

BOTSWANA'S POLICY FOR WASTEWATER / SANITATION MANAGEMENT

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Background

The rapid development of Botswana since independence in 1966 has seen the transformation from a country with a population of only 350,000 with virtually no access to a safe supply of water to today when 90% of the 1.5 million population have a safe piped water supply. The provision of adequate wastewater and sanitation systems has lagged behind the provision of water supply. At present approximately 65% of the population, living in the urban and major villages, is served by waterborne sewerage systems, and the remainder of the population use on-site sanitation systems or nothing.

Botswana is a semi-arid country with scarce water resources. These resources, particularly groundwater, are at risk as a result of pollution arising from the use of septic tanks and un-lined pit latrines, and from the use of un-lined waste stabilisation ponds. Surface waters are also at risk from the unsatisfactory quality of effluent discharges arising from overloaded or inadequately maintained plants.

Institutional, financial and technical responsibilities within the wastewater/sanitation sector at present are fragmented, resulting in uncoordinated planning, design and implementation, as well as unsatisfactory operation and maintenance. With pollution of the country's water resources already occurring and the volume of wastewater expected to increase 2.5 times by the year 2020, the Government has recognised the need to develop a comprehensive National Wastewater / Sanitation Management Policy to prevent the situation worsening.

The newly established Department of Sanitation and Waste Management (DSWM), within the Ministry of Local Government, has been tasked with developing a draft Policy and will co-ordinate the implementation of the Policy when it is approved by the Cabinet of the Government of Botswana.

Aims and Objectives of the Proposed Policy

The aims of the proposed policy are complementary and are described as being to:

- provide affordable and sustainable wastewater / sanitation infrastructure;
- protect and improve public health;
- prevent pollution of water resources; and
- conserve water resources.

The objectives of the policy are to:

- create an enabling environment through institutional and organisational reforms, supported by an appropriate legislative and regulatory framework;
- introduce effective development planning and management involving central government, local authorities, communities and users;

- promote appropriate, affordable and sustainable systems in both rural and urban situations, including effective and sustainable operation and maintenance;
- establish principles and guidelines for pricing and cost recovery;
- establish a framework for prevention of pollution of the environment through national effluent discharge quality standards and the control of industrial effluent pollution;
- conserve water resources by encouraging the utilisation of treated wastewater;
- promote health and sanitation education / awareness programmes; and
- encourage and facilitate private sector participation in wastewater and sanitation.

These aims are to be achieved through implementing measures in three main areas; institutional, technical and planning. This paper describes the proposed measures.

Institutional Measures

Organisation

At present there are a number of central and local government institutions involved in the provision of wastewater and sanitation services. However, a lack of clarity over the extent of each institution's roles and responsibilities has often led to confusion, duplication and omission. For example, treatment plants have been designed and constructed by central government institutions and handed over to local authorities for operation and maintenance without adequate consultation of the latter. As a result, the local authorities have not provided for the necessary financial and manpower resources to maintain the plants. As a further example, treatment plants have been designed and constructed without determining whether the effluent will be disposed of to surface waters or used for irrigation. Consequently, some plants have been over-designed with capital expenditure higher than necessary.

In the light of the Government's policies of decentralisation and privatisation, it is proposed that the key responsibilities for the sector are assigned to three institutions:

- The Department of Sanitation and Waste Management (DSWM) will be responsible for policy administration, national master planning, sector co-ordination, issuing licences for the construction of wastewater treatment plants, and monitoring sector performance.
- Local authorities will be responsible for the operation and maintenance of off-site wastewater systems, installing new user connections, servicing on-site sanitation (as a contractor), and managing trade effluent discharges to sewers.
- The Department of Water Affairs (DWA) will assume responsibility for issuing discharge permits to surface and groundwater, monitoring compliance with discharge quality standards, and enforcing compliance.

In addition, opportunities for private sector participation either exist, or will be encouraged, in the areas of consulting services, construction, contracting of services, contracting of operations and maintenance, and as an investor in capital works.

