uses the community participation as a key element on the development of the technical solution for the system. The model is based in the ideas that appropriate technology can only be generated with the participation of the community it tries to attend, and that only through this participation is that sustainable solutions can be achieved. The resulting Condominial system allows more flexibility of implementation, savings of up to 65% when compared to the costs of installing the conventional sewerage systems and more operation and maintenance simplicity.

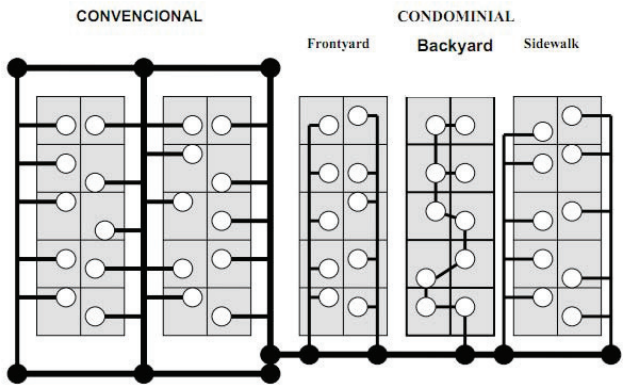
The Condominial System is an engineering solution based on the community participation. A condominial network cannot be constructed without the community participation, because the community participation is what allows the system to be taken to its most positive solutions. When the community acts as a unit, where a collective solution is drawn in a place of an individual one, the system works at its best, resulting in the best technical solution, which is usually the cheapest and simplest one.

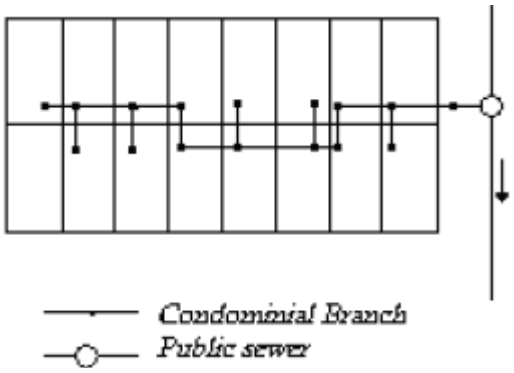
The community participation allows a natural adaptation of the system to the most diverse existing physical and cultural conditions, which is a basic requirement in most the periphery-urban areas of the cities, where the existent cultural situation plays a significant role in the success of any project. Community participation is the basis of the condominial system. Through it, the proposals, ideas and solutions for the system to be implanted are put into practice, leading to its understanding and adequate use. It has the aim of promoting participation and understanding of the system's installation process and its future operation.

From an engineering point of view, in the condominial system , the sewerage network is divided in two parts, the public one, constituted by the main network, called Public Sewer, and the condominial one, represented by the Condominial Branch, which is considered the collective connection to the Public Sewer. The Condominial Branch basically attends what would be the smallest group of houses in a TOWN. This group of houses are linked to the main public network by a single condominial branch. In this way the public sewer only reaches the group houses, the block, in a way to receive the collective connection. It only touches the block instead of surrounding it as in the conventional system.

2.1 Condominial branch

The Condominial Branch is the pipeline that collects all the wastewater produced within an urban block. It acts as a collective connection, connecting the domestic installation of each household of a block to the public sewer that passes along the block extremity. The condominial branch can be of several sorts, according to technical considerations or neighbours decision. The final lay out of the condominial branch should both obey to strict technical recommendations and be the result of the neighbours discussion and approval. The following lay-outs are the most commonly types of condominial branches used in the system.

