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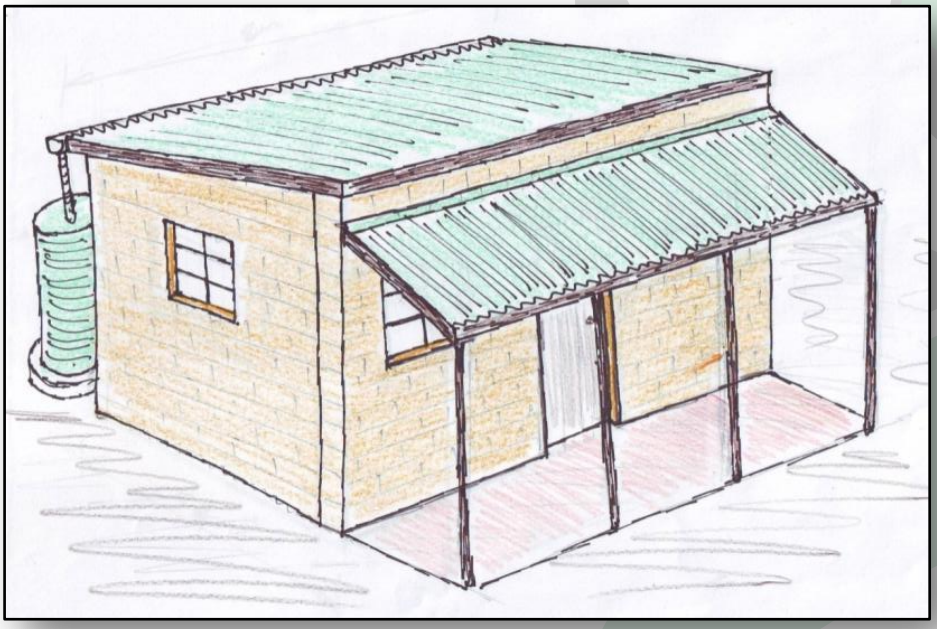

PROJECT:

MANAGED LAND SETTLEMENT HYPOTHETICAL CASE STUDY PROJECT

DOCUMENT:

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Prepared by: Louis Fourie Pr Eng Pr CPM

Head Office: 27 Bauhinia Drive
Vincent Heights
East London, 5247
Postal: Po Box 19568
Tecoma, 5214
Tel: 043-726 2827
Fax: 086 520 6942
Website: www.newground.co.za

newground projects

QUALITY MANAGEMENT

Revision:	Draft
Date:	
Drafted by:	Izak du Plessis
Signature:	
Checked by:	Louis Fourie Pr Eng Pr CPM
Signature:	
Authorised by:	Louis Fourie Pr Eng Pr CPM
Signature:	
Reference:	PC11015 - Managed Land Settlement

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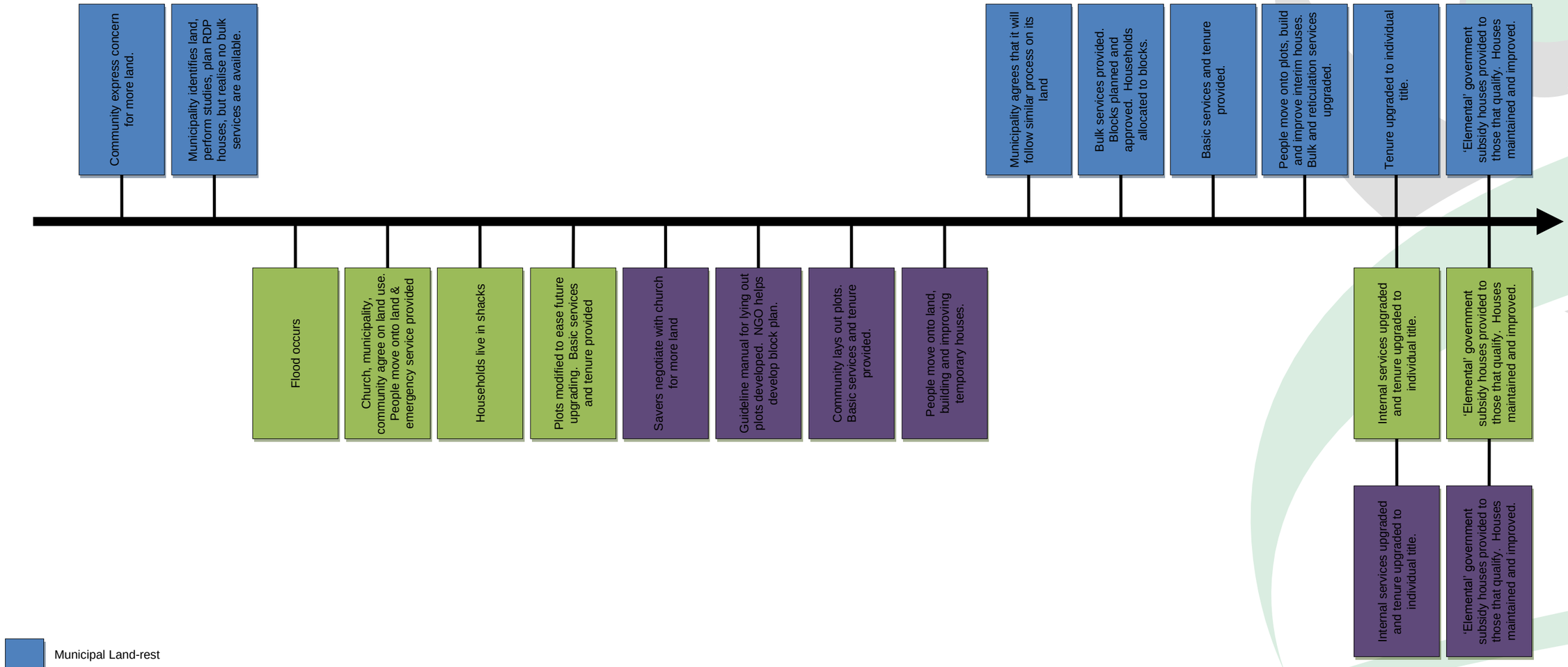
1. BACKGROUND AND PROBLEM STATEMENT

Brief summary of the story.


Community express concern for more land.
Municipality identifies land, perform studies, plan RDP houses, but realise no bulk services are available.
Flood occurs
Church, municipality, community agree on land use. People move onto land & emergency service provided
Households live in shacks
Plots modified to ease future upgrading. Basic services and tenure provided
Savers negotiate with church for more land
Guideline manual for lying out plots developed. NGO helps develop block plan.
Community lays out plots. Basic services and tenure provided.
People move onto land, building and improving temporary houses.
Municipality agrees that it will follow similar process on its land
Bulk services provided. Blocks planned and approved. Households allocated to blocks.
Basic services and tenure provided.
People move onto plots, build and improve interim houses. Bulk and reticulation services upgraded.
Tenure upgraded to individual title.
'Elemental' government subsidy houses provided to those that qualify. Houses maintained and improved.
Internal services upgraded and tenure upgraded to individual title.
'Elemental' government subsidy houses provided to those that qualify. Houses maintained and improved.
Internal services upgraded and tenure upgraded to individual title.
'Elemental' government subsidy houses provided to those that qualify. Houses maintained and improved.
Municipal Land-rest
Church - Invaders
Church - Savers

2. SANITATION

2.1 Introduction

Adequate sanitation facilities are vital for the health of people, especially when living in close proximity of each other. There are a vast number of different options with regards to such facilities. In selecting the type of facility various factors need to be taken into account. These factors include, but are not limited to:

- Density of the population.
- Terrain conditions and site layout.
- Finance available, regarding both capital and maintenance.
- Expected level of service.

2.2 Definitions

Level of Services	Intermediate	Full
Church (Flood Victim)	(1) Communal chemical toilets (2) VIP toilets per 4 houses	(1) Composting toilet per house, or (2) Small bore waterborne
Church (Savings)	(1) VIP toilets per 4 houses	(1) Composting toilet per house, or (2) Small bore waterborne
Municipal	(1) Communal ablution with septic tank and soak away	(1) Toilet per house with municipal sewer system

2.3 Chemical Toilets

2.3.1 Provision of Toilets

As part of the emergency services that are provided for the flood victims, chemical toilers are provided. One chemical toilet will be shared between four dwellings.

2.3.2 Description of the System

Chemical toilets are in essence a container with a seat on it. The container has a water and chemical mixture in it. The purpose of the chemicals in the system is to deodorize and disinfect the sewage. The image below is an example of a chemical toilet.

Figure 2.1: Example of a chemical toilet

These types of toilets a commonly used on construction sites, at sporting events, in caravans, etc.

2.3.3 Advantages

- Portable
- Easy to establish on site
- The toilets can either be rented or bought

2.3.4 Disadvantages

- Strong chemical smell
- Some chemicals are harmful to the environment
- Periodic emptying and addition of chemicals required
- Chemicals are expensive
- It is not a viable long term solution

2.3.5 Cost

Capital cost: ± R 5 000
Maintenance cost: ± R5/ℓ of sanitation fluid

2.4 Ventilated Improved Pit Latrine

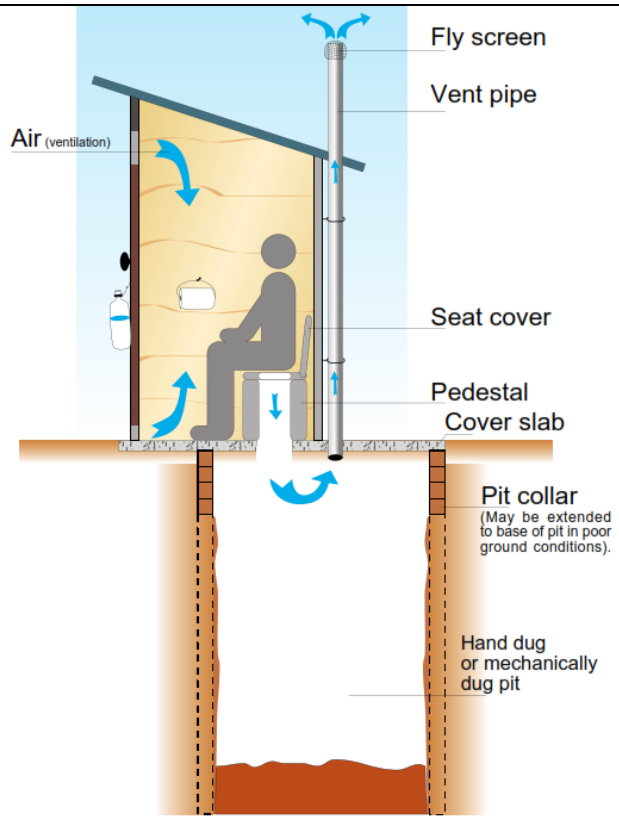
2.4.1 Provision of Toilets

Ventilated Improved Pit latrines are provided for both the flood victims and the people from the Savings Scheme once the Church agrees to the sale of their land. One toilet is shared between four dwellings.

2.4.2 Description of the System

A Ventilated Pit Latrine is exactly as the name describes. It consists of a pit, that can be dug by hand or mechanically, with the toilet structure over it. Depending on the soil conditions, the pit might need to be lined. A ventilation pipe is provided for the pit. This removes most of the odours from within the superstructure. The figure below illustrates the system.

Figure 2.2: Ventilated improved pit latrine



A top-structure over a pit. The pit is vented by a pipe over which a fly-screen is fixed. The pit may be lined (recommende where emptying is required), or unlined where soil conditions allow.

In time, the pit will fill up. When this happens either the pit will need to be emptied using a "Honey sucker", or a new pit can be dug at a different location and the existing superstructure placed over it. If a new pit is dug, the old pit needs to be filled in with soil. A fruit tree can be planted in the old pit.

2.4.3 Advantages

- Very basic system
- Is relatively inexpensive
- Superstructure can easily be moved
- The system is virtually maintenance free

2.4.4 Disadvantages

- Not recommended to be incorporated into a house
- Some unpleasant smells may be present
- Possible contamination of groundwater

2.4.5 Cost

Capital cost:	± R2 500 – R8 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R250/year

2.5 Communal Ablution with Septic Tank and Soak Away

2.5.1 Provision of Toilets

Communal ablution is provided as an initial sanitation service for the people that settles on the government land. An ablution block is provided for each block of houses.

2.5.2 Description of the System

The communal ablution facilities comprise of a number of toilets in the same building (refer to the images on the following page). Each toilet, which has a lockable door, is allocated to a specific group of households, that will be provided with a key for that toilet. Wash troughs are also provided.

The wastewater from the facility is collected in a septic tank. A soak away is provided to allow the liquid from the septic to soak into the soil. The sludge will have to be periodically removed from the septic tank using a "Honey sucker". The time between required emptying of the septic tank is dependent on the size of the tank.

