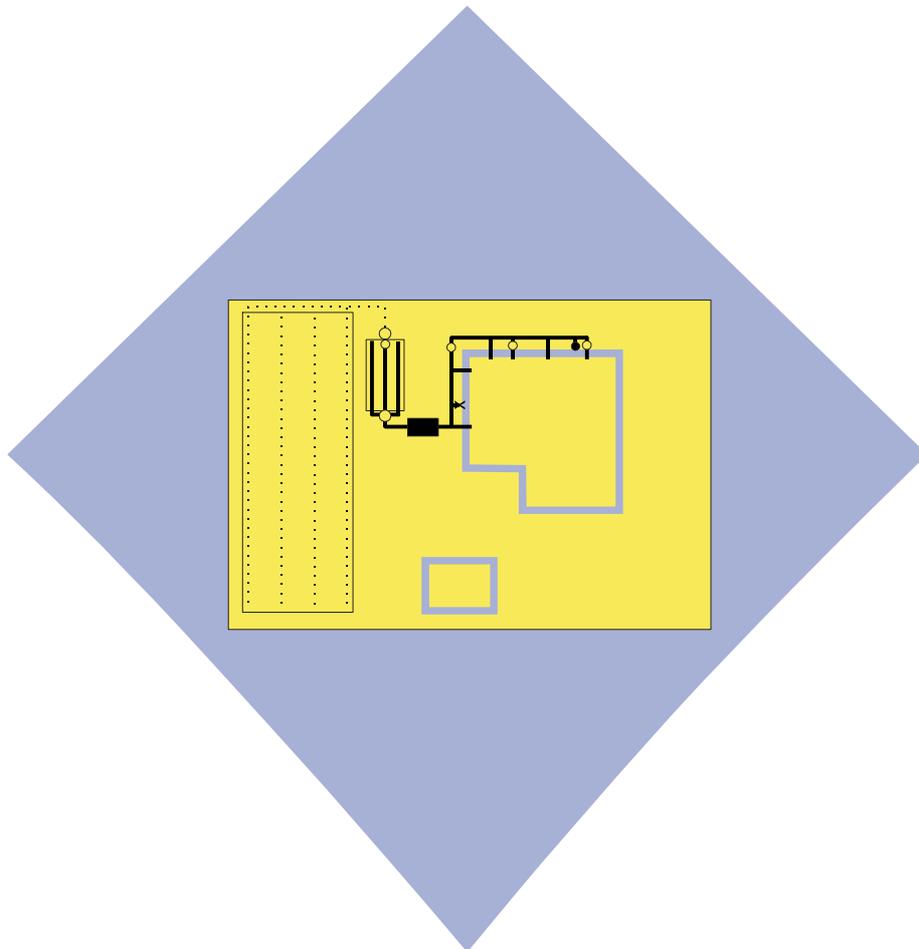


Waste Control Systems

STANDARD FOR THE
CONSTRUCTION, INSTALLATION AND OPERATION
OF SEPTIC TANK SYSTEMS IN SOUTH AUSTRALIA

SUPPLEMENT A

Aerobic Sand Filters



Waste Control Systems

STANDARD FOR THE
CONSTRUCTION, INSTALLATION AND OPERATION
OF SEPTIC TANK SYSTEMS IN SOUTH AUSTRALIA

SUPPLEMENT A
Aerobic Sand Filters

*This Standard is to be read in conjunction with
the South Australian Health Commission Code,
"Waste Control Systems - Standard for the Construction, Installation
and Operation of Septic Tank Systems in South Australia"*



March, 1998.

Supplement A - Aerobic Sand Filters

Price: \$4.50.

Issued by the Environmental Health Branch
of the Public and Environmental Health Service,
South Australian Health Commission.
Level 2, Commercial Union Building,
150 Grenfell St, Adelaide SA.
PO Box 6 Rundle Mall SA 5000.

First published November 1989.
Revised December 1990, August 1993,
March 1995.
Reprinted March 1998 (Corrigendum added).
Reprinted February 2000.
This issue supercedes all previous issues.

Not to be reprinted in whole or in
part without the written consent of the
South Australian Health Commission.

National Library of Australia Cataloguing-
in-Publication Data:

Waste control systems: standard for the
construction, installation and operation
of septic tank systems in South
Australia.

{Rev. ed.}.
ISBN 0 7308 4810 8.
ISBN 0 7308 4811 6 (suppl. A).
ISBN 0 7308 4812 4 (suppl. B).
ISBN 0 7308 4809 4 (set).

1. Septic tanks - Standards - South
Australia. I. South Australian
Health Commission. Environmental
Health Branch.

628.742

FOREWORD

In July 1993 the Public and Environmental Health Act was amended to prescribe standards to be observed in installing and operating *Waste Control Systems*. The powers of the Act cover the setting of fees and regulation of construction, installation, operation, alteration and maintenance of such systems.

The Waste Control Regulations under the Public and Environmental Health Act have been framed to enable administration by Local Government of waste control systems covered by a prescribed code, with the SA Health Commission retaining the standard setting role, administration in districts outside of local government areas, and the approval of products and non standard systems.

Waste Control Regulation 4 prescribes codes to be read in conjunction with the regulations.

This Supplement details the technical aspects to be considered in the planning stages of a waste control system (aerobic sand filter) and sets out the requirements relating to applying for approval, and for the installation and operation of systems.

The information has been prepared to assist the relevant administering authorities in their respective roles as well as providing advice for consultants, for plumbers and drainers, for builders, and for owners and/or occupants of premises on the design, installation and operation of aerobic sand filters.

The Supplement advises of the need to take into account the requirements of other agencies to ensure the installation and operation of the waste control system does not create an adverse environmental impact.

The information in this Supplement and the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia* requires interpretation. It seeks overall to achieve an acceptable end result, that is, the design of a septic tank system to serve the specific requirements of the premises without creating nuisance or risk to health.

This Supplement needs to be read in conjunction with the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*, other prescribed codes and the Waste Control Regulations.

In accordance with Waste Control Regulation 4 this Supplement is a prescribed code. Non compliance with its provisions is deemed to be an offence under Regulations 23 and 26 and the relevant authority may institute legal proceedings.

CONTENTS

FOREWORD	iii
GLOSSARY OF TERMS	vii
1 PRIMARY TREATMENT	1
2 SIZING OF SAND FILTER	1
Non standard fixtures.....	2
Spa baths.....	2
Food waste disposal units.....	2
3 FILTER SAND SPECIFICATION	4
Filter sand certification.....	4
4 SYSTEM CERTIFICATION	4
5 CONSTRUCTION REQUIREMENTS	5
Distribution pipes.....	5
Collection pipes.....	5
Plastic liner.....	6
Distribution/inspection sump.....	6
Collection/pump sump.....	6
The aggregate.....	7
Other general requirements.....	7
6 SAND FILTER PERFORMANCE & DISCHARGE CRITERIA	8
Disinfection.....	8
7 ALARM SYSTEMS	8
8 SURFACE IRRIGATION DISPOSAL AREA	8
Sizing of disposal area.....	9
Landscaping.....	10
Irrigation system.....	11
9 ALLOTMENT REQUIREMENTS	11
Recreational, social & domestic use areas.....	11
Setback distances for the sand filter.....	12
Setback distances for the surface irrigation disposal area.....	12

CONTENTS (cont.)

10	OPERATING REQUIREMENTS	14
11	APPLICATIONS & APPROVALS	15
	Public & Environmental Health (Waste Control) Regulations	15
	Application to install a septic tank and sand filter	15
	Information to be provided with the application.....	16
	Enquiries.....	18
APPENDIX I		
	Suitable plants for the surface irrigation disposal area	25
APPENDIX II		
	Aerobic sand filter BOD loadings	28

TABLE OF FIGURES

1	Sand filter construction layout	19
2	Collection/distribution pipe details	20
3	Collection pump/sump	21
4	Distribution/inspection sump	22
5	Typical site layout plan	23
6	Building layout plan	24

GLOSSARY OF TERMS

Aerobic bacteria:	Bacteria that grow in the presence of oxygen.
Aerobic sand filter:	A system that treats effluent by filtration and subsequent oxidation by aerobic and nitrifying organisms.
Approve/approved/ approval:	Includes a written endorsement, authorisation or consent issued by the relevant authority and it may be subject to conditions and/or as otherwise indicated in the Public and Environmental Health (Waste Control) Regulations.
AS:	Australian Standard (latest version)
BOD:	The <i>biochemical oxygen demand</i> of sewage and other polluted waters is a measure of the organic content in terms of oxygen required for bacterial oxidation. The standard test measures oxygen used in 5 days at 20°C (BOD ₅).
Building:	A building as classified under the Development Act provisions; or building work requiring Development Act approval; or as defined by the Public and Environmental Health Act.
Chlorination:	The addition of chlorine releasing compounds to the treated effluent for the purpose of disinfection.
Daily flow:	The volume of sewage and liquid wastes flowing into a septic tank during a 24 hour period.
Desludging:	Removal of the accumulated sludge and scum from the septic tank compartments.
Disinfection:	A process which destroys, inactivates or removes pathogenic micro-organisms.
DN 100:	Is the nominal pipe diameter in millimetres.
Domestic residential premises:	Includes single domestic dwellings, flats, units, townhouses, retirement villages (no communal food service areas) and like premises.
Effluent:	The treated liquid leaving the septic tank.
Effluent disposal system:	A constructed system utilising various methods and materials to effectively dispose of septic tank effluent.

GLOSSARY OF TERMS (cont.)

Faecal coliforms:	Thermotolerant coliform organisms mainly indicating faecal pollution. <i>Escherichia coli</i> is generally the dominant species.
Free residual chlorine:	Chlorine that is not combined with ammonia and is available to destroy organic matter and ensure disinfection. (Also known as <i>free available chlorine</i> .)
Friable soil:	Soil that is easily crumbled and consists predominantly of sand and loam.
Hydraulic loading:	Flow required to be handled by the treatment process.
Multiple occupancy residential premises:	More than one residential dwelling unit or flat constructed on one or more allotments and discharging into a common or multiple septic tank system/s and generally under one or more Titles.
Non domestic/residential premises:	Includes nursing homes, rest homes, retirement villages with communal food service areas, hotels, motels, lodging houses, camps, hospitals, institutional facilities and like premises.
Nutrients:	The foods for microbial and plant life; mainly compounds of nitrogen and phosphorus.
Pooling:	Water from any source that collects to form a pool or puddle which persists longer than the period between irrigation pump cycles.
Primary treatment:	Is the treatment of sewage that occurs in the septic tank compartment/s of a waste control system.
Relevant authority:	<ul style="list-style-type: none"> • is the local council where the installation of a septic tank system is in an area subject to local government control, • is the SA Health Commission where the installation of a septic tank system is in an area not subject to local government control; or the installation is for the local council; or the proposed system is of a kind not covered by a SA Health Commission Code/Standard • is the SA Health Commission where approval is required for the manufacture, supply or installation of a waste control system, appliance, equipment, product or process within South Australia.
Reclaimed water:	Water that has been derived from wastewater and treated to a standard which is satisfactory for its intended use.
Reticulated water:	Any water supply obtained from a reticulated system and includes any bore, river or dam water supply.

