/09	NONE	SAMPLE	28.400	3.0	0.6	1074.64	22.704
2330CB00059 MOJADJE'S LOCATION PTN. SETALENG	-23.6081	30.314722	SETALENG MOJADJES	1995/02/13	NONE	SAMPLE	38.600	3.0	0.6	1074.64	16.704
2330CB00054 MODJADJE'S PTN. MADUMELENG	-23.6133	30.330278	MADUMELENG	1995/02/15	NONE	SAMPLE	33.200	3.0	0.6	1074.64	19.421
2330AD0065 STATELAND PTN. REFILWE	-23.395	30.436667	REFILWE	1995/05/11	NONE	SAMPLE	50.100	3.0	0.6	1074.64	12.870
HARMONIC MEAN JAMELA (DUP NAME 5765)	-23.4394	30.348611	JAMELA (DUPL NAME 1)	1995/04/26 to 1995/05/23	NONE	SAMPLE	5.916	3.0	0.6	1074.64	108.990
GA MOLAI	-23.5461	30.399167	GA MOLAI	1995/04/11	NONE	SAMPLE	36.000	3.0	0.6	1074.64	17.911
HARMONIC MEAN JAMELA (DUP NAME 5766)	-23.4403	30.348889	JAMELA (DUPL NAME 2)	1995/04/25 to 1995/05/21	NONE	SAMPLE	16.771	3.0	0.6	1074.64	38.446
2330AD00057 STATELAND PTN. MAMAILLA	-23.4122	30.458611	MAMAILLA (DUPL NAME 3)	1995/05/30	NONE	SAMPLE	92.200	3.0	0.6	1074.64	6.993
HARMONIC MEAN 2330AD00067 STATELAND PTN. NAKAMPE H07-1058	-23.3986	30.468333	2330AD00067 NAKAMPE H07-1058	2005/05/29 to 2005/04/12	NONE	SAMPLE	77.537	3.0	0.6	1074.64	8.316
2330AD00056 STATELAND PTN. MAMAILLA	-23.4125	30.459167	MAMAILLA (DUPL NAME 1)	1995/05/29	NONE	SAMPLE	70.100	3.0	0.6	1074.64	9.198
2330CB00306 MODUBUNG	-23.6369	30.28917	2330CB00306 MODUBUNG	1995/07/19	NONE	SAMPLE	1.500	3.0	0.6	1074.64	429.856
SENAKWE	-23.5619	30.411944	SENAKWE	1995/07/19	NONE	SAMPLE	194.000	3.0	0.6	1074.64	3.324
2330CB00458 MODJADJE'S LOCATION PTN. MODUBUNG	-23.6364	30.294167	MODJADJES (DUPL NAME 23)	1997/07/13	NONE	SAMPLE	34.400	3.0	0.6	1074.64	18.744
HARMINIC MEAN 2330CA00042 MEIDINGEN H07-0009	-23.6414	30.246667	MEIDINGEN (DUPL NAME 6)	1997/07/21 to 2007/09/16	NONE	SAMPLE	10.609	3.0	0.6	1074.64	60.777

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330CA00052 MEIDINGEN PTN. RAKWADU - H07-1025	-23.6644	30.243333	MEIDINGEN (DUPL NAME 7)	1997/07/11	NONE	SAMPLE	5.900	3.0	0.6	1074.64	109.285
2330CB00367 MEIDINGEN - H07-0566	-23.6378	30.250556	MEIDINGEN (DUPL NAME 8)	1997/08/01	NONE	SAMPLE	5.400	3.0	0.6	1074.64	119.404
HARMONIC MEAN 2330CB00384 MODJADJE'S PTN. BOSHAKGE - H07-0899	-23.5969	30.331111	MODJADJES (DUPL NAME 24)	1997/08/05 to 2008/02/01	NONE	SAMPLE	48.469	3.0	0.6	1074.64	13.303
2330CB00201 MODJADJE'S LOCATION PTN. MALEMATSA	-23.6081	30.2925	MODJADJES (DUPL NAME 25)	1997/08/04	NONE	SAMPLE	8.800	3.0	0.6	1074.64	73.271
2330CB00353 MODJADJES	-23.6089	30.295556	MODJADJES (DUPL NAME 26)	1997/08/01	NONE	SAMPLE	13.200	3.0	0.6	1074.64	48.847
2330CB00360 MODJADJE'S PTN. TLATSA - H07-06	-23.5819	30.335	MODJADJES (DUPNAME 27)	1997/08/06	NONE	SAMPLE	45.900	3.0	0.6	1074.64	14.048
HARMONIC MEAN 2330CB00504 MODJADJE'S LOCATION PTN. MALEMATSA H07-0974	-23.6189	30.275	MODJADJES (DUPL NAME 68)	1997/07/27 to 2005/04/01	NONE	SAMPLE	9.329	3.0	0.6	1074.64	69.116
HARMONIC MEAN 2330CB00431 MEIDINGEN PTN. RABOTHATA H07-0976	-23.6264	30.259167	MEIDINGEN (DUPL NAME 20)	1997/07/26 to 2005/04/01	NONE	SAMPLE	12.284	3.0	0.6	1074.64	52.490
2330CB00366 MODJADJE'S LOCATION PTN. MALEMATHA - H07-0685	-23.6122	30.288056	MODJADJES (DUPL NAME 69)	1997/07/28	NONE	SAMPLE	16.200	3.0	0.6	1074.64	39.801
2330CB00370 MODJADJE'S LOCATION PTN. MADUMELANA - H07-0687	-23.6217	30.269167	MODJADJES (DUPL NAME 70)	1997/07/26	NONE	SAMPLE	7.700	3.0	0.6	1074.64	83.738
2330CB00430 MODJADJE'S LOCATION PTN MADUMELANA	-23.6214	30.269444	MODJADJES (DUPL NAME 71)	1997/07/31	NONE	SAMPLE	10.700	3.0	0.6	1074.64	60.260
2330CB00336 MODJADJE'S PTN. MADUMELANA - H07-0268	-23.6114	30.315833	MODJADJES (DUPL NAME 72)	1997/08/10	NONE	SAMPLE	17.200	3.0	0.6	1074.64	37.487
2330CB00305 MODJADJES	-23.6617	30.251389	MODJADJES (DUPL NAME 73)	1997/08/07	NONE	SAMPLE	6.900	3.0	0.6	1074.64	93.447
2330CB00350 MODJADJE'S LOCATION - H07-0422	-23.6231	30.351667	MODJADJES (DUPL NAME 31)	1997/08/19	NONE	SAMPLE	16.300	3.0	0.6	1074.64	39.557
2330CB00352 MODJADJE'S LOCATION PTN. BOSHAKGE	-23.6028	30.322778	MODJADJES (DUPL NAME 77)	1997/08/19	NONE	SAMPLE	20.200	3.0	0.6	1074.64	31.920
2330CB00401 MODJADJES	-23.6336	30.280278	MODJADJES (DUPL NAME 79)	1997/08/18	NONE	SAMPLE	21.600	3.0	0.6	1074.64	29.851
HARMONIC MEAN 2330CB00306 MODJADJES H070014	-23.6369	30.289167	MODJADJES (DUPL NAME 80)	1997/08/16 to 2002/12/19	NONE	SAMPLE	35.092	3.0	0.6	1074.64	18.374
2330CB00307 MODJADJE'S LOCATION - H07-0015	-23.6194	30.344167	MODJADJES (DUPL NAME 81)	1997/08/14	NONE	SAMPLE	21.800	3.0	0.6	1074.64	29.577
2330CB00308 MODJADJES	-23.6239	30.349444	MODJADJES (DUPL NAME 38)	1997/09/04	NONE	SAMPLE	10.400	3.0	0.6	1074.64	61.998

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330CB00309 MODJADJES	-23.6219	30.349444	MODJADJES (DUPL NAME 40)	1997/09/06	NONE	SAMPLE	12.300	3.0	0.6	1074.64	52.421
KROMRIVIERFONTEIN (DUP NAME 7303)	-23.5450	30.398333	KROMRIVIERFONTEIN (DUPL NAME 3)	1997/09/09	NONE	SAMPLE	27.000	3.0	0.6	1074.64	23.881
2330CB00328 MODJADJES - H07-0071	-23.5522	30.402500	MODJADJES (DUPL NAME 42)	1997/09/09	NONE	SAMPLE	387.800	3.0	0.6	1074.64	1.663
2330CB00437 MODJADJE'S LOCATION PTN. MAKWASELA	-23.6456	30.268056	MODJADJES (DUPL NAME 86)	1997/09/04	NONE	SAMPLE	9.200	3.0	0.6	1074.64	70.085
2330CB00387 SENOBELA - H07-0909	-23.5525	30.412500	SENOBELA (DUPL NAME 5)	1997/09/11	NONE	SAMPLE	147.200	3.0	0.6	1074.64	4.380
2330CB00470 MODJADJE'S LOCATION PTN. KHEFOLWE	-23.6425	30.312222	MODJADJES (DUPL NAME 88)	1997/09/03	NONE	SAMPLE	4.800	3.0	0.6	1074.64	134.330
MODJADJES (DUP NAME 7305)	-23.6583	30.263333	MODJADJES (DUPL NAME 43)	1997/09/01	NONE	SAMPLE	10.000	3.0	0.6	1074.64	64.478
2330CB00379 MODJADJE'S LOCATION PTN. MORWASETLA - H07-0836	-23.6189	30.366111	MODJADJES (DUPL NAME 47)	1997/09/21	NONE	SAMPLE	7.900	3.0	0.6	1074.64	81.618
2330AD00300 NORTHHAMPTON	-23.4733	30.466111	NORTHHAMPTON	1997/09/16	NONE	SAMPLE	257.200	3.0	0.6	1074.64	2.507
HARMONIC MEAN 2330CB00454 MODJADJES H071022	-23.6306	30.297778	MODJADJES (DUPL NAME 49)	1997/10/03 to 2002/12/19	NONE	SAMPLE	20.234	3.0	0.6	1074.64	31.866
2330AD00263 STATELAND PTN. MAPHALLE - H07-0102	-23.4578	30.321389	MAPHALLE STAATSGROND	1997/11/28	NONE	SAMPLE	180.700	3.0	0.6	1074.64	3.568
STAATSGROND (DUP NAME 7539)	-23.4583	30.334444	STAATSGROND (DUPL NAME 31)	1997/11/04	NONE	SAMPLE	93.900	3.0	0.6	1074.64	6.867
2330CB00270 STATELAND PTN. MAPHALLE - H07-0461	-23.4533	30.34	STAATSGROND (DUPL NAME 11)	1997/12/08	NONE	SAMPLE	123.100	3.0	0.6	1074.64	5.238
MAPHELLE STAATSGROND	-23.45722	30.318056	MAPHELLE STAATSGROND	1997/12/10	NONE	SAMPLE	121.600	121.600	3.0	1074.64	26.513
2330AD00295 STATELAND PTN. NAKAMPE - H07-0831	-23.40833	30.445556	STAATSGROND (DUPL NAME 32)	1998/02/02	NONE	SAMPLE	105.900	105.900	3.0	1074.64	30.443

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
NWAMANKENA	-23.38056	30.530833	NWAMANKENA	1998/01/13	NONE	SAMPLE	1153.800	1153.800	3.0	1074.64	2.794
2330AD00286 BELLEVUE PTN. MAUPA	-23.4094	30.384722	BELLEVUE MAUPA	1994/12/10	NONE	SAMPLE	64.800	3.0	0.6	1074.64	9.950
MOROKA	-23.5311	30.456389	MOROKA	1994/12/03	NONE	SAMPLE	89.700	3.0	0.6	1074.64	7.188
MAPHALLE	-23.4567	30.333889	MAPHALLE (DUPL NAME 2)	1994/12/09	NONE	SAMPLE	88.200	3.0	0.6	1074.64	7.310
2330BC00165 KURANT A - H07-0198	-23.46	30.517222	KURANT A	1995/05/15	NONE	SAMPLE	77.600	3.0	0.6	1074.64	8.309
BOTSHABELA	-23.38	30.509167	BOTSHABELA	1995/05/18	NONE	SAMPLE	209.300	3.0	0.6	1074.64	3.081
HARMINIC MEAN 2330AD00205 DITSHOSHING H07-0454	-23.4911	30.325	2330AD00205 DITSHOSHING H07-0454	2005/01/18 to 2005/04/16	NONE	SAMPLE	277.839	3.0	0.6	1074.64	2.321
2330AD00259 DITSHOSHING	-23.4683	30.346389	DITSHOSHING (DUPL NAME 1)	1995/05/24	NONE	SAMPLE	101.400	3.0	0.6	1074.64	6.359
HARMINIC MEAN DITSHOSHING	-23.4844	30.344722	DITSHOSHING (DUPL NAME 2)	1995/05/28 to 1995/06/10	NONE	SAMPLE	71.502	3.0	0.6	1074.64	9.018
2330AD00255 FEMANE	-23.4917	30.388056	FEMANE	1995/06/12	NONE	SAMPLE	142.200	3.0	0.6	1074.64	4.534
2330AD00296 NEBO	-23.4081	30.446389	NEBO (DUPL NAME 10)	1995/06/10	NONE	SAMPLE	102.600	3.0	0.6	1074.64	6.284
MOROKO	-23.5356	30.450556	MOROKO	1995/07/19	NONE	SAMPLE	302.000	3.0	0.6	1074.64	2.135
SENOBELLA-A-BOLEBEDU	-23.4933	30.461944	SENOBELLA-A-BOLEBEDU	1995/08/18	NONE	SAMPLE	342.200	3.0	0.6	1074.64	1.884
2330BC00223 STATELAND PTN. MAEKGWE	-23.4894	30.510278	MAEKGWE (STAATSGROND)	1995/10/12	NONE	SAMPLE	44.100	3.0	0.6	1074.64	14.621

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330CB00434 MOHOKONI/BOLOBEDU	-23.5008	30.435556	LOBEDU (DUPL MOHOKONI/BO NAME 1)	1996/09/19	NONE	SAMPLE	142.600	3.0	0.6	1074.64	4.522
2330CB00434 WORCESTER PTN. MOHOKONI	-23.5017	30.43611	2330CB00434 MOHOKONI	1996/09/18	NONE	SAMPLE	133.300	3.0	0.6	1074.64	4.837
2330AD00292 WORCESTER PTN. MOHOKONI - H07-0747	-23.4953	30.4375	MOHOKONI/BOLOBEDU (DUPL NAME 2)	1996/09/18	NONE	SAMPLE	347.600	3.0	0.6	1074.64	1.855
2330CB00205 WORCESTER PTN. MOHOKONI	-23.5069	30.441667	2330CB00205 MOHOKONI	1996/09/18	NONE	SAMPLE	411.000	3.0	0.6	1074.64	1.569
2330AD00300 NORTHAMPTON	-23.4731	30.466667	NORTHAMPTON (DUPL NAME 7)	1996/09/28	NONE	SAMPLE	253.800	3.0	0.6	1074.64	2.541
ELANDSFONTEIN (DUP NAME 30931)	-23.4272	30.521667	ELANDSFONTEIN (DUPL NAME 3)	1997/01/24	NONE	SAMPLE	368.200	3.0	0.6	1074.64	1.751
2330CB00330 STATELAND PTN. RAMBEBE H07-0169	-23.5317	30.455833	RAMBEBE STAATSGROND	1997/01/26	NONE	SAMPLE	116.000	3.0	0.6	1074.64	5.558
2330AD00258 STATELAND PTN. MOHLABANENG - H07-0089	-23.4739	30.372222	MOHLABANENG STAATSGROND	1997/01/18	NONE	SAMPLE	132.500	3.0	0.6	1074.64	4.866
2330AD00296 STAATSGROND PTN. PHAPHADI - H07-0831A	-23.4075	30.446389	STAATSGROND REFILWE	1997/01/26	NONE	SAMPLE	158.300	3.0	0.6	1074.64	4.073
2330AD00286 BELLEVUE	-23.4097	30.384167	BELLEVUE (DUPL NAME 16)	1997/01/16	NONE	SAMPLE	66.200	3.0	0.6	1074.64	9.740
2330AD00284 STATELAND PTN. MAMOKHADE - H07 0548	-23.4311	30.453611	MAMOKHADE STAATSGROND	1997/01/25	NONE	SAMPLE	100.800	3.0	0.6	1074.64	6.397
WORCESTER (DUP NAME 30933)	-23.5056	30.410556	WORCESTER (DUPL NAME 26)	1997/01/21	NONE	SAMPLE	215.900	3.0	0.6	1074.64	2.986
HARMINIC MEAN 2330AD00268 NAKAMPE STAATSGROND H070139	-23.4089	30.459444	NAKAMPE STAATSGROND	1997/01/22 to 2003/01/13	NONE	SAMPLE	63.436	3.0	0.6	1074.64	10.164
HARMINIC MEAN 2330AD00259 SHAWELA STAATSGROND H070095	-23.4681	30.346667	SHAWELA STAATSGROND	1997/01/14 to 2004/04/01	NONE	SAMPLE	105.201	3.0	0.6	1074.64	6.129
2330AD00289 BELLEVUEPTN. MAUPA - H07-0704	-23.4194	30.384722	BELLEVUE (DUPL NAME 3)	1997/01/11	NONE	SAMPLE	52.600	3.0	0.6	1074.64	12.258
GAMELA	-23.4217	30.520833	GAMELA (DUPL NAME 1)	1997/02/06	NONE	SAMPLE	302.100	3.0	0.6	1074.64	2.134
HARMINIC MEAN 2330AD00411 STAATSGROND MAMAILA H070848	-23.3833	30.429167	STAATSGROND MAMAILA	1997/01/18 to 2004/06/13	NONE	SAMPLE	64.134	3.0	0.6	1074.64	10.054
2330AD00267 STATELAND PTN. REFILWE H07-0127	-23.3909	30.436389	MAMAILA STAATSGROND	1997/01/22	NONE	SAMPLE	75.500	3.0	0.6	1074.64	8.540

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a
BELLEVUE (DUP NAME 30935)	-23.4358	30.349444	BELLEVUE (DUPL NAME 4)	1997/01/11	NONE	SAMPLE	12.100	3.0	0.6	1074.64	53.288
HARMINIC MEAN 2330AD00266 STAATSGROND BELLEVUE H070117	-23.4194	30.403333	STAATSGROND BELLEVUE	1997/01/15 to 2003/01/08	NONE	SAMPLE	53.588	3.0	0.6	1074.64	12.032
HARMINIC MEAN 2330AD00020 STATELAND PTN. DITSHUSHING - H07-0705	-23.4956	30.336111	STAATSGROND DITSHUSHING	1997/01/15 to 2003/07/04	NONE	SAMPLE	123.188	3.0	0.6	1074.64	5.234
HARMINIC MEAN 2330CB00500 KROMRIVIERFONTEIN H070545	-23.5147	30.356111	KROMFONTEIN	1997/01/17 to 2003/01/07	NONE	SAMPLE	57.590	3.0	0.6	1074.64	11.196
MAPHALELE STAATSGROND BELLEVUE	-23.4628	30.314167	MAPHALELE STAATSGROND BELLEVUE	1997/01/10	NONE	SAMPLE	364.200	3.0	0.6	1074.64	1.770
2330CB00376 MODJADJE'S LOCATION PTN. RAMOTATA - H07-0798	-23.6364	30.283056	MODJADJES (DUPL NAME 51)	1997/02/16	NONE	SAMPLE	12.200	3.0	0.6	1074.64	52.851
HARMINIC MEAN 2330CB00304 MEIDINGEN H070011	-23.6633	30.2525	MEIDINGEN (DUPL NAME 10)	1997/02/12 to 2002/12/18	NONE	SAMPLE	5.098	3.0	0.6	1074.64	126.478
HARMINIC MEAN 2330CB00436 MODJADJES H070987	-23.6436	30.275278	MODJADJES (DUPL NAME 52)	1997/02/20 to 2007/09/15	NONE	SAMPLE	8.172	3.0	0.6	1074.64	78.902
HARMINIC MEAN 2330CB00334 MODJADJES H070267	-23.6353	30.280556	MODJADJES (DUPL NAME 53)	1997/02/17 to 2002/12/08	NONE	SAMPLE	6.565	3.0	0.6	1074.64	98.215
2330CB00371 MODJADJE'S LOCATION PTN. MARAKA - H07-0729	-23.6317	30.286667	MODJADJES (DUPL NAME 54)	1997/02/18	NONE	SAMPLE	12.000	3.0	0.6	1074.64	53.732
HARMINIC MEAN 2330CB00345 MODJADJES H070387	-23.5728	30.346667	MODJADJES (DUPL NAME 1)	1997/02/19 to 2003/01/08	NONE	SAMPLE	34.191	3.0	0.6	1074.64	18.858
2330CB00476 MODJADJE'S PTN MABULANA	-23.5764	30.3475	MODJADJI	1997/02/15	NONE	SAMPLE	38.100	3.0	0.6	1074.64	16.923
2330CB00180 MEIDINGEN	-23.6642	30.2525	MEIDINGEN (DUPL NAME 1)	1997/02/16	NONE	SAMPLE	4.700	3.0	0.6	1074.64	137.188
2330CB00439 MODJADJE'S LOCATION PTN. MADIBONG	-23.6339	30.2925	MODJADJES (DUPL NAME 2)	1997/02/20	NONE	SAMPLE	18.100	3.0	0.6	1074.64	35.623
2330CB00497 MEIDINGEN	-23.6639	30.251944	MEIDINGEN (DUPL NAME 2)	1997/02/26	NONE	SAMPLE	4.600	3.0	0.6	1074.64	140.170
2330AC00377 VLAKFONTEIN PTN. MOTHOBEKI - H07-0799	-23.54	30.375556	VLAKFONTEIN (DUPL NAME 10)	1997/02/23	NONE	SAMPLE	93.700	3.0	0.6	1074.64	6.881
HARMINIC MEAN 2330CB00454 MODJADJES	-23.6247	30.298056	MODJADJES (DUPL NAME 3)	1997/03/04 to 1997/03/21	NONE	SAMPLE	13.910	3.0	0.6	1074.64	46.354

