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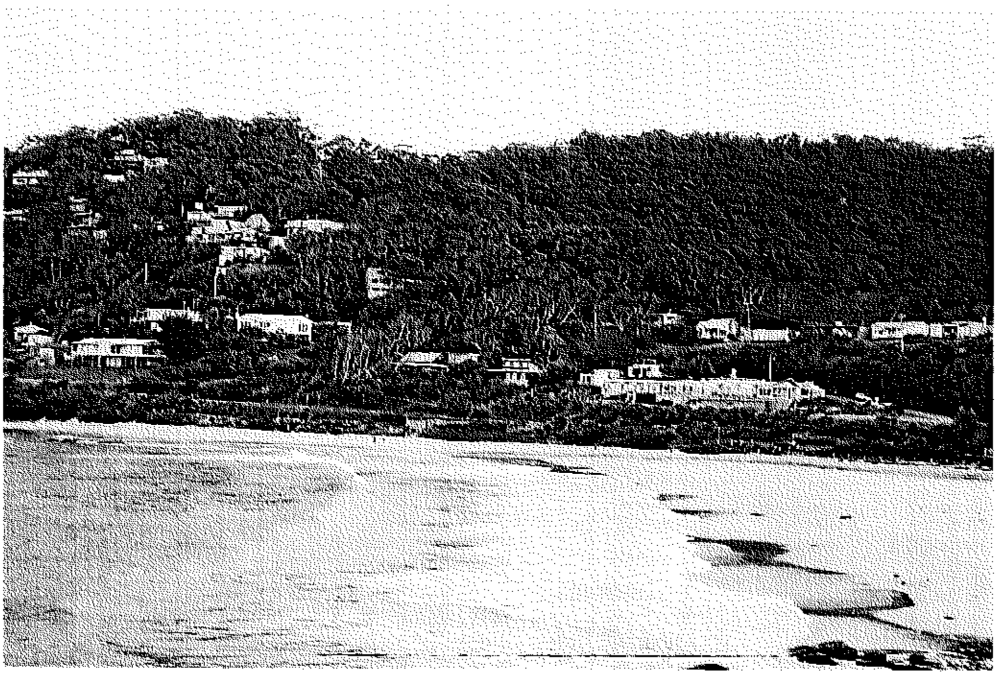

Issues Paper

Wastewater Management

Wye River and Separation Creek

May 2002

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Executive Summary

Colac Otway Shire is committed to assessing and facilitating the development of responsible domestic wastewater management practices in unsewered areas throughout the shire. In the Wastewater Management Strategy (WMS), adopted by Council on 27 February 2002, it was shown that the current practices of wastewater disposal are creating risks to public health, the environment and future development.

The WMS compared the collective risks associated with wastewater systems in 8 townships (Skenes Creek was not included, as it is due for sewerage in late 2004). Wye River and Separation Creek were considered the highest risk in regards to site conditions, the current condition of wastewater systems, township characteristics, public health and environmental concerns.

This report is an Issues Paper to assist all stakeholders including property owners, policy makers, planners and regulatory and enforcement agencies in developing and implementing a long term, sustainable and manageable strategy for domestic wastewater systems.

This report will be used as a basis for stakeholders to understand and determine the most appropriate wastewater system to minimise risk. Community values will be articulated within the consultation process and then used as a determinant for the most suitable wastewater system options.

The outcome from this report will be to prepare a Strategic Plan for wastewater systems in Wye River and Separation Creek. This Strategic Plan will define the future direction of wastewater systems.

Findings from initial studies into the existing wastewater systems of Wye River and Separation Creek have identified the following risks:

- The volume of sullage and effluent being discharged off-site into street drains.
- Offensive conditions, such as odour, potential mosquito breeding areas, and the ponding of sullage and effluent.
- The wide variety and age of waste water disposal systems that operate at varying levels of effectives, treatment and compliance.
- Most systems, using effluent trench disposal, will have reached their life expectancy within the next ten years.

- Disposal trenches installed in the past are insufficient in length (under current guidelines).
- An increase in occupation rates is likely to create increased failures in septic systems.
- Future development and re-development will be limited, even stopped, on 96% of blocks.
- Water testing has indicated that there are concerns regarding future public health safety.