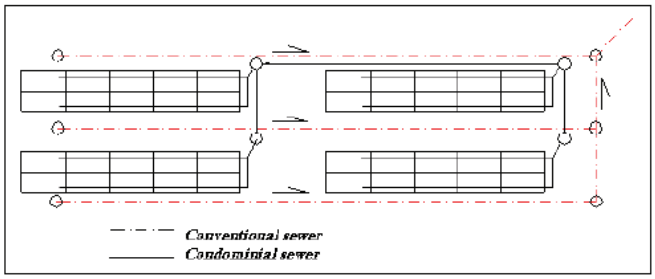




2.2 Public sewer

Is the pipeline that collects the wastewater from the condominial branches. This pipeline is always on the public area of the town. It follows the last inspection box of each condominial branch, and is installed, if possible on the sidewalk of the streets. When this is not possible it will be installed at the road. When the public sewer passes along the face of a Block, no condominial branches are needed at this side of the block and connection are done directly into the public sewer.

With the use of the condominial system, the total length of the public sewers is drastically reduced, when compared to the traditional sewerage system. In the condominial system most of the network is made of condominial branches and only around 30 – 40 % of the system is made of public sewers. It must be emphasized that less sewers on the public areas of the city mean less risks of obstruction or damage to the system, for the condominial branches, mostly constructed in protected areas have a natural increased protection against external factors. The general lay out of a condominial system,with the condominial branches and public sewer can be as follows:



3. THE CONDOMINIAL SYSTEM MAIN CHARACTERISTICS

The condominial system tries to collect the wastewater from its point of production and take it to the discharge point in the shortest , shallowest and the most simplest possible way. In order that this can be achieved, some characteristics make it distinctive from the traditional sewerage system, allowing the achievement of lower implementation and operational costs. The following characteristics represent the basic tools for this to be achieved, not forgetting that the designer's creativity is the most important tool to be used in the design of a system.

3.1 Minimum diameters

The minimum diameter adopted for the condominial system is 100mm, both for the condominial branch as for the public sewer. The use of small diameters, especially in low flow conditions permit a better transport condition for the solids that are present at the wastewater. As most of the pipes has an important function in the general behaviour of the system. So, in the condominial the system the minimum diameters to be used are:

Sewer type	Minimum Diameter
Condominial Branch	100m
Public Sewer	100m

3.2 Minimum pipe coverage

In the condominial system the designer should always try to locate the pipes on the protected areas of the city, in order to minimize the risk of damage due to traffic or misuse conditions. The minimum coverage for the pipes is defined according to the position they are places on the streets, in a way that is possible to lower the installation costs without the risk of causing damage to the pipes. In this way the minimum coverage adopted for the condominial system are:

Position of the pipes	Minimum coverage
Traffic roads	0,90m
Side walk	0,60m
Inside of the lot	0,30m

3.3 Minimum depth

The depth to install the pipes is the one that allows the gravity collection of all the wastewater and that permits the pipes to be protected against damage according to the minimum desired coverage. The minimum depth varies according to the position of the pipes in the urban area. When inside of the lots, a protected area, the minimum required depth is usually the one that allows the receiving of the wastewater from the internal installation of the household. In a way to always get the lowest escavationvolume, in all the situations where the natural slope of the ground is higher than the minimum required slope, the minimum depth should be adopted.

The minimum recommended depth for the pipes are as follows:

Sewer type	Minimum depth
Side walk condominial branch	0,70m
Front lot condominal branch	0,40m
Back lot condominial branch	0,40m
Side walk public sewer	0,80m
Traffic road sewer	1,10m

3.4 Inspection devices types

The inspection devices are the element of the sewerage network that have the main objective of allowing access to the pipeline in order to permit its maintenance in the case of obstruction. As the inspection devices allow the access to the interior of the system, they represent a vulnerable part of the system as they are a way for improper elements to enter the system causing obstruction to occur. In this way the inspection elements, called inspection boxes when installed at the condominial branches, and manholes when installed at the public sewers, should be adopted in a very conservative way, in order to reduce the risks of obstruction. The condominial system allows a significant reduction of the manholes costs because most of the pipes are of the condominial type, when the inspection boxes are very small devices at protected areas. Also the general depth reduction allowed by the system leads to significant costs reduction.

