GUIDELINES,

DESIGN CRITERIA AND STANDARDS FOR

SEPTIC TANK EFFLUENT DISPOSAL SCHEMES

Amended December, 1997
(Refer Shaded Areas)

1. GENERAL

The establishment of Septic Tank Effluent Disposal Schemes (STEDS) are subject to the following legislative requirements:

a. The approval of the South Australian Health Commission (SAHC) under the provisions of the Waste Control Regulations.

b. The licensing under the provisions of the Environment Protection Act as follows:

   i. Where the treatment and disposal of STEDS effluent is within a Water Protection area and the peak load of the plant is greater than 100 persons.

   ii. Where the treatment and disposal of STEDS effluent is in an area outside a Water Protection area and the peak load of the plant is greater than 1,000 persons.

c. The approval of the Development Assessment Commission where the works involve the discharge of septic tank effluent to land, where the peak loading capacity of the treatment plant is designed for more than 100 persons per day.

2. APPLICATIONS FOR APPROVAL

The detail required to be submitted for approval of a STEDS will vary according to the Authorities requirements but should include at least the following aspects.

General

- Summary statement of the STEDS system, treatment plant type, the treatment process and the method of reuse or disposal of the treated wastewater.
- Design parameters inflow effluent.
- Source of wastewater.
- Hydraulic load, i.e.: flow per person, and total design flow as kL/day.
- Organic loading rate as BOD_5.
- Suspended solid load.
- Locality plan.

- Drawings of the drainage network, detail of drainline gradient and pipe size and detail of pump stations and other associated structures.
- Design parameters for drain, pump line and pumping system sizing, including provision for emergency storage etc.
- Site plan showing the location and layout of the treatment plant, proximity of residential dwellings, any associated storage tanks, lagoons, channels, drains etc., soil sampling locations and the area of land to be used for the reuse or disposal of the treated wastewater.
- Contour plan of treatment plant and reuse or disposal area.
- Treatment for noise and odour control.
- Site screening.
- Perimeter fencing and access gates.
- Vehicular access and maneuvering.
- Summary of existing land use.
- Land title particulars.
- Land area occupied by the plant and the reuse or disposal area.
- Expected wastewater quality after treatment, BOD_5, suspended solids, nitrogen, phosphorus, alkalinity etc.
- Additional proposed treatment prior to reuse or disposal. e.g. filtration, disinfection etc. including method and rates of flow through the system.
- Sludge volume, and storage, handling and disposal techniques.
- Plant fault alarm system, including remote alarm monitoring.
- Plant or parts duplication (pumps aerators etc.)
- Provision for storage of inflow wastewater during plant or power supply failure

Disposal to Land by Irrigation

- Proposed method of irrigation. (e.g. surface spray, drip, subsurface etc.)
- Proposed use of irrigated area. (e.g. public access, food crop, stock grazing etc.)
- Plan of irrigation design and layout, sprinkler type, range, droplet size, direction of throw, height etc.
- Irrigation rate litres per second and litres/m^2/day.
- Daily application rates (mm/day).
- Times when irrigation will occur.
- Soil profile of area to be irrigated.
- Hydraulic conductivity of soil.

- Soil infiltration rate.
- Flood risk. (e.g. 1 in 25 year event)
- Rainfall and evaporation details
- Irrigation area required
- Type of crop/vegetation to be irrigated
- Storage requirements

Management Plan

- Operation maintenance of plant
- Operator training
- Emergency response
- Routine monitoring
- Monitoring of soil and crop management

3. GRAVITY DRAINS

All gravity drains shall be designed to comply with A.S.2566 and the following:

Design Flows and Minimum Velocity

For design purposes the minimum velocity shall be 450mm per second at half full pipe.

The design flow shall be based on the ultimate population (including any periodic influx) with an average daily contribution of 140 litres per person per day, with a peak flow of 0.00486 litres/second or 17.5 litres/hour/person, which allows for three times the average dry weather flow.

Pipe Sizes

A minimum of 100mm diameter pipe shall apply.

As soon as design flows indicate that a 100mm diameter pipe will flow more than 60% of full capacity at full development, then a 150mm diameter pipe should be adopted to ensure adequate ventilation. Similarly, with other pipe sizes the next size of pipe available should be used when the design flow exceeds 60% of the capacity of the smaller pipe.

Pipes of a larger size than that required to carry the design flow should not be used to take advantage of the lesser grade.

Minimum Grades

The minimum grades are as follows: 100mm diameter = 0.4%
150mm diameter = 0.25%
225mm diameter = 0.15%

These grades should **not** be used as a standard but as the extreme.