Figure 2.3: Plan layout of communal ablution facility

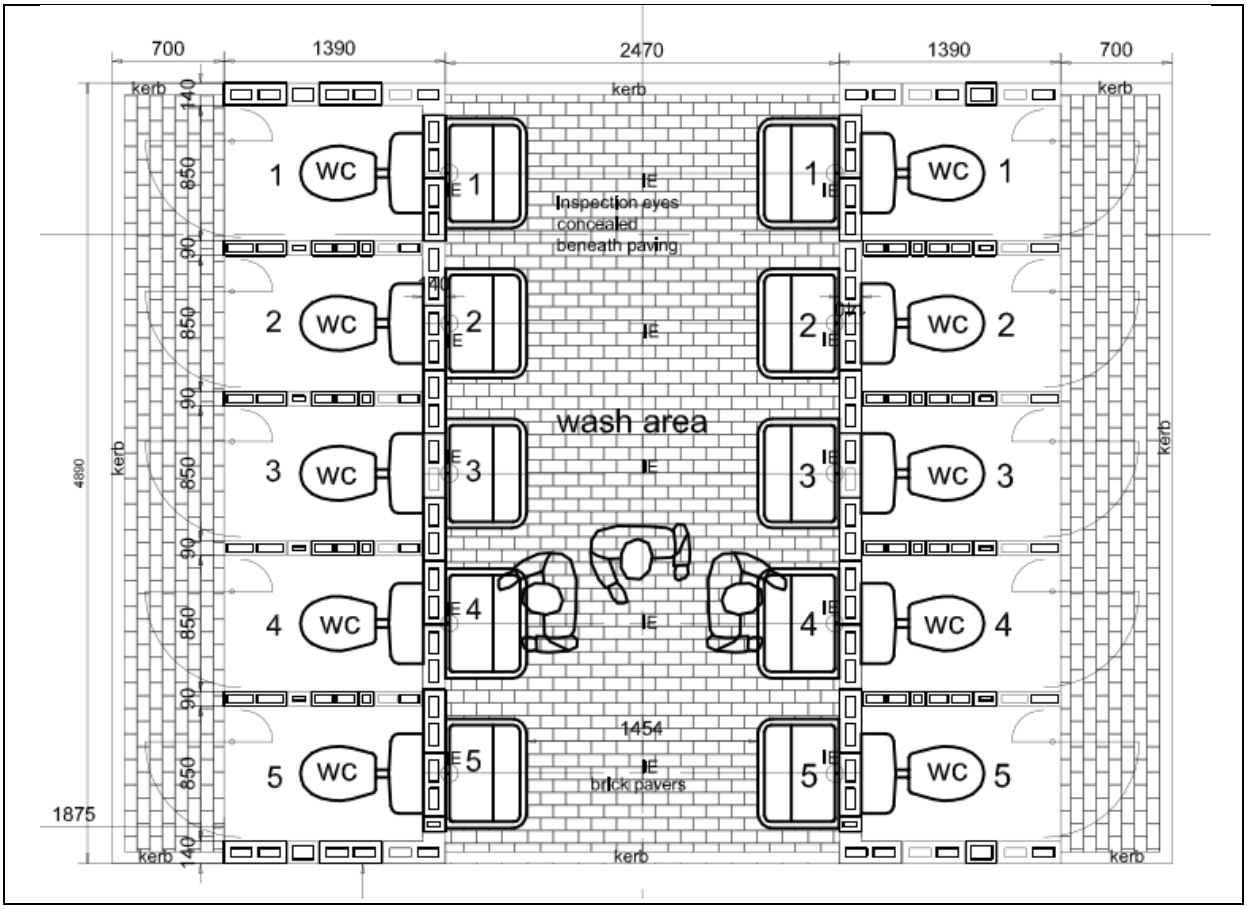


Figure 2.4: Cross section of communal ablution facility

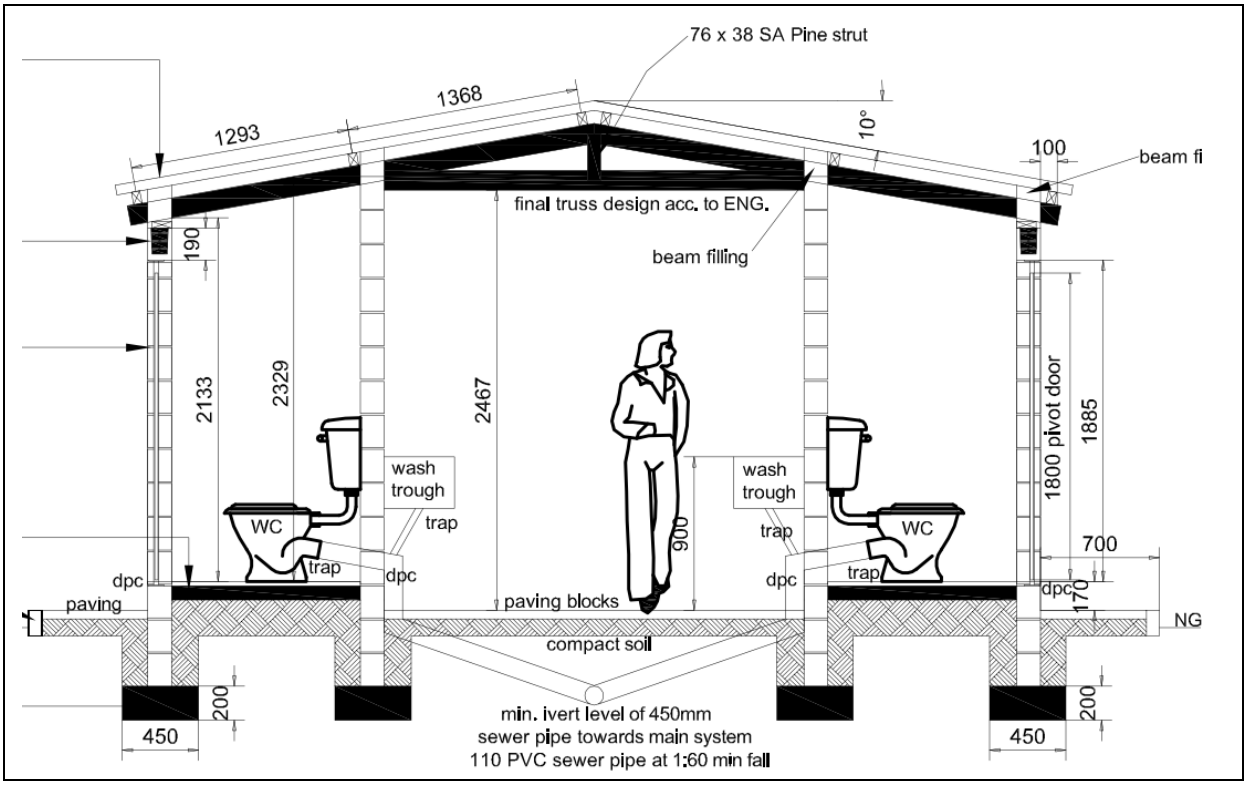
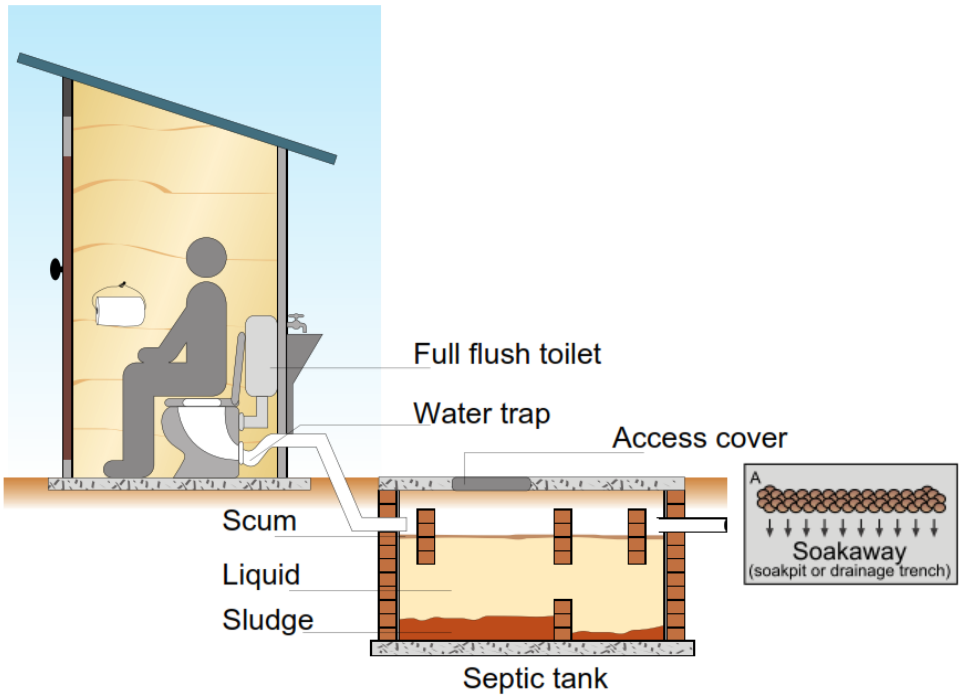


Figure 2.4: Septic tank



Septic tank and soakaway: *An in-house full flush-toilet connected via pipe and plumbing fixtures to an underground watertight settling chamber (the 'digester') with a liquids outlet to a subsoil drainage/soakaway system.*

2.5.3 Advantages

- Economically viable as one block serves a large number of families, e.g. a block of 10 toilets can serve 40 families.
- Is relatively inexpensive
- Is easy to control and maintain if done daily

2.5.4 Disadvantages

- If facility is not managed well then it can fall into disrepair quickly
- If facility is not cleaned properly it can become a community health risk

2.5.5 Cost

Capital cost:	± R 150 000 depending on the choice of construction material, site conditions, number of toilets in ablution block, etc.
Maintenance cost:	± R2500/month

2.6 Composting Toilets

2.6.1 Provision of Toilets

The permanent sanitation service that is provided for the people settling on the church land will be a composting toilet per plot.

2.6.2 Description of the System

A composting toilet works on the principle that the faeces are deposited into a chamber where it is biologically broken down. Two chambers are provided to allow one chamber to be used for collection while the other houses the decomposing faeces. Dry absorbent organic material, such as wood, ash, straw or vegetable matter is added after each use. This is to deodorize the decomposing faeces, control the moisture content and facilitate biological breakdown (composting). Urine may be separated through use of specially adapted pedestals.

After a suitable amount of time the decomposed faeces can be used as compost in the gardens. During this decomposing time the second chamber is for collection of the waste. After the compost is removed from the chamber the toilet seat is moved back over that chamber while the other chamber houses the decomposing faeces.

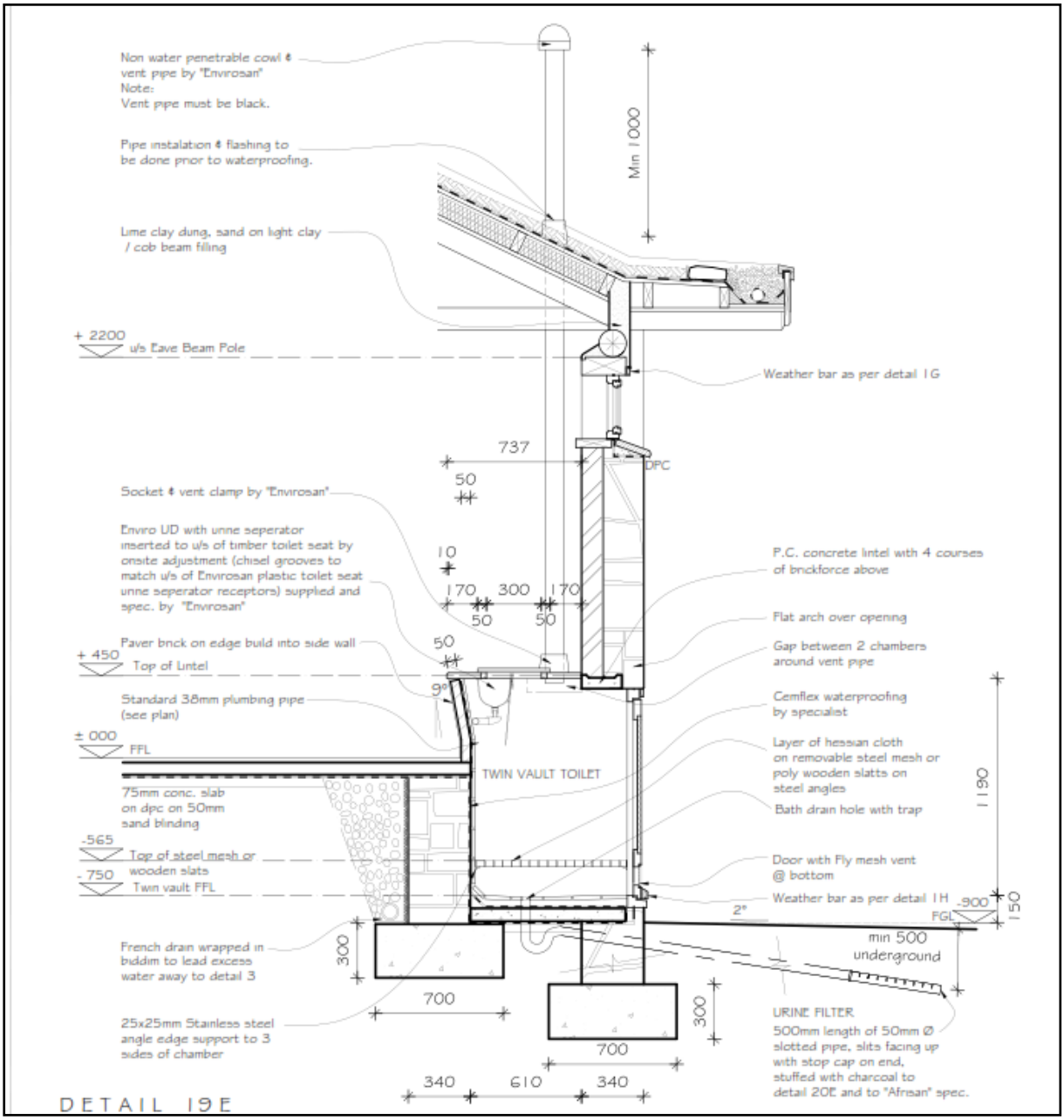
Composting toilets can be designed as:

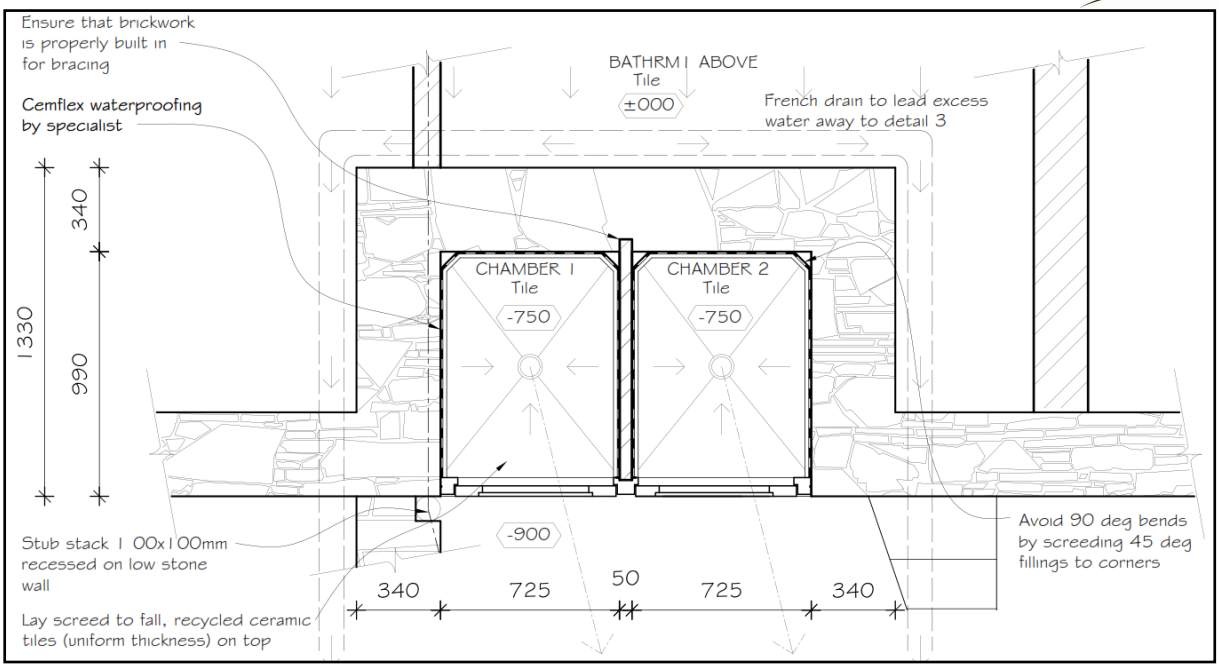
- Part of a dwelling; or
- Free standing.

Both these options have been used successfully in the past.

Hereunder please find examples of composting toilets that have been installed as part of dwelling.

Figure 2.5: Composting toilet in house





The picture hereunder is for a free standing unit in the more peri-urban environment.

Figure 2.6: Free standing composting toilet

2.6.3 Advantages

The advantages for using composting toilets are:

- No groundwater pollution.
- High usage of local material.
- Contractor can increase local labour content by manufacturing of M4 blocks as well.
- Production of compost from human waste.
- Ability to create local enterprises during construction period.
- Empowerment of local people through training and employment.
- Not dependant on municipal bulk services and especially water supply.

2.6.4 Disadvantages

- Not well known technology to local community.
- There is a risk that this will not be acceptable culturally.
- Decomposing faeces is sensitive to the moisture content.
- Local education programs are essential to make this solution a success.

2.6.5 Cost

Capital cost:	± R6 500 - R8 500 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R150/year depending on the people's willingness to handle and dispose of the compost.

2.7 Municipal Waterborne Sewer System (Small Bore)

2.7.1 Provision of Toilets

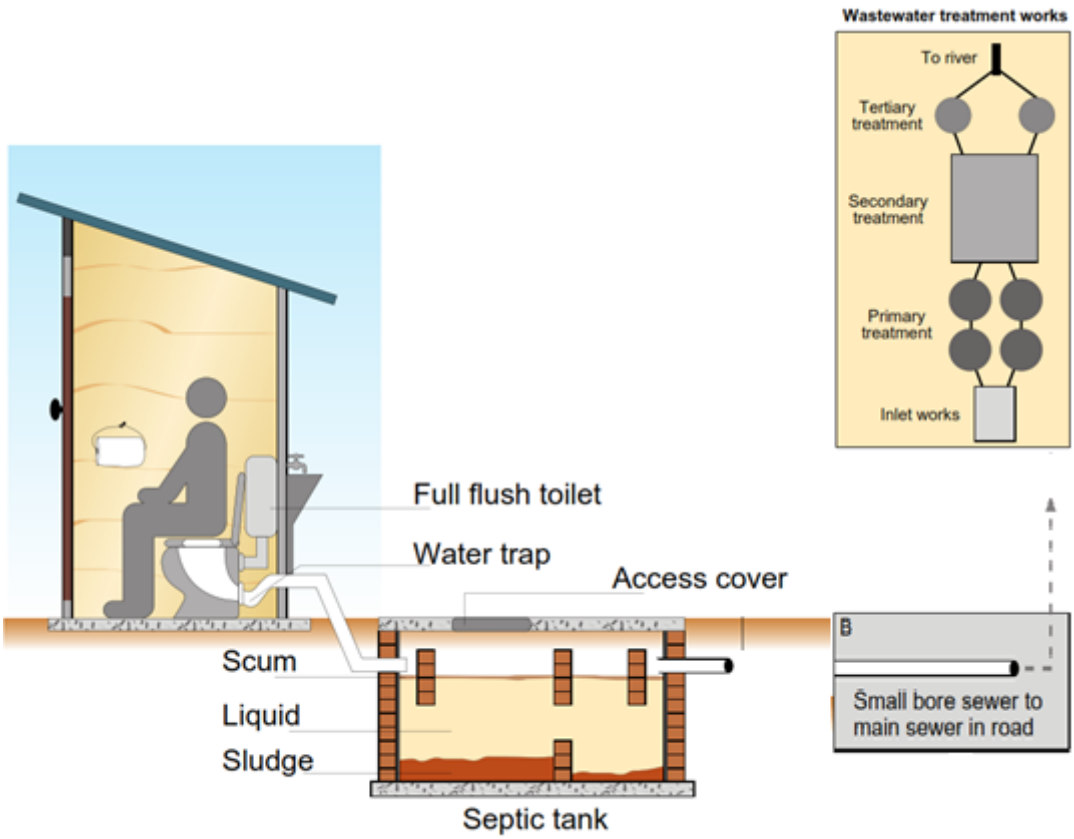
A municipal sewer system is installed on the municipal land as a full service (small bore). The installation of formal waterborne sewer systems where "informal" houses has been constructed is often challenging and may cause technical difficulties with respect to the position of the sewer lines, gradients, access to sewer lines for maintenance etc. It is therefore suggested to consider the small bore waterborne systems in these cases. Low flush systems work perfectly with small bore waterborne sewer systems.

2.7.2 Description of the System

Sewage is flushed from the toilet using low volumes of water. The sewage flows to a standard septic tank. Overflow/effluent is connected to the main sewer system.

The advantage of this system is that the small bores are can be installed by local builders and is slope and alignment sensitive. Because not prone to blockages. conventional toilet. Water used for flushing toilets can be as high as 60% of the total household water usage. Low flush toilets can thus make a major contribution to saving water.

Figure 2.7: Small Bore Waterborne Sewage System



Septic tank and soakaway: *An in-house full flush-toilet connected via pipe and plumbing fixtures to an underground watertight settling chamber (the 'digester') with a liquids outlet to a subsoil drainage.*

2.7.3 Advantages

- Small bores are can be installed can be installed retrospectively.
- Can be installed by local builders as infrastructure is not slope and alignment sensitive.
- Small diameter sewer pipes can be installed, less costly.
- Small bore is not prone to blockages.
- Can operate with very low flow, therefore water saving positive.
- Sewage treatment works can be smaller as primary treatment of sewage takes place in septic tanks.

2.7.4 Disadvantages

- Cost of septic tanks.
- Maintenance of septic tanks.
- Operation of septic tanks.

