SEWAGE SYSTEMS IN REMOTE INDIGENOUS COMMUNITIES

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Abstract

A desktop study has been undertaken which has identified the present situation in Australia with regards to sewage disposal in remote Indigenous communities. The study has identified some 76,000 Indigenous people living in around 1,100 separate remote communities. 37% of this target population was found to be served by full sewage systems, 22% by common effluent disposal (CED) systems, 31% by septic tank systems, 7% by pit toilets and 3% with other systems (including systems not identified). Taking into account the difficulties of arriving at any conclusion from such a desktop study, it was found that in general the basic technologies used for sewage disposal *per se* were adequate. The problem areas concerned the installation, operation and maintenance of the sewage systems in the remote Indigenous communities. A further study looking at actual systems in the field is recommended.

Keywords

central, ced, indigenous, on-site, pit, remote, sewage,

1 Introduction

Poor performance of sewage systems and inadequate sewerage hardware has consistently been identified as major contributors to poor health in remote Indigenous communities (Miller & Torzillo 1996). The efficient removal of waste has been identified as a high priority by many organisations involved with improving Indigenous health. In addition the Aboriginal and Torres Strait Islander Commission (ATSIC) is concerned that the problem has not been solved despite, the considerable being directed towards the problem. To help understand the issues involved, ATSIC asked the Centre for Appropriate Technology (CAT) to undertake a study of the status of sewage systems in remote Indigenous communities. The emphasis on remote communities in particular is because it is thought that the problems experienced by such communities are quite different from those communities with access to large town non-Indigenous service provision.

This desktop report is the first stage of such a study. It is a desktop study in the sense that it has been compiled from existing information supplemented with telephone inquires to community personnel where the existing information was thought to be lacking. The problems of using such data gathering methodologies are well known and it is realised that what people express verbally is not always a good representation of what is actually in place.

With the above difficulty noted, the present survey then details the current status of sewage systems located in remote Indigenous communities in Australia with regard to the funding, regulation, construction, use and maintenance of systems. Common problems with system hardware, use and management are identified.

2 Survey Methodology

The background literature revealed that relatively little information has been recorded about the management of sewage systems in remote Indigenous communities. As a result, much of the data for this survey was collected from telephone conversations with relevant personnel associated with the management of sewage in remote communities. The sources of information included Commonwealth and State/Territory government personnel from a range of departments (health, water resources, housing, environment, policy), industry contractors associated with government agencies or communities, and a range of community personnel (advisers, Essential Service Officers - ESOs,

plumbers, environmental health workers, residents). In all over 200 persons were contacted across Australia.

General community information was obtained primarily from the 1992 "Housing and Infrastructure Needs Survey" (HINS) funded by ATSIC . From this database community names, locations, populations and sewage system types were obtained. This information was updated where possible using state government databases (available in WA and NT only), other pertinent recent surveys including the Environmental Health Needs Survey undertaken in WA in 1997, Australian Bureau of Statistics (ABS 1997) data and direct contact with government and community personnel. In many cases the HINS data concerning sewage system types on individual communities was found to be out of date or inaccurate, possibly because of poor wording of the survey categories in the original survey form.

Information on the physical performance of sewage systems was gathered mainly by telephone conversations with government, industry and community personnel directly associated with community sewage management. A handful of published studies was also identified which discussed the performance of on-site sewage systems (see Khalife el al.1997, and reports by Lange Dames and Campbell 1994, .Ove Arup & Partners 1998 and Sinclair Knight and Mertz 1997). No existing study, however, was found which looked only at centralised sewage systems.

The administration of sewage systems included the maintenance regimes developed by individual communities, the regulation of systems by government agencies and the funding for installation and maintenance of systems by various tiers of government. Information on these aspects was gathered from a range of sources including Commonwealth and State government agencies, industry contractors employed by government agencies and a range of community personnel.

Information on alternative sewage systems was collected from Australian system manufacturers, state government publications, various overseas aid publications and the Internet.