SAHC:	South Australian Health Commission
Sanitary fixtures:	The plumbing fixtures connected to the system including a bath, basin, clothes and dishwashing machines, food waste disposal unit, kitchen sink, laundry trough, spa bath, toilet and other sanitary fixtures as permitted by AS 3500-2.
Secondary treatment:	The process of filtration, natural aeration, biological reduction and disinfection.
Septic tank:	A tank receiving the discharge of sewage and sullage wastes from sanitary fixtures including a water closet, bath, basin, shower, laundry trough, washing machine, kitchen sink and similar plumbing fixtures.
Septic tank system:	Includes the sanitary plumbing fixtures, traps, waste pipes, vents, inspection openings, drains, septic tank and or other treatment units and method of effluent disposal.
Surface irrigation disposal area:	A dedicated area of land suitably landscaped for the disposal of reclaimed water by means of surface irrigation onto a suitable medium and plants capable of effecting a high rate of evapo-transpiration.
Subsurface soakage:	A trench, bed, well or pipe system from which effluent percolates into the soil.
Suspended solids:	Solid particles held in suspension including settleable and non-settleable matter.
Treated effluent:	Effluent which has undergone (wholly or partly) secondary treatment including aeration and or clarification but has not been subject to disinfection.
Waste control system:	As defined by the Public and Environmental Health Act and includes any system providing for the collection, treatment or disposal of human, commercial or industrial wastes in solid or liquid form incorporating biological, chemical or artificial means and fixtures, fittings, appliances, plant, processes associated with such a system.
Wastewater:	Water which is collected and transported through waste pipes and sewers. Wastewater normally includes water from domestic, commercial and industrial sources.

1. PRIMARY TREATMENT

All inflow effluent to the sand filter must be pre-treated through a septic tank of an approved capacity. The minimum size septic tank for a residential dwelling for up to 6 persons with standard plumbing fixtures is 3 000 litres (refer to Chapter 5 of the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*).

Septic tanks discharging to the sand filter must be desludged in accordance with the approval conditions and/or the sand filter manufacturer's operating instructions. This is normally every four years for a dwelling serving up to 6 persons. Some sand filter manufacturers recommend the septic tank be desludged more frequently. An existing septic tank connected to a sand filter must be desludged prior to commissioning of the system.

2. SIZING OF THE SAND FILTER

The sand filter provides secondary treatment by filtration, natural aeration and biological oxidation through aerobic and nitrifying organisms.

To ensure the reduction process remains balanced, the sand filter is sized according to the hydraulic and organic load, and must not exceed 50 litres hydraulic and 25 gram BOD₅ per square metre of top surface area of the filter bed over 24 hours.

The actual surface area is based on the larger amount when calculating the hydraulic and organic loading requirements.

The sizing criteria for a sand filter receiving the discharge from an all waste septic tank are:

- 150 litres hydraulic load per person per day,*
- 50 grams BOD₅ organic load per person per day,*
- 25 grams BOD₅ organic load per 1m² top surface area,
- 50 litres hydraulic load per 1m² top surface area.

* These figures may vary for other use conditions.

EXAMPLE

The size of a sand filter receiving the discharge from an all waste septic tank sized for up to 6 persons is calculated as follows:

Hydraulic load

$$\begin{aligned} 6 \text{ persons} \times 150 \text{ litres per person} &= 900 \text{ litres} \div 50 \text{ litres per m}^2 \\ &= 18\text{m}^2 \text{ top surface area} \end{aligned}$$

Organic load

$$\begin{aligned} 6 \text{ persons} \times 50 \text{ grams per person} &= 300 \text{ grams} \div 25 \text{ grams per m}^2 \\ &= 12\text{m}^2 \text{ top surface area} \end{aligned}$$

As the hydraulic load is the greater amount, the sand filter size is 18m² top surface area.

NON STANDARD FIXTURES

Non standard fixtures are permitted, but their use will result in modification of the sand filter size to take into account such factors as increased organic and hydraulic loadings.

Some examples are given to indicate the changes required for the following sanitary fixtures.

Spa baths

The sizing of the sand filter and the irrigation area is dependent on the capacity of the spa bath; e.g.

<i>Capacity of spa bath</i>	<i>Treatment capacity</i>	<i>Irrigation area</i>
less than 120 litres	no change	no change
121 - 370 litres	increase hydraulic loading by 250 litres	increase irrigation area by 55m ²
371 - 680 litres	increase hydraulic loading by 500 litres	increase irrigation area by 110m ²

No alteration to BOD₅ loading.

EXAMPLE

A system designed for a residential premises for up to six persons (all waste) with a spa bath of 300 litres capacity requires an aerobic sand filter system designed for a hydraulic loading of 1150 litres per day ((6x150) + 250) and provision of an irrigation area of 255m² (1150 ÷ 4.5 litres/m²).

Food waste disposal units

The installation of a food waste disposal unit requires the installation of a system having a larger primary and secondary treatment capacity and may require a larger disposal system depending on use conditions.

Details of the primary treatment capacities are contained in Section 5.7 *Non Standard Fixtures* of the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*.

The increased loadings are as follows:

- hydraulic loading increase by 10% (see note)
- organic loading increase by:
 - domestic residential premises 33%
 - non domestic/residential premises 33%
 - restaurants/dining/meals areas 50%

NOTE: *No increase required for the hydraulic flow where the food waste disposal unit is installed in domestic residential premises.*

EXAMPLE

A residential premises for up to 6 persons (all waste) including a food waste disposal unit discharging into a sand filter system would require a capacity as follows:

- 900 litres hydraulic (6 x 150),
- organic loading of 400 grams BOD₅ ((6 x 50) + 33%),
- 200m² irrigation area (900 ÷ 4.5),
- 4 000 litre primary (septic tank), (3 000 + 50% sludge scum),

- sand filter size.
 - $\frac{900}{50}$ litres hydraulic = 18m^2 $\frac{400}{25}$ grams organic = 16m^2
 - hydraulic flow has greatest requirement,
 - sand filter size = 18m^2 top surface area.

EXAMPLE

A restaurant with no liquor licence catering for a maximum of 100 meals per day and four employees requires a sand filter system designed for the hydraulic and organic load including a food waste disposal unit (FWDU) as follows:

Loading requirements

- organic
 - 10 grams BOD₅ per meal (assume 1 meal = 1 person),
 - 20 grams BOD₅ per employee
- sludge scum
 - 35 litres/person
- hydraulic
 - 15 litres/person

System requirements

- primary (septic tank)
 - 100 persons + 4 staff = 104 persons
 - sludge scum*
 - 104 x (35 + 17.5 litres) = 5 460 litres (includes 50% for sludge scum)
 - As greater than 5 000 litres for 1 year, desludging frequency is 2 yearly
 - 5 460 x 2 = 10 920 litres sludge scum capacity
 - hydraulic*
 - 104 x (15 + 1.5 litres) = 1 716 litres (includes 10% hydraulic)
 - Total primary capacity = 12 636 litres
- hydraulic (sand filter)
 - 100 persons + 4 staff = 104 persons
 - 104 x (15 + 1.5 litres) = 1 716 litres (includes 10% for FWDU)
- organic (sand filter)
 - 100 persons x (10 + 5 grams) = 1 500 grams (includes 50% for FWDU)
 - 4 staff at 20 grams = 80 grams
 - Total organic* = 1 580 grams
- sand filter size
 - hydraulic - 1 716 ÷ 50 litres = 34.3m^2
 - organic - 1 580 ÷ 25 grams = 63.2m^2
 - organic load has higher requirement
 - sand filter size = 63m^2 top surface area

Additional data on hydraulic loadings of various use conditions are contained in Chapter 11 - *Table 1* of the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*.

For further information on the organic loading requirements refer to Appendix II of this Supplement.

It may be necessary to add the various amounts to arrive at the total hydraulic and organic loadings.

Where Table 1 of the Code or Appendix II of Supplement A, referred to above, do not list the specific type of premises or activity, it may be necessary to select a *similar* use/activity and use that figure or adjust accordingly. The relevant authority reserves the right to request additional data to substantiate the nominated loadings and/or vary such loadings.

3. FILTER SAND SPECIFICATION

Only filter sand conforming with the following criteria must be used:

- the effective sand particle size must not be less than 0.25mm and not greater than 0.6mm,
- the sand must have a uniformity co-efficient of less than 4,
- the sand must contain less than 5% volume of clay and fine silts as determined by the test method in AS 1141, section 33.

Where the:

Effective Size

= maximum particle size of the smallest 10% (D10) by mass of the sample,

Uniformity Co-efficient (UC)

= the ratio of the maximum particle size of the smallest 60% (D60) by mass of the sample to the maximum particle size of the smallest 10% (D10) by mass of the sample,

$$\frac{D60}{D10} = UC$$

FILTER SAND CERTIFICATION

Certification must be provided by the supplier of the filter sand stating that the quantity supplied was adequate for the required sand filter size and that the sand supplied complied with the criteria as detailed above. The applicant must submit this certification to the relevant authority.

4. SYSTEM CERTIFICATION

The installer of the sand filter must provide to the relevant authority, upon completion of all work associated with the septic tank and sand filter treatment/irrigation system, certification that the sand filter has been installed in accordance with the conditions detailed in this Standard and any other site specific requirements imposed with regard to the sand filter/irrigation system by the relevant authority.

5. CONSTRUCTION REQUIREMENTS

THE DISTRIBUTION PIPES

The distribution pipes are required to evenly distribute the effluent over the entire sand filter bed and must comply with the following:

- the distribution pipes are to be DN90 smooth bore uPVC slotted storm water pipe (AS 1254),
- the slots in the distribution pipes are to be 6mm wide by 80mm long and be positioned along the pipe and located at 30° below the horizontal as shown in Figure 2,
- the slots within the distribution pipe are to be longitudinally positioned along the pipe axis at 200mm centres and terminate 100mm from the pipe ends,
- the total area of the slot openings is to be 4 800mm² for each metre length of pipe,
- the fittings used are to be solvent welded and must not be slotted,
- the pipes are to be laid level and are to be capped at the terminal end,
- slotted distribution pipes are positioned no closer than 500mm from the sand filter side and end walls,
- the distance between multiple runs of distribution pipes must not exceed 1 000mm centre to centre,
- they are to be installed as required by this Standard and positioned as indicated in the detailed drawings (see Figure 1) and/or as shown on the approved plan.
- the distribution pipes must be installed level along the longitudinal axis of the pipe and across the horizontal axis of the slots and be hydraulically tested during installation to ensure a uniform discharge from each and all of the discharge slots.

COLLECTION PIPES

The collection pipes are designed and installed to collect and transport the treated effluent from the sand filter bed to the collection/pump sump.

