Lessons and Experiences from the eThekwini Pilot Shallow Sewer Study

Executive Summary

1. INTRODUCTION

The Shallow Sewer concept has been successfully implemented in Brazil, Greece, Australia, USA, Bolivia, India and has become the norm in Pakistan, and has proven to be an extremely practical, low cost solution for installing water borne sewage systems within highly dense, informal communities. The technology is intended to develop and uplift communities while enabling governments and service providers to provide greater coverage of sanitation services. This is done through the relaxation of several design characteristics of conventional sewerage and in the process allows for shallower depths, smaller diameter pipes, flatter gradients and community based construction, operation and management.

Besides offering the convenience and health benefits of waterborne sanitation, the methodology with its intensive social programme, is intended to provide people living in communities with the skills to pull themselves out of poverty and to better organise themselves to use their social, intellectual and other capital for their own upliftment, while at the same time reducing the operational load of the service provider.

eThekwini Water Services (EWS), in a joint venture with Water and Sanitation Services (South Africa) (WSSA) and the Water Research Commission (WRC), investigated, through a Pilot project, whether Shallow Sewers would provide a viable alternative waterborne sanitation system to the urban poor in dense settlements. The practical applications of the Shallow Sewer methodology were evaluated in two eThekwini communities, Emmaus and Briardale.

1.1 The eThekwini Pilot Application

With no South African experience of consequence to use as a guide, the implementation and management for the eThekwini pilot was based on the successful model used in La Paz, Bolivia, as imported by WSSA's Project Manager who had had extensive experience of the implementation of this model. The two pilot communities, Briardale and Emmaus, were selected based on the results of a social evaluation of five potential communities in eThekwini.

The research objectives were to assess the financial, social acceptance, quality of life, technical, legal and institutional management aspects of Shallow Sewers in eThekwini. In addition, this initiative evaluated the methodology and how it was applied to the La Pas model imported from Bolivia, and discusses the suitability and relevance of such interventions to the South African environment.

1.2 Parameters and Constraints

Emmaus was an existing community with free hold property rights, who had already been upgraded and therefore had already received their Provincial Housing Board (PHB) subsidies. The existing on-site sanitation system had failed. The community consists of 96 households, with a wide range of incomes, which are distributed into a richer and a poorer sector of the community. One third of the community earn is excess of R1800 per household per month, whilst 36% are very poor, with an income of less than R600 per household per month (5).

The Briardale community was a green-fields development made up of 157 households who were the over-spill from other upgrade projects. This development was being undertaken by an NGO using a "self help" scheme, on land being developed under the Communal Property Association Act. The average household income of this community was approximately R700 /month which was normally distributed about the mean (5).

There were two major factors, one at each of the sites, that were beyond the control of the project management, and that had serious consequences on the project: (1) at Emmaus, during the Local Council elections, the aspirant councillor, who was subsequently elected, promised the community "free basic water" which was interpreted to mean that this included all internal plumbing, connection and consumption costs; and (2) at Briardale the developer was unsuccessful at registering the housing scheme, which meant that the PHB subsidies were not forthcoming, which subsequently lead to the collapse of the development.

1.3 Status Quo Report

The final commissioning and operational phase has not been completed on either project due to community pressures. In the case of Emmaus, a large percentage of the community have not installed the wet core services, including the water connection and sewer connection costs and Municipal charges, citing:

- Lack of funds, despite initiatives put in place to contribute to these costs, through payment to the community involved in the construction.
- The promise of free basic water, and the community's understanding that this included all internal plumbing, connection and consumption costs

In the case of Briardale, the community has rejected all initiatives it has associated with the failed housing development initiative, including the Shallow Sewers.

2. FINDINGS

Undertaking this research in South Africa through the eThekwini Shallow Sewer Pilot study has revealed considerable insight into the sanitation environment in general, with particular reference to Shallow Sewers. It has also provided an opportunity to guide the development of a range of similar technologies that would be applicable in the South African context.

