ON-SITE SEWAGE AND WASTEWATER MANAGEMENT STRATEGY

2013

This page is intentionally left blank

TABLE OF CONTENTS

Part A – Introduction to Lismore City Council On-Site Sewage and Wastewater Management Strategy

Part B – On-Site Management Systems Design

Section1- New On-site Sewage Management Systems and Section 68 Applications

Section 2- Rezoning and Residential Release Proposals, Subdivisions and other Development Applications

Section 3- Existing Systems and Alterations

Section 4- Installer Requirements

Section 5- General

This page is intentionally left blank

PART A

Introduction to Lismore City Council On-Site Sewage and Wastewater Management Strategy

1.0 INTRODUCTION

This Strategy contains Lismore City Council's requirements for owners, applicants, installers, consultants and developers on all aspects of on-site sewage and wastewater management for single domestic households, from planning through to construction and maintenance.

This strategy aims:

- to provide a framework to manage and regulate on-site sewage management systems in a sustainable manner;
- to protect the environment and public health;
- to provide appropriate information to the general community, owners, plumbers and consultants to improve on-site sewage management outcomes, and ensure user accountability;
- to assist in the assessment of proposed on-site wastewater systems design.

This Strategy is designed to complement the NSW *Environment & Health Protection Guidelines: On-site Sewage Management for Single Households* (1998) (The Silver Bullet), and highlights certain features of the Lismore City Council area which are not typical of NSW as a whole, such as our exceptionally high seasonal rainfall and volcanic soils, often on undulating and steep terrain interspersed with drainage channels and watercourses.

The 2013 Strategy review was conducted in consultation with an industry working group.

1.1 Legislative Background

In March 1998 the NSW Government introduced changes to its on-site sewage management regulations in response to the need for improved health and environmental outcomes. This On-Site Sewage and Wastewater Management Strategy has been developed in response to these statutory reforms.

This Strategy encompasses all single dwelling domestic on-site wastewater management systems within the Lismore City Council area and is divided into two main sections with supporting documents presented in Appendixes A - E.

- **Part A** – *"Introduction to Lismore City Council On-Site Sewage and Wastewater Management Strategy".* This part includes information on the applicability of the Strategy, Legislation, aims, objectives and definitions.
- **Part B** - *"On Site Management Systems Design Document"* provides step-by-step guidance in preparing consultants technical reports, plumbing reports and on-going operational requirements.
- **Appendix A –** *"Treatment Systems"*. Supporting information
- **Appendix B** – *"Land Application".* Supporting information
- **Appendix C –** *"Irrigation Design Checklist"*
- **Appendix D –** *"Irrigation Certification Checklist"*
- **Appendix E –** *" Blank Site Evaluation Forms"*

1.2 Applicability

This strategy applies to all rezoning and development applications under the *Environmental Planning & Assessment Act 1979* and Section 68 applications under the *Local Government Act 1993*. The Strategy applies to land within the local government area of Lismore City Council and supersedes all previous information issued by Lismore City Council with respect to on-site sewage and wastewater management. In the event of any inconsistency between this strategy and any Development Control Plans, Standards, Policies or Codes, this strategy shall prevail.

1.3 Commencement Date

This Strategy became effective on September 1, 2013.

1.4 Objectives

The general objectives are:

- to ensure the protection of the environment and public health through the design, operation and maintenance of sustainable on-site sewage management systems;
- to maintain and improve community amenity;
- to encourage re-use of resources through ecologically sustainable design;
- to enhance public education of on-site sewage treatment systems;
- to encourage the installation of low-tech on-site sewage management systems.

1.5 Companion Legislation and Guidelines

AS1546:1998 - On Site Domestic Wastewater Treatment Units
AS/NZS1547:2012 - the Australian/New Zealand Standard: *On-site domestic - wastewater management*
Environment & Health Protection Guidelines: *On-site Sewage management for Single Households* (1998)
Lismore City Council Local Environment Plan
Lismore City Council Development Control Plan
Local Government Act 1993
Local Government (General) Regulation 2005
Protection of the Environment Operations Act 1997
Public Health Act 2010
Plumbing and Drainage Act 2011
Plumbing and Drainage Regulation 2012
Plumbing Code of Australia (PCA)
Rous Water On-site Wastewater Management Guidelines 2008

Additional information relevant to NSW on-site sewage management may be obtained from:

- NSW Department of Local Government at www.dlg.nsw.gov.au which covers the Department's sewage and wastewater management programs. See Septic Safe Program.
- NSW Department of Health at http://www.health.nsw.gov.au/publichealth/environment/water/waste_water.asp
- NSW Office of Water. http://www.water.nsw.gov.au

1.6 Definitions

"Absorption" absorption and/or uptake of effluent into soil by infiltration and capillary action.

"Absorption area/trench/bed" a land application system which uses the principle of absorption.

"Absorption Rate" rate of discharge of water into soil.

"Adsorption" physical or chemical attachment of substances to the surface of soil particles.

"Aerated Wastewater Treatment System (AWTS)" a wastewater treatment process typically involving: settling of solids and flotation of scum; oxidation and consumption of organic matter through aeration; clarification - secondary settling of solids, and disinfection of wastewater before irrigation/disposal.

"Appropriately qualified and experienced irrigation designer" a person holding specialist qualifications in irrigation design and/or who has demonstrated to the satisfaction of Council that they have relevant experience in the competent design of wastewater irrigation systems. (Note: An individual who holds current accreditation as a Certified Irrigation Designer (CID) as issued by Irrigation Australia Ltd is one way of satisfying this criterion).

"Approval to Install" is an approval granted by the Council to install, construct or alter a waste treatment device or a human waste storage facility or a drain connected to any such device or facility in accordance with Section 68 of the Local Government Act 1993.

"Approval to Operate" means an approval granted by the Council that requires an owner/occupier to manage an on-site wastewater management system in accordance with the conditions of approval issued under Section 68 of the Local Government Act 1993.

"Batch System – Composting Toilet" a composting toilet system involving two or more alternating chambers.

"Biochemical Oxygen Demand (BOD)" the amount of oxygen required for the biological decomposition of organic matter, measured over a period of 5 days (BOD_5).

"Certified Irrigation Designer (CID)" an individual who holds a current certified irrigation designer (CID) certificate as issued by Irrigation Australia Ltd, and who can provide evidence of design work completed using treated wastewater in landscape, horticultural and/or agricultural projects.

"Certified Irrigation Design Plan (CIDP)" an irrigation design proposing subsurface drip irrigation, spray irrigation or a surface irrigation-under-mulch design that is certified by an appropriately qualified and experienced irrigation designer.

"Compost Toilet" treatment units which employ the process of biological degradation in which organic material is converted into humus like material through the action of micro-organisms and invertebrates.

"Continuous System – Composting Toilet" a composting toilet using a single chamber.

"Design Loading Rate" the Long Term Acceptance Rate LTAR, (see definition below), reduced by a factor of safety.

"Dispersive soil" a soil that has the ability in water to form a cloudy suspension that will not settle.

"Durable aggregate" aggregate, metal or stones which are graded to AS 2758.1 for single size coarse aggregate for nominal sizes, usually ranging from 20mm to 50mm.

"Effluent filter" placed in the outlet of septic or greywater tanks to reduce the level of solids entering the effluent disposal area. Effluent filters do not provide secondary treatment.

"Effluent Water" treated water which has passed through a treatment system.

"Evaporation" the transfer of water from a liquid to a gas.

"Evapotranspiration" removing water from soil by evaporation and from vegetation by transpiration.

"Evapotranspiration/absorption (ETA) bed" a prepared bed or area which embodies the principals of evaporation, transpiration and absorption.

"Faecal Coliforms" a type of bacteria that live only in the gut of warm-blooded animals. Can be detected in the general environment if that environment is contaminated with human excreta, and therefore can act as an indicator of recent faecal contamination.

"Geotextile" a water permeable material used in foundation stabilisation. Soil particles mobilised by water are designed not to pass thorough the geotextile fabric (care should be taken as there are different fabric spacing sizes and qualities).

"Greywater" the component of domestic wastewater which excludes water closet, kitchen and urinal wastes.

"Greywater Diversion Device (GDD)" – for the purposes of this document a GDD is defined as the installation and operation of a system/device used to divert greywater generated on a single residential premise to a garden or lawn on that premise by means of sub-soil disposal. Kitchen waste is not permitted in any greywater diversion.

"***Greywater Treatment System (GTS)"*** a system that collects, stores, treats, and may disinfect, greywater to the standards specified in the NSW Health ***Domestic Greywater Treatment Systems Accreditation Guidelines (February 2005)*** to provide treated greywater for reuse for irrigation, toilet flushing and washing machine use.

"Groundwater" the body of water in the soil, all the pores of which is saturated with water, includes water below the water table and seepage from springs etc.

"Gully – Ephemeral Stream" these watercourses have channels which are above the water table at all times and therefore do not receive spring or groundwater flows. They carry water only during and immediately after rain. They may be dry for extended periods but subjected to flash flooding during high intensity storms.

"Indexing Valve" allows pumped effluent to be delivered to up to 6 separate land application areas.

"Intermittent Watercourse" watercourses that flow for only certain times of the year, when they receive water from surface runoff or from springs or ground water. During dry years they may be reduced to a series of separate pools or may even cease to flow entirely. However, these pools are still connected to the water table/ground water.

"Irrigation Systems" pressurised surface spray, surface drip, drip under mulch and sub-surface drip irrigation systems (i.e. effluent disposal). These all require tertiary treated effluent.

"Infiltration" the passage of water into the soil.

"Land Application Area (LAA)" the area over which treated wastewater is applied i.e. disposal area.

"Long Term Acceptance Rate (LTAR)" the long term average rate effluent water can be absorbed into the natural soil at a selected disposal site, expressed in litres per square metre per day (L/m^2/day). This rate is influenced by effluent water quality, method of dosing, the soil permeability and the slime layer interface equilibrium of the receiving soil.

"Low Tech" passive designed gravity fed systems with minimal maintenance requirements.

"LPED Irrigation" subsurface irrigation of tertiary treated effluent into topsoil through low pressure effluent distribution (LPED) lines.

"LPED line" pressure line perforated with drilled holes placed with a distribution line.

"New System" a system requiring approval under Section 68 of the *Local Government Act 1993*

"Pan Evaporation" the loss of water by evaporation measured in a Class A pan under controlled conditions.

***"Pathogens*"** micro-organisms that are potentially disease causing; these include, but are not limited to, bacteria, protozoa and viruses.

"Percolation" a general term describing the rate of water movement through a soil or through a biological mat within an effluent disposal area.

"Perennial Watercourse" watercourses that essentially flow all year-round and consist of baseflow during dry periods**.**

"Permeability" a calculated value derived from the rate at which a head of liquid is absorbed into soil, usually measured in m/d as Saturated Hydraulic Conductivity (K_{sat}).

"Primary Treatment" the separation of suspended material from wastewater by settlement and/or floatation in septic tanks prior to discharge to either a secondary-treatment process, or to a land-application system.

***"Scum*"** the floatable material which accumulates on the liquid during primary wastewater treatment. Material includes oils, grease, soaps and plastics.

"Secondary Treatment" aerobic biological processing and settling or filtering of effluent received from a primary treatment unit. Effluent quality following secondary treatment is expected to be equal to or better than 20 mg/L BOD_5 and 30mg/L suspended solids.

"Septic Tank" wastewater treatment device that provides a preliminary form of treatment for wastewater, comprising sedimentation of suspended solids, flotation of oils and fats, and anaerobic digestion of sludge.

"Sewage Management" any activity carried out for the purpose of holding or processing, or reusing or otherwise disposing of, sewage or by-products of sewage.

"Sludge" mainly organic semi-solid product produced by wastewater treatment processes.

"Soil Absorption" subsurface land application systems that rely on the capacity of the soil to accept and transmit the applied hydraulic load. (includes leach drains, drain fields, absorption trenches, seepage beds and seepage pits)

"Sub-soil" this is the depth below surface level from 300mm downwards i.e. for disposal of primary treated wastewater.

"Sub-surface" this is the depth from 100mm – 150mm below surface level.

"Sub-surface Irrigation" pressurised irrigation system requiring secondary treated and disinfected effluent. Irrigation lines are situated approximately 150mm below the ground surface.

"Sustainable" capable of continual operation with minimal long-term adverse effect on public health and the environment.

Substantial Upgrade" a substantial upgrade relates to situations that cannot be addressed through maintenance or repair work. This may relate to the replacement / upgrade of the treatment device and/or the associated disposal area.

"Transpiration" the transfer of water to the atmosphere through plants.

"Wastewater" water discharges from a dwelling or other activity which are of a lower quality than the Sensitive Water Standard as defined by the EPA.

This page is intentionally left blank

PART B

On-site Sewage Management Systems Design & Installation Requirements and Consultants Reports

---

Section 1: New On-site Sewage Management Systems and Section 68 Applications

Section 2: Rezoning and Residential Release Applications, and Subdivision and other Development Applications

Section 3: Existing Systems & Alterations

Section 4: Installer Requirements

Section 5: General

SECTION 1 – New On-site Sewage Management Systems and Section 68 Applications

1.1 Details required in consultants reports

- *Proposed system*: an outline of the proposed system and associated components are to be stated within an executive summary of the report. If any departures from the Strategy are proposed they're to be discussed in the executive summary.
- *Site Specific*: reports are to be specific, succinct and with information relevant to the site under review. Justification of the type of system nominated is to be included in the report. If any departures from the Strategy are proposed, cogent argument and all necessary documentation must be provided.
- *Site Constraints*: reports are to accurately indicate the distances to environmental features on-site in relation to the land application area. Should a proposal be designed within the relevant buffer distances or have environmental constraints, **upfront** acknowledgement of the limitation is to be reported and explanation of how it is proposed for the limitation to be managed e.g. maximising the buffer distance or installing a secondary treatment device, such as, a reed bed, sand filter, AWTS, etc.
- *Owners Acknowledgement*: on-site sewage management reports are to include a statement by the owner that they are aware of the type of system being nominated in the report and of the maintenance schedule required to be carried out for the nominated system.
- *Irrigation Reports*: subsurface drip irrigation, spray irrigation or surface irrigation-under-mulch designs are to be produced by an appropriately qualified and experienced irrigation designer. All Irrigation designs must be certified in accordance with Council's Irrigation Certification Checklist Appendix D.

  Council's Irrigation Design Check List (Appendix C) is to be certified and submitted with the design.
- *Irrigation designs*: are to accompany waste water reports at the time of submission to Council. Wastewater reports that nominate irrigation as the land application method will not be accepted without a certified irrigation design plan (CIDP).