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
HARMINIC MEAN 2330CB00361 MODJAJE'S LOCATION PTN. IKETLENG - H07-0654	-23.6225	30.298889	MODJAJES	1997/03/05 to 1997/04/16	NONE	SAMPLE	12.184	3.0	0.6	1074.64	52.921
2330CB00477 MODJADJES	-23.5769	30.323889	MODJADJES (DUPL NAME 4)	1997/02/21	NONE	SAMPLE	48.100	3.0	0.6	1074.64	13.405
HARMINIC MEAN 2330CA00019 SCHOONGELEGEN PTN. MEIDINGEN / MPHAKANE - H07-1409	-23.6672	30.25	MEIDINGEN (DUPL NAME 4)	1997/02/20 to 2006/04/05	NONE	SAMPLE	8.564	3.0	0.6	1074.64	75.290
HARMINIC MEAN 2330CB00475 MODJADJES H070993	-23.6108	30.313333	MODJADJES (DUPL NAME 5)	1997/03/07 to 2003/01/13	NONE	SAMPLE	40.785	3.0	0.6	1074.64	15.809
HARMINIC MEAN 2330CB00372 MODJADJES H070754	-23.6472	30.271667	MODJADJES (DUPL NAME 6)	1997/02/25 to 2002/12/18	NONE	SAMPLE	10.893	3.0	0.6	1074.64	59.193
HARMINIC MEAN 2330CB00438 MODJADJES H070989	-23.6275	30.286667	MODJADJES (DUPL NAME 7)	1997/02/18 to 2002/12/19	NONE	SAMPLE	37.365	3.0	0.6	1074.64	17.256
VLAKFONTEIN (DUP NAME 30978)	-23.5617	30.377778	VLAKFONTEIN (DUPL NAME 53)	1997/03/10	NONE	SAMPLE	143.500	3.0	0.6	1074.64	4.493
VLAKFONTEIN (DUP NAME 30979)	-23.5506	30.390556	VLAKFONTEIN (DUPL NAME 54)	1997/03/08	NONE	SAMPLE	451.200	3.0	0.6	1074.64	1.429
2330CB00332 MODJADJE'S LOCATION PTN. SETALENG - H07-0264	-23.6097	30.316389	MODJADJES (DUPL NAME 55)	1997/03/07	NONE	SAMPLE	35.000	3.0	0.6	1074.64	18.422
HARMINIC MEAN VLAKFONTEIN (DUP NAME 30985)							289.255	3.0	0.6	1074.64	2.229
MODJADJES (DUP NAME 30993)	-23.41944	30.357778	MODJADJES (DUPL NAME 56)	1997/03/17	NONE	SAMPLE	63.700	3.0	0.6	1074.64	10.122
2330CB00186 MODJADJE'S PTN. MATSWE	-23.57806	30.355833	MODJADJES (DUPL NAME 57)	1997/03/16	NONE	SAMPLE	24.600	3.0	0.6	1074.64	26.211
2330CB00187 MODJADJE'S PTN. GA-MATSWE	-23.5833	30.3675	MODJADJES (DUPL NAME 58)	1997/03/13	NONE	SAMPLE	33.700	3.0	0.6	1074.64	19.133
2330CB00435 WORCESTER	-23.5006	30.44305	2330CB00435 WORCESTER	1997/04/08	NONE	SAMPLE	244.700	3.0	0.6	1074.64	2.635
VLAKFONTEIN (DUP NAME 31011)	-23.5486	30.388889	VLAKFONTEIN (DUPL NAME 13)	1997/04/04	NONE	SAMPLE	54.000	3.0	0.6	1074.64	11.940
VLAKFONTEIN (DUP NAME 31012)	-23.5481	30.388611	VLAKFONTEIN (DUPL NAME 14)	1997/04/05	NONE	SAMPLE	18.100	3.0	0.6	1074.64	35.623

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
MODJADJES (DUP NAME 31013)	-23.6447	30.274167	MODJADJES (DUPL NAME 8)	1997/04/09	NONE	SAMPLE	26.300	3.0	0.6	1074.64	24.517
2330CB00185 MODJADJE'S PTN. GA-MATSWE	-23.5783	30.355278	MODJADJES (DUPL NAME 9)	1997/04/15	NONE	SAMPLE	57.200	3.0	0.6	1074.64	11.272
2330CB00443 MODJADJE'S PTN. MATSWE	-23.5772	30.3575	MODJADJES (DUPL NAME 10)	1997/04/16	NONE	SAMPLE	33.000	3.0	0.6	1074.64	19.539
2330CB00498 MODJADJES	-23.5897	30.371944	MODJADJES (DUPL NAME 11)	1997/04/24	NONE	SAMPLE	106.300	3.0	0.6	1074.64	6.066
2330CB00499 MODJADJES	-23.5833	30.363611	MODJADJES (DUPL NAME 12)	1997/04/18	NONE	SAMPLE	97.900	3.0	0.6	1074.64	6.586
2330CB00374 MODJADJE'S LOCATION PTN. MORWATSHEHLA - H07-0760	-23.5919	30.376667	MODJADJES (DUPL NAME 13)	1997/04/26	NONE	SAMPLE	33.600	3.0	0.6	1074.64	19.190
KROMRIVIERFONTEIN (DUP NAME 31025)	-23.5464	30.397778	KROMRIVIERFONTEIN (DUPL NAME 1)	1997/05/01	NONE	SAMPLE	145.900	3.0	0.6	1074.64	4.419
2330CB00323 MODJADJES	-23.5828	30.368889	MODJADJES (DUPL NAME 14)	1997/04/24	NONE	SAMPLE	31.100	3.0	0.6	1074.64	20.733
2330CB00322 MODJADJE'S PTN. GA-MATSWE - H07-0050	-23.5894	30.360278	MODJADJES (DUPL NAME 15)	1997/04/22	NONE	SAMPLE	55.600	3.0	0.6	1074.64	11.597
2330CB00373 MODJADJE'S LOCATION PTN. MATSWE - H07-0757	-23.5856	30.371667	MODJADJES (DUPL NAME 17)	1997/04/25	NONE	SAMPLE	74.800	3.0	0.6	1074.64	8.620
BELLEVUE (DUP NAME 31026)	-23.4358	30.349722	BELLEVUE (DUPL NAME 17)	1997/04/23	NONE	SAMPLE	9.600	3.0	0.6	1074.64	67.165
HARMINIC MEAN SENOBELA (DUP NAME 31033)	-23.5431	30.412778	SENOBELA (DUPL NAME 2)	1997/05/11	NONE	SAMPLE	14.315		0.6	1074.64	45.043
KROMRIVIERFONTEIN (DUP NAME 31034)	-23.5453	30.398056	KROMRIVIERFONTEIN (DUPL NAME 2)	1997/05/05	NONE	SAMPLE	14.500	3.0	0.6	1074.64	44.468
HARMINIC MEAN 2330CB00394 MODJADJES H071001	-23.6386	30.281667	MODJADJES (DUPL NAME 19)	1997/05/10 to 2002/12/18	NONE	SAMPLE	9.726	3.0	0.6	1074.64	66.295
MODJADJES (DUP NAME 31051)	-23.6311	30.295278	MODJADJES (DUPL NAME 61)	1997/05/23	NONE	SAMPLE	25.500	3.0	0.6	1074.64	25.286
2330CB00455 MODJADJE'S PTN. SOTONG	-23.6297	30.302222	MODJADJES (DUPL NAME 62)	1997/05/24	NONE	SAMPLE	16.600	3.0	0.6	1074.64	38.842
HARMINIC MEAN 2330CB00419 MODJADJE'S H07-1074	-23.6303	30.299167	2330CB00419 MODJADJES H07-1074	1997/05/17 to 2005/08/26	NONE	SAMPLE	26.332	3.0	0.6	1074.64	24.487
2330CA00043 MEIDINGEN - H07-0010	-23.6356	30.249167	MEIDINGEN (DUPL NAME 11)	1997/05/14	NONE	SAMPLE	9.200	3.0	0.6	1074.64	70.085
WORCESTER (DUP NAME 31052)	-23.3919	30.387778	WORCESTER (DUPL NAME 28)	1997/05/16	NONE	SAMPLE	141.700	3.0	0.6	1074.64	4.550

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330CB00456 MODJADJE'S LOCATION PTN. SHOTONG	-23.6336	30.296111	MODJADJES (DUPL NAME 20)	1997/05/25	NONE	SAMPLE	15.100	3.0	0.6	1074.64	42.701
2330CB00400 MODJADJES LOCATION PTN. TLATSA	-23.5797	30.33	MODJADJES (DUPL NAME 21)	1997/06/13	NONE	SAMPLE	67.700	3.0	0.6	1074.64	9.524
2330CB00342 MODJADJE'S PTN. SEKOTI - H07-0379	-23.5808	30.331389	MODJADJES (DUPL NAME 65)	1997/06/18	NONE	SAMPLE	49.700	3.0	0.6	1074.64	12.974
2330CB00342 MODJADJE'S PTN. SEKOTI - H07-0379	-23.5808	30.331389	MODJADJES (DUPL NAME 65)	2008/01/31	NONE	SAMPLE	62.488	4.0	0.6	1074.64	10.319
2330CA00047 MEIDINGEN - H07-0567	-23.6439	30.241111	MEIDINGEN (DUPL NAME 12)	1997/06/08	NONE	SAMPLE	14.100	3.0	0.6	1074.64	45.729
2330CA00046 MEIDINGEN PTN. MAPANA - H07-0562	-23.6589	30.237222	MEIDINGEN (DUPL NAME 18)	1997/06/25	NONE	SAMPLE	6.300	3.0	0.6	1074.64	102.347
2330AD00245 STATE LAND PTN. BELLEVUE - H07-0621	-23.41056	30.421389	2330AD00245 STATE LAND - BELLEVUE	2000/01/27	NONE	SAMPLE	246.543	10	0.6	1074.64	2.615
2330CB00294 STATE LAND - SENOBELA	-23.55083	30.398056	2330CB00294 STATE LAND - SENOBELA	2000/01/29	NONE	SAMPLE	102.226	10	0.6	1074.64	6.307
2330AD00247 STATEGROUND H07-0586	-23.46306	30.36778	2330AD00247 STATEGROUND H070586	2001/07/28	NONE	SAMPLE	171.453	10	0.6	1074.64	3.761
2330BC00205 STATELAND H07-1133	-23.4764	30.5025	2330BC00205 STATELAND H071133	2002/01/15	NONE	SAMPLE	250.778	10.0	0.6	1074.64	2.571
2330CC00055 MOHLABAS LOCATION H08-1322	-23.9293	30.23947	2330CC00055 MOHLABAS LOCATION H081322	2002/06/28	NONE	SAMPLE	51.937	10.0	0.6	1074.64	12.415
HARMINIC MEAN 2330AD00250 NDENGEZA CLINIC H14-0856	-23.3153	30.40646	2330AD00250 NDENGEZA CLINIC H140856	2002/07/03 to 2002/07/11	NONE	SAMPLE	388.574	10.0	0.6	1074.64	1.659
2330AD00251 ZONNEBLOEM H10-0629	-23.2958	30.30861	2330AD00251 ZONNEBLOEM H100629	2002/08/28	NONE	SAMPLE	100.743	10.0	0.6	1074.64	6.400
2330AD00297 STATELAND H07-0841	-23.4583	30.33444	2330AD00297 STATELAND H070841	2002/10/11	NONE	SAMPLE	891.682	10.0	0.6	1074.64	0.723
HARMINIC MEAN 2330BC00219 KORANTA H07-0200	-23.4656	30.51955	2330BC00219 KORANTA H07-0200	2002/10/21 to 2005/11/14	NONE	SAMPLE	143.408		0.6	1074.64	4.496
2330BC00387 STATELAND H07-0512	-23.4948	30.51111	2330BC00387 STATELAND H070512	2002/10/22	NONE	SAMPLE	81.693	10.0	0.6	1074.64	7.893
2330CB00488 STATELAND H22-0472	-23.5829	30.48583	2330CB00488 STATELAND H220472	2002/11/02	NONE	SAMPLE	97.323	10.0	0.6	1074.64	6.625
HARMINIC MEAN 2330AD00409 STATELAND H07-0458	-23.435	30.34832	2330AD00409 STATELAND H070458	2002/11/10 to 2003/01/09	NONE	SAMPLE	42.722	10.0	0.6	1074.64	15.093

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
HARMINIC MEAN 2330AD00248 BELLEVUE PORTION MAUPA - H07-0713	-23.4192	30.38443	2330AD00248 BELLEVUE PORTION MAUPA - H070713	2002/01/28 to 2002/07/21	NONE	SAMPLE	64.157	10.0	0.6	1074.64	10.050
2330CB00305 MEIDINGEN PTN. RAKWADU - H07-0012	-23.6621	30.25155	2330CB00305 MEIDINGEN H070012	2002/12/18	NONE	SAMPLE	11.656	10.0	0.6	1074.64	55.318
2330CB00497 MEIDINGEN H070498	-23.664	30.25236	2330CB00497 MEIDINGEN H070498	2002/12/18	NONE	SAMPLE	5.000	10.0	0.6	1074.64	128.957
2330CB00478 MEIDINGEN H071000	-23.6662	30.2508	2330CB00478 MEIDINGEN H071000	2002/12/18	NONE	SAMPLE	5.000	10.0	0.6	1074.64	128.957
2330CB00395 MODJADJES H071003	-23.6272	30.29033	2330CB00395 MODJADJES H071003	2002/12/19	NONE	SAMPLE	11.015	10.0	0.6	1074.64	58.537
HARMINIC MEAN 2330CB00323 MODJADJES H070051	-23.5836	30.36913	2330CB00323 MODJADJES H070051	2002/12/18 to 2008/01/24	NONE	SAMPLE	29.876	10.0	0.6	1074.64	21.582
HARMINIC MEAN 2330AD00007 VLAKFONTEIN H070408	-23.5525	30.36519	2330AD00007 VLAKFONTEIN H070408	2003/01/07 to 2008/01/28	NONE	SAMPLE	112.995	10.0	0.6	1074.64	5.706
HARMINIC MEAN 2330CB00498 MODJADJES H070502	-23.5908	30.372	2330CB00498 MODJADJES H070502	2003/01/09 to 2008/01/22	NONE	SAMPLE	95.522	10.0	0.6	1074.64	6.750
HARMINIC MEAN 2330CB00499 MOJADJES H070519	-23.5838	30.3638	2330CB00499 MOJADJES H070519	2003/01/13 to 2008/01/26	NONE	SAMPLE	121.155	10.0	0.6	1074.64	5.322
HARMINIC MEAN 2330CB00501 KROMRIVIERFONTEIN H070698	-23.5339	30.39538	2330CB00501 KROMRIVIERFONTEIN H070698	2003/01/08 to 2005/04/01	NONE	SAMPLE	128.468	10.0	0.6	1074.64	5.019
2330AD00410 STATELAND H070806	-23.4211	30.40302	2330AD00410 STATELAND H070806	2003/01/08	NONE	SAMPLE	11.979	10.0	0.6	1074.64	53.826
2330CB00477 MODJADJES H070995	-23.577	30.32405	2330CB00477 MODJADJES H070995	2003/01/08	NONE	SAMPLE	48.163	10.0	0.6	1074.64	13.388
2330AD00412 STATELAND H070111	-23.3916	30.38597	2330AD00412 STATELAND H070111	2003/01/15	NONE	SAMPLE	101.366	10.0	0.6	1074.64	6.361
HARMINIC MEAN 2330AD00414 STATELAND H070627	-23.3928	30.44302	2330AD00414 STATELAND H070627	2003/01/13 to 2008/01/20	NONE	SAMPLE	118.183	10.0	0.6	1074.64	5.456
HARMINIC MEAN 2330AD00415 BELLEVUE H070861	-23.4195	30.38122	2330AD00415 BELLEVUE H070861	2003/03/22 to 2004/06/20	NONE	SAMPLE	79.8502	10.0	0.6	1074.64	8.075
HARMINIC MEAN 2330CB00502 SENOBELA H070659	-23.5357	30.43186	2330CB00502 SENOBELA H070659	2003/07/30 to 2005/04/06	NONE	SAMPLE	79.391	10.0	0.6	1074.64	8.122
2330CB00353 MODJADJES H070683	-23.6094	30.29444	2330CB00353 MODJADJES H070683	2003/07/29	NONE	SAMPLE	18.657	10.0	0.6	1074.64	34.560

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330CB00366 MODJADJES H070685	-23.6126	30.28738	2330CB00366 MODJADJES H070685	2003/07/29	NONE	SAMPLE	14.778	10.0	0.6	1074.64	43.631
2330CB00374 MODJADJES H070760	-23.5921	30.37672	2330CB00374 MODJADJES H070760	2003/07/24	NONE	SAMPLE	60.434	10.0	0.6	1074.64	10.669
MODJADJES H070974	-23.6182	30.277	2330CB00504 MODJADJES H070974	2003/07/29	NONE	SAMPLE	5.000	10.0	0.6	1074.64	128.957
2330AD00418 WORSHESTER H070983	-23.4996	30.44327	2330AD00418 WORSHESTER H070983	2003/07/29	NONE	SAMPLE	213.311	10.0	0.6	1074.64	3.023
2330AD00261 STATELAND H070098	-23.4628	30.31416	2330AD00261 STATELAND H070098	2003/07/10	NONE	SAMPLE	260.600	10.0	0.6	1074.64	2.474
HARMINIC MEAN 2330AD00416 NORTHAMPTON H07-0710	-23.4626	30.47658	2330AD00416 NORTHAMPTON H07-0710	2003/07/09 to 2005/08/09	NONE	SAMPLE	519.917	10.0	0.6	1074.64	1.240
2330AD00300 NORTHAMPTON H07-0984	-23.472	30.46497	2330AD00300 NORTHAMPTON H070984	2003/07/09	NONE	SAMPLE	266.045	10.0	0.6	1074.64	2.424
2330AD00417 STATELAND H07-1181	-23.4628	30.31336	2330AD00417 STATELAND H071181	2003/07/07	NONE	SAMPLE	355.680	10.0	0.6	1074.64	1.813
2330CB00308 MODJADJES H07-0016	-23.6243	30.3493	2330CB00308 MODJADJES H070016	2003/10/29	NONE	SAMPLE	40.775	5.0	0.6	1074.64	15.813
2330CB00309 MODJADJES H07-0017	-23.62255	30.34958	2330CB00309 MODJADJES H070017	2003/10/29	NONE	SAMPLE	20.480	5.0	0.6	1074.64	31.484
2330AD00283 MAMAILE A H070539	-23.38361	30.42897	2330AD00283 MAMAILE A H070539	2003/10/26	NONE	SAMPLE	65.128	5.0	0.6	1074.64	9.900
2330CB00505 MODJADJES H07-1081	-23.6226	30.34655	2330CB00505 MODJADJES H071081	2003/10/08	NONE	SAMPLE	129.665	5.0	0.6	1074.64	4.973
2330CB00506 AKANANI PRIMARY SCHOOL/MAMITWASKOP H07-0819	-23.725	30.36852	2330CB00506 AKANANI PRIMARY SCHOOL/MAMITWASKOP H07-0819	2003/12/24	NONE	SAMPLE	81.538	5.0	0.6	1074.64	7.908
2330CB00378 TUMEDI PRIMARY SCHOOL/MODJADJES H07-0834	-23.6171	30.37949	2330CB00378 TUMEDI PRIMARY SCHOOL/MODJADJES H07-0834	2003/12/17	NONE	SAMPLE	20.729	5.0	0.6	1074.64	31.105
2330CB00358 SHOTONG PRIMARY SCHOOLE H07-0633	-23.6311	30.29727	2330CB00358 SHOTONG PRIMARY SCHOOLE H07-0633	2003/12/15	NONE	SAMPLE	34.897	5.0	0.6	1074.64	18.477
2330CB00359 MODIPE HIGH SCHOOL H07-0634	-23.6387	30.38963	2330CB00359 MODIPE HIGH SCHOOL H07-0634	2003/12/16	NONE	SAMPLE	18.134	5.0	0.6	1074.64	35.557
2330CB00507 KHEOPENG SCHOOL H07-1195	-23.63869	30.36088	2330CB00507 KHEOPENG SCHOOL H07-1195	2004/01/20	NONE	SAMPLE	6.602	5.0	0.6	1074.64	97.665

