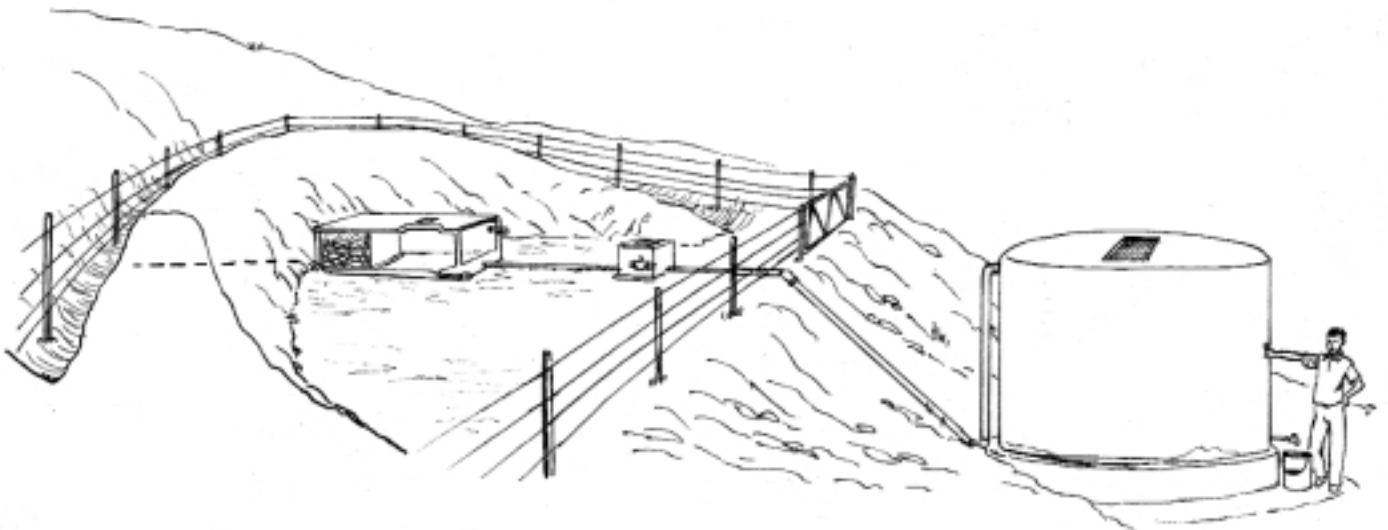


Groundwater Protection



Guidelines for Protecting Springs



NORAD

DIREKTORATET FOR
UTVIKLINGSSAMARBEID
NORWEGIAN AGENCY FOR
DEVELOPMENT COOPERATION

TOOLKIT for WATER SERVICES: Number 3.2

This document is written primarily for Water Services Authorities, Water Services Providers, implementing agencies and Catchment Management Agencies in order to provide guidelines and tools to help protect rural community water supply sources from potential contamination.

Groundwater Protection - Guidelines for Protecting Springs

© DWAF, March 2004

Published by

Department of Water Affairs and Forestry
Directorate: Information Programmes
Private Bag X313
PRETORIA 0001
Republic of South Africa
Tel: (012) 336 7500

This publication may be reproduced only for non-commercial purposes and only after appropriate authorisation by the Department of Water Affairs and Forestry has been provided. No part of this publication may be reproduced in any manner without full acknowledgement of the source.

Implemented by

CSIR

Written by

Freternity Rusinga

Editing

Anthea Josias and Kerry Harris

Artwork

Vusi Malindi

Layout and design

Gill McDowell

Inputs

Freternity Rusinga, Phillip Ravenscroft, Kerry O'H Murphy

Produced under:

**The NORAD-Assisted Programme for the Sustainable Development of Groundwater Sources
under the Community Water and Sanitation Programme in South Africa**

Foreword

Toolkit for Water Services

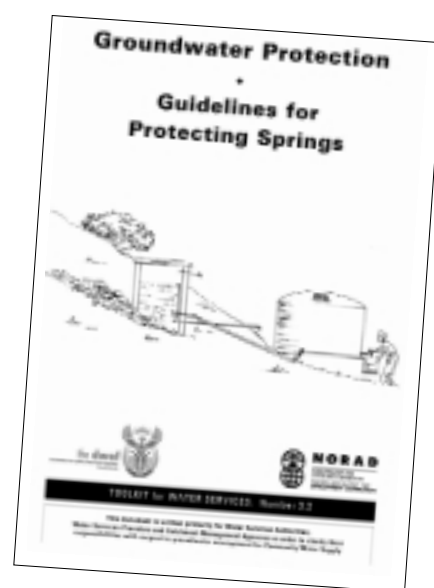
Groundwater has historically been given limited attention, and is not perceived as an important water resource, in South Africa. This is reflected in statistics showing that only 13 % of the nation's total water supply originate from groundwater. Because of the highly distributed nature of the water demand in rural and informal peri-urban settlements, regional schemes are, in most instances, not economically feasible. And because of decreasing available river and spring flows during low flow and drought periods, as well as wide-spread problems of surface water pollution in rural areas, groundwater will be the most feasible option for a large part of the new water demand.