  Council reserves the right to submit irrigation designs to third party review.
- *Site Plans*:
  all reports are to include two site plans as follows:
  1) a small scale plan extending to surrounding areas, usually using a 1:25,000 topographic map, showing contours; and
  2) a large scale plan showing the location of : the proposed sewage management system and any existing on-site sewage management components, pegged out effluent application areas including soil analysis bore logs, wells/bores, buildings and facilities, trees, environmentally sensitive areas, bunds, berms, drains or swales for the diversion of run-off around effluent application areas and buffers surrounding the effluent application areas.
- *Plan of land application area:* this is to be a detailed design plan suitable for assessment by Council Officers and for construction purposes by the installer.
- *Full specifications and engineering details:* submission of full details of the chosen treatment systems (including composting toilets) which include all NSW Health accreditation documents along with justification for the choice, including calculations, to allow Council to assess all individual components of the sewage management system including construction, installation, operation and maintenance.
- *Completed site evaluation and soil assessment forms*: all matters must be addressed.
- *Alternate (reserve) land application area:* is to be nominated. This is a critical component to ensure long term sustainable on-site wastewater management.

- *Number of residents*: this should be the number of bedrooms plus 1 unless the actual number of people residing in the dwelling is to be greater.
- *Drinking Water Catchments*: for properties located within or adjoining identified water catchment zones, the Rous Water On-site Wastewater Management Guidelines are to be read in conjunction with this Strategy.
  See Maps
  http://www.legislation.nsw.gov.au/mapindex?type=epi&year=2013&no=66
- *Printout* of the daily disposal model calculation.
- *Plans of management*, including operation, maintenance and service requirements of all components of the proposed sewage management system. This information must be specific to the particular system proposed, and provide all necessary instructions for the occupier/owner or servicing personnel. The schedule is to stipulate the type of system, the person responsible for maintaining the various components of the system including treatment device and disposal area (i.e. owner or servicing agent) and specific time frames or conditions for servicing the various components. It will be a condition of approval that this information be displayed in an appropriate place for the benefit of future occupiers, owners and service personnel.

New systems on land previously zoned
Any site requiring on-site wastewater management should be examined in accordance with the Site and Soil Evaluation Parameters described in the next section. This assessment shall then be used to determine the appropriate location for on-site land application. There may be situations where the wastewater siting has to be selected first, irrespective of the house siting, as no other locations on the allotment would be environmentally suitable.

1.2 Responsibilities of Council – Section 68 Applications

Council's role in the approval process for on-site sewage management applications is that of the assessing/approving authority. Through this role Council's objective is to ensure that the application/approval process adequately satisfies the objectives of the legislative framework, companion guidelines and this Strategy. Council's role is not that of applicant, designer or installer and as such it does not take on the responsibilities associated with these roles. Council will review designs through the assessment/approval process to ensure the objectives, goals, guiding principles and design parameters of legislative and/or guideline frameworks are adequately satisfied.

Council will primarily communicate assessment matters with the nominated applicant and/or the owner. Communication may also occur with other parties, as deemed necessary in the individual case. The applicant, installer and operator carry the responsibility for compliance with the terms of any approval issued by Council. It is important that the above distinction between the various parties' roles and responsibilities is recognised and the applicable roles are fulfilled accordingly to achieve an effective design, approval and installation outcome.

SECTION 2 – Rezoning and Residential Release Proposals, Subdivisions and other Development Applications

2.1 Overview

Land use planning for residential development must be consistent with the principles of ecologically sustainable development, total catchment management, water cycle management, and the protection of the environment and public health.

Although on-site sewage management is only one of the issues to be addressed for these proposals and applications, it is an issue that will have major implications on the suitability of the land for residential development and for determining lot density and lot sizes.

This Strategy requires a rigorous and systematic approach to land use planning, site assessment, and the selection, design and operation of on-site sewage management systems.

2.2 Applications and Consultants Reports

A full site assessment is required to determine all restrictions/constraints/limitations that impact the development. Other documents including the NSW Government *Environment and Health Protection Guidelines - On-site Sewage Management for Single Households* February 1998, Australian Standard 1547:2012, and other relevant literature may need to be used in addition to this strategy to assess site suitability at the rezoning, subdivision and other development application stage.

Additional requirements for rezoning and residential release applications and for subdivision and other development applications include:

- the need to provide "gravity fed low-tech systems" i.e. including septic tank and ETA beds, compost toilet with greywater tank and ETA beds, septic tank, reed bed and ETA beds and the like;
- provide buffers to watercourses and drainage lines strictly in accordance with Section 5.4.1 (f) of this Strategy. The determination of whether a watercourse is "perennial", "intermittent" or a "gully" must be clearly justified by carrying out a detailed site assessment;
- assessment of the characteristics of the upstream and receiving catchment, including land uses and physical constraints;
- assessment of groundwater extraction points with 250m of the development;
- nutrient balance calculations for the catchments involved.

For rezoning and residential release applications, subdivisions and other development applications where a Section 68 approval is to be obtained at a later time the details required in consultants reports must be in accordance with the requirements of this section and Part B Section 1, except as provided below:

1. Full construction, engineering and installation specifications of treatment systems and land application areas are not required provided that it can be clearly demonstrated that appropriate systems can be provided and that effluent loadings can be treated and managed in accordance with the Strategy requirements on the land. In some circumstances a range of options that can clearly satisfy the requirements of the strategy may be given.

2. Certification of irrigation designs is not required at this time. However, the type, sizing and location of irrigation areas must be clearly demonstrated and must comply with all the constraints/limitations determined from the assessment and reporting process.

3. Detailed plans of management are not usually required but an overview of key management matters must be discussed. Please note that there may be some applications where plans of management are critical to the assessment of the application prior to Section 68 application submission.

SECTION 3 - Existing Systems and Alterations

3.1 Upgrade of Failing Septic Tank Systems

Many of the on-site sewage management system failures relate the age of the system and/or damage from livestock and vehicles.

The majority of failing septic tank systems require the installation of an effluent filter and a new land application area i.e. ETA Beds.

However, in cases where these failing septic tanks are located on poor soils (from light to heavy clays) or are within buffer distances to environmentally sensitive areas or are located on a constrained site, then secondary treatment of the wastewater may be required. In Lismore this is usually achieved by either installing a reed bed after the septic tank or installing a device that holds a NSW Department of Health accreditation for secondary treatment e.g. AWTS.

3.2 Upgrade of Pit or Pan Toilets

Due to the risk these types of toilets pose to public health and the environment, they will be required to upgrade to a minimum standard of a composting toilet. Council will negotiate individual upgrading programs with individual owners.

3.3 Upgrade of AWTS's Land Application Areas

To retain an existing sprinkler system, the upgrade of the sprinkler system will need to comply with the following:

- the installation of a 4 or 6way indexing valve to allow for multiple delivery lines;
- the installation of a 130 micron, 40mm (1 ½ inch) inline filter;
- the use of heavy droplet sprinklers on hard risers;
- delivery lines to be buried a minimum of 100mm;
- a suitably sized pump to drive the indexing valve;
- the LAA will be sized according to Council's Daily Disposal Model (using SDI parameter).

3.4 Requirements for Plumbers Reports for Building Additions and Alterations with On-site Sewage Management Systems

Lismore City Council receives regular development applications to undertake building additions and alterations to dwellings. In many cases this will involve an extra wastewater load entering the on-site sewage management system. It is therefore necessary for a plumber to prepare a report/statement and a plan of the proposed system. This report is to be submitted with the (S68 application) to Council.

If there is no extra wastewater load then Council still requires a report/statement to say as much. In the event the system is failing or is likely to fail with extra load, upgrade details are required prior to determination of the application.

Plumber's reports shall include the following:

- an accurately dimensioned plan of the existing on-site sewage management system and distance to relevant site features.
- details of the existing on-site sewage management system (i.e. type and capacity of the tank, bed/trench length) and its current condition (i.e. is it showing signs of deterioration, is effluent pooling, etc.).
- buffer distances to environmentally sensitive areas i.e. waterways, dams, drinking bores, gullies etc.
- state whether the extension results in an extra wastewater load in the household.
- if there is a load increase, what is the system's ability to cope with the additional load?
- if there is a load increase and the on-site system needs upgrading, details of the proposed upgrade of the on-site system are to be provided to Council.
- if the upgrade is on a constrained site, Council will require an on-site sewage management system report from a wastewater consultant.

- All upgrades are to meet the requirements of this Strategy.

3.5 Auditing of Existing Systems

As part of Council's ongoing On-Site Sewage Management Program, existing systems are inspected periodically. Systems shall also be inspected subsequent to property transfer, prior to issuing a Certificate of Approval to Operate (CAO). Improvements to the existing system will be discussed as required following these inspections, and as a result of improvements carried out; changes to the conditions of the CAO may result. Any building additions that are carried out between inspections will be noted and owners asked to upgrade the system to meet any new demands on the existing system.

Existing systems need to be evaluated for activities such as the following:

- proposed additions and alterations to an existing dwelling. A site evaluation as listed below will be required.
- change of use. A site evaluation as listed below will be required.
- increase in the generation of wastewater for a development.
- a failing existing on-site system.

All cases require a site evaluation by an appropriately qualified person, as described below.

Failing Systems

Should your on-site wastewater disposal system be failing, the following steps should be undertaken to rectify the problem:

1. Seek advice from a qualified plumber or consultant to determine the source of the failure.
2. Contact Council's Compliance Officers for advice on what upgrades are needed.
3. Complete the form *"Application To Install, Construct or Alter a Sewage Management Facility and Issue an Operating Licence"* and submit to Council for approval prior to commencement of works.

SECTION 4 - Installer Requirements

4.1 Plumbing

Plumbing & Drainage Work: All plumbing work is to be carried out by a Licensed Plumber and carried out in accordance with the provisions of AS/NZS 3500, the Plumbing Code of Australia (PCA), *Plumbing and Drainage Act 2011* and *Plumbing and Drainage Regulation 2012.*

What must plumbers do in order to carry out plumbing work?

Step 1 – Approval. The development activity and associated plumbing must be approved by Council in accordance with Section 68 of the *Local Government Act 1993* before the plumber starts work on the job. Approval is obtained by making an Application to Council. Check with the owner or Council to see if an approval has been issued. For domestic circumstances this is commonly done concurrently with the Development Application (DA).

Step 2 – Notification. Following the issue of an approval the Licensed Plumber must submit to Council a "**Notice of Work**" under the *Plumbing and Drainage Act 2011* at least two (2) days prior to commencing the work. There are no fees for this Notice. Plumbers are required to look or check for any conditions of approval that affects their work.

Step 3 – Inspections. The Licensed Plumber must call for necessary inspections. All inspections must be paid for before the inspection is booked with Council. Council customer service staff will not book an inspection unless there is an inspection fee in place. Inspections can be booked by calling 1300 87 83 87. Council will collect a minimum of two inspection fees at the time of application for Approval in sewered areas and a minimum of three inspection fees in non-sewered areas (that is, locations where on-site sewage management systems are installed).

(Typically, inspections can be paid at lodgement of the DA or the Notice of Work however, it is the Licensed Plumber's responsibility to ensure inspections are paid for prior to booking inspections. The number of inspections required will depend on the type and nature of the work).

Step 4 – Compliance. On completion of work the Licensed Plumber must submit a "**Certificate of Compliance**" to Council within two (2) days of completing works. The Certificate of Compliance must be accompanied by a Sewerage Service Diagram (SSD).

For futher information, including 'combined Notice of Work and Certificate of Compliance' visit:

http://www.fairtrading.nsw.gov.au/Tradespeople/Plumbers_and_drainers.html

SECTION 5 - General

5.1 Consultant Reporting

When designing on-site sewage and wastewater management systems for single dwellings the following steps must be satisfied:

1. Undertake desktop assessment to determine site attributes and constraints.
2. Conduct a site inspection.
3. Complete Site Evaluation and Soil Assessment Forms. All limitations must be addressed.
4. Calculate the land application area using the computer model. If Soil Category is 6 (Table 4), then soil conditioning will be necessary (e.g. gypsum for dispersive soils).
   Soil texture/structure must be modelled on the most limiting soil layer within the 1000mm Soil profile. Refer to Table B1. of Appendix B for daily flow allowances.
5. In consultation with the client, determine suitable treatment systems and land application systems.
6. Prepare a detailed report for submission to Council.
7. Peg and identify effluent disposal areas where reporting identifies site limitations critical to the design layout.
8. Drinking Water Catchments: for properties located within or adjoining identified water catchment zones, the Rous Water On-site Wastewater Management Guidelines are to be read in conjunction with this Strategy.
   See Maps
   http://www.legislation.nsw.gov.au/mapindex?type=epi&year=2013&no=66
9. Submit two (2) copies of the report to Council with a completed Section 68 application.
10. Should any site or soil limitations be found, consultants must clearly report them in these assessment forms, while in the body of the report the appropriate mitigation measures intended to be taken to address these limitations need to be clearly identified.

5.2 Small Blocks

Small residential lots proposed to accommodate on-site sewage management systems will require special consideration as they generally do not meet the broad design objective of this Strategy.

The first priority with restricted sites is to protect public health and deal with the hydraulic load. This usually involves the secondary treatment of the wastewater and in some cases the installation of a compost toilet to reduce the hydraulic load.

With upgrades on small blocks it is sometimes necessary to place the LAA (i.e. disposal area) inside buffers. In these cases it is usual practice that if the buffers cannot be met secondary treatment is required and depending on the site constraints, disinfection may also be required.

5.3 Guiding Principles – Design and Operation

The following principles should be applied in the design and operation of on-site sewage management systems:

- Selection of a treatment system and land application area: first consider low-tech passive design gravity fed systems i.e. a septic tank, reed beds and ETA beds, compost toilet with greywater tank and ETA beds.
- Maximise the opportunity for nutrient and water re-use by vegetation uptake. Re-use by evapotranspiration is preferred, but disposal may be considered in particular circumstances given the environmental sensitivity of an area and the individual circumstances of the case.
- Evenly distribute effluent throughout the effluent application area.
- Irrigation effluent must be tertiary treated.
- Systems must minimise the risk of runoff of wastewater including during rain/storm events.
- Systems must minimise the risk, to householders and the public, of spread of pathogens/micro-organisms.
- Intermittent dosing of effluent fields is desirable.
- The minimum number of persons in a household is calculated to be equivalent to the number of bedrooms plus one. If it is known that number of persons will be greater than this value, then the calculation will be the actual number of persons.
- Irrigation systems are to be certified by an appropriately qualified and experienced irrigation designer in accordance with Council's Irrigation Certification Checklist (Appendix D)
- Council's Irrigation Design Check List (Appendix C) is to be certified with the design submitted and approved by Council.
- Irrigation systems are to be installed by a person with suitable expertise and experience. A "works as executed" plan is to be submitted to Council with the Certificate of Compliance after installation.
- Irrigation systems are to be provided with a maintenance schedule for approval by Council and be maintained on a quarterly basis.

5.4 Site Evaluation and Soil Assessment

The site evaluation task in the design of systems is critical to the overall successful long term operation of an environmentally sustainable system. There are different situations that require different levels of information.