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPITATION (mm/a)	RECHARGE (mm/a)
2330CB00508 MODJADJES/PJAPJAMELA SCHOOL H07-1271	-23.62877	30.3985	2330CB00508 MODJADJES/PJAPJAMELA SCHOOL H07-1271	2004/01/18	NONE	SAMPLE	17.795	5.0	0.6	1074.64	36.234
2330BC00410 MEIDINGEN/RAJEKO H07-1198	-23.48897	30.50711	2330BC00410 MEIDINGEN/RAJEKO H07-1198	2004/01/10	NONE	SAMPLE	65.238	5.0	0.6	1074.64	9.884
2330CB00509 MOHLOTI SCHOOL H07-1299	-23.69227	30.35066	2330CB00509 MOHLOTI SCHOOL H071299	2004/02/22	NONE	SAMPLE	20.516	5.0	0.6	1074.64	31.428
2330AD00008 SHAWELA H07-0455	-23.48486	30.34505	2330AD00008 SHAWELA H07-0455	2004/03/30	NONE	SAMPLE	240.174	5.0	0.6	1074.64	2.685
2330AD00012 SHAWELA H07-0456	-23.47999	30.34735	2330AD00012 SHAWELA H070456	2004/04/03	NONE	SAMPLE	187.988	5.0	0.6	1074.64	3.430
2330CB00329 GAFAMANE H07-0079	-23.5003	30.41058	2330CB00329 GAFAMANE H070079	2004/05/04	NONE	SAMPLE	288.803	5.0	0.6	1074.64	2.233
2330AD00255 FEMANE H07-0082	-23.4917	30.38802	2330AD00255 FEMANE H070082	2004/05/06	NONE	SAMPLE	150.884	5.0	0.6	1074.64	4.273
2330AD00256 GA NTATA H07-0083	-23.4766	30.45672	2330AD00256 GA NTATA H070083	2004/05/12	NONE	SAMPLE	169.221	5.0	0.6	1074.64	3.810
2330BC00161 BOTSHABELO H07-0142	-23.4273	30.52124	2330BC00161 BOTSHABELO H070142	2004/05/08	NONE	SAMPLE	488.346	5.0	0.6	1074.64	1.320
2330AD00274 GA NTATA H07-0474	-23.4731	30.44413	2330AD00274 GA NTATA H070474	2004/05/09	NONE	SAMPLE	194.02	5.0	0.6	1074.64	3.323
2330AD00285 MAPHALE H07-0464	-23.4569	30.31777	2330AD00285 MAPHALE H070464	2004/06/20	NONE	SAMPLE	117.328	5.0	0.6	1074.64	5.496
2330BC00243 SIKHIMING H07-0530	-23.4267	30.15305	2330BC00243 SIKHIMING H070530	2004/04/28	NONE	SAMPLE	216.268	4.0	0.6	1074.64	2.981
2330CA00074 KGAPANE H07-1204	-23.6587	30.2376	2330CA00074 KGAPANE H071204	2004/05/17	NONE	SAMPLE	15.139	5.0	0.6	1074.64	42.591
2330CB00514 MAVELE H07-1300	-23.6759	30.41805	2330CB00514 MAVELE H071300	2004/04/20	NONE	SAMPLE	80.223	5.0	0.6	1074.64	8.037
2330CB00512 VHULAKANJANI SCHOOL H07-1304	-23.7361	30.48602	2330CB00512 VHULAKANJANI SCHOOL H071304	2004/05/18	NONE	SAMPLE	134.342	5.0	0.6	1074.64	4.800
2330CB00511 MAVELE PRIMARY SCHOOL H07-1305	-23.675	30.41955	2330CB00511 MAVELE PRIMARY SCHOOL H071305	2004/04/20	NONE	SAMPLE	56.268	5.0	0.6	1074.64	11.459
2330DA00049 UKUTHULA SCHOOL H14-1064	-23.5491	30.71141	2330DA00049 UKUTHULA SCHOOL H141064	2004/04/22	NONE	SAMPLE	171.512	5.0	0.6	1074.64	3.759
2330AD00291 MAPHALLA H07-1179	-23.4568	30.32085	2330AD00291 MAPHALLA H071179	2004/06/24	NONE	SAMPLE	115.63	5.0	0.6	1074.64	5.576

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMONIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AD00293 MAMAILA A H07-0951	-23.3943	30.43702	2330AD00293 MAMAILA A H070951	2004/06/24	NONE	SAMPLE	95.438	5.0	0.6	1074.64	6.756
2330CA00077 MANDELA PARK H07-1308	-23.6618	30.248	2330CA00077 MANDELA PARK H071308	2004/07/26	NONE	SAMPLE	8.449	5.0	0.6	1074.64	76.315
2330AD00175 MAPHALLE H071309	-23.4717	30.32352	2330AD00175 MAPHALLE H071309	2004/07/29	NONE	SAMPLE	135.649	5.0	0.6	1074.64	4.753
HARMINIC MEAN 2330AD00176 MAMAILA H071310	-23.3954	30.4365	2330AD00176 MAMAILA H071310	2004/08/04 to 2007/09/14	NONE	SAMPLE	75.421		0.6	1074.64	8.549
2330AD00211 MAKGAKGAPTSE H07-0137	-23.3709	30.49759	2330AD00211 MAKGAKGAPTSE H07-0137	2005/04/08	NONE	SAMPLE	146.712	4.0	0.6	1074.64	4.395
2330AD00212 MAKGAKGAPASTA H07-0646	-23.3936	30.495	2330AD00212 MAKGAKGAPASTA H07-0646	2005/04/12	NONE	SAMPLE	89.572	4.0	0.6	1074.64	7.198
2330CB00157 POLASENG H07-0745	-23.5357	30.3962	2330CB00157 POLASENG H07-0745	2005/04/01	NONE	SAMPLE	156.562	4.0	0.6	1074.64	4.118
2330CB00158 MOTHOBEKI H07-0797	-23.5568	30.37717	2330CB00158 MOTHOBEKI H07-0797	2005/04/01	NONE	SAMPLE	30.682	4.0	0.6	1074.64	21.015
2330CB00161 WORCESTER H07-0827	-23.5268	30.42889	2330CB00161 WORCESTER H07-0827	2005/04/02	NONE	SAMPLE	107.908	4.0	0.6	1074.64	5.975
2330CB00162 MOTHOBEKI H07-0843	-23.5477	30.37161	2330CB00162 MOTHOBEKI H07-0843	2005/04/01	NONE	SAMPLE	96.382	4.0	0.6	1074.64	6.690
2330AD00213 MAHLABONENG H07-0845	-23.4726	30.38653	2330AD00213 MAHLABONENG H07-0845	2005/04/10	NONE	SAMPLE	151.547	4.0	0.6	1074.64	4.255
2330CB00164 SENOPELWA H07-0999	-23.563	30.37444	2330CB00164 SENOPELWA H07-0999	2005/04/01	NONE	SAMPLE	464.804	4.0	0.6	1074.64	1.387
2330AD00217 THAKO H07-1359	-23.4964	30.30897	2330AD00217 THAKO H07-1359	2005/04/01	NONE	SAMPLE	10.602	4.0	0.6	1074.64	60.817
2330BC00175 RATJEKE H07-0233	-23.5019	30.49956	2330BC00175 RATJEKE H07-0233	2005/04/16	NONE	SAMPLE	58.454	4.0	0.6	1074.64	11.031
2330AD00224 SEDIBENE H07-0110	-23.3905	30.38572	2330AD00224 SEDIBENE H07-0110	2005/04/27	NONE	SAMPLE	158.524	4.0	0.6	1074.64	4.067
2330AD00226 MAMOKGADI H07-0118	-23.4249	30.45511	2330AD00226 MAMOKGADI H07-0118	2005/04/22	NONE	SAMPLE	195.409	4.0	0.6	1074.64	3.300
2330AD00227 SEAPHOLE H07-0522	-23.498	30.46417	2330AD00227 SEAPHOLE H07-0522	2005/04/12	NONE	SAMPLE	1202.026	4.0	0.6	1074.64	0.536
2330AD00228 JAMELA H07-0526	-23.4477	30.33919	2330AD00228 JAMELA H07-0526	2005/04/15	NONE	SAMPLE	91.768	4.0	0.6	1074.64	7.026
2330CB00169 RAMAROKA SOUTH H07-0542	-23.5159	30.35531	2330CB00169 RAMAROKA SOUTH H07-0542	2005/04/13	NONE	SAMPLE	44.640	4.0	0.6	1074.64	14.444

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETECTION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPITATION (mm/a)	RECHARGE (mm/a)
2330DA00092 MAEKGWE H07-0569	-23.501	30.51056	2330DA00092 MAEKGWE H07-0569	2005/04/09	NONE	SAMPLE	103.062	4.0	0.6	1074.64	6.256
2330AD00229 LEBAKA H07-0728	-23.474	30.37025	2330AD00229 LEBAKA H07-0728	2005/04/18	NONE	SAMPLE	287.503	4.0	0.6	1074.64	2.243
2330BC00164 KORANTA H07-0202	-23.453	30.51845	2330BC00164 KORANTA H07-0202	2005/05/12	NONE	SAMPLE	184.801	4.0	0.6	1074.64	3.489
2330AD00223 NAKAMPE H07-1222	-23.3988	30.44775	2330AD00223 NAKAMPE H07-1222	2005/05/18	NONE	SAMPLE	56.672	4.0	0.6	1074.64	11.377
2330AD00209 DITSHONENG H07-1368	-23.4988	30.32333	2330AD00209 DITSHONENG H07-1368	2005/07/25	NONE	SAMPLE	208.570	4.0	0.6	1074.64	3.091
2330AD00210 DITSHONENG H07-1369	-23.4921	30.32461	2330AD00210 DITSHOSENG H07-1369	2005/07/26	NONE	SAMPLE	211.664	4.0	0.6	1074.64	3.046
2330AD00277 MOHLABANENG H07-0447	-23.4709	30.37752	2330AD00277 MOHLABANENG H07-0447	2005/08/08	NONE	SAMPLE	289.420	4.0	0.6	1074.64	2.228
2330CB00048 MODJADJES H07-0918	-23.5718	30.37019	2330CB00048 MODJADJES H07-0918	2005/08/21	NONE	SAMPLE	3863.412	4.0	0.6	1074.64	0.167
2330AD00312 SEAPHOLE H07-1147	-23.4861	30.466	2330AD00312 SEAPHOLE H07-1147	2005/09/12	NONE	SAMPLE	122.988	4.0	0.6	1074.64	5.243
2330AD00313 SEOPOLE H07-1148	-23.4969	30.45973	2330AD00313 SEOPOLE H07-1148	2005/08/23	NONE	SAMPLE	135.415	4.0	0.6	1074.64	4.762
2330AD00231 SEFOFOTSE H07-0116	-23.434	30.4103	SEFOFOTSE H07-0116	2005/08/06	NONE	SAMPLE	134.992	4.0	0.6	1074.64	4.776
2330CB00170 KROMRIVIERFONTEIN H07-0724	-23.5286	30.40261	KROMRIVIERFONTEIN H07-0724	2005/08/18	NONE	SAMPLE	437.242	4.0	0.6	1074.64	1.475
2330AD00232 BELLEVUE H07-0822	-23.398	30.37547	BELLEVUE H07-0822	2005/08/04	NONE	SAMPLE	100.082	4.0	0.6	1074.64	6.443
2430BA00067 BISMARCK H08-1297	-23.398	30.37547	BISMARCK H08-1297	2005/08/05	NONE	SAMPLE	184.296	4.0	0.6	1074.64	3.499
2330BC00225 ELANDSFONTEIN H07-1080	-23.4309	30.51306	2330BC00225 ELANDSFONTEIN H07-1080	2005/08/27	NONE	SAMPLE	326.415	4.0	0.6	1074.64	1.975
2330AD00207 BELLEVUE H07-1389	-23.4343	30.35	2330AD00207 BELLEVUE H07-1389	2005/11/18	NONE	SAMPLE	45.398	4.0	0.6	1074.64	14.203
2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	-23.4637	30.36994	2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	2006/03/28	NONE	SAMPLE	168.171	4.0	0.6	1074.64	3.834
2330AD00235 STATELAND PTN. MAMAILA - H07-1408	-23.3937	30.43511	2330AD00235 STATELAND PTN. MAMAILA - H07-1408	2006/03/30	NONE	SAMPLE	67.59	4.0	0.6	1074.64	9.540

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	-23.5527	30.39552	2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	2006/03/25	NONE	SAMPLE	345.713	4.0	0.6	1074.64	1.865
2330AD00276 NORTHAMPTON PTN. GA-NTATA - H07-0476	-23.4752	30.44773	2330AD00276 NORTHAMPTON PTN. GA-NTATA - H07-0476	2006/07/06	NONE	SAMPLE	363.658	4.0	0.6	1074.64	1.773
2330AD00231 SEFOFOTSE H07-0116	-23.434	30.4103	SEFOFOTSE H07-0116	2005/08/06	NONE	SAMPLE	134.992	4.0	0.6	1074.64	4.776
2330CB00170 KROMRIVIERFONTEIN H07-0724	-23.5286	30.40261	KROMRIVIERFONTEIN H07-0724	2005/08/18	NONE	SAMPLE	437.242	4.0	0.6	1074.64	1.475
2330AD00232 BELLEVUE H07-0822	-23.398	30.37547	BELLEVUE H07-0822	2005/08/04	NONE	SAMPLE	100.082	4.0	0.6	1074.64	6.443
2430BA00067 BISMARCK H08-1297	-23.398	30.37547	BISMARCK H08-1297	2005/08/05	NONE	SAMPLE	184.296	4.0	0.6	1074.64	3.499
2330BC00225 ELANDSFONTEIN H07-1080	-23.4309	30.51306	2330BC00225 ELANDSFONTEIN H07-1080	2005/08/27	NONE	SAMPLE	326.415	4.0	0.6	1074.64	1.975
2330AD00207 BELLEVUE H07-1389	-23.4343	30.35	2330AD00207 BELLEVUE H07-1389	2005/11/18	NONE	SAMPLE	45.398	4.0	0.6	1074.64	14.203
2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	-23.4637	30.36994	2330AD00233 STATELAND PTN. LEBAKA / MOHLABANENG - H07-1407	2006/03/28	NONE	SAMPLE	168.171	4.0	0.6	1074.64	3.834
2330AD00235 STATELAND PTN. MAMAILA - H07-1408	-23.3937	30.43511	2330AD00235 STATELAND PTN. MAMAILA - H07-1408	2006/03/30	NONE	SAMPLE	67.59	4.0	0.6	1074.64	9.540
2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	-23.5527	30.39552	2330CB00191 SENOBELA PTN. SENOPELA - H07-1413	2006/03/25	NONE	SAMPLE	345.713	4.0	0.6	1074.64	1.865
2330CB00321 MODJADJE PTN. MATSWE - H07-0047	-23.5868	30.3575	2330CB00321 MODJADJE PTN. MATSWE - H07-0047	2006/07/07	NONE	SAMPLE	132.882	4.0	0.6	1074.64	4.852
2330CB00420 MODJADJES PTN. MATSHWE - H07-1075	-23.5856	30.3572	2330CB00420 MODJADJES PTN. MATSHWE - H07-1075	2006/10/09	NONE	SAMPLE	45.918	4.0	0.6	1074.64	14.042
2330AD00308 WORCESTER PTN. FEMANE - H07-0081	-23.4998	30.41298	2330AD00308 WORCESTER PTN. FEMANE - H07-0081	2007/09/16	NONE	SAMPLE	1764.776	4.0	0.6	1074.64	0.365
2330AD00315 BELLEVUE PTN. JAMELA - H07-0814	-23.4382	30.35005	2330AD00315 BELLEVUE PTN. JAMELA - H07-0814	2007/09/12	NONE	SAMPLE	73.771	4.0	0.6	1074.64	8.740
2330AD00336 STATELAND PTN. MAMAILA - H07-0852	-23.3832	30.43195	2330AD00336 STATELAND PTN. MAMAILA - H07-0852	2007/09/15	NONE	SAMPLE	76.099	4.0	0.6	1074.64	8.473
2330AD00180 STATELAND PTN. BELLEVUE - H07-0622	-23.4158	30.41739	2330AD00180 STATELAND PTN. BELLEVUE - H07-0622	2007/09/13	NONE	SAMPLE	69.22	4.0	0.6	1074.64	9.315
2330CB00203 DJADJES PTN. MATSWE - H07-0756	-23.5794	30.36589	2330CB00203 MODJADJES PTN. MATSWE - H07-0756	2008/01/23	NONE	SAMPLE	53.885	4.0	0.6	1074.64	11.966

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330CB00207 ODJADJES LOC. PTN. BOSHAGE - H07-1472	-23.5728	30.34563	2330CB00207 MODJADJES PTN. BOSHAGE - H07-1472	2008/01/29	NONE	SAMPLE	65.392	4.0	0.6	1074.64	9.860
2330CA00051 MNGEN PTN. RAPITSI - H07-0783	-23.6632	30.23166	2330CA00051 MEIDINGEN PTN. RAPITSI - H07-0783	2008/02/07	NONE	SAMPLE	9.924	4.0	0.6	1074.64	64.972
2330CA00032 SCHOONGELEGEN PTN. RAPITSI - H07-1482	-23.6725	30.23246	2330CA00032 SCHOONGELEGEN PTN. RAPITSI - H07-1482	2008/02/19	NONE	SAMPLE	7.311	4.0	0.6	1074.64	88.194
2330CA00036 SCHOONGELEGEN PTN. RAPITSI - H07-1498	-23.6699	30.23401	2330CA00036 SCHOONGELEGEN PTN. RAPITSI - H07-1498	2008/02/17	NONE	SAMPLE	9.14	4.0	0.6	1074.64	70.545
2330CA00078 SLEGEN PTN. GA-RAPITSI - H07-1499	-23.6686	30.23463	2330CA00078 SCHOONGELEGEN PTN. GA-RAPITSI - H07-1499	2008/02/20	NONE	SAMPLE	8.606	4.0	0.6	1074.64	74.923
2330CB00211 JADJES PTN. SEKHUTENG - H07-1516	-23.6196	30.32668	2330CB00211 MODJADJES PTN. SEKHUTENG - H07-1516	2008/05/22	NONE	SAMPLE	59.877		0.6	1074.64	10.768
HARMONIC MEAN FOR CHLORIDE IN GROUNDWATER FOR QUATERNARY CATCHMENT B81G							**25.592**			**TOTAL RECHARGE**	**25.195**

Table A-7: Recharge for Middle Letaba (B82D) quaternary catchment.

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEAT.URE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AC00119 VAALWATER	-23.4189	30.143611	VAALWATER (DUPL NAME 5)	1995/11/13	NONE	SAMPLE	24.700	3.0	0.6	1074.710	20.330
HARMONIC MEAN 2330AC00118 ROERFONTEIN	-23.3878	30.1625	ROERFONTEIN (DUPL NAME 4)	1995/11/13 to 1995/12/10	NONE	SAMPLE	14.789	3.0	0.6	1074.710	33.955
HARMONIC MEAN 2330AC00237 ROERFONTEIN	-23.3881	30.163056	ROERFONTEIN (DUPL NAME 5)	1995/11/17 to 1995/12/11	NONE	SAMPLE	14.890	3.0	0.6	1074.710	33.725
HARMONIC MEAN 2330AC00237 ROERFONTEIN	-23.3881	30.163056	ROERFONTEIN (DUPL NAME 5)	1995/12/13 to 1998/05/19	NONE	SAMPLE	22.510	3.0	0.6	1074.710	22.308
2330AC00115 ZOETFONTEIN	-23.3767	30.18	ZOETFONTEIN (DUPL NAME 3)	1995/11/28	NONE	SAMPLE	36.300	3.0	0.6	1074.710	13.834
2330AC00116 ROERFONTEIN	-23.3936	30.161111	ROERFONTEIN (DUPL NAME 1)	1995/11/24	NONE	SAMPLE	20.000	3.0	0.6	1074.710	25.108
LEMONDOKOP (DUP NAME 7177)	-23.4411	30.155	LEMONDOKOP (DUPL NAME 2)	1997/07/09	NONE	SAMPLE	14.900	3.0	0.6	1074.710	33.702
GROOTFONTEIN (DUP NAME 7180)	-23.2978	30.318333	GROOTFONTEIN (DUPL NAME 58)	1997/07/13	NONE	SAMPLE	364.700	3.0	0.6	1074.710	1.377
ZONNEBLOEM (DUP NAME 7183)	-23.2986	30.303611	ZONNEBLOEM (DUPL NAME 5)	1997/07/18	NONE	SAMPLE	33.900	3.0	0.6	1074.710	14.813
ZONNEBLOEM (DUP NAME 7186)	-23.2958	30.308611	ZONNEBLOEM (DUPL NAME 3)	1997/07/20	NONE	SAMPLE	53.100	3.0	0.6	1074.710	9.457
LEMONDOKOP (DUP NAME 7187)	-23.4406	30.141111	LEMONDOKOP (DUPL NAME 1)	1997/07/07	NONE	SAMPLE	7.400	3.0	0.6	1074.710	67.859
2330AC00227 KLIPKRAAL PTN. THAKGALANE - H10-0213	-23.4472	30.053611	KLIPKRAAL (DUPL NAME 1)	1997/07/11	NONE	SAMPLE	10.900	3.0	0.6	1074.710	46.070
GROOTFONTEIN (DUP NAME 7189)	-23.2906	30.321944	GROOTFONTEIN (DUPL NAME 7)	1997/07/15	NONE	SAMPLE	60.900	3.0	0.6	1074.710	8.246
KWAGGAFONTEIN (DUP NAME 7196)	-23.2797	30.327222	KWAGGAFONTEIN (DUPL NAME 1)	1997/07/16	NONE	SAMPLE	41.700	3.0	0.6	1074.710	12.042
UITSPAN (DUP NAME 7225)	-23.4636	30.001944	UITSPAN (DUPL NAME 3)	1997/07/24	NONE	SAMPLE	61.600	3.0	0.6	1074.710	8.152
HARMONIC MEAN 2330AC00231 UITSPAN H100624	-23.4594	30.001944	UITSPAN (DUPL NAME 4)	1997/07/30 to 2002/10/04	NONE	SAMPLE	4.737	3.0	0.6	1074.710	106.008
UITSPAN (DUP NAME 7226)	-23.4603	30.0025	UITSPAN (DUPL NAME 5)	1997/07/21	NONE	SAMPLE	5.500	3.0	0.6	1074.710	91.302