The last 30 metres of the terminal ends of all gravitational drains shall have a minimum grade of 1%.

4. MATERIALS

Materials for gravity drains and rising/pumping mains shall comply with all the relevant Australian Standards and shall be,

Gravity Drains

a. Ridgid Unplasticized Polyvinal Chloride (uPVC)

or

b. other materials approved for use in a high Sulphide environment.

uPVC pipes and fittings shall comply with A.S.1260 parts 1 to 3 inclusive.

Excepting for expansion joints, pipes and fittings shall have ends formed for solvent welded joints and shall be joined using a cleaning fluid and solvent cement suitable for use with the pipe and fittings in accordance with the manufacturers directions.

uPVC pipes and fittings shall be installed in accordance with A.S.2032-1977 and A.S.3500.2-1990.

Rising/Pumping Mains

a. Ridgid Unplasticized polyvinal Chloride (uPVC), minimum Class 9

or

b. other material approved for use in a high Sulphide environment.

uPVC pipes shall comply with A.S.1477 parts 1 and 6.

uPVC Fittings shall comply with A.S.1477 parts 2 and 6, and be at least a class higher than that of the rising/pumping main.

Pipes up to 40mm internal diameter shall have ends formed for solvent welded joints.

Pipes and fittings larger than 40mm internal diameter shall have ends formed for rubber ring joints.

Rubber rings shall comply with A.S.1646-1987 and may be of Natural Rubber or of Styrene-Butadiene. The durometer hardness shall be in the range of 41-50 measured at 10 seconds delay at $20^{o}C$ and shall comply with A.S. 1646.

Gravity Drains and Rising/Pumping Mains Above Ground

Where gravity drains and rising/pumping mains are above ground, (e.g. creek crossings) Ductile Iron Cement Lined (DICL) shall be used complying with A.S.2280 and be of a Class appropriate to the use.

Pipe and fitting joints shall be either flanged or spigot and socket using tyton joint.

All fittings shall be in accordance with A.S.2544.

All flanges shall be in accordance with A.S.2129.

Where DICL piping is installed below ground it shall be protected by a loose polyethylene sleeving as well as the bituminous coating in accordance with the manufacturers directions.

Polyethylene Pipe and Fittings for Pressure Applications

Polyethylene pipe and fittings shall be Medium Density Polyethylene (MDPE) minimum Class 9, conforming with A.S. 1159.

All joints shall be made by electrofusion welding or with flanges using stainless steel backing plates.

Stainless Steel

All stainless steel piping, fittings, brackets, fixings, bolts, nuts etc. shall be of grade 316 conforming with A.S.1204.

Concrete

All concrete and mortar used in the construction of any structure coming into contact with the septic tank effluent, shall be suitable for use in a high Sulphide environment and shall be made using **Sulphide Resistant cement and Calcareous Aggregate.**

5. EXCAVATION, BEDDING AND COVER

The excavation for the installation of gravity drains, rising/pumping mains and associated structures shall be excavated to the depths required to allow construction of the drains, rising mains and structure at the specified depth and/or gradient.

The floor of the trench/excavation shall be trimmed to remove all intrusions and loose material to produce a firm subgrade of a depth which will provide for a uniform sand or aggregate bedding beneath the drain, rising main or structure.

Where the trench subgrade is not firm specialist geotechnical advice should be sought.

Bedding

Gravity drains and rising/pumping mains shall be bedded on sharp, non plastic sand suitable to provide a sound, compact and continuous base to support the pipe at the required grade.

The sand shall be free from clay lumps, organic matter, including noxious weeds, and other foreign material and be obtained from naturally occurring deposits or from the crushing of rock.

Where water is encountered in trenches, pipes shall be bedded on 10mm course aggregate.

The bedding material shall spread and compacted over the full width of the trench.

The bedding material shall not exceed 75mm in thickness unless aggregate is used or specific arrangements are made to ensure adequate compaction of the bedding material.

Cover over Drains

Where sand is used as the bedding material for gravity drains and rising/pumping mains the initial cover over the pipe shall be sand.

The Initial covering over the pipes shall be at least 150mm above the top of the pipe before final backfill with excavated material having a maximum aggregate size of 75mm.

Where the excavated backfill material includes rock exceeding 75mm, the initial sand cover should be increased to 300mm.

Where ground water is encountered above the base of the trench and 10mm course aggregate is used as the bedding material the drain and rising main shall be covered with 150mm of 10mm aggregate.