The design and installation of the collection pipes must comply with the following:

- the collection pipes are to be DN100 uPVC sewer grade pipe (AS 1415, 1 & 2),
- multiple collection pipes are required at the ratio of one collection pipe for every two distribution pipes, except where three distribution pipes are used, then one collection pipe will suffice,
- slots in the collection pipe are to be 10mm wide through 180° across the pipe and spaced at 200mm centres along the pipe and terminate 100mm from the pipe ends (see Figure 2),
- the total area of the slot openings is 9 000mm² for each metre length of pipe and be faced downwards,
- the fittings used are to be solvent welded and are not to be slotted,
- the capped ends of the collection pipes must terminate 500mm from the inlet and end trench wall,
- pipes must be laid on a grade of 0.50%, except in the case of the interconnecting pipes,
- the base of the sand filter must be graded to discharge to a collection pipe. Where multiple pipes are utilised, these are to be connected to a common outlet,
- the collection pipes are to be installed as required by this Standard and positioned as indicated on the detailed drawings (see Figure 1) and/or as shown on the approved plan.

PLASTIC LINER

The plastic liner used in the construction of the sand filter must comply with the following:

- the plastic liner for the filter bed must be 0.5mm PVC sheeting manufactured from virgin materials and be suitable for use with effluent from primary treated sewage,
- all PVC sheeting must have the brand name and sheet thickness marked thereon and be installed with the name and thickness facing upwards and inwards,
- all joints shall be lapped and be joined by high frequency welding in accordance with the manufacturer's requirements,
- the liner must be assembled prior to placement in the excavation and all corners must, where practicable, be formed by folding the sheeting rather than cutting and high frequency welding,
- all pipe/fitting penetrations through the liner must be sealed by taping on both sides in a manner recommended by the manufacturer of the liner material and be watertight,
- the liner must extend up to the finished ground surface,
- where the sand filter is to be installed on material such as rock or shale type soils, the liner must be placed over a 75mm layer of clean sand suitable for concrete or bricklaying work,
- where the liner is damaged during installation it must be patched with a layer of parent material extending at least 150mm beyond the damaged area. The repair is to be sealed as for jointing and be watertight,
- the liner is not to be folded back over the top of the sand filter.

DISTRIBUTION/INSPECTION SUMP

A distribution/inspection sump is required on the inlet to the sand filter and must be constructed of impervious materials as approved by the SA Health Commission and/or as covered in Sections 7.5 and 7.6 *Offsite Disposal and Ancillary Structures* of the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*.

The base of the sump and the invert levels of the distribution pipe outlets must be constructed so as to be level within a tolerance of 0.5mm and ensure an even flow from the weir to each distribution pipe outlet.

The distribution/inspection sump shall terminate 100mm above the finished ground level and be provided with a baffle as shown in Figure 4.

COLLECTION/PUMP SUMP

A collection/pump sump (the sump) is required for the collection, chlorination and storage of the treated effluent prior to irrigation of a dedicated area. The sump must comply with the following:

- the sump must be of a capacity to ensure adequate disinfection of the treated effluent at peak flow,
- where the collection pipe discharges into the sump positioned adjacent to the sand filter bed a DN100 inspection opening is to be provided on the collection pipe prior to its discharge from the filter bed (see Figure 1). The inspection opening must be shafted to the surface level and be finished in accordance with the requirements as detailed in AS 3500-2 National Plumbing Code - Sanitary Plumbing and Sanitary Drainage,
- the sump must be constructed of impervious materials so as to prevent the egress/ingress of treated effluent/water and be constructed of materials as approved by the SA Health Commission and/or as covered in sections 7.5 and 7.6 *Offsite Disposal and Ancillary Structures* of the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*. The top of the sump must terminate at least 100mm above the final finished ground surface level,

- the sump must be emptied by an automatic electrically operated submersible pump of sufficient capacity to discharge the reclaimed effluent from the spray heads in the irrigation area. The top level of the treated effluent must be at least 100mm below the invert of the collection pipe where it discharges into the sump with the alarm level being set 75mm below the invert level of the collection pipe (see Figure 3),
- all electrical connections shall comply with the requirements of the supply authority service rules and AS 3000 SAA Wiring Rules,
- the sump must be vented with a DN100 screened induct vent or similar alternative as approved by the SA Health Commission.

THE AGGREGATE

All aggregates are to be clean hard quartz stone or other approved stone, be of the specified size range and be free of dust, dirt, loam, soft particles, organic matter or other foreign material and be suitable for use with septic tank effluent.

The aggregates and sand must be placed within the lined sand filter bed in such manner as not to damage the liner, collection and distribution pipes, inlet and outlet structures, distribution sump and pump sump.

OTHER GENERAL REQUIREMENTS

The sand filter bed can be constructed on a 2:1 to a 10:1 length to width ratio.

The minimum depth of the approved filter sand must be *not less than* 750mm.

The inlet and outlet pipe trenches to and from the sand filter must be sealed to the trench wall and base for the full height of the trench using 100mm concrete keyed at least 75mm into the trench walls and base.

Where it is not possible to discharge by gravity to the sand filter within the limits of 25mm minimum to 825mm maximum from the top of the distribution pipes to the underside of the top layer of the 5-10mm aggregate, then it will be necessary for the effluent to be pumped to the sand filter. This permits the sand filter to be installed to a maximum depth of 1165mm from the distribution pipe invert to the finished ground level (that is, top layer of 20-25mm aggregate can vary from a minimum of 200mm to 1000mm depth).

The top 50mm layer of 5-10mm aggregate of the sand filter must be covered with a *geotextile* having a minimum mass of 100g/m² prior to placement of the sandy loam layer.

A DN100 screened induct vent is required to be provided on the outlet pipe from the septic tank to the sand filter.

Where a distribution sump has ventilation provisions, it must be screened to prevent the ingress or egress of mosquitoes as detailed in Chapter 8 of the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*.

The sand filter must be protected from migrating surface and subsurface waters and be provided with mounds or cut-off drains to deflect water to an area beyond the sand filter. Sand filters are not recommended on sites having land gradients greater than 20% (1:5) unless specifically approved.

The area over the sand filter can be planted with lawn or be covered with scoria, woodchips or pinebark, provided they do not interfere with the aerobic operation of the sand filter (only light watering should be provided for flora planted over the sand filter).

The top soil covering over the sand filter must be *sandy loam only* and be graded at 3.35% (1:30) across the top of the sand filter as shown on the drawings, see Figure 1.

The maximum depth of the sandy loam at the exterior edges of the sand filter bed must not exceed 200mm.

6. SAND FILTER PERFORMANCE & DISCHARGE CRITERIA

The sand filter is to be constructed and operated to ensure the discharge of treated effluent to the collection/pump sump complies with the following:

- BOD₅ not greater than 20mg/litre,
- Suspended solids not greater than 30mg/litre.

DISINFECTION

All treated effluent collected and stored within the collection/pump sump must be disinfected with chlorine so as to provide a microbial standard of not greater than *10 faecal coliforms per 100ml* and ensure a minimum of *0.5mg/litre free residual chlorine* in the reclaimed water at the sampling valve located at the first discharge point within the dedicated irrigation area; that is, the first spray head or dripper in the disposal area. Depending on the type of chlorine compounds used, retention times may vary from 30 minutes to 120 minutes at peak flow.

In certain circumstances, usually for commercial or non domestic residential applications, higher levels of free residual chlorine may be required as a condition of approval.

As an alternative, reclaimed water can be pumped from the sand filter to a holding/storage tank before distribution to the surface irrigation disposal area or other disposal method as approved. Sufficient chlorine must be added to the reclaimed water to ensure at least 0.5mg/litre free residual chlorine in the holding/storage tank and at discharge from the first spray head or dripper in the surface irrigation disposal area.

The relevant authority reserves the right to inspect individual systems and to conduct any tests or require the provision of test results to confirm compliance with regulatory and/or approval requirements.

7. ALARM SYSTEMS

An audible and visible alarm (indicator light) must be provided to warn of pump failure. The alarm must be positioned within the premises and be provided with muting facilities for the audible alarm. A suggested location for the alarm is either the kitchen or laundry.

For multiple occupancy residential premises, an indicator light and audible alarm, with muting facilities for the audible component, must be provided in the kitchen or laundry of each residence, with an external flashing visible alarm in a suitable location to indicate a system malfunction.

For commercial and non domestic residential premises, an indicator light and audible alarm, with muting facilities for the audible component, must be provided in a prominent location inside the building with an external flashing visible alarm provided in a suitable location to indicate a system malfunction.

8. SURFACE IRRIGATION DISPOSAL AREA

The surface irrigation disposal area must be dedicated for the sole use of receiving reclaimed water. The area must be landscaped, preferably with shrubs and trees and should be designed to discourage pedestrian and vehicle access.

SIZING OF DISPOSAL AREA

The surface irrigation disposal area is calculated using a maximum hydraulic loading of 4.5 litres per square metre over a 24 hour period. For a daily flow of 150 litres per person and a minimum of 6 persons, the area of the surface irrigation disposal system is:

$$\frac{6 \times 150}{4.5} = 200 \text{ m}^2$$

For multiple occupancy residential premises such as flats, units and townhouses, the size of the surface irrigation disposal area is calculated on the basis of the total number of bedrooms plus one and a daily flow of 300 litres per bedroom, subject to the installation of standard plumbing fixtures.

EXAMPLE

- 4 units each with 2 bedrooms = 8 bedrooms
- 8 bedrooms plus one bedroom = 9 bedrooms
- 9 bedrooms x 300 litres/bedroom = 2 700 litres
- 2 700 ÷ 4.5 litres/m² = 600m²

All additional fixtures; for example, food waste disposal units and spa baths, will require an increase in treatment and disposal capacity. Refer to examples in Section 2, *Sizing of the Sand Filter*.

In certain circumstances, the surface irrigation disposal area for specialist care hostel type accommodation may be sized at a figure less than 300 litres/bedroom where it can be demonstrated by legal documentation that the occupancy rate for each unit does not exceed one person at any time (e.g. 150 litres/person). The relevant authority reserves the right to incorporate an allowance for visitors and other use.

- NOTE:**
- (1) *Where the only source of water is rainwater or carted water the minimum area required will be based on a hydraulic flow of 125 litres/person/day. This will equate to a minimum surface irrigation area of 166 m² for a typical residential dwelling for up to 6 persons.*
 - (2) *Where the land gradient is greater than 10% (1:10) and it is practicable, the surface irrigation disposal area may need to be modified by benching or bunding etc. and/or increased in size to enable satisfactory disposal of the reclaimed water.*
 - (3) *If the land gradient is greater than 20% (1:5) the application will be individually assessed, with drip irrigation being mandatory where approved.*
 - (4) *Specific provisions of the Development Plan under the Development Act, namely, the Mt. Lofty Ranges Comprehensive No. 2 and amendments preclude the siting of an effluent disposal system on land:*
 - *having a slope greater than 20% (1:5),*
 - *having less than 1.2m depth from the surface to bedrock, seasonal or permanent water table,*
 - *situated in an area likely to be inundated by a 10 year return period flood event.*
 - (5) *Specific provisions of the Environment Protection Act and Regulations are applicable for sand filters installed in a "Water Protection Area" and having a capacity greater than 100 persons.*

- (6) *On some sites it may be necessary to require tertiary treatment of the effluent and a specific sub-surface irrigation system with microprocessor control to regulate discharge cycles and quantity of effluent. It may also incorporate backflushing devices to maintain the sub-surface irrigation system.*

LANDSCAPING

Most sites are initially unsuitable for evapo-transpiration of reclaimed water. Where this is the case and there is surface rock or water; near surface ground water or rock; or heavy soils, the site must be modified.