2.7.5 Cost

Capital cost:	± R15 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 500/year

2.8 Municipal Waterborne Sewer System

2.8.1 Provision of Toilets

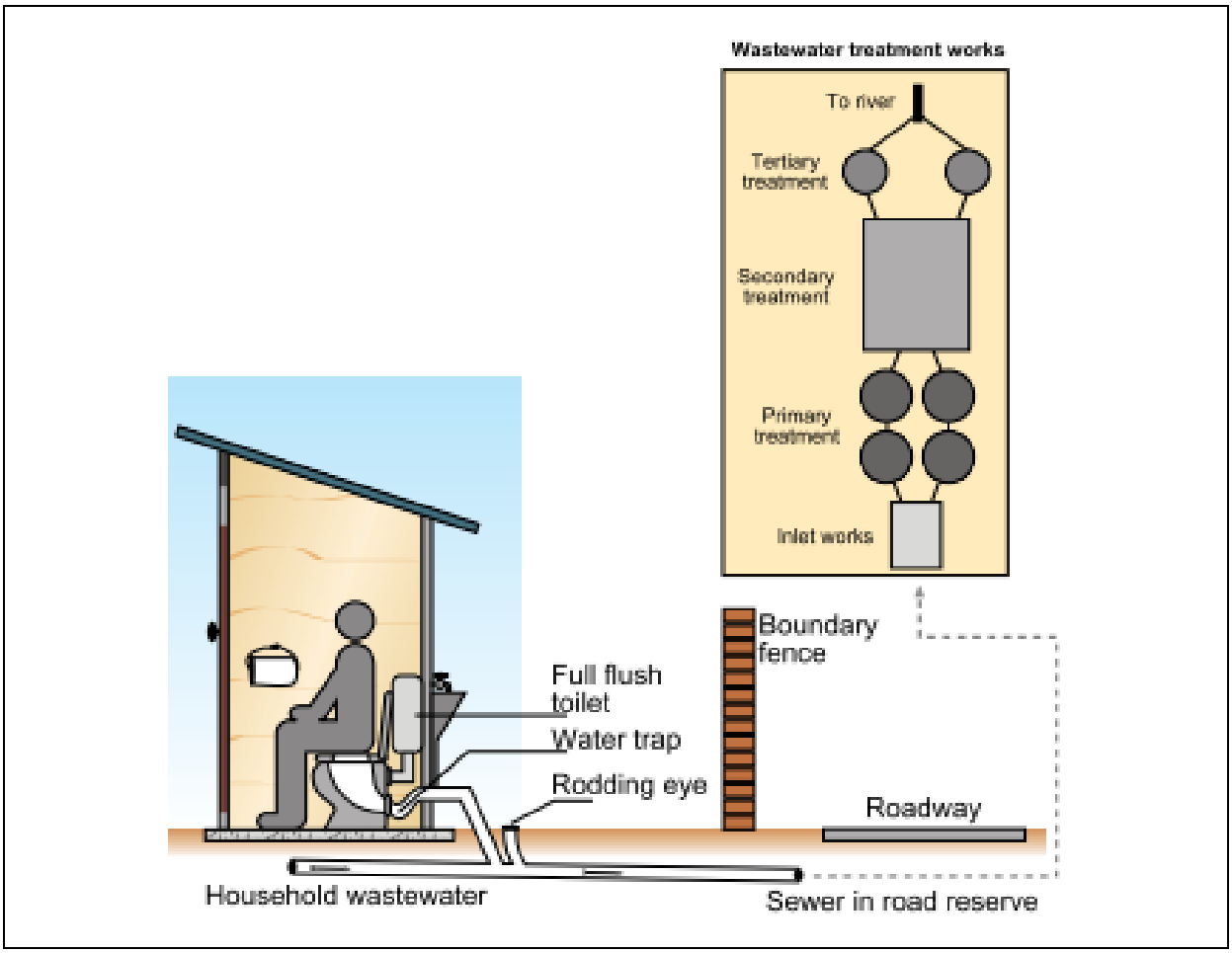
A municipal sewer system is installed on the municipal land as a full service. Low flush toilets are provided for the houses.

2.8.2 Description of the System

Sewage is flushed from the toilet using significant volumes of water. The sewage flows through the pipe network to a wastewater treatment facility. Here the wastewater is treated to a point where the effluent is clean enough to be safely released into the environment.

Low flush toilets are provided for the households. The low flush toilet uses half the amount of water as the conventional toilet. Water used for flushing toilets can be as high as 60% of the total household water usage. Low flush toilets can thus make a major contribution to saving water.

Figure 2.7: Municipal wastewater treatment plant



2.8.3 Advantages

- Convenience for the end user.

2.8.4 Disadvantages

- Large capital cost.
- Wastewater treatment works with sufficient capacity required.

2.8.5 Cost

Capital cost:	± R20 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 000/year

3. WATER SUPPLY

3.1 Introduction

Water supply is often one of the most difficult challenges to overcome. Rainwater harvesting is often overlooked as a sustainable source, especially in combination with groundwater or even unreliable municipal supply (water tankers).

Water supply with respect to this case study is looked at from the perspective that formal water supply will not be available in the nearby future but there are plans to extend the water reticulation network within the next 10 years. Unfortunately the beneficiaries of this project are unable to wait for another 10 years.

3.2 Definitions

Level of Services	Intermediate	Full
Church (Flood Victim)	(1) Water tankers (2) Standpipe (per block) (3) Additional rainwater harvesting where roofs are available.	(1) Piped water to all (limited flow/trickle flow) (2) Grey water recycling
Church (Savings)	(1) Standpipe (per block) (2) Additional rainwater harvesting where roofs are available.	(1) Piped water to all (limited flow/trickle flow) (2) Grey water recycling
Municipal	(1) Piped water to communal ablution blocks. (2) Rainwater harvesting from roofs also available both at the house and the ablution building.	(1) Piped water to all (limited flow/trickle flow) (2) Grey water recycling

3.3 Water Tankers

3.3.1 Provision of Service

As part of the emergency services that are provided for the flood victims, water will be provided by municipal water tankers.

3.3.2 Description of the System

Water is carted by trucks from an available source to a central point of delivery. The residents collect the water at these points in containers and carry these back to their dwelling.

3.3.3 Advantages

- No local water infrastructure requirements.
- Service can be provided with immediate effect.
- Flexible points of delivery.

3.3.4 Disadvantages

- Fuel for the vehicle is costly.
- Costly to maintain vehicle.

3.3.5 Cost

Capital cost: ± R30 000 - R35 000 depending on the choice of construction material, site conditions, etc.

Maintenance cost: ± R1 500/year - R2 500/year

3.4 Rainwater Harvesting

3.4.1 Provision of Service

Rainwater tanks and gutters are provided to all the houses for the collection of water from the roofs of the dwellings. This is an additional phase during the supply of the intermediate service.

3.4.2 Description of the System

Rainwater harvesting is the first cheapest resource available. It however is not reliable due to varying rainfall through the year.

The system works by catching rainwater run-off from roofs in gutters that allows the ware to flow into a storage tank.

For the purpose of this case study average monthly rainfall figures for this particular area have been taken. It is assumed that the roof area that will be available for rainwater harvesting is 40m2.

With respect to Figure 3.1, the following is to be noted:

- Daily rainwater consumption per household is 80 litres;
- The tank size is 1,500 litres;
- The roof area is 40m^2;
- It is to be noted that for July the water inventory will be close to 0;
- The rainwater collections efficiency is 90%.

Figure 3.1: Rainwater harvesting potential calculation

Calculating Your Rainwater Harvesting Tank Size Based on Your Roof Area, Rainfall, and Consumption

First: Estimate your monthly household water usage (exclude gardening and irrigation use - you can add these later if you like, but it takes a lot of water to irrigate)

The average number of people using water in your house each day = 4

Enter the average number of litres that you think each person is using in your home each day. litres = 20 per person per day

Second: Entering your roof area and gutter efficiency.

Enter the total area of your guttered roof area for rainwater harvesting. 40 square metre

Enter the efficiency of your collection system

If you have a high quality, well maintained gutter system the efficiency is probably about 75 to 90%.

If your gutter system integrity is questionable and you see a lot of water running over the edge during a rain storm, the efficiency is probably about 50 to 70% Efficiency = 90 percent

Third: Now we'll enter rainfall data for your area of the world and automatically calculate and graph several things simultaneously.

There are a lot of sources of global, monthly rainfall data on the internet (unfortunately, not too much on max intensity). Several links are provided at the right of this page for your convenience. For now, follow the link to worldclimate.com, type in your nearest city, select "Average Rainfall", then fill in the monthly data in inches in the yellow boxes below. The graph will change shape as you enter data. The dark blue line is collected water. The purple line is your monthly consumption, and the yellow line is your tank inventory at the end of each month.

Enter your inches of rainfall per month here Try http://www.worldclimate.com for rainfall in your area

This is your total litres of rainwater collected in the gutter each month. It may or may not be available in the tank if your tank is of a size such that is overflows at times.

This is your total household consumption per month based on the information you typed in above.

The amount of water you have at the end of each month will depend on **which month you plan on emptying your tank for maintenance**. This isn't always an obvious choice.

It appears that **Jul** would be the best month, in this case, for you to empty and maintain you tank based on the calculated tables at end of this section.

The tables also suggest you would probably need a tank size less than **6 232** litres.

You might not need a tank this big. It's time to do some what-if calculations. You can watch what your end of the month inventory will do as you increase or decrease your tank size.

Fourth: Now for the fun part - sizing your tank!

We are going to assume that you will have zero inventory at the end of **Jul**

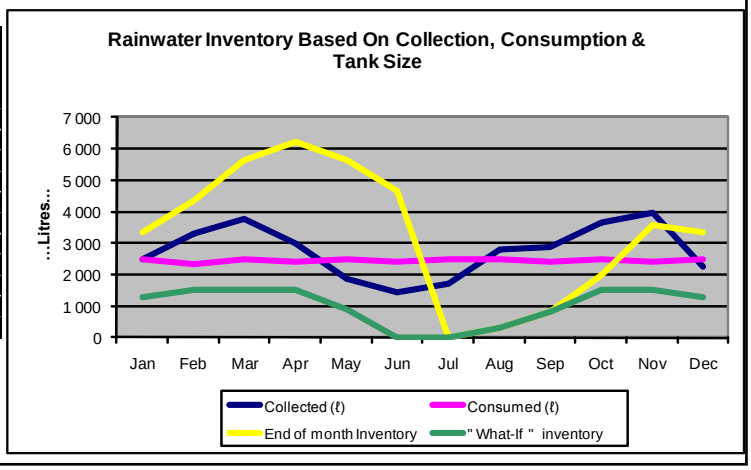
1 500

Simply type in a tank sizes over the 1,000 in this red box and the green graphic line will indicate what your end of the month inventory will be.

Notice the number of months you have zero inventory. If this is unacceptable, continue to increase the tank size until the numbers don't change (and the green covers the yellow line). That is your maximum tank size. Any larger of a tank will be wasted, or you will need to fill it with something other than rainwater.

		monthly rainfall mm	Collected (?)	Consumed (?)	End of month Inventory	" What-If " inventory
1	Jan	69	2 484	2 480	3 352	1 292
2	Feb	92	3 312	2 320	4 344	1 500
3	Mar	105	3 780	2 480	5 644	1 500
4	Apr	83	2 988	2 400	6 232	1 500
5	May	52	1 872	2 480	5 624	892
6	Jun	40	1 440	2 400	4 664	0
7	Jul	47	1 692	2 480	0	0
8	Aug	78	2 808	2 480	328	328
9	Sep	80	2 880	2 400	808	808
10	Oct	102	3 672	2 480	2 000	1 500
11	Nov	110	3 960	2 400	3 560	1 500
12	Dec	63	2 268	2 480	3 348	1 288

Total rainfall	Total guttered	Total Consumed	Maximum tank inventory
0	33 156	29 280	6 232



3.4.3 Advantages

- Free water source.
- Relatively small capital expense.
- Minimal maintenance required.

3.4.4 Disadvantages

- Unreliable water source.

3.4.5 Cost

Capital cost: ± R6 000
Maintenance cost: None

3.5 Communal Standpipes

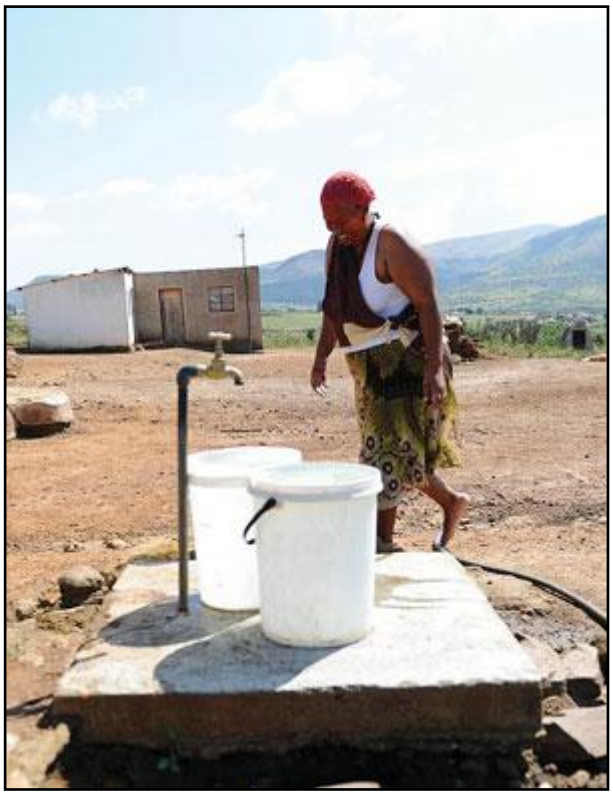
3.5.1 Provision of Service

Communal standpipes will be provided as an additional phase to the intermediate service for the flood victims and as the initial phase to the intermediate service for the people from the savings scheme.

3.5.2 Description of the System

The system utilizes the local boreholes and surface water abstracted from the river. A small local water treatment package plant is provided to treat the water. From the treatment plant it is taken to the standpipes through a pipe network.

Figure 3.2: Photograph of stand pipe



3.5.3 Advantages

- Fewer infrastructures required than with full reticulation network, thus smaller cost.
- Dependable source of potable water.

3.5.4 Disadvantages

- People need to carry the water to their homes.

- Water wastage common due to people not closing the tap.

3.5.5 Cost

Capital cost:	± R30 000 - R35 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 500/year - R2 500/year

3.6 Water to Communal Ablution Facilities

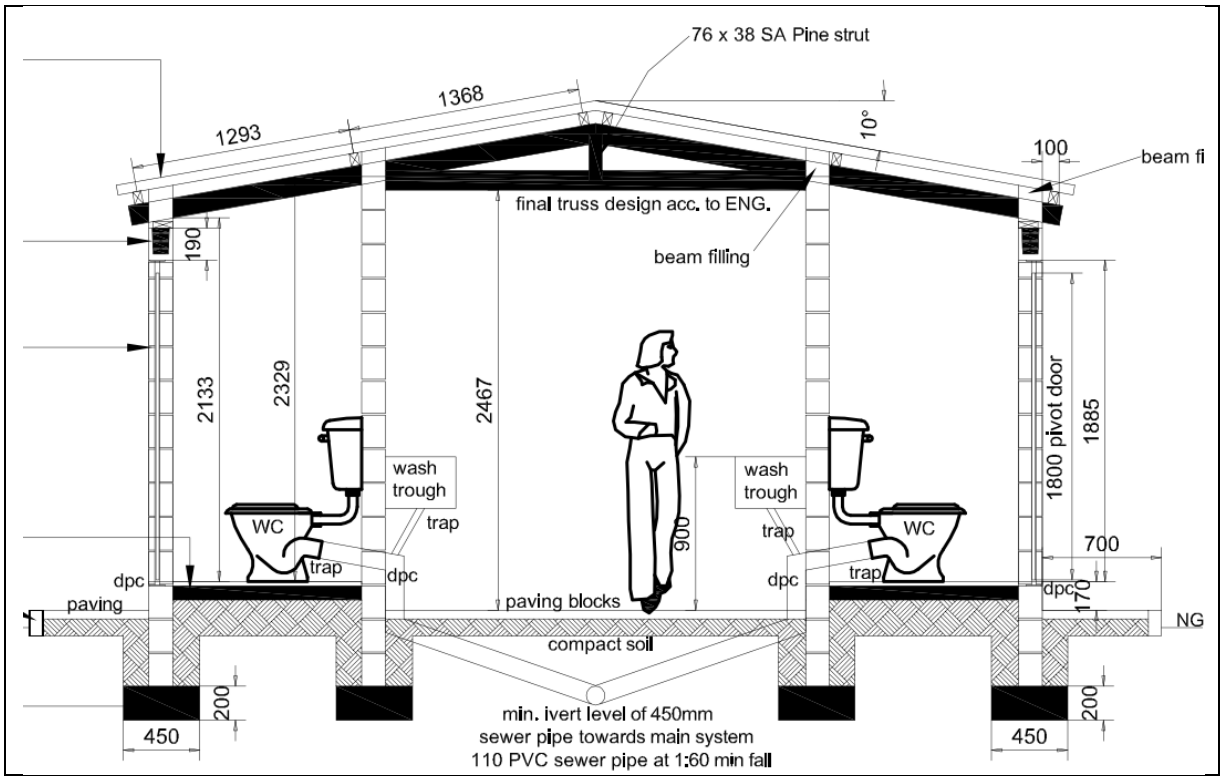
3.6.1 Provision of Service

As the intermediate service to the people settling on the municipal land, potable water is supplied to the communal ablution facilities.

3.6.2 Description of the System

The system utilizes the local boreholes and surface water abstracted from the river. A small local water treatment package plant is provided to treat the water. From the treatment plant it is taken to the communal ablution facilities through a pipe network. This provides a point where potable water can be collected by the community. Rainwater tanks will also be connected to the facility.

Figure 3.3: Communal ablution facility will also provide washing facilities



3.6.3 Advantages

- Fewer infrastructure required than with full reticulation network, thus smaller cost.
- Dependable source of potable water.

3.6.4 Disadvantages

- People need to carry the water to their homes.

3.6.5 Cost

Capital cost:	± R30 000 - R35 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 500/year - R2 500/year

3.7 Greywater Recycling

3.7.1 Provision of Service

As part of the full service that will be provided to everyone on both the church and municipal land, greywater recycling systems will be provided.

3.7.2 Description of the System

Greywater recycling does not necessarily require complicated systems. The greatest part of greywater recycling is education of the community. Greywater recycling can be as simple as emptying washing water into the garden, rather than just simply throwing it onto the ground. With full water services these systems can however become more complicated where water from the bath/shower is collected, treated and used to flush the toilet or water a vegetable garden.

3.7.3 Advantages

- Through greywater recycling the water consumption is drastically reduced.
- Lower impact on infrastructure and treatment works.
- Topsoil nitrification.
- Watering of plants.

3.7.4 Disadvantages

- None

3.7.5 Cost

Capital cost:	± R0 - R5 000 depending on the requirements, complexity, etc.
Maintenance cost:	± R0/year

3.8 Municipal Trickle Feed House Connections

3.8.1 Provision of Service

This service is the full water service for everyone.

3.8.2 Description of the System

The municipality installs a reticulation network that is connected to the bulk water services. The water flows into a 200ℓ tank on the roof of the house, through a low-flow control valve. From the tank water is distributed into the house. The low-flow valve restricts the flow, and thus the water consumption.

3.8.3 Advantages

- Convenient house connection for the end user.
- Lower water consumption due to restricted flow.

3.8.4 Disadvantages

- Higher capital cost required than normal reticulation network.