This information will be used as background data to inform property owners of the risks associated with retaining existing wastewater disposal systems.

The scenarios for on-site wastewater systems, mentioned on page 41 of this Issues Paper, provide improvements on current conditions. There is no guarantee that the systems will provide a sustainable wastewater process for the lifetime of the development. Ultimately, the only way of ensuring a long-term environmentally sustainable method of wastewater management in Wye River and Separation Creek is to introduce the most appropriate off-site process that satisfies community values and minimises the risks of slope instability and maximises environmental sustainability.

1. Introduction

This Issues Paper commences Phase 2 of the Colac Otway Shire strategy for reducing the risks associated with wastewater disposal in unsewered townships throughout the shire. Phase 1 was the adoption of *Colac Otway Shire Wastewater Management Strategy, February 2002*, which can be accessed on Colac Otway Shire's website: www.colacotway.vic.gov.au)

Aims

The aims of this Issues Paper are to:

- Inform stakeholders of the risks involved in unsewered areas;
- Outline the process of performing an environmental and social assessment of centralised, decentralised and on-site wastewater systems over their whole life.
- Consider wastewater options that result in low environmental, public health and social impact risks for the community of Wye River and Separation Creek.

Objectives

This Issues Paper is prepared to give property owners and other stakeholders an opportunity to:

- Understand current wastewater treatment and disposal systems.
- Understand the future risks of these systems.
- Reassess and define stakeholder values.
- Understand options for the upgrade of existing systems and/or the installation of new wastewater technology.
- Participate in developing a wastewater plan for the future.

Research

The preparation of this report involved:

- investigation of current waste water disposal practices in Wye River and Separation Creek and their risks on public health, the environment and development;
- research of legislation, guidelines, stakeholders, previous and proposed strategies; and
- research of options for long term sustainable wastewater systems.

Consultation Process

The proposed consultation process is to develop outcomes from this Issues Paper, which draws background information from the *Colac Otway Shire Wastewater Management Strategy, February 2002*, as well as, provide information on alternative systems of wastewater treatment and disposal. The Issues Paper will be made available a minimum of 4 weeks prior to the community forums. Comments regarding community values, the preferred options for wastewater disposal and any other comments relevant to the Issues Paper will be received in writing until **Friday 19 July 2002.** Comments, discussion and preferred options identified at the community forums will be recorded and used as part of the feedback process. It is hoped that many of the property owners and townsfolk can attend the forums and contribute or listen to the discussions.

Copies of the Issues Paper will be distributed within the community. The paper will also be available for viewing on Colac Otway Shire's Internet Website www.colacotway.vic.gov.au. A pamphlet advising of the contents of this Issues Paper will be forwarded to each property owner in Wye River and Separation Creek.

At the end of this period two community forums will be held. One will be in Wye River the other to be in Melbourne. The objectives of these forums are to:

- Present background information.
- Determine values that are important to the community (the final wastewater option must match these values).
- Determine the most appropriate wastewater options to consider.

These community values and wastewater options will be developed into a Strategic Plan for further community discussion. Professionals in the respective fields of the wastewater options will provide input into this Strategic Plan. The Strategic Plan will be distributed similarly to the Issues Paper mentioned earlier.

Community forums will again be held to discuss the information and options. Professionals for the respective wastewater options will be in attendance to answer questions.

Following these meetings a survey will be distributed to all township property owners to vote on a preferred option. The results of this survey will determine the next course of action. If the vast majority approve one option then the relevant organisation/authority will be notified and requested to make provisions for the installation of that system or systems. If there is inconclusiveness then the results will be recorded and reported back to Council with recommendations for future action.

2. Background

2.1 Natural Environment

A fundamental consideration when designing a domestic on-site wasterwater system is the natural environment and its potential impact on the system. These natural constraints include the physical characteristics of the site, its geology, soil type, the township topography, climate, ground water and water balance.

Physical Characteristics

When considering site suitability for wastewater disposal it is necessary to have suitable physical factors. These factors are influenced by lot size, slope of the land, the soil percolation rate, depth to the Winter/Spring water table, and the annual rainfall. If one or more of these factors are unsuitable an application for installation for a septic system may be refused.