Landform modification prior to commissioning of the sand filter system includes soil cultivation, with at least 150mm depth of friable soil and or other suitable material such as pinebark, woodchips, scoria etc. to the specified depth over the entire surface irrigation disposal area; for example, 100mm layer of friable soil and a 50mm layer of pinebark. Hay, straw or mulch may be used, but more frequent replacement will be necessary. The area should be planted with appropriate flora to ensure loss of the reclaimed water by means of transpiration as well as normal evaporation.

Where the surface irrigation disposal area is constructed over rock, or where there is a danger of reclaimed water escaping to adjacent areas, impervious materials must be used to contain the reclaimed water totally within the dedicated area.

If the existing vegetation is not suitable or adequate for evapo-transpiration, extra trees and shrubs must be planted, and additional landscaping may be necessary.

Plants within the surface irrigation disposal area must be suitable for the transpiration of reclaimed water and be salt and nutrient tolerant.

The surface irrigation disposal area must not be located on land prone to waterlogging or subject to flood or surface water inundation.

Landscaping must be designed so that the reclaimed water does not pool within, or run-off from the surface irrigation disposal area.

As a public health precaution where spray irrigation is used, vegetables or food plants, including fruit and nut trees, must not be grown in the surface irrigation disposal area. However, if drip irrigation is used, fruit and nut trees may be allowed. In some situations it may be appropriate to dispose of the reclaimed water by subsurface irrigation.

As a precautionary measure, pedestrian traffic, except for maintenance purposes, should be excluded from the surface irrigation disposal area.

All roof waters must be diverted away from the surface irrigation disposal area. Where practicable, roof water should be diverted to the street water table or to a point beyond the surface irrigation disposal area.

It is important to ensure the spray irrigation system is installed, operated and maintained to prevent contamination of rainwater catchment areas and rainwater tanks.

Within the irrigation area at least *four* warning signs must be provided, one on each side, and clearly positioned to inform the occupants of the premises that reclaimed water is being used for irrigation.

The signs shall be on a white background with *RED* lettering of at least 20mm height and worded as follows;

WARNING - RECLAIMED WATER NOT SUITABLE FOR HUMAN CONTACT/CONSUMPTION

NOTE: *All landscaping and flora plantings **should** be completed and the surface irrigation disposal system **must** be in operation prior to occupation/use.*

IRRIGATION SYSTEM

The reclaimed water must be distributed evenly over the entire surface irrigation disposal area without spray drift, pooling and/or run-off from the area.

The spray heads must be suitable for use with reclaimed water and the spray plume must not exceed 600mm in height above the finished level of the surface irrigation disposal area.

Spray drift onto adjacent areas is not permitted and some sites may require *drip irrigation* due to adverse conditions (e.g. exposed sites subject to strong prevailing winds, no fencing provided, land slope excessive etc.)

Care must be taken in the selection of the type and placement of the spray heads to ensure the spray plume is contained totally within the surface irrigation disposal area. This may require the use of 90° and 180° sprays around the perimeter of the surface irrigation disposal area.

A dripper system can be used as an alternative to spray irrigation, provided there is no pooling or run-off of the reclaimed water within or from the surface irrigation disposal area. The number of outlets required is dependant on the type and capacity of the drippers, the sand filter, pump and landscaping. A detailed plan is to be submitted with the application showing the discharge quantity and the area to be served by each dripper, including details of trees, shrubs or plants to confirm uptake of the applied reclaimed water. Approval will be granted on an individual basis.

The irrigation system including the pump, pressure lines and distribution points must be of sufficient capacity to ensure the rate of discharge is at least 50% greater than the maximum volume delivered at any one time into the sand filter. Imposed pressures such as friction or static head must be taken into account when sizing the system.

The minimum standard for all pipework to and within the surface irrigation disposal area must be polyethylene complying with AS 2698. Pipework must also be suitable for use with reclaimed water and be buried at least 150mm underground. UPVC potable water pipes are not permitted under any circumstances for use in the irrigation system.

The surface irrigation disposal system must not be capable of connection to the reticulated water supply. For public health reasons, the use of garden hoses and fittings are not permitted under any circumstances.

For residential premises, the irrigation system must be a fixed system.

For commercial and/or industrial premises, a moveable system may be allowed, subject to individual assessment and approval. Any moveable system must be installed so as to confine the discharge of reclaimed water solely within the surface irrigation disposal area.

Timer switches are not permitted for the operation of the surface irrigation disposal system unless they are electrically operated in conjunction with the irrigation pump.

9. ALLOTMENT REQUIREMENTS

RECREATIONAL, SOCIAL & DOMESTIC USE AREAS

Sufficient space must be provided on the site for domestic, social and recreational use *in addition* to the area required for:

- building and perimeter paving,
- foot and vehicle access,
- vehicle parking, carports, garages and storage sheds,
- septic tank and sand filter,
- surface irrigation disposal area.

For single occupancy residential premises, the area provided for domestic, social and recreational use must be at least 50% of the area required for the dedicated surface irrigation disposal area. For multiple residential premises, this must be at least 25% of the area required for the dedicated irrigation disposal area and be evenly distributed amongst the residences. This includes;

- lawns,
- patios,
- outdoor entertainment,
- children's play areas,
- clothes drying,
- garden area.

NOTE: (1) *The narrow areas created by minimum setback distance of 1.5 metres or less are not to be used for the determination of the requirements of the domestic, social and recreational use areas.*

(2) *Commercial and/or industrial premises may be exempted from recreational, social and domestic use requirements subject to adequate land being available for disposal of the reclaimed water.*

SETBACK DISTANCES FOR THE SAND FILTER

The sand filter must be positioned so as to be;

- 3.0m from any building (see note below re upslope provisions), boundary, septic tank and pump sump,
- as far as practicable and in all cases at least 10 metres from any well, bore, dam and watercourse used or likely to be used for human or domestic purposes,
- where practicable, positioned downslope from any building located on the site,
- 1.5m from the surface irrigation disposal area,
- above the 1 in 10 year return period flood event and where located adjacent to the River Murray and Lakes, above the 1956 flood level.

NOTE: (1) *Where located upslope from any building, the sand filter must be located at least 3.0m from the building alignment. In addition, the footing design engineer should be consulted to determine the likely impact on the building footing and the need for any additional requirements, such as diversion trenches or greater set-back distances. Confirmation of the footing design engineer's requirements should be provided with the application.*

(2) *Specific provision of the Development Plan under the Development Act, namely, the Mt. Lofty Ranges Comprehensive No. 2 and amendments apply with regard to siting of effluent treatment systems.*

(3) *Specific provisions of the Environment Protection Act and Regulations are applicable for sand filters installed in a "Water Protection Area" and having a capacity greater than 100 persons.*

SETBACK DISTANCES FOR THE SURFACE IRRIGATION DISPOSAL AREA

To protect buildings, structures and adjoining properties, a range of minimum setback distances apply to the *surface irrigation disposal area*.

On a flat or gently sloping site gradient less than 1% (1 in 100);

- 0.5 metres from boundaries,
- 1.5 metres from buildings, including those erected on adjoining allotments.

On a sloping site, gradient greater than 1% (1 in 100);

- 0.5 metres from upslope boundary,
- 1.5 metres upslope from lower boundaries,
- 1.5 metres downslope from buildings,
- 3.0 metres upslope from a lower cut face/bench,
- 3.0 metres upslope from buildings, including those erected on adjoining allotments.

From swimming pools, including surrounding paved areas;

- 3.0 metres on flat land,
- 3.0 metres downslope,
- 6.0 metres upslope.

From any well, bore or dam used or likely to be used for human or domestic use;

- 50 metres.

From any watercourse identified on a current series 1:50 000 Department of Environment and Natural Resources topographic map and used or likely to be used for human and/or domestic use;

- 50 metres (refer to note 3).

From a water source used for agricultural, aquacultural or stock purposes;

- 50 metres.

From the pool level of the River Murray and Lakes;

- 100 metres and above the 1956 flood level.

From any septic tank and/or sand filter;

- 1.5 metres.

NOTE: (1) *Where it is intended to locate the surface irrigation disposal area upslope of a building, the footing design engineer should be consulted to determine the likely impact on the building footing and the need for any additional requirements such as diversion trenches. Confirmation of the footing design engineer's requirements should be provided with the application.*

(2) *Specific provisions of the Development Plan under the Development Act may preclude siting of effluent disposal systems in certain areas and include:*

(a) *The Mt. Lofty Ranges Comprehensive No. 2 and amendments*

- *no effluent disposal system within 50m of a watercourse identified on a current series 1:50 000 Department of Environment and Natural Resources topographic map,*

(b) *The Regional Coastal Areas Policies requires that effluent disposal systems should not be located less than 100m from the mean highwater mark along coastal foreshore areas.*

(3) *Whilst a watercourse is defined as a blue line on a 1:50 000 topographic map there are situations where a watercourse exists and is poorly defined on the 1:50 000 map or is excluded by other detail. Therefore, it is important to ensure that the 50m setback is maintained to prevent contamination of the State's water resources.*

(4) *Disposal of septic tank effluent, treated effluent or reclaimed water is not permitted within the 1956 River Murray & Lakes Flood Zone.*

(5) Where possible setbacks greater than the above are recommended.

(6) Specific provisions of the Environment Protection Act and Regulations are applicable for sand filters installed in a "Water Protection Area" and having a capacity greater than 100 persons.

10. OPERATING REQUIREMENTS

The system must be operated at all times to ensure that the following requirements are satisfied:

- the reclaimed water from the sand filter complies with the discharge criteria,
- the irrigated reclaimed water must be chlorinated to the minimum "residual free chlorine" standard as measured at a sampling valve located at the first point of discharge within the irrigation area,
- the irrigation system must be operated in such manner that it does not create environmental nuisance and/or risk to health. Such operation must prevent the occurrence of spray drift, misting, pooling and run-off from the surface irrigation disposal area. Heavy penalties apply for the illegal or unauthorised discharge of effluent, treated effluent or reclaimed water.

To ensure that the operation of the septic tank and sand filter system is efficient and trouble-free, the use and discharge of strong alkalis, oils, acids, bleaches, disinfectants, chemical detergents, pesticides and herbicides to the system should be avoided. Where bio-degradable cleansers are used, the manufacturer's recommendations should be followed.

Should the discharge to a sand filter be highly variable with excessive flows, it may be necessary to provide flow balancing devices such as a tipping bucket or similar.

To ensure that the surface irrigation disposal area operates at its maximum efficiency, the required medium, such as friable soil, pine bark, wood chips, scoria etc. and suitable plants capable of effecting a high evapo-transpiration rate, must be maintained at all times.