3.8.5 Cost

Capital cost:	± R30 000 - R35 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 500/year - R2 500/year

4. Storm Water

4.1 Introduction

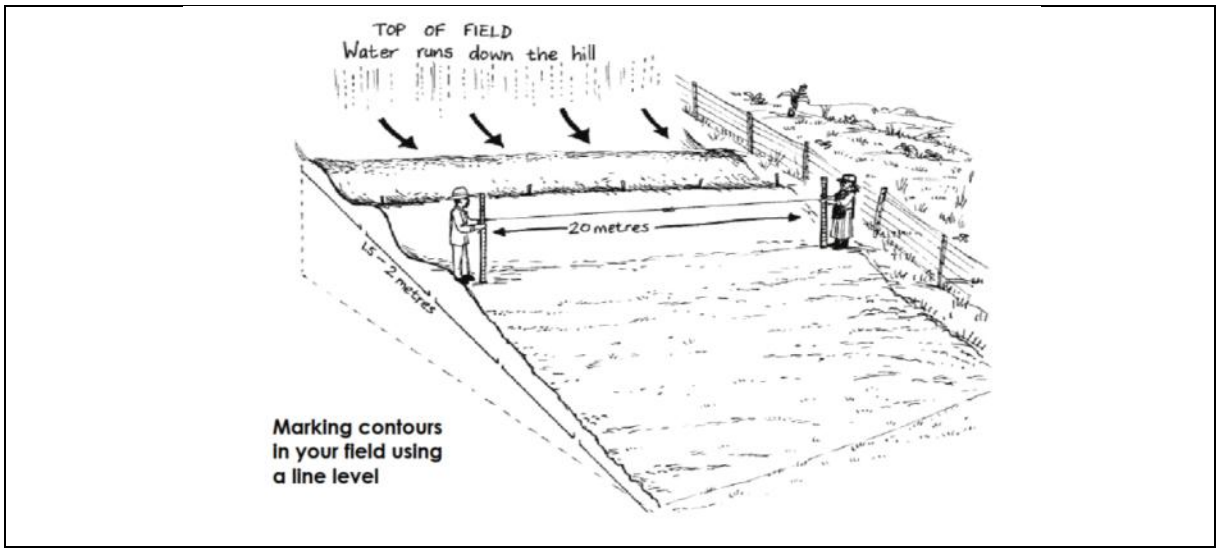
Management of storm water is one of the most important, and yet one of the most neglected, components in terrain planning and landscaping. Run-off water during storm events is the cause of erosion to both the terrain and gravel roads. Households and infrastructure should thus be protected from damage due to the run-off water.

4.2 Possible Storm Water Management Solutions

Earthworks will be done to ensure that storm water is controlled by means of:

- The construction of swales to retain water, increasing infiltrations into the soil for gardening purposes;
- The construction of water detention ponds that can be used for the irrigation of community gardens;
- Surplus storm water will be retained by means of retention ponds or sports fields; and
- Storm water ditches and channels will be constructed to remove surplus storm water away from roads and other infrastructure.

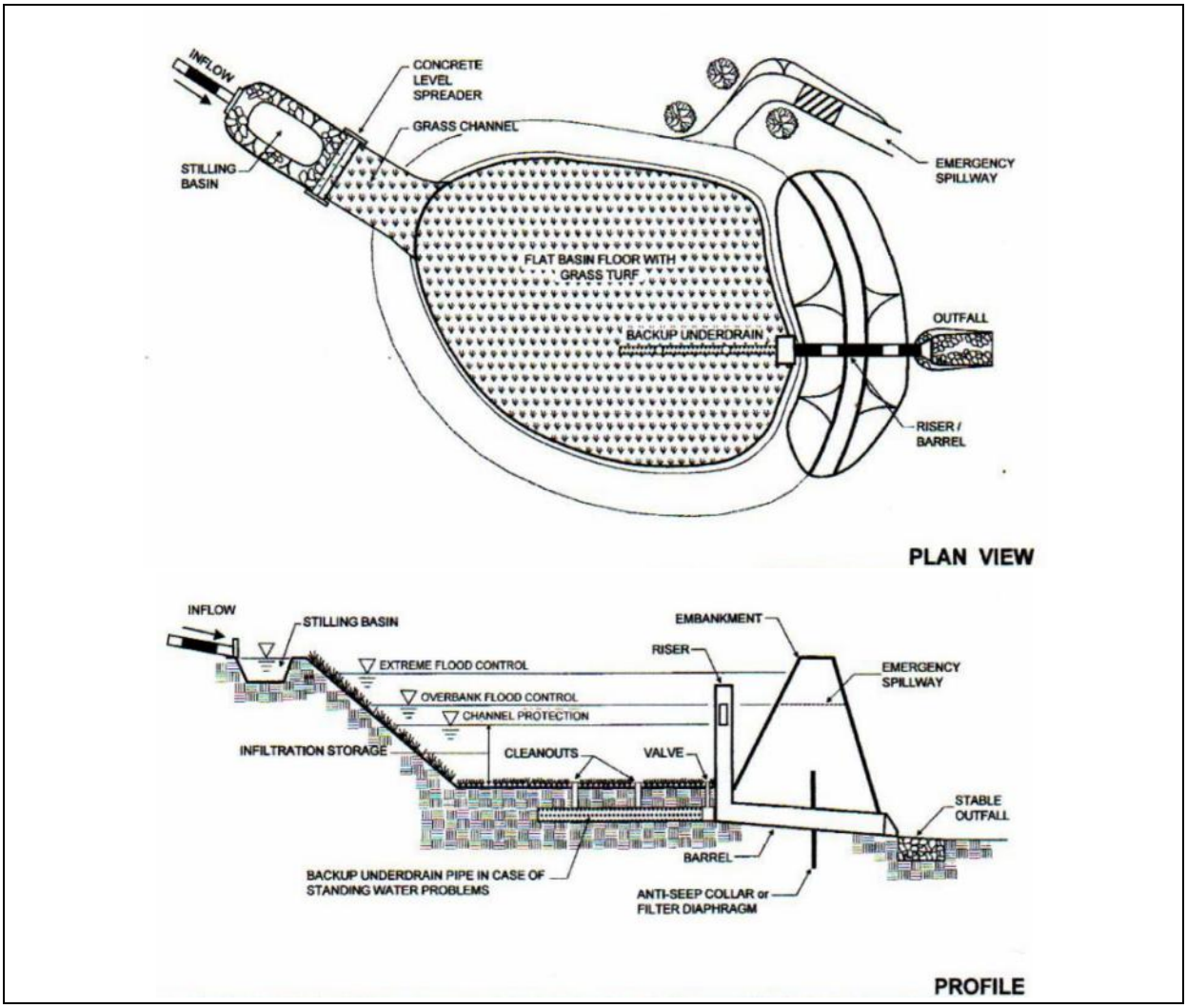
Figure 4.1: The construction of swales reduces runoff



Storm water drainage will be incorporated in the final design, these will include the following:

- Construction of culverts/cross pans.
- Construction of stilling basins to avoid soil erosion where applicable.
- Construction of mitre drains where necessary.

Figure 4.2: Storm water retention ponds is useful for irrigation of community gardens



4.3 Cost Implications

Capital cost:	± R30 000 - R35 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 500/year - R2 500/year

5. ROADS/STREETS

5.1 Introduction

Roads are in essence convenient corridors with which people move between locations. The standard of the road can vary greatly depending on its use. For example, a farmer in the field simply needs a dirt track to get to his animals. The road does not carry large volumes of traffic. The capital cost and maintenance of these tracks can often be negligibly small. In contrast the N1 highway between Pretoria and Johannesburg is a paved road with ten lanes in some sections. It carries vast numbers of vehicles per day. The cost to construct and maintain this road is enormous.

5.2 Definitions

Level of Services	Intermediate	Full
Church (Flood Victim)	(1) None (2) Low grade gravel main access roads with concrete strip roads in steep areas.	(1) Paving main access roads. High grade gravel secondary roads with concrete strip roads in steep areas.
Church (Savings)	(1) Low grade gravel main access roads with concrete strip roads in steep areas.	(1) Paving main access roads. High grade gravel secondary roads with concrete strip roads in steep areas.
Municipal	(1) Low grade gravel main access roads with concrete strip roads in steep areas.	(1) Paving main access roads. High grade gravel secondary roads with concrete strip roads in steep areas.

5.3 Low Grade Gravel Road

5.3.1 Provision of Service

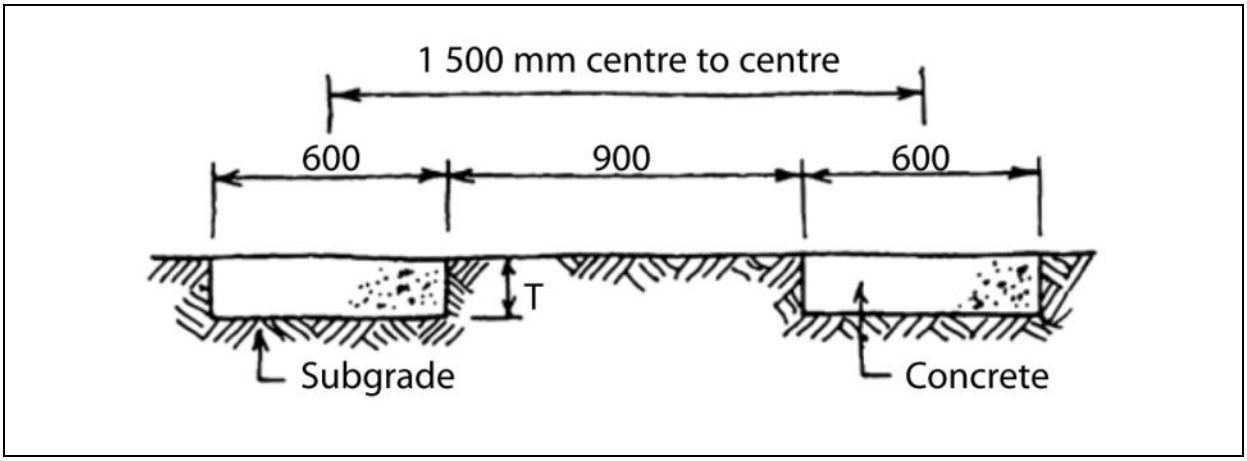
Initially the flood victims settle on the church land as an emergency measure and there is no time to first construct roads. As a second phase to the intermediate service for the flood victims, low grade gravel roads, with concrete strip roads in the steep/clayey areas. Low grade gravel roads will be provided as the intermediate service for the church land and the municipal land. Concrete strip roads are constructed where the terrain is steep/clayey.

5.3.2 Description of the System

Low specification gravel roads will be constructed. This will typically entail stripping the topsoil layer and compacting the in situ material to specification. Unsuitable material will have to be removed and replaced with low grade material such as G9.

Concrete strip roads will be constructed in areas where low specification gravel roads will not be suitable, such as on steep/clayey sections of road. These areas will need to be identified on site. The strip roads consist of a well compacted sub-grade unto which concrete strips are cast.

Figure 5.1: Example of typical strip road



5.3.3 Advantages

- Fast construction.
- Low capital costs.

5.3.4 Disadvantages

- High maintenance requirements, especially in wet regions.

5.3.5 Cost

Capital cost:	± R30 000 - R35 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 500/year - R2 500/year

5.4 High Grade Gravel Road

5.4.1 Provision of Service

The secondary roads on both the church and municipal land are upgraded to high grade gravel roads as a full service. Concrete strip roads are provided in excessively steep sections.

5.4.2 Description of the System

A high grade gravel road consists of a base of sufficiently high grade, such as a G5, over which a wearing course is placed. The thickness and quality of material is influenced by the traffic loading that the road will experience. It is essential to design the geometry and drainage correctly to prevent erosion of the road.

5.4.3 Advantages

- Good system for low traffic conditions.

5.4.4 Disadvantages

- Can be dusty in dry season.
- Muddy in dry season.
- Need to be maintained often.

5.4.5 Cost

Capital cost:	± R30 000 - R35 000 depending on the choice of construction material, site conditions, etc.
Maintenance cost:	± R1 500/year - R2 500/year

5.5 Paved Road

5.5.1 Provision of Service

The primary access roads on both the church and municipal land are upgraded to paved roads as a full service. Concrete strip roads are provided in excessively steep sections.

5.5.2 Description of the System

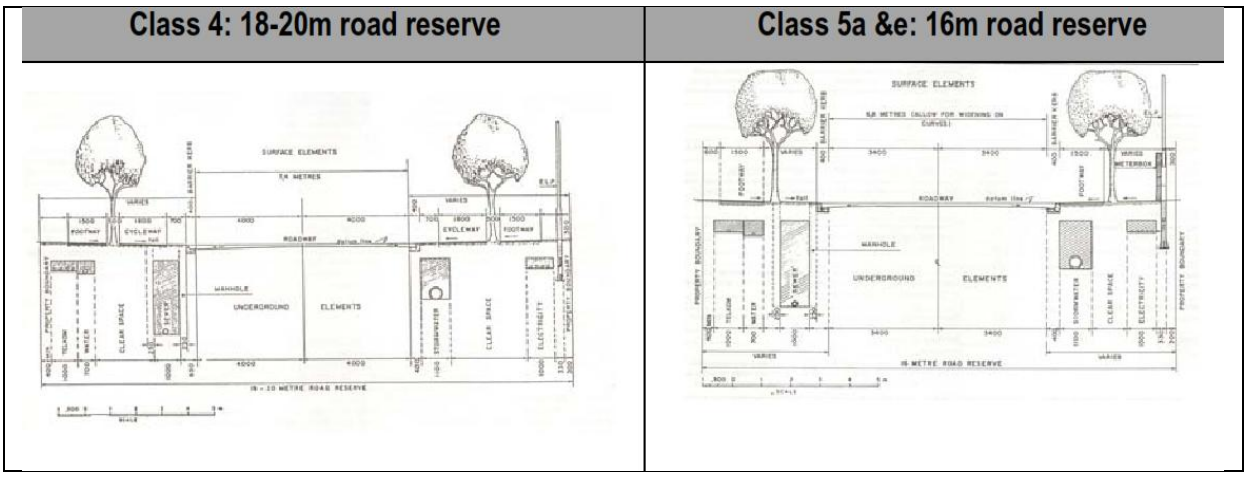
The road consists of a sub-base and base which is designed according to the loading that the road will experience. There is a number of different option when it comes to the paving of the road. The road can be surfaced with paving bricks, concrete, asphalt, bitumen seals, etc. The type of paving selected will depend on the requirements of the client as well as practical and design considerations.

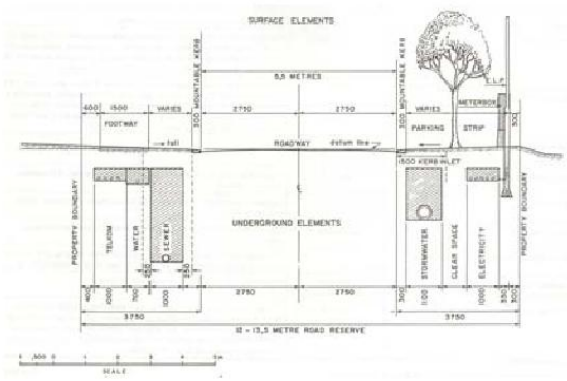
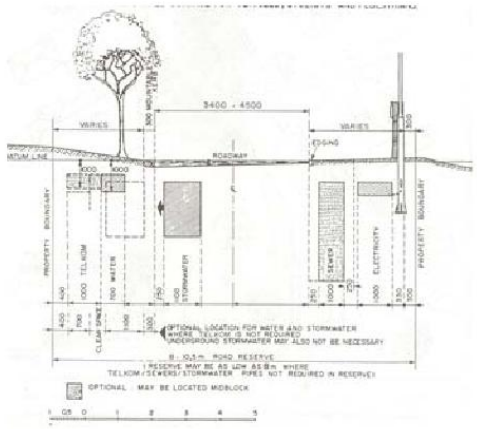
Traditionally infrastructure placed additional requirements on the width of the street, especially since it is unadvisable to place infrastructure under the street surface as this might cause major disturbances during maintenance work. Infrastructure can however be placed under pedestrian walkways.

Traditionally, the following minimum distances from the road reserve boundary are required for engineering infrastructure:

- Sewer: 1.0m
- Water: 0.7m
- Telkom: 1.0m
- Electricity: 1.0m
- Storm water: 1.0m

Figure 5.2: Specification of Traditional Road Reserves



Class 5b & c: 12-13.5m	Class 5d & f: 18-10.5m
	

5.5.3 Advantages

- Better driving surface.
- No dust.
- Less road noise.
- Lower maintenance.

5.5.4 Disadvantages

- High capital cost.