Geology

Wye River and Separation Creek are located within deposits of rock known as the Otway Group which formed approximately 100 million years ago in the Lower Cretaceous period. The sedimentary composition of the Otway Group is sandstone, siltstone, mudstone and shale.

The Otway Group is regarded as the most landslide prone of the geological units within the Shire. Landslides occur in both the rock and the soil materials, even where the rock is not significantly weathered (Wood, 1982).

Soil Type

The hill slopes generally consist of two main soil types; brown gradational soils and brown duplex soils. North and west facing slopes and some upper slopes have brown gradational soils that consist of dark-brown loam surface soils which grade into brown or yellowish brown medium clays or silty clays occurs at a depth of around 20cm. Weathering parent material is encountered between 80cm and 130cm. Soil permeability is only moderate and considerable surface runoff occurs after heavy or prolonged rainfall.

South and east facing slopes may develop brown duplex soils. Surface soils are well-structured black loams to fine sandy clay loams, overlaying sporadically bleached loams or clay loams at approximately 15cm depth. At 30cm depth brown or yellowish brown medium to heavy silty clays with strongly developed structure and low dispersibility are encountered. Weathering sandstones and mudstones are found at a depth of about 1m (Pitt 1981).

Topography

Wye River and Separation Creek are located on steep to very steep land, (many properties with slopes over 20°). The township of Wye River rises from sea level to 100m and Separation Creek to a height of 80m. The Wye River watercourse originates from a number of minor tributaries in the Otway Ranges at 600m above sea level. It winds for over 5.5km through the Otway State Forest. Separation Creek commences in the Otway Ranges at approximately 500m above sea level and winds for over 7km though steep valleys in the Otway State Forest.

There is extensive native vegetation within both towns with most developed properties making use of existing flora.

Climate

This coastal region has a temperate climate. Summers are warm and dry, most rain falls in winter. The warmest months are January and February where the mean daily maximum temperature is between 23° and 25°. July is the coldest month with a mean daily temperature of between 11° and 13°. Extreme temperatures above 40° rarely occur.

The average annual rainfall is around 1000mm. This varies from 40mm to 50mm in January and February up to 120mm in August. The Wye River and Separation Creek watercourses commence in rainfall catchment areas of around 1200mm/annum.

Groundwater

The sandstone and mudstone rocks, which underlie Wye River and Separation Creek are regarded as fractured rock aquifer of relatively low permeability. Groundwater recharge occurs through the infiltration of rainfall and ponded surface water.

There is limited information on the depth of the watertable throughout the year but it is expected that due to the horizons of the soil perched watertables can be expected above the clay deposits in the wetter months.

The steep terrain ensures that the groundwater flows in local systems, discharging into nearby streams and ocean.

2.2 Built Environment

Wye River and Separation Creek are considered as one settlement because of their close proximity and urban form, although a major ridgeline divides the two (U.S.E. Consultants Pty. Ltd, Brian Haratsis).

There are 498 blocks within the townships. The vast majority of these are $1000m^2$ or less. Over 77% of the blocks have been developed. Most are domestic properties which are used as holiday homes. It is estimated that less than 15% of Wye River and Separation Creek dwellings are permanently occupied. Whereas, during the holiday season the population may increase to 3500.

There has been an increase in the popularity of bed and breakfast accommodation. It is presumed that a number of properties are available for seasonal rental opportunities and usage by people other than the owners.

Wye River and Separation Creek are serviced with power and telephone. There is no water, sewerage or gas supply.

The road structure is predominantly unsealed roads. There are limited networks of stormwater barrel drains. Most stormwater drainage is by open earth trench systems. Dwellings that were previously permitted to discharge treated effluent off-site, discharge to those open earth drains. Drainage outfall is to the ocean and Wye River and Separation Creek watercourses.

Recreational activities in Wye River and Separation Creek are predominantly environment related and include swimming, surfing, fishing and bush walking. Passive recreation is keenly sought by holiday makers.