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPITATION (mm/a)	RECHARGE (mm/a)
2330AC00225 BLINKWATER	-23.4456	30.058889	BLINKWATER (DUPL NAME 5)	1997/07/25	NONE	SAMPLE	12.200	3.0	0.6	1074.710	41.161
HARMONIC MEAN 2330AC00226 BLINKWATER PTN. THAKGALANE - H10-0617	-23.4444	30.059722	BLINKWATER (DUPL NAME 6)	1997/07/29 to 2002/10/04	NONE	SAMPLE	10.662	3.0	0.6	1074.710	47.098
UITSPAN (DUP NAME 7227)	-23.4603	30.001944	UITSPAN (DUPL NAME 2)	1997/08/02	NONE	SAMPLE	5.500	3.0	0.6	1074.710	91.302
ZONNEBLOEM (DUP NAME 7235)	-23.3044	30.296111	ZONNEBLOEM (DUPL NAME 6)	1997/08/02	NONE	SAMPLE	45.900	3.0	0.6	1074.710	10.940
HARMONIC MEAN ZONNEBLOEM (DUP NAME 7239)	-23.2972	30.299722	ZONNEBLOEM (DUPL NAME 4)	1997/08/05 to 2002/08/27	NONE	SAMPLE	25.990	3.0	0.6	1074.710	19.321
2330AC00206 VAALWATER - H10-0196	-23.4183	30.144444	VAALWATER (DUPL NAME 1)	1997/08/15	NONE	SAMPLE	20.000	3.0	0.6	1074.710	25.108
HARMONIC MEAN 2330AC00205 VAALWATER - H10-0194	-23.4172	30.145833	VAALWATER (DUPL NAME 2)	1997/08/14 to 2008/01/15	NONE	SAMPLE	28.502	3.0	0.6	1074.710	17.618
HARMONIC MEAN 2330AC00204 VAALWATER - H10-0191	-23.4156	30.153611	VAALWATER (DUPL NAME 3)	1997/08/12 to 2002/08/30	NONE	SAMPLE	45.024	3.0	0.6	1074.710	11.153
2330AD00171 BLINKWATER - H10-0005	-23.4042	30.3375	2330AD00171 BLINKWATER	1997/09/08	NONE	SAMPLE	209.100	3.0	0.6	1074.710	2.402
2330AC00207 VAALWATER - H10-0198	-23.4139	30.146111	VAALWATER (DUPL NAME 4)	1997/08/19	NONE	SAMPLE	77.500	3.0	0.6	1074.710	6.479
AMSTERDAM (DUP NAME 7306)	-23.3967	30.289722	AMSTERDAM (DUPL NAME 7)	1997/09/02	NONE	SAMPLE	96.300	3.0	0.6	1074.710	5.215
HARMONIC MEAN 2330AC00188 ROTTERDAM - H100013	-23.4158	30.244722	ROTTERDAM (DUPL NAME 4)	1997/09/05 to 2004/06/08	NONE	SAMPLE	63.636	3.0	0.6	1074.710	7.891
2330AD00322 ROTTERDAM - H10-0012	-23.4072	30.265833	ROTTERDAM (DUPL NAME 5)	1997/09/02	NONE	SAMPLE	194.100	3.0	0.6	1074.710	2.587
HARMONIC MEAN 2330AD00325 ROTTERDAM - H10-0011	-23.4006	30.268889	AMSTERDAM (DUPL NAME 8)	1997/09/09 to 2004/06/16	NONE	SAMPLE	264.531	3.0	0.6	1074.710	1.898
AMSTERDAM (DUP NAME 7361)	-23.4017	30.301389	AMSTERDAM (DUPL NAME 24)	1997/09/14	NONE	SAMPLE	93.600	3.0	0.6	1074.710	5.365
2330AD00170 BLINKWATER	-23.4097	30.335556	2330AD00170 BLINKWATER	1997/09/15	NONE	SAMPLE	147.600	3.0	0.6	1074.710	3.402
OLIFANTSHOEK (DUP NAME 7362)	-23.3297	30.273889	OLIFANTSHOEK (DUPL NAME 8)	1997/09/22	NONE	SAMPLE	28.700	3.0	0.6	1074.710	17.497
OLIFANTSHOEK (DUP NAME 7363)	-23.3292	30.273056	OLIFANTSHOEK (DUPL NAME 9)	1997/09/18	NONE	SAMPLE	9.800	3.0	0.6	1074.710	51.241

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AD00318 AMSTERDAM - H10-0008	-23.4033	30.304722	AMSTERDAM (DUPL NAME 25)	1997/09/22	NONE	SAMPLE	305.400	3.0	0.6	1074.710	1.644
2330AD00172 BLINKWATER - H10-0007	-23.4022	30.324444	2330AD00172 BLINKWATER	1997/09/09	NONE	SAMPLE	204.100	3.0	0.6	1074.710	2.460
2330AD00096 STATELAND PTN. NDEGEZA A	-23.3117	30.403889	NDEGEZA A (HOOFKRAAL	1997/09/19	NONE	SAMPLE	91.300	3.0	0.6	1074.710	5.500
OLIFANTSHOEK (DUP NAME 7415)	-23.3289	30.270556	OLIFANTSHOEK (DUPL NAME 1)	1997/10/20	NONE	SAMPLE	23.000	3.0	0.6	1074.710	21.833
HARMONIC MEAN 2330AC00193 ROERFONTEIN - H10-0029	-23.3756	30.178056	ROERFONTEIN (DUPL NAME 2)	1997/11/04 to 2002/08/29	NONE	SAMPLE	53.306	3.0	0.6	1074.710	9.420
2330AC00191 ROERFONTEIN - H10-0024	-23.3753	30.178611	ROERFONTEIN (DUPL NAME 3)	1997/11/01	NONE	SAMPLE	39.200	3.0	0.6	1074.710	12.810
2330AD00128 STATELAND PTN. XIMAWUSA - H10-0002	-23.4044	30.345556	BLINKWATER (DUPL NAME 7)	1997/10/24	NONE	SAMPLE	24.500	3.0	0.6	1074.710	20.496
2330AC00317 ROTTERDAM	-23.4228	30.259722	ROTTERDAM (DUPL NAME 6)	1997/10/18	NONE	SAMPLE	117.400	3.0	0.6	1074.710	4.277
OLIFANTSHOEK (DUP NAME 7416)	-23.3289	30.271667	OLIFANTSHOEK (DUPL NAME 2)	1997/10/11	NONE	SAMPLE	29.400	3.0	0.6	1074.710	17.080
OLIFANTSHOEK (DUP NAME 7417)	-23.3289	30.270833	OLIFANTSHOEK (DUPL NAME 3)	1997/10/19	NONE	SAMPLE	13.100	3.0	0.6	1074.710	38.333
OLIFANTSHOEK (DUP NAME 7418)	-23.3289	30.270278	OLIFANTSHOEK (DUPL NAME 4)	1997/10/16	NONE	SAMPLE	32.000	3.0	0.6	1074.710	15.692
ROTTERDAM (DUP NAME 7419)	-23.4156	30.243889	ROTTERDAM (DUPL NAME 7)	1997/10/18	NONE	SAMPLE	59.400	3.0	0.6	1074.710	8.454
HARMONIC MEAN OLIFANTSHOEK (DUP NAME 7420)	-23.3361	30.286389	OLIFANTSHOEK (DUPL NAME 5)	1997/10/12 to 2002/10/08	NONE	SAMPLE	72.738	3.0	0.6	1074.710	6.904
2330AD00149 MAGORO - MAGR11	-23.2881	30.327778	MAGORO (DUPL NAME 1)	1997/10/28	NONE	SAMPLE	302.000	3.0	0.6	1074.710	1.663
2330AD00152 MAGORO - MAGR22	-23.2933	30.315833	MAGORO (DUPL NAME 2)	1997/10/28	NONE	SAMPLE	73.500	3.0	0.6	1074.710	6.832
HARMONIC MEAN 2330AC00192 ROERFONTEIN - H10-0028	-23.3836	30.175	ROERFONTEIN (DUPL NAME 7)	1997/10/30 to 2002/08/29	NONE	SAMPLE	29.546	3.0	0.6	1074.710	16.996
2330AD00116 STATELAND PTN. NOBLEHOEK PTN. MAHLAHLANDELA	-23.3511	30.370833	NOBLEHOEK MAHLAHLANDELA	1997/10/30	NONE	SAMPLE	131.700	3.0	0.6	1074.710	3.813
2330AD00262 STATELAND PTN. MAPHALLE - H07-0101	-23.4578	30.309167	MARHALLE STAATSGROND	1997/11/28	NONE	SAMPLE	271.000	3.0	0.6	1074.710	1.853

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AD00298 STATELAND PTN. MAPHALLE - H07-0865	-23.4611	30.304722	STAATSGROND (DUPL NAME 30)	1997/11/01	NONE	SAMPLE	693.000	3.0	0.6	1074.710	0.725
2330AD00271 STATELAND PTN. MAPHALLE - H07-0462	-23.4561	30.308611	STAATSGROND (DUPL NAME 10)	1997/12/07	NONE	SAMPLE	346.800	3.0	0.6	1074.710	1.448
2330AD00397 HERDERWATER PTN. RIBUNGWANI	-23.2714	30.288056	RIBUNGWANI (DUPL NAME 3)	1997/12/02	NONE	SAMPLE	20.000	3.0	0.6	1074.710	25.108
2330AC00315 HARTE BEEST FONTEIN PTN. REMBULUWANI - H17-0279	-23.2986	30.244167	RIBUNGWANI (DUPL NAME 1)	1997/12/10	NONE	SAMPLE	96.800	3.0	0.6	1074.710	5.188
HARMONIC MEAN 2330AD00088 STATELAND PTN. NDENGEZA	-23.315	30.404722	NDENGEZA (DUPL NAME 1)	1997/10/17 to 1997/12/15	NONE	SAMPLE	150.727	3.0	0.6	1074.710	3.332
NDENGEZA	-23.2969	30.405556	NDENGEZA (DUPL NAME 2)	1997/12/08	NONE	SAMPLE	138.700	3.0	0.6	1074.710	3.620
2330AD00360 STATELAND PTN. NDENGEZA	-23.3139	30.401944	NDENGEZA (DUPL NAME 3)	1997/11/12	NONE	SAMPLE	46.600	3.0	0.6	1074.710	10.776
STAATSGROND (DUP NAME 7647)	-23.2881	30.291667	STAATSGROND (DUPL NAME 12)	1997/11/20	NONE	SAMPLE	28.400	3.0	0.6	1074.710	17.682
2330AD00406 HELDER WATER PTN. RIBUNGWANI	-23.2717	30.288611	RIBUNGWANI (DUPL NAME 2)	1998/01/21	NONE	SAMPLE	29.000	3.0	0.6	1074.710	17.316
2330AD00398 HELDERWATER PTN. RIBUNGWANI	-23.2714	30.288611	RIBUNGWANI (DUPL NAME 4)	1998/01/21	NONE	SAMPLE	29.900	3.0	0.6	1074.710	16.795
2330AD00362 STATE LAND PTN. NDENGEZA	-23.3136	30.404444	STATE LAND (DUPL NAME 8)	1998/02/02	NONE	SAMPLE	79.200	3.0	0.6	1074.710	6.340
HARMONIC MEAN 2330AD00369 STATELAND PTN. NOBLEHOEK PTN. MUHL	-23.3456	30.367778	STATELAND (DUPL NAME 13)	1998/02/02 to 1998/05/01	NONE	SAMPLE	85.389	3.0	0.6	1074.710	5.881
2330AD00367 STATELAND PTN. NOBLEHOEK PTN. MUHL	-23.3328	30.376944	STATELAND (DUPL NAME 1)	1998/02/09	NONE	SAMPLE	145.200	3.0	0.6	1074.710	3.458
HELDERWATER (DUP NAME 8000)	-23.2878	30.270556	HELDERWATER (DUPL NAME 1)	1998/02/13	NONE	SAMPLE	16.200	3.0	0.6	1074.710	30.998
STATELAND (DUP NAME 8019)	-23.3264	30.413611	STATELAND (DUPL NAME 4)	1998/02/14	NONE	SAMPLE	101.300	3.0	0.6	1074.710	4.957
2330AD00370 STATELAND PTN. NOBLEHOEK PTN. MUKL	-23.3294	30.376944	STATELAND (DUPL NAME 5)	1998/02/10	NONE	SAMPLE	112.200	3.0	0.6	1074.710	4.476
STATELAND (DUP NAME 8020)	-23.3428	30.371389	STATELAND (DUPL NAME 6)	1998/02/11	NONE	SAMPLE	66.200	3.0	0.6	1074.710	7.585
2330AD00160 HELDERWATER PTN. RIBUNGWANI - H17-0113	-23.2647	30.288056	HELDERWATER (DUPL NAME 2)	1998/05/14	NONE	SAMPLE	20.300	3.0	0.6	1074.710	24.737

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPITATI ON (mm/a)	RECHARGE (mm/a)
HELDERWATER (DUP NAME 8066)	-23.285	30.292222	HELDERWATER (DUPL NAME 3)	1998/05/23	NONE	SAMPLE	25.300	3.0	0.6	1074.710	19.848
HARMONIC MEAN 2330AC00238 KLIPKRAAL H100215	-23.4533	30.052778	KLIPKRAAL (DUPL NAME 18)	1998/05/17 to 2002/10/03	NONE	SAMPLE	19.409	3.0	0.6	1074.710	25.873
HARMONIC MEAN 2330AC00232 KLIPKRAAL PTN. THAGALANE - H10-0213	-23.4617	30.051111	KLIPKRAAL (DUPL NAME 2)	1998/05/08 to 2008/02/25	NONE	SAMPLE	20.668	3.0	0.6	1074.710	24.296
HARMONIC MEAN 2330AC00233 KLIPKRAAL H100214	-23.4581	30.048056	KLIPKRAAL (DUPL NAME 3)	1998/05/10 to 2004/06/03	NONE	SAMPLE	18.170	3.0	0.6	1074.710	27.637
HARTEBEESFONTEIN (DUP NAME 8082)	-23.275	30.243611	HARTEBEESFONTEIN (DUPL NAME 18)	1998/05/28	NONE	SAMPLE	192.300	3.0	0.6	1074.710	2.611
2330AC00317 HARTEBEESTFONTEIN PTN MASAKONA-NEWSTAN -H17-0280	-23.2864	30.242222	HARTEBEESFONTEIN (DUPL NAME 7)	1998/05/19	NONE	SAMPLE	67.400	3.0	0.6	1074.710	7.450
MIDDAGZON 524LS	-23.4539	29.998611	MIDDAGZON 524LS	1979/04/19	NONE	SAMPLE	27.700	3.0	0.6	1074.710	18.129
2330AD00262 MAPHALLE	-23.4575	30.309444	MAPHALLE (DUPL NAME 1)	1995/07/19	NONE	SAMPLE	241.000	3.0	0.6	1074.710	2.084
MALEKWA	-23.2978	30.2975	MALEKWA	1996/05/04	NONE	SAMPLE	96.700	3.0	0.6	1074.710	5.193
HARMONIC MEAN MIDDELWATER (DUP NAME 30795)	-23.3986	30.224444	MIDDELWATER (DUPL NAME 3)	1996/10/29 to 2008/01/18	NONE	SAMPLE	304.222	3.0	0.6	1074.710	1.651
2330AC00142 ZEEKOEFONTEIN PTN. MIDDELWATER - H10-0169	-23.3906	30.214722	MIDDELWATER (DUPL NAME 4)	1996/10/28	NONE	SAMPLE	31.800	3.0	0.6	1074.710	15.791
2330AC00196 HARTEBEESTFONTEIN PTN. GA-MAMAILA - H10-0158	-23.3456	30.246944	GA-MAMAILA (DUPL NAME 1)	1996/10/20	NONE	SAMPLE	69.100	3.0	0.6	1074.710	7.267
2330AC00198 HARTEBEESTFONTEIN PTN. GA-MAMAILA	-23.3594	30.234444	GA-MAMAILA (DUPL NAME 2)	1996/10/26	NONE	SAMPLE	110.500	3.0	0.6	1074.710	4.544
2330AC00197 HARTEBEESTFONTEIN PTN. MAMAILA - H10-0165	-23.3583	30.236944	HARTEBEESFFONTEIN	1996/10/24	NONE	SAMPLE	76.300	3.0	0.6	1074.710	6.581
2330AC00210 ZEEKOEWATER PTN. MIDDELWATER - H10-0183	-23.4203	30.203333	ZEEKOEIWATER (DUPL NAME 1)	1996/11/01	NONE	SAMPLE	53.400	3.0	0.6	1074.710	9.404
2330AC00203 ZEEKOEWATER PTN. MIDDELWATER - H10-0181	-23.4225	30.200278	ZEEKOEIWATER (DUPL NAME 2)	1996/11/08	NONE	SAMPLE	18.600	3.0	0.6	1074.710	26.998
ZEEKOEIWATER	-23.4192	30.2025	ZEEKOEIWATER (DUPL NAME 3)	1996/11/02	NONE	SAMPLE	50.500	3.0	0.6	1074.710	9.944
HARMONIC MEAN 2330AC00067 MIDDELWATER H100442	-23.3953	30.228333	2330AC00067 MIDDELWATER H100442	1996/11/02 to 2004/08/03	NONE	SAMPLE	117.333	3.0	0.6	1074.710	4.280

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPITATI ON (mm/a)	RECHARGE (mm/a)
MIDDELWATER (DUP NAME 30848)	-23.3989	30.234722	MIDDELWATER (DUPL NAME 5)	1996/11/03	NONE	SAMPLE	59.800	3.0	0.6	1074.710	8.397
MIDDELWATER (DUP NAME 30849)	-23.4025	30.232222	MIDDELWATER (DUPL NAME 6)	1996/10/31	NONE	SAMPLE	101.500	3.0	0.6	1074.710	4.947
2330AC00201 HARTEBEESTFONTEIN PTN. MAMAILA - H10-0171	-23.3625	30.234722	GA-MAMAILE	1996/10/30	NONE	SAMPLE	54.200	3.0	0.6	1074.710	9.265
2330AC00071 HARTEBEESFONTEIN - H10-0472	-23.3506	30.235556	HARTEBEESFONTEIN (DUPL NAME 5)	1996/10/25	NONE	SAMPLE	157.700	3.0	0.6	1074.710	3.184
HARMONIC MEAN HARTEBEESFONTEIN (DUP NAME 30850)	-23.3589	30.224722	HARTEBEESFONTEIN (DUPL NAME 6)	1996/11/08 to 1996/11/09	NONE	SAMPLE	37.641	3.0	0.6	1074.710	13.341
2330AC00283 BONTFONTEIN PTN. GA-PHOOKO - H10-0342	-23.3758	30.153056	ZOETFONTEIN (DUPL NAME 19)	1996/11/16	NONE	SAMPLE	32.400	3.0	0.6	1074.710	15.499
HARMONIC MEAN 2330AC00217 ZOETFONTEIN PTN. GA-PHOOKO - H10-0598	-23.3669	30.158611	ZOETFONTEIN (DUPL NAME 20)	1996/11/11 to 2002/08/30	NONE	SAMPLE	54.289	3.0	0.6	1074.710	9.250
2330AC00195 BONTFONTEIN PTN. GA-PHAAKO - H10-0151	-23.37	30.148611	BONTFONTEIN (DUPL NAME 2)	1996/12/02	NONE	SAMPLE	26.400	3.0	0.6	1074.710	19.021
HARMONIC MEAN 2330AC00218 BONTFONTEIN PTN. GA-PHOOKO - H10-0431	-23.3614	30.144722	BONTFONTEIN (DUPL NAME 3)	1996/11/25 to 2005/01/19	NONE	SAMPLE	40.784	3.0	0.6	1074.710	12.313
2330AC00220 ROERFONTEIN PTN. GA- PHOOKO - H10-0601	-23.38	30.168611	ROERFONTEIN (DUPL NAME 6)	1996/12/10	NONE	SAMPLE	67.700	3.0	0.6	1074.710	7.417
2330AC00135 ZOETFONTEIN	-23.3775	30.16889	2330AC00135 ZOETFONTEIN	1996/11/02	NONE	SAMPLE	61.900	3.0	0.6	1074.710	8.112
ZOETFONTEIN (DUP NAME 30908)	-23.3647	30.150556	ZOETFONTEIN (DUPL NAME 21)	1996/12/07	NONE	SAMPLE	20.300	3.0	0.6	1074.710	24.737
BONTFONTEIN (DUP NAME 30909)	-23.3817	30.142778	BONTFONTEIN (DUPL NAME 4)	1996/12/04	NONE	SAMPLE	15.400	3.0	0.6	1074.710	32.608
ZOETFONTEIN (DUP NAME 30910)	-23.3661	30.165833	ZOETFONTEIN (DUPL NAME 22)	1996/12/10	NONE	SAMPLE	47.800	3.0	0.6	1074.710	10.505
ZOETFONTEIN (DUP NAME 30911)	-23.3697	30.160556	ZOETFONTEIN (DUPL NAME 4)	1996/11/29	NONE	SAMPLE	118.900	3.0	0.6	1074.710	4.223
ZOETFONTEIN (DUP NAME 30912)	-23.3364	30.153333	ZOETFONTEIN (DUPL NAME 5)	1996/11/25	NONE	SAMPLE	35.500	3.0	0.6	1074.710	14.145
BONTFONTEIN (DUP NAME 30914)	-23.3575	30.1475	BONTFONTEIN (DUPL NAME 1)	1996/11/19	NONE	SAMPLE	33.400	3.0	0.6	1074.710	15.035
2330AC00199 ARTEBEESFONTEIN PTN. MIDDELWATER - H10-0167	-23.3492	30.235833	MIDDELWATER (DUPL NAME 7)	1996/10/25	NONE	SAMPLE	45.200	3.0	0.6	1074.710	11.110
WORCESTER (DUP NAME 30932)	-23.3472	30.42	WORCESTER (DUPL NAME 25)	1997/01/21	NONE	SAMPLE	71.900	3.0	0.6	1074.710	6.984