2.1 Benefits of Shallow Sewer Systems

There are potentially substantial benefits for "Shallow Sewer type" systems. The study showed that Shallow Sewers can provide all the convenience and benefits of waterborne sanitation at half the capital cost of conventional sewers and that they may even compare favourably with the cost of pit latrines.

Technical aspects

From a technical perspective, there is no apparent reason why Shallow Sewers should not function as well as, nor provide the same level of service to the customer, as conventional ones. In densely settled areas where space between buildings and space for the evapo-transporation is limited, thus limiting the use of conventional sewers and on-site sanitation systems, Shallow Sewers may provide the only technical solution. Their shallow depth, reduces the amount of excavated material that is required to be moved considerably, thus allowing access to areas which are not accessible to conventional sewers.

The approach of reducing the construction standards has positive effects on the construction and maintenance, and consequently the cost, achieved by simply laying the sewer at a shallower depth. Of particular note is that the soil volumes that are handled are far smaller than in conventional sewers, the

pipes are also generally laid above the rock and water table, thus reducing the cost even further. In addition, because of the shallow depth, access to the pipe can be done from the surface thus obviating the reason to have "manholes" large enough for a man to enter. Thus not only the depth of the access point is reduced, but the cross-section dimension too. Access chambers costs were found to be an order of magnitude cheaper than conventional manholes. In addition the smaller diameter pipes should provide better solids transportation than conventional sewers in situations where low flush volumes are utilised.

Community-based development

There were, nationally, a number of similar community based development projects that were running concurrently with the Shallow Sewers project. Within these technologies there were a group that had similar philosophies and tenets to that of the Shallow Sewers, with slightly different techniques of achieving certain specifics. The Shallow Sewer technology could provide the basis for a "South Africanised" development technology, based on these philosophies, where the best of the various techniques are combined. Further, the Shallow Sewers technology is not a single technology but rather a suite of technologies. A range of models could be developed to suite a number of different situations.

Social aspects

Shallow Sewers improve the householder's quality of life by offering the convenience and health benefits of a water supply and waterborne sanitation to each home. One of the features of this technology lies in the social development of the communities. Social upliftment skills were provided at a number of levels.

- At household level, health and hygiene and general waterborne sewerage utilisation skills were provided.
- At sub-community level the community is divided into "condominium" which operate a sewer line. The condominiums were taught the fundamentals of maintaining the sewer system as well as the management skills required to keep the condominium sub-community functional.
- Also at the sub-community level certain of the trade skills such as elementary pipe-laying, brick-laying and plumbing was provided to certain key individuals in the community.
- At community level management skills were developed. These included skills such as conducting meetings, handling and managing finances, etc.
- At a different level participants were taught how to identify and facilitate the solutions to their own problems. They also acquired skills on how to communicate with other community members as well as external parties, and began to understand, that through shared knowledge and human capital, projects can be undertaken even if there are limited resources within the community.

It was concluded that a social intervention that builds capacity in people to enable them to undertake development for themselves is very important and that perseverance to get the formula right for South African communities could benefit the country enormously. The social aspect is much wider than providing sanitation.

Financial aspects

Shallow Sewers can be installed at significantly reduced capital costs. The results of the evaluation demonstrated that Shallow Sewers could be installed at approximately 50% of the capital cost of conventional sewers, if the costs are "ring-fenced" to the site of the development (i.e. ignoring the capital costs of the bulk reticulation and treatment works). The "on development project" capital cost of Shallow Sewers also compares favourably to that of VIPs: i.e., using the same ring-fencing of the costs as above, then the capital cost per household for Shallow Sewers is similar to that of a double vault VIP. The cost of the social intervention has been included in the capital cost for the Shallow Sewers, for the purpose of this comparison.

The provision of Shallow Sewers is compatible with the steps and timing of the Provincial Housing Board's subsidised housing system. They are also affordable to all, provided that the first six kilolitres per month of water is supplied to each household free of charge.