Where aggregate is used as a bedding and cover material a layer of geotextile fabric (weight not less than 180g/m^2) shall be placed over the aggregate cover prior to back fill with the excavated material.

6. HYDRAULIC COEFFICIENTS (Gravity Drains)

For calculating flow velocities and drain pipe capacities the following roughness coefficients shall be used in Manning's formula.

a. uPVC Pipe 0.011

b. Vitrified Clay Pipe 0.013

These coefficients allow for biological growth, slime deposits, encrustation and disturbances by flow from branches.

7. MANHOLES

It is desirable that manholes be installed as follows:

a. At the intersections of two or more major drains. (i.e. drains that serve more than 40 allotments and where drain depth exceeds 2.0 metres)

b. adjacent to pumping stations.

There shall be a minimum of 35mm fall through a manhole. (That is min 3% gradient)

The minimum diameter of manholes for effluent schemes shall be 1200mm.

8. INSPECTION OPENINGS AND FLUSHING POINTS

Combined inspection/flushing point openings shall be used to facilitate location, inspection and regular flushing of the drains and be located as follows.

a. At the terminal end of gravitational drains;

b. At all changes of direction, 15^{o} or greater;

c. At the junction of two or more drains where a manhole is not required;

d. At any change in pipe diameter on a through drain.

e. Every 120 metres along the line of drain.

The combined inspection/flushing point riser shall,

i. be of the same diameter of the gravity drain,

ii. enter the drain using a standard inspection opening and

iii. be installed immediately downstream of changes in direction, drain junctions and pipe size changes.

Intermediate inspection/flushing points shall be positioned equal distance between those at drain junctions and/or changes in direction.

9. GRADIENT THROUGH CHANGES IN DIRECTION

Where a drain is at minimum grade and changes direction 45 degrees or greater, a step-up must be provided to compensate for the frictional head loss through the bend.

For a change of direction between 45 degrees and 135 degrees a step up of 0.015m is required, and if the change of direction is greater than 135 degrees a step-up of 0.030 is required.

Where the gradient exceeds 2% a step-up is not required.

Where a change of direction exceeds 90 degrees the change shall be made with two or more bends.

10. EXPANSION JOINTS

Where uPVC pipe is used, expansion joints shall be fitted at the ingress side of each pumping sump and each side of a manhole.

The expansion joint shall be wrapped in "Denso" tape to seal against entry of dirt and tree roots. Each turn of Denso tape shall overlap by half the width of the tape and shall extend 100mm beyond each side of the expansion joint.

11. PIPE JUNCTIONS AND SIZE CHANGES

Pipe Junctions

The junction of branch and connection drains into a main or through drain shall be made so that the branch drain invert at point of entry to the main drain is at, or above the centre line of the main or through drain.

Where drains junctions occur at invert levels sufficient to allow a vertical jump-up, such jump-ups shall be incorporated in a standard combined inspection/flushing point.

The higher drain shall enter the combined inspection/flushing point riser using an 87^{o} junction. The combined inspection/flushing point riser shall enter the main or lower drain using an 87^{o} bend or a standard inspection opening.

Where a jump-up occurs at a manhole it shall be made external to the manhole. The junction between the graded drain and the vertical riser shall be made using an inverted 45^{o} junction and bend, with the graded drain extended through the manhole wall and sealed with a screwed cap.

Where invert level differences at pipe junctions are less than required to construct a jump-up as above the drains shall be graded to match inverts as per the first paragraph of this Clause.

Pipe Size Changes

Pipes of different sizes will meet soffit to soffit to allow uninterrupted air passage.

Where pipe size changes occur at a manhole the reduction in pipe size shall be made external to the manhole.

12. MINIMUM COVER ON GRAVITATIONAL PIPES AND RISING MAIN

The minimum cover on all pipes shall be as specified in the relevant code for the type of pipe being used. For uPVC the minimum cover is as follows:

(a)	Not Subject to Vehicular Loading	500mm
(b)	Subject to Vehicular Loading	
	Not in Roadways	600mm
	In Sealed Roadways	750mm
	In Unsealed Roadways	750mm
	Pipes in Embankments or Subject to Construction Equipment Loading	750mm

The location of cross services or obstructions should be taken into account when determining the depths of drain lines and/or connections thereto.

13. CONNECTIONS

The minimum size of all property connections off a main drain shall be 100mm diameter.

Property connections shall be laid at a minimum grade of 1% and have sufficient depth to allow connection of any septic tank or sullage water system (or in the case of vacant

land, any future system) on the property to the STED scheme connection point by gravity flow.