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
HARMONIC MEAN ZONNEBLOEM (DUP NAME 31054)	-23.3047	30.293333	ZONNEBLOEM (DUPL NAME 1)	1997/06/14 to 2002/08/27	NONE	SAMPLE	32.561	3.0	0.6	1074.710	15.422
HARMONIC MEAN 2330AC00175 LEMONDOKOP H10-0579	-23.4397	30.141944	2330AC00175 LEMONDOKOP H10-0579	1997/06/22 to 2002/08/30	NONE	SAMPLE	10.579	3.0	0.6	1074.710	47.468
HARTEBEESFONTEIN (DUP NAME 31055)	-23.3511	30.235278	HARTEBEESFONTEIN (DUPL NAME 17)	1997/06/16	NONE	SAMPLE	163.400	3.0	0.6	1074.710	3.073
HARMONIC MEAN ZONNEBLOM	-23.3053	30.293333	ZONNEBLOM	1997/06/19 to 2002/08/27	NONE	SAMPLE	31.030	3.0	0.6	1074.710	16.183
ZONNEBLOEM (DUP NAME 31066)	-23.2953	30.299167	ZONNEBLOEM (DUPL NAME 2)	1997/06/20	NONE	SAMPLE	35.100	3.0	0.6	1074.710	14.307
2330AD00246 HELDERWATER - HELDERWATER CLINIC	-23.2811	30.29583	2330AD00246 HELDERWATER - HELDERWATER CLINIC	2000/02/03	NONE	SAMPLE	30.223	3.0	0.6	1074.710	16.615
HARMONIC MEAN 2330AC00147 LEMONDOKOP - H100657	-23.4394	30.1461	2330AC00147 LEMONDOKOP	2000/06/01 to 2002/08/30	NONE	SAMPLE	6.998	3.0	0.6	1074.710	71.758
HARMONIC MEAN 2330AC00345 MORGENZON H17-0415	-23.2739	30.24416	2330AC00345 MORGENZON H17-0415	2001/05/08 to 2007/07/12	NONE	SAMPLE	95.982	3.0	0.6	1074.710	5.232
2330AC00150 VOORSPOED (PLANTATION) - H100662	-23.3783	30.068889	2330AC00150 VOORSPOED (PLANTATION) - H100662	2001/06/08	NONE	SAMPLE	19.687	3.0	0.6	1074.710	25.507
2330AC00152 VAALWATER H100580	-23.4543	30.05049	2330AC00152 VAALWATER H100580	2001/08/26	NONE	SAMPLE	5.000	3.0	0.6	1074.710	100.432
HARMONIC MEAN 2330AC00153 VAALWATER H100461	-23.4362	30.15955	2330AC00153 VAALWATER H100461	2001/08/31 to 2002/11/02	NONE	SAMPLE	24.163	3.0	0.6	1074.710	20.782
HARMONIC MEAN 2330AC00055 VAALWATER H100479	-23.3914	30.14921	2330AC00055 VAALWATER H100479	2001/09/20 to 2002/09/26	NONE	SAMPLE	80.873	3.0	0.6	1074.710	6.209
HARMONIC MEAN 2330AC00057 VAALWATER H100436	-23.3899	30.14808	2330AC00057 VAALWATER H100436	2001/09/08 to 2008/02/22	NONE	SAMPLE	41.521	3.0	0.6	1074.710	12.094
2330AD00249 AMSTERDAM H100646	-23.401	30.27491	2330AD00249 AMSTERDAM H100646	2002/05/25	NONE	SAMPLE	177.311	3.0	0.6	1074.710	2.832
HARMONIC MEAN 2330AD00250 NDENGEZA CLINIC H140856	-23.3153	30.40646	2330AD00250 NDENGEZA CLINIC H140856	2002/07/03 to 2002/07/11	NONE	SAMPLE	388.574	3.0	0.6	1074.710	1.292
2330AD00251 ZONNEBLOEM H100629	-23.2958	30.30861	2330AD00251 ZONNEBLOEM H100629	2002/08/28	NONE	SAMPLE	100.743	3.0	0.6	1074.710	4.985

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AC00169 ROERFONTEIN H100024	-23.4753	30.17861	2330AC00169 ROERFONTEIN H100024	2002/08/29	NONE	SAMPLE	48.262	3.0	0.6	1074.710	10.405
2330AC00171 HARTEBEESFONTEIN H100158	-23.3454	30.24597	2330AC00171 HARTEBEESFONTEIN H100158	2002/08/28	NONE	SAMPLE	81.260	3.0	0.6	1074.710	6.180
2330AC00172 HARTEBEESFONTEIN H100165	-23.3584	30.23763	2330AC00172 HARTEBEESFONTEIN H100165	2002/08/28	NONE	SAMPLE	70.936	3.0	0.6	1074.710	7.079
2330AC00143 HARTEBEESFONTEIN H100167	-23.3494	30.23627	2330AC00143 HARTEBEESFONTEIN H100167	2002/08/28	NONE	SAMPLE	68.236	10.0	0.6	1074.710	7.359
2330AC00176 ZEEKOEIWATER H100593	-23.4111	30.21327	2330AC00176 ZEEKOEIWATER H100593	2002/08/29	NONE	SAMPLE	147.062	10.0	0.6	1074.710	3.415
2330AD00156 ZONNEBLOEM H100633	-23.304	30.29594	2330AD00156 ZONNEBLOEM H100633	2002/08/27	NONE	SAMPLE	70.791	10.0	0.6	1074.710	7.094
2330AD00252 GROOTFONTEIN H100743	-23.2865	30.3233	2330AD00252 GROOTFONTEIN H100743	2002/08/31	NONE	SAMPLE	39.923	10.0	0.6	1074.710	12.578
2330AD00253 STATELAND H140330	-23.3267	30.387	2330AD00253 STATELAND H140330	2002/08/29	NONE	SAMPLE	70.540	10.0	0.6	1074.710	7.119
HARMONIC MEAN 2330AD00254 STATELAND PTN. MUHLAHLANDLELA - H14-0801	-23.3449	30.37002	2330AD00254 STATELAND H140801	2002/08/30 to 2006/07/03	NONE	SAMPLE	48.234		0.6	1074.710	10.411
2330AC00179 ZOETFONTEIN H100154	-23.375	30.16916	2330AC00179 ZOETFONTEIN H100154	2002/09/02	NONE	SAMPLE	78.709	10.0	0.6	1074.710	6.380
2330AC00180 LEMONDOKOP H100186	-23.4603	30.15333	2330AC00180 LEMONDOKOP H100186	2002/09/02	NONE	SAMPLE	42.403	10.0	0.6	1074.710	11.843
HARMONIC MEAN 2330AC00186 HOPEFUL H170358	-23.2609	30.21002	2330AC00186 HOPEFUL H170358	2002/09/02 to 2002/10/22	NONE	SAMPLE	66.636		0.6	1074.710	7.536
2330AC00347 LEMONDOKOP H100034	-23.4467	30.16244	2330AC00347 LEMONDOKOP H100034	2002/09/10	NONE	SAMPLE	44.516	10.0	0.6	1074.710	11.280
2330AC00348 ZOETFONTEIN H100038	-23.3683	30.16175	2330AC00348 ZOETFONTEIN H100038	2002/09/02	NONE	SAMPLE	144.240	10.0	0.6	1074.710	3.481
2330AC00146 BONTFONTEIN H100151	-23.6167	30.14875	2330AC00146 BONTFONTEIN H100151	2002/09/10	NONE	SAMPLE	32.093	10.0	0.6	1074.710	15.647
2330AC00349 ZOETFONTEIN H100604	-23.3666	30.15366	2330AC00349 ZOETFONTEIN H100604	2002/09/10	NONE	SAMPLE	26.482	10.0	0.6	1074.710	18.962
2330AC00350 ZOETFONTEIN H100611	-23.3616	30.16963	2330AC00350 ZOETFONTEIN H100611	2002/09/11	NONE	SAMPLE	60.701	10.0	0.6	1074.710	8.273
HARMONIC MEAN 2330AC00351 VAALWATER PTN. WENWAMOKGOPE - H10-0748	-23.4114	30.15113	2330AC00351 VAALWATER H100748	2002/09/12 to 2006/07/23	NONE	SAMPLE	156.782		0.6	1074.710	3.203

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AD00407 MORGENZON H170578	-23.2777	30.25597	2330AD00407 MORGENZON H170578	2002/08/29	NONE	SAMPLE	124.379	10.0	0.6	1074.710	4.037
HARMONIC MEAN 2330AD00408 MORGENZON H170119	-23.262	30.25562	2330AD00408 MORGENZON H170119	2002/08/28 to 2007/08/07	NONE	SAMPLE	65.603		0.6	1074.710	7.655
HARMONIC MEAN 2330AC00033 MOSTERTHOEK H100423	-23.4036	30.11233	2330AC00033 MOSTERTHOEK H10-0423	2002/09/26 to 2004/12/03	NONE	SAMPLE	26.309		0.6	1074.710	19.087
2330AD00297 STATELAND H070841	-23.4583	30.33444	2330AD00297 STATELAND H070841	2002/10/11	NONE	SAMPLE	891.682	10.0	0.6	1074.710	0.563
2330AD00323 OLIFANTSHOEK H100015	-23.3291	30.27155	2330AD00323 OLIFANTSHOEK H100015	2002/10/07	NONE	SAMPLE	52.745	10.0	0.6	1074.710	9.521
2330AD00330 OLIFANTSHOEK H100022	-23.3294	30.27291	2330AD00330 OLIFANTSHOEK H100022	2002/10/07	NONE	SAMPLE	26.136	10.0	0.6	1074.710	19.213
HARMONIC MEAN 2330AC00235 MOPANI H100421	-23.4479	30.03905	2330AC00235 MOPANI H100421	2002/10/04 to 2004/06/10	NONE	SAMPLE	14.996		0.6	1074.710	33.486
2330AC00352 MOPANI H100636	-23.3606	30.04511	2330AC00352 MOPANI H100636	2002/10/04	NONE	SAMPLE	10.666	10.0	0.6	1074.710	47.080
2330AC00355 MOSTERTHOEKPOORT H100752	-23.4051	30.10833	2330AC00355 MOSTERTHOEKPOORT H100752	2002/09/26	NONE	SAMPLE	40.674	10.0	0.6	1074.710	12.346
2330AC00356 LEMONDOKOP H100580	-23.4378	30.1468	2330AC00356 LEMONDOKOP H100580	2002/11/03	NONE	SAMPLE	5.000	10.0	0.6	1074.710	100.432
2330AC00358 BOSCHBOKHOEK H100755	-23.4475	30.03352	2330AC00358 BOSCHBOKHOEK H100755	2002/11/06	NONE	SAMPLE	18.061	10.0	0.6	1074.710	27.804
2330AD00168 HELDERWATER H170116	-23.2773	30.28428	2330AD00168 HELDERWATER H170116	2002/11/18	NONE	SAMPLE	56.275	10.0	0.6	1074.710	8.923
2330AC00359 HARTEBEESFONTEIN H100766	-23.37	30.21083	2330AC00359 HARTEBEESFONTEIN H100766	2003/03/01	NONE	SAMPLE	24.490	10.0	0.6	1074.710	20.505
2330AC00360 MIDDELWATER H100767	-23.4058	30.21666	2330AC00360 MIDDELWATER H100767	2003/03/03	NONE	SAMPLE	84.579	10.0	0.6	1074.710	5.937
2330AC00362 MOSTERTHOEK H100747	-23.3994	30.10372	2330AC00362 MOSTERTHOEK H100747	2003/03/20	NONE	SAMPLE	74.997	10.0	0.6	1074.710	6.696
2330AC00315 HARTEBEESFONTEIN H170279	-23.2986	30.24483	2330AC00315 HARTEBEESFONTEIN H170279	2003/07/15	NONE	SAMPLE	70.630	10.0	0.6	1074.710	7.110
2330AD00419 OLIFANTSHOEK H100664	-23.3397	30.27744	2330AD00419 OLIFANTSHOEK H10066423.	2003/10/06	NONE	SAMPLE	153.463	5.0	0.6	1074.710	3.272
2330AC00376 BONTFONTEIN MOTSOKOTSA SCHOOL H100669	-23.3565	30.14287	2330AC00376 BONTFONTEIN MOTSOKOTSA SCHOOL H100669	2004/02/16	NONE	SAMPLE	56.568	5.0	0.6	1074.710	8.877

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPITATION (mm/a)	RECHARGE (mm/a)
2330AC00377 LEMONDOKOP H100670	-23.4564	30.15051	2330AC00377 LEMONDOKOP H100670	2004/02/13	NONE	SAMPLE	126.605	5.0	0.6	1074.710	3.966
2330AC00378 MIDDELWATER H100671	-23.3889	30.23844	2330AC00378 MIDDELWATER H100671	2004/02/14	NONE	SAMPLE	308.944	5.0	0.6	1074.710	1.625
2330AC00225 THAKGALANE 2 H100616	-23.4457	30.05824	2330AC00225 THAKGALANE 2 H100616	2004/06/07	NONE	SAMPLE	17.943	5.0	0.6	1074.710	27.986
2330BC00243 SIKHIMING H070530	-23.4267	30.15305	2330BC00243 SIKHIMING H070530	2004/04/28	NONE	SAMPLE	216.268	4.0	0.6	1074.710	2.322
2330AC00124 ROTTERDAM H100209	-23.3291	30.27155	2330AD00323 OLIFANTSHOEK H100015	2002/10/07	NONE	SAMPLE	20.833	10.0	0.6	1074.710	24.104
2330AD00203 PFUMELANG H10-0668	-23.3535	30.28977	2330AD00203 PFUMELANG H10-0668	2004/12/01	NONE	SAMPLE	131.003	4.0	0.6	1074.710	3.833
2330AC00151 NANAKWE H10-0672	-23.4464	30.16969	2330AC00151 NANAKWE H10-0672	2004/12/01	NONE	SAMPLE	23.220	4.0	0.6	1074.710	21.626
2330AD00204 MSENGI H10-0673	-23.4121	30.3358	2330AD00204 MSENGI H10-0673	2004/12/01	NONE	SAMPLE	81.136	4.0	0.6	1074.710	6.189
2330AC00170 TSHABELANE EAST H10-0675	-23.3978	30.15972	2330AC00170 TSHABELANE EAST H10-0675	2004/12/01	NONE	SAMPLE	23.391	4.0	0.6	1074.710	21.468
2330AC00266 ITIELENE H10-0084	-23.4034	30.09108	2330AC00266 ITIELENE H10-0084	2004/11/29	NONE	SAMPLE	16.849	4.0	0.6	1074.710	29.804
2330AC00173 LEMONDOKOP H10-0100	-23.4548	30.14419	2330AC00173 LEMONDOKOP H10-0100	2004/12/05	NONE	SAMPLE	27.495	4.0	0.6	1074.710	18.264
2330AC00290 OLIFANTSHOEK H10-0205	-23.3658	30.29497	2330AC00290 OLIFANTSHOEK H10-0205	2004/12/10	NONE	SAMPLE	41.592	4.0	0.6	1074.710	12.073
2330AC00269 PHOOKO H10-0554	-23.3366	30.16369	2330AC00269 PHOOKO H10-0554	2004/12/06	NONE	SAMPLE	30.218	4.0	0.6	1074.710	16.618
2330AC00263 ITIELENE H10-0645	-23.396	30.09408	2330AC00263 ITIELENE H10-0645	2004/11/29	NONE	SAMPLE	13.978	4.0	0.6	1074.710	35.925
2330AC00261 PHOOKHO H10-0713	-23.3313	30.16372	2330AC00261 PHOOKHO H10-0713	2004/12/09	NONE	SAMPLE	31.438	4.0	0.6	1074.710	15.973
2330AC00174 ITIELENE H10-0753	-23.3981	30.07758	2330AC00174 ITIELENE H10-0753	2004/12/01	NONE	SAMPLE	25.938	4.0	0.6	1074.710	19.360
2330AC00177 THAKGALANE H10-0754	-23.4456	30.02722	2330AC00177 THAKGALANE H10-0754	2005/01/05	NONE	SAMPLE	13.576	4.0	0.6	1074.710	36.989
2330AD00068 MAMAILA H10-0519	-23.3566	30.25388	2330AD00068 MAMAILA H10-0519	2005/01/05	NONE	SAMPLE	97.533	4.0	0.6	1074.710	5.149

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AC00178 PHOOKO H10-0143	-23.3558	30.14052	2330AC00178 PHOOKO H10-0143	2005/01/23	NONE	SAMPLE	43.451	4.0	0.6	1074.710	11.557
2330AC00074 RAPHAHLELO H10-0429	-23.3705	30.16028	2330AC00074 RAPHAHLELO H10-0429	2005/01/26	NONE	SAMPLE	173.056	4.0	0.6	1074.710	2.902
2330AD00206 MUKHLAHLANDELA H14-1099	-23.3456	30.36976	2330AD00206 MUKHLAHLANDELA H14-1099	2005/01/24	NONE	SAMPLE	539.937	4.0	0.6	1074.710	0.930
2330AD00219 NDENGEZA H17-0961	-23.2681	30.3818	2330AD00219 NDENGEZA H17-0961	2005/04/01	NONE	SAMPLE	87.741	4.0	0.6	1074.710	5.723
2330AD00119 XIMAUSA H14-0323	-23.3772	30.36703	2330AD00119 XIMAUSA H14-0323	2005/05/01	NONE	SAMPLE	113.569	4.0	0.6	1074.710	4.422
2330AC00187 PAARDEDOOD H10-0682	-23.4534	30.16388	PAARDEDOOD H10-0682	2005/08/05	NONE	SAMPLE	37.648	4.0	0.6	1074.710	13.338
2330AC00189 PAARDEDOOD H10-0683	-23.4534	30.16452	PAARDEDOOD H10-0683	2005/08/03	NONE	SAMPLE	42.068	4.0	0.6	1074.710	11.937
2330AC00200 PAARDEDOOD H10-0776	-23.4544	30.16286	PAARDEDOOD H10-0776	2005/08/07	NONE	SAMPLE	37.661	4.0	0.6	1074.710	13.334
HARMONIC MEAN 2330AC00219 ZOETFONTEIN PTN. GA-PHOCKO - H10-0600	-23.3623	30.16141	2330AC00219 ZOETFONTEIN H10-0600	2005/08/29 to 2006/10/12	NONE	SAMPLE	32.06731		0.6	1074.710	15.660
2330AC00202 VAALWATER H10-0777	-23.4097	30.14433	VAALWATER H10-0777	2005/09/14	NONE	SAMPLE	56.342	4.0	0.6	1074.710	8.913
2330AC00294 HARTEBEESFONTEIN PTN. MAMAILA CLINIC - H10-0651	-23.3508	30.2425	2330AC00294 HARTEBEESFONTEIN PTN. MAMAILA CLINIC - H10-0651	2006/03/18	NONE	SAMPLE	99.345	4.0	0.6	1074.710	5.055
2330AC00209 ZOETFONTEIN PTN. RAPHAHLELO - H10-0778	-23.3653	30.16316	2330AC00209 ZOETFONTEIN PTN. RAPHAHLELO - H10-0778	2006/03/05	NONE	SAMPLE	89.977	4.0	0.6	1074.710	5.581
2330AC00267 ZEEKOEIFONTEIN PTN. MIDDELWATER - H10-0076	-23.4113	30.19636	2330CD00251 MOHLABA'S LOC. PTN. MOHLABA HEAD KRAAL - H08-1584	2006/07/25	NONE	SAMPLE	238.927	4.0	0.6	1074.710	2.102
2330AD00236 ZONNEBLOEM PTN. MAGORO / HLANGANANI - H10-0681	-23.3063	30.29738	2330AD00236 ZONNEBLOEM PTN. MAGORO - H10-0681	2006/07/10	NONE	SAMPLE	81.694	4.0	0.6	1074.710	6.147
2330AD00238 KWAGGAFONTEIN PTN. MAGORO - H10-0740	-23.2813	30.32777	2330AD00238 KWAGGAFONTEIN PTN. MAGORO - H10-0740	2006/07/23	NONE	SAMPLE	23.735	4.0	0.6	1074.710	21.157
HARMONIC MEAN 2330AD00239 ZONNEBLOEM PTN. MAGORO / HLANGANANI - H10-0780	-30	30.2973	2330AD00239 ZONNEBLOEM PTN. MAGORO - H10-0780	2006/07/23 to 2008/01/14	NONE	SAMPLE	190.85		0.6	1074.710	2.631
2330AC00211 VAALWATER PTN. SENWAMOKGOPE - H10-0783	-23.4128	30.14405	2330AC00211 VAALWATER PTN. WENWAMOKGOPE - H10-0783	2006/06/03	NONE	SAMPLE	46.456	4.0	0.6	1074.710	10.809

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AD00241 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0606	-23.3351	30.2753	2330AD00241 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0606	2006/06/30	NONE	SAMPLE	171.943	4.0	0.6	1074.710	2.921
2330AD00166 HELDERWATER PTN. RIBUNGWANI / HELDERWATER CLINIC - H17-1063	-23.2815	30.29727	2330AD00166 HELDERWATER PTN. RIBUNGWANI / HELDERWATER CLINIC - H17-1063	2006/08/09	NONE	SAMPLE	73.142	4.0	0.6	1074.710	6.866
2330AD00242 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0784	-23.3349	30.27456	2330CD00260 GLADSTONE PTN. GLADSTONE - H09-0187	2006/10/27	NONE	SAMPLE	128.134	4.0	0.6	1074.710	3.919
2330AC00221 VAALWATER PTN. SENWAMOKGOPE - H10-0785	-23.4103	30.15419	2330AD00242 OLIFANTSHOEK PTN. OLIFANTSHOEK - H10-0784	2006/10/11	NONE	SAMPLE	235.387	4.0	0.6	1074.710	2.133
2330AC00223 LEMONDOKOP PTN. LEMONDOKOP - H10-0792	-23.4366	30.14475	2330AC00223 LEMONDOKOP PTN. LEMONDOKOP - H10-0792	2006/12/10	NONE	SAMPLE	10.556	4.0	0.6	1074.710	47.571
2330AC00236 ROTTERDAM PTN. ROTTERDAM - H10-0789	-23.4164	30.24322	2330AC00236 ROTTERDAM PTN. ROTTERDAM - H10-0789	2006/12/04	NONE	SAMPLE	47.603	4.0	0.6	1074.710	10.549
2330AD00243 ROTTERDAM PTN. ROTTERDAM - H10-0787	-23.4094	30.26019	2330AD00243 ROTTERDAM PTN. ROTTERDAM - H10-0787	2006/12/08	NONE	SAMPLE	281.85	4.0	0.6	1074.710	1.782
2330AC00240 LEMONDOKOP PTN. LEMONDOKOP - H10-0793	-23.4354	30.14497	2330AC00240 LEMONDOKOP PTN. LEMONDOKOP - H10-0793	2006/12/13	NONE	SAMPLE	10.651	4.0	0.6	1074.710	47.147
2330AC00298 KLIPKRAAL PTN. THAGHALANE - H10-0656	-23.4513	30.0461	2330AC00298 KLIPKRAAL PTN. THAGALANE - H10-0656	2007/02/04	NONE	SAMPLE	12.956	4.0	0.6	1074.710	38.759
2330AD00304 GROOTFONTEIN PTN. MAGORO - H10-0798	-23.2957	30.32325	2330AD00304 GROOTFONTEIN PTN. MAGORO - H10-0798	2007/03/30	NONE	SAMPLE	101.128	4.0	0.6	1074.710	4.966
2330AC00249 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1101	-23.2941	30.24222	2330AC00249 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1101	2007/08/03	NONE	SAMPLE	144.919	4.0	0.6	1074.710	3.465
2330AD00307 MORGENZON PTN. MASAKONA - H17-1100	-23.2783	30.2558	2330AD00307 MORGENZON PTN. MASAKONA - H17-1100	2007/08/05	NONE	SAMPLE	168.042	4.0	0.6	1074.710	2.988
2330AC00279 VAALWATER PTN. TSHABALANE WEST - H10-0760	-23.3957	30.14866	2330AC00279 VAALWATER PTN. TSHABALANE WEST - H10-0760	2008/01/16	NONE	SAMPLE	161.387	4.0	0.6	1074.710	3.112
2330AC00222 BONTFONTEIN PTN. PHOOKO - H10-0609	-23.3485	30.14285	2330AC00222 BONTFONTEIN PTN. PHOOKO - H10-0609	2008/02/15	NONE	SAMPLE	38.948	4.0	0.6	1074.710	12.893
2330AC00280 SCHOONUITZICHT PTN. MASAKONA - H17-0282	-23.2875	30.23383	2330AC00280 SCHOONUITZICHT PTN. MASAKONA - H17-0282	2008/03/02	NONE	SAMPLE	107.304	4.0	0.6	1074.710	4.680
2330AC00326 ZOETFONTEIN PTN. RAPHAHLELO - H10-0801	-23.3679	30.15841	2330AC00326 ZOETFONTEIN PTN. RAPHAHHLELO - H10-0801	2008/04/06	NONE	SAMPLE	54.779	4	0.6	1074.710	9.167