5.5.5 Cost

Capital cost: ± R800 000/km depending on the construction material, site conditions, etc.
Maintenance cost: ± R5 000/km/year

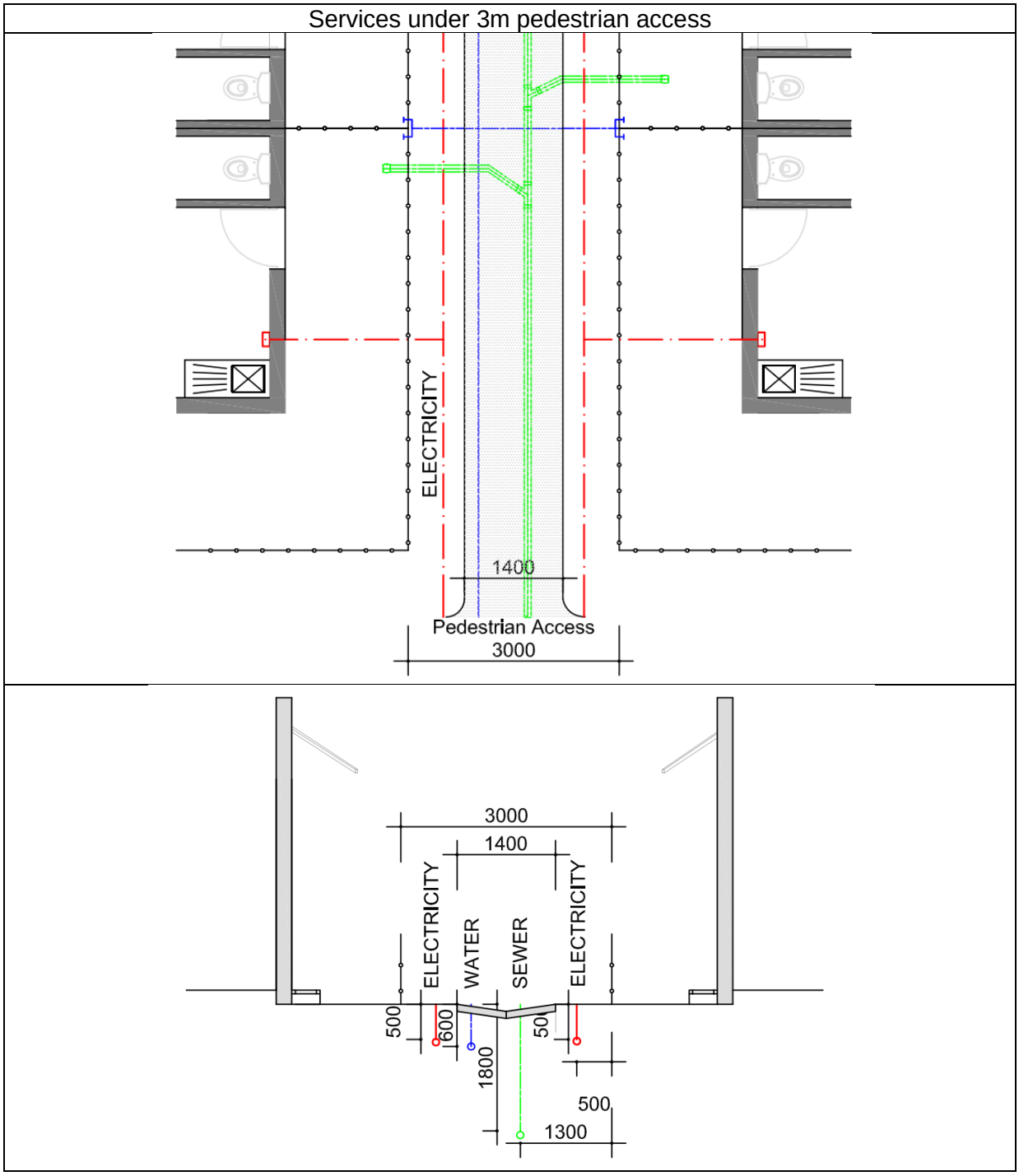
5.6 Pedestrian Walkways

5.6.1 Provision of Service

The pedestrian walkways on both the church and municipal land are constructed with concrete walkways (not paving). These walkways are constructed to also accommodate storm water.

5.6.2 Description of the System

Figure 5.3: Specification of Proposed Pedestrian Walkways



The pedestrian road is 3m wide and is designed to accommodate abovementioned services and emergency services where required. It is also to be designed in the shape of V-drains to accommodate internal storm water from houses only.

5.6.3 Advantages

- Formalised pedestrian corridors.
- Formalised and protected services corridors.

- Formalised storm water.
- Access for emergency vehicles.

5.6.4 Disadvantages

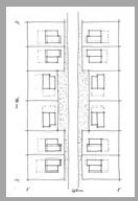
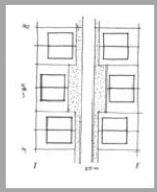
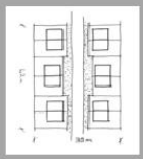
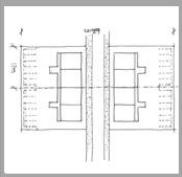
- None.

5.6.5 Cost

Capital cost: ± R800 000/km depending on the construction material, site conditions, etc.
Maintenance cost: ± R5 000/km/year

5.7 Summary

Figire 5.4: Road/Street Costs for Various Housing Densities

EXAMPLE	1	2	3	4	5
SUBDIVISIONAL SAMPLE					
RESIDENTIAL UNIT					
House configuration	Single	Semi-Detached	Semi-Detached	Walk-Up	High Rise
Floors	1	1	2	3	8
Total erf frontage length	156	92	89	68	68
Road length in sample	78	48	42	34	34
Area of road sample (4m wide)	390	240	210	170	170
Average land portion/ unit	219	111	87	74	20
Net residential. Density	46	90	115	136	494
Gross residential density	23	45	57	68	247
Road surface area to erf ratio	33	20	18	7	1
[1]Cost of road per unit @ R130/m²	**4225.00**	**2600.00**	**2275.00**	**920.83**	**172.66**

6. ENERGY

6.1 Introduction

Although house designs are not the responsibility of the engineer, we prefer to work closely with the architect to ensure that the project objectives are met with respect to sustainability.

The choice of building materials and the use of natural resources has a major impact on the energy demand of the development.

Design guidelines/specifications are to be communicated clearly to home owners to ensure that efficiency levels are met. A small investment (suggest 80/20 principal) will have huge long-term impact.

6.2 Definitions

Level of Services	Intermediate	Full
Church (Flood Victim)	(1) None (2) Solar lights at toilets.	(1) House connection and solar geysers. Street lights.
Church (Savings)	(1) Solar lights at toilets.	(1) House connection and solar geysers. Street lights.
Municipal	(1) Street lights and lights at communal ablution.	(1) House connection and solar geysers. Street lights.

6.3 Solar Lights

6.3.1 Provision of Service

Solar lights are provided at the toilets as an intermediate service.

6.3.2 Description of the System

There is a vast number of solar lights available varying in strength, design, etc. A solar light works on the principle that the sun's energy is harvested through a solar panel. This is used to charge a battery. As the sun sets a light sensor switches the light on, drawing power from the battery. When the sun raises again the light switches of and solar energy is used to recharge the battery again. These lights use LED lights, which does not draw too much power.

6.3.3 Advantages

- No electrical cables required.
- No additional energy required.

6.3.4 Disadvantages

- Theft of infrastructure.
- LED technology not yet financially competitive (is improving).

6.3.5 Cost

Capital cost: ± R500 depending on the type of light, etc.
Maintenance cost: ± R50/year

6.4 Street and Security Lighting

6.4.1 Lighting Options

6.4.1.1 Why Provide Lighting?

In analyzing our lighting policy the first question that needed to be answered is "Why does the Municipality Provide Lighting"? Some of the reasons are listed below:

- Road Safety and Better Traffic Flow
- It helps deter Crime and Vandalism
- Improves the General Appearance of Residential Areas
- Improves General Living Standards
- To Provide Security

6.4.1.2 What do our consumers in low-income areas want?

While it is not the Municipality's responsibility to provide security lighting, this is the main requirement in low income areas.

The Municipality needs to balance this requirement with its responsibility to provide street lighting and in so doing ensure customer satisfaction.

If the above can be done, then communities will take ownership of the street lighting thus reducing vandalism.

Parts of the community want to retain high mast lighting because, when working, they provide security lighting. Adequate security lighting can be provided with the use of street front lighting. This requires that the street front lighting be correctly designed and a luminaire fit for purposed be used. For the consumer to accept this new type of lighting they need to be informed. Pilot projects can also be used to show consumers what to expect.

The type of lighting to be used is dependent on the nature of the terrain and the income level of the residents. In a high income area where most homes have their own security lighting, but traffic is higher, mainly road lighting is required. In lower income areas where there are fewer cars and the consumers do not have security lighting, a combination is required.

6.4.2 High Masts

We then looked at the different types of Lighting (High mast and streetlights).

6.4.2.1 Advantages

- To the uninitiated, high mast lighting is apparently cheaper to operate and maintain.
- It provides security lighting.
- It is purported to be less susceptible to vandalism.

6.4.2.2 Disadvantages

- Costly when vandalized.
- Usually a combination of streets lights and high mast lights are required.
- Costly to install.
- Costly to maintain.
- Hazardous to motorists due to the glare.
- When not functioning, large areas are left in total darkness.
- Highly susceptible to damage by lightning and birds.
- Light Pollution.

6.4.2.3 Light Pollution

- Environmental issues have become a major concern worldwide.
- Light pollution has been spotlighted.
- Some countries have already adopted legislation to reduce light emissions.
- It was felt that South Africa would follow with its own legislation.
- The type of lights used on high mast systems are designed to provide security and sports field lighting.
- As these types of fittings are not shrouded, light is lost upwards causing sky glow (light pollution).

Figure 6.1: High Mast Vandalism

Cost of a typical incident of vandalism • The damage to this high mast light cost R40 000,00 to repair. All the luminaries, trailing cable, steel cable and the control panel were stolen. • The lighting platform and door all had to be replaced due to the damage.	

6.4.3 Conventional Streetlights / Post Tops

6.4.3.1 Advantages

- Enhances the appearance of the residential area.
- Cheaper than high mast lighting (on existing electrical installation).
- Conforms to SABS 098 – 1.
- Post Top luminaries provide security lighting without being obtrusive.
- Residents take ownership of their lights.

Figure 6.2: Streetlights Example

Easy to install and maintain • Shown in the picture is a local resident who has been trained to install streetlights. • Some municipalities have taken this training further and use local residents to change light bulbs thus creating work opportunities. • All electrical connections are completed by electricians.	

6.4.3.2 Disadvantages

- Costly to install if no existing network is available.
- Conventional street lighting provides very little security lighting to houses.
- **NOTE:** If planned correctly electrification and street lighting can be done simultaneously, therefore making street lighting the cheaper choice.

6.4.4 Security Lighting

As security lighting is a big issue in low income areas we looked at how to provide security lighting in the most cost effective way.

6.4.4.1 High Mast Lights

- High masts when working provide security lighting, but are very obtrusive and the high glare can affect drivers of vehicles.
- It has been found that because high mast lights cover a large area, they became targets for the criminal element within communities. Without the lights working they have a large area of darkness to operate in. Lights, which have been vandalised, could be inoperative for several days depending on weather conditions, damage caused by vandals, and the availability of spares required for the repairs.
- It has been found that usually a combination of high mast lighting and street lighting is required to meet street lighting standards.
- This can be due to land contours or large buildings causing shadowed areas.

6.4.4.2 Street Lighting (Post tops)

- This type of lighting provides very good security lighting without being obtrusive and provides street front lighting, which meets the requirements of the SABS street lighting standards.
- It has been found that the consumer, for whom the light provides security, takes responsibility for it and immediately reports any fault to the Municipality.
- Vandalism is also reduced because communities take ownership.

6.4.5 Cost Comparison

The real aim of the exercise is always the cost. What is the cheapest way to provide lighting that meets all customer needs?

6.4.5.1 Installation Costs

(This cost is based on installing the lighting on an existing reticulation network)

	High Mast	Conventional/ Post Top
Supply Cable	R2,000	ON EXISTING
Foundations	R17,100	N/A
Mast (40 m)	R52,000	N/A
Crane	R11,600	N/A
Labour to erect mast no electrical work	R6,500	N/A
Control Panel	R6,000	R2,500
Light Fittings	R25,000	R71,500
Lighting cable	R1,800	R1,200
TOTAL	**R122,000**	**R75,200**

Note:

- The above table is based on prices as quoted on 10 May 2004 and may vary. The lighting head on the high mast is fitted with 6 (six) 1000 W HPS floodlights.
- Cost based on the installation of 55 (70 watt) hps luminaries on existing network

6.4.5.2 Maintenance Costs

Shown below is a comparison of typical faults, which occur, in the street lighting network:

Task	High Mast		Post Top	
	Materials	Labour	Materials	Labour
Cable	R720	R400	R16,00	R35
Lamp	R490	R200	R114,70	R50
Ballast	R781	R350	R180,35	R200
Complete Luminaire	R2 197	R350	R950,00	R100

After monitoring the budget on a monthly basis it was found that on average R25,000 is spent on the maintenance of the 120 high mast lights compared to R5,000 for the ±4,000 streetlights on materials alone.

As can be seen from the above comparison of typical faults, the labour for the repairs to the high mast lighting is very high. This is due to the fact that the lighting platform needs to be lowered for work to be carried out.

As this task falls under the Occupation Health and Safety Act (lifting gear), it requires a competent person to be available on site at all times. Typically it takes 25 minutes to both lower and raise the platform on the mast (i.e. 50 minutes total).

For lamp replacement on a high mast to be cost effective you need to have at least 3 lamps out. This of course reduces the effectiveness of the mast in the interim.

There is a substantial increase in costs when a fault occurs to the steel trailing cable/lighting platform, which requires the hiring of a 30 ton crane.

Such faults, which occur, can be attributed to:

- Birds nest on the lighting platform.
- Jamming of the Platform Lowering Mechanism.
- Vandalism.
- High mast lights are susceptible to lightning (lightning strikes cause damage to trailing cables).

For the use of a mobile crane to be cost effective you have to allow for at least 3 high masts to be repaired at a time. This cannot always be done, as each high mast provides lighting over a large area and therefore cannot be inoperative for an extended period of time.

As the crane must be hired for a full day the cost incurred is at least R8,000. It should be noted that work on a high mast can only be carried out on calm days (light wind). Any delays caused by wind once the crane is on site increase the costs. High winds are common in the Eastern Cape.

6.4.6 Energy Consumption Costs

The comparison below is based on an area covered by a 40 m high mast. It has been established that you would require between 50 and 60 (70 Watt) hps light fittings to cover the same area using conventional street lights. We have based our calculations on 55 fittings.

6.4.6.1 High Mast

6 x 1,000 W = 6,000 Watts

Taking an average of 10 hours working per day the cost of running a high mast per year would be:

- 6 kW x 10 h x 365 days x R0.26/kWh = R5,694 per annum

6.4.6.2 Conventional Street lights / Post Tops

55 x 70 Watts = 3 850 Watts

Taking an average of 10 hours working per day the cost of running the conventional street lights would be:

- 3.85 kW x 10 h x 365 days x R0.26/kWh = R3,654 per annum.
- The Annual Energy cost for high mast lighting is R2,040 higher than that of the equivalent street lighting.

6.4.7 CONCLUSION

High mast lighting is more expensive to install and maintain.

Security lighting can be provided without having to resort to high mast lighting.

Because conventional street lighting is situated closer to consumers they take ownership, thus reducing vandalism.

Light pollution can be reduced by installing the correct type of lighting for the job on hand. (i.e. use post top fittings to provide security as this type up fitting reduces upward light, and therefore reduces sky glow but still provides adequate lighting without being obtrusive).

After considering the above the Buffalo City Municipality have taken the following decisions:

- To remove all high mast lighting installations as and when they fail.
- To install only conventional street lighting or Post Top fittings.

This of course does not mean that high mast lights do not have a place, such as security lighting of factories and for sports field lighting.

6.5 House Connections

6.5.1 Provision of Service

House connections and solar geysers are provided to each house, on both the municipal and church land, as a full service.

6.5.2 Description of the System

An electrical reticulation network is installed and each house connected to the network. The electricity is supplied by the municipality. Prepaid metering boxes are installed. Additionally solar geysers are supplied to each dwelling. This reduces the electrical demand and utilizes alternative renewable energy.

6.5.3 Advantages

- Convenience for end user.
- Solar geyser reduces electrical demand.

6.5.4 Disadvantages

- High capital cost, but Eskom subsidies are available.

6.5.5 Cost

Capital cost:	± R800 000/km depending on the construction material, site conditions, etc.
Maintenance cost:	± R5 000/km/year

6.6 Solar Geysers

6.6.1 Provision of Service

House connections and solar geysers are provided to each house, on both the municipal and church land, as a full service.

6.6.2 Description of the System

An electrical reticulation network is installed and each house connected to the network. The electricity is supplied by the municipality. Prepaid metering boxes are installed. Additionally solar

geysers are supplied to each dwelling. This reduces the electrical demand and utilizes alternative renewable energy.

6.6.3 Advantages

- Convenience for end user.
- Solar geyser reduces electrical demand.

6.6.4 Disadvantages

- High capital cost, but Eskom subsidies are available.

6.6.5 Cost

Capital cost:	± R800 000/km depending on the construction material, site conditions, etc.
Maintenance cost:	± R5 000/km/year

7. FOOD PRODUCTION

7.1 Introduction

Urban agriculture can be divided into:

- Agriculture/food production in own backyard; and
- Food production in community gardens.

In order to achieve this one needs to ensure that the following infrastructure processes are not overlooked:

- Layout and positioning of the community garden to be socially acceptable;
- Security to be such that it encourage and protect women and elderly people;
- Storm water runoff to be captured and stored for irrigation purposes; and
- Ensure that fertile soil is identified for community gardens.

7.2 Urban Agriculture

The development will be laid out to encourage the practice of urban agriculture.