Septic systems have been installed for commercial and other non-domestic properties. These include the:

- Rookery Nook Hotel, which operates an Environment Protection Authority (EPA), approved sand filter system that discharges off-site;

- Wye Valley Caravan park with over 227 sites. A new EPA approved commercial package plant has been installed to treat the effluent to a high standard before discharged on-site.
- Foreshore Caravan Park with over 60 sites has a conventional septic tank system. The age, potential lifespan of this system and its impact on the Wye River are unknown.
- The general store has a full kitchen and provides seating for diners. It also has a conventional septic system.

Plate 1: Discharge of grey water to street drain

3. Reports

Preliminary Effluent and Groundwater Schemes for Wye River and Separation Creek

In 1988 the Otway Shire Council requested the Otway Region Water Authority to prepare a paper on the installation of sewerage. This was prepared and released for public comment. There was significant opposition to the proposal for sewerage. The principal reasons for objection were:

- Disagreement that the ground becomes saturated from septic tanks;
- Disagreement that septic systems could be a major risk for landslips;
- Excavation required for the installation of sewerage pipes may increase the risk of landslip; and
- Most properties are only used during the summer months when the ground is dry.

These general themes were included in a report prepared by Hardcastle et al., 22 March 1989, for the Wye River and Separation Creek Progress Association. The report proposed that further investigation was required to identify pollution sources, areas which are constantly saturated and infiltration tests over at least 10 sites to establish a profile of soil absorption rates.

There has been no further work on planning for sewerage in Wye River and Separation Creek since this time. Consequently, Barwon Water (which assumed control of the Otway Region Water Authority in 1997) does not have these townships on its project list for future sewerage works.

Comments/Responses

In 1999 a regular water sampling programme of drain outlets and watercourses was commenced to determine their quality and impact on public health and environment.

Landslide risk management in the Colac Otway Shire was investigated in a report prepared for Council by Dahlhaus Environmental Geology Pty Ltd and P.J. Yttrup & Associates in June 2001.

A subsequent report was prepared by Dahlhaus Environmental Geology Pty Ltd in 2002 to comment on aspects of landslide risk management related to wastewater disposal. 10 Land Capability Assessment reports have recently been entered into a new database to be used to analyse soil profile patterns in the two towns.

Wye River Structure Plan

Colac Otway Shire contracted U.S.E. Consultants Pty. Ltd, Brian Haratsis to prepare the Wye River Structure Plan through a consultative process. Council adopted this report on 12 June 1996. The vision for Wye River and Separation Creek was that they should develop as hamlets which offer the opportunity for visitors, part-time residents and residents to enjoy the attributes of the area to the fullest, without impacting on the natural environment.

Issues and objectives raised in this Plan relevant to wastewater disposal are:

- A need to clarify geo-technical characteristics of all undeveloped settlement properties to identify the extent and location of those allotments that are not capable or suitable for development.
- The limitation of further development over the ridgelines and no further inclusions of private land holdings in the township boundaries.
- The limitation of activity levels by not providing engineering services such as reticulated water, sewerage and underground drainage works. Sewerage should be avoided unless effluent disposal causes public health problems. Sampling is required to benchmark pollution levels.
- A detailed strategy for landscape improvements on public and private land.
- That relatively low development intensities are retained.
- Development guidelines should be prepared to ensure infill subdivisions retain the character of the area.

Comments/Responses

Based on the greater awareness of landslide risk management issues it is recommended that a review of all geotechnical, geological, physiological and environmental aspects of the townships be considered before finally determining the suitability or otherwise of any future wastewater disposal systems and schemes. This review is currently being conducted.

The geo-technical assessment of properties needs to be conducted for all of the Wye River and Separation Creek township, not just for new developments.

This is fundamental when determining future wastewater and stormwater management issues, landscaping proposals and road and driveway improvements.

Risk management requires that alternative wastewater disposal options are implemented before effluent causes public health problems.

Draft Coastal Action Plan

The guiding principles for coastal and estuarine planning and management are to protect significant environmental features, ensure sustainable use of natural coastal resources, provide a direction for the future, and use these principles to facilitate suitable development.