The maximum gradient at the terminal end of a connection drain shall be 2%.

The minimum depth of all connections shall be 1 metre.

Lesser connection depth may be acceptable where site waste system depths are known or where site ground falls are towards the connection point. Minimum cover requirements and cross service depths should be considered.

The connection drain shall enter the main drain as provided for in Clause 9 of this standard.

14. SYSTEM VENTING

Generally venting of the scheme will be through the headvents on buildings served by the scheme. The induct vent provided initially to vent the septic tank is to be removed when the connection of the septic tank is made to STED scheme.

Pumping sumps shall be vented with an educt vent.

The vertical section of the educt vent shall be at least 150mm internal diameter prefabricated from heavy gauge steel pipe (5.4mm wall thickness) and hot dipped galvanised after manufacture.

The vent shall extend at least 9 metres in height above the top surface of the pump sump cover slab.

Consideration may need to be given to increasing the vent height to 12 metres where adjacent buildings or atmospheric conditions may limit dispersal of gases. In such case the vent diameter may need to be increased to 200mm to ensure stability.

15. PUMPING STATIONS

All pumping stations shall be equipped with two pumps each capable of full independent duty at peak design flow for the area under consideration.

The pumps shall operate by automatic control so that one pump acts as a duty pump and the second pump as a standby pump.

At no time shall both pumps operate together.

In general both positive displacement and centrifugal (submersible) pumps have been found suitable for use on effluent drainage schemes. Impeller clearances are not critical provided the installation is protected both electronically and mechanically. The hydraulic design will determine the type of installation.

The pumps shall be suitable for use with septic tank effluent without undue corrosion or wear to the casing, shaft, impeller or seals.

The final selection of the pumps shall be made in consultation with the Council or owner of the scheme.

The pumps shall be capable of delivering the peak design flows from the areas served.

Connecting pipework

Pipe work connecting the pumps with the rising/pumping main shall be Stainless Steel or Medium Density Polyethylene, or combination of these materials to the standard expressed in this document.

Strainers shall not be fitted on any suction pipes.

Pump Operation

(a) Each pump shall be called to duty by an automatic **start** regulator.

Wiring Should be arranged so that the pumps;

i. will operate automatically between the start and stop regulators,

ii. will alternate duty automatically on each consecutive start,

iii. be capable of individual automatic operation,

iv. and be capable of individual manual selection and operation.

(b) The pumps shall be shut off by an automatic **stop** regulator at a level above the suction inlet to the pumps.

The manual operation of the pumps shall not override the **Stop Float Control** nor any of the other pump control systems.

Pump Control Systems

a. **High Level Control**

Each pump station shall include a **high level** float switch to activate the **alarm** when the liquid level is 200mm above the limit pump start regulator. **The high level switch shall not shut down the pumps**.

b. **Over Current**

Each pump shall be fitted with a thermal overload relay having positive single phasing protection characteristics, set to suit the running current of the motor.

c. **No Flow Control**

Positive displacement pumps having an outlet size of 80mm or greater should be protected by a **no flow** switch activated by the non-return valve to ensure that the operating pump does not operate for a duration greater than that recommended by the pump manufacturer when there is no flow.

Alternatively, where recommended by the Manufacturer, consideration may be given to the installation of a **low level** stop regulator or other safeguard to ensure the pumps do not operate when the liquid level in the sump falls below the pump suction inlet.

d. **Moisture Probes**

All submersible pumps shall be fitted with **seal check** probes and relay to detect the ingress of water within the lower motor casing and ensure that the pump does not operate when moisture is present at a level exceeding that recommended by the pump manufacturer.

e. **High Pressure limiting Switch**

Where positive displacement pumps are used a **pressure limiting** switch shall be provided in the pump discharge main to ensure that the pumps do not operate above a pressure recommended by the manufacturer and set by the Designer.

f. **Thermistors**

Where the power rating of the pump motor is 4.0 kilowatt or greater, the motor should be fitted with a 1000ohm thermistor in addition to any thermal overload (over current) protection.

Pump Alarm System

Each pump station shall be provided with an alarm system.

The alarm system shall be activated when any of the above pump control system relays are energised.

The **Alarm system** shall automatically shut down the operating pump and activate the alarm. **(With the exception of the High Level Control Float)**

The alarm shall remain active until canceled manually by an alarm cancel function.

System reset shall be required.

The standby pump shall assume normal duty.