Figure 7.1: Community involvement during planning stage

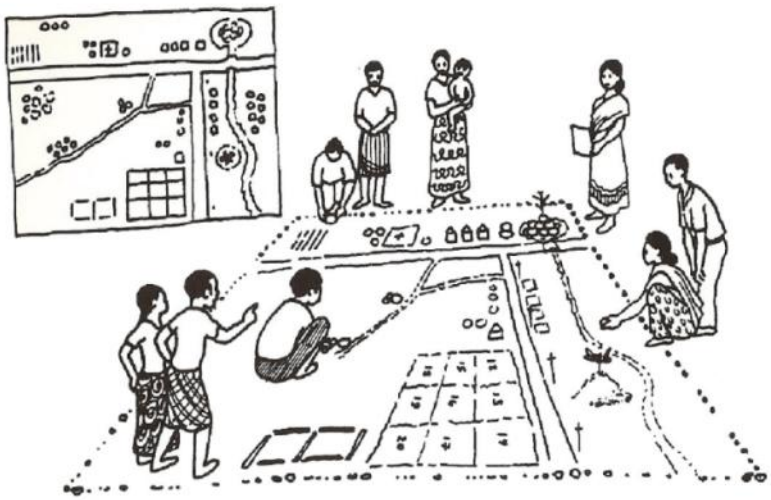


Figure 7.2: Ensure that planning meets specific needs

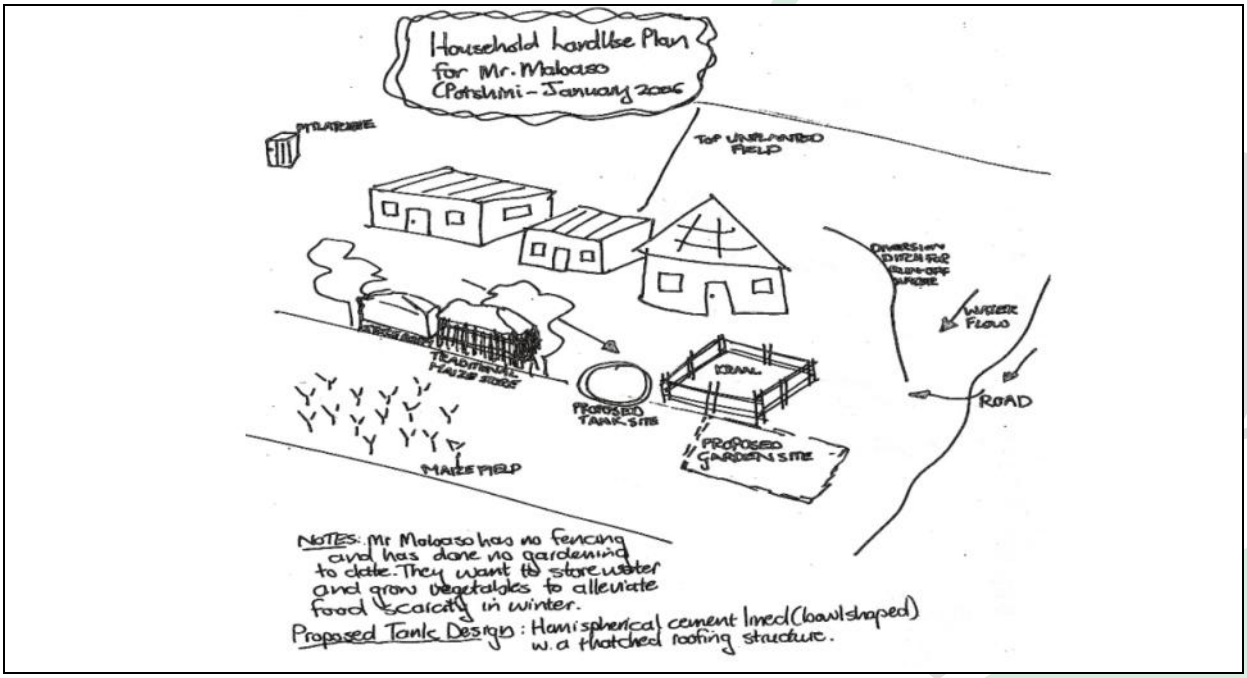


Figure 7.3: Community gardens to be planned to optimise production

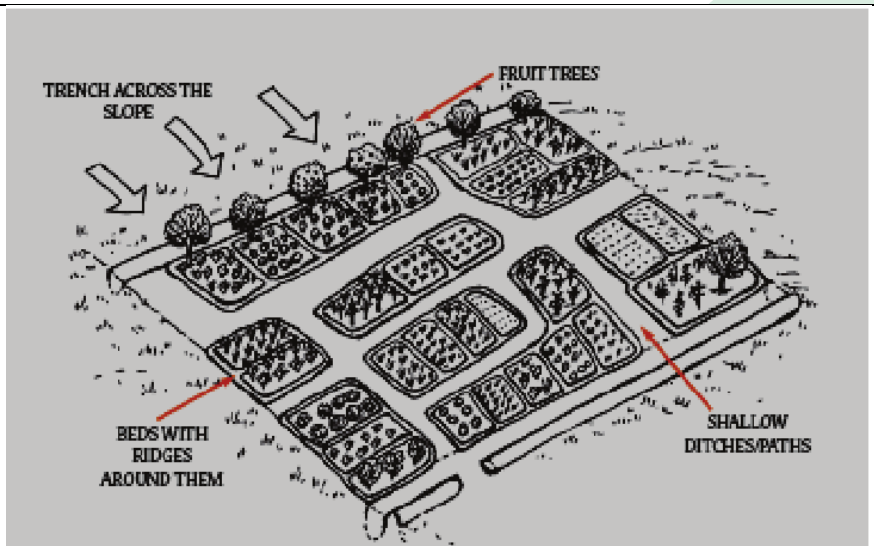


Figure 7.4: The use of simple irrigation equipment can improve productivity

Figure 7.5: Ensure that fencing is in place

7.3 Added Advantages

It is suggested that urban agriculture also be used to achieve the following:

- The creation of **windbreaks** by planting trees in rows next to roads in swales,
- These trees to be fruit trees if possible;
- Trees to be planted to provide shade, a right combination of trees important.

Figure 7.6: Vegetation/trees as windbreaks

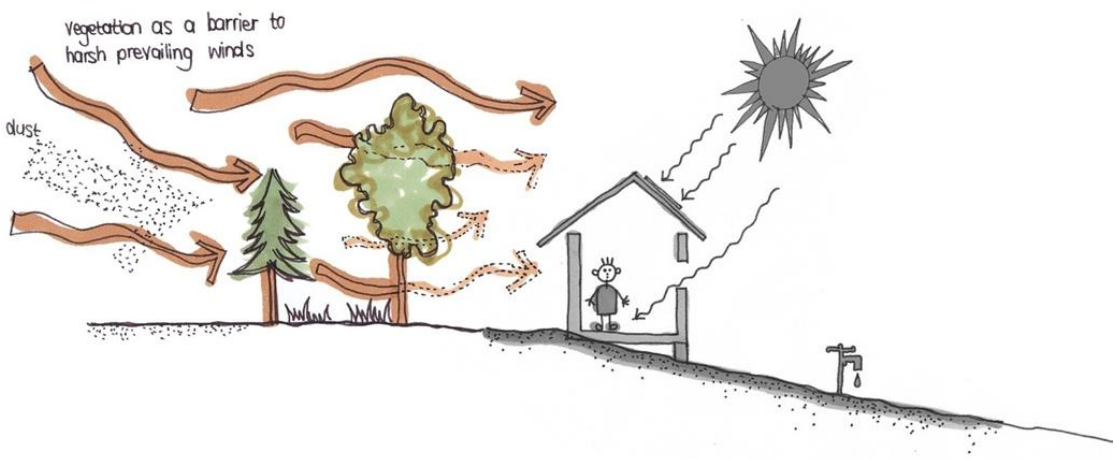
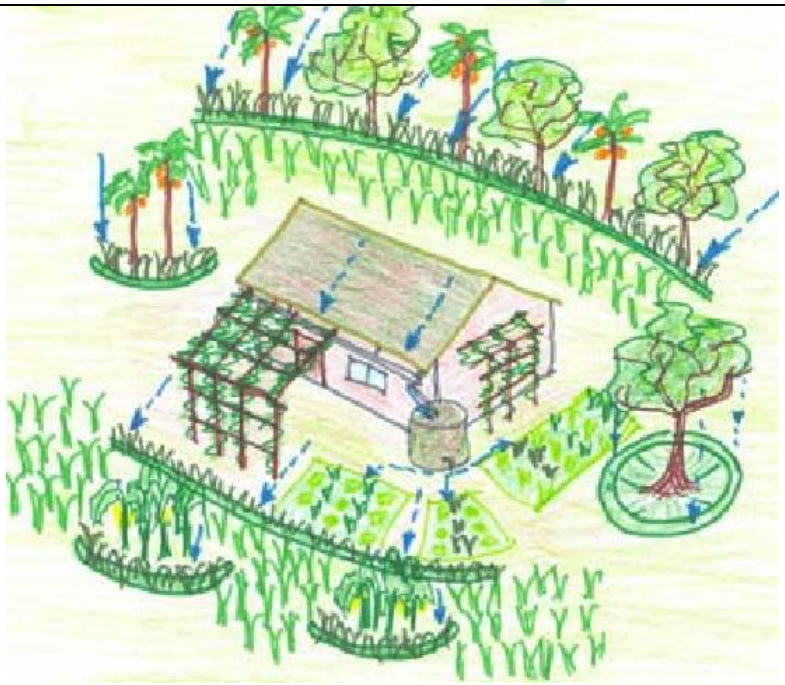


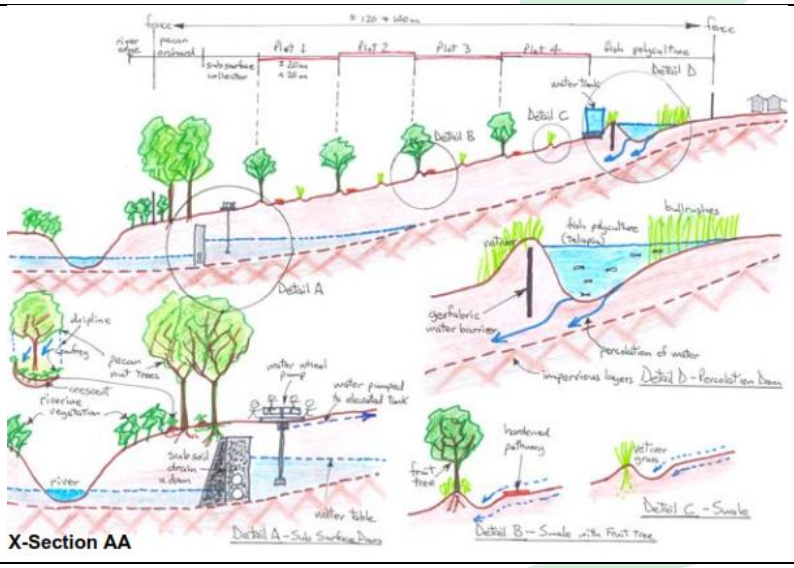
Figure 7.7: Fruit trees as windbreaks



7.4 Technical Planning

Technical planning of community gardens are critical to ensure that available natural resources are utilised optimally. See example of typical technical plan hereunder.

Figure 7.8: Example of technical planning



8. SOLID WASTE

8.1 Introduction

The way that solid waste is treated depends not only on the developer but relies heavily on the homeowners. This is because the separation of solid waste needs to occur within the individual units. Facilities to promote the separation of waste in the units can be provided through the architectural design. Within the development, facilities can be provided to dispose of the various types of waste, such as paper, plastic, glass, organic, etc. Composting is a positive way of handling organic solid waste, our designs also allows for the necessary composting infrastructure at household level.

Social programmes focussing on solid waste handling is instrumental in influencing homeowners to implement the correct solid waste protocols associated with this type of development.

8.2 Definitions

Level of Services	Intermediate	Full
Church (Flood Victim)	(1) Central skips with recycling and composting.	(1) Central skips with recycling and composting.
Church (Savings)	(1) Central skips with recycling and composting.	(1) Central skips with recycling and composting.
Municipal	(1) Central skips with recycling and composting.	(1) Central skips with recycling and composting.

8.3 Skips at Strategic Positions

8.3.1 Provision of Service

Central skips are provided as full services on both the church and the municipal land. This is done from the start of settlement on the land.

8.3.2 Description of the System

Skips are large metal containers. These are placed centrally to allow easy access for the residents to dispose of their waste. The skips are periodically emptied by municipal trucks.

8.3.3 Advantages

- Central waste collection points.

8.3.4 Disadvantages

- High capital cost.

8.3.5 Cost

Capital cost:	± R800 000/km depending on the construction material, site conditions, etc.
Maintenance cost:	± R5 000/km/year

8.4 Recycling and Composting

8.4.1 Provision of Service

Educational programs are provided at the initial settlement of both the municipal and church land.

8.4.2 Description of the System

The programs demonstrate the importance of recycling and how easy and effective it can be. It informs the people about what can be recycled and how to go about recycling. This includes creating compost from organic waste.

8.4.3 Advantages

- Reduction in waste produced.
- Environmentally friendly.
- Create environmental awareness and responsibility.

8.4.4 Disadvantages

- None.

8.4.5 Cost

Capital cost:	± R0
Maintenance cost:	± R0

9. SECURITY

9.1 Introduction

The concept of “design for security” is to be enforced strictly. Security involves:

- Lighting;
- Private spaces for individuals and groups/clusters of people;
- Protection of areas used as food protection plots;
- Protection of areas used by children;
- Installation of strategic fencing to encourage community groups to take ownership of their own security through social structures e.g. CPF;
- Construction of access roads that will allow policing to be done efficiently.

9.2 Interim Service: High Mast Lights

High masts at strategic positions will improve security.

9.3 Full Service: High Mast Lights and Security Fencing

Outstanding.

9.4 Cost Estimate: Interim Service

Outstanding

9.5 Cost Estimate: Full Service

Outstanding.

10. HOUSING

10.1 Introduction

Incremental Housing

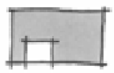
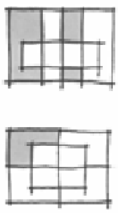
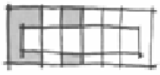
A house has been designed that allow for incremental improvement/conversion from a shack type house to a house that meets the minimum requirements set by the National Building Regulations. The intention of the design was to:

- Construct the main functional components of the house first i.e. the roof and the front wall.
- With the functional components in place, it is possible for a new homeowner to live on the land and to close off the remainder of his house for protection against the elements. These can be done by means of corrugated iron, mud structure, plastic sheeting, etc.
- As the homeowner manages to save funds, he is then able to construct his house over a longer period of time investing cash into a permanent structure.
- Once the house is complete, it can be sold as it is supposed to meet the minimum requirements.

Hi Density Housing

Some areas are earmarked for high-density housing. It is recommended that these developments be done by means of formalised developers.

Figure 10.1: Density and Configuration Options

TYPOLOGY	DENSITY	ERF CONFIGURATION	ERF AREA	GROSS DENSITY	NETT DENSITY	BUILDING SIZE	COVERAGE	
SINGLE STOREY DETACHED	Low	12m x 20m	240m²	25du/ha 125p/ha	42du/ha 210p/ha	30m²	13%	
SINGLE STOREY SEMI-DETACHED	Low/ medium	9m x 16m	144m²	33du/ha 237p/ha	69du/ha 345p/ha	36m²	25%	
DOUBLE STOREY SEMI-DETACHED	Medium	7m x 16m	112m²	73du/ha 327p/ha	99du/ha 495p/ha	48m²	21%	
DOUBLE STOREY ROW HOUSE QUADRUPLE X	Medium / high	5,5m x 16m 8m x 11m	88m²	88du/ha 400p/ha	395du/ha 1190/ha	52m²	29%	
DOUBLE STOREY ROW HOUSE (6)	High	4,5m x 12m 7m x 12m	54m² 84m²	118du/ha 550p/ha	835du/ha 1670p/ha	52m²	38%	

10.2 Definitions

Level of Services	Intermediate	Full
Church (Flood Victim)	(1) Informal shacks	(1) Elemental houses
Church (Savings)	(1) Informal shacks	(1) Elemental houses
Municipal	(1) Elemental houses	(1) Elemental houses

10.3 High Density Housing

Figure 10.2: High Density Options

HIGH DENSITY		
Medium-income groups	Economic	Fully & Partially Subsidised
		
85 units per hectare 340 persons per hectare	90 units per hectare 360 persons per hectare	100 units per hectare 400 persons per hectare

10.3.1 High Density Development Potential

This option will not be considered as part of this project.

10.4 Medium Density Housing

Figure 10.3: Medium Density Options

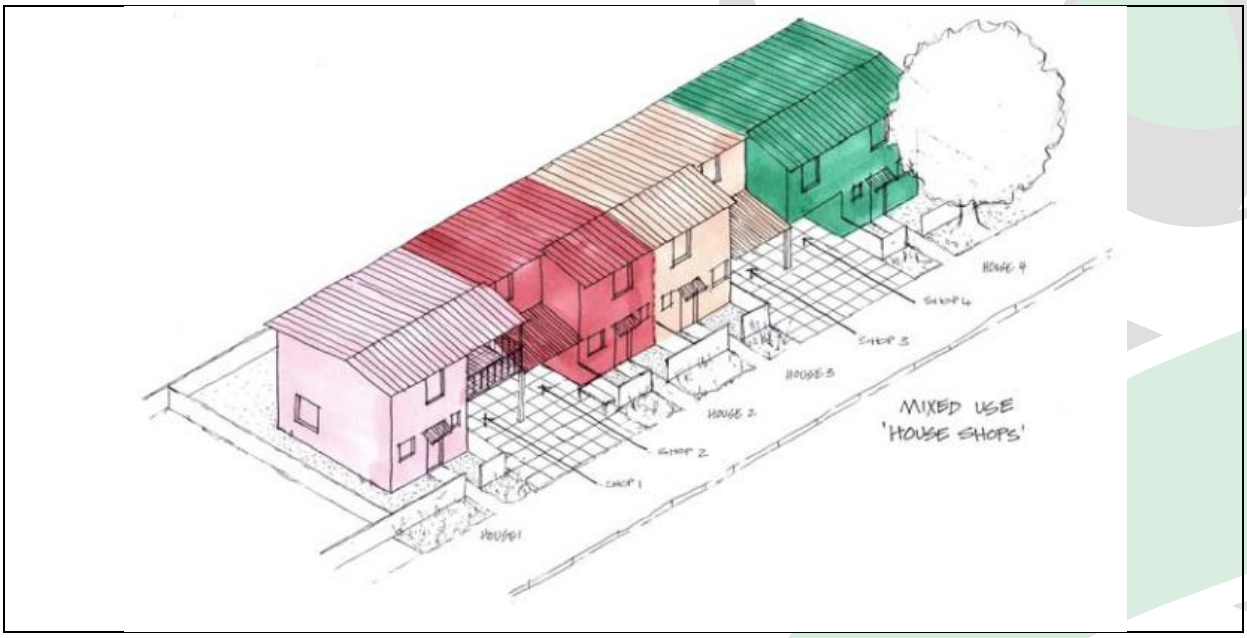
MEDIUM DENSITY		
High-income groups	Economic	Fully & Partially Subsidised
		
35 units per hectare 123 persons per hectare	55 units per hectare 220 persons per hectare	65 units per hectare 325 persons per hectare

10.4.1 Medium Density Development Potential

This option of development will benefit the project as there are areas that will require medium density development.

A consideration that may benefit this project is to combine medium density housing with spaza shops (mixed use). See example hereunder.

Figure 10.4: Mixed Use Options

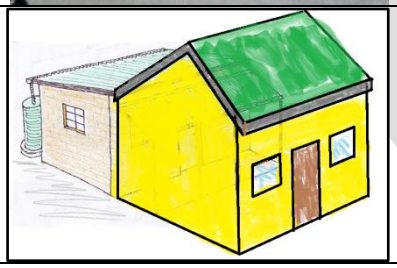
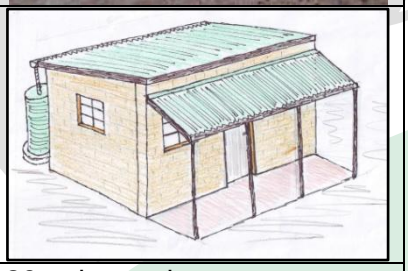


10.4.2 Contractual Arrangements

The first phase of this option will not be suitable for the owner builder developer. However, this project will look into the construction of the minimum required infrastructure. This phase of the development will be done by commercial/private developer. Houses will be further developed by the owner builder with own money and own time.