The draft *Central West Victoria Regional Coastal Action Plan, December 2001,* recognises in its Human Settlement Action Plan, page 31, the need to minimise the impact of effluent disposal in coastal settlements. This can be achieved by developing and encouraging the regional application of a septic management system, including the audit of all unsewered townships and improving current monitoring regimes.

Where effluent disposal is impacting on the local coastal marine values a regional forum should be convened on effluent management.

Draft Estuarine Action Plan

The draft *Central West Victoria Regional Estuaries Action Plan, December 2001,* recognises estuaries in Wye River and Separation Creek and the impact that septic tank systems can have through the leakage of potentially harmful bacteria and nutrients into these estuaries.

Geo-technical Report

A report, commissioned by Colac Otway Shire, on the physical elements and slope instability at Wye River, Separation Creek and Kennett River was completed by Dahlhaus Environmental Geology P/L in January 2002. Details from this report have been used when describing the physical characteristics and landslip risks in Wye River and Separation Creek.

A review of all previous landslip assessments in the shire was collected as part of the 2 year Landslip Risk Management study completed in June 2001. Since these previous assessments followed no standard format, interpretation of landslide risk was required. An adopted landslide risk in accordance with guidelines published by the Australian Geomechanics Society (AGS2000), was interpreted for all previous assessments.

The interpreted results estimates there are over 25% of properties in Wye River that have either a high or very high risk level classification, while only 5% of properties in Separation Creek had high or very high risk level classification. These properties require further detailed investigations and extensive implementation of treatment options to reduce the risk to an acceptable level. Moderate risk level classification, which is tolerable provided a treatment plan is implemented to maintain or reduce risks, was estimated for 50% of Wye River properties and 55% of Separation Creek properties. It is estimated that 25% of properties in Wye River and around 40% in Separation Creek had low or very low risks that were usually acceptable without significant treatment plans or remedial works.

Dahlhaus Environmental Geology P/L concluded that the towns of Wye River and Separation Creek are considered to have a significant potential for the occurrence of landslides. This can be exacerbated by a number of factors including on-site wastewater disposal.

The report of Dahlhaus Environmental Geology P/L advises that:

> *Neilson. J.L. concluded in an unpublished report Discussion from Completion Report on Slope Stability Studies at Wye River and Separation Creek, Shire of Otway1992 that minor slope problems are a common hazard in Wye River and Separation Creek although major slope hazards are not widespread. Whilst natural and long term geological processes are involved, other factors such as the cutting of deep cuts into the slopes for road and house construction and water saturation from drainage and liquid wastes must also be controlled to avoid triggering failures.*
>
> *Whilst the degree of saturation of any slope is dependent on a number of climatic and environmental variables including rainfall, evaporation, transpiration, soil moisture deficit, soil/rock permeability and even slope*

angle, the current on site discharge practices can only contribute additional water inputs into the water balance equation.

As yet a detailed water balance has not been conducted these townships.

Planning Controls

The Planning Scheme requires all new dwellings located in unsewered areas to treat and contain their wastewater on-site. For new subdivisions in unsewered areas, planning applications must include land assessments which demonstrates the capability of the lots to treat and retain all wastewater on site.

Therefore, the scheme requires Council to refuse any application for dwellings in unsewered areas where it cannot be demonstrated that wastewater can be treated and contained on-site. There are undoubtedly vacant sites in Wye River and Separation Creek which do not have this capacity. Unless reticulated sewerage, decentralised wastewater systems or the consolidation of properties occur, these blocks may not be able to be developed.

Off site discharge

The condition to restrict off site discharge was defined in the EPA Guidelines for Domestic Wastewater Management 629 (November 1998). The principle guideline was that discharges of treated wastewater to streams or watercourses (this includes drains) of less than 1ML a day was not permitted. This document effectively stopped future off-site discharges.

4. Effluent Disposal in Wye River and Separation Creek

Effluent disposal has been the responsibility of property owners since the commencement of the township. Early disposal methods would have been drop toilets and minimal length of pipework to take sullage away from the dwelling's foundations.