Site and Soil Evaluation Parameters:
This section explains in detail the various parameters required for site assessment.

5.4.1 Site Evaluation

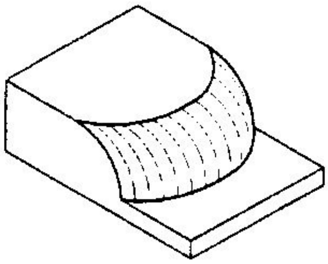
Most of the following information is similar to that of the Australian Standard (AS/NZS1547, 2012). The information will help you fill out a Site Evaluation Form, like the sample shown with hypothetical results in Table 8.

a) Slope Angle

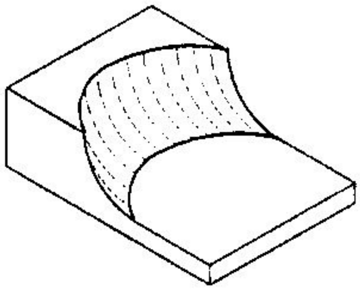
The slope of the site should be determined in the field, through the use of such instruments as an inclinometer, or through a formal survey of the site. Site slope must be expressed as a percentage.

b) Slope shape

The shape of the slope may either assist or hinder drainage as shown in the following diagrams.



Best water-shedding shape



Worst water-shedding shape

Cut-off drains and bunds may be used to ameliorate poor drainage likely to result from poor shape. The reader is referred to the Australian Standard for more detailed diagrams of these various types of slope shape. A minimum distance of 20 metres will be required to measure and determine the degree of slope. It is strongly recommended that the site be surveyed to aid slope assessment.

c) Aspect

Use a compass to ascertain the direction of the slope. North and North East facing slopes are recommended positions due to greater exposure to sunlight, hence higher evapotranspiration.

d) Exposure

The exposure to sunlight and prevailing winds aids the uptake of water vapour through transpiration and evaporation, depending on the disposal system selected. It is noteworthy that meteorological stations, which supply climate information, are always fully exposed to sun and wind. Thus the daily water balance model used in this Strategy, based on Alstonville climate records, would not be representative of a damp shaded area. Any such areas should be marked on the site plan.

e) Boulders/Floaters/Rock Outcrops

Boulders/floaters or rock outcrops may allow wastewater to short circuit the disposal field and enter water supplies. Therefore the site should be traversed on foot, and the presence of any boulders/floaters or rock outcrops should be recorded in the site plan. Note: A boulder's middle dimension is at least 600mm (see Definitions).

f) Buffer Distance

An accurate distance must be recorded to watercourses, gullies and other environmental features in relation to the land application area. In the event a proposal cannot achieve the relevant buffer distance nominated below or have environmental constraints, upfront acknowledgement of the limitation is to be clearly reported in the executive summary of the report with an explanation of how it will be managed for the limitation e.g. maximising the buffer distance, installing secondary treatment with disinfection etc. is to be stated. This provides the potential for some level of flexibility subject to a merit-based assessment for single lots with an existing dwelling entitlement.

This level of flexibility is not afforded to rezoning and subdivision applications as buffer distances are treated as absolute minimums.

The following buffer distances apply to disposal areas situated near watercourses:

- 100m buffer
  Watercourse: Perennial and Intermittent systems
- 40m buffer
  Gully - Ephemeral Stream
- 250m
  Domestic groundwater wells/bores

The following buffer distances apply to disposal areas situated near property:

- 6m up-gradient of property boundaries, swimming pools, driveways and buildings
- 3m down-gradient of property boundaries, swimming pools, driveways and buildings
- 12m up-gradient of property boundaries for ETA beds (though 6m for swimming pools, driveways and buildings)
- 6m down-gradient of property boundaries for ETA beds (though 3m for swimming pools, driveways and buildings)
- 10m from telegraph poles

g) Run-on and Upslope Seepage

Any run-on or upslope seepage must be recorded on the site plan. If uncontrollable by the construction of a catch drain above the disposal field, then an alternative location must be chosen. The presence of flood debris and silt deposits may assist in identifying run-on.

h) Flooding Potential

The flooding potential of the site must be determined, especially for low-lying areas. Disposal areas should be above the 1 in 20 year flood height, and treatment systems should be above the 1 in 100 year flood level.

i) Site Drainage

The frequency and duration of seasonal shallow waterlogging should be noted. Signs of poor drainage include hard packed soils, vegetation growth characteristic of damp sites, and pooling of water. It is not recommended that land application areas be installed within sites with poor drainage. The location of channelled (concentrated) runoff on site, as well as any runoff likely to move onto neighbouring properties, should be noted on the site plan.

j) Vegetation Indicating Waterlogging

While wetland species such as bullrushes etc. are obvious signs of frequent waterlogging, other less obvious species such as sedges and buffalo grass indicate seasonal waterlogging in this region. These species should be noted in the site plan.

k) Surface Condition

Note cracks, hardness, previous compaction, dampness and the location of seepage areas.

l) Fill

The location, depth and type of any fill should be noted on the site plan (AS/NZS1547, 2012). Clean fill consisting of soil, which has settled and is on a stable site, may be considered for use for wastewater disposal. However other types of fill with coarse fragments etc., and/or where located on steep sites, are unsuitable for wastewater disposal.

An analysis of any fill to be introduced to a site is required by Council prior to the fill entering the site in order to assess its suitability and identify any contaminants.

If fill is to be introduced for the specific purpose of constructing a wastewater envelope, the section 68 application must be accompanied by an appropriate engineering report that supports the use of the nominated fill as suitable media for effluent application.

m) Erosion/Mass Movement

The location and details of existing mass movement and erosion, such as gullies, slips and rills should be recorded on the site plan. To protect against future erosion, adequate drainage controls must be undertaken to ensure that wastewater is not concentrated within one location, and upslope runoff is diverted around the disposal area.

n) Trees

ETA Bed location must meet the following vegetation setbacks.
Small trees (<3m) no closer than five (5) metres
Large trees (>3m) outside the drip line of the tree
Tree species with vigorous root/growth habits need to be assessed on their merits.

5.4.2 Soil Evaluation

Each individual disposal site must be inspected by a competent professional and estimation made of the soil conditions. The four key tests to be performed are:

- the manual bolus or ribbon test to determine soil *texture*
- the visual test to determine soil *structure*
- the modified Emerson Aggregate test to determine soil *dispersiveness*
- depth to bedrock and/or ground water

Soil texture and structure determine the soil's ability to accept effluent, which in turn relates to the appropriate effluent loading rate. Soil texture/structure values used in the wastewater model must be based on the most limiting layer within the 1000mm soil profile assessment and must be addressed in the terminology used in Table 4. Dispersiveness is an indication of the damaging effect that excessive sodium has on soil structure, causing soil and clay particles to deflocculate, leading to reduced permeability.

Soil parameter values within any one soil type can be highly variable and therefore generally cannot be sourced from *Soil Landscapes of the Lismore-Ballina 1:100,000 Sheet,* Morand (1994), though this is a good reference for some soil parameters. As part of the initial desk top study the soil unit from this text will need to be ascertained in order to identify *likely* site and soil limitations as well as indicate likely phosphorous sorption rates. The following table will assist in this process.

Table 1. Soil units in LCC area (complete list) showing likely limitations for effluent disposal, and phosphorous sorption. Sources: Morand (1994), OSWMS (1999), P-sorption analyses by EAL, Southern Cross University 1998.

Soil Unit (Morand, 1994)	**Code** (Morand, 1994)	**Broad Soil Type** (as per 1999 version of Strategy)	**Likely limitations** Asterisk (*) indicates comments from Morand (1994)	**P-sorption kg/ha/m** (as per 1999 version of Strategy)
Bagotville	**ba**	Sandy Duplex	**Flood prone footslopes*.**	8,000
Bangalow	**bg**	Red Basaltic	**Steep, shallow*. May need skinny beds/trenches on slopes.**	10,000
Burns Point	**bp**	Alluvial / Humic Gleys	**Unsuitable for effluent disposal*.**	
Coffee Camp	**cc**	Sandy Duplex	**Shallow, steep*. May need skinny beds/trenches on slopes.**	8,000
Coraki	**ck**	Sandy Duplex	**Low CEC. Localised seasonal waterlogging*.**	8,000
Calico	**cl**	Clayey Duplex	**Steep, dispersive soils. Mass movement. * May need skinny beds/trenches on slopes.**	8,000
Coolamon	**co**	Red Basaltic / Dark Basaltic	**Steep, shallow, stony soils, mass movement*.**	10,000
Disputed Plain	**dp**	Alluvial (highly reactive)	**Waterlogged, impermeable soils, high watertables*.**	10,000
Dungarubba	**du**	Includes some Humic Gley	**Flood hazard, waterlogging, permanently high watertables. Unsuitable for effluent disposal. ***	
Eltham	**el**	Red Basaltic	**Locally waterlogged, flood hazard, proximity to streams. ***	10,000
Empire Vale	**ep**	Alluvial (highly reactive)	**Dispersive, waterlogged subsoils, high watertables. ***	10,000
Ewingsdale	**ew**	Red Basaltic	**High permeability, but mass movement hazard near drainage lines, waterlogging on lower slopes.***	10,000
Frederick	**fr**	Dark Basaltic	**Low to moderate permeability. May be shallow and rocky, seasonal waterlogging. ***	12,000
Georgica	**ge**	Dark Basaltic	**Low to moderate permeability. May be shallow and rocky, seasonal waterlogging *. May need skinny beds/trenches on slopes.**	12,000
Leycester	**le**	Alluvial (highly reactive)	**Shrink-swell soils, localised waterlogging and high watertables*.**	10,000
Mackellar	**ma**	Dark Basaltic	**Very steep slopes, shallow soils* May need skinny beds/trenches on slopes.**	12,000
Mount Burrel	**mb**	Red Basaltic / Dark Basaltic	**Steep slopes, mass movement*. May need skinny beds/trenches on slopes.**	10,000
McKee	**mc**	Dark Basaltic	**Shallow soils, seasonal waterlogging*.**	12,000
Minyon	**mi**	Sandy / Clayey Duplex	**Steep slopes, rockiness, seasonal waterlogging and shallow soils (all localised)***	8,000
North Casino	**nc**	Alluvial (highly reactive)	**Shrink-swell soils, localised waterlogging and high watertables*.**	10,000
Nightcap	**ni**	Varied: includes Red Basaltic, Clayey Duplex	**Steep slopes, mass movement, rockiness***	8,000
Nimbin Rocks	**nr**	(Nimbin Rhyolite)	**Severe limitations for development on cliff-footslopes***	
Rosebank	**ro**	Red Basaltic	**Steep slopes, mass movement*. May need skinny beds/trenches on slopes.**	10,000
Terania	**te**	Alluvial (varied, not highly reactive, and doesn't easily fit Great Soil Group or profile categories)	**Close to watercourse, flooding, stream-bank erosion, slumping*.**	10,000

Soil Unit (Morand, 1994)	Code (Morand, 1994)	Broad Soil Type (as per 1999 version of Strategy)	Likely limitations Asterisk (*) indicates comments from Morand (1994)	P-sorption kg/ha/m (as per 1999 version of Strategy)
Tuckean	**tu**	Humic Gley	**Unsuitable for effluent disposal.**	
Tyagarah	**ty**	Alluvial /Sandy Podzolic	**Waterlogging, high watertables, low CEC*.**	1,000
Wollongbar	**wo**	Red Basaltic	**High permeability*.**	10,000

a) Soil Texture Classification

Soil texture is a measure of the behaviour of a small amount of soil when moistened and kneaded into a ball (bolus) and then manipulated between the thumb and forefinger to form a ribbon. There are 19 commonly recognised grades of texture, which are determined from the behaviour of the moistened bolus. Soils are made from four basic components being sand, silt, clay and organic matter, which affect the texture characteristics of a soil sample. *There are six broad texture categories which are used to determine the permeability of the soils*. Each texture group and texture group change within the soil profile should be recorded, along with the corresponding pH. The following table is included to enable the soil texture category to be determined.

Table 2. The Grades of Soil Texture Source: Northcote (1979)

Soil Category (Texture Group)	Grade of Soil Texture	Behaviour of moist bolus	Indicative Ribbon length mm
1 - Gravels & sands	Sand	nil to very slight coherence, won't mould, single grains adhere to fingers	-
	Loamy sand	slight coherence	≤ ~6.35
	Clayey sand	slight coherence, sticky when wet, many sand grains stick to fingers, discolours fingers with clay stain	6.35-13
2 - Sandy loams	Sandy loam	bolus just coherent, v.sandy to touch, dominant sand grains readily visible	13-25
	Fine sandy loam	bolus coherent; fine sand can be felt and heard when manipulated (clearly seen under hand lens)	13-25
	Light sandy clay loam	strongly coherent bolus, sandy touch, med. size sand grains easily visible	20-25
3 - Loams	Loam	bolus coherent, spongy, smooth (not sandy / silky) feel when manipulated	~ 25
	Loam, fine sandy	bolus coherent and slightly spongy, fine sand can be felt and heard when manipulated	~ 25
	Silt loam	coherent bolus; very smooth to silky when manipulated	~ 25
	Sandy clay loam	strongly coherent bolus, sandy touch, med. size sand grains in finer matrix	25-38
4 - Clay loams	Clay loam	coherent plastic bolus, smooth	38-50
	Silty clay loam	coherent smooth bolus, plastic and silky to touch	38-50
	Fine sandy clay loam	coherent bolus, fine sand can be felt and heard when manipulated	38-50
5 - Light clays	Sandy clay	plastic bolus; fine to med. sands seen, felt or heard in clayey matrix	50-75
	Silty clay	plastic bolus; smooth and silky to manipulate	50-75
	Light clay	plastic bolus; smooth to touch; slight resistance to shearing between thumb and forefinger	50-75
	Light medium clay	plastic bolus; smooth to touch; slightly greater resistance to shearing between thumb and forefinger	~ 75
6 - Medium to heavy clays	Medium clay	plastic bolus; like plasticine and can be moulded into rods without fracture; some resistance to ribboning	≥ 75

Soil Category (Texture Group)	Grade of Soil Texture	Behaviour of moist bolus	**Indicative Ribbon length mm**
		shear	
	Heavy clay	Smooth plastic bolus; like stiff plasticine; can be moulded into rods without fracture; firm resistance to ribboning shear	≥ 75

b) Soil Structure

The soil structure is to be determined from visual assessment of the site and from borehole testing, through the examination of exposed soil surfaces. The following is a summary of soil structures:

Table 3. Soil structure according to degree of pedality

Degree of Pedality	Appearance
Massive	Coherent, with any partings both vertically and horizontally spaced at greater than 100 mm. Pieces do not break along planes of weakness but break according to stress loads
Single grained	Loose, incohesive, structureless e.g. sands
Weak	Peds indistinct and barely observable on pit face. When disturbed approximately 30% consist of peds smaller than 100mm
Moderate	Peds well formed and evident, but not distinct in undisturbed soil. When disturbed 30% - 60% consists of peds smaller than 100mm
Strong	Peds quite distinct in undisturbed soil. When disturbed >60% consists of peds smaller than 100mm

c) Soil Permeability Determination

In order to establish an appropriate design loading rate (DLR) the soil texture and structure are combined into a single description (e.g. *weakly structured clay loam*). Where this description is in doubt, or where the assessor desires additional confirmation of the soil category in order to assist in establishing the DLR, soil permeability may be determined through measurements using a constant head permeameter. The method is described in Appendix G of AS/NZS1547 (2012). The following table relates the soil description, indicative permeability and DLR for trenches and beds.