3 The Study Sample

The study sample consisted of remote Indigenous communities. For the purposes of this study, a "remote community" was defined as:

> *Any discrete Indigenous community or outstation which was not directly serviced from a non-Indigenous town, and where sewage was managed largely within the community.*

This (rather loose) definition was adopted because many peri-urban Indigenous communities and "town camps" either use town sewage systems or potentially have access to sewage management services of the town. The definition is loose because we are not defining the exact distance that the remote community has to be from the non Indigenous centre. It is thought that the number of "borderline" communities, that is those that may or may not be called remote depending on the strictness of the definition, are small compared to the total remote population and that their inclusion (or exclusion) will not affect the general analysis of the situation. This definition meant that only three states, (SA, WA, Qld) and the NT needed to be considered. For the survey, communities were divided into three population categories. The categories chosen were as follows:

- *Large communities >200 persons*
- *Medium communities 50 – 200 persons*
- *Small communities* and *outstations < 50 persons*

3.1 Remote population

The study identified a total remote population of around 76,000 people in the three states and the Northern Territory. The NT was found to have the highest remote population with over 34,000 people, whereas SA had the lowest remote population of 3,280 people, most of whom live in the Anangu Pitjantjatjara (AP) Lands of north-west SA. The NT has by far the highest proportion (69%) of Indigenous people living in remote communities compared to Indigenous people living in non-remote centres. Figure 1 shows the remote and total Indigenous population.

3.2 Remote Community size distributions

The study identified some 1,100 remote communities in the three states and the NT. Communities ranged in size from single family outstations to large towns. The largest remote community identified was an island community in Qld with 3,300 inhabitants. Of the total remote population, nearly two thirds of the inhabitants (64%) were found to live in 91 large communities (with a population greater than 200). 17% of the remote population lived in 125 medium sized communities (between 50 and 200 persons), while the remaining 18% of the remote population lived in 906 small communities or outstations (with fewer than 50 inhabitants).

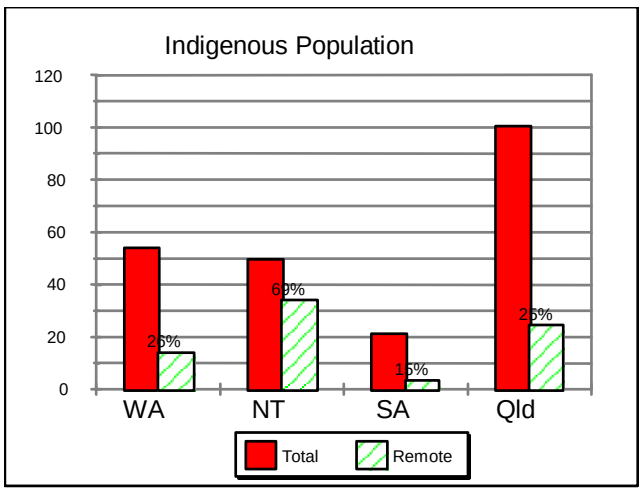


Figure 1: Total and remote Indigenous population

Significant differences are seen to exist between the states and the NT as far as the distribution of community sizes is concerned. The NT has the highest number of small communities or outstations (523), reflecting a long history of outstation development. Queensland has the largest communities, with twelve having more than 500 inhabitants, and also the largest single community (3,300 persons). SA has no single community with more than 500 persons although the AP Lands in the NW of the state have a combined population of around 3,000 persons. For the small communities and outstations it is highly likely that they would not all be occupied at any one time.

3.3 Remote household size

High household populations in remote communities are reported to be very common. The reason is attributed to the combined forces of a shortage of housing and high population mobility. Several studies have measured house populations, including a survey of 15 NT communities, which found average populations ranged between 2.0 and 4.6 persons per bedroom. In Pipalyatjara, SA, a *Healthabitat* study (Pholoros et al. 1993) identified average populations per house to be 8, 7.5 and 10.6 persons in three different surveys over several time periods

3.4 Population changes in remote communities

Significant population fluctuations between and within remote communities are known to occur for social, cultural and climatic reasons. The resulting high fluctuations in individual household populations also have the potential to cause serious impacts on sewage system performance. There is considerable evidence to suggest that population fluctuations are common across many remote populations of WA, NT, SA and Qld, especially for the small and medium size communities. Regular household size changes of between zero and 30 persons have been observed. Fluctuations of this magnitude can overload systems to the point where they fail.