The alarm system shall activate,

a. an amber coloured pilot light on the front of the control panel, and

b. a red alarm warning light on the top of the control cabinet or pump shed,

until the reason for the alarm is ascertained and reset occurs.

Each fault indicator on the control panel shall be appropriately labeled.

In addition to the alarm system operating a warning light consideration should be given to the provision of a system for the remote monitoring of alarm conditions.

General

A time delay relay shall ensure that the on/off operation of either pump cannot be more frequent than 15 starts per hour.

The following shall be mounted on the front cover of the control cabinet:

a. Duty selector switch (Auto-1-2)

b. Stop/Reset push button

c. Control switch (Man-off-Auto) for each pump

d. Alarm cancel button

e. Labeled pilot lights for each alarm condition

f. hour run indicators for each pump, reading 10,000 hours with 1/10th hour increments

g. lamp test switch for external alarm warning light and all pilot lights

h. Provision shall be made for access to power and light at each pump station. All power outlets to be RDC protected.

Pumping Sump

The materials used for the construction of the pumping sump shall be suitable for use in a high risk Sulphide environment and if concrete, shall incorporate sulphide resistant cement and calcareous aggregate as indicated under "Materials" in this document and shall comply with Australian Standard 3735-1991 "Concrete Structures for Retaining Liquids", Exposure Classification "D", Table 4.2 and 4.3.

The high water level (pump start level) in the sump shall not rise above the invert level of the lowest incoming drain.

The sump must provide adequate storage capacity in the pumping range (between start and stop regulator) to ensure that the number of pump operations does not exceed the rating of the switch gear, usually 15 starts per hours, maximum.

Furthermore the sump and drainage system should provide adequate capacity for emergency storage of the incoming flows in the event of a power or major equipment failure. (50% of the daily flow is desirable in remote locations)

In areas of high flow (e.g. main pumping stations) emergency storage capacity may be reduced to the average duration of power failure for the area based upon information obtained from the power authority. In any event storage should not be less than 20% of the average daily flow.

The volume of the storage shall be calculated using the pump start level, as the lower level, and the invert of the lowest connection point on the drainage system, as the higher level.

Emergency Storage volumes less than 20% may be considered where,

a. remote alarm monitoring is incorporated into the pump control system,

b. in addition to reacting to all alarm conditions, the remote alarm monitoring system includes a **Critical** pathway that identifies total equipment or power failure or activation of the High Level alarm regulator, and

c. the owner operator establishes a contingency plan to deal with flows during emergency situations.

The contingency plan should include provision of equipment such as a tanker or trailer mounted, standby pumping facilities.

Pump sumps shall be vented as required by this document. (Refer "System Venting")

16 HYDRAULIC COEFFICIENTS (Pumping Mains)

For calculating head losses in pumping mains a hydraulic coefficient equivalent to C=125 in Hazen and Williams formulae should be used for uPVC pipes, or alternatively the head losses obtained from the manufacturers charts should be increased by 20% to allow for biological growth, slime deposits and encrustation of the pipe.

17. RISING/PUMPING MAINS

All pipes and fittings shall be unplasticized Polyvinyl Chloride (uPVC) as previously stated in this document and be designed to comply with A.S.2566.

The class of the rising main pipe shall be selected to withstand dynamic stress adequate for a 50 year life.

The minimum Class uPVC piping for use in rising/pumping mains shall be **Class 9** unless a higher class is required to withstand hydraulic pressure and avoid failure due to fatigue as above.

The pipe diameter shall be matched to handle the peak design flow for the area under consideration, calculated as in 14 above and shall have a cleansing velocity of not less than 0.3 metres per second.

Calculations for Pump Duty

The calculation of pump duty shall be based on the number of units discharging to the pump station using the following peak flow rates:-

- For each allotment (house, flat, separate dwelling, caravan site or vacant allotment) allow;

  3.5 persons per allotment x 17.5 litres/person/hour.

- For Commercial premises allow;

  Number of employees x 10 = Litres/hour.

- For Hospitals allow;

3.4 x number of beds x 17.5 = Litres/hour.

- For Schools allow;

  Total students and staff x 4.5 = Litres/hour.

- For Hotels allow;

  $\left(\frac{\text{staff + number beds+ 10}}{3.5}\right) \times 60 =$ Litres/hour.

A minimum pump duty of 1.5 litres per second should be considered where duties calculated as above are lower.