The NORAD-Assisted Programme for the Sustainable Development of Groundwater Sources under the Community Water and Sanitation Programme in South Africa was managed by the Department of Water Affairs and Forestry (DWAF) between 2000 and 2004. The Programme undertook a series of inter-related projects aimed at enhancing capacity of water services authorities and DWAF to promote and implement sustainable rural water supply schemes based on groundwater resources and appropriate technologies.

Page 2 has a full list of the Programme outputs. The formats for these range from documents to software programmes and an internet portal, to reference sites where communities have implemented appropriate technologies. For more information on the "package" of Programme outputs contact your nearest DWAF Regional Office or Head Office in Pretoria.

It is our sincere hope that this Programme will contribute to the body of work that exists to enable more appropriate use and management of groundwater in South Africa.

Guidelines for Protecting Springs is Number 3.2 in the Toolkit for Water Services. This document is written primarily for Water Services Authorities, Water Services Providers, implementing agencies and Catchment Management Agencies in order to provide guidelines and tools to help protect rural community water supply sources from potential contamination.



Toolkit for Water Services

1 Overview documentation

- 1.1 A Framework for Groundwater Management of Community Water Supply
- 1.2 Implementing a Rural Groundwater Management System: a step-by-step guide

2 Descriptors

- 2.1 Standard Descriptors for Geosites

3 Groundwater Protection

- 3.1 Involving community members in a hydrocensus

3.2 Guidelines for protecting springs

- 3.3 Guidelines for protecting boreholes and wells
- 3.4 Guidelines on protecting groundwater from contamination
 - 3.4.1 Animal kraals, watering points and dipping tanks
 - 3.4.2 Burial sites
 - 3.4.3 Informal vehicle servicing, spray painting and parts washing facilities
 - 3.4.4 Pit latrines
 - 3.4.5 Runoff water
 - 3.4.6 Subsistence agriculture
 - 3.4.7 Informal waste disposal

4 Maps

- 4.1 Thematic Groundwater Maps

5 Software

- 5.1 Sustainability Indexing Tool (SusIT)
 - 5.1.1 SusIT User Guide
 - 5.1.2 SusIT Field Data Capturer's User Manual
 - 5.1.3 SusIT Questionnaire
 - 5.1.4 SusIT Information Brochure
- 5.2 Aquimon Management System
 - 5.2.1 Aquimon Information Brochure
- 5.3 Geohydrological Data Access System (GDAS)
 - 5.3.1 GDAS Information Brochure

6 Monitoring

- 6.1 Groundwater Monitoring for Pump Operators

7 Sustainability

- 7.1 Sustainability Best Practices Guidelines for Rural Water Services
- 7.2 Introductory Guide to Appropriate Solutions for Water and Sanitation
- 7.3 Decision Making Framework for Municipalities

8 Reference Sites

- 8.1 Genadendal Information Brochure
- 8.2 Kammiesberg Information Brochure
- 8.3 Maputland Information Brochure

Table of Contents

Foreword	1
Toolkit for Water Services	2
Acronyms	4
Introduction	5
Set-back distances for springs	6
References and additional reading	9
Flowchart: On-Site Test for spring protection	10

Acronyms

CBO	Community-Based Organisation
CMA	Catchment Management Agency
CWSS	Community Water Supply and Sanitation
DPLG	Department of Provincial and Local Government
DWAF	Department of Water Affairs and Forestry
O&M	Operation and Maintenance
SABS	South African Bureau of Standards
SANS	South African National Standards
SSA	Support Services Agent
WMA	Water Management Area
WRM	Water Resource Management
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Services Provider
WSDP	Water Services Provision Contract
WUA	Water User Association

Introduction

■ Guidelines for protecting springs

A spring is a place on the earth's surface where groundwater emerges naturally. The water source of most springs is rainfall that seeps into the ground uphill from the spring outlet.

Spring water moves downhill through soil or cracks in rock until it is forced out of the ground by natural pressure. Like shallow wells, springs may be contaminated by surface runoff or other contamination sources on or below the ground surface. Potential contamination sources include livestock gathering points, pit latrines and waste disposal sites located upslope from the spring outlet.