Table 4. **Relationship of soil category, permeability and DLR**

Soil category	Soil Texture	Soil Structure	*Indicative Permeability (Ksat) (m/d)**	Primary-treated Conservative DLR (mm/d)**	Primary-treated Maximum Rate DLR (mm/d)**	Secondary-treated DLR (mm/d)**
1	Gravels & Sands	Structureless	>3.0	20 ¶	35 ¶	50 ¶
2	Sandy loams	Weakly structured Massive	>3.0 1.4 - 3.0	20 15	35 25	50 50
3	Loams	High/mod structured Weakly structured/massive	1.5 - 3.0 0.5 - 1.5	15 10	25 15	50 30
4	Clay loams	High/mod structured Weakly structured Massive	0.5 - 1.5 0.12 - 0.5 0.06 - 0.12	10 6 4	10 10 5	30 20 10
5	Light clays	Strongly structured Moderately structured Weakly structured/massive	0.12 - 0.5 0.06 - 0.12 <0.06	5	8 5	12 10 8
6	Medium to heavy clays OR dispersive soils	Strongly structured Moderately structured Weakly structured/massive	0.06 - 0.5 <0.06 <0.06			

* Permeability refers to the rate of movement of clean water through saturated soil not used for effluent disposal, whilst DLR refers to the much slower rate of effluent loading into an established disposal area on the same soil.

** These values are incorporated into the Daily Disposal computer model.

¶ Special design and distribution techniques required to achieve even distribution of effluent.

d) Colour Description

Using an appropriate soil colour chart, a colour description of the soil profile should be given, and described in the moist condition by the following colours: black, white, grey, red, brown, orange, yellow, green or blue. The classification can be modified as required by the words pale, dark or mottled. Transitional colours may be described as a combination of these colours (e.g. red-brown).

When a soil horizon has a predominant colour with mottles of another colour, is it described in the form: (predominant colour) mottled (secondary colour), e.g. grey mottled red-brown. Where two colours are present in roughly equal proportions, the colour description is described in the form: mottled (first colour) and (second colour), e.g. mottled brown and red-brown.

e) Assessment of Coarse Fragments

Coarse fragments include hard rock material and nodules or segregations. These may be separated from the fine earth component of a soil sample by using a 2 mm sieve. This is a difficult process when a soil is moist and heavy, in which case a field estimate using abundance charts is acceptable. A visual estimate of abundance should be recorded, along with the size range of rock fragments and their corresponding amounts, using the following table:

Table 5. **Abundance and Size of Coarse fragments**

Class	% of coarse fragments
Very few	<2
Few	2-10
Common	10-20
Many	20-50
Abundant	50-90
Profuse	>90

Type of rock	Size of coarse fragments mm
Fine gravel	2-6
Medium gravel	6-20
Coarse gravel	20-60
Cobbles	60-200
Stones	200-600
Boulders	>600

Where coarse fragments occupy more than 20% of soil volume *and* larger pores correspondingly accompany these coarse fragments, the flow of water is not expected to be impeded. Where coarse fragments occupy more than 20% of the soil volume but large pores accompanying the larger fragments are not present, the water flow is expected to be impeded and the Soil Category should be increased by one class e.g. a Clay Loam should be classed as a Light Clay.

Where there are more than 20% cobbles, stones and boulders, this can impede surface preparation and excavation and contribute to trench collapse.

f) Field pH

The pH of a soil can alter the availability of nutrient elements for plant uptake and can cause metal toxicities if pH is too low or too high. Acid soils tend to be leached of major plant nutrients e.g. calcium, magnesium, nitrogen and possibly molybdenum, while phosphorus may not be present in plant-available form. Alkaline soils are often deficient in iron, manganese, copper or zinc (Morand, 1994). A field pH level should be undertaken to determine the acidity/alkalinity of the soils. Soil pH of between 6.5 to 8 is ideal for plant uptake of phosphorous, potassium and nitrogen.

g) Dispersive Class (Modified Emerson Aggregate test - SAR 5)

This is a modification of the Emerson Aggregate Test (Emerson, 1967), providing a field assessment of aggregate stability, carried out using effluent water or a prepared solution of the same quality as will be applied to the soil being tested (for septic tank effluent this is equivalent to a solution with SAR of 5 and EC around 1000 μS/cm) (Patterson, 1998). The test involves placing about three 5mm diameter undisturbed soil aggregates from the soil profile into a beaker of the above solution, and left undisturbed for 5 hours. The behaviour of the aggregates is then recorded from the following:

Class 1: No change to aggregate, therefore non-dispersive.
Class 2: Aggregates slake - smaller aggregates/particles fall off the original aggregate.
Class 3: Aggregates disperse (cloud solution).
Class 4: Worked bolus material disperses.

If any of the replicates are in Classes 3 or 4 then the soil shall be considered *dispersive* and the Soil Category should be Group 6, as though for a Texture Grade of Medium to Heavy Clays (AS/NZS1547, 2012). Gypsum will need to be applied to the disposal area at a predetermined rate in order to prevent soil structure degradation.

h) Soil Depth

A soil depth of less than 0.6 metres to bedrock from the base of a 0.4m deep ETA bed might not have enough capacity to filter nutrients and pathogens; it is therefore a requirement that soil borehole assessments are based on a soil profile of no less than one (1) metre in depth.

i) Soil Evaluation – Acid Sulphate Soils (ASS)

Lismore LGA has approximately 26,000 Ha of acid sulphate soils, which have the potential to cause major degradation of both land and water resources. Landowners and contractors should consult ASS maps of their area during the site and soil assessment. ASS maps are available from Council's website and ASS risk maps are available from the NSW Office of Environment & Heritage.

http://www.lismore.nsw.gov.au/cp_themes/default/page.asp?p=DOC-NCV-32-24-36

5.4.3 Filling out the Site and Soil Assessment Forms

Use the information in preceding sections to fill out the site and soil assessment forms. The value or characteristic of each parameter may imply a *limitation* which will have a bearing on certain other design decisions, for instance, in sizing the disposal area. Where it is required to indicate whether a limitation exists, a tick box will be provided on the Site and Soil Assessment forms. To ascertain site and soil limitations, refer to Tables 6 and 7.

Blank assessment forms are located in Appendix E

Table 6. **Site Limitations**

Site Feature	No limitation exists	Limitation exists	Potential Management Response
Slope	<15%	>15%	Secondary treatment and alternate to ETA Beds such as irrigation
Landform	Divergent (drainage-spreading) land shape e.g. hill crests	Convergent (drainage-concentrating) land shape	Bunds above concentrating sites
Exposure Good aspect and exposure to sun enhances evapotranspiration.	Facing within NW or NE quadrant, and high sun-wind exposure	Facing within SW or SE quadrant, and sheltered from sun-wind	Plant uptake encouraged
Distance to Water Body and man-made features Potential for polluting downstream waters	>100m to perennial and intermittent watercourse AND >250m to domestic groundwater wells AND >40m to gullies AND In the case of SDI, spray or dripper under mulch > 6m if up-gradient and >3m if down-gradient of property boundaries, swimming pools, driveways and buildings. (In the case of ETA beds: >12m if up-gradient and >6m if down-gradient of property boundaries, but 6m/3m as above for pools, dwellings etc)	<100m to perennial and intermittent watercourse OR <250m to domestic groundwater wells OR <40m to gullies OR In the case of SDI, spray or dripper under mulch <6m if up-gradient and <3m if down-gradient of property boundaries, swimming pools, driveways and buildings. (In the case of ETA beds: <12m if up-gradient and <6m if down-gradient of property boundaries, but 6m/3m as above for pools etc)	Maximise buffer to the feature Secondary treatment and site dependent, disinfection of effluent
Run-off/seepage entering site from above	minor	major, where diversion not practical	Swales, diversion drains
Flooding Potential	Disposal system above 1 in 20 year flood contour AND Treatment system above 1 in 100 year flood contour	Disposal system below 1 in 20 year flood contour OR Treatment system below 1 in 100 year flood contour	Pump out of 1:20 year flood zone
Site Drainage	No visible signs of surface dampness	Signs of surface dampness	If due to shading, trim trees or find alternative area
Vegetation indicating waterlogging	Absence of sedges etc that indicate waterlogged soil	Presence of sedges etc that indicate waterlogged soil	Secondary treatment
Surface Condition	No bare ground or cracking	Bare ground or cracking	Secondary treatment
Fill	Disposal area not on fill	Disposal area contains fill	Attempt to find alternative area
Erosion/Mass Movement	No sign of rills, slips	Rills, slips	Promote appropriate vegetation growth

Table 7. Soil Limitations

Soil Feature	No limitation	Limitation	Potential Management Response
Carry over from previous table ✓ ***or*** ✗			
Soil Category	Receiving soils for primary treated effluent: Soil Categories 1-5 excluding mod. or weakly structured light clays. Receiving soils for secondary treated effluent: Soil Categories 1-5	Receiving soils for primary treated effluent: Soil Categories 5,6 excluding strongly structured light clays Receiving soils for secondary treated effluent: Soil Category 6 (as noted: dispersive or shrink-swell soils are to be considered as Soil Category 6 soils)	Secondary treatment
Coarse Fragments Coarse fragments, rocks, boulders impede absorption	Occupies <20% of soil volume	Occupies >20% of soil volume (Need to increase Soil Category by one class - See Table 4)	Increasing Soil Category means increasing disposal area
Field pH (Raupach mixed indicator/barium sulfate) pH extremes inhibit plant growth	>5.5	other	Secondary treatment. Conditioning with lime may assist if pH<5.5
Dispersiveness using modified Emerson Aggregate test	Class 1 or 2	Class 3 or 4	Secondary treatment. Soil amelioration with gypsum.
Soil Depth	Soil depth of >1m before bedrock or groundwater is encountered	Soil depth of <1m before bedrock or groundwater is encountered	Secondary treatment and irrigation (subsurface, spray etc) with disinfection.

➢ ***Site Evaluation and Soil Assessment Step 1***: Fill out the Site Assessment form.

Table 8. Recommended Site Evaluation Form, with sample fill-in

SITE ASSESSMENT		
Details of Proposed Development	*On-site septic system for household of 4*	
Address Lot, DP Number	*Lot 0, DP 00000*	
Local Government Area	*Lismore City Council*	
Date of assessment	*15 Nov 2011*	
Proposed Water Supply **(see Appendix B)**	*On-site roof water harvesting*	
Recent Weather Conditions	*Mostly dry with intermittent light rain*	
SITE DESCRIPTION		
Allotment Size	*5 ha*	
Existing Vegetation	*Cleared paddock with some light scrub*	
Slope (%)	*4%*	✓
Landform (for water spreading)	*Hill crest*	✓
Exposure	*North facing, exposed to sun and wind*	✓
Boulders/Floaters/Rock Outcrops	*None*	✓
Buffer Distance	*35 m to dry gully*	✗
Run on and Upslope seepage	*None*	✓
Flooding Potential Above 1 in 20 year for disposal area and above 1 in 100 year for treatment system	*None, as site is situated on a hill crest*	✓
Site Drainage	*Good. No channelled runoff to neighbouring properties.*	✓
Vegetation indicating waterlogging	*No sign of sedges*	✓
Surface Condition Bare ground, cracking etc	*Grassed*	✓
Fill	*None*	✓
Erosion/mass movement Rills, slips etc	*Signs of mass movement, but long since stabilised*	✓
Limitations	**Overall : no limitations = ✓, limitation(s) = ✗** **If there are any limitations in the above tick boxes, place a cross in the box at right, otherwise a tick.**	✗
Depth to Water Table	*>10m*	

➢ ***Site Evaluation and Soil Assessment Step 2*:** Fill out the following Soil Assessment form. A minimum of **two boreholes** are to be dug to a depth of no less than 1000mm in the land application area to examine the soil profile. Boreholes should be spread out and preferably representative of the highest and lowest areas within the land application area. Additional boreholes must be dug and assessed if there are marked soil differences between boreholes. The location of boreholes must be identified in the report.

Table 9. Recommended Soil Assessment - with sample fill-in

SOIL ASSESSMENT								
BOREHOLE no.:	*1*							
SOIL UNIT (Morand ,1994):	*Georgica*							
Horizon	**Depth (mm)**	**Texture**	**Structure**	**Colour**	**Soil Category** (cf. Texture)	**Coarse Fragments**	**Soil pH**	**Dispersive Class**
A	*0-20mm*	*Clay loam*	*Moderate*	*Red-brown*	*4*	*None*	*6*	*1*
B	*20-1000*	*Light Clay*	*Moderate*	*Red*	*4*	*None*	*6*	*1*
		Tick box:	**no limitation** **limitation**	= ✓ = ✗	✓	✓	✓	✓
					Over all:	**no limitation** **limitation(s)**		✓

SOIL ASSESSMENT								
BOREHOLE no.:	*2*							
SOIL UNIT (Morand ,1994):	*Georgica*							
Horizon	**Depth (mm)**	**Texture**	**Structure**	**Colour**	**Soil Category** (cf Texture)	**Coarse Fragments**	**Soil pH**	**Dispersive Class**
A	*0-20mm*	*Light Clay*	*Strong*	*Red-brown*	*5*	*None*	*5.5*	*1*
B	*20-1000*	*Light Clay*	*Strong*	*Red-brown*	*5*	*None*	*5.5*	*1*
		Tick box:	**no limitation** **limitation**	*(✓)* *(x)*	✓	✓	✓	✓
					Over all:	**no limitation** **limitation(s)**		✓

***Site Evaluation and Soil Assessment Step 3* - does the site have any limitations? :** The final tick in the last row of the Site Evaluation and Soil Assessment forms indicates that the site or soil has no limitations for effluent disposal. A cross indicates at least one limitation. Limitations determine the acceptable design loading rate for the effluent. This information is used in running the computer model which sizes the area required for effluent land application.