18. TREATMENT FACILITIES

18.1 Facultative (Oxidation) Lagoons

Location

The location of facultative lagoons should give consideration to;

- the size or capacity of the lagoon,
- topography of site and surrounding land,
- screening from residential areas
- meteorological conditions such as prevailing winds,
- zoning of site and adjacent areas,
- potential future development, (adjacent the site and to allow for future expansion of the facility) and
- soil types relevant to constructing the lagoon.

The minimum acceptable buffer zone between a facultative lagoon, for up to 5,000 persons, and residential development is 350 metres.

All proposed lagoon sites require individual consideration in respect to location

The Environmental Protection Authority, Department of Environment and Natural Resource should be consulted in respect siting of facultative lagoons.

An application for Development Approval is required under the provisions of the Development Act for any works involving the discharge of treated or untreated septic tank effluent to land or water.

Design Loading Criteria

Domestic:

BOD_5 : 50g/person/day (360mg/L)

Dry weather flow : 140 litres/person/day

Industrial:

Industrial premises with trade wastes shall not be connected to the drainage scheme unless specific design load parameters have been established.

System Design

A series of lagoons is needed to produce an effluent low in BOD, suspended solids and faecal bacteria.

The introduction of any industrial waste changes the basic parameters for design.

Before an industrial waste can be permitted into a STED system the following should be given consideration:

- The nature of the waste and whether or not it is suitable for admission into the drainage and pumping system.
- What pre-treatment if any is required so that the waste is reduced to a similar BOD_5, suspended solid, fat, temperature and pH values as that of domestic septic tank effluent.
- The quantity of waste and additional lagoon capacity required.

The general lagoon configuration shall be 2:1 length to width ratio divided into 5 compartments.

First Lagoon

Where the loading is domestic only, the first lagoon should have a detention of 36 days, based on dry weather flow.

Subsequent Lagoons

Four lagoons, each having a detention of 7.5 days, based on dry weather flow, are required.

General Features

The water depth should be in the range 1 to 1.5 metres, and 1.2 metres is recommended.

The lagoon shall be constructed from materials that have an extremely low or zero permeability, and in such a manner, that there should be no leakage through the lagoon floor and banks.

Where baffle fences are used to separate lagoons, (diversion fencing) they must have adequate freeboard allowance (200mm maximum).

Diversion Fencing

Lagoon diversion fencing shall be constructed using timber posts and rails of Radiata Pine pressure treated with copper chrome arsenic salts suitable for long term immersion in septic tank effluent and be seasoned before use.

All exposed cuts should be treated with a protective application of an approved chemical.

The diversion fence shall be clad in Glass Fibre Reinforced Polyester (G.P.R.) corrugated sheets of an approved stiffness complying with A.S. 2376, part 2, Type SC & CT, Class 2400, incorporating an approved Isophthalic resin such as Aropol 4033.

The G.P.R. sheeting shall be fixed to the timber rails using Monel metal screws with an epoxy coating applied over the screw head.

At the level of the top rail the sheeting shall be clamped between two timber rails joined together with stainless steel bolts.

Openings should be made in the diversion fencing to provide a flow pattern that will avoid short circuiting.

Some openings should be provided at the bottom of the fencing to avoid uneven pressures during filling and emptying.

Soil Characteristics (Floor and Embankment Construction)

Soil testing shall be conducted at the lagoon site with recommendations for:

- Excavation techniques.
- Embankment design and construction including the soils to be used in construction and those that need to be discarded and handling, placement, moisture and compaction requirements .
- Any special treatment of lagoon floors and embankments to ensure leakage will not occur.
- Any special requirements regarding erosion control of embankments.

The extent of laboratory tests required will depend on the variation of soil types on site.

The tests should include at least:

- Soil classification, particle size and plasticity, with reports on its suitability for earthworks, erodability and permeability.
- In situ density and moisture, compaction tests, with quantitative data on earthworks, including "bulking" or shrinkage from cut to fill and moisture requirements.
- Permeability.
- Soil dispersion (erodability).

- The design shall be carried out in accordance with the recommendations of the soil tests.

The minimum requirement for bank construction will be:

- internal face 3:1 batter
- external face 2:1 batter
- top of bank 3.0 metres wide
- embankment freeboard 600mm.

Perimeter Fencing

The lagoon shall be fenced with a 1.830 metre high galvanised chain mesh fence with galvanised posts, constructed so as to be man proof. The fence shall be located at least 4 metres from the external toe of the banks.

A gate shall be included in the fence having a clear opening of at least 3.6 metres.