An inspection devices should be used in all of these situations:

- At the start of the branch
- At each time the condominial branch reaches 60 m of length
- At each time the public sewer reaches 100 m of length
- At the connection between the internal installation and the condominial branch.
- At the point where the pipe changes its direction or its slope.
- At any point where different upstream branches meet and discharge in the same downstream branch.

In a condominial system the following inspection devices are usually used:

- Sewer with a depth not longer than 0.90m, devices of the inspection boxes type with a diameter of 0.4m.
- Sewer with a depth between 0,90m – 1,20m, devices with inspection boxes type with a diameter of 6,0m.
- Sewer with a depth of more than 1,20m, devices of the manhole type, with a 1,20m diameter inspection chamber and a 0,60m diameter access chimney.

3.4.1 Pre-cast concrete inspection devices

The construction of condominial systems with concrete pre-cast inspection boxes is recommended in places where PVC units are not available or too expensive in comparison to the concrete ones. The use of the pre-cast concrete devices has some disadvantages though, as they require a good construction quality control, require more handicraft for its installation and are not always water tight , what can be a problem at areas with high ground water level. The main advantage of pre cast concrete units is that they are easily obtainable, and easily replaceable in case of damage. They also have the advantage of dispensing any fitting at the connection of the pipes, as they are on site fixed with mortar.

The recommended inspection devices in pre-cast concrete are the following:

3.4.1.1 Inspection box with 40 cm diameter – IB40

This inspection box is recommended for the condominial branches,being mostly used to make the connection between the internal installation and the condominial branch. As normally the condominial branch has a depth of less than 0,90m, this inspection box is the most used one at this kind of branch

3.4.1.2 Inspection box with 60 cm diameter – IB60

This inspection box is recommended for the condominial branches with a depth of more than 0,90m, and specially for the side walk branches, where the depth of the sewer is usually more than 0,90m.

3.4.1.3 Manholes – MH120 AND MH150

This inspection devices are recommended for the public sewer, especially when its depth is more than 1,20m. As Manholes are normally installed in areas where heavy traffic can take place, the manhole must be reinforced and able to withstand a trucks weight on cover. Manholes are constructed in the same way as the inspection boxes only that due to their size, a lifting equipment is needed for its transportation and mounting. The inspection chamber has a diameter of 1,20m for the sewers of a diameter of 0,60 m, and of 1,50 meters for sewers of a maximum of 0,80 m.

3.4.2 On site molded concrete inspection devices

The construction of sewers with "in situ" molded concrete inspection boxes is recommended when the diameter of the sewer is more than 0,80 m.

3.4.3 Inspection devices special elements

When the upstream segment of the sewer and the downstream segment have a significant level difference, special elements for the inspection devices are considered

4. COMMUNITY MOBILIZATION TEAM

The community mobilization team which will be responsible for the programming, and accomplishing of the meetings with residents, in the way to define the choice for the condominial branch. This team is responsible for preparatory work before the meeting, such as contacting the residents, setting the place and time of the meetings, distributing invitations, running the actual meeting, as well as following-up, including the receiving of the letter of agreement from the neighbours.

5. APPROPRIATE TECHNOLOGY

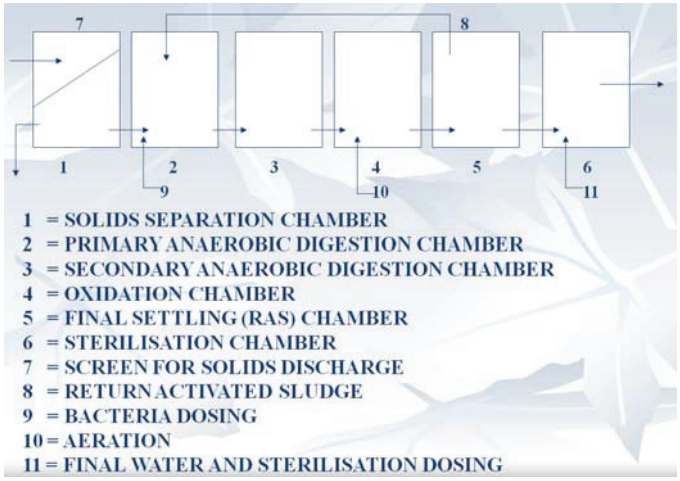
Considering the local characteristics, a sanitation project should try to introduce appropriate technology into the treatment plants to be constructed. A technology that not only is of low-cost, but also reliable and with a reasonable performance regarding the pollutants removal. To establish what is appropriate technology is not so easy, as many technologies that might be appropriate in one town are not appropriate to other cities. In this way, the following general guidelines could be referred as the basic conditions that should be used in order to achieve appropriate technology in the project:

The use of natural treatment processes whenever possible. A natural process is understood as the one that does not depend on external energy sources. In this type of technology the treatment process should proceed in a most natural way, not depending on many external devices to operate. This characteristic leads to reliable processes, where operational stability is high, not demanding high operational supervision, and in consequence, reducing the operational complexity and costs.

- Minimize the use of mechanical equipment. This is possible where the process works mainly due to its self configuration and less on the dependence of mechanical devices
- Automation of all of the necessary equipment. when the use of mechanical equipment is indispensable, a fully automatic operation should be adopted, with the extensive use of digital controllers to operate the equipment. This technology is getting very reliable and affordable, allowing considerable personal costs reduction.
- The use of treatment processes that allow simple and general known construction methods. The costs of a treatment plant are directly related to the lay-out and construction methods used. In this way, special attention must be given in the use of technologies that do not use sophisticated works.

6. MODULAR SEWERAGE TREATMENT WORKS

The Modular Waste Water Treatment Works is a South African concept using existing technology in an innovative way. The Modular WWTW eliminates pump stations, pumping mains and outfall sewers. It produces effluent quality exceeding general standards, reduces construction cost of more than 40% less than conventional plant. Electricity consumption can be as little as 20% of a conventional plant.



TYPICAL LAYOUT OF A MODULAR WWTW

BANKENVELD GOLF ESTATE – MODULAR WWTW

BANKENVELD GOLF ESTATE – EFFLUENT

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INNOVATIVE PROCUREMENT IN A MUNICIPAL ENVIRONMENT TO ACHIEVE ELIMINATION OF SANITATION BACKLOGS

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P ALLEN Pr Eng – Peter Allen Inc Professional Engineers

1. INTRODUCTION

Application of the Strategic Framework for Water Services (Department of Water Affairs and Forestry, 2003) is not legislated, but it has certainly been adopted as a rigorous handbook by the Department of Water Affairs. The Strategic Framework sets the following goals for the water services sector:

1.1. All people living in South Africa [must] have access to an appropriate, acceptable, safe and affordable basic water supply and sanitation service.

The Strategic Framework goes on to note that the bucket system is an unsuitable and inappropriate level of service, and that all water services authorities must identify and implement programmes for the eradication of all bucket systems by 2006 (later extended to the end of 2007).

The Strategic Framework recognises that there is no single sanitation solution, and suggests that Ventilated Improved Pit toilets ("VIPs") in rural areas would be appropriate. (It is noted that properly built VIPs are a first class design and that the full flush system that everyone wants will not work where not enough water is available or the community cannot afford the expanded water supplies and wastewater treatment which national government cannot yet fund.)

Chris Hani District Municipality ("CHDM") achieved the bucket-eradication target, and prioritised the supply of potable water to rural communities. This paper describes the CHDM approach to sanitation, particularly rural sanitation.

In the Overview to their Integrated Development Plan ("IDP"), Chris Hani DM unequivocally lists the first four priority needs as

- Local Economic Development
- Poverty alleviation and food security
- Water and sanitation, and
- Municipal Health and environmental management.

To put the above priorities into context, CHDM has a population of about 800 000 in approximately 200 000 households, of which 71% are rural households, and 53 000 households are indigent to the extent that they are considered to suffer chronic hunger.