Table 10. Final determination of site/soil limitation (illustration only)

	Tick box: **no limitations exist *(✓)*** **limitation(s) exist *(x)***
Site Assessment (from Table 8)	x
Soil Assessment (from Table 9)	✓
No limitations overall?	x

Guidelines for Land Application (Disposal) Systems

- *Soil Absorption Systems (including disposal trenches and conventional beds)* - commonly used for disposal of primary treated effluent. This system relies on absorption only with no nitrogen uptake by planting and *has limited application under the strategy* because of possible groundwater contamination from pathogens and nutrients. Some clay soil types found in the local area also limit their use. Effluent is to be evenly distributed throughout disposal beds, which must be large in area to achieve adequate treatment.

- *Evapotranspiration/Absorption Beds* - used for the application of primary or secondary treated effluent. The designs are based on the principle of maximising water and nutrient uptake via a grass coverage. Effluent is to be evenly distributed throughout the beds.

  ETA beds are the *preferred option* due to their low energy and maintenance requirements. ETA Beds are to be centrally fed and to be located on slopes not exceeding 15%.

  Should the site slope exceed 15%, engineering of the site to accommodate ETA Beds may be permissible if supported by comprehensive engineering plans.

- *Surface Irrigation Systems* - used for tertiary treated effluent. The potential for public health and environmental problems is of concern. Effluent must be evenly distributed and sprinkler plume height must not exceed 1m.

  Application will only be approved in particular circumstances where the concerns are negated by verification of long term compliance with disinfection standards and measures to prevent contact with site occupants, crops and water supplies. Typical approval would be on in a designated irrigation area on a large rural property.

- *Sub-Surface Drip Irrigation* - used for tertiary treated effluent. Effluent is applied to the root zone (250mm to 100mm) of vegetation to increase nutrient uptake, treatment and evapotranspiration. The irrigation system design is to be certified by an appropriately qualified and experienced irrigation designer and installed by a qualified person. Effluent is to be evenly distributed throughout the disposal area.

- *Irrigation Design Considerations* – the design must consider items, such as, site constraints, block size, drainage of laterals at pump shut down, nitrogen and phosphorus loads, buffer distances and a maximum run-off of nitrogen of 15 kg/N/ha.

  Details of the computer model that is to be used to size the land application areas can be found on Council's webpage.

5.4.4 Calculating the Land Application Area

A computer model is provided by Lismore City Council to calculate the area required for effluent disposal. The spreadsheet page showing the calculated area must be submitted with the application. The parameters used are drawn from many sources, including the on-site soil evaluation. See the *User Manual for Daily Disposal Model* on Council's webpage for the theory and operation of this model. Table 8 is a sample determination of site and soil limitations illustrating that a site must have a perfect score on all site and soil points to qualify as "limitation-free".

In rare instances where primary treatment only is allowable or feasible *and* there are absolutely no site or soil limitations, the Maximum Rate of DLR is permissible (Table 4).

The model will not allow operation for Soil Category 6 (Medium to Heavy Clays, or dispersive or shrink-swell soils). To calculate the effluent disposal area in this situation it will be necessary to provide secondary treatment of effluent, and to ameliorate soils if they are dispersive (see Table 9 Soil Limitations), then to apply the computer model as though the site had a weakly structured Light Clay soil with DLR value of 5mm/d.

All modelling must be based on the most limiting soil profile layer to 1m in depth.

REFERENCES

AS/NZS1547 2012. *Australian/New Zealand Standard™ : On-site domestic-wastewater management*. SAI Global Limited under licence from Standards Australia Limited & Standards New Zealand, Sydney NSW 2001 & Wellington NZ 6140.

Davison, L., Bayley, M., Kohlenberg, T. and Craven, J. 2002. *Performance of Reed Beds and Single Pass Sand Filters with Characterisation of Domestic Effluent: NSW North Coast*. NSW Department of Local Government's *Septic Safe* Scheme, Lismore City Council, Lismore Water, Lismore NSW.

E&HP Guidelines 1998. *On-Site Sewage Management for Single Households*. Dept. of Local Govt, Environmental Protection Authority NSW, NSW Health, Dept. Land and Water Conservation, Dept. of Urban Affairs and Planning.

Emerson, W.W. 1967. A classification of soil aggregates based on their coherence in water. *Aust.J.Soil Res.* **5**: 47-57.

Gersberg, R.M., Elkins, B.V., Lyons, R., Goldman, C.R., 1986. Role of aquatic plants in wastewater treatment by artificial wetlands. *Water Research* **20**, pp. 363-367.

Grant, N. and Griggs, J. 2001 *Reed beds for the treatment of domestic wastewater*, CRC, London.

Morand, D.T. 1994. *Soil Landscapes of the Lismore-Ballina 1:100000 Sheet*. DCLM, Sydney.

NDLG 2000. *The Easy Septic Guide*. Developed by Social Change Media for the NSW Department of Local Government.

Northcote, K.H. 1979. *A Factual Key for the Recognition of Australian Soils*. Rellim Technical Publications, PO Box 1619 Coffs Harbour, NSW 2450.

Patterson, R. 1998. *Soil Capabilities for On-Site Wastewater Treatment and Disposal*. Lanfax Laboratories, Armidale NSW.

Reed, S.C., Crites, R.W. and Middlebrooks, E.J. 1995 *Natural Systems for Waste Management and Treatment*, McGraw Hill, New York.

United States Environmental Protection Agency, 1999. *Wastewater Technology Fact Sheet – Intermittent Sand Filters*. EPA Office of Water, Washington, D.C. EPA 832/F-99-067.

This page is intentionally left blank

APPENDIX A

Treatment Systems

APPENDIX A: Treatment Systems

CHOOSING A TREATMENT SYSTEM

On-site sewage and wastewater management is summarised in the following diagram:

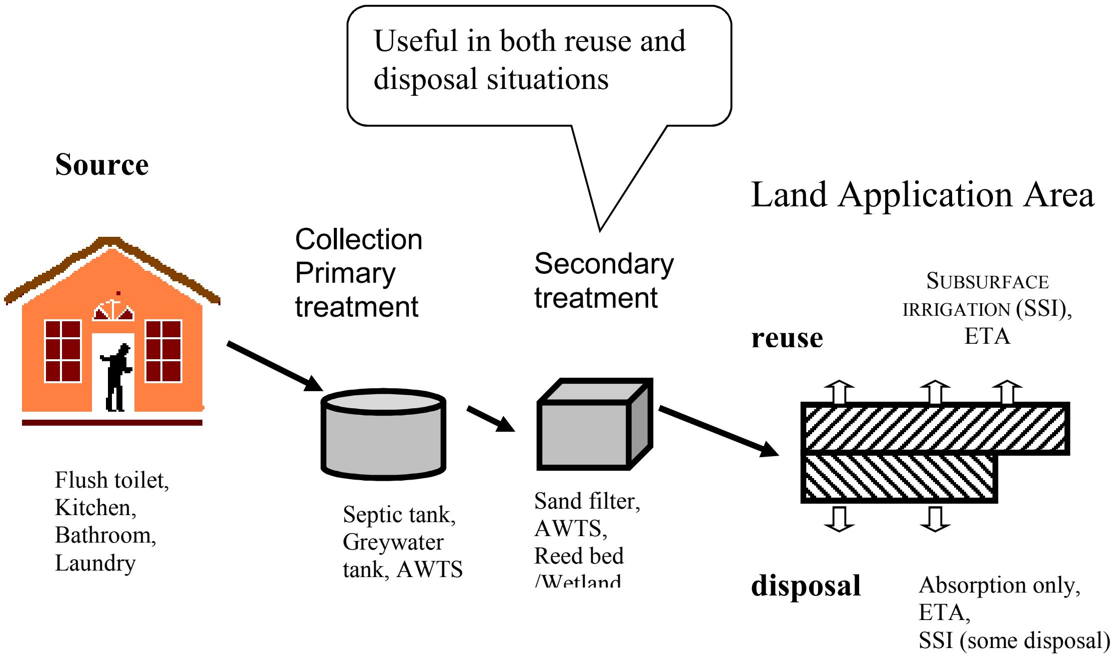


Figure 1: The Treatment Train

There are a number of different treatment systems available in the Lismore Council area and the performance of these can vary due to climatic conditions, population characteristics, loading cycles, human dietary habits, and influent quality.

In regards to the maintenance of these systems it should be pointed out that these systems are "living" systems that rely on micro-organisms to treat the effluent to varying degrees. The heavy use of chemicals in these systems will lead to a reduction in the systems treatment performance.

The types of on-site disposal systems are listed below:

1.0 SEPTIC TANKS

The septic tank used for single houses is a small anaerobic oxidation plant, which removes suspended solids from the wastewater and breaks them down anaerobically. The resultant effluent is low in settled solids but high in biological oxygen demand (BOD) and requires biological treatment before release to the environment. The septic tank to be installed must have at least one internal buffer.

Other solids settle to the bottom of the tank, whilst most fats, oils and greases float, and the middle zone of wastewater within the tank overflows to the disposal beds. Natural enzymes can be added to the system to promote natural bacteria, reducing the amount of sludge and therefore increasing the time between the pumping out of the tank, and reducing the smell of the tank.

Induct vents are no longer required on septic tanks due to these structures allowing flies and mosquitoes to breed in the tank (E&HP Guidelines, 1998). Due to the larger septic tank size, (>3000L) grease traps are no longer required. The smaller tanks were found to be too small to trap grease effectively. With the larger tanks the kitchen wastes can be connected directly into the septic tank with a baffle installed.(E&HP Guidelines, 1998).

All new septic tanks and those requiring upgrading are now required to have an effluent filter installed on the outlet of the septic tank. It is advised that the effluent filter is fitted to the outside of the septic tank to allow ease of maintenance. Also, the owner does not have to put their hands in the system.

The location of the septic tank must be at a greater distance than 3m from any building. Allowances must be made for easy access to the tank in order for the pumping contractor to get a truck near the septic tank so that the contents of the tank can be pumped out (desludging the tank).

All septic tanks need to be manufactured in accordance with Standards Australia, and have an appropriate AS Standards Mark. Lists of the currently approved tanks are available from the NSW Health Department website at**:**
http://www.health.nsw.gov.au/publichealth/environment/water/waste_water.asp

While alternate tank shapes are mentioned in the standard, in the Tweed Richmond region there are only cylindrical tanks available “off the shelf”. Cast-in-situ tanks are specified in Section 7 of AS1546. The NSW Health Department Register certifies manufacturers of the septic tanks and collection wells.
The Australian Standard for septic tanks is AS1546 (1998). Septic tank sizes are nominated for domestic flows of up to 14,000 L per week or daily flows of 2000 L. AS1546 states that the function of a septic tank is to provide a relatively still zone of adequate size for all domestic flows. Scum and solids are separated from the wastewater flow and must be periodically removed. The serviceable life of the tank is stated as 15 years. The minimum tank sizes are stated below.

Table A1: Conventional Septic Tank Capacities (Litres)

Type of Wastewater	**1 to 5 Persons**	**6 to 10 Persons**
All wastewater	3000	4500
Greywater only	1800	2700
Blackwater only	1500	2500

Split systems are recognised in AS/NZS1547 (2012) and AS1546 (1998).

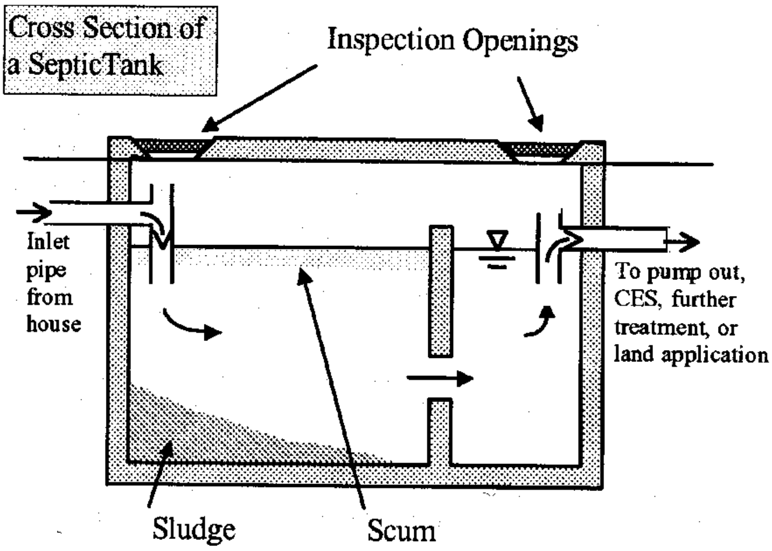


Figure 2: Cross Section of a Septic Tank

1.1 Maintenance for Septic Tanks and Trenches/ETA Beds

For longevity of the on-site sewage management system the following maintenance regime should be employed by the owner/occupier of the dwelling.

- Bleach, bleach-based products, whiteners, nappy soakers and spot removers shall not be disposed of into the on-site system. They shall be disposed of on a disused area of a garden, well away from the disposal area.
- The effluent filter is to be checked monthly and regularly cleaned.
- It will be necessary to have the contents of the septic tank pumped out on average every three (3) to five (5) years. Generally speaking households of meat eaters would need to pump out their septic every 3 to 5 years and vegetarians every 4 to 6years.
- Ensure that the septic tank is mosquito and fly proof.
- Hygiene products, condoms, tampons, sanitary napkins, disposable nappies and cotton buds and the like shall not be disposed of via the on-site disposal system. They should be disposed of into garbage bins in sealed plastic bags.
- Only the recommended amounts of disinfectants should be used. Biodegradable products for septic systems are recommended.
- The septic tank should be serviced annually including the assessment of sludge and scum levels, and checked for blockages of the outlet and inlet square junctions on a regular basis, at least annually.
- Runoff diversion banks to be inspected annually and maintenance as required undertaken to ensure that surface runoff is diverted around each of the disposal areas.
- No vehicular, stock or pedestrian access should be made across the disposal field.
- Vegetation from the irrigation area needs to be harvested to promote young growth and the area may need to be replanted with new plants every five years, depending on plant condition. This work should be undertaken during dry season (August to October).
- Effluent from disposal system should not be discharged to the stormwater system or over the ground.
- The effluent distribution pipes and aggregate are to be inspected for blockage etc. and flushed clean or replaced as required.

1.2 Warning Signs of Possible Troubles

If any of the following signs of system failure occur contact a plumber as soon as possible:

- surface ponding and run-off of treated wastewater.
- degradation of soil structure - e.g. sheet and rill erosion, surface crusts, or hard surfaces are evident.
- poor vegetation growth in land application area.
- unusual odours.
- wastewater is backing back up into the house.
- drain pipes that gurgle or make noises when the air bubbles are forced back through the system.

2.0 EFFLUENT FILTERS

An effluent filter is a plastic tube type filter used to reduce suspended solids to a level of about 30 ppm or less and reduce the potential for carry over of suspended solids into the disposal area. This will help prevent the voids in the disposal bed from clogging. Types of effluent filter currently used in the Lismore City Council area are Biotube, Taylex, Zoeller or Zabel filters. There are more advanced filters coming onto the market and it could be argued that these are treatment systems. However, it should be noted that an effluent filter does not provide secondary treatment of the effluent, in spite of some manufacturers' claims.