Legislation

Current legislative provisions related to sanitation and wastewater are spread across at least eleven existing Acts and their associated by-laws and regulations. In addition a revised draft Water Act has been under consideration since 1995.

Approval of the National Wastewater/Sanitation Management Policy, with its consequent implications for institutional change, will require the current potentially confusing legislative framework to be rationalised, gaps in the legislation filled, and penalties for non-compliance raised to a level where it is no longer cheaper to ignore the law than incur the costs of compliance.

Although wastewater/sanitation legislation could be incorporated into the Waste Management Act, which gives DSWM its powers related to solid waste, or the proposed new Water Act, this could be more time consuming than drafting a separate new Wastewater/Sanitation Act.

Irrespective of the route chosen, the legislation will need to address:

- institutional responsibilities including enforcement of the legislation;
- the framework for cost recovery;
- licensing arrangements for discharges;
- trade effluent control;
- national and local planning;
- operation and maintenance;
- environmental protection and management;
- powers to enforce connection to public sewers; and
- discharge standard compliance monitoring and enforcement.

Cost Recovery

At present, most local authorities make only a token gesture at recovering the costs of the provision of wastewater services and require only a nominal contribution to the construction of on-site sanitation facilities. This situation has arisen as a result of the very strong economic position of the Government following the establishment of the diamond industry after independence and the consequent major investments by the Government in infrastructure improvements and services to meet social needs. Producers of waste products, including wastewater, generally want them taken away – “out of sight, out of mind” and are reluctant to pay for the service.

Government now recognises that social expenditure is not sustainable in the long run and requires that the inadequate cost recovery in the sector be addressed. The basic principle being adopted is that a service such as wastewater/sanitation has to be paid for by charges that reflect the investment and operation costs.

The Government recognises that cost recovery proposals should take account of affordability and, therefore, in some instances subsidy requirements will need to be defined and justified. However, in the case of industrial dischargers the “polluter pays” principle will be employed and local authorities will be required to impose a charging system with incentives for industry to treat its own wastewaters.

Operation and Maintenance

Standards of operation and maintenance of wastewater and sanitation facilities have been unsatisfactory for a number of reasons, including inadequate budgetary provision, insufficient capable and experienced staff, and confusion over responsibilities.

In future, the responsibility for the operation and maintenance of wastewater systems will rest with the local authorities. They will also take over the operation and maintenance of wastewater systems at Government institutions, most of which are inadequately maintained by the institutions themselves, and will be paid by Government for this service. However, so as not to put an unfair burden on the local authorities, the Government institutions concerned will be expected to arrange for the funding and execution of upgrading works where the plants are currently below an acceptable operating standard.

Responsibility for the maintenance and emptying of on-site sanitation facilities will become the clear responsibility of the individual householder. Local authorities may continue to provide this service on a cost covering contract basis, or progressively withdraw and leave the work to the private sector.

The proposed policy document sets out specific recommendations for improved operations and maintenance (O&M) practices:

- fit and proper personnel are to be employed for O&M work;
- all O & M tasks should be clearly defined;
- Codes of Working Procedures and of Safe Working Practices should be prepared and issued to each employee;
- all O & M personnel should have clearly defined responsibilities and have received appropriate training including the use of the above Codes; and
- the safety of O&M personnel is paramount and therefore every precaution should be taken to protect personnel from disease or injury.

Human Resource Development

As in many countries, wastewater and sanitation has been accorded little priority or recognition. Therefore, the sector suffers from a critical shortage of local personnel with adequate skills and experience. At the lower levels, staff are Batswana with limited education or training. Technical and professional staff are often ex-patriates on contract, without the transfer of skills to local staff.