In the event of failure to operate the sand filter system, septic tank and irrigation system in accordance with the above conditions, or operating the system in a manner prejudicial to public health, the relevant authority may;

- require modification of the system,
- impose sampling of the effluent, treated effluent or reclaimed water with the user (owner or occupier) bearing all sampling costs,
- require replacement of the sand filter system,
- require the removal of the effluent, treated effluent or reclaimed water from the site by tanker for final disposal in an approved manner and location,
- institute legal proceedings under the Public and Environmental Health Act and/or the Public and Environmental Health (Waste Control) Regulations.

The installer/supplier of the sand filter system is required to supply the owner/occupier with an *operating and maintenance manual*. The manual is required to clearly detail how the system operates and the necessary maintenance procedures to be followed to ensure the inspection/distribution sump, sand filter, pump sump, chlorination, pump, pump high liquid level alarm, irrigation reticulation system and the dedicated irrigation area is operated to maintain the reclaimed water at the required standard and to prevent the discharge of reclaimed water beyond the designated irrigation disposal area. The manual is also required to indicate the procedures to be followed by the system user in the event of system malfunction.

NOTE: *The relevant authority may impose additional requirements with respect to the installation of the sand filter or its operation, depending on specific site conditions.*

11. APPLICATIONS & APPROVALS

NOTE: *This Supplement only provides details on the requirements for aerobic sand filters. Therefore to obtain other relevant information required with an application for approval to install an aerobic sand filter system it will also be necessary to refer to the SA Health Commission "Waste Control System - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia".*

PUBLIC & ENVIRONMENTAL HEALTH (WASTE CONTROL) REGULATIONS

The Public and Environmental Health (Waste Control) Regulations detail the legislative requirements to be satisfied with regard to the manufacture, installation and operation of Waste Control Systems.

REGULATION 6 defines the relevant authorities and their respective areas of authority.

REGULATION 7 provides that;

A person must not install or alter a waste control system except as approved by the relevant authority.

REGULATION 9 provides that;

A person must not manufacture or construct a waste control system or a component, part or product for a waste control system except as approved by the relevant authority.

REGULATION 10 provides that;

A person must not sell, or expose for sale, or have in his or her possession for the purpose of sale a waste control system unless it has been manufactured or constructed under an approval from the relevant authority.

REGULATION 11 provides that;

A person must not use a waste control system except as approved by the relevant authority.

REGULATION 12 provides that;

(1) The application:

- be on a form determined by the SA Health Commission,
- contain the required information as detailed on the form and as set out in the relevant code and be accompanied by the required plans,
- include such other data as required by the relevant authority,
- be accompanied by the required fee.

(2) Penalties apply for false or misleading information.

REGULATION 13 (3) provides that;

The applicant, owner or the occupier of the premises are obliged to ensure the waste control system complies with the approval conditions at all times.

Penalties apply for non compliance with the relevant regulations.

APPLICATION TO INSTALL A SEPTIC TANK & A SAND FILTER

Prior to installing a septic tank and a sand filter system it is necessary to submit an application to and receive an approval from the relevant authority.

The relevant authority is:

The local council for the area in which the system is to be installed, *or*

The South Australian Health Commission for areas of the State not under local government control.

Application for approval to install a septic tank and sand filter system must be made on the required application form and provide the necessary information. The application form can be obtained from the relevant authority.

INFORMATION TO BE PROVIDED WITH THE APPLICATION

Application form

The application form requires completion of the appropriate sections relating to the:

- location of the installation,
- owner/applicant,
- premises and system,
- non standard fixtures,
- septic tank,
- land capability assessment,
- sand filter details including:
 - manufacturer's name,
 - model number (where applicable)
 - sand filter top surface area (m²)
 - BOD₅ loading in grams
 - hydraulic loading in litres
- surface irrigation disposal area
- alarm system
- declaration and signatures.

To assist with the identification of the site the application details should include the following information:

- *where situated with a defined suburb or township:*
provide street number, and/or allotment number, street name, suburb or township,
- *where situated within a rural area:*
provide hundred, section, allotment number, name of road, name of township or district,
- *where the location of the installation is not within a defined township:*
provide clear directions and a location plan,
- *the site must be identified:*
provide a sign positioned at the front of the allotment, showing the owner's name and the allotment number.

NOTE: (1) *Applications not signed by the OWNER will be returned for the appropriate endorsement.*

(2) *Before proceeding with the preparation of an application to install a septic tank and sand filter system, preliminary assessment of the site is necessary. Refer to Section 7.2 "Site Assessment Criteria" of the SA Health Commission Code "Waste Control Systems - Standard for the Construction, Installation, and Operation of Septic Tank Systems in South Australia".*

(3) *Failure to satisfy the requirements in Section 7.2 "Site Assessment Criteria" of the SA Health Commission Code "Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia" may necessitate:*

- *increased disposal system requirements,*
- *consideration of alternative treatment and or disposal methods.*

The applicant is responsible to ensure that the installation of the septic tank and sand filter system is installed in accordance with the approved plan and approval conditions. For this reason the owner should when possible be the applicant. Refer to the comment on Regulation 13 (3) in this Section.

NOTE: *Work on the installation of a septic tank and sand filter system should not commence until copies of the "approved plan and approval conditions" have been received by the applicant. Installation of the system without approval may result in action by the relevant authority.*

Site layout plan

(see Figure 5)

A detailed site layout plan must be provided (in duplicate) drawn to a scale of 1 in 500 showing:

- block dimensions,
- contours indicating natural ground fall,
- proposed location of the building and all other structures including sheds, swimming pools and paving etc,
- position of the proposed septic tank, the sand filter and surface disposal irrigation area including setback distances from boundaries, buildings, the sand filter, the irrigation system, swimming pools etc,
- location of any building on the boundary alignment,
- details of any site modifications e.g. benching, cutting and filling,
- details and location of any diversion trenches to collect surface or migrating subsurface water,
- details and location of storm, surface and roof water disposal,
- details of any well, bore or dam used or likely to be used for human and or domestic use,
- details of any water source used for agricultural, aquacultural or stock purposes,
- details of any water course, identified on a current 1:50 000 Department of Environment and Natural Resources topographic map, used or likely to be used for human and or domestic purposes,
- type of proposed septic tank - e.g. precast or constructed in situ,
- capacity of the proposed septic tank and/or pump sump,
- type of sand filter to be installed,
- details, type and position of audible and visible alarm.
- details of the sand filter system including:
 - location of the distribution, inspection sump and warning signs,
 - location of the collection pump sump and chlorination treatment system
 - location of inspection shaft and cover as applicable,
 - position of irrigation lines,
 - information as to the location of irrigation discharge points,
 - method of construction of surface irrigation disposal area bed, including the materials to be used,
 - an indication of salt and nutrient tolerant flora to be provided to achieve evapo-transpiration effect (types of plants and general locations),
 - where a split irrigation system is used; details of mechanisms to ensure even discharge to each area and to prevent overloading of individual areas.

Building layout plan

(See Figure 6)

A detailed building layout plan must be provided (in duplicate), and drawn to a scale of 1:100, providing the information as outlined in Section 3.3 of the SA Health Commission Code *Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia*.

Application fee

Payment of an application fee must accompany each application. Refer to the relevant authority for details as the fee varies according to system capacity and other factors.

NOTE (1) *Failure to provide the relevant information may delay approval.*

(2) *The applicant/owner is required to provide geotechnical evidence demonstrating that the nominated disposal area satisfies the requirements contained in Chapter 7 of the SA Health Commission Code "Waste Control Systems - Standard for the Construction, Installation and Operation of Septic Tank Systems in South Australia".*

ENQUIRIES

Enquiries regarding aerobic sand filter systems can be made to:

- (1) The local council office for the area where the system is to be installed
- (2) Where situated in an area not under local government control, the South Australian Health Commission.