It is recommended that the effluent filter is fitted to the outside of the tank so that owners do not have to place their hands in the tank, and for ease of maintenance. This can be used by fitting a "U" trap on the outlet.

3.0 AERATED WASTEWATER TREATMENT SYSTEMS

Aerated wastewater treatment systems (AWTS) have become more common following NSW Health Department certification in 1983. These systems employ anaerobic and aerobic processes. They have multi-chambered tanks, which provide primary treatment through settling and an aeration process. They typically settle solids and float scum in an anaerobic chamber, much like a septic tank, then aerate in a second chamber. The aerobic process consists of injecting compressed air into the effluent for secondary treatment. Disinfection usually consists of chlorination in the collection chamber.

Some AWTS include an activated sludge process that enables the breakdown of sludge and a theoretically better effluent quality without the need for periodic de-sludging. The aerated section of the AWTS oxidises the wastewater and organic matter is consumed. A clarification process is carried out through secondary settling of solids.

There are a number of systems which are certified by the NSW Health Department pursuant to Clause 41 Local Government (General) Regulation 2005. The minimum size for AWTS tanks would be in accordance with accreditation from NSW Department of Health. The AWTS to be installed will be approved by the NSW Health Department.

It should be noted that AWTS's are accredited with disinfection i.e. chlorine tablets or UV and that this disinfection device cannot be removed because the disinfection is part of the systems accreditation requirements. Also in the case of chlorine, the chlorine helps control algal growth in the pipe work.

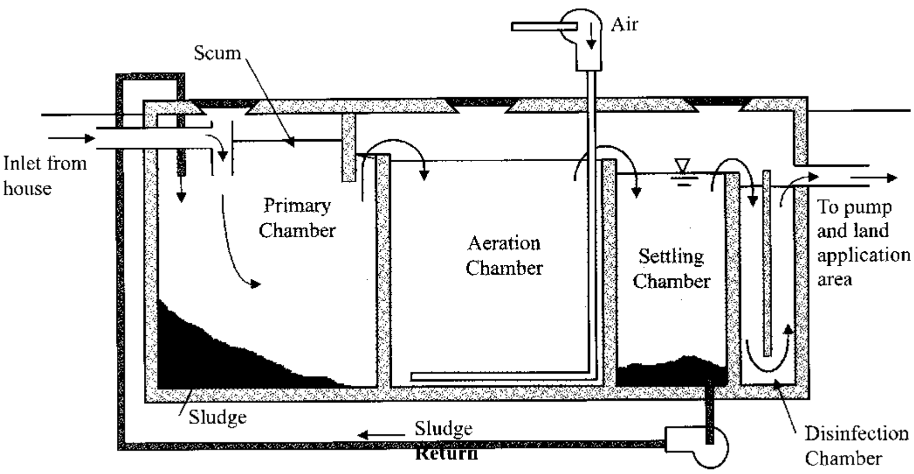


Figure 3: Cross Section of an AWTS

3.1 Maintenance of the Aerated Wastewater & Other Treatment Systems

Regular servicing and maintenance is required, commonly on a quarterly basis. The owner therefore must enter a service contract with a service agent.

A copy of the service report is forwarded to Council within 7 days from the date of service.

At each service, the treatment system and effluent disposal system should be checked, including:

- all pumps;
- the air blower, fan or air venturi:
- the alarm system:
- the operation of the sludge return system, where installed:
- pH from a sample taken from the irrigation chamber;
- check on sludge accumulation in the septic tank (primary treatment chamber) and the clarifier where appropriate;
- a thorough inspection & testing (if appropriate) of the effluent disposal field and all fixtures to ensure operation is in accordance with the approved design;
- a sludge bulking test is required annually if activated sludge or contact aeration is used;
- at the completion of the service a report submitted;
- a complete flush of the land application area.

4.0 REED BEDS (ARTIFICIAL WETLANDS)

For a detailed description of reed beds the reader is referred to Lismore City Council's publication, "*The Use of Reed Beds for the Treatment of Sewage & Wastewater from Domestic Households*".

Surface area
Council will accept a reed bed with a 5 day residence time as a secondary treatment device (i.e. achieving BOD < 20mg/L, TSS < 30 mg/L). Multiple reed beds must be installed in series.

Lismore City Council's Daily Disposal Model allows users to size reed beds accurately.

Reed Bed Construction
There are essentially five functional elements to a reed bed as shown in Figure 6. These are:

- the containment or outer structure;
- the substrate or porous medium;
- the macrophytes or aquatic plants;
- the inlet structure; and
- the outlet structure.

This section describes some of the constraints and possibilities in relation to each of these elements.

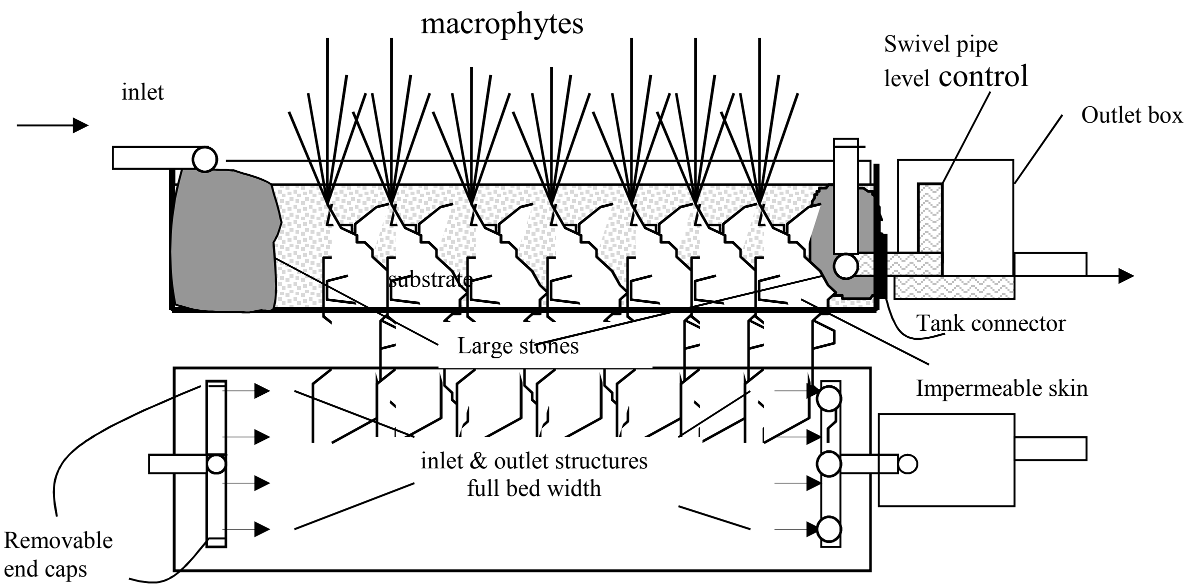


Figure 6: Elevation and plan views of typical horizontal subsurface flow wetland showing major components

Outer Structure or containment

The purpose of the reed bed skin is to prevent the escape of partially treated wastewater and the spread of macrophytes from the bed while excluding surface water, groundwater, adjacent soil and weeds. It therefore needs to be impermeable, durable and be able to resist penetration by macrophyte roots. Materials that have been used on the NSW North Coast include fabricated reinforced concrete slabs, ferro-cement, stainless steel, polyethylene cattle troughs, fibreglass troughs, sealed concrete blocks laid on concrete slab, and in the past flexible liner membranes.

The use of a liner membrane is not allowed in the Lismore City Council area due to poor workmanship, indications that the liner will not last 15years (as required by the Local Government Act 1993) and evidence that voids behind the liner can provide penetration sites for macrophyte rhizomes. *Pharagmites australis* has a particularly penetrative rhizome and has caused problems in this respect with at least two flexible liners in NSW reed beds having been penetrated by *Phragmites* roots.

The edge/lip of the reed bed needs to be constructed in such a way that overland flow is diverted around the bed. In some cases gravel drains/trenches are placed around the reed bed or swales constructed above the reed bed to divert stormwater away from the reed bed.

Substrate

The choice of wetland substrate will depend on the type and quality of influent and the desired quality of effluent. Gravel of 20 mm diameter is commonly used for domestic wastewater. As a rule, media consisting of larger particles will have higher hydraulic conductivities and be less prone to clogging. It is advisable to place larger stones/rocks, >50mm, around the inlet and outlet pipes to allow for ease of checking for root intrusion and in the case of 20mm gravel to limit the possibility of clogging. Ideally 20mm gravel should be placed away from the inlet pipe. For example, if using molded tubs, the 20mm gravel should be placed in the second and following tubs to reduce the possibility of clogging.

Macrophytes

While there is general consensus in the literature regarding the benefits of macrophyte presence in a bed, there is no agreement on which is the most suitable species. Various macrophytes have been used in reed beds throughout the world with species from the genera *Phragmites, Schoenoplectus* and *Typha* being the most commonly used. Macrophytes that have been used in this region are *Schoenoplectus validus* (river club rush), *Typha orientalis* (bull rush), *Bolboschoenus fluviatilis* (marsh clubrush), *Lomandra hystrix* and *Baumea articulata* (jointed twigrush). Certain reed beds are planted with *Melaleuca quinquenervia*.

Tube stock for most wetland plant species may be purchased from nurseries that specialise in wetland plants. These plants can also be propagated vegetatively by dividing root clumps obtained from existing constructed wetlands.

Inlet structure

The inlet structure for small reed beds, usually a 100mm diameter PVC spreader pipe, should extend almost the full width of the reed bed with large stones placed around it. The large stones/rocks (>50mm) allow easy access for maintenance.

Outlet structure

A simple outlet structure design incorporates a PVC pipe spanning the reed bed width randomly drilled with holes of approximately 15 mm diameter and surrounded by larger stones (up to 100 mm). Figure 1 shows an outlet structure consisting of a series of 150 mm diameter, capped, vertical towers spaced evenly across the width of the bed.

Effluent enters the towers via 15-25 mm diameter holes surrounded by stones > 50 mm diameter. Hand access to the towers is available should clogging of the holes occur. The reed bed is connected to an outlet box containing a device such as a swivel pipe, which can be used to adjust the water level in the reed bed. A series of variable length stand pipes can achieve the same result. In this way the wetland can be flooded to help with control of terrestrial weeds during establishment. Water level lowering can encourage downward root penetration, promoting oxygenation of the lower level of the bed and thereby enhancing treatment at that level. Drying of the upper layers will also enhance breakdown and return to the atmosphere of carbon and nitrogen in organic material trapped in substrate interstices.

Operation and Maintenance

Providing reed beds are properly designed and constructed, they require minimal maintenance. Harvesting of reeds, while not necessary, does promote fresh green growth and thus enhance a reed bed's aesthetic appeal while resulting in increased nutrient removal. This job is easily performed using appropriate PPE, a sharp knife, sickle or whipper snipper. January (after the spring/summer growth flush) and May (prior to dormancy) are probably the optimum harvest times from the perspective of both nutrient removal and aesthetics.

The reeds are cut back to approximately 20cm in height. The cut material can be used as mulch or left on the bed to break down and ultimately contribute to the pool of reactive organic carbon necessary for effective denitrification. In the case of *Melaleuca quinquenervia* the trees should be cut when approximately 2.5metre high and cut to chest level (1.5metres). This will allow them to bush out.

During macrophyte establishment, bed weeding may be necessary. Weeds can be pulled out very easily from the wet gravel. Flooding may be used to drown out terrestrial weeds. Because substrate blockage is the primary failure mode of reed beds steps should be taken to minimize carryover of solids from the primary treatment device. The septic tank should have an effective outlet filter fitted. This filter should be cleaned regularly, sludge and scum levels checked and, when necessary, tank pumpout conducted. Where blockage has already occurred, lowering of the water level has been found to lead to recovery.

5.0 WATERLESS COMPOST TOILETS

Compost is a mixture of decomposing vegetable refuse, manure etc for fertilising and conditioning soils. Dry compost produced from a compost toilet is normally composted again with garden compost before it is used as a soil conditioner in the planted garden. Jenkins (1994) states that the complete elimination of pathogens occurs after both these composting processes. A local study demonstrated the complete destruction of parasites and commensals in the humus of seven composting toilets (Safton, 1996).

Dry composting toilets may be either constructed individually on-site (owner built) following a specific design plan, or commercial units such as the Clivus Multrum and the Rota Loo purchased "off the shelf". All commercial compost toilets in NSW must satisfy the requirements of the *NSW Health Waterless Composting Toilets Accreditation Guidelines 2005.*

Dry composting toilets require a bulking agent such as coarse wood shavings, which need to be applied after each use. This bulking agent also covers the faecal material and aids in reducing any odours from the compost. The toilets are vented and some have mechanical ventilation to ensure good air flow in difficult situations around the compost heap. After a period of time compost is produced from the unit, and removed from a door at the base of the unit.

The subtropical climate of the Tweed Richmond region is suitable for compost toilets all year round. The process is biological and involves micro-organisms attacking the faecal heap and gradually composting the material to humus. The time taken to reduce the material to humus is variable, and the operator of a compost toilet must recognise that the compost heap is a living

entity and needs to be cultivated and protected. There are texts available for those wishing to use a compost toilet and these should be read and understood so that the compost process is encouraged by the household activities.
The use of a compost toilet will remove a significant nutrient and hydraulic component from the wastewater flow of a dwelling or development. The greywater will still need to be collected and treated in an appropriate manner. The reduced flow rates are incorporated into Council's computer model. Greywater can be treated in conventional septic tanks or AWTS or in tanks specifically designed for that purpose.

Leachate from the compost toilet must be directed to the greywater tank or its own designated trench or other suitable disposal alternative. This can actually help the biological process in the greywater tank by adding valuable bacteria. If a reed bed is used the nutrients in the leachate help promote reed growth. Leachate management must be included in any treatment design.

Reference should also be made to the Australian Standard titled "On-site Domestic Wastewater Treatment Units - Waterless Composting Toilets (AS/NZS1546.2, 2001)".

5.1 Maintenance for Composting Toilets

Operation & Maintenance

It is intended that the householder should:

- record the commissioning date of each chamber for multi chamber systems;
- ensure that the toilet lid is closed when the toilet is not in use to control fly breeding;
- ensure that the material is spread evenly over the compost heap;
- ensure that the material is clear of the chute;
- clean the pedestal, with minimal use of water and no use of disinfectants.
- consult the service agent in case of vermin and excessive odour.
- **DO NOT USE SAWDUST AS THE SOLE BULKING AGENT**. This will lead to clogging. Wood shavings are preferred over sawdust as they allow for greater aeration of the compost pile;
- quarterly servicing of the toilet, including a check of the fan operation and check of the amount and spreading of the compost within the compost chamber;
- depending on what type of compost toilet you have, the compost will need to be removed. A Clivus Multrum being used by a family of 5 would need to remove the first batch of compost after 12-18months and then periodically every 6months;
- compost is only to be disposed of after the minimum composting period has lapsed, as stated by the NSW Public Health Certificate. The minimum composting period is twelve months;
- compost should be buried on site under clean friable soil to a depth of no less than 100mm, and in a position which is not subject to erosion or flooding;
- compost must not be buried in an area used for cultivation of crops for human consumption, unless:
    - compost is placed in a separate lidded compost bin providing aeration, for at least three months, with no further addition; and
    - compost has seasoned underground for at least three months;

Checking of the composting toilet should be undertaken periodically and weekly for continuous batch systems.