10.5 Low Density Housing

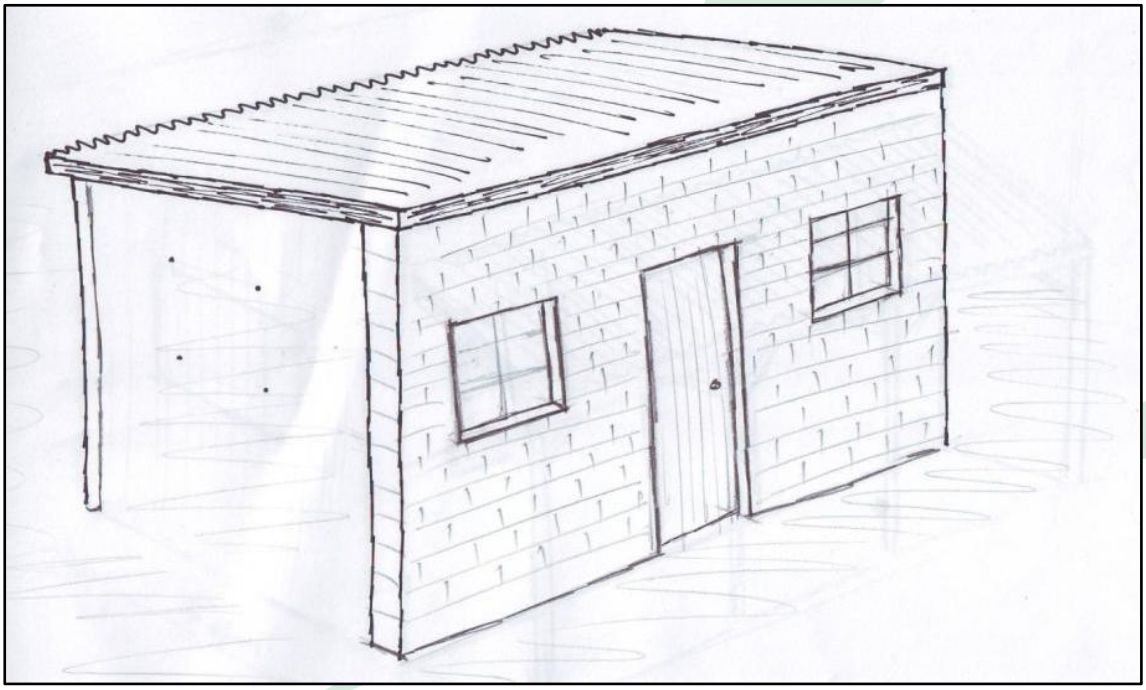
Figure 10.5: Low Density Options

LOW DENSITY		
High-income groups	Economic	Fully & partially subsidised
		
		
12 units per hectare 42 persons per hectare	18 units per hectare 72 persons per hectare	30 units per hectare 150 persons per hectare

10.5.1 Interim Service: Phase 1-2

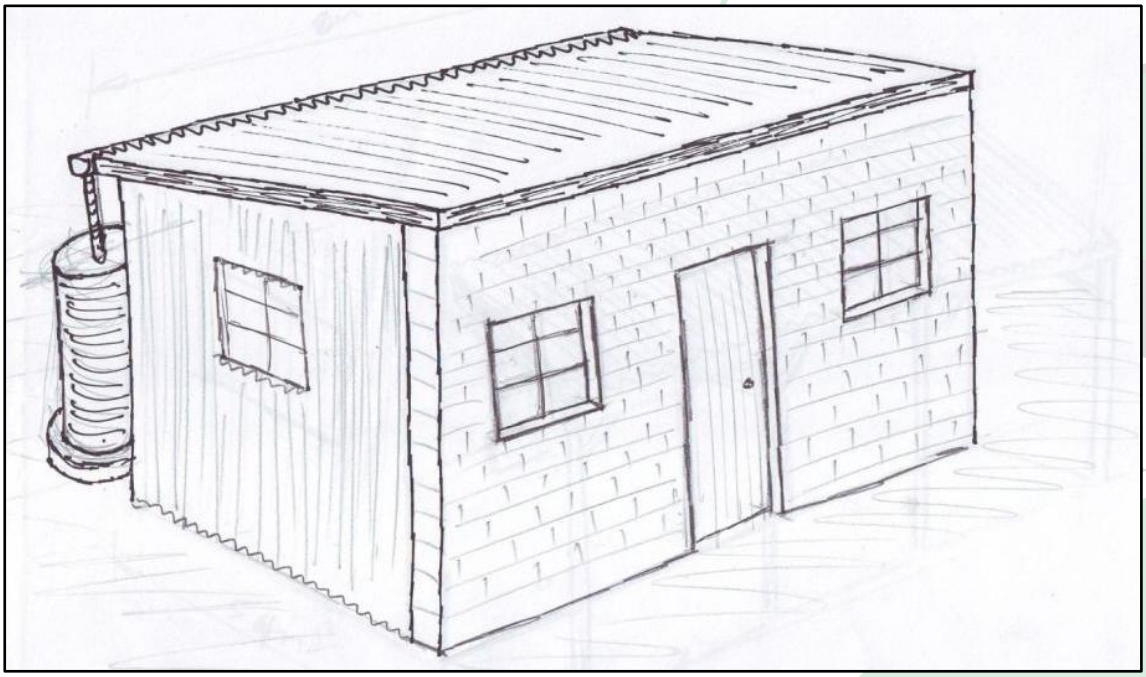
Phase 1 consists of a roof and front wall constructed of concrete blocks. The roof and block wall is to be constructed meeting the minimum specifications.

Figure 10.6: Low Density House Phase 1



Phase 2 consists of the closing of the structure with any material the owner can lay his hands on. this phase also includes the installation of a rainwater harvesting system.

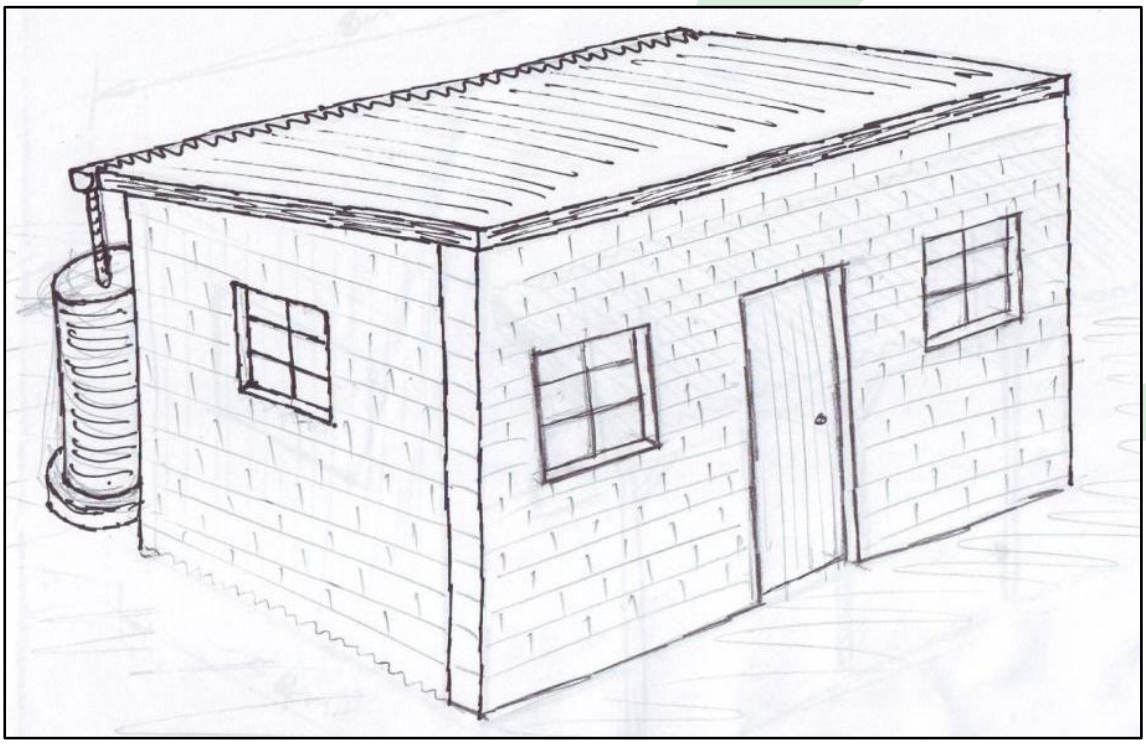
Figure 10.7: Low Density House Phase 2



10.5.2 Full Service: Phase 3-5

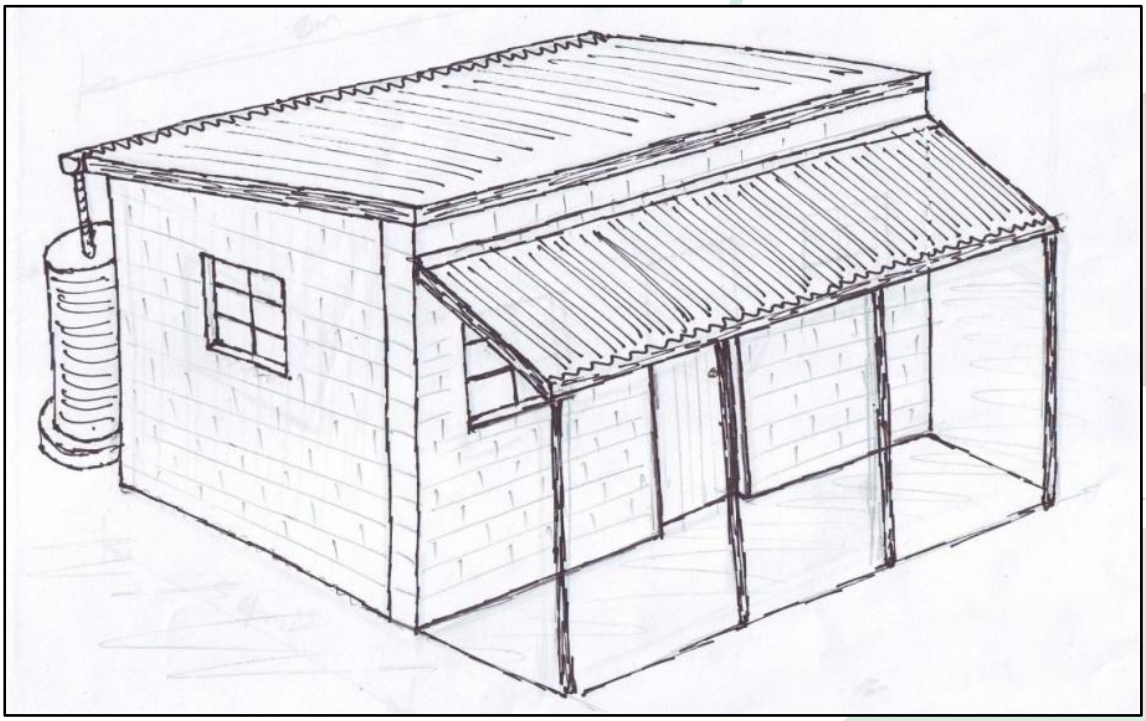
Phase 3 consists of the formulisation of the building project. Temporary corrugated iron/plastic sheets/etc are removed, a foundations is casted and a formal block wall is built.

Figure 10.8: Low Density House Phase 3



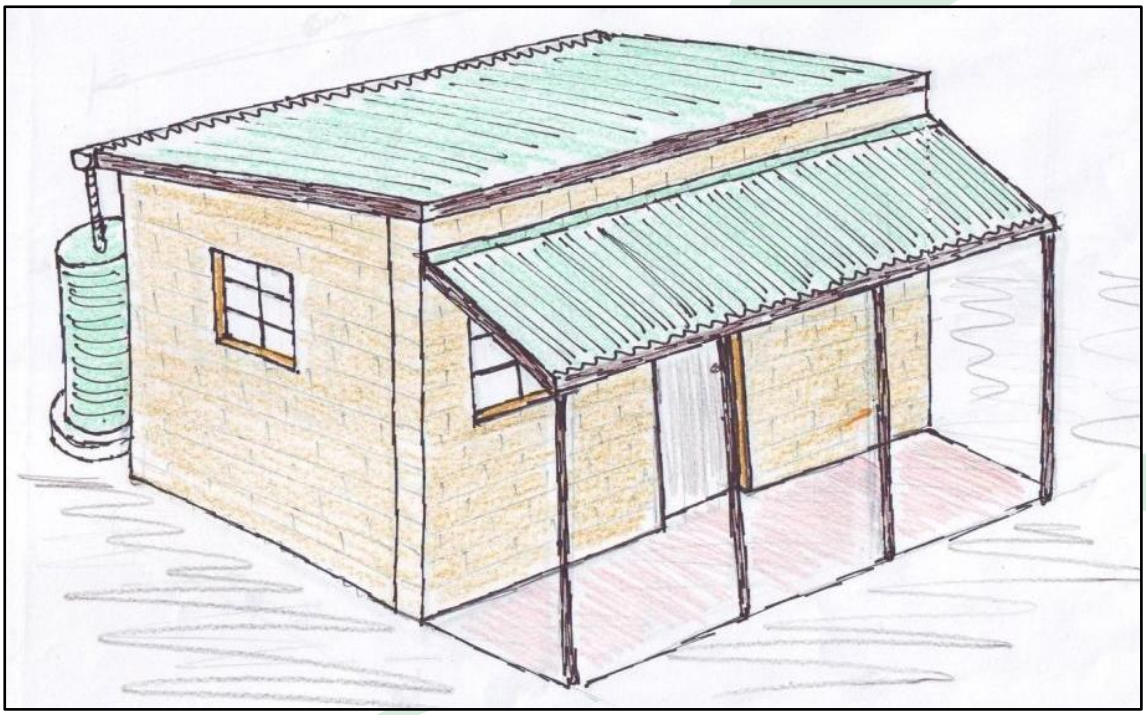
Phase 4 consists of the construction of a veranda.

Figure 10.9: Low Density House Phase 4



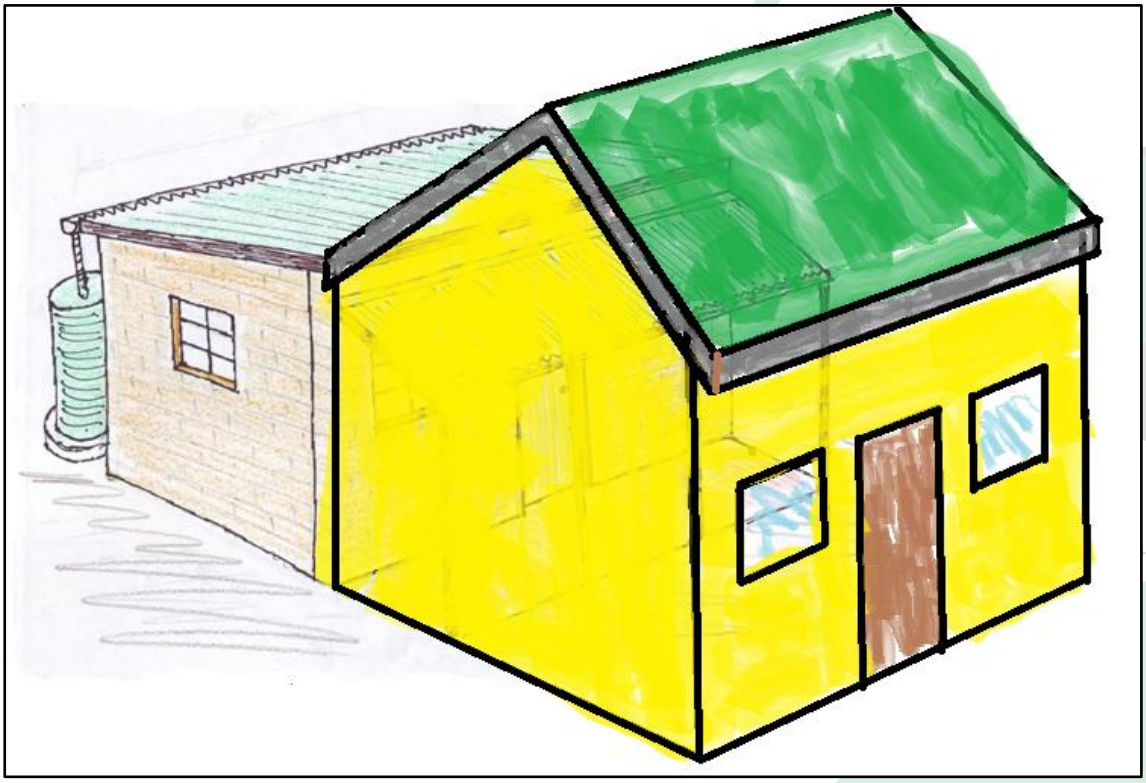
Phase 5 consists of the final phases of the house and includes the finishing touches such as painting.

Figure 10.10: Low Density House Phase 5



The next phase includes a final phase that converts the original RDP house to a house meeting higher levels of service requirements.

Figure 10.10: Low Density – Economic House



10.6 Cost Estimate: Interim Service

Outstanding.

10.7 Cost Estimate: Full Service

Outstanding.