MONITOTING POINT NAME	LATITUDE	LONGITUDE	LOCATED ON FEATURE NAME	SAMPLE START DATE	PRESER-VATIVE	ACTION TYPE	HARMO-NIC MEAN OF Cl-DISS-WATER-RESULT	Cl-DISS-WATER-DETEC-TION LIMIT	TOTAL ATMOSPHERIC CHLORIDE DEPOSITION (mg/l)	MEAN ANNUAL PRECIPI-TATION (mm/a)	RECHARGE (mm/a)
2330AC00337 VAALWATER PTN. SENWAMOKGOPE - H10-0802	-23.4067	30.14735	2330AC00337 VAALWATER PTN. SENWAMOKGOPE - H10-0802	2008/04/10	NONE	SAMPLE	69.069	4	0.6	1074.710	7.270
2330AC00363 MOSTERDHOEK PTN. IIIELENE - H10-0818	-23.3999	30.12618	2330AC00363 MOSTERDHOEK PTN. IIIELENE - H10-0818	2008/04/07	NONE	SAMPLE	39.166	4	0.6	1074.710	12.821
2330AC00364 ZOETFONTEIN PTN. RAPHALELO - H10-0820	-23.3753	30.17857	2330AC00364 ZOETFONTEIN PTN. RAPHALELO - H10-0820	2008/04/13	NONE	SAMPLE	87.105	4	0.6	1074.710	5.765
2330AC00379 LEMONDOKOP PTN. LEMONDOKOP - H10-0814	-23.46	30.15285	2330AC00379 LEMONDOKOP PTN. LEMONDOKOP - H10-0814	2008/04/11	NONE	SAMPLE	34.302	4	0.6	1074.710	14.639
2330AC00380 VAALWATER PTN. SENWAMOKGOPE - H10-0816	-23.4185	30.15202	2330AC00380 VAALWATER PTN. SENWAMOKGOPE - H10-0816	2008/04/04	NONE	SAMPLE	69.301	4	0.6	1074.710	7.246
2330AC00381 LEMONDOKOP PTN. LEMONDOKOP - H10-0831	-23.441	30.15278	2330AC00381 LEMONDOKOP PTN. LOEMONDOKOP - H10-0831	2008/04/17	NONE	SAMPLE	17.031	4	0.6	1074.710	29.485
2330AC00385 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1137	-23.2926	30.2486	2330AC00385 HARTEBEESFONTEIN PTN. REMBULUWANE - H17-1137	2008/06/15	NONE	SAMPLE	49.828	4	0.6	1074.710	10.078
HARMONIC MEAN FOR CHLORIDE FROM GROUNDWATER FOR QUTERNARY CATCHMENT B82D							**32.650**		**TOTAL RECHARGE**		**15.380**

Table A-8: Depth to water table data for Molototsi (B81G) quaternary catchment.

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H07-0009	B81G	LPLT398	MEIDINGEN PTN. MEDINGEN	30.24625	-23.64159	32.44
H07-0010	B81G	LPLT398	MEIDINGEN PTN. MEDINGEN	30.25014	-23.63545	24.97
H07-0011	B81G	LPLT398	MEIDINGEN PTN. MAMPHAGATHER	30.25217	-23.66391	8.61
H07-0012	B81G	LPLT398	MEIDINGEN PTN. MAMPHAGATHER	30.25096	-23.66302	11.30
H07-0014	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.28880	-23.63813	18.90
H07-0015	B81G	LPLT424	MODJADJES PTN. MODJADJI HEADKRAAL	30.34454	-23.62029	30.20
H07-0016	B81G	LPLT424	MODJADJES PTN. MODJADJI HEADKRAAL	30.34907	-23.62487	19.15
H07-0017	B81G	LPLT424	MODJADJES PTN. MODJADJI HEADKRAAL	30.34935	-23.62329	14.36
H07-0047	B81G	LPLT424	MODJADJES PTN. MATSWE	30.35766	-23.58672	8.45
H07-0050	B81G	LPLT424	MODJADJES PTN. MATSWE	30.36029	-23.59003	14.29
H07-0051	B81G	LPLT424	MODJADJES PTN. MATSWE	30.36895	-23.58432	3.28
H07-0062	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.39040	-23.55147	14.69
H07-0063	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.39089	-23.55079	14.42
H07-0063A	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.39078	-23.55074	14.22
H07-0066	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.38782	-23.54910	11.11
H07-0067	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.38797	-23.55047	7.70
H07-0071	B81G	LPLT362	SENOBELA PTN. SENOPELWA	30.40227	-23.55182	3.32
H07-0079	B81G	LPLT200	WORCESTER PTN. FEMANE	30.41037	-23.50100	25.02
H07-0081	B81G	LPLT200	WORCESTER PTN. FEMANE	30.41301	-23.49978	21.57
H07-0082	B81G	LPLT200	WORCESTER PTN. FEMANE	30.38774	-23.49239	13.14
H07-0083	B81G	LPLT201	NORTHAMPTON PTN. GA-NTATA	30.45643	-23.47735	13.62
H07-0089	B81G	LPLT000	STATELAND PTN. LEBOKA	30.36970	-23.47360	25.22
H07-0095	B81G	LPLT000	STATELAND PTN. SHAWELA	30.35456	-23.47122	10.75
H07-0095A	B81G	LPLT000	STATELAND PTN. SHAWELA	30.35456	-23.47119	8.38
H07-0096	B81G	LPLT360	KROMRIVIERFONTEIN PTN. RAMAROKA NORT	30.35723	-23.50555	26.16
H07-0097	B81G	LPLT000	STATELAND PTN. DITSHOSING	30.32500	-23.49111	12.09
H07-0098	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.31320	-23.46358	25.19
H07-0102	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.31945	-23.46108	19.61
H07-0103	B81G	LPLT150	BELLEVUE PTN. JAMELA	30.34978	-23.43650	19.75
H07-0103A	B81G	LPLT150	BELLEVUE PTN. JAMELA	30.34975	-23.43655	21.94
H07-0110	B81G	LPLT000	STATELAND PTN. SEDIBENE	30.38573	-23.39047	4.20
H07-0116	B81G	LPLT000	STATELAND PTN. SEFOFOTSE	30.41037	-23.43391	11.87
H07-0117	B81G	LPLT000	STATELAND PTN. BELLEVUE	30.40284	-23.42008	20.69
H07-0118	B81G	LPLT000	STATELAND PTN. MAMOKGADI	30.45509	-23.42486	10.04
H07-0127	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.43601	-23.39072	22.62
H07-0137	B81G	LPLT000	STATELAND PTN. MAKGAKGAPATSE	30.49759	-23.37086	10.23
H07-0139	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.45954	-23.40969	26.33
H07-0142	B81G	LPLT235	ELANDSFONTEIN PTN. BOTSHABELO	30.52104	-23.42811	21.10
H07-0169	B81G	LPLT000	STATELAND PTN. RAMPEPE	30.45581	-23.53220	13.82
H07-0202	B81G	LPLT000	STATELAND PTN. KORANTA	30.51846	-23.45302	7.40
H07-0233	B81G	LPLT000	STATELAND PTN. MAEKGWE / RATJEKE	30.49962	-23.50194	19.67
H07-0264	B81G	LPLT424	MODJADJES PTN. MOLLONG	30.31604	-23.61053	5.52
H07-0267	B81G	LPLT424	MODJADJES PTN. RABOTHATHA	30.28047	-23.63611	15.14
H07-0267A	B81G	LPLT424	MODJADJES PTN. RABOTHATHA	30.28055	-23.63573	16.82
H07-0268	B81G	LPLT424	MODJADJES PTN. MOLLONG	30.31577	-23.61138	8.12
H07-0379	B81G	LPLT424	MODJADJES PTN. MABULANE	30.33208	-23.58198	29.04
H07-0383	B81G	LPLT200	WORCESTER PTN. SENAKWE	30.41998	-23.51476	7.96
H07-0386	B81G	LPLT362	SENOBELA PTN. SENAKWE	30.41287	-23.54289	14.15
H07-0408	B81G	LPLT359	VLAKFONTEIN PTN. MOTHOBEKI	30.36496	-23.55311	19.80

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H07-0422	B81G	LPLT424	MODJADJES PTN. MODJADJI HEADKRAAL	30.35121	-23.62393	3.52
H07-0426	B81G	LPLT360	KROMRIVIERFONTEIN PTN. SENOPELWA	30.39778	-23.54558	12.00
H07-0432	B81G	LPLT424	MODJADJES PTN. MOLLONG	30.32269	-23.60411	3.84
H07-0433	B81G	LPLT398	MEIDINGEN PTN. MOSHAKGO	30.26281	-23.65899	6.05
H07-0448	B81G	LPLT000	STATELAND PTN. MAEKGWE / RATJEKE	30.50682	-23.48963	31.60
H07-0454	B81G	LPLT000	STATELAND PTN. DITSHOSING	30.32467	-23.49214	10.25
H07-0455	B81G	LPLT000	STATELAND PTN. SHAWELA	30.34479	-23.48560	1.93
H07-0456	B81G	LPLT000	STATELAND PTN. SHAWELA	30.34715	-23.48069	2.76
H07-0458	B81G	LPLT150	BELLEVUE PTN. JAMELA	30.34786	-23.43517	14.72
H07-0461	B81G	LPLT000	STATELAND PTN. JAMELA	30.33956	-23.45441	14.70
H07-0464	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.31750	-23.45761	6.67
H07-0474	B81G	LPLT201	NORTHAMPTON PTN. GA-NTATA	30.44387	-23.47374	32.70
H07-0476	B81G	LPLT201	NORTHAMPTON PTN. GA-NTATA	30.44773	-23.47519	35.69
H07-0477	B81G	LPLT000	STATELAND PTN. MOHLABANENG	30.37773	-23.47083	11.56
H07-0482	B81G	LPLT000	STATELAND PTN. MOHLABANENG	30.37376	-23.45805	11.26
H07-0498	B81G	LPLT398	MEIDINGEN PTN. MAMPHAGATHER	30.25215	-23.66475	6.92
H07-0519	B81G	LPLT424	MODJADJES PTN. MATSWE	30.36354	-23.58454	4.36
H07-0522	B81G	LPLT000	STATELAND PTN. SEAPHOLE	30.46451	-23.49721	9.30
H07-0526	B81G	LPLT000	STATELAND PTN. JAMELA	30.33947	-23.44697	6.30
H07-0530	B81G	LPLT235	ELANDSFONTEIN PTN. BOTSHABELO	30.51315	-23.42675	18.34
H07-0539	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.42870	-23.38436	5.64
H07-0542	B81G	LPLT359	VLAKFONTEIN PTN. RAMAROKA SOUTH	30.35531	-23.51588	20.04
H07-0545	B81G	LPLT359	VLAKFONTEIN PTN. RAMAROKA SOUTH	30.35509	-23.51591	20.20
H07-0548	B81G	LPLT000	STATELAND PTN. MAMOKGADI	30.45370	-23.43172	35.40
H07-0558	B81G	LPLT424	MODJADJES PTN. MATSWE	30.35489	-23.57901	15.86
H07-0560	B81G	LPLT424	MODJADJES PTN. MATSWE	30.35590	-23.57827	13.48
H07-0561	B81G	LPLT424	MODJADJES PTN. MATSWE	30.36856	-23.58471	0.83
H07-0562	B81G	LPLT398	MEIDINGEN PTN. RAPITSI	30.23734	-23.65948	19.84
H07-0566	B81G	LPLT398	MEIDINGEN PTN. MEDINGEN	30.25028	-23.63851	23.98
H07-0567	B81G	LPLT398	MEIDINGEN PTN. MEDINGEN	30.24084	-23.64462	24.87
H07-0569	B81G	LPLT000	STATELAND PTN. MAEKGWE / RATJEKE	30.51076	-23.50055	9.35
H07-0586	B81G	LPLT000	STATELAND PTN. LEBAKA	30.36792	-23.46275	3.15
H07-0605	B81G	LPLT150	BELLEVUE PTN. MAUPA	30.38434	-23.41028	20.67
H07-0618	B81G	LPLT360	KROMRIVIERFONTEIN PTN. SENOPELWA	30.39778	-23.54647	19.02
H07-0621	B81G	LPLT000	STATELAND PTN. BELLEVUE	30.42150	-23.41092	8.79
H07-0622	B81G	LPLT000	STATELAND PTN. BELLEVUE	30.41742	-23.41571	6.74
H07-0624	B81G	LPLT000	STATELAND PTN. BELLEVUE	30.41879	-23.41594	8.17
H07-0627	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.44282	-23.39356	5.51
H07-0633	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29697	-23.63182	6.78
H07-0636	B81G	LPLT424	MODJADJES PTN. MABULANE	30.33625	-23.58117	34.92
H07-0646	B81G	LPLT000	STATELAND PTN. MAKGAKGAPATSE	30.49473	-23.39439	11.50
H07-0654	B81G	LPLT424	MODJADJES PTN. IKETLENG	30.29973	-23.62342	12.81
H07-0659	B81G	LPLT362	SENOBELA PTN. SENAKWE	30.43161	-23.53649	8.70
H07-0679	B81G	LPLT424	MODJADJES PTN. KOOPE	30.32396	-23.61700	5.37
H07-0683	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.29390	-23.61000	3.94
H07-0684	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.29241	-23.60927	28.86
H07-0685	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.28704	-23.61330	1.44
H07-0687	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.26464	-23.62502	23.14
H07-0698	B81G	LPLT360	KROMRIVIERFONTEIN PTN. MOTHOBEKI	30.39518	-23.53468	10.20

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H07-0704	B81G	LPLT150	BELLEVUE PTN. MAUPA	30.38445	-23.42019	49.71
H07-0705	B81G	LPLT000	STATELAND PTN. DITSHOSING	30.33590	-23.49635	15.60
H07-0710	B81G	LPLT203	STERKFONTEIN PTN. PETERSON	30.47659	-23.46333	5.57
H07-0713	B81G	LPLT150	BELLEVUE PTN. MAUPA	30.38440	-23.42077	37.33
H07-0724	B81G	LPLT360	KROMRIVIERFONTEIN PTN. MOTHOBEKI	30.40257	-23.52869	11.57
H07-0728	B81G	LPLT000	STATELAND PTN. LEBAKA	30.37026	-23.47396	7.53
H07-0729	B81G	LPLT424	MODJADJES PTN. RABOTHATHA	30.28651	-23.63278	19.76
H07-0745	B81G	LPLT360	KROMRIVIERFONTEIN PTN. MOTHOBEKI	30.39617	-23.53568	12.80
H07-0747	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.43759	-23.49616	10.96
H07-0748	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.43566	-23.50067	11.72
H07-0749	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.43583	-23.50103	10.07
H07-0750	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.43612	-23.52132	25.80
H07-0754	B81G	LPLT424	MODJADJES PTN. MOTSINONI	30.27094	-23.64775	11.70
H07-0756	B81G	LPLT424	MODJADJES PTN. MATSWE	30.37019	-23.58384	3.34
H07-0757	B81G	LPLT424	MODJADJES PTN. MATSWE	30.37160	-23.58633	3.70
H07-0760	B81G	LPLT424	MODJADJES PTN. MATSWE	30.37653	-23.59292	11.05
H07-0783	B81G	LPLT398	MEIDINGEN PTN. RAPITSI	30.23166	-23.66323	35.50
H07-0797	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.37944	-23.55865	9.83
H07-0798	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.28312	-23.63730	4.00
H07-0799	B81G	LPLT359	VLAKFONTEIN PTN. MOTHOBEKI	30.37520	-23.54104	44.65
H07-0814	B81G	LPLT150	BELLEVUE PTN. JAMELA	30.35003	-23.43821	30.71
H07-0820	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.31320	-23.46358	6.46
H07-0823	B81G	LPLT000	STATELAND PTN. DITSHOSING	30.33590	-23.49632	7.50
H07-0827	B81G	LPLT000	STATELAND PTN. SENAKWE	30.42917	-23.52568	10.45
H07-0831	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.44645	-23.40889	6.56
H07-0831A	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.44645	-23.40891	8.49
H07-0832	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.44529	-23.40853	5.87
H07-0836	B81G	LPLT424	MODJADJES PTN. MODJADJI HEADKRAAL	30.36491	-23.62051	1.63
H07-0841	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.33328	-23.45769	8.82
H07-0843	B81G	LPLT359	VLAKFONTEIN PTN. MOTHOBEKI	30.37138	-23.54828	19.75
H07-0845	B81G	LPLT000	STATELAND PTN. MOHLABANENG	30.38659	-23.47338	6.00
H07-0848	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.42951	-23.38483	7.44
H07-0852	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.43138	-23.38272	16.70
H07-0861	B81G	LPLT150	BELLEVUE PTN. MAUPA	30.38095	-23.42022	53.83
H07-0894	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29000	-23.63552	4.62
H07-0899	B81G	LPLT424	MODJADJES PTN. SEKGOTHI	30.33040	-23.59593	10.96
H07-0900	B81G	LPLT424	MODJADJES PTN. MARAKA	30.26882	-23.64509	17.81
H07-0909	B81G	LPLT362	SENOBELA PTN. SENAKWE	30.41245	-23.55228	6.57
H07-0910	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.43667	-23.39519	25.00
H07-0914	B81G	LPLT000	STATELAND PTN. MAEKGWE / RATJEKE	30.49765	-23.49802	20.98
H07-0918	B81G	LPLT424	MODJADJES PTN. MATSWE	30.36994	-23.57249	8.89
H07-0949	B81G	LPLT000	STATELAND PTN. MAEKGWE / RATJEKE	30.49733	-23.49750	10.00
H07-0951	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.43694	-23.39503	5.37
H07-0968	B81G	LPLT360	KROMRIVIERFONTEIN PTN. SENOPELWA	30.39760	-23.54588	13.00
H07-0974	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.27676	-23.61889	3.70
H07-0975	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.26918	-23.62209	13.43
H07-0976	B81G	LPLT398	MEIDINGEN PTN. MEDINGEN	30.25412	-23.62464	15.09
H07-0977A	B81G	LPLT360	KROMRIVIERFONTEIN PTN. SENOPELWA	30.39799	-23.54493	9.20
H07-0981	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.43765	-23.49613	12.07

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H07-0983	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.44305	-23.50029	14.75
H07-0983A	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.44445	-23.50130	15.47
H07-0984	B81G	LPLT201	NORTHAMPTON PTN. PETERSON	30.46473	-23.47266	7.53
H07-0984A	B81G	LPLT201	NORTHAMPTON PTN. PETERSON	30.46470	-23.47272	6.39
H07-0985	B81G	LPLT424	MODJADJES PTN. RAMBOTHATHA	30.28786	-23.63022	8.75
H07-0987	B81G	LPLT424	MODJADJES PTN. MOTSININI	30.27548	-23.64450	4.01
H07-0988	B81G	LPLT424	MODJADJES PTN. MOTSINONI	30.27365	-23.64602	3.70
H07-0989	B81G	LPLT424	MODJADJES PTN. MARAKA	30.28650	-23.62854	5.10
H07-0990	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29224	-23.63423	22.80
H07-0991	B81G	LPLT424	MODJADJES PTN. MADIBENG	30.29806	-23.62554	9.60
H07-0991A	B81G	LPLT424	MODJADJES PTN. MADIBENG	30.29806	-23.62553	9.70
H07-0992	B81G	LPLT424	MODJADJES PTN. IKETLENG	30.29827	-23.62232	13.28
H07-0993	B81G	LPLT424	MODJADJES PTN. MOLLONG	30.31295	-23.61143	19.07
H07-0994	B81G	LPLT424	MODJADJES PTN. MABULANE	30.34769	-23.57707	17.58
H07-0995	B81G	LPLT424	MODJADJES PTN. MABULANE	30.32369	-23.57767	21.51
H07-0997	B81G	LPLT398	MEIDINGEN PTN. MAMPHAGATHER	30.24965	-23.66890	1.81
H07-0999	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.37468	-23.56215	5.75
H07-0999A	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.37473	-23.56241	4.78
H07-1000	B81G	LPLT398	MEIDINGEN PTN. MAMPHAGATHER	30.25042	-23.66691	5.05
H07-1001	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.28153	-23.63913	1.80
H07-1003	B81G	LPLT424	MODJADJES PTN. RABOTHATHA	30.29004	-23.62793	8.10
H07-1010	B81G	LPLT424	MODJADJES PTN. MATSWE	30.35751	-23.57807	12.61
H07-1011A	B81G	LPLT424	MODJADJES PTN. RABOTHATHA	30.28967	-23.62765	9.00
H07-1020	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29878	-23.63089	3.26
H07-1021	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29785	-23.62923	5.82
H07-1022	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29525	-23.63131	2.04
H07-1023	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.30191	-23.63026	4.44
H07-1024	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29552	-23.63476	3.47
H07-1025	B81G	LPLT398	MEIDINGEN PTN. RAKWADU	30.24297	-23.66490	6.57
H07-1028	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29390	-23.63602	18.12
H07-1036	B81G	LPLT424	MODJADJES PTN. MABULANE	30.32863	-23.58041	9.77
H07-1051	B81G	LPLT424	MODJADJES PTN. RABOTHATHA	30.27961	-23.63408	9.19
H07-1058	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.46923	-23.39975	23.99
H07-1061	B81G	LPLT000	STATELAND PTN. BELLEVUE	30.42131	-23.41633	9.73
H07-1068	B81G	LPLT000	STATELAND PTN. BELLEVUE	30.42006	-23.41569	4.95
H07-1075	B81G	LPLT424	MODJADJES PTN. MATSWE	30.35724	-23.58560	6.51
H07-1077	B81G	LPLT362	SENOBELA PTN. SENOPELWA	30.39771	-23.55169	1.83
H07-1080	B81G	LPLT235	ELANDSFONTEIN PTN. BOTSHABELO	30.51310	-23.43083	31.63
H07-1081	B81G	LPLT424	MODJADJES PTN. MODJADJI HEADKRAAL	30.34638	-23.62337	29.08
H07-1105	B81G	LPLT359	VLAKFONTEIN PTN. SENOPELWA	30.38902	-23.54780	11.58
H07-1147	B81G	LPLT000	STATELAND PTN. SEAPHOLE	30.46607	-23.48613	15.85
H07-1148	B81G	LPLT000	STATELAND PTN. SEAPHOLE	30.45992	-23.49630	23.58
H07-1177	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.31204	-23.46912	13.96
H07-1179	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.32059	-23.45755	2.46
H07-1198	B81G	LPLT000	STATELAND PTN. MAEKGWE / RATJEKE	30.50683	-23.48961	20.34
H07-1204	B81G	LPLT398	MEIDINGEN PTN. MAPAANA	30.23733	-23.65940	16.65
H07-1222	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.44775	-23.39875	27.09
H07-1232	B81G	LPLT200	WORCESTER PTN. SENAKWE	30.42112	-23.51741	2.85
H07-1308	B81G	LPLT398	MEIDINGEN PTN. MAMPHAGATHER	30.24797	-23.66181	2.38