Compost, including partially composted material must not be removed from the premises unless written consent from the Council is obtained. The Council may specify removal and disposal requirements.

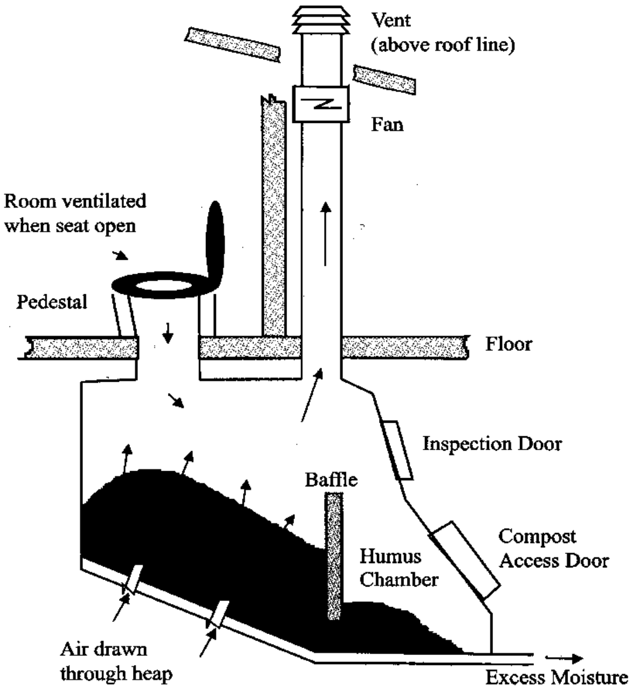


Figure 7: Cross Section of a Compost Toilet

6.0 GREYWATER SYSTEMS

Greywater is the wastewater produced from hand basins, washing machines, showers while black water is that produced from the toilet and kitchen sink. There are many treatment systems approved by NSW Public Health solely for greywater treatment and these systems are designed for re-use in the house usually for toilet flushing and garden irrigation The basic greywater system involves the greywater being collected in a collection tank (minimum size 1800Litres) before being dispersed in a disposal bed. The size of the greywater disposal area will vary depending on wastewater loading and is to be calculated using the Council's computer model. In general the size of land application area required for greywater is less than that of blackwater due to greywater containing fewer nutrients and the blackwater component is not included.

7.0 SEPARATE SYSTEMS VERSUS COMBINED SYSTEMS

There are differing views on the desirability of separate or combined on-site wastewater treatment and disposal systems. The usual split separates greywater from blackwater. Some experts advocate an all waste system in preference to separately treated greywater and blackwater, because of the increased clogging which occurs with greywater alone, due to its higher C/N ratio generating polysaccharides (Laak, 1986 cited in Patterson, 1994).

The use of compost toilets presupposes a separate greywater system. There are situations where the design of the structure and the characteristics of the land require two systems which may or may not be split along strict greywater /black water lines. A combined system is less costly due to the need to purchase only one tank and install one disposal field, particularly if an AWTS is used.

As the minimum size for a septic tank is 3000L the separation of treatment is less economic. On the other hand a separate system provides a longer retention time, hence better treatment, as two separate tanks have a greater combined capacity than one.

8.0 THE HYBRID TOILET SYSTEM

An alternate toilet (blackwater) system is the “Hybrid Toilet System” which incorporates parts of the various other technologies to provide a high quality effluent, with no mains power usage and low maintenance. This technology was developed in Australia by James Cook University, Townsville City Council and others.

The system involves a drop toilet (no flush) into a primary tank where solids are retained and broken down into a liquid form. The effluent passes to a second tank for treatment before being disposed of in an absorption bed disposal area. The system is closed and is not influenced by rainwater other than in the disposal area. The only power is a solar powered exhaust fan. Sludge must be pumped out every 5 years. Both the primary and secondary tank are filled with water at the time of installation. The tanks are sized to provide 43 days storage in the primary tank and 25 days in the secondary tank. The secondary tank contains media with a high void space ratio and incorporates upflow and downflow water features. This intricate flow path ensures maximum contact with the biomass at all times.

9.0 DISINFECTION

There are a number of options for effective long-term disinfection for on-site systems. Chlorination disinfection is most commonly used with AWTS installations. For irrigation systems the effluent must be disinfected and secondary treated. Methods for disinfection include chlorine, bromine and UV radiation. It should be noted that AWTS’s and other secondary treatment devices are accredited with disinfection e.g. chlorine tablets or UV and that this disinfection device cannot be removed because the disinfection is part of the systems accreditation requirements.

10.0 PUMP WELLS

Pump wells are to be sized at a minimum of 1800 litres. One (1) pump systems are acceptable where storage capacity is equivalent to 3 times the daily flow. Two (2) pumps are required for systems with less than 3 days storage.

Note: Alarm systems are mandatory for ongoing maintenance and management of pump well systems.

Pump wells are to be serviced annually and have an overflow trench in case of pump failure. The minimum size of this trench shall be 1.5metres long by 500mm wide by 400mm deep and shall utilise one length of arch trenching (i.e. half round, hoop).

APPENDIX B

Land Application

APPENDIX B: Land Application

The E&HP Guidelines (1998) and AS/NZS1547 (2012) describe the various systems that are available for land application areas in some detail.

Generic sketches (B8-B9) are provided for Evapo-Transpiration Beds incorporating the design requirements of the Lismore Council.

Site and soil-specific parameters largely determine the appropriate system for any given situation. But cost and maintenance requirements also play a part in choosing a system. The strengths and weaknesses of various land application systems are summarised in Table B2.
Common to all systems is the following maintenance principles, to protect land application areas:

Generic maintenance principles

- Do not drive over land application areas, except with ride-on mowers.
- Keep the grass short and trim the vegetation when necessary to let sunlight in, promote plant uptake and remove nutrients from the land application area.
- Keep vehicles and stock i.e. cattle, away from the land application area and fence where necessary.

Table B1: Wastewater Design Flow Allowances

Source	**LCC wastewater design flows (L/person/day)**	
	Roof water harvesting	**Reticulated Supply (inc. bore, spring, creek)**
Households with standard fixtures	**140**	**180**
Households with full water reduction facilities (see Note 1)	**120**	**150**
NOTE 1: For the purpose of this Strategy, Full water reduction facilities are defined as "All water using fixtures having a Water Efficiency Labelling and Standards (WELS) rating of a minimum of five stars, or greater if required by the Basix Certificate that accompanies the Construction Certificate". Installer must produce a certificate demonstrating compliance with this requirement.		

Table B2. **Strengths and weaknesses of land application systems**.

Performance criteria	Absorption trenches	ETA beds	Subsurface irrigation (SSI)		Spray irrigation	Surface dripper under mulch	Sand Mound (includes SSI)
			Pressure Compensating	Perforated pipe in ag.line (shallow trench)			
Application (LCC & AS/NZS 1547:2012)	only on very constrained sites (LCC)	suits clay loams or heavier (AS/NZS 1547:2012)	most sites	most sites	application area remote from human contact on large acreage	suits shrub based landscaping -large acreage only	high water tables or clay soils
Disposal or reuse?	mainly disposal	mainly disposal. Shallow pipes and heavier soils enhance proportion reused	mainly reuse if area sized correctly and appropriate harvest regime implemented	mainly reuse if area sized correctly and appropriate harvest regime implemented	mainly reuse if area sized correctly and appropriate harvest regime implemented	reuse occurs only if appropriate harvest regime implemented	reuse occurs via ET through turf cover. Minimisation of downward flow is usually imperative
Risk to environment (nutrient discharge)	can be high if trenches undersized or in high densities	can be high if beds undersized or in high densities	low	low	low	low	low if correctly designed, built & operated
Power required?	no	no	pump needed	dosing siphon will suffice with >2m fall	pump needed	pump needed	pump needed
Fall of site	some needed	some needed	any	any (with pump)	any	any	site usually flat
Surface area	small	moderate to large	moderate to large	moderate to large	moderate to large	moderate to large	moderate
Maintenance	small, owner can do	moderate –owner can do	high, contractor required	moderate, owner can do	moderate, owner can do	high, owner can probably do	high, contractor required
Construction cost	moderate	moderate	high	moderate	high	high	very high
Minimum level of pretreatment required	primary	primary	secondary	secondary	secondary	secondary	secondary
Intermittent dosing needed?	no	no	yes	yes	yes	yes	yes
Root retardant (herbicide) required?	no	no	yes	no	no	no	Yes, if Netafim or Wasteflow used
Active disinfection (eg Cl or UV) required	no	no	no	no	yes	yes	no
Risk to health (pathogen exposure)	moderate if surface ponding occurs, otherwise low	moderate if surface ponding occurs, otherwise low	low	low	low if disinfection satisfactory, otherwise moderate	low, particularly if disinfection satisfactory	low unless surface ponding occurs at base of mound
Visual impact	hidden	largely hidden - can be landscaped	largely hidden - can be landscaped	largely hidden	visible - can be landscaped	visible - can be landscaped	visible turfed mound, can be incorporated into gardenscape
Awareness? Does the device invite user participation & hence awareness/commitment?	No	No	No	No	Yes	Yes	Possibly

1.0 ABSORPTION BEDS

Absorption trenches are not generally considered appropriate in the Lismore City Council area for effluent disposal.
Comprehensive justification would need to be referenced should an absorption system be proposed.

These beds rely only on absorption of effluent water into the ground. Historically this was the only wastewater disposal method used in the Richmond Region, irrespective of the soil type consisting generally of plastic arch and concrete box. The space in the trench is filled with clean gravel usually sourced from local quarries.

2.0 MOUND SYSTEMS

Mounded systems are effluent drain fields constructed on the surface of the soil from imported fill material, usually washed river sand. Patterson (1994) states that the system can operate with a low rate dosing pump to inject effluent into a distribution system buried on the mound. A gravity fed siphon would also achieve the same result.

The main use of the mounded bed system is in situations where drainage of the natural soil is a problem. Other uses are in locations where low height flooding may occur.
They are used as an alternative to below ground drainage fields. Water disposal is by evaporation and some low level of soil absorption.

Careful consideration would need to be given to the installation of this type of effluent disposal system due to the high rainfall of this region and the adverse environmental consequences of system failure. The mound will need to be turfed to prevent erosion.

3.0 EVAPOTRANSPIRATION/ABSORPTION BEDS (ETA)

These beds (Design 1&2) are a combination of evaporation beds with a permeable base. Lismore City Council encourages the use of mowed grass on the top of ETA beds due to its ease of maintenance, evaporation of effluent reaching the surface and the fact that the vegetation is regularly removed. Shrubs are not recommended to be planted on ETA Beds.

Distribution of the effluent water through the beds is critical as the grass and plants need to be well watered to survive. The soils in the bed may need to be conditioned by the addition of coarse granular sand like material or loam, to improve water movement through the bed.

To encourage the even movement of water, distribution pipes consisting of 100mm slotted pipe are placed in the bed, usually 500mm in from the sidewalls of the bed. The distribution pipes must be centrally fed into the beds and are **NOT** to have geotextile socks fitted to them as this may lead to the pipes clogging.

Where sandy soil is present at the base of the ETA bed, Geotextile fabric must line the base to prevent the ingress of sand into the blue metal.

Even if the pipe is damaged in some way the whole bed is designed to be a large storage area and allow through movement of water both vertically and horizontally. Experience in this region shows that if there is available water in the bed the plant roots do not need to concentrate around the pipes.

Evapotranspiration/absorption beds **DO** require managing in regards to plant harvesting and perhaps plant replacement at regular intervals, e.g. by mowing or pruning to encourage young growth.

The pipes used in this system are generally slotted pipe or arched trenching. Council prefers the use of slotted pipes as they are more rigid than arched trenches and are more easily set level.

Evapotranspiration/absorption beds must be spaced at a minimum separation distance of 2m between beds. Where effluent is distributed through a distribution box a maximum of three ETA beds only will be permitted.

Operation and Maintenance

- Apply the generic maintenance principles outlined above.
- If using a septic tank, have it pumped out every 3 – 5 years to avoid stressing/over-loading the land application system.

4.0 IRRIGATION DISPOSAL SYSTEMS

Sub-surface irrigation (SSI) is considered a high maintenance and high tech land application method and is only considered to be appropriate where there are major site or soil limitations or constraints.

Sub surface drip, surface and under mulch irrigation designs submitted to Council for approval are to be designed and certified by an appropriately qualified and experienced irrigation designer.

All irrigation designs are to include the Irrigation Design Check List (Appendix C). Council will conduct random audits of submissions by referring them to an irrigation technical expert for review. Sub surface drip, surface and under mulch irrigation designs are to be installed by a person with suitable experience in irrigation installation.

All irrigation areas are to be maintained on a quarterly basis as per the condition of approval for the installation. An Irrigation Maintenance Report is to be submitted to Council within 7days of servicing the irrigation area.

4.1 Sub-surface Drip Irrigation

Sub-surface drip irrigation is discussed in the E&HP Guidelines and AS/NZS1547: 2012
(Pages 155 -169) in some detail. Council requires that irrigation systems be designed by an appropriately qualified and experienced irrigation designer.
The irrigation area is to be planted with grass. The soils in the irrigation area may be conditioned with rotary hoeing and addition of sands to break down the soil structure prior to installation. The amount of conditioning depends on the soil type.
The sub-surface drip irrigation area is to be maintained on a quarterly basis as per the condition of approval for the installation.

SSI Designs

SSI Designs when submitted as part of a Section 68 application shall include the following as minimum requirements.

- 2 sets of A3 plans at 1:200
- 2 sets of A3 plans at 1:250

All irrigation designs are to include the following:

- inline filters
- liquid filled pressure gauges either side of the filter
- tech filters
- offset distances to boundaries, buffers , site features, etc
- legend with reference to all irrigation system components
- orientation reference
- contours at 0.5m and relative levels
- overland water diversion swales – batter and berm details
- building positions to further establish the LAA site location
- detail of vegetative cover requirements
- pump performance details and duty points for irrigation and flushing

Other Design Considerations

- Council expects that the design submitted for approval shall be able to be read easily by an installer. If a poor design is submitted to Council it shall be refused and returned to the applicant for amendments.
- The discharge of greywater to SDI without first undergoing tertiary treatment will not be permitted.
- The ability of the proposed pump to deliver effluent and to flush (scour) the lines at a minimum velocity of 0.8m/s must be addressed.

