

EXECUTIVE SUMMARY

Septic tank and soakaway systems are the most widely used system of waste water disposal in the South African coastal area. In view of the highly variable loadings linked to holiday seasons, few resorts have water-borne sewerage and even many of the newer developments rely on conservancy tanks and a centralized waste water soakaway system. The design and management of these systems vary from area to area and even within single municipalities, as different design criteria have been applied over the years. This *ad hoc* approach, coupled with rather limited local technical expertise, has led to septic tank systems being the single most important pollution hazard in the region. Not only does it involve contamination of groundwater, but also stormwater runoff and ultimately the local lagoon, estuary or bay. Bacteria, viruses, nitrate and synthetic organic chemicals have been identified as the major pollutants (Canter & Knox, 1986).

The potential for serious pollution from septic tank systems is increased due to the fact that:

- (a) many of the resorts/towns/settlements are located on unconfined sandy aquifers;
- (b) shallow groundwater levels and poor storm drainage during the wet winter season cause serious water logging in the Southern Cape;
- (c) many existing waste water disposal systems were not designed for the higher population densities now found in the coastal area, especially with the peak loads experienced during holiday periods;
- (d) groundwater is often abstracted via wellpoints in close proximity to soakaways;
- (e) the more affluent nature of the people making use of the area is resulting in an increase in the use of modern household cleaning agents, which contribute an ever-increasing number of synthetic organics and other chemicals; and
- (f) there is no standard set of guidelines applicable to South African conditions.

The subject of septic tank systems and possible groundwater contamination has received extensive coverage in the developed world. A wealth of technical information therefore exists and, if correctly installed and designed, septic tank systems are highly effective means of waste water treatment and disposal.

Initial indications, however, showed that the average property owner, and even local authorities, have a very rudimentary understanding of septic tank systems. Many of the holiday homes are owned by city dwellers, who are accustomed to water-borne sewage and have therefore never had to ponder about what happens to waste water beyond the toilet bowl and kitchen sink. This, combined with the lack of specific national legislation on the use of septic tank systems, has led to the general misuse of this technology, with often disastrous effects. The major issue therefore appeared to be the adaptation of existing information to the South African situation and the transfer of technology and provision of decision support to local administrators/managers/town engineers.

In order to address this situation the Water Research Commission provided funds for the CSIR to undertake an 18 month study to:

define the issues related to septic tank systems in the coastal zone and develop documents for the transfer of existing technical knowledge to the user level.

The study was divided into three components: the collection of information, field verification and technology transfer.

Methodology

A comprehensive literature search was undertaken using WATERLIT of the South African Water Information Centre. In addition personal contact was made with a number of researchers in South Africa, North America, Australia and the United Kingdom. Two different questionnaires were sent out: one to all regional and local authorities along the Cape coastline and one to all consulting civil engineers operating in the coastal zone.

Field verification involved visits to those towns/settlements between the Berg and Great Kei River mouths. Past CSIR pollution assessment investigations which took place within the coastal zone were revisited. Five of these were found to have relevance to the present study and this information could be incorporated in the project. A brief case study was undertaken in the South-Western Cape to obtain a better understanding of the effectiveness of these systems in coastal sands. Groundwater quality monitoring was done at three different septic tank systems. These were considered representative of the most common categories of usage along the coastline.

During the course of the project it became clear that there were three target groups for the technology transfer: those responsible for designing and constructing septic tank systems, the local and regional authorities responsible for administration/management and the individual user/property owner. Their different needs were met by means of three technology transfer documents:

- (a) "Septic tank systems in the South African coastal zone";
- (b) "Guidelines for the use of septic tank systems in the South African coastal zone"; and
- (c) "SEPTIC TANKS - how do they work & what can go wrong?".

Study results

- (a) The septic tank system is the most commonly used method of domestic waste water treatment in the coastal zone. The design and management of these systems vary greatly within the region. Differences even occur within single local authority areas.
- (b) Waste water disposal by means of septic tank systems is a well-established technology and a wealth of technical information is available on design criteria. There is, however, a general lack of technical knowledge at the user level. This is reinforced by a lack of legislation pertaining specifically to septic tank systems.
- (c) The majority of septic tank problems are caused by blocked or inadequate drainage

fields and may be attributed to poor location, poor design and lack of maintenance. Greater emphasis should be placed on the land capability assessment and ongoing maintenance. Local hydrogeological conditions invariably play a major role in the regional variation of the same generic problem.

- (d) Lack of a sufficiently thick unsaturated zone is the greatest problem encountered in the coastal zone. This is due to:
- relatively impermeable layers such as clay lenses and calcrete units causing perched water tables;
 - highly permeable layers such as gravel/pebble beds serving as preferential flow paths;
 - shallow depths to bedrock.
- These invariably lead to horizontal flow at shallow depths, water-logged conditions and return flow.
- (e) Pollutants of greatest concern in the coastal context are nutrients (nitrates and phosphates) and biological contaminants (bacteria, parasites and viruses). Field studies indicated that a correctly designed and constructed drainage field effectively retains these pollutants within a radius of 15 to 20 m of the discharge point. Nitrate does, however, have the potential to contaminate groundwater and should be regarded as a conservative constituent. Ideally the drainage field should be 5 m above any impermeable layer and/or water table and 30 m away from any surface water body. The distance from a groundwater supply point should be at least 50 m and ideally 100m.
- (f) There is an urgent need for greater control in the use of septic tank systems within the coastal zone. Greater attention must be given to the drainage field component of septic tank systems, as this currently receives minimal attention and is the cause of most pollution problems. Although the highly seasonal use of these systems results in peak loads, it also means that the system has long periods in which to recover. This recovery period results in many systems that would fail under normal circumstances operating efficiently in the long term.
- (g) The disposal of septic tank/conservancy tank effluent at communal sites, either by surface spreading or trench infiltration, must be closely monitored. Such operations should require a permit from the Department of Water Affairs and Forestry and routine groundwater quality maintenance.
- (h) The septic tank system remains the most cost efficient means of domestic waste water disposal for the coastal zone. The system must, however, be correctly designed, constructed and maintained.

Conclusion

The study achieved its overall objective in that a better understanding was obtained of the status of septic tank technology in the coastal zone, user groups were identified and technology transfer documents were developed.

Recommendations

- (a) The use of septic tank systems should continue and be actively promoted as a cost-efficient means of domestic waste water disposal.**
- (b) Regional and local authorities need to develop their technical capabilities further in order to manage septic tank system usage effectively. The usage of septic tank systems should be based firstly on land capability maps and secondly on site-specific assessments.**
- (c) Communal/municipal effluent disposal sites (in whichever form these may occur) should comply with the Water Act. This must be actively enforced by the DWA&F and receive the same priority rating as landfill sites.**
- (d) Any further research/investigations relating to septic tank systems in the coastal sands should be site-specific and problem-related.**