Table: 1

	Population Serviced (%)									
System Type	WA		NT		SA		Qld		Total	
Full sewage	970	(7)	15364	(45)	0	(0)	11690	(47)	28024	(37)
CED sewage	7059	(50)	3024	(9)	1744	(53)	4470	(18)	16482	(22)
Septic tanks	4620	(33)	11049	(32)	661	(20)	7570	(31)	23900	(31)
Pit toilets	360	(3)	4071	(12)	841	(26)	425	(2)	5697	(7)
Other	*130	(1)	**185	(0.5)	0	(0)	0	(0)	315	(0)
None	250	(2)	229	(1)	34	(1)	0	(0)	513	(1)
Not determined	678	(5)	245	(1)	0	(0)	472	(2)	1395	(2)
Total Population	14067	(100)	34167	(100)	3280	(100)	24627	(100)	76141	(100)

4 Results

4.1 Sewage systems identified

The present study identified four basic sewage technologies in common usage. These were:

- full sewage systems
- common effluent disposal (CED) systems
- on-site septic systems
- pit toilets and grey-water systems

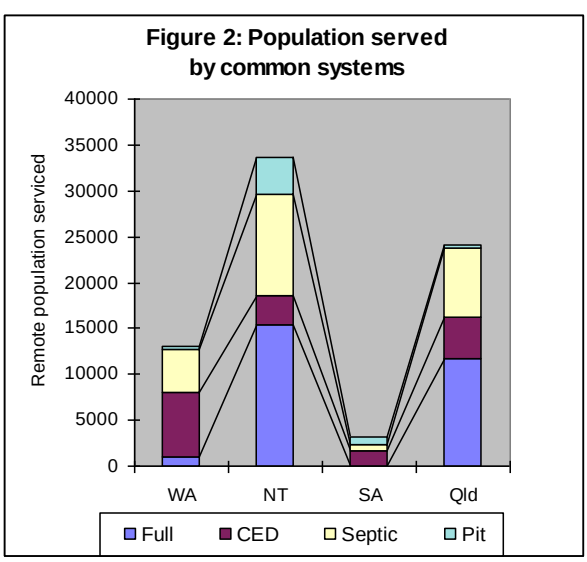
The basic technologies employed were virtually identical across each state and the NT although the management of those technologies was found to vary significantly between states. In addition the study identified a handful of communities with sewage technologies other than those identified above.

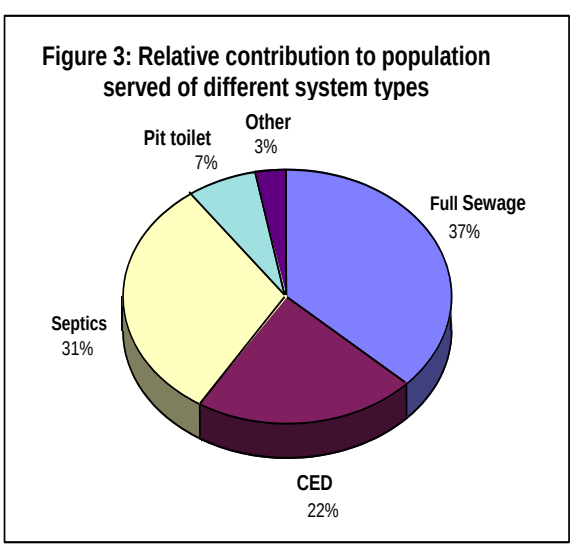
Table 2:

Sanitation System...	Number of Communities & Outstations Serviced					
	WA	NT	SA	Qld	Total	% popn.
Full sewage	2	30	0	12	44	(37)
CED sewage	31	8	7	4	50	(22)
Septic tanks	150	292	15	63	520	(31)
Pit toilets	26	209	58	18	311	(7)
Other	1	1	0	0	2	(0)
None	11	29	7	0	47	(1)
Not determined	81	49	0	18	148	(2)
Total Communities	302	618	87	115	1122	(100)