Operation and Maintenance

- Apply the generic maintenance principles outlined above.
- Systems must be serviced quarterly by a suitably qualified person
- An Irrigation Maintenance Report is to be submitted to Council within 7days of servicing the irrigation area.

4.2 Surface Spray Irrigation

Within the Lismore Council area the use of surface spray irrigation of disinfected effluent is not favoured due to public health risks. Consideration for surface spray irrigation will be given for those on-site systems on large acreage where the disposal area is a reasonable distance from dwellings. Other considerations would be for those systems on heavy clay or sandy soils, areas of high bedrock, or water table.

The surface spray irrigation area is to be maintained on a quarterly basis as per the condition of approval for the installation. An Irrigation Maintenance Report is to be submitted to Council within 7 days of servicing the irrigation area.

The irrigation fields usually contain above-ground heavy droplet sprinklers placed in soil-conditioned garden beds with appropriate warning signs. All surface spray irrigation systems will require disinfection. Disinfection involves methods such as, UV radiation, chlorine or bromine.

Operation and Maintenance

- Apply the generic maintenance principles outlined above.
- Systems must be serviced by a suitably qualified person on a quarterly basis
- An Irrigation Maintenance Report is to be submitted to Council within 7days of servicing the irrigation area.

4.3 Surface Dripper under Mulch Irrigation

The Lismore Council area is a productive farming area with many plantations growing a variety of crops. Disposal of wastewater effluent by drippers in plantations is appropriate in some rural applications. Such plantations, with appropriate warning signs, would not be suitable for recreation. Provision should also be made to allow for disconnecting the irrigation line in times of heavy machinery use on the plantation to minimise pipe damage.

These systems must have disinfected effluent and be designed by an appropriately qualified and experienced irrigation designer and installed by a qualified person.
The surface dripper under mulch irrigation area is to be maintained on a quarterly basis as per the condition of approval for the installation.

Maintenance

- Apply the generic maintenance principles outlined above.
- Systems must be serviced by a suitably qualified person on a quarterly basis
- An Irrigation Maintenance Report is to be submitted to Council within 7days of servicing the irrigation area.

4.4 Components used in Land Application Areas

Indexing Valves

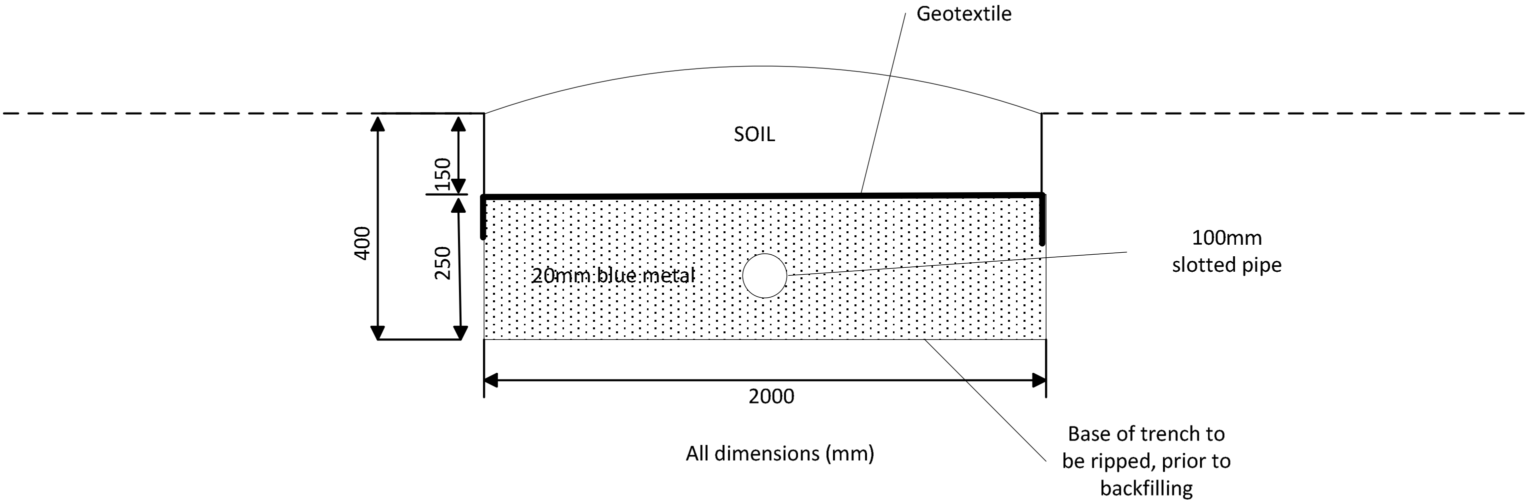
Indexing valves allow multiple land application areas (beds or irrigation areas), to be used. The indexing valve will apply a set volume of effluent to the first application area after which the pump turns off and the valve automatically switches to the second application area where the process is repeated. Indexing valves are used in sub-surface drip irrigation and ETA bed LAA's. This creates a dry/wet effect in the beds allowing for greater treatment of the wastewater.

Dosing Siphons

Gravity-driven dosing siphons are located after the collection tank (greywater or septic tank) and can be used to dose reed beds or ETA beds. Siphons ensure that effluent reaches the ends of ETA beds thus providing even distribution.

Distribution boxes

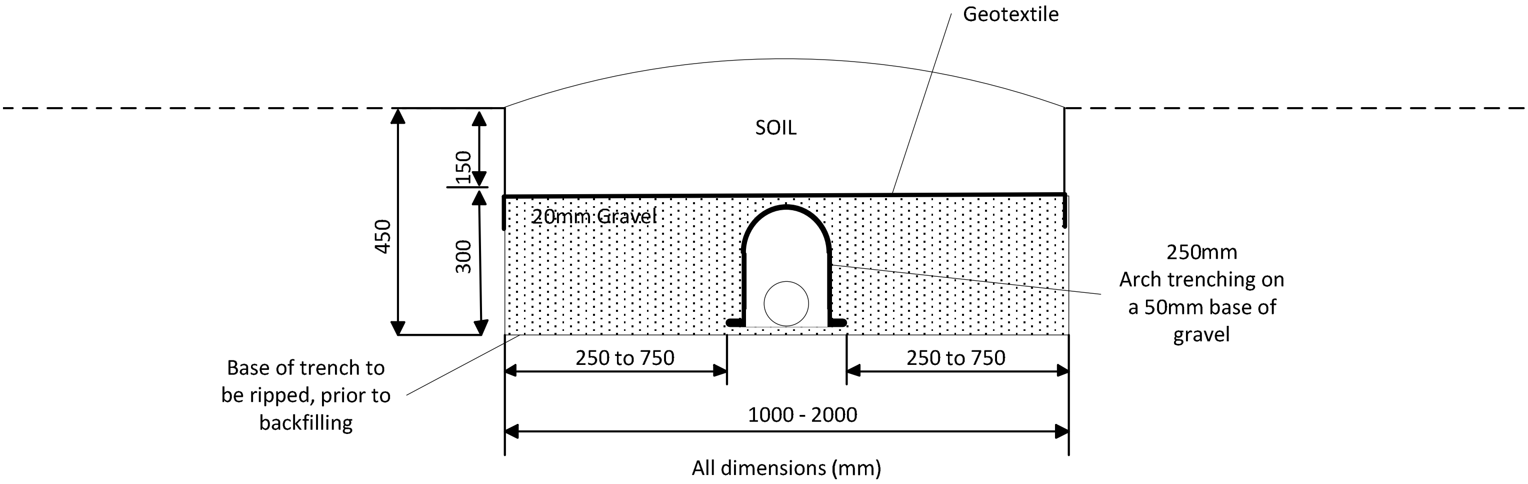
These are concrete boxes used when installing two or more ETA beds and allow for the even distribution of wastewater between the individual beds. Distribution boxes must be concrete and are to be installed level to ensure an even delivery of wastewater to each bed and they must be structurally secured to prevent movement overtime.



Design 1
EVAPO-TRANSPIRATION AND ABSORPTION (ETA) BED

NOT TO SCALE

- ETA Beds are to be centrally fed
- Maximum bed length is 20m
- Only suitable on slopes less than 15%
- ETA Bed is to be grassed
- Vehicles and livestock are to be excluded from ETA Bed area
- Base of the ETA Bed must be level and ripped prior to backfilling
- Swales/bunds/diversion drains must be used to prevent run on/run off
- Heavy clays/puggy or sandy soils require special design features



DESIGN 2
EVAPO-TRANSPIRATION AND ABSORPTION (ETA) BED

NOT TO SCALE

- ETA Beds are to be centrally fed
- Maximum bed length is 20m
- Only suitable on slopes less than 15%
- ETA Bed is to be grassed
- Vehicles and livestock are to be excluded from ETA Bed area
- Base of the ETA Bed must be level and ripped prior to backfilling
- Swales/bunds/diversion drains must be used to prevent run on/run off
- Sites with heavy clays/puggy or sandy soils will require special design features

This page is intentionally left blank

APPENDIX C

Irrigation Design Checklist

APPENDIX C: Irrigation Design Checklist

Property

No. ………. Street/Road……………………………………………………………………………….

Locality…………………………………………………………………………………………………

Lot No. ………... DP/SP/NP No……………………………………………………………………..

Owner(s) Details

Name……………………………………………………………………………………………………

Full Postal Address……………………………………………………………………………………..

…………………………………………………………………Postcode…………………………..…..

Telephone – Private:…………………..……Mobile:……………..……..Business:……………………….……….

………………………………..

………………………………..
Signature/s of **ALL** owners

Effluent management report provided by…………………………..……………………………………..

Irrigation system designer – Company…………………………..……………………………………..

Individual…………………………..……………………………………...

Design Reference No. ………………………..…………………………

Certified by Individual…………………………………………………………………....

Dated..………………………………………………………………………….

ITEM	**UNITS**	**RESULT**			
Number of Persons	EP				
Total Daily Output	l/day				
Nutrient Loading Area	m^2				
Hydraulic Loading Area	m^2				
Soil type	texture/ structure				
Average Site Slope	%				
Long Term Application Rate Allowed	mm/day				
Vegetation	type				
Lateral Spacing	metres				
Lateral Length (Average)	metres				
Lateral Length (Maximum)	metres				
Gross Application Rate	mm/hr				
Number of Irrigation Zones	No.				
Holding Tank Volume	litres				
Pump Out Volume	litres				
Quantity Applied/Irrigation Event	mm				
Irrigation Duration	minutes				
Irrigation Interval	hours				
Distribution Uniformity (Spray only)	%				
Flush Pit	**Volume (m^3)**	**Porosity (%)**			
PIPEWORK	**Material (PE, PVC)**	**Diameter (O.D. mm)**	**Class (PN)**	**Length (m)**	
Mainline					
Submain					
Flushline					
Flushing Main					
Laterals		**Manufacturer**	**Description**	**Emitter Flow**	**Emitter Spacing**
PUMP PERFORMANCE	**Type**	**Model**			
Pump					
IRRIGATION DUTY	Flow		l/min		
	Pressure		metres		
FLUSHING DUTY	Flow		l/min		
	Pressure		metres		
Accessories	**Manufacturer**	**Model**	**Qty**		
Control Valve					
Air Release Valve					
Flush Valve					
Vacuum Breaker					
Indexing Valve					
Filter					
Root Intrusion Inhibitor					
Check Valves					
Pump Starter/Controller					

This page is intentionally left blank

APPENDIX D

Irrigation Certification Checklist

APPENDIX D: Irrigation Certification Checklist

Requirements/Responsibilities

- It is the responsibility of the designer to ensure the irrigation design is fit for purpose i.e. the design is appropriate for the site and application.
- The design needs to be consistent with the associated Effluent Management Report

Before certifying an irrigation design the following information is to be provided to the Certifier
- A copy of the Effluent Management Report.
- The report must contain an accurate site plan and shall include the following;

	TICK
Contours @ no less than 0.5m intervals	
Aspect	
A designated Land Application Envelope	
Upfront acknowledgement of any constraints which in turn will affect the overall irrigation design i.e. distance to buffers, slope %, drainage, trees, soil profile/groundwater etc	
Soil profile details including soil type, texture and structure along with the DIR	

The irrigation system design must meet the following requirements

The design must complement WH&S and ease of maintenance. i.e. above ground tech & disc filters	
Irrigation system must be designed to achieve effective flushing velocity of 0.8 - 1m/s to remove build-up of bio-film and other contaminants.	
Pump efficiency – high frequency watering to be avoided.	
Irrigation system must be matched to a suitable pump – certification must assess proposed pump against irrigation and flushing duties.	
The irrigation design/s and Appendix C- Irrigation Design Checklist must contain the certifiers' signature, design reference no. and be dated.	
Provide two A3 plans: @ 1:150 or 1:200 depending on size of field with detail for installation containing a legend, and one plan @ 1:250 showing the whole land parcel with irrigation zone relative to house, driveway and any other features/constraints.	

Effluent Report Reference - …………………………………………………………………………….

Design Reference No. - ……………………………………………………………………………

Certified By - …………………………………………………………………………………...

Signature…………………………………………………Dated……………………………………..

APPENDIX E

BLANK SITE EVALUATION FORMS

APPENDIX E: BLANK SITE EVALUATION FORMS

SITE ASSESSMENT		
Details of Proposed Development		
Address Lot, DP Number		
Local Government Area		
Date of assessment		
Proposed Water Supply		
Recent Weather Conditions		
SITE DESCRIPTION		
Allotment Size		
Existing Vegetation		
Slope (%)		
Landform (for water spreading)		
Exposure		
Boulders/Floaters/Rock Outcrops		
Buffer Distance		
Run on and Upslope seepage		
Flooding Potential Above 1 in 20 year for disposal area and above 1 in 100 year for treatment system		
Site Drainage		
Vegetation indicating waterlogging		
Surface Condition Bare ground, cracking etc		
Fill		
Erosion/mass movement Rills, slips etc		
Limitations	**Overall : no limitations = √, limitation(s) = ×** **If there are any limitations in the above tick boxes, place a cross in the box at right, otherwise a tick.**	
Depth to Water Table		

SOIL ASSESSMENT								
BOREHOLE no.: *1*								
SOIL UNIT (Morand ,1994):								
Horizon	Depth (mm)	Texture	Structure	Colour	Soil Category (cf Texture)	Coarse Fragments	Soil pH	Dispersiv Class
		Tick box:	no limitation limitation	(√) (x)				
					Overall:	no limitation limitation(s)		

SOIL ASSESSMENT								
BOREHOLE no.: *2*								
SOIL UNIT (Morand ,1994):								
Horizon	Depth (mm)	Texture	Structure	Colour	Soil Category (cf Texture)	Coarse Fragments	Soil pH	Dispersiv Class
		Tick box:	no limitation limitation	(√) (x)				
					Overall:	no limitation limitation(s)		

Please Place a Sketch of the Site Plan Below