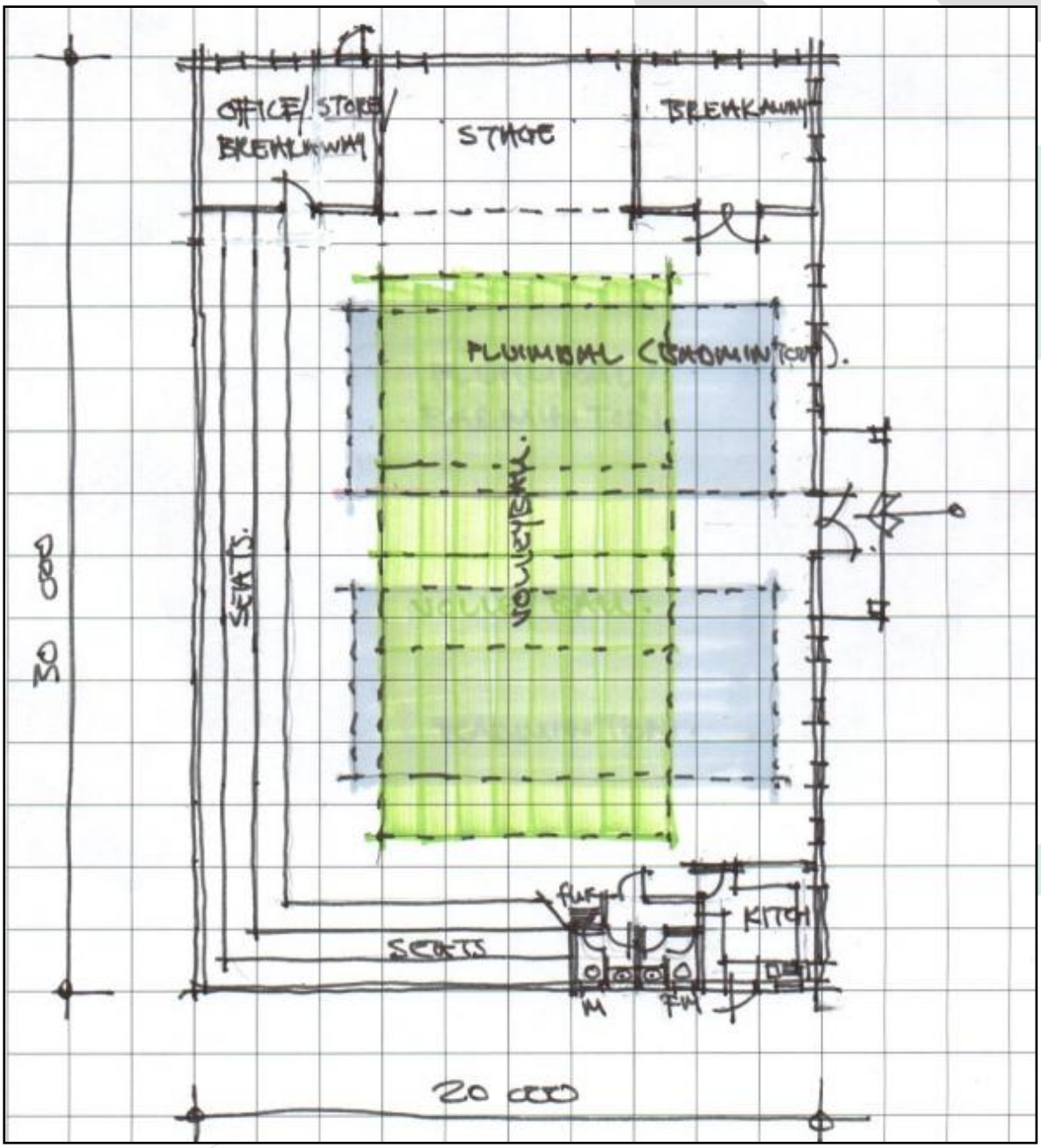
11. COMMUNITY FACILITIES

11.1 Introduction

Well planned community facilities is pivotal in ensuring a healthy project as this fulfil basic needs of the community at the early stages and later contribute towards healthy and safe social structures and basic business opportunities.

11.2 Interim Service: Business

Figure 11.1: Multipurpose centre



The concrete floor of the multi-purpose centre will fulfil the purpose as materials depot (yard).

The offices showed on the above plan can fulfil the function of housing support centre/office in the interim. A temporary security fence around the concrete slab will secure building materials.

The intention is that as soon as this facility fulfilled its purpose as interim business facility, the multi-purpose hall be completed and then be used to fulfil full social services.

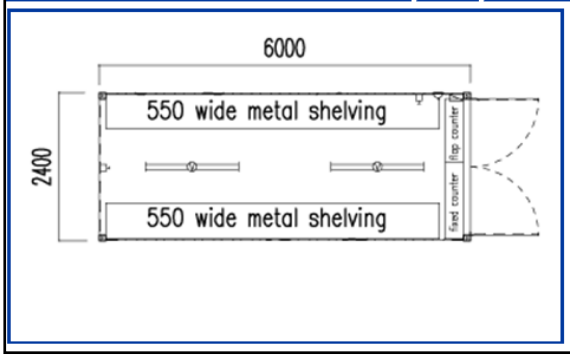
11.3 Interim Service: Social

It is intended that the interim social services such as crèches, police facilities, church facilities, social functions be provided by means of converted containers. Examples of such facilities are provided hereunder.

It is anticipated that the multi-purpose hall will replace thee facilities eventually. The floor of the multi-purpose hall will be used as the interim business site.

Figure 11.2: Examples of converted containers

Heavy Duty Steel Storage Container



6m x 2.4m CONTAINER

UNIT SPECS

Container - Steel, pre-owned

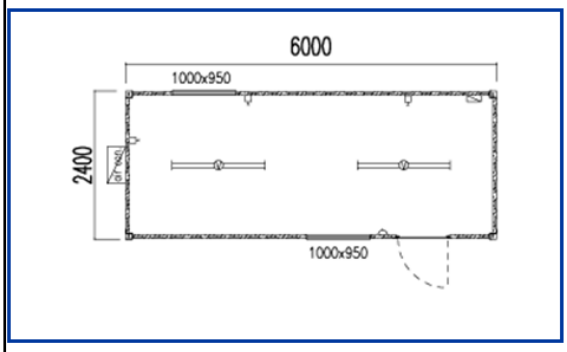
Painting - Wire brushed, treated for rust, painted outside (grey with blue trim)

Sealant - Poly rubber sealant on roof to prevent leaks

Electrics - Distribution board, earth leakage, 2 x 15amp plug points, 2 x Single fluorescent lights

Shelving - 2 x Steel racks with 4 rows each of 600mm heavy duty shelving

Insulated Office Container with Aircon



6m x 2.4m CONTAINER

UNIT SPECS

Container - Steel, pre-owned with poly rubber sealant on roof to prevent leaks

Painting - Wire brushed, treated for rust, painted outside (grey with blue trim)

Insulation - 40mm polystyrene insulation with Chromadek cladding internally

Ceiling - 40mm white Chromadek insulated ceiling panels

Windos - 2 x large steel windows (C2H - 950mm x 1000mm) with steel burglar guards

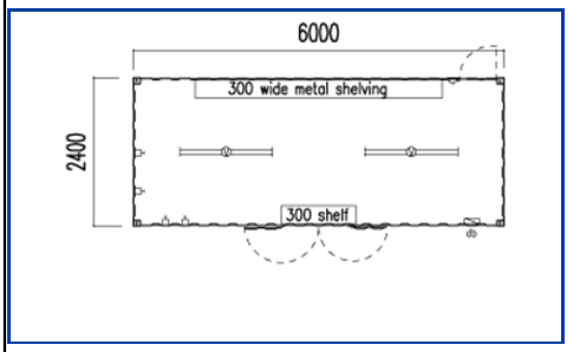
Door - 1 x external steel door with Chromadek cladding (790mm x 1980mm)

Electrics - Distribution board, earth leakage, 3 x 15amp plug points, 2 x single fluorescent lights

Aircon - 1 x 12000btu cooling only air conditioner with dedicated a plug point

Flooring - Marley industrial flooring

Tuck-Shop Container



6m x 2.4m CONTAINER

UNIT SPECS

Container - Steel, pre-owned with poly rubber sealant on roof to prevent leaks

Painting - Wire brushed, treated for rust, painted outside (grey with blue trim)

Windows - 4 x NG1 small steel windows (533mm x 350mm) with steel burglar guards

Door - 1 x External steel door with Chromadek cladding (790mm x 1980mm)

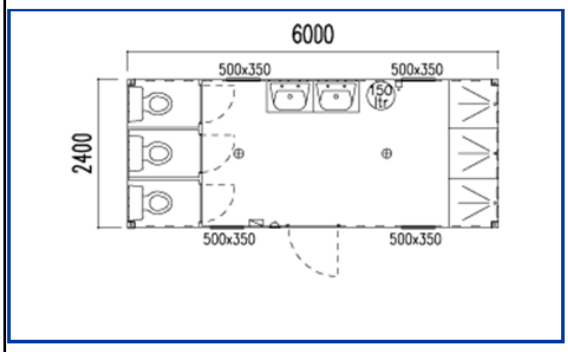
Hatch - 1 x Steel serving hatch (1200mm x 600mm) with shelf

Shelving - 2 x Rows of 300mm wide shelving

Electrics - Distribution board, earth leakage, 2 x Waterproof lights

Flooring - Painted floor

Ablution Container - 3 Toilet / 3 Shower



6m x 2.4m CONTAINER

UNIT SPECS

Container - Steel, pre-owned with poly rubber sealant on roof to prevent leaks

Painting - Wire brushed, treated for rust, painted outside (grey with blue trim)

Windows - 4 x NG1 small steel windows (533mm x 350mm) with steel burglar guards

Door - 1 x External steel door with Chromadek cladding (790mm x 1980mm)

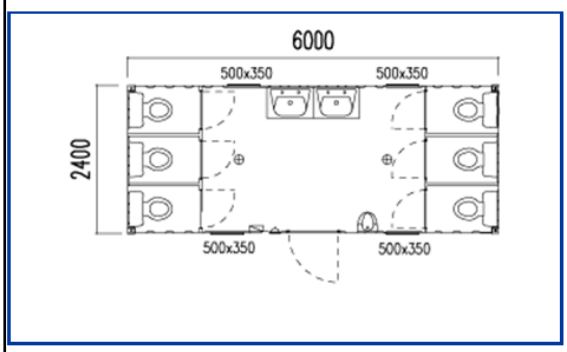
Electrics - Distribution board, earth leakage, 2 x Waterproof lights

Hand Basin - 1 x Double fibreglass hand basin with taps

Ablution - 3 x Ceramic toilets with plastic cistern and seat enclosed in wooden cubicles, 3 x Shutter ply-fibreglass treated shower bases in wooden cubicles, 1 x 150L geyser, 1 x fibreglass urinal

Flooring - Painted floor

Ablution Container - 6 Toilet Units



6m x 2.4m CONTAINER

UNIT SPECS

Container - Steel, pre-owned with poly rubber sealant on roof to prevent leaks

Painting - Wire brushed, treated for rust, painted outside (grey with blue trim)

Windows - 4 x NG1 small steel windows (533mm x 350mm) with steel burglar guards

Door - 1 x External steel door with Chromadek cladding (790mm x 1980mm)

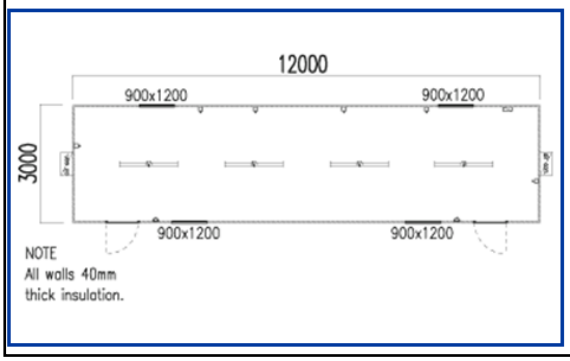
Electrics - Distribution board, earth leakage, 2 x Waterproof lights

Hand Basin - 1 x Double fibreglass hand basin with taps

Ablution - 6 x Ceramic toilets with plastic cistern and seat enclosed in treated wooden cubicles, 1 x fibreglass urinals

Flooring - Painted floor

12m x 3m - Park Home - with Aircon



12m x 3m PARK HOME

UNIT SPECS

Insulation - 40mm polystyrene insulation with Chromadek cladding internally and externally

Ceiling - 40mm white Chromadek insulated panels

Windows - 4 x large aluminium windows (900mm x 1200mm) with burglar guards and vertical blinds

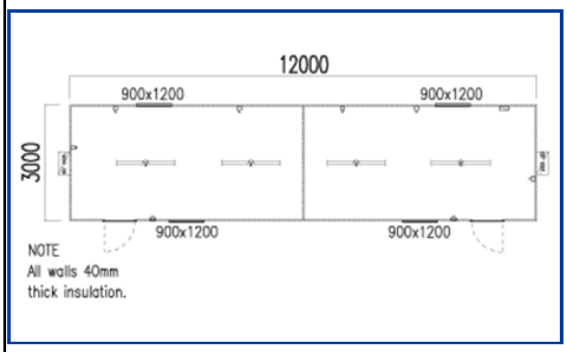
Doors - 2 x external Chromadek doors (840mm x 2040mm)

Electrics - Distribution board, earth leakage, 4 x 15 amp plug points, 4 x single fluorescent lights

Flooring - Marley industrial flooring

Aircon - 2 x 12000btu cooling only air conditioners with dedicated plug points

12m x 3m - Park Home - Divided into 2 with Aircon



12m x 3m PARK HOME

UNIT SPECS

Insulation - 40mm polystyrene insulation with Chromadek cladding internally and externally

Ceiling - 40mm white Chromadek insulated panels

Divisions - 1 x Chromadek division

Windows - 4 x large aluminium windows (900mm x 1200mm) with burglar guards and vertical blinds

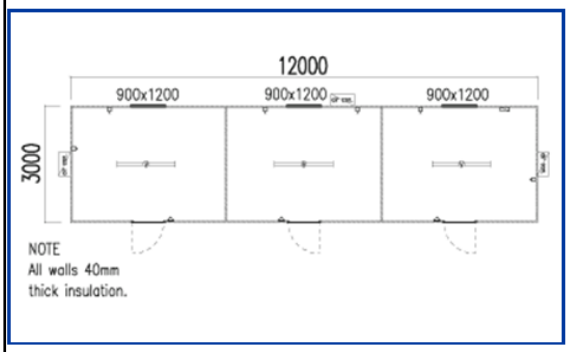
Doors - 2 x external Chromadek doors (840mm x 2040mm)

Electrics - Distribution board, earth leakage, 4 x 15 amp plug points,4 x single fluorescent lights

Flooring - Marley industrial flooring

Aircon - 2 x 12000btu cooling only air conditioners with dedicated plug points

12m x 3m - Park Home - Divided into 3 with Aircon



12m x 3m PARK HOME

UNIT SPECS

Insulation - 40mm polystyrene insulation with Chromadek cladding internally and externally

Ceiling - 40mm white Chromadek insulated panels

Divisions - 2 x Chromadek division

Windows - 3 x large aluminium windows (900mm x 1200mm) with burglar guards and vertical blinds

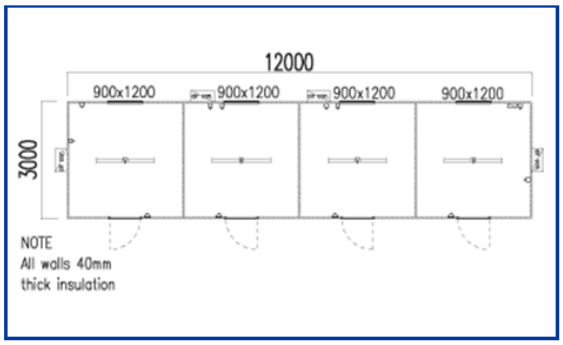
Doors - 3 x external Chromadek doors (840mm x 2040mm)

Electrics - Distribution board, earth leakage, 3 x 15 amp plug points, 3 x single fluorescent lights

Flooring - Marley industrial flooring

Aircon - 3 x 12000btu cooling only air conditioners with dedicated plug points

12m x 3m - Park Home - Divided into 4 with Aircon



12m x 3m PARK HOME

UNIT SPECS

Insulation - 40mm polystyrene insulation with Chromadek cladding internally and externally

Ceiling - 40mm white Chromadek insulated panels

Divisions - 3 x Chromadek division

Windows - 4 x large aluminium windows (900mm x 1200mm) with burglar guards and vertical blinds

Doors - 4 x external Chromadek doors (840mm x 2040mm)

Electrics - Distribution board, earth leakage, 4 x 15 amp plug points, 4 x single fluorescent lights

Flooring - Marley industrial flooring

Aircon - 4 x 12000btu cooling only air conditioners with dedicated plug points

Sporting facilities are to be constructed during the early stages of the project. It is suggested that the landscaping be done at early stages as this wil also be used to fulfil the purpose as a flood retention pond.

The positioning of the communal ablution blocks are to be in close proximity of the sporting facilities as this will be converted to be used by people using the sporting facilities once the full sanitation services have been installed and connected to households.

11.4 Full Service: Business

Containers will be converted into business facilities. The site is to be laid out such that this conversion can be done easily. It will also make sense to combine this site with the communal ablution facilities that will at this stage be converted to be used by business owners and their clients.

11.5 Full Service: Social

It is intended that the multi-purpose hall be constructed in close proximity of the communal ablution facility. This facility will then be converted to fulfil the function of ablution facilities used by people using the social facilities.

See hereunder the anticipated multi-purpose hall after completion. It makes provision for a crèche, functions, church facility and a facility for the Community Police Forum.

11.6 Cost Estimate: Interim Service

Outstanding

11.7 Cost Estimate: Full Service

Outstanding.

12. CONTRACTUAL/FUNDING ARRANGEMENTS

12.1 Introduction

Outstanding.

12.2 Funding for Infrastructure

See CMIP funding requirements.

12.3 Funding for Housing

See "Housing and Land Funding Programme Review Report in Support of LANDfirst Approach, Veda and Associates, March 2009.

12.4 Contractual for Infrastructure

All civil and electrical infrastructure will be designed and constructed according to industry norms with the exception of some specific recommendation highlighted in this report and other similar reports that focus on the incremental housing and LANDfirst options. A phased development approach will in most cases be followed that will allow for the gradual raise in the level of service provided by the municipality.

12.5 Contractual for Housing

Outstanding.

12.6 Challenges

Outstanding.

12.7 Solutions

Outstanding.

13. REFERENCES

1. Guidelines for Human Settlement Planning and Design – Volume 2, Compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology.

2. WHO Design Principles: Various Sanitation Options.

3. Water Services Act No.108 of 1997.

4. Revision (Dated 26 March 2004) of General Authorisations in terms of Section 39 of the National Water Act, 1998.

5. National Water Act No. 36 of 1998.

6. WRC Report: 1539/1/06.

7. WRC Report: 1524/1/07.

8. WRC Report: Package Plant.

ANNEXURE A: LAYOUT DRAWING