Table: 3

Sanitation system	Number of remote communities in WA, NT, SA & Qld in population range						
	Small		Medium		Large		Total
	1 to 20	21 to 50	51 to 100	101 to 200	201 to 500	over 500	Communities
Full sewage	0	0	0	5	21	18	44
CED sewage	0	1	7	14	22	6	50
Septic tanks	264	160	37	35	22	2	520
Pit toilets	222	70	19	0	0	0	311
Other	0	0	0	2	0	0	2
None	41	4	2	0	0	0	47
Not determined	135	9	3	1	0	0	148
Total communities	662	244	68	57	65	26	1122





4.2 Population served by the different sewage systems

Figures 2 and 3 show the different types of sewage systems in place as a function of the population served. For the combined study area, centralised sewage systems were found to service 59% of the remote population and on-site systems serviced 38% of the population. The remaining 3% of the population were found to have either no sewage, alternative systems or a status which could not be determined. Table 1 shows that the remote population serviced by different sewage systems in the different states. The table shows there were significant differences between the states and the NT in regard to the type of centralised system or on-site system preferred. For centralised systems, full sewage systems were preferred in the NT and Qld, while CED systems were favoured in WA and SA. For on-site systems, pit toilets were rarely used in WA or Qld as primary sanitation systems, but were far more prevalent in the NT and SA.

4.3 Number of sewage systems in place

The number of communities using different types of sewage systems across the states and the NT is shown in Table 2. It is clear that there is a distinct difference between the number of communities using centralised sewage systems (95) and the number of communities using on-site systems (831). However, centralised sewage systems are generally installed in large communities and so service a large percentage of the remote population. Thus, whereas centralised systems are only installed in 8% of communities, they service 59% of the population. On the other hand, 74% of communities use on-site systems (septic systems and pit toilets) but these only service 38% of the total remote population. Table 3 shows the type of sewage systems used by communities of different sizes. The table shows distinct variations in system use across different community sizes.

4.4 Large Communities

Large Communities comprise 64% of remote population (91 communities with more than 200 inhabitants). The data indicate that all inhabitants of these communities use water borne flush toilets. No communities of this size were identified as using pit toilets as their primary sanitation system. 74% of large communities currently use centralised sewage systems and 26% currently use on-site septic systems. Several communities in this category with on-site septic systems were found to have plans to upgrade to centralised sewage systems. Eight such communities are currently earmarked for HIPP/NAHS upgrades (Downs 1997) to centralised sewage systems (seven of which are in the NT).

4.5 Medium Sized Communities

Medium Sized Communities comprise 17% of the remote population (125 communities with between 51 and 200 inhabitants). Here a greater range of sewage systems was found to be in use. 26 communities (21%) had centralised sewage systems. 72 communities (58%) used on-site septic systems; (five of these are earmarked for NAHS upgrades to centralised systems). 19 medium sized communities (15%) used pit toilets as the primary sewage system, 15 of these were NT communities which had made conscious decisions to retain pit toilets and not move to flush toilet systems because of reduced maintenance requirements.

4.6 Small Communities and Outstations

Small Communities and Outstations represent 18% of remote population (906 small communities and outstations with between 0 and 50 inhabitants) Information on sewage system types was found for only 822 of these communities. Only one is known to have a centralised sewage system. Due to the small community sizes, others are unlikely to receive centralised systems while the populations remain low. The exceptions are communities with particularly adverse site conditions for on-site wastewater disposal (e.g. several Torres Strait Island communities). Some of these latter communities may receive small-centralised systems in future. 424 communities (47%) had on-site septic systems, and this figure is likely to grow as new houses are constructed containing flush toilets. 292 communities (32%) had pit toilets. Many outstations (particularly in the top end of the NT and the AP lands of SA) had made conscious decisions to retain pit toilets due to lower maintenance requirements. Many other outstations with temporary pit toilets were in early stages of development (e.g. Cape York Peninsula outstations). These communities may choose to retain pit toilets or convert to flush toilets as infrastructure is developed. 45 communities (5%) had no sanitation systems at the time of the survey. It is likely that many of latter communities will gain flush toilets or pit toilets in the future if the communities themselves are not abandoned (ATSIC 1998).