In order to address the sanitation priority, CHDM began by drawing up a sanitation masterplan to clarify the considerations and processes to be followed.

2. INSTITUTIONAL STATUS QUO

The IDP notes that CHDM is a District Municipality. Within its area of jurisdiction there are eight local municipalities. CHDM is the designated Water Services Authority ("WSA") for the region, unlike in other parts of South Africa where each local municipality is a Water Services Authority . The consequence of this is that CHDM, not the local municipalities, is responsible for ensuring the provision of water and sanitation throughout the region. Actual service provision will be through a formalised Water Services Provider ("WSP") arrangement initiated by the WSA. In compliance with Section 78 of the Municipal Systems Act (the determination of the optimal service delivery mechanism), a formal assessment recommended that the WSP function should be the local, rather than district, municipality. The reasons for this recommendation included accountability of local municipalities to their residents, and the linking of water services with other basic service provision. However many of the local municipalities in Chris Hani District currently lack sufficient capacity to fulfil the WSP role adequately.

The Section 78 assessment report proposed that the four western local municipalities of Inkwanca, Inxuba Yethemba, Lukhanji and Tsolwana should, in principle, be appointed as Water Service Providers for their areas of jurisdiction. The four eastern municipalities of Emalahleni, Intsika Yethu, Engcobo and Sakhisizwe were considered to have insufficient capacity for this role, and therefore the District Municipality would have to retain the Water Service Provider function in these areas in the short to medium term.

Coincidentally, the biggest sanitation backlogs were generally in the local municipalities lacking institutional capacity.

3. SANITATION STATUS QUO

According to the Draft 2008/9 IDP, Chris Hani DM has total population of about 799 000 people in 203 000 households. According to the 2007 Water Services Delivery Plan, the population is 823 588 people. STATS SA considers the population to be somewhere between these two figures. The differing population figures illustrate the challenge of establishing accurate numbers in a rural context. The difference might only be a small proportion of the total population, but could have a large effect on the budget required to eliminate any backlog of services. Sanitation backlog estimates range from 45% to 56% of the CHDM population.

The CHDM sanitation masterplan proposed that, for planning and budgetary purposes, the number of households without sanitation would be assumed to be the highest number generated by the various assessments to date (102 757 households). In the execution of the programme to eliminate the backlog, the first task to be addressed would be to verify or correct the number of households without sanitation.

4. SANITATION SERVICE LEVELS

CHDM accepted that the minimum acceptable standard of sanitation is a ventilated, improved pit latrine (VIP), but recognised that most people would aspire to full waterborne sanitation. Given that nothing is "free", and that installation, operation and maintenance of all sanitation systems must be paid for in some way, the masterplan noted that CHDM would take the principles below into consideration when determining the appropriate sanitation system. If circumstances warranted, and after due consideration, Chris Hani DM would waive or vary any of the principles.

CHDM SANITATION MASTERPLAN PROVISIONS:

In general, those who can afford to pay for their choice of sanitation system will do so, and indigent households will be provided with a VIP at no cost to the household

a. Bucket latrines have been eliminated, and will not be re-installed.

b. Waterborne sanitation

In circumstances where sufficient water is available in pipes laid to the household, AND where street sewers are already available or planned in the normal course of events, AND where the respective household is considered able to afford the service, Chris Hani DM will consider the installation of full waterborne sanitation, at the cost of the householder.

c. Dry systems

Rural households requiring free basic sanitation will be provided with a VIP, at no cost to the household, unless special circumstances dictate otherwise.

The specification for the VIP will be a durable, weatherproof top-structure on a properly-constructed pit sized to last at least five years before the pit becomes full. Preference will be given to systems where the top structure can be relocated to a new pit (once the pit is full), but systems that allow the pit to be easily emptied will be accommodated.

The structure will allow easy access and privacy, and will not be susceptible to damage by wind.

Other subsystems, such as the composting, and urine-diversion,