Environmental aspects

Environmentally, Shallow Sewers have a similar impact to that of waterborne sanitation, protecting watercourses, people and the environment in general from human waste.

2.2 Drawbacks of Shallow Sewers

The Shallow Sewer System potentially provides an excellent sanitation solution in the "water and sanitation package" for South African communities. However, there are some primary drawbacks for the South African context.

Legal issues

Certain issues need to be resolved before Shallow Sewers can become a viable option for service providers.

Community ownership of the common sewer line is in conflict with land tenure principles. At Emmaus, where the homeowners have title to their individual lots, the legal status of the Shallow Sewer and the necessary requirement that the homeowner must be a member of the condominium is not written into the title deeds and are therefore not enforceable. Briardale has been developed under the Community Property Association Act, and the necessary legal arrangements for the formation of the condominiums have been written into the community property owners' constitution

There are also contractual difficulties with indigent people. Frustration arises from a lack of enforceability of obligations imposed contractually on indigent parties who, due to lack of financial means are unable to fulfil these obligations.

Technical issues

Shallow Sewer technology transgresses the National Building Regulations (NBR) in a number of cases − e.g., pipe diameter and manhole size. The prime one arises due to the unauthorised drainage work undertaken by the community.

Laying the sewer to a shallow depth obviously changes the risk of damage due to imposed load considerably. Bye-laws very often control the minimum depth to which sewers may be laid, and this may conflict with the depth tenet of Shallow Sewers. Due to the shallower depth at which the sewers are laid, a number of the appurtenances that have been designed for conventional sewers, are either no longer applicable, do not fit the Shallow Sewers, or their technology is inappropriate for the construction practice. In this particular instance, the conventional gully was replaced by an in situ built, brick grease trap. These grease traps turned out to be very efficient and needed cleaning regularly, which the communities complained about. Initially the ingress of soil into the sewer system was a problem, which was resolved by raising the inspection chambers by one course of bricks.

Institutional issues

This study could not fully evaluate and quantify how onerous the management of Shallow Sewers would be on the services authority. The final consolidation phase, which has taken longer than planned due to the local situation and dynamics, had not yet been completed and eThekwini Water Services had not taken over the responsibility of retaining the system by the time the research reports were written. However, it was evident that the key to the successful implementation of Shallow Sewers rests in the

social intervention, which requires knowledge and dedication on the part of the implementing agency. An essential lesson learned from this experience was that, besides requiring extensive participation by the community in the installation and maintenance of the system, this technology also requires extensive support and participation by the service provider, and that technical support and training needs to be ongoing.

Institutionally, the service provider needs to be structured in a way that it can provide community-based services. An interdisciplinary approach is one of the tenets of the Shallow Sewer system, meaning that community liaison staff and social professionals need to team up with technical staff to provide holistic operation and management solutions. In this instance, it would have been beneficial to have other municipal departments dealing with the housing, treasury and others drawn into the team, to ensure an integrated approach to development of the area as a whole. Developmental interventions pressurize the communities, and sometimes polarize sectors of the community. Therefore the community leadership needs to be strong enough and have the community support, to guide its members though the implementation.

Social issues

A practical drawback relating to training in a community was associated with finding a time that suited the whole group, as limited time windows were available to those members of the community that worked. Some communications were made through condominium representatives, a strategy that did not always work well. It was important that as many members of the community as possible were exposed to the educational sessions; however, it is proposed that at least one senior member of each family received the full education. In cases when Condominium leaders changed at Briardale, the new leaders sometimes had not received sufficient training or communication. This may also be attributed to conducting training in a green fields situation where some of the community members have not permanently moved to the site.

Generally in both communities it was found that the condominium (Iqoqo) leaders did not continue to manage the condominiums well over the research period, although there were exceptions to this at Emmaus. These exceptions could, perhaps, be attributed to the fact Emmaus is a well-established community and therefore they may be more self-reliant.