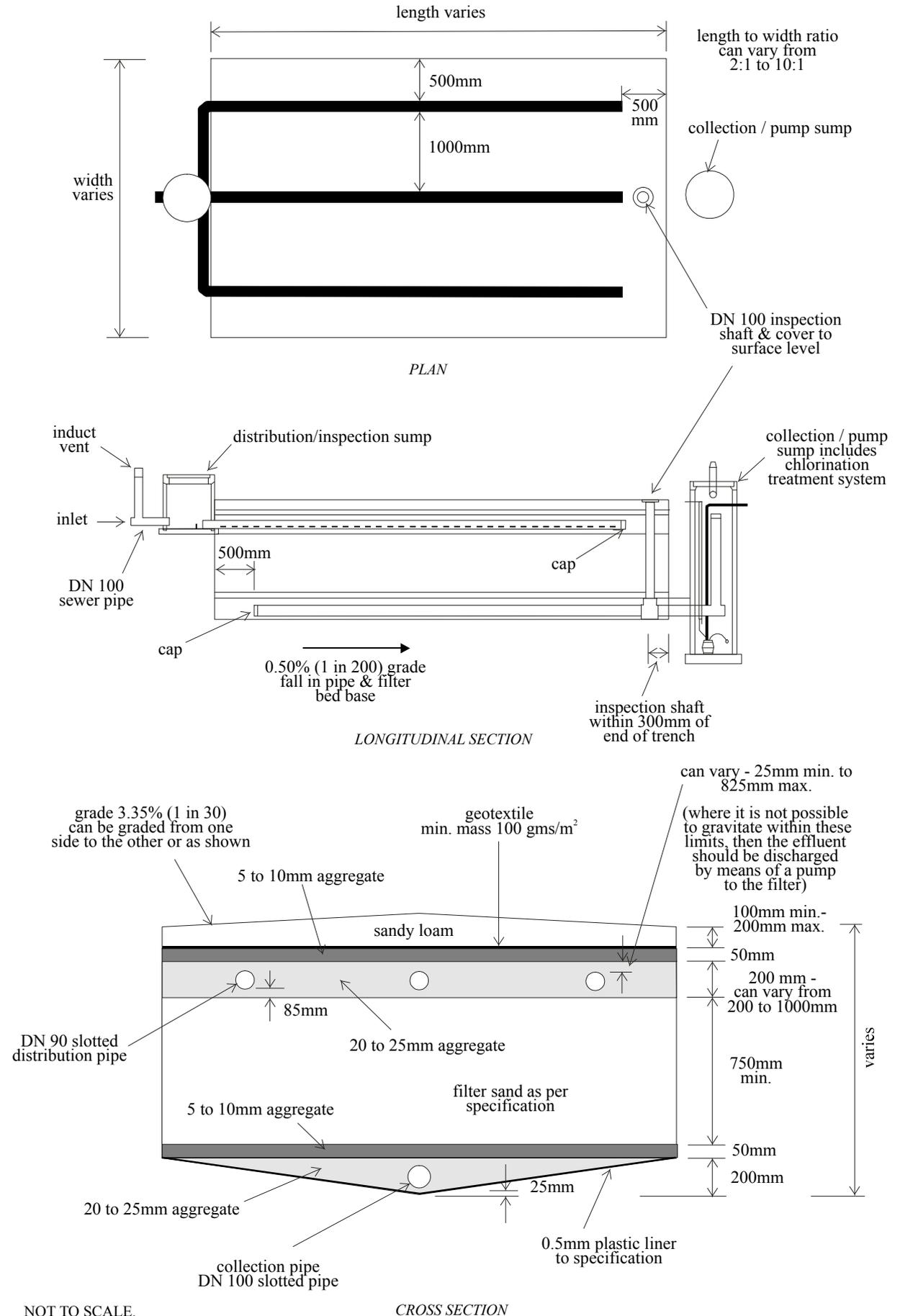
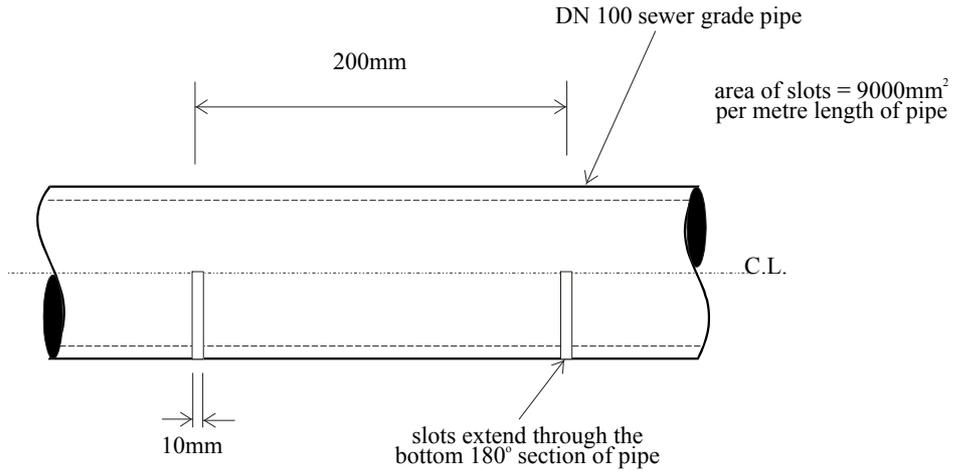
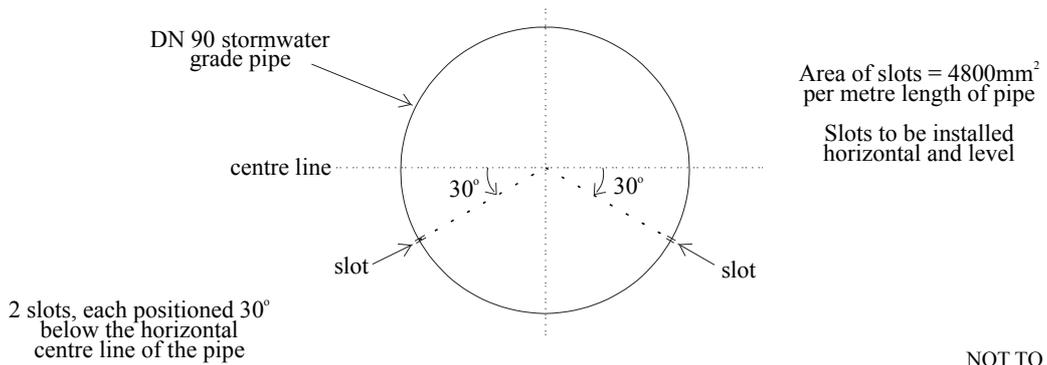
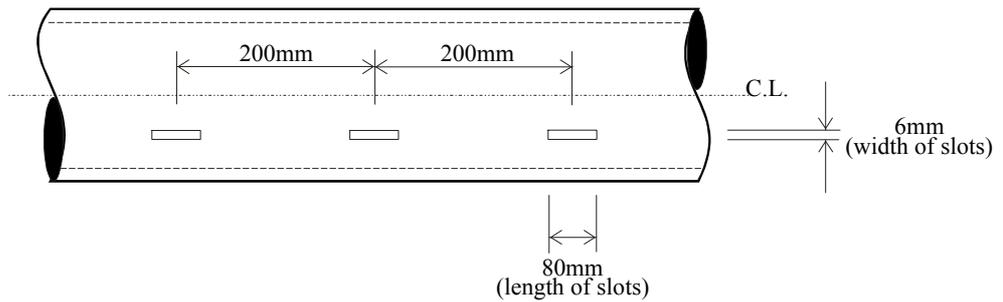