Inlet and Outlet Structures

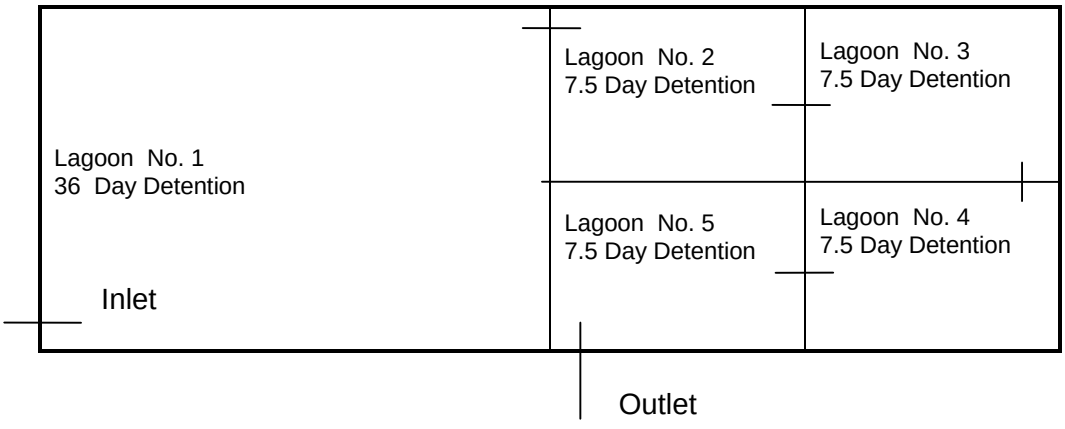
The inlet structures shall be designed so that the effluent is discharged above the operating level of the effluent in the lagoon.

The inlet pipe shall be constructed so as to prevent the discharge of effluent from the lagoon in the event of a failure in the rising/pumping main.

Where baffle fences are used, holes in the fence shall be used for the transfer of effluent from section to section, positioned to avoid short circuiting.

The outlet structure shall be located at the surface of the final compartment so as to facilitate maximum detention time, maintain a constant liquid depth and be constructed so as to avoid fouling by surface debris.

DIAGRAM OF POSSIBLE LAGOON ARRANGEMENT



18.2 Wastewater Treatment Plants

General Design Considerations

The wastewater treatment plant should produce a clear wastewater low in suspended solids and BOD_5 which can be easily treated for reuse and/or disposal.

The use and design of wastewater treatment plants in conjunction with STED schemes should give consideration to at least the following:-

- Capital cost
- Operation and maintenance costs
- Long term replacement costs
- Plant location, distance to nearest habitable dwelling or public place and access for maintenance vehicles
- Noise and odour nuisance
- The Requirements of the Planning Authority
- The Requirements of the Environment Protection Authority (EPA) and the South Australian Health Commission (SAHC)
- The population to be served by the plant
- The characteristics of the wastewater
- The potential for future extension
- The availability of experienced maintenance personnel
- Sensitivity of the plant to fluctuating flows
- Wastewater quality
- The method to be used for reuse or disposal of the reclaimed water.
- The need to further treat the wastewater prior to disposal
- Containment, removal and disposal of biosolids.

The Site

Selection of the treatment plant site should provide a suitable buffer zone from the nearest habitable dwellings and public places and should have regard for surrounding terrain and prevailing winds.

Wastewater treatment plant isolation by distance or constructed buffer should be considered in terms of economic feasibility, but be sufficient to limit impact from noise, odour and other nuisance resulting from the operation of the plant including spray drift, aerosols and any other health factors

All weather access for maintenance personnel and vehicles is essential.

Perimeter Fencing

The wastewater treatment plant shall be fenced with a 1.830 metre high galvanised chain mesh fence with galvanised posts, topped with three (3) rows of barbed wire, and constructed so as to be man proof. The fence should be located to allow vehicular access to all components of the treatment plant.

A gate shall be included in the fence having a clear opening of at least 3.6 metres.

The Treatment Plant

The plant shall be capable of continuos daily operation over twenty four (24) hours regardless of the quantity of inflow from the collection system.

The treatment plant should be capable of accepting seasonal or extreme variations in organic and hydraulic loads from tourist or other activity and should be capable of producing adequate treatment despite variations in load.

Provision should be made in the design of the treatment plant to provide storage for incoming flows in the event of treatment plant failure due to interruption of the electricity supply and/or mechanical breakdown.

The treatment plant should be designed to provide a minimum operating life of at least twenty five (25) years.

The treatment plant shall be designed for unmanned operation and be capable of both automatic and manual control.