Decision aids in the form of a set-back distance decision chart and a flowchart have been developed to help guide decision makers on the most appropriate courses of action to follow in protecting springs. Recommendations on possible actions are also presented. These decision tools are applicable for sources of pathogenic contamination such as cattle kraals, stock watering points and pit latrines.

These decision tools assume the existence of a spring catchment protection structure. If such a structure does not exist or there is reason to believe it is not performing as it should, the advice of a specialist should be sought. To obtain detailed information on the design and building of spring catchment protection structures and on related protection zones, please refer to Pearson *et al.* (2003) and Meule and Wehrle (2001).

Set-back distances for springs

The recommended set-back distances for springs in different hydrogeological regions are presented in the set-back distance decision chart below. The minimum set-back distance specification of 100 metres for a waste disposal site from a surface water body has been adopted from government regulations (NWA, 1998). This is designated as "Protection Zone 1" in these guidelines. Protection zones 2, 3 and 4 are based on the concepts presented in the World Bank /GW-MATE Briefing Note No: 8 (Foster *et al*, 2002) and on ARGOSS (2001) – See the General User Guide document of this series for more information.

- ◆ **Protection zone 1:**
This represents a no-go area, where no potential contaminating activity should be allowed, upslope of a spring. It has been set equal to 100 metres. Any potentially contaminating activities located within this distance, such as cattle kraals, stock watering points and pit latrines should preferably be closed down.

- ◆ **Protection zone 2:**
This is the distance outwards, upstream of the spring box, beyond 100 metres, for which the travel time of groundwater is less than 25 days.

- ◆ **Protection zone 3:** This is the distance outwards, upstream of the spring box, beyond protection zone 2, for which the travel time of groundwater is between 25 days and 50 days.

- ◆ **Protection zone 4:** This is the distance outwards, upstream of the spring box, beyond protection zone 3, for which the travel time of groundwater is more than 50 days.

The actions that are recommended for each protection zone are listed below:

■ Protection zone 1 _____

Recommended Action:

Stopping the contamination source / activity, or moving it to a safer zone, should be given high priority. If in doubt, seek the advice of a specialist. There should be regular monitoring of the water supply for indicator organisms and / or related contaminants, and the water abstracted for potable purposes should be disinfected.

■ Protection zone 2 _____

Recommended Action:

Alternative options are available:

- (1) Stop the contamination source / activity, or else move it to a safer zone.
- (2) Install protective measures.
- (3) Obtain the input of a specialist.

There should be regular monitoring of the water supply for indicator organisms and / or related contaminants, and the water abstracted for potable purposes should be disinfected as a precautionary measure.

■ Protection zone 3 _____

Recommended Action:

Alternative options are available:

- (1) If feasible, move the contamination source / activity to a safer zone.
- (2) Install protective measures.
- (3) Obtain the input of a specialist.

The water abstracted for potable purposes should be disinfected as a precautionary measure.