FIGURE 1: SAND FILTER CONSTRUCTION LAYOUT



DETAIL OF SLOTS ON COLLECTION PIPE



DETAIL OF SLOTS ON DISTRIBUTION PIPE

NOT TO SCALE.
Refer to Approval
Conditions & Guidelines
for specific details

FIGURE 2: COLLECTION / DISTRIBUTION PIPE DETAILS

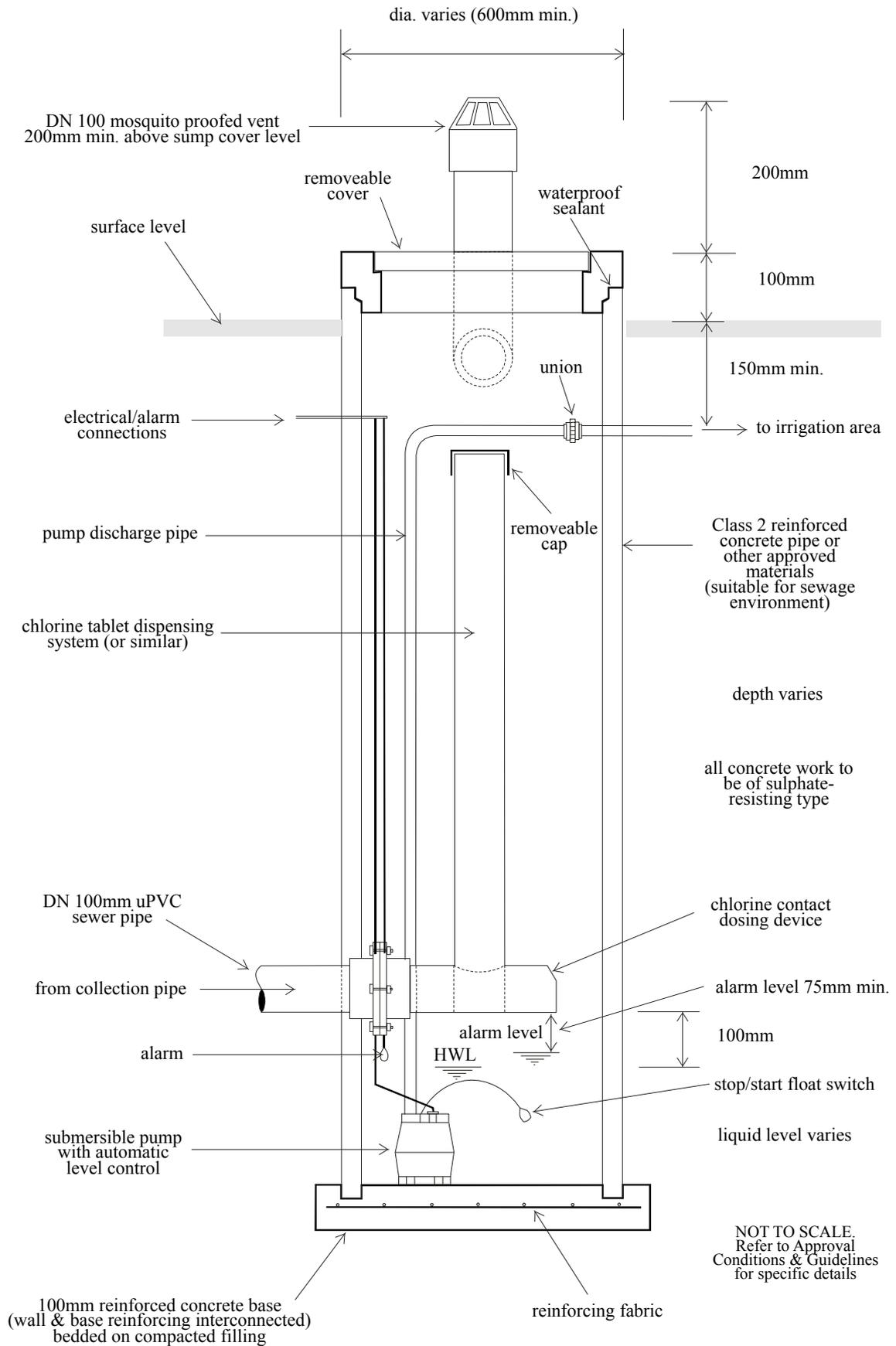


FIGURE 3: COLLECTION / PUMP SUMP

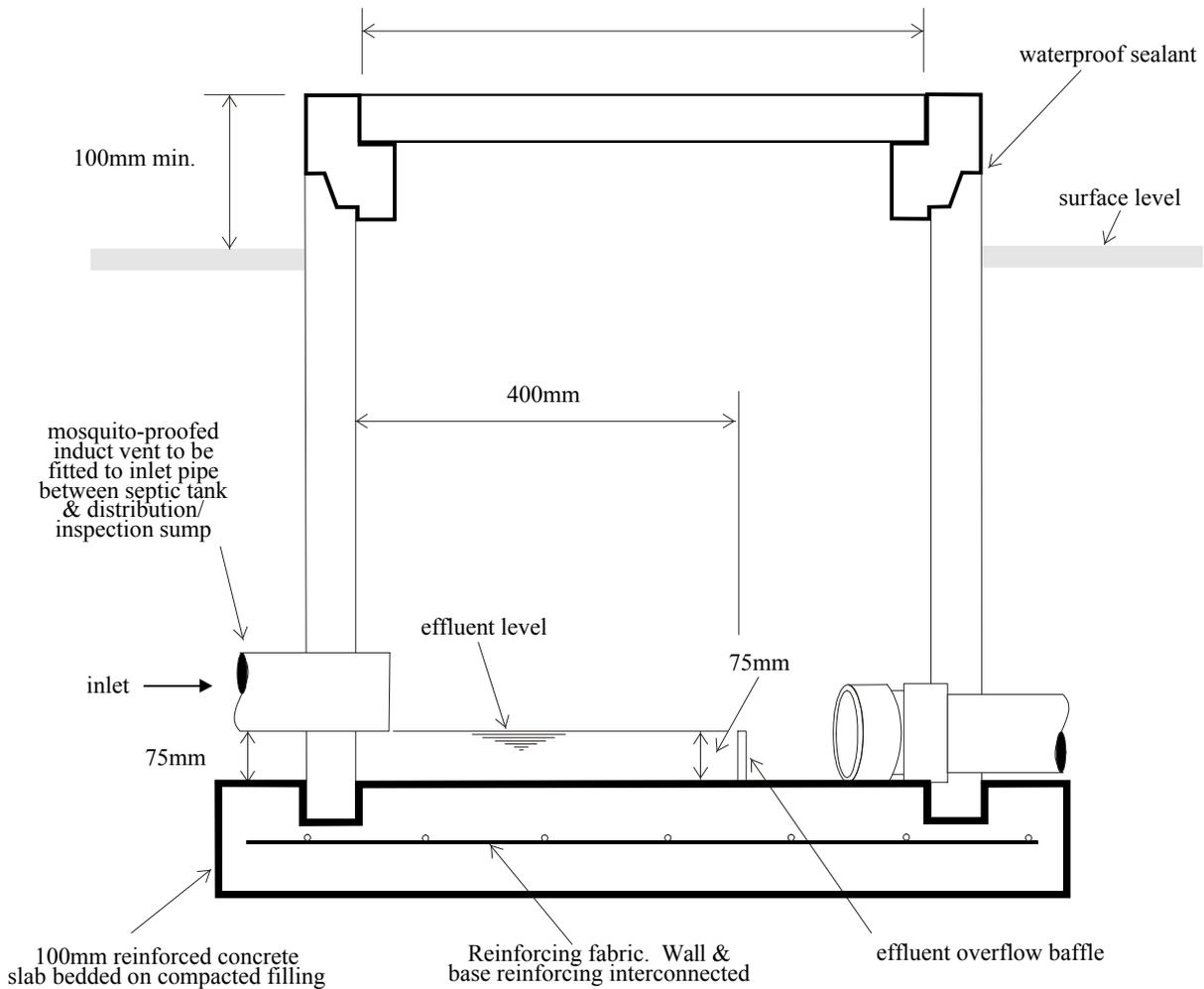
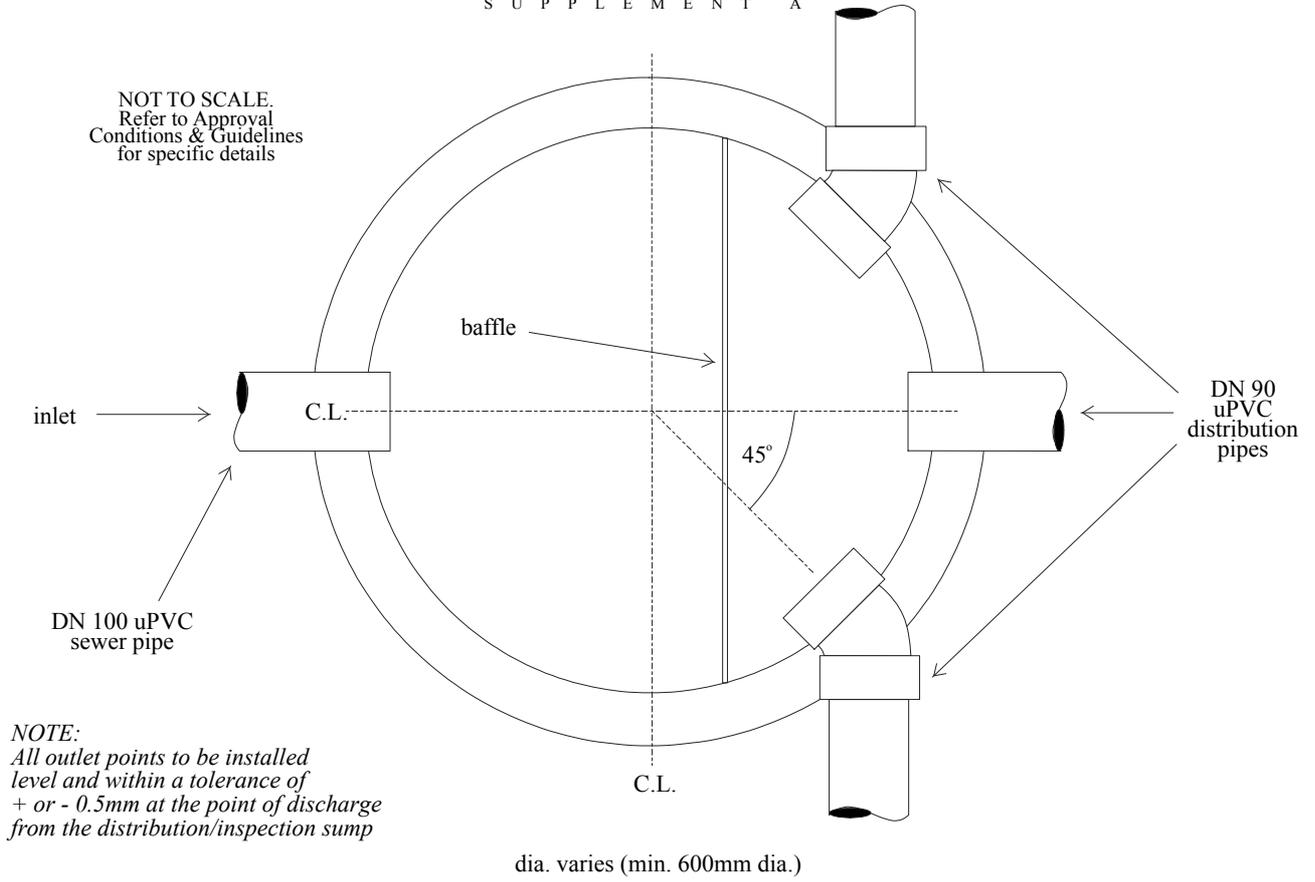
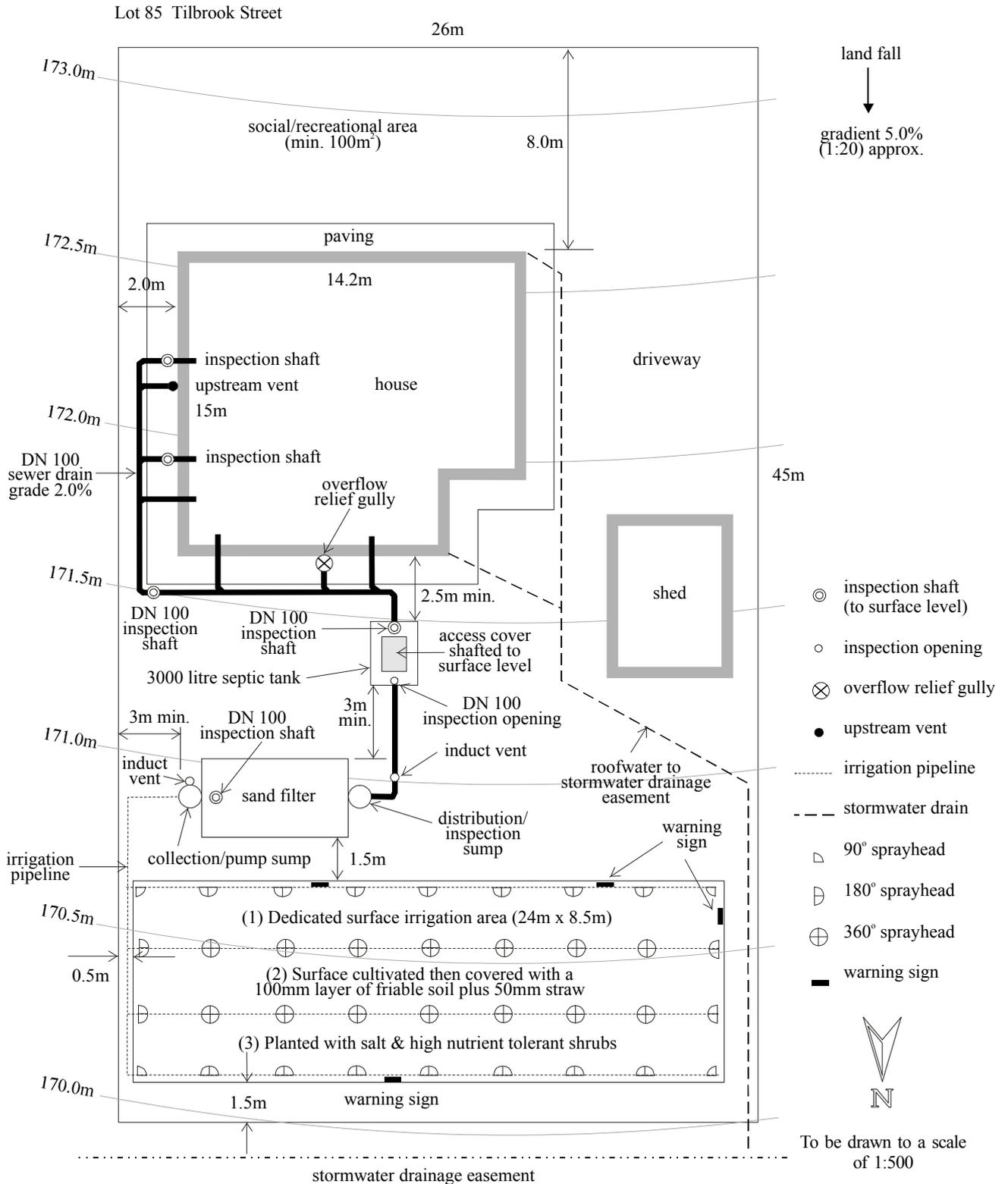
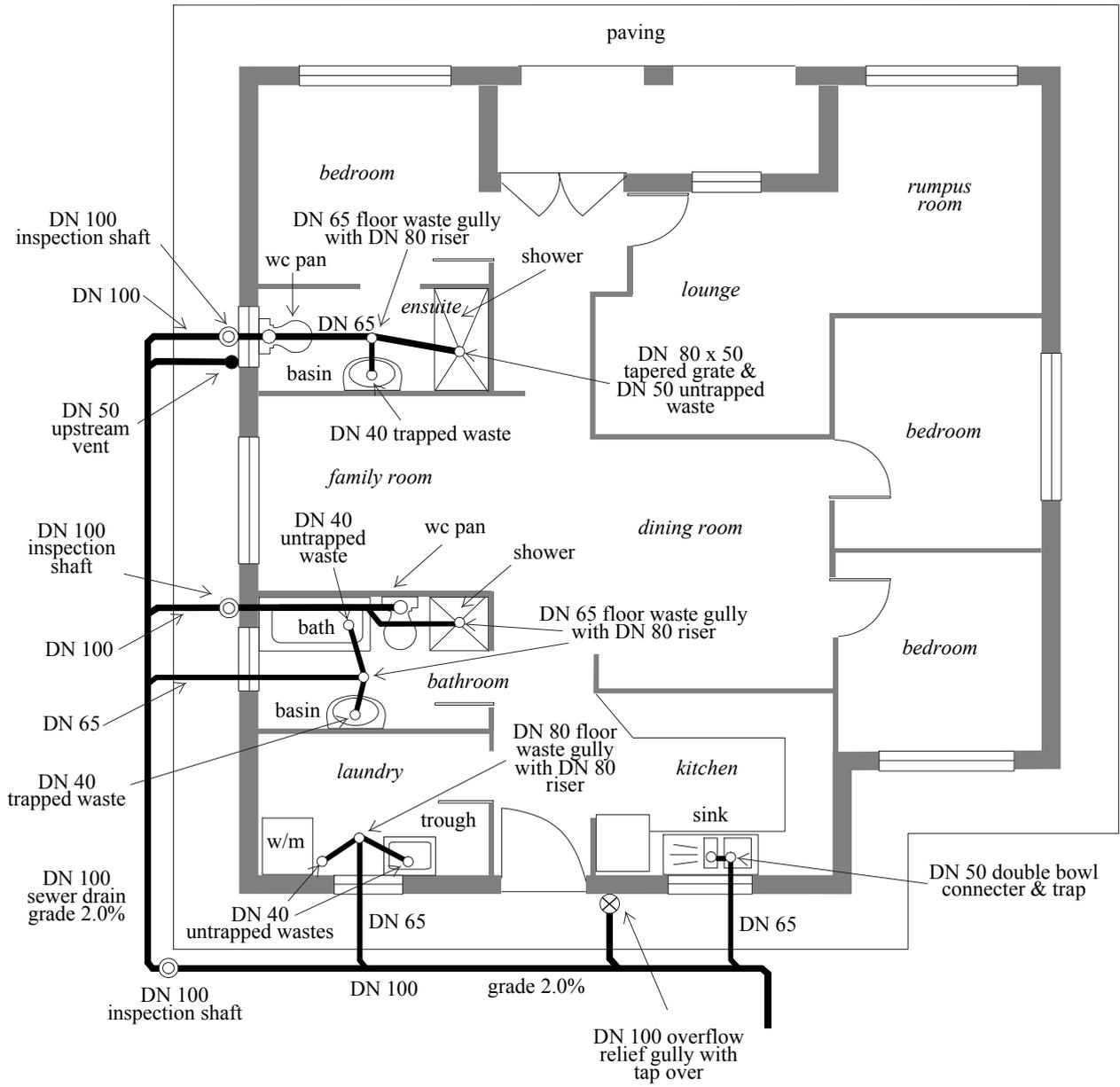