The long term sustainability of the sector requires that the skills of Batswana be raised to an adequate level and that working in the sector be recognised as an essential service. This is recognised through the policy statements that:

- managers will be required to undertake training and personnel development programmes to develop management and planning skills;
- technical support should be provided by central government institutions to local authorities as the latter assume responsibility for works previously handled at the central level; and

- operators should receive hands on and classroom training which includes competency testing leading to a nationally recognised vocational training qualification.

Public Awareness

The general attitude of people towards wastewater and sanitation, i.e. "out of sight – out of mind", has contributed to the poor state of these facilities throughout the country, in particular on-site sanitation schemes. For example:

- misuse of facilities by disposal of non-human waste;
- failure to maintain on-site facilities through emptying;
- failure to understand the need for contributing to the costs of sanitation services; and
- lack of understanding of the potential for re-use of treated wastewaters, sludges, and composted materials.

Under the proposed Policy, the Government will encourage the use of the media to develop and carry out public awareness schemes at a national level. At the local level, public awareness programmes will be implemented with and through organisations such as Village Health Committees, health clinics and schools.

Technical Measures

Recommended Wastewater / Sanitation Technologies and their Application

Groundwater Vulnerability

In addition to conventional selection criteria, the appropriate wastewater / sanitation technology for a given situation will be dependent on the service standard of the water supply, i.e. premises with an individual water connections or those without. In Botswana, with its water scarcity and significant reliance on groundwater, the choice will also be dependent largely on the vulnerability of the groundwater aquifers in the area, the cost-effectiveness of the technology, and the affordability to users.

In areas of high groundwater vulnerability, in order to prevent pollution of aquifers, the technologies being recommended for premises with individual water connections are waterborne sewers or septic tanks connected to small bore sewer systems.

For premises in these areas that do not have an individual water connection, the recommended on-site technologies will be sealed VIDP latrines or sealed dry composting latrines. Both these two technologies have the advantage of not only preventing the pollution of local groundwater, but also reducing the requirement for tanker emptying because the latrines can be emptied by the user.

However, the social acceptance by householders of handling the dried waste material is, as yet, unproven. Pilot schemes involving dry composting latrines have been initiated recently and will be monitored for a period of at least two years to ascertain their performance and user-acceptability. Cost information related to use in particular locations for both the VIDP and the composting latrines will also be collected to compare the comparative cost-effectiveness of the two technologies.

In summary, the proposed Policy sets out the following choices depending on the level of water supply service and groundwater vulnerability:

Groundwater Vulnerability	Premises With an Individual Water Connection	Premises Without an Individual Water Connection
High	<ul style="list-style-type: none"> ➤ Waterborne sewers + wastewater treatment ➤ Septic Tanks + small bore sewers + wastewater treatment 	<ul style="list-style-type: none"> ➤ Sealed VIDP latrines ➤ Sealed dry composting latrines
Low	<ul style="list-style-type: none"> ➤ Waterborne sewers + wastewater treatment ➤ Septic Tanks 	<ul style="list-style-type: none"> ➤ Single pit VIP latrines ➤ VIDP latrines ➤ Sealed dry composting latrines

Replacement of On-site Sanitation by Waterborne Systems

Outside the main urban centres, a particular feature of Botswana is the widespread nature and low population density of settlements. In spite of a previously expressed policy to provide waterborne sanitation to all settlements with a population over 5,000, decisions will need to be made in the future on a number of economic and technical factors as to when on-site facilities should be replaced by waterborne sewer systems. These include:

- population, density of housing, and number of individual connections sufficient for minimum design flows and economic construction;
- the presence of hospitals and other government institutions;
- the presence of industry producing significant quantities of wastewater;
- potential for groundwater pollution or public health risks from existing on-site technologies; and
- plans for upgrading the water supply system.

Connection to Waterborne Systems

Where a waterborne sanitation system is available or being provided it is proposed that the following should be connected to the system, whenever feasible:

- industries and hospitals, with appropriate pre-treatment where necessary; and
- commercial establishments and government institutions (as opposed to having independent facilities).