The treatment plant and pumping systems shall be designed to provide stand-by facilities in the event of failure of the operating equipment, and automatic, remote monitoring, fault alarm systems to indicate plant shutdown and/or equipment failure.

All materials and equipment used in the design and construction of the treatment plant shall be the best of their kind, suitable for its purpose, capable of long efficient service and low operation and maintenance cost and be capable of operation in a corrosive environment, and under the local ambient conditions which may prevail (e.g. heat, dust etc.) in the area regardless of whether the location is inside or outside a building.

Where possible equipment and components should be interchangeable and compatible to provide a practical degree of standardisation between parts of the treatment plant and be capable of local repair or replacement in the event of failure.

Particular attention should be given to abrasion and corrosion resistance, in the design, and care should be taken to avoid contact between metals having a differing electro-chemical potential.

Parts of the treatment plant which will be subjected to continuous or repeated wetting, or high humidity conditions shall be designed to eliminate moisture traps and other areas where water can collect or be mechanically vented.

The design of the treatment plant should provide for sludge containment, storage, treatment, handling and disposal.

Provision shall be made for flow metering to allow continuous measurement of the total effluent flow through the plant.

The Contract for the establishment of the treatment plant should give consideration to providing for a defects liability period of sufficient duration to prove treatment plant performance, and provide for appropriate instruction on the operation of the treatment plant, for a person or persons nominated by the treatment plant Operator.

During the defects liability period sampling of the treated wastewater should be carried out to ensure compliance with the standard set out herein, and for compliance with approving authorities requirements. The timing of sampling events should give consideration to the load on the treatment plant and seasonal variations. The cost of sampling during the defects liability period should be a cost borne by the plant installer.

Provision for the supply of any special tools and spare parts required for day to day operation and maintenance of the scheme should be made and provided to the Operator as a part of the installation contract.

A potable water supply should be provided to the treatment plant for washdown during maintenance operations and for personal hygiene.

Treatment Plant Capacity

The design of the treatment plant, for areas having more than seventy (70) residential premises shall be based on the following wastewater inflow parameters:

For treatment plants receiving flows from less than seventy (70) residential premises refer to South Australian Health Commission requirements.

- Average yearly flow of septic tank effluent,
  170 litres per capita per day.
- Design Population,
  The design population shall include, the number of persons resident in the area (permanent or casual), seasonal variation and use of the system by external users (e.g. area school, hotels, motels, hospital, caravan park etc.) and shall make allowance for future growth.
- Organic Loading
  Septic Tank Effluent, 40 gm BOD_5 / cap / day
- Suspended Solids Loading
  Septic Tank Effluent, 25gm / cap / day

Outflow Effluent Quality

The standard for the outflow from the plant (treated wastewater/reclaimed water) shall be equal to or better than,

- BOD_5 = 20 mg/L,
- Suspended Solids = 20 mg/L
- Microbiological Quality

  The microbiological quality of the reclaimed water shall comply with the "Guidelines for the Use of Reclaimed Water in South Australia" appropriate to the selected reuse or disposal option.

  The reclaimed water may require filtration and disinfection depending on the selected method of reuse or disposal.

- Nitrogen and Phosphorus.

  Consideration may need to be given to the reduction of Nitrogen and Phosphorus levels in the reclaimed water dependent on the selected reuse or disposal option, refer to the "Guidelines for the Use of Reclaimed Water in South Australia" .

19. EFFLUENT REUSE OR DISPOSAL

All proposals for a STED scheme shall include provision for the end disposal of the effluent.

Methods of reuse or disposal of Reclaimed Water may include:

a. Reuse Options

The reuse of reclaimed water shall comply with "Guidelines for the Use of Reclaimed Water in South Australia".

The use of reclaimed water may be considered for a range of activities including, irrigation of ovals, golf courses, reserves, parks and gardens, woodlotting, agriculture etc.

b. Disposal Options

<u>Evaporation pans</u>

Disposal by evaporation shall be calculated on an annual cycle based upon 80% of the effective evaporation rate for the area.

Where disposal is by evaporation and reuse in the future is not being considered, the lagoon capacity may be reduced to 36 day detention.

In such cases the evaporation pans shall be divided to provide water depths that allow sanitary operation.

Evaporation pans shall be fenced with a stock proof 1.2 metre high galvanised ringlock fence with galvanised steel corner posts, timber (Treated Radiata Pine) intermediate posts and steel droppers, topped with 2 strands of galvanised barbed wire.

A gate shall be included in the fence having a clear opening of at least 3.6 metres.

As Amended, December, 1997