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H07-1309	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.32326	-23.47244	21.68
H07-1310	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.43623	-23.39611	8.56
H07-1368	B81G	LPLT000	STATELAND PTN. DITSHOSING	30.32331	-23.49881	9.79
H07-1369	B81G	LPLT000	STATELAND PTN. DITSHOSING	30.32461	-23.49211	10.67
H07-1373	B81G	LPLT424	MODJADJES PTN. LENOKWE	30.34280	-23.59361	7.10
H07-1386	B81G	LPLT424	MODJADJES PTN. MOTSINONI	30.27726	-23.64244	5.05
H07-1387	B81G	LPLT424	MODJADJES PTN. MOTSINONI	30.27900	-23.64005	3.54
H07-1389	B81G	LPLT150	BELLEVUE PTN. JAMELA	30.35000	-23.43425	35.01
H07-1407	B81G	LPLT000	STATELAND PTN. LEBAKA	30.36990	-23.46366	8.10
H07-1408	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.43511	-23.39372	5.05
H07-1409	B81G	LPLT432	SCHOONGELEGEN PTN. MAMPHAGATHER	30.23822	-23.66839	6.90
H07-1413	B81G	LPLT362	SENOBELA PTN. SENOPELWA	30.39547	-23.55278	4.50
H07-1416	B81G	LPLT200	WORCESTER PTN. WORCESTER	30.43571	-23.50123	9.75
H07-1457	B81G	LPLT424	MODJADJES PTN. MABULANE	30.34715	-23.57532	22.80
H07-1472	B81G	LPLT424	MODJADJES PTN. BOSHAGE	30.34564	-23.57281	32.38
H07-1482	B81G	LPLT432	SCHOONGELEGEN PTN. RAPITSI	30.23246	-23.67245	18.75
H07-1498	B81G	LPLT432	SCHOONGELEGEN PTN. RAPITSI	30.23401	-23.66986	18.03
H07-1499	B81G	LPLT432	SCHOONGELEGEN PTN. RAPITSI	30.23464	-23.66850	12.07
H07-1516	B81G	LPLT424	MODJADJES PTN. SEKHUTENG	30.32669	-23.61960	6.30
H07-1518	B81G	LPLT000	STATELAND PTN. DITSHOSING	30.33808	-23.48597	9.95
H07-1520	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.28003	-23.61875	19.25
H07-1531	B81G	LPLT000	STATELAND PTN. JAMELA	30.34767	-23.45291	16.93
H07-1532	B81G	LPLT000	STATELAND PTN. NAKAMPE	30.45088	-23.39164	15.63
H07-1533	B81G	LPLT235	ELANDSFONTEIN PTN. BOTSHABELO	30.51165	-23.43152	36.21
H07-1536	B81G	LPLT000	STATELAND PTN. MAPHALLE	30.31169	-23.46910	18.04
H07-1537	B81G	LPLT000	STATELAND PTN. RAMPEPE	30.45969	-23.53461	15.86
H07-1539	B81G	LPLT000	STATELAND PTN. RAMPEPE	30.45587	-23.53790	18.46
H07-1542	B81G	LPLT359	VLAKFONTEIN PTN. MOTHOBEKI	30.37442	-23.55181	19.59
H07-1564	B81G	LPLT424	MODJADJES PTN. MALEMATSA	30.28915	-23.61497	24.47
H07-1617	B81G	LPLT000	STATELAND PTN. MAMAILA A	30.44011	-23.39247	15.27
H07-1697	B81G		STATELAND PTN. GA-MOKGWATHI	30.60453	-23.60164	23.00
H14-0194	B81G	LPLT000	STATELAND PTN. NWAMANKENA WEST	30.52187	-23.37692	15.00
H14-0208	B81G	LPLT000	STATELAND PTN. NWAMANKENA WEST	30.52248	-23.37814	14.30
H14-0305	B81G	LPLT000	STATELAND PTN. NWAMANKENA WEST	30.52776	-23.37389	13.90
H14-0381	B81G	LPLT000	STATELAND PTN. NWAMANKENA	30.53026	-23.38208	10.60
H14-0786	B81G		STATELAND PTN. DZUMERI	30.73720	-23.57039	28.00
H14-0787	B81G		STATELAND PTN. DZUMERI	30.73859	-23.57089	34.00
H14-0789	B81G		STATELAND PTN. DZUMERI	30.73740	-23.57065	27.00
H14-0842	B81G	LPLT000	STATELAND PTN. XAWELA	30.30723	-23.46510	5.05
H14-0981	B81G		STATELAND PTN. DZUMERI	30.73914	-23.59714	123.00
H14-0986	B81G		STATELAND PTN. N'WAMARHANGA	30.73717	-23.60194	18.05
H14-1000	B81G		STATELAND PTN. DZUMERI	30.73229	-23.61406	45.00
H14-1232	B81G	LPLT000	STATELAND PTN. NWAMANKENA WEST	30.52044	-23.36910	29.46
H14-1243	B81G	LPLT000	STATELAND PTN. NWAMANKENA	30.52056	-23.36852	24.04
H14-1347	B81G		STATELAND PTN. N'WAMARHANGA	30.73531	-23.60642	22.84
H14-1351	B81G		STATELAND PTN. N'WAMARHANGA	30.73641	23.61533	24.39
H14-1362	B81G		STATELAND PTN. N'WAMARHANGA	30.73758	-23.61547	21.16

Table A-9: Depth to water table data for Middle Letaba (B82D) quaternary catchment.

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H07-0101	B82D	LPLT000	STATELAND PTN. RAMAHLATSHI	30.30925	-23.45877	6.07
H07-0462	B82D	LPLT000	STATELAND PTN. RAMAHLATSHI	30.30834	-23.45686	4.04
H07-0463	B82D	LPLT000	STATELAND PTN. RAMAHLATSHI	30.30862	-23.45630	6.00
H07-0822	B82D	LPLT000	STATELAND PTN. SEDIBENE	30.37542	-23.38991	20.14
H07-0865	B82D	LPLT000	STATELAND PTN. RAMAHLATSHI	30.30444	-23.46185	5.30
H07-0982	B82D	LPLT000	STATELAND PTN. RAMAHLATSHI	30.31173	-23.45661	12.50
H07-1074	B81G	LPLT424	MODJADJES PTN. MADUBUNG	30.29871	-23.30607	7.00
H10-0001	B82D	LPLT159	ROTTERDAM PTN. ROTTERDAM	30.2597242	-23.4231073	18.84
H10-0002	B82D	LPLT151	BLINKWATER PTN. MSENGI	30.3452876	-23.4051899	12.25
H10-0003	B82D	LPLT153	AMSTERDAM PTN. ROTTERDAM	30.2785861	-23.3969147	17.40
H10-0004	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2713107	-23.3297527	37.65
H10-0005	B82D	LPLT151	BLINKWATER PTN. MSENGI	30.3372287	-23.4051921	5.70
H10-0006	B82D	LPLT151	BLINKWATER PTN. MSENGI	30.3352872	-23.4096351	8.81
H10-0007	B82D	LPLT151	BLINKWATER PTN. MSENGI	30.3244447	-23.4024177	3.98
H10-0008	B82D	LPLT153	AMSTERDAM PTN. ROTTERDAM	30.3034204	-23.4039143	5.75
H10-0009	B82D	LPLT153	AMSTERDAM PTN. ROTTERDAM	30.2888921	-23.3979146	10.27
H10-0010	B82D	LPLT159	ROTTERDAM PTN. ROTTERDAM	30.2570270	-23.4102748	17.00
H10-0011	B82D	LPLT153	AMSTERDAM PTN. ROTTERDAM	30.2690024	-23.4013033	23.39
H10-0012	B82D	LPLT159	ROTTERDAM PTN. ROTTERDAM	30.2658078	-23.4081361	9.72
H10-0013	B82D	LPLT159	ROTTERDAM PTN. ROTTERDAM	30.2447764	-23.4167466	40.00
H10-0014	B82D	LPLT159	ROTTERDAM PTN. ROTTERDAM	30.2440874	-23.4173846	37.24
H10-0015	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2713949	-23.3296433	38.59
H10-0016	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2705609	-23.3296394	35.19
H10-0017	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2702848	-23.3296381	34.57
H10-0018	B82D	LPLT153	AMSTERDAM PTN. ROTTERDAM	30.3000592	-23.4022755	12.69
H10-0019	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2736166	-23.3304752	9.77
H10-0021	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2861171	-23.3368620	6.55
H10-0022	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2727849	-23.3299206	36.76
H10-0024	B82D	LPLT161	ROERFONTEIN PTN. RAPHAHLELO	30.1783310	-23.3760293	25.46
H10-0024A	B82D	LPLT161	ROERFONTEIN PTN. RAPHAHLELO	30.1780531	-23.3765824	26.07
H10-0028	B82D	LPLT161	ROERFONTEIN PTN. RAPHAHLELO	30.1747208	-23.3843566	27.86
H10-0029	B82D	LPLT161	ROERFONTEIN PTN. RAPHAHLELO	30.1777809	-23.3763093	26.52
H10-0035	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1608301	-23.4313054	37.00
H10-0076	B82D	LPLT157	ZEEKOEFONTEIN PTN. MIDDELWATER	30.1963611	-23.4113330	6.57
H10-0083	B82D	LPLT170	BOSCHBOKHOEK PTN. THAKGALANE 4	30.0411046	-23.4482440	16.52
H10-0084	B82D	LPLT133	NOOITGEDACHT PTN. ITIELENE	30.0910833	-23.4034437	47.76
H10-0086	B82D	LPLT163	MOSTERDHOEK PTN. ITIELENE	30.1134403	-23.4004142	0.50
H10-0088	B82D	LPLT162	VAALWATER PTN. TSHABALANE WEST	30.1399415	-23.3986921	13.65
H10-0100	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1430492	-23.4551838	27.73
H10-0143	B82D	LPLT136	BONTFONTEIN PTN. PHOOKO	30.1405249	-23.3558339	31.50
H10-0151	B82D	LPLT136	BONTFONTEIN PTN. RAPHAHLELO	30.1483297	-23.3707534	26.35

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H10-0154	B82D	LPLT137	ZOETFONTEIN PTN. RAPHAHLELO	30.1680505	-23.3779691	21.39
H10-0158	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2466690	-23.3463110	27.33
H10-0165	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2366634	-23.3590806	8.01
H10-0166	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2341633	-23.3601905	18.03
H10-0167	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2355567	-23.3499212	30.58
H10-0169	B82D	LPLT157	ZEEKOEFONTEIN PTN. MIDDELWATER	30.2144480	-23.3913058	8.49
H10-0171	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2344433	-23.3632503	10.76
H10-0176	B82D	LPLT156	MIDDELWATER PTN. MIDDELWATER	30.2238056	-23.3984437	17.58
H10-0181	B82D	LPLT158	ZEEKOEWATER PTN. MIDDELWATER	30.2000041	-23.4232484	15.70
H10-0183	B82D	LPLT158	ZEEKOEWATER PTN. MIDDELWATER	30.2030505	-23.4210249	20.48
H10-0189	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1544358	-23.4460244	28.00
H10-0191	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1529457	-23.4175514	28.63
H10-0192	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1524997	-23.4163065	31.36
H10-0194	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1450000	-23.4181942	12.74
H10-0196	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1441643	-23.4190791	11.01
H10-0198	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1458295	-23.4146371	22.43
H10-0205	B82D	LPLT140	STERKWATER PTN. OLIFANTSHOEK	30.2947002	-23.3665557	8.81
H10-0213	B82D	LPLT176	KLIPKRAAL PTN. THAKGALANE 1	30.0508250	-23.4624131	29.32
H10-0214	B82D	LPLT176	KLIPKRAAL PTN. THAKGALANE 1	30.0481038	-23.4591044	8.20
H10-0215	B82D	LPLT176	KLIPKRAAL PTN. THAKGALANE 1	30.0527696	-23.4549136	6.97
H10-0341	B82D	LPLT137	ZOETFONTEIN PTN. RAPHAHLELO	30.1527759	-23.3765792	43.01
H10-0400	B82D	LPLT158	ZEEKOEWATER PTN. MIDDELWATER	30.2027500	-23.4216664	19.13
H10-0421	B82D	LPLT170	BOSCHBOKHOEK PTN. THAKGALANE 4	30.0385928	-23.4476841	0.40
H10-0423	B82D	LPLT163	MOSTERDHOEK PTN. ITIELENE	30.1120513	-23.4043305	23.91
H10-0424	B82D	LPLT161	ROERFONTEIN PTN. TSHABALANE EAST	30.1595850	-23.3907482	37.20
H10-0429	B82D	LPLT137	ZOETFONTEIN PTN. RAPHAHLELO	30.1602802	-23.3704696	4.85
H10-0431	B82D	LPLT136	BONTFONTEIN PTN. PHOOKO	30.1472196	-23.3616113	10.14
H10-0436	B82D	LPLT162	VAALWATER PTN. TSHABALANE WEST	30.1480807	-23.3898594	23.50
H10-0442	B82D	LPLT156	MIDDELWATER PTN. MIDDELWATER	30.2280564	-23.3960234	22.81
H10-0446	B82D	LPLT156	MIDDELWATER PTN. MIDDELWATER	30.2344429	-23.3996392	19.08
H10-0461	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1594700	-23.4362451	13.41
H10-0463	B82D	LPLT156	MIDDELWATER PTN. MIDDELWATER	30.2319471	-23.4032475	16.51
H10-0471	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2350011	-23.3632503	10.56
H10-0472	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2352805	-23.3513111	21.91
H10-0479	B82D	LPLT162	VAALWATER PTN. TSHABALANE WEST	30.1491363	-23.3913593	15.12
H10-0519	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2536157	-23.3573896	6.87
H10-0548	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1547189	-23.4418527	7.61
H10-0549	B82D	LPLT137	ZOETFONTEIN PTN. PHOOKO	30.1710000	-23.3599997	0.58
H10-0550	B82D	LPLT136	BONTFONTEIN PTN. PHOOKO	30.1466117	-23.3528888	11.96
H10-0554	B82D	LPLT113	KOEDOESFONTEIN PTN. PHOOKO	30.1634148	-23.3373075	0.40
H10-0578	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1433614	-23.4407718	17.86
H10-0579	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1416954	-23.4412447	19.80

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H10-0580	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1466083	-23.4386338	18.43
H10-0593	B82D	LPLT158	ZEEKOEWATER PTN. MIDDELWATER	30.2136092	-23.4124168	9.33
H10-0597	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2244399	-23.3624203	6.42
H10-0598	B82D	LPLT137	ZOETFONTEIN PTN. RAPHAHLELO	30.1583296	-23.3676898	5.12
H10-0600	B82D	LPLT137	ZOETFONTEIN PTN. PHOOKO	30.1616900	-23.3621941	28.60
H10-0601	B82D	LPLT161	ROERFONTEIN PTN. RAPHAHLELO	30.1685816	-23.3781102	34.40
H10-0604	B82D	LPLT137	ZOETFONTEIN PTN. PHOOKO	30.1530499	-23.3676882	6.64
H10-0605	B82D	LPLT136	BONTFONTEIN PTN. PHOOKO	30.1502475	-23.3649444	4.55
H10-0606	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2753200	-23.3350197	14.57
H10-0607	B82D	LPLT157	ZEEKOEFONTEIN PTN. MIDDELWATER	30.2071110	-23.4128887	6.50
H10-0609	B82D	LPLT136	BONTFONTEIN PTN. PHOOKO	30.1428584	-23.3484733	36.28
H10-0611	B82D	LPLT137	ZOETFONTEIN PTN. PHOOKO	30.1693595	-23.3623058	2.56
H10-0612	B82D	LPLT136	BONTFONTEIN PTN. PHOOKO	30.1424694	-23.3581671	13.21
H10-0613	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2930592	-23.3054727	33.30
H10-0614	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2930562	-23.3060324	35.42
H10-0615	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2990872	-23.2958661	12.06
H10-0616	B82D	LPLT165	BLINKWATER PTN. THAKGALANE 4	30.0579654	-23.4464664	3.70
H10-0617	B82D	LPLT165	BLINKWATER PTN. THAKGALANE 4	30.0594288	-23.4451843	7.06
H10-0618	B82D	LPLT176	KLIPKRAAL PTN. THAKGALANE 4	30.0533308	-23.4479641	22.70
H10-0620	B82D	LPLT172	UITSPAN PTN. SEKGOSESE	30.0016557	-23.4610188	60.01
H10-0621	B82D	LPLT172	UITSPAN PTN. SEKGOSESE	30.0022135	-23.4610223	52.89
H10-0623	B82D	LPLT172	UITSPAN PTN. SEKGOSESE	30.0016600	-23.4643502	30.62
H10-0624	B82D	LPLT172	UITSPAN PTN. SEKGOSESE	30.0016554	-23.4601832	50.31
H10-0627	B82D	LPLT104	GROOTFONTEIN PTN. MAGORO	30.3180614	-23.2985317	18.24
H10-0628	B82D	LPLT104	GROOTFONTEIN PTN. MAGORO	30.3216669	-23.2913154	3.44
H10-0629	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.3083355	-23.2965840	11.94
H10-0631	B82D	LPLT096	KWAGGAFONTEIN PTN. MAGORO	30.3269497	-23.2804759	8.99
H10-0632	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.3033340	-23.2993648	18.81
H10-0633	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2958359	-23.3051944	37.43
H10-0634	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2994438	-23.2979749	15.75
H10-0638	B82D	LPLT161	ROERFONTEIN PTN. TSHABALANE EAST	30.1627803	-23.3888075	57.69
H10-0641	B82D	LPLT161	ROERFONTEIN PTN. RAPHAHLELO	30.1716966	-23.3976089	6.60
H10-0645	B82D	LPLT133	NOOITGEDACHT PTN. ITIELENE	30.0940830	-23.3960274	23.62
H10-0646	B82D	LPLT153	AMSTERDAM PTN. ROTTERDAM	30.2749160	-23.4009717	16.35
H10-0651	B82D	LPLT139	HARTEBEESFONTEIN PTN. MAMAILA	30.2425037	-23.3507511	24.70
H10-0656	B82D	LPLT176	KLIPKRAAL PTN. THAKGALANE 4	30.0461048	-23.4513039	35.70
H10-0657	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1458305	-23.4401892	2.27
H10-0662	B82D	LPLT132	VOORSPOED PTN. VOORSPOED	30.0686102	-23.3790822	11.51
H10-0664	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2771695	-23.3405019	5.52
H10-0669	B82D	LPLT136	BONTFONTEIN PTN. PHOOKO	30.1425960	-23.3572227	21.79
H10-0670	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1502393	-23.4571047	35.99
H10-0671	B82D	LPLT156	MIDDELWATER PTN. MIDDELWATER	30.2381679	-23.3896651	13.35