Appropriate Wastewater Treatment

In general, a wastewater treatment facility should satisfy the following basic requirements:

- employ an appropriate level of technology;
- be relatively easy to operate and maintain;
- be robust and capable of consistently producing an effluent that complies with the required standards;

- be located in an area of suitable geology, preferably of low ecological importance, and remote from water sources such as boreholes and impounding reservoirs; and
- be located reasonably close to the urban area but separated from it by a planned 'buffer' zone.

To ensure that the selected method of treatment is appropriate for the particular local conditions in Botswana, the proposed policy sets out six additional guidelines:

- preliminary treatment in an inlet works comprising screening, grit removal and flow measurement, will be required at all wastewater treatment plants;
- for treatment plants with a design flow of less than 10,000 m³/day, the inlet works should not be mechanised;
- waste stabilisation ponds should always be considered as the first choice of process for municipal wastewater treatment plants and only in exceptional circumstances should other treatment processes be considered. The next choice of technology should be the extended aeration process using the oxidation ditch or one of its variants;
- the location of treatment plants should be such that they will serve drainage catchment areas rather than administrative areas, and administrative boundaries should not be a barrier to the acquisition of land for treatment facilities;
- hydrogeological conditions in the vicinity of the chosen site should minimise the potential for the pollution of groundwater, and the design of waste stabilisation ponds should take account of these conditions in the decision to provide an impermeable lining to the ponds; and
- to facilitate the O&M of waste stabilisation ponds, the design should include bypass pipework for the isolation of individual ponds; vehicle access ramps into facultative ponds to facilitate desludging; facilities for the treatment/drying/interim storage of sludge; and provisions for the ease of desludging of anaerobic ponds by pumping.

Environmental Protection and Pollution Control

National Guidelines

In order to provide for protection of the environment and control of pollution, under the proposed policy the Government will publish:

- National Guidelines for the Discharge of Effluents to the Environment;
- National Guidelines for the Discharge of Effluents to Public Sewers; and
- a Model Trade Effluent Agreement for use by local authorities.

Groundwater Pollution

The Government is concerned particularly that unlined pit latrines in many villages appear to have been a major source of local groundwater pollution. This pollution cannot be eliminated overnight, but phased improvement of groundwater quality can be achieved in areas of particular vulnerability. The Policy proposes measures to achieve this by:

- upgrading pit latrines to waterborne sewers where this can be justified on technical and economic grounds;

- construction of small bore sewers to collect the effluent from existing and future septic tanks; and
- gradual replacement of unlined pit latrines with sealed VIP latrines or by sealed dry composting latrines.

It is proposed that the extent of the problem of groundwater pollution from inadequate or inappropriate sanitation facilities will be quantified, both in terms of area and severity. Remedial wastewater / sanitation measures could take a long time to have any effect and the cost of replacing all sanitation facilities in particular areas by the measures outlined above would be high. In these areas, the option of eliminating health risks by investing in appropriate treatment of the groundwater will be investigated as an alternative.

Control of Industrial Pollution

The objectives of the proposed industrial effluent control policy are to protect human health and welfare, wastewater collection and treatment facilities, and the environment, particularly, water resources. These objectives will be achieved by the implementation of a control strategy based upon the "polluter pays" principle, which comprises:

- compulsion of industries by local authorities to discharge their trade effluents to a public sewer;
- introduction of lists of prohibited and restricted discharges to prevent damage to the sewerage system, treatment processes and workers;
- control of individual discharges by the introduction of trade effluent agreements for all industrial premises;
- monitoring of actual discharges and the enforcement of the agreements; and
- introduction of a system of charges based on the actual cost of conveying and treating industrial wastewater, including administrative costs such as inspection and monitoring and revenue collection.