■ Protection zone 4 _____

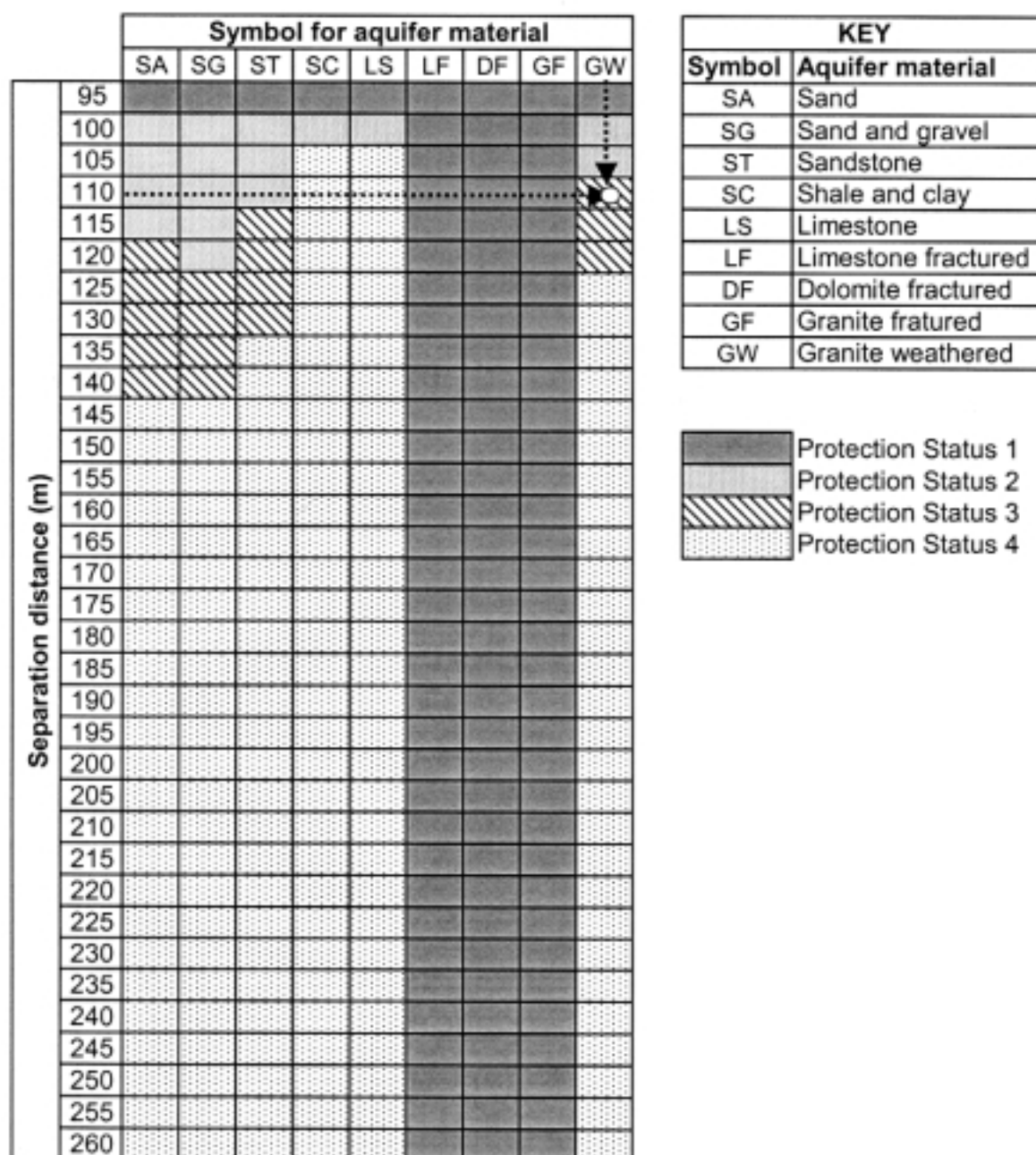
Recommended Action:

Disinfect water used for drinking, especially if sanitary conditions in the home warrant it. If in doubt, install protective measures or obtain the input of a specialist.

Note:

The set-back distance decision chart for springs is not recommended for use with heavy contaminant loads, and neither is it suitable when the contaminant source is located over karstic / fractured dolomites or limestone, shallow or non-existent soils over bedrock or fault zones and dykes. In the latter cases, there is potential for contamination of the groundwater resource irrespective of how far set back the contaminant source is. Seek the advice of a geohydrologist and/or sanitation expert.

Table: Set-back distance decision chart for springs



An example of how to use the decision chart:

A household pit latrine is located at a distance of 110m (measured from the edge of the pit) upstream of a community water supply springbox. The aquifer material is a weathered granite basement aquifer.

Problem: Is the community water supply spring safe from household pit latrine contamination?

Answer: The symbol for weathered granite is GW. The point of intersection for GW and 110m as shown by the dotted arrows in the chart falls in the protection status 3, so consult actions for protection zone 3.

References and additional reading

ARGOSS (2001) *Guidelines for assessing the risk to groundwater from on-site sanitation*. British Geological Survey Commissioned Report, CR/01/142. Keyworth, Nottingham, UK:BGS.

Foster, S., Garduño, H., Kemper, K., Tuinhof, A., Nanni, M and Dumars, C (2002). *Groundwater Quality Protection: Defining Strategy and Setting Priorities*. World Bank Briefing Note 8. World Bank, Washington

Meule, C and Wehrle, K (2001). Spring Catchment. *SKAT Series of Manuals on Drinking Water Supplies*, Volume 4. Swiss Centre for Development Cooperation in Technology and Management, Switzerland.

Pearson, I., Weaver, J. and Ravenscroft, P (2003). *The Reliability of Small Spring Water Supply Systems*. Water Research Commission Report No. 859/1/03, Water Research Commission, Pretoria.

Pearson, L A., Bhagwan, J., Kariuki, W. and Banda, W (2002). *Guidelines on Appropriate Technologies for Water Supply and Sanitation in Developing Countries*. Water Research Commission Report No. 520/1/01, Water Research Commission, Pretoria.

South Africa: Department of Water Affairs and Forestry (1994). *Minimum requirements for waste disposal by landfill*. Department of Water Affairs and Forestry. Pretoria

South Africa: *National Water Act, 1998* (Act No. 36 of 1998)

Flowchart: On-site Test for spring protection

Flowchart On-site Test: Spring protection