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H10-0672	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1496940	-23.4463877	35.10
H10-0673	B82D	LPLT151	BLINKWATER PTN. MSENGI	30.3358500	-23.4120797	16.37
H10-0674	B82D	LPLT161	ROERFONTEIN PTN. TSHABALANE EAST	30.1638330	-23.3927767	23.45
H10-0675	B82D	LPLT161	ROERFONTEIN PTN. TSHABALANE EAST	30.1597220	-23.3978327	14.99
H10-0713	B82D	LPLT113	KOEDOESFONTEIN PTN. PHOOKO	30.1634426	-23.3320856	18.71
H10-0740	B82D	LPLT096	KWAGGAFONTEIN PTN. MAGORO	30.3277780	-23.2813330	3.18
H10-0747	B82D	LPLT163	MOSTERDHOEK PTN. ITIELENE	30.1034398	-23.4001919	21.07
H10-0748	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1509440	-23.4121107	32.79
H10-0753	B82D	LPLT133	NOOITGEDACHT PTN. ITIELENE	30.0775827	-23.3980776	29.92
H10-0754	B82D	LPLT171	SCHOONGEZICHT PTN. THAKGALANE 2	30.0269422	-23.4463831	43.07
H10-0755	B82D	LPLT170	BOSCHBOKHOEK PTN. THAKGALANE 2	30.0332420	-23.4482718	27.90
H10-0760	B82D	LPLT162	VAALWATER PTN. TSHABALANE WEST	30.1486363	-23.3957479	18.88
H10-0766	B82D	LPLT158	ZEEKOEWATER PTN. MIDDELWATER	30.2107100	-23.4263297	11.57
H10-0767	B82D	LPLT158	ZEEKOEWATER PTN. MIDDELWATER	30.2164167	-23.4067497	5.24
H10-0771	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2943900	-23.3084297	34.72
H10-0773	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1516900	-23.4445197	31.52
H10-0775	B82D	LPLT163	MOSTERDHOEK PTN. ITIELENE	30.1168800	-23.3980597	11.64
H10-0777	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1443300	-23.4097297	16.02
H10-0778	B82D	LPLT137	ZOETFONTEIN PTN. RAPHAHLELO	30.1631666	-23.3653053	12.78
H10-0783	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1437785	-23.4135236	29.67
H10-0784	B82D	LPLT106	OLIFANTSHOEK PTN. OLIFANTSHOEK	30.2745608	-23.3349467	13.51
H10-0785	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1541944	-23.4103052	40.56
H10-0787	B82D	LPLT159	ROTTERDAM PTN. ROTTERDAM	30.2601944	-23.4094163	11.41
H10-0789	B82D	LPLT159	ROTTERDAM PTN. ROTTERDAM	30.2432222	-23.4163608	25.79
H10-0792	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1447500	-23.4366385	25.74
H10-0793	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1449722	-23.4353885	33.98
H10-0798	B82D	LPLT104	GROOTFONTEIN PTN. MAGORO	30.3232500	-23.2956941	24.36
H10-0801	B82D	LPLT137	ZOETFONTEIN PTN. RAPHAHLELO	30.1584100	-23.3678497	6.44
H10-0802	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1473500	-23.4066597	13.93
H10-0806	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2963889	-23.3100274	26.00
H10-0814	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1528500	-23.4599597	17.45
H10-0816	B82D	LPLT162	VAALWATER PTN. SENWAMOKGOPE	30.1520400	-23.4175097	34.26
H10-0818	B82D	LPLT163	MOSTERDHOEK PTN. ITIELENE	30.1261800	-23.3999397	11.41
H10-0820	B82D	LPLT137	ZOETFONTEIN PTN. RAPHAHLELO	30.1796700	-23.3728297	4.59
H10-0822	B82D	LPLT176	KLIPKRAAL PTN. THAKGALANE 1	30.0522100	-23.4517197	11.87
H10-0824	B82D	LPLT105	ZONNEBLOEM PTN. MAGORO	30.2895000	-23.3129717	23.63
H10-0831	B82D	LPLT184	LEMONDOKOP PTN. LEMONDOKOP	30.1541300	-23.4419997	15.53
H14-0170	B82D	LPLT000	STATELAND PTN. XIKHUMBA	30.90713	-23.51005	29.19
H14-0171	B82D	LPLT000	STATELAND PTN.XIKHUMBA NORTH	30.89072	-23.49688	23.36
H14-0172	B82D	LPLT000	STATELAND PTN. XIKHUMBA NORTH	30.87994	-23.48974	31.96
H14-0173	B82D	LPLT000	STATELAND PTN. XIKHUMBA NORTH	30.88205	-23.48821	32.00
H14-0174	B82D	LPLT000	STATELAND PTN. XIKHUMBA NORTH	30.89147	-23.46908	51.00
H14-0223	B82D	LPLT000	STATELAND PTN. NDENGEZA	30.40390	-23.31473	5.56

BOREHOLE	DRAINAGE	FARM_NO	SITE_NAME	LONGITUDE	LATITUDE	WATER LEVEL (m)
H14-0224	B82D	LPLT000	STATELAND PTN. NDENGEZA	30.40417	-23.31578	4.74
H14-0225	B82D	LPLT000	STATELAND PTN. NDENGEZA	30.40148	-23.31470	1.80
H14-0226	B82D	LPLT000	STATELAND PTN. PHIKELA	30.39217	-23.32209	18.60
H14-0227	B82D	LPLT000	STATELAND PTN. PHIKELA	30.39531	-23.31917	18.54
H14-0321	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.37056	-23.34686	13.40
H14-0323	B82D	LPLT000	STATELAND PTN. XIMAVUSA	30.36703	-23.37722	3.42
H14-0421	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.37767	-23.33400	17.40
H14-0422	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.37778	-23.33339	16.24
H14-0423	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.36734	-23.34620	10.58
H14-0424	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.36826	-23.34617	19.82
H14-0425	B82D	LPLT000	STATELAND PTN. PHIKELA	30.40304	-23.32720	26.05
H14-0426	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.37151	-23.35231	11.47
H14-0427	B82D	LPLT000	STATELAND PTN. PHIKELA	30.38709	-23.32823	17.55
H14-0427A	B82D	LPLT000	STATELAND PTN. PHIKELA	30.38706	-23.32803	18.70
H14-0801	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.39777	-23.34567	7.65
H14-0816	B82D	LPLT000	STATELAND PTN. XIKHUMBA	30.88083	-23.50000	26.21
H14-0856	B82D	LPLT000	STATELAND PTN. NDENGEZA	30.40623	-23.31609	6.87
H14-0992	B82D	LPLT000	STATELAND PTN. XIKHUMBA NORTH	30.88733	-23.47735	27.60
H14-1134	B82D	LPLT000	STATELAND PTN. MUHLAHLANDELA	30.36736	-23.34512	4.70
H17-0117	B82D	LPLT095	HELDERWATER PTN. RIBUNGWANI	30.29194	-23.28576	29.04
H17-0118	B82D	LPLT109	HARTEBEESTFONTEIN PTN. MASAKONA	30.24995	-23.28959	11.82
H17-0212	B82D	LPLT095	HELDERWATER PTN. RIBUNGWANI	30.29834	-23.28932	16.02
H17-0252	B82D	LPLT064	WAGENDRIFT PTN. MAJOSI	30.34140	-23.27798	12.60
H17-0278	B82D	LPLT108	HARTEBEESTFONTEIN PTN. REMBULUWANE	30.24205	-23.29607	16.00
H17-0279	B82D	LPLT108	HARTEBEESTFONTEIN PTN. REMBULUWANE	30.24456	-23.29939	15.56
H17-0280A	B82D	LPLT108	HARTEBEESTFONTEIN PTN. MASAKONA	30.24195	-23.28714	17.58
H17-0282	B82D	LPLT111	SCHOONUITZICHT PTN. MASAKONA	30.23383	-23.28753	70.43
H17-0283	B82D	LPLT094	MORGENZON PTN. MASAKONA	30.24334	-23.27576	8.00
H17-0354	B82D	LPLT095	HELDERWATER PTN. RIBUNGWANI	30.28834	-23.27215	27.98
H17-0381	B82D	LPLT095	HELDERWATER PTN. RIBUNGWANI	30.28834	-23.27242	27.51
H17-0413	B82D	LPLT095	HELDERWATER PTN. RIBUNGWANI	30.29556	-23.28187	45.10
H17-0415	B82D	LPLT094	MORGENZON PTN. MASAKONA	30.24385	-23.27476	2.50
H17-1063	B82D	LPLT095	HELDERWATER PTN. RIBUNGWANI	30.29700	-23.28228	33.95
H17-1100	B82D	LPLT094	MORGENZON PTN. MASAKONA	30.25581	-23.27828	0.46
H17-1101	B82D	LPLT109	HARTEBEESTFONTEIN PTN. REMBULUWANE	30.24222	-23.29406	8.21
H17-1137	B82D	LPLT109	HARTEBEESTFONTEIN PTN. MASAKONA	30.24860	-23.29257	7.57
M17-0961	B82D	LPLT062	CALEDON PTN. NDENGEZA	30.38180	-23.26805	35.00

Table A-10(a): Indicate infiltration test using Double Ring Infiltrometer of 15 cm radius.

Test:	**Stop1**	**Double Ring**		**Radius**	**15**	**cm**	**Infiltration**
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**K (cm/s)**	**Ku (m/s)**	**I (cm/s)**	**I (m/s)**
60	0.4	706.5	4.71	0.0067	6.66667E-05	0.006667	6.66667E-05
120	0.6	706.5	3.53	0.0050	0.00005	0.005	0.00005
180	0.9	706.5	3.53	0.0050	0.00005	0.005	0.00005
240	1.2	706.5	3.53	0.0050	0.00005	0.005	0.00005
300	1.5	706.5	3.53	0.0050	0.00005	0.005	0.00005
360	1.8	706.5	3.53	0.0050	0.00005	0.005	0.00005
420	2	706.5	3.36	0.0048	4.7619E-05	0.004762	4.7619E-05
480	2.3	706.5	3.39	0.0048	4.79167E-05	0.004792	4.79167E-05
540	2.6	706.5	3.40	0.0048	4.81481E-05	0.004815	4.81481E-05
600	2.9	706.5	3.41	0.0048	4.83333E-05	0.004833	4.83333E-05
660	3.1	706.5	3.32	0.0047	4.69697E-05	0.004697	4.69697E-05
720	3.3	706.5	3.24	0.0046	4.58333E-05	0.004583	4.58333E-05
Average					5.01239E-05	0.005012	5.01239E-05

Table A-10(b): Indicate infiltration test using Double Ring Infiltrometer of 15 cm radius under unsaturated and saturated condition.

Test:	**Stop7**	**Double Ring**		**Radius**	**15**	**cm**	
Prewetting							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ku (cm/s)**	**Ku (m/s)**	**I (cm/s)**	**I (m/s)**
60	1.1	706.5	12.95	0.0183	0.000183333	0.018333	0.000183
120	1.9	706.5	11.19	0.0158	0.000158333	0.015833	0.000158
180	2.5	706.5	9.81	0.0139	0.000138889	0.013889	0.000139
240	3.1	706.5	9.13	0.0129	0.000129167	0.012917	0.000129
300	3.6	706.5	8.48	0.0120	0.00012	0.012	0.00012
360	4.1	706.5	8.05	0.0114	0.000113889	0.011389	0.000114
Average				0.0141	0.000140602	0.01406	0.000141
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**I (cm/s)**	**I (m/s)**
60	0.9	706.5	10.60	0.0150	0.00015	0.015	0.00015
120	1.6	706.5	9.42	0.0133	0.000133333	0.013333	0.000133
180	2.1	706.5	8.24	0.0117	0.000116667	0.011667	0.000117
240	2.6	706.5	7.65	0.0108	0.000108333	0.010833	0.000108
300	3.1	706.5	7.30	0.0103	0.000103333	0.010333	0.000103
360	3.6	706.5	7.07	0.0100	0.0001	0.01	0.0001
Average				0.0119	0.000118611	0.011861	0.000119

Table A-10(c): Indicate percolation test using an Auger of 7.5 cm radius under prewetting condition.

Test: 1	AP12	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	s (cm)	A (cm2)	Q (cm3/s)	Ku (cm/s)	Ku (m/s)	P (cm/s)	P (m/s)
332	1	176.625	0.53	0.0030	3.01205E-05	0.003012	3.01205E-05
806	2	176.625	0.44	0.0025	2.48139E-05	0.002481	2.48139E-05
1442	3	176.625	0.37	0.0021	2.08044E-05	0.00208	2.08044E-05
2200	4	176.625	0.32	0.0018	1.81818E-05	0.001818	1.81818E-05
Average					2.34802E-05	0.002348	2.34802E-05

Test: 2	AP14	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	s (cm)	A (cm2)	Q (cm3/s)	Ku (cm/s)	Ku (m/s)	P (cm/s)	P (m/s)
51	1	176.625	3.46	0.0196	0.000196	0.019608	0.000196
108	2	176.625	3.27	0.0185	0.000185	0.018519	0.000185
170	3	176.625	3.12	0.0176	0.000176	0.017647	0.000176
234	4	176.625	3.02	0.0171	0.000171	0.017094	0.000171
310	5	176.625	2.85	0.0161	0.000161	0.016129	0.000161
Average				0.0178	0.000178	0.017799	0.000178

Test: 3	AP15	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	s (cm)	A (cm2)	Q (cm3/s)	Ku (cm/s)	Ku (m/s)	P (cm/s)	P (m/s)
80	1	176.625	2.21	0.0125	0.000125	0.0125	0.000125
163	2	176.625	2.17	0.0123	0.000123	0.01227	0.000123
246	3	176.625	2.15	0.0122	0.000122	0.012195	0.000122
338	4	176.625	2.09	0.0118	0.000118	0.011834	0.000118
446	5	176.625	1.98	0.0112	0.000112	0.011211	0.000112
Average				0.0120	0.00012	0.012002	0.00012

Test: 4	AP19	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	s (cm)	A (cm2)	Q (cm3/s)	Ku (cm/s)	Ku (m/s)	P (cm/s)	P (m/s)
71	1	176.625	2.49	0.0141	0.000141	0.014085	0.000141
149	2	176.625	2.37	0.0134	0.000134	0.013423	0.000134
235	3	176.625	2.25	0.0128	0.000128	0.012766	0.000128
321	4	176.625	2.20	0.0125	0.000125	0.012461	0.000125
433	5	176.625	2.04	0.0115	0.000115	0.011547	0.000115
Average				0.0129	0.000129	0.012856	0.000129

Test: 5	AP20	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	s (cm)	A (cm2)	Q (cm3/s)	Ku (cm/s)	Ku (m/s)	P (cm/s)	P (m/s)
83	1	176.625	2.13	0.0120	0.00012	0.012048	0.00012
165	2	176.625	2.14	0.0121	0.000121	0.012121	0.000121
255	3	176.625	2.08	0.0118	0.000118	0.011765	0.000118
355	4	176.625	1.99	0.0113	0.000113	0.011268	0.000113
455	5	176.625	1.94	0.0110	0.00011	0.010989	0.00011
Average				0.0116	0.000116	0.011638	0.000116

Test: 6	AP33	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ku (cm/s)**	**Ku (m/s)**	**P (cm/s)**	**P (m/s)**
34	1	176.625	5.19	0.0294	0.000294	0.029412	0.000294
70	2	176.625	5.05	0.0286	0.000286	0.028571	0.000286
105	3	176.625	5.05	0.0286	0.000286	0.028571	0.000286
145	4	176.625	4.87	0.0276	0.000276	0.027586	0.000276
182	5	176.625	4.85	0.0275	0.000275	0.027473	0.000275
Average				0.0283	0.000283	0.028323	0.000283

Table A-10(d): Indicate percolation test using an Auger of 7.5 cm radius under prewetting and saturated condition.

Test: 1	Stop4	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ku (cm/s)**	**Ku (m/s)**	**P (cm/s)**	**P (m/s)**
60	0	176.625	0.00	0.0000	0	0	0
131	1	176.625	1.35	0.0076	7.63E-05	0.007634	7.63E-05
140	2	176.625	2.52	0.0143	0.000143	0.014286	0.000143
151	3	176.625	3.51	0.0199	0.000199	0.019868	0.000199
161	4	176.625	4.39	0.0248	0.000248	0.024845	0.000248
173	5	176.625	5.10	0.0289	0.000289	0.028902	0.000289
Average				0.0159	0.000159	0.015922	0.000159
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P (cm/s)**	**P (m/s)**
10	1	176.625	17.66	0.1000	0.001	0.1	0.001
22	2	176.625	16.06	0.0909	0.000909	0.090909	0.000909
35	3	176.625	15.14	0.0857	0.000857	0.085714	0.000857
52	4	176.625	13.59	0.0769	0.000769	0.076923	0.000769
63	5	176.625	14.02	0.0794	0.000794	0.079365	0.000794
Average				0.0866	0.000866	0.086582	0.000866

Test: 2	Test C1	Percolation		Radius	7.5	cm	
Prewetting							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ku (cm/s)**	**Ku (m/s)**	**P (cm/s)**	**P(m/s)**
92	1	176.625	1.92	0.0109	0.000108696	0.01087	0.000108696
196	2	176.625	1.80	0.0102	0.000102041	0.010204	0.000102041
302	3	176.625	1.75	0.0099	9.93377E-05	0.009934	9.93377E-05
417	4	176.625	1.69	0.0096	9.59233E-05	0.009592	9.59233E-05
527	5	176.625	1.68	0.0095	9.48767E-05	0.009488	9.48767E-05
Average				0.0100	0.000100175	0.010017	0.000100175
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P (cm/s)**	**P(m/s)**
172	1	176.625	1.03	0.0058	5.81395E-05	0.005814	5.81395E-05
353	2	176.625	1.00	0.0057	5.66572E-05	0.005666	5.66572E-05
543	3	176.625	0.98	0.0055	5.52486E-05	0.005525	5.52486E-05
758	4	176.625	0.93	0.0053	5.27704E-05	0.005277	5.27704E-05
952	5	176.625	0.93	0.0053	5.2521E-05	0.005252	5.2521E-05
Average				0.0055	5.50674E-05	0.005507	5.50674E-05

Test: 3	Test C2	Percolation		Radius	7.5	cm		
Prewetting								
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ku (cm/s)**	**Ku (m/s)**	**P(cm/s)**	**P(m/s)**	
50	2	176.625	7.07	0.0400	0.0004	0.04	0.0004	
78	3	176.625	6.79	0.0385	0.000385	0.038462	0.000385	
116	4	176.625	6.09	0.0345	0.000345	0.034483	0.000345	
147	5	176.625	6.01	0.0340	0.00034	0.034014	0.00034	
Average				0.0367	0.000367	0.036739	0.000367	
Saturated								
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P(cm/s)**	**P(m/s)**	
48	1	176.625	3.68	0.0208	0.000208	0.020833	0.000208	195
93	2	176.625	3.80	0.0215	0.000215	0.021505	0.000215	240
140	3	176.625	3.78	0.0214	0.000214	0.021429	0.000214	287
196	4	176.625	3.60	0.0204	0.000204	0.020408	0.000204	343
258	5	176.625	3.42	0.0194	0.000194	0.01938	0.000194	405
Average				0.0207	0.000207	0.020711	0.000207	

Test: 4	Test C3	Percolation		Radius	7.5	cm		
Prewetting								
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ku (cm/s)**	**Ku (m/s)**	**P(cm/s)**	**P(m/s)**	
46	1	176.625	3.84	0.0217	0.000217	0.021739	0.000217	
93	2	176.625	3.80	0.0215	0.000215	0.021505	0.000215	
145	3	176.625	3.65	0.0207	0.000207	0.02069	0.000207	
215	4	176.625	3.29	0.0186	0.000186	0.018605	0.000186	
300	5	176.625	2.94	0.0167	0.000167	0.016667	0.000167	
Average				0.0198	0.000198	0.019841	0.000198	

Saturated								
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P(cm/s)**	**P(m/s)**	
78	1	176.625	2.26	0.0128	0.000128	0.012821	0.000128	378
160	2	176.625	2.21	0.0125	0.000125	0.0125	0.000125	460
244	3	176.625	2.17	0.0123	0.000123	0.012295	0.000123	544
354	4	176.625	2.00	0.0113	0.000113	0.011299	0.000113	654
476	5	176.625	1.86	0.0105	0.000105	0.010504	0.000105	776
Average				0.0119	0.000119	0.011884	0.000119	

Table A-10(e): Indicate percolation test using an Auger of 7.5 cm radius under saturated condition.

Test:2	BP01	Percolation		Radius	7.5	cm	
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P(cm/s)**	**P(m/s)**
91	1	176.625	1.94	0.0110	0.00011	0.01098901	0.00010989
96	2	176.625	3.68	0.0208	0.000208	0.02083333	0.00020833
102	3	176.625	5.19	0.0294	0.000294	0.02941176	0.00029412
108	4	176.625	6.54	0.0370	0.00037	0.03703704	0.00037037
114	5	176.625	7.75	0.0439	4.39E-04	0.04385965	0.0004386
Average				0.0284	0.000284	0.02842616	0.00028426

Test:2	**BP01**	**Percolation**		**Radius**	**7.5**	**cm**	
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P(cm/s)**	**P(m/s)**
69	1	176.625	2.56	0.0145	0.000145	0.014493	0.000145
77	2	176.625	4.59	0.0260	0.00026	0.025974	0.00026
82	3	176.625	6.46	0.0366	0.000366	0.036585	0.000366
90	4	176.625	7.85	0.0444	0.000444	0.044444	0.000444
89	5	176.625	9.92	0.0562	0.000562	0.05618	0.000562
Average				0.0355	0.000355	0.035535	0.000355

Test: 3	**BP01**	**Percolation**		**Radius**	**7.5**	**cm**	
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P(cm/s)**	**P(m/s)**
37	1	176.625	4.77	0.0270	0.00027	0.027027	0.00027
41	2	176.625	8.62	0.0488	0.000488	0.04878	0.000488
51	3	176.625	10.39	0.0588	0.000588	0.058824	0.000588
56	4	176.625	12.62	0.0714	0.000714	0.071429	0.000714
60	5	176.625	14.72	0.0833	0.000833	0.083333	0.000833
Average				0.0579	0.000579	0.057879	0.000579

Test: 4	**BP01**	**Percolation**		**Radius**	**7.5**	**cm**	
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P(cm/s)**	**P(m/s)**
43	1	176.625	4.11	0.0233	0.000233	0.023256	0.000233
57	2	176.625	6.20	0.0351	0.000351	0.035088	0.000351
61	3	176.625	8.69	0.0492	0.000492	0.04918	0.000492
71	4	176.625	9.95	0.0563	0.000563	0.056338	0.000563
85	5	176.625	10.39	0.0588	0.000588	0.058824	0.000588
Average				0.0445	0.000445	0.044537	0.000445

Test:5	**BP01**	**Percolation**		**Radius**	**7.5**	**cm**	
Saturated							
t (s)	**s (cm)**	**A (cm2)**	**Q (cm3/s)**	**Ks (cm/s)**	**Ks (m/s)**	**P(cm/s)**	**P(m/s)**
32	1	176.625	5.19	0.0294	0.000294	0.029412	0.000294
34	2	176.625	11.04	0.0625	0.000625	0.0625	0.000625
37	3	176.625	14.32	0.0811	0.000811	0.081081	0.000811
36	4	176.625	19.63	0.1111	0.001111	0.111111	0.001111
40	5	176.625	22.08	0.1250	0.00125	0.125	0.00125
43	6	176.625	24.65	0.1395	0.001395	0.139535	0.001395
Average				0.0914	0.000914	0.09144	0.000914