FIGURE 4: DISTRIBUTION / INSPECTION SUMP



(Schematic & reduced for printing)

FIGURE 5: TYPICAL SITE LAYOUT PLAN



To be drawn to a scale of 1:100

FIGURE 6: BUILDING LAYOUT PLAN

(Schematic & reduced for printing)

APPENDIX I

SUITABLE PLANTS FOR THE SURFACE IRRIGATION DISPOSAL AREA

NOTE: *This list is only intended to provide a selection of trees, shrubs and other plants which may be considered suitable for the surface irrigation disposal area. However, because of wide climatic and soil variations it is essential that further investigations be made with your local plant nursery before finalising your plant choice to suit your particular locality and site conditions.*

<i>Botanical name</i>	<i>Common name</i>	<i>Approximate height in metres</i>
TREES		
<i>Agonis flexuosa</i>	Willow Myrtle	5 - 6 m
<i>Acacia baileyana</i>	Cootamundra Wattle	3 - 5 m
<i>Banksia spp.</i>		3 - 10 m
<i>Casuarina glauca</i>	Swamp Oak	6 - 12 m
<i>Casuarina stricta</i>	Drooping She Oak	3 - 5 m
<i>Casuarina cunninghamiana</i>	River She Oak	6 - 10 m
<i>Callistemon viminalis</i>	Red Bottlebrush	3 - 6 m
<i>Callistemon salignus</i>	White Bottlebrush	3 - 6 m
<i>Eucalyptus robusta</i>	Swamp Mahogany	6 - 9 m
<i>Eucalyptus saligna</i>	Sydney Blue Gum	15 - 20 m
<i>Eucalyptus grandis</i>	Flooded Gum	10 - 20 m
<i>Eucalyptus camaldulensis</i>	River Red Gum	15 - 20 m
<i>Eucalyptus cosmophylla</i>	Cup Gum	5 - 6 m
<i>Hymenosporum flavum</i>	Native Frangipani	3 - 6 m
<i>Leptospermum laevigatum</i>	Coast Tea Tree	5 - 6 m
<i>Melaleuca armillaris</i>	Bracelet Honey Myrtle	3 - 4 m
<i>Melaleuca quinquenervia</i>	Broad Paperbark	5 - 7 m
<i>Melaleuca nesophila</i>	Western Tea Myrtle	2 - 4 m
<i>Pittosporum spp.</i>		2 - 4 m
<i>Syzygium paniculatum</i>	Bush Cherry	8 - 10 m
<i>Tristania laurina</i>	Kanuka	3 - 5 m

<i>Botanical name</i>	<i>Common name</i>	<i>Approximate height in metres</i>
SHRUBS		
<i>Abelia x grandiflora</i>	Abelia	2 - 3 m
<i>Acacia floribunda</i>	Gossamer Wattle	2 - 4 m
<i>Acacia longifolia</i>	Sallow Wattle	2 - 4 m
<i>Acacia iteaphylla</i>	Flinders Range Wattle	2 - 3 m
<i>Cotoneaster spp.</i>		2 - 4 m
<i>Cortaderia selloana</i>	Pampas Grass	2 - 3 m
<i>Cyperus alternifolius</i>	Umbrella Grass	0.5 - 1 m
<i>Cyperus papyrus</i>	Papyrus	1 - 2 m
<i>Cassia spp.</i>		1 - 3 m
<i>Chamelaucium uncinatum</i>	Geraldton Wax	2 - 4 m
<i>Dryandra formosa</i>		1 - 3 m
<i>Eremophila spp.</i>		1 - 2 m
<i>Grevillea spp.</i>		1 - 3 m
<i>Hebe spp.</i>	Veronica	0.5 - 1 m
<i>Iris pseudacorus</i>	Yellow Flag Iris	0.5 - 1 m
<i>Nerium oleander</i>	Oleander	2 - 3 m
<i>Melaleuca decussata</i>	Cross leaved Honey Myrtle	1 - 2 m
<i>Phormium tenax</i>	New Zealand Flax	2 - 2.5 m
PERENNIALS/GROUND COVER		
<i>Aster novi-belgii</i>	Perennial Aster	0.5 - 1 m
<i>Canna</i>		1 - 2 m
<i>Chrysanthemum frutescens</i>	Marguerite Daisy	1 m
<i>Chrysanthemum maximum</i>	Shasta Daisy	1 m
<i>Gazania ringens</i>	Black eyed Susan	0.4 m
<i>Impatiens spp.</i>		0.4 m
<i>Salvia uliginosa</i>	Bog Salvia	0.4 m
<i>Viola spp.</i>		0.4 m

<i>Botanical name</i>	<i>Common name</i>	<i>Approximate height in metres</i>
CLIMBERS		
<i>Bougainvillea spp.</i>		variable
<i>Clematis spp.</i>		variable
<i>Hardenbergia violacea</i>	Purple Coral Pea	variable
<i>Hibbertia scandens</i>	Snake Vine	variable
<i>Jasminum grandiflorum</i>		variable
<i>Jasminum polyanthum</i>		variable
<i>Jasminum officinale</i>	Common Jasmin	variable
<i>Kennedia rubicunda</i>	Dusky Coral Pea	variable
<i>Lonicera japonica</i>	Japanese Honeysuckle	variable
<i>Passiflora spp.</i>	Passion Flower	variable
<i>Vitis coignetiae</i>	Glory Vine	variable

APPENDIX II

AEROBIC SAND FILTER B.O.D. LOADINGS

The following data is provided to assist with determining BOD₅ loading of the system based on use conditions. In some cases it may require the addition of a range of uses to obtain the total BOD₅ loading.

Airports (highest daily number)

- 8 grams per passenger per day
- 20 grams per employee per day

Caravan parks, camping sites

- 160 grams per site - casual occupation
- 180 grams per site - permanent occupation
- 120 grams per site - camping site

Child day-care centres (highest daily number)

- 40 grams per person - including children and staff

Churches, public halls (highest daily number)

- 8 grams per person, *plus*
- 5 grams per person - where kitchen provided

Clubs (highest daily number)

- 15 grams per person, *plus*
- 5 grams per person - licensed area, bar trade, *plus*
- 5 grams per person - restaurant, meals area, *plus*
- 20 grams per employee

Coffee / tea shops (highest daily number)

- 10 grams per person, *plus*
- 20 grams per employee

Coin operated laundry

- 350 grams per machine, *or*
- 65 grams per load

Construction camps (highest daily number)

- 50 grams per person

Holiday camps (highest daily number)

- 50 grams per person

Hospitals

- 200 grams per bed

Hotels, motels

- 80 grams per room/unit, *plus*
- 50 grams per person - permanent resident/staff, *plus*
- 10 grams per person - bar trade, *plus*
- 10 grams per person - dining room, lounge area, *plus*
- 20 grams per person - non-resident staff, *or*
- 25 grams per person - non-resident staff - shower provided

Medical consulting rooms

- 20 grams per person - staff, *or*
- 25 grams per person - staff - shower provided, *plus*
- 40 grams per consulting room

Nursing home

- 90 grams per bed

Offices

- 20 grams per employee, *or*
- 120 grams per 100 square metres

Public swimming pool (highest daily number)

- 10 grams per person, *or*
- 15 grams per person - shower provided, *plus*
- 20 grams per employee

Public toilets (highest daily number)

- 10 grams per person, *or*
- 15 grams per person - shower provided

Residential premises including apartments, flats, townhouses

- 50 grams per person

Restaurants (highest daily number)

- 10 grams per meal - no liquor licence, *or*
- 15 grams per meal - with liquor licence, *plus*
- 20 grams per employee per shift

Rest homes, boarding and lodging houses

- 50 grams per person, *plus*
- 20 grams per non-resident employee, *or*
- 25 grams per non-resident - shower provided

Roadhouses, service stations

- 20 grams per employee per shift, *or*
- 25 grams per employee per shift - shower provided, *plus*
- 10 grams per car, *plus*
- 200 grams per bus

Schools, kindergartens

- 15 grams per person - staff and students, *or*
- 20 grams per person - staff and students -shower provided, *plus*
- 5 grams per person - canteen facilities

Seminar, conference rooms (maximum capacity)

- 20 grams per person, *or*
- 25 grams per person - meals provided - no liquor licence, *or*
- 30 grams per person - meals provided - liquor licence

Shopping centres

- 150 grams per 100 square metres, *or*
- 20 grams per employee

Sports centres (highest daily number)

- 30 grams per person, *plus*
- 20 grams per employee per shift

Staff ablutions, work place installations

- 20 grams per employee per shift, *or*
- 25 grams per employee per shift - shower provided, *plus*
- 5 grams per employee per shift - canteen facilities, *or*
- 10 grams per employee per shift - hot meals provided

Tavern

- 10 grams per person - bar trade, *plus*
- 15 grams per person - dining room, *plus*
- 20 grams per employee - non-resident staff

Theatres

- 10 grams per seat

Theatres - drive-in

- 10 grams per car space

Wineries

- 8 grams per person - wine tasting, *plus*
- 15 grams per person - meals dining, *plus*
- 20 grams per employee - non-resident staff

NOTE: *BOD₅ loading based on 50 grams per person ex the septic tank.*