Social and political influences

Some of the more affluent members of the community at Emmaus wanted a full pressure water supply. The majority of the community wanted semi-pressure and the policy of the eThekwini Water department was to supply only one level of service into a community. The unhappiness that this created led to one of the condominiums withdrawing from the project.

Local Council elections occurred during the project, and one of the aspirant councillors promised "free water for all". The aspirant councillor and subsequently the community undertook this to mean that all water supplies, at all service levels, including all connection costs, would be provided by the Council free of charge. This undermined the premise under which the project was undertaken and the community would no longer uphold their side of the agreement and make their water and sewer connections. Certain influences are beyond the control of the implementing team. For instance, there is no mechanism in the political system to deal with political promises that do not align with mainstream understanding or the tenets of the project. In this instance the local government elections, occurred during the project. Even if the project team had foreseen the problem, it is unlikely that they could have done much to influence its impact on the project.

Timing issues

An issue that arose in relation to the project management was the mismatch between "deadline" related construction, which implies time related management, and community/social management, which implies that the interventions proceed at the rate of community development. This potential conflict occurs on two levels.

The contractual arrangements for the Project Manager and the social consultant had time and cost restrictions although both contracts were extended. Both the parties left the project at the end of the works implementation phase when only two houses in each community had been completed and connected to the sewer and water supply, leaving certain critical interventions incomplete. It was also at this point in the development when serious social issues in both communities surfaced. Working with communities in this type of project does not lend itself to such restrictions and these problems may not have occurred if the service provider had the resources to undertake such interventions in-house, at a pace more suited to the pace of skills assimilation in the community. Continuity of management is also important in maintaining community commitment.

At the political level there is a demand that there should be social development with all infrastructure development. At the same time there is a demand for rapid catch-up of backlogs in infrastructure. Currently there is no guideline to for developers to prioritise between the two. This leads to uncertainty and conflict.

3. CONCLUSIONS

At this point in South Africa's development, Shallow Sewers in its pure form (i.e. as intended by the La Paz model) are not applicable to the country in general, although there may be instances where it may work to a degree. This is concluded primarily because:

- Of the mismatches between communities' expectation that the "government will provide" and the self-help tenet of the Shallow Sewers;
- the governments assume that rapid infrastructure development and community social upliftment are concordant;
- The legal conflict between the private land tenure and communal ownership of fixed property on that land; and
- The institutional arrangements at local government are not structured for interdisciplinary community development.

The potential capital saving provided by a reduced depth sewer is enormous, and technically it should not be difficult to develop a reduced depth, conventionally owned and operated, sewer from the lessons learned from the Shallow Sewers pilot.

This research has provided some understanding of the urban poor market, and some of the lessons learnt from the Shallow Sewer pilot study could be applied to improve the success of other community development projects. In this regard, should it still be the government's intention that infrastructure development should encompass community social development, then the Shallow Sewer methodology could form the basis of a "South Africanised" community development methodology.

4. RECOMMENDATIONS

- As the institutional and long-term aspects of the Shallow Sewer project have not been evaluated, resources need to be set aside for these evaluations to be undertaken.
- In order to diminish the conflicts such as "community upliftment" vs. hardware delivery; "self help" vs. "government will provide" etc., a policy review and upgrading of development policies needs to be undertaken, certainly at local authority level, but preferably nationally. In particular

the conflict in policy between rapid service provision and community development must be resolved.

- To facilitate rapid service provision and provide technical advantages over conventional sewers whilst policy issues (above) are being clarified, it is recommended that a reduced depth sewer system, based on the technical advantages of Shallow Sewers, be developed and tested as soon as possible. The development of these reduced depth sewers need to take into consideration the findings of this study, i.e. issues such as the legal conflict regarding land tenure, etc.

As community-based development can be used to empower communities, and should the policy review indicate that this is desirable and the process is unfettered, then it is considered that a single uniform methodology would be appropriate to undertake this type of development. In this instance, it is recommended that the Shallow Sewer methodology be used as the basis for this methodology.

The full report is available from the Water Research Commission, Pretoria, South Africa
www.wrc.org.za