5 Results

5.1 Performance

Overall most communities with centralised systems reported satisfaction with the performance of the systems and felt that they kept people adequately separated from sewage. The evidence obtained suggested that the main reason for successful operation of centralised systems was the effectiveness of formal recurrent maintenance programs, which generally kept systems in good working order. Some problems with the centralised systems were identified, however, with the main ones appearing to stem from high solids loads entering systems because of inappropriate use of toilets.

In contrast, on-site septic systems appeared to have significant failure rates across many communities, with evidence suggesting that poor installation, inappropriate use and lack of maintenance were the prominent reasons for the failures. Because of the distributed nature of the on-site septic systems, it is likely that even a few failing systems in a community may subject a good proportion of the community to sewage-related health risks. If the problems identified with septic systems are verified by field surveys, then it will mean a broad range of issues must be tackled to improve septic system performance. Pit toilet systems on the other hand seemed to be used successfully on many outstations and provided a level of reliability not achieved by septic systems. Pit toilets, however were found to have a poor image and many communities were reluctant to retain them if flush toilet options were available. Specific problems identified by the survey with regards to sewage systems in remote communities are summarised as follows:

5.2 Water borne sewage systems

- poor initial construction of internal wet areas and household drainage pipes;
- Blocked flush toilets due to both misuse and inappropriate use by children and adults;
- Leaking taps and taps left running causing overload of water borne disposal systems (both on-site and centralised)

5.3 Centralised sewage systems

- Septic tanks (for CED systems) filling with solids due to irregular pump out of tanks allowing solids through to the pipe network and lagoons;
- Break down of pumping station infrastructure, often due to high intermittent solids loads.
- Deterioration of old sewerage pipes;
- Lagoon failure due to high water loads and inadequate maintenance;
- Poor initial construction of some systems.

5.4 On-site sewage systems

- Septic tanks filling with solids due to irregular pump-out, allowing solids to wash through and clog absorption trenches;
- Poor initial construction and/or undersizing of septic tanks and absorption trenches causing system failures;
- Poor siting of systems allowing vehicle damage or restricted access for maintenance.
- Inappropriate site conditions including non-absorbing soils (clays), rocky ground and high water tables;
- Irregular maintenance of all aspects of septic systems, particularly leaks and septic tank pump-out;
- Poor image of pit toilets;
- Inadequate disposal of grey-water where pit toilets are used.

A handful of communities reported that they had overcome most of the above problems and that their sewage systems were currently working well. It appeared this was achieved slowly and was the result of careful planning, ongoing user education, replacement of failing hardware and good management of systems. Some communities with successfully operating systems were found to have pooled their resources to create local service provider organisations servicing all sewage systems. The regional approach to sewage system maintenance and management as practised in the AP lands looked particularly promising and may be a model for other remote areas.

5.5 Other systems

In addition to the above four common types of systems, a range of alternative sewage systems was examined for their potential applicability to remote communities. It was concluded, however, that very few of these systems were as appropriate as the common systems and would most likely suffer the same problems in regard to inappropriate management and use. Household systems that needed continuous electrical power though particularly prone to failure.

5.6 Organisational aspects

From an organisational aspect there appeared to be a lack of communication between different tiers of government in respect to the provision, use and maintenance of sewage infrastructure. This could be improved through better co-operation between government departments. Community councils, in particular, appeared to need technical and financial assistance to develop adequate maintenance programs for infrastructure currently under their control. Appropriate training materials and training programs pertaining to the use and maintenance of wastewater systems were found to be particularly sparse.

6 Conclusions

It was felt that coming to any conclusion from the evidence obtained from a desktop study, without confirmatory field results, was fraught with difficulties. Nevertheless a general feeling emerged that the basic sewage technologies available per se were adequate; the problem areas concerned the installation, operation and maintenance of the sewage systems. Fieldwork, undertaken at the Centre for Appropriate Technology in other areas, suggests that the difficulties of operating and maintaining **any** technology in a remote location cannot be overemphasised. If the above basic conclusion is supported by a field study then the solution would point to increased funding for operation and maintenance, training and institutional support.

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