Utilisation of Treated Wastewater and Sludge

Drinking water in Botswana is becoming an increasingly scarce and expensive commodity. Water resources are being exploited at increasing distances from the centres of demand, at increasingly high cost. Measures must therefore be taken to conserve these vital resources. Internationally, wastewater is reused for a large variety of purposes: from the use of untreated wastewater to irrigate forest plantations to the highly sophisticated treatment of wastewater for "direct use" as drinking water. However, in Botswana, in spite of technical recognition of the benefits of the utilisation of treated effluent and sludge, practical implementation has been hampered by public concerns over the potential risks to public health.

The proposed Policy recommends a number of areas for the potential reuse of treated wastewater, subject to further research and the establishment of National Effluent Utilisation Quality Standards. These are:

- commercial irrigation of crops in the Primary and Secondary Settlement Centres;
- watering of municipal parks and gardens;

- augmentation of water resources for the Primary Settlement Centres, in particular, Gaborone City;
- commercial cultivation of fish; and
- use by industry, in particular the mining industry.

Similar proposals are made for the potential use or disposal of sewage sludge, subject to research and establishing re-use standards, including:

- all sludge should be treated to render it safe for reuse or disposal and be used, where practicable, as a soil conditioner and fertiliser;
- where treated sludge is not being utilised, it should be disposed of to an approved waste management facility; and
- dried latrine sludge from VIDP latrines and dry composting latrines should also be disposed of to an approved waste management facility if it is not to be used as a soil conditioner

Planning Measures

National Level

The Government recognises the importance of setting, and meeting, targets for providing communities with appropriate wastewater / sanitation facilities. The detailed strategy to implement the proposed National Wastewater / Sanitation Policy will be developed through the preparation of a National Wastewater / Sanitation Master Plan. This Plan will address the key strategic and planning issues required to fulfil the aims and objectives of the Policy and will contain the following elements:

- compilation of a computerised data bank of the existing wastewater / sanitation facilities;
- formulation of development strategies and programmes at national and local level;
- identification and prioritisation of wastewater / sanitation projects;
- preparation of an appropriately phased sector implementation and financing plan related to an overall 25 year planning horizon;
- recommendations on the implementation of the required capacity building measures in the sector;
- preparation of wastewater / sanitation design criteria guidelines;
- formulation of a national pollution control strategy, including the preparation of national effluent discharge standards and a model Trade Effluent Agreement; and
- formulation of a preferred strategy for the utilisation of treated wastewater.

Local Planning

Planning at the national level needs to be translated into local wastewater / sanitation sector development plans in order to assist the local authorities in their key responsibility for the development and management of the wastewater / sanitation facilities within their municipal boundary.

Local development plans will be developed to provide the local authorities, and in particular the planning departments, with the tools to ensure that the optimum use is made of existing central wastewater / sanitation facilities. This will enable new development to be steered, as far as is possible, to locations where the connection to such centralised wastewater facilities is most practical.

The development of both a national master plan and local development plans will also facilitate the resolution of any transboundary issues between local authorities in order that the most cost effective and technically appropriate option for providing wastewater / sanitation facilities in such circumstances can be achieved.

Conclusion

The preparation of the National Wastewater / Sanitation Policy marks a major step forward towards achieving a state of sustainable wastewater and sanitation management in Botswana and the recognition of the importance of the sector in protecting the environment and natural resources of the country, particularly the scarce water resources.

The passing of the necessary enabling legislation and the preparation of the National Master Plan will follow the Government's approval of the draft Policy. Together these activities will establish the framework for implementing new capital schemes in a cost effective manner, and for ensuring efficient and cost effective operation and maintenance to protect past and future investments.

Commitments to ensure support of the Policy and the public's participation in its implementation will be obtained through the development of awareness and education programmes directed at, for example, householders, industries, central and local government officers, political and traditional leaders, and environmental NGOs.

Acknowledgement

The author wishes to acknowledge the permission of the Department of Sanitation and Waste Management to publish this paper. However, while the paper has drawn on the content of the draft National Wastewater / Sanitation Management Policy currently under consideration by the Government of Botswana, the views and interpretations expressed are those of the author and not necessarily those of the Department.