These methods were superseded by split septic systems where only toilet water was required to be treated and retained on site. Sullage or "grey water" which consisted of kitchen waste, laundry waste and bathroom waste was allowed to be discharged off-site to a stormwater drainage system, land or surface water. Over 40 % of properties still use this type of system.

During the last 20 to 25 years all-waste septic systems were required to be installed to treat and retain effluent on site. There was also the option to provide secondary treatment to effluent which may then be discharged off-site to the satisfaction of Council (this practice ceased in 1999 due to EPA guidelines and changes to statewide planning controls). This only occurred on properties that were too small for retaining effluent on-site.

A survey of septic tank systems was conducted in 1999 and 2000. The results indicated that Wye River and Separation Creek have a cross-section of all types of systems, from drop toilets to sand-filters/package plants that treat waste prior to discharging off-site.

From the field observations there were 63 (20%) of systems that discharged some or all wastewater off-site. This leaves 251 (80%) of systems that treat and dispose of wastewater on-site.

Table 1 provides information on the number and variety of septic tank systems.

Table 1 – Septic Tank Systems

Township	No of properties assessed	Types of systems						
		ASFOff	ASFOn	AOS 60m	AON 30m	Other	WC SOff	WC SOn
Separation Creek	77	6	4	15	15	7	3	27
Wye River	237	25	18	30	54	7	29	74
Total	**314**	**31**	**22**	**45**	**69**	**14**	**32**	**101**

Legend – AWSFOff – All waste sandfilter with offsite discharge, ASFOn – Allwaste sand filter with on-site discharge, AOS 60m – Allwaste onsite to 60m drain, AON30m – Allwaste onsite to 30m drain, Other – packaged treatment plants, bioloos and drop pits. WCSOff – Split system with sullage off site, WCSOn – Split system with sullage on -site

Note: Data in this table is from properties that could be accessed and septics were able to be located. This will create inconsistency with the number of properties mentioned earlier in the report.

4.1 Defective Systems

Table 2 provides data on the number of defective systems that were identified during the inspections. This table shows that over 30% of septics have defects. It should be noted that because of the large number of properties involved, officers were simply requested to identify any obvious defects. They were not instructed to conduct the time consuming tasks of testing sand filter and aerated wastewater treated effluent, to ensure that it complied with the standard, or to trace the discharge of effluent off-site.

A review of septic system complaints for Wye River and Separation Creek indicates that properties on the lower side of each street are generally unable to discharge to the street drain. In these cases, when a septic system is unable of containing effluent on-site it is diverted or allowed to discharge onto a neighbour's property. Other complaints are about wastewater odours. These can be attributed to open drains in which wastewater is discharged to and the surfacing of wastewater in backyards.

Table 2 – Types of defect

Type of defect	Separation Creek	Wye River
No of properties	77	237
Tank /sandfilter/effluent drains covered with inappropriate vegetation	2	-
Pooling effluent/blocked drains	1	4
Effluent discharging onto neighbouring properties	2	3
Distribution pit blocked	-	5
More soil required over drains/tanks	-	1
Septic tank not accessible	22	48
Damaged tanks/pits./pipes/effluent drains	2	4
System not complete	-	-
Driveways/other structure over sand filter/effluent drains	-	1
Total	29	66

Defects have included septic tanks that are not accessible. This is because septic systems are more than just tanks and pipes. The monitoring and maintenance of systems are critical to ensure that they are operating effectively. If not monitored, the risk of failure is significantly increased. On a number of site inspections property occupiers were unable to locate their septic tank. This provides the added risk where property development such as extensions, shedding and landscaping may negatively impact on the septic system.

4.2 Age of Systems

Under normal usage conditions, and if well maintained, the effluent drains of a septic tank system are expected to last 25 or more years. After this period new effluent drains may need to be constructed on the property.

The survey showed that on-site effluent disposal via trench systems occurs on 57 properties in Separation Creek and 187 properties in Wye River. Of these 30% are over 24 years of age and 40% are between 15 and 24 years of age.

Using 25 years as the minimum expected life of effluent drains for a septic system these results indicate that in 10 years time 70% of on-site effluent disposal drains will have reached their life expectancy. This suggests that the failure rate for septic systems will increase during the next 10 years.

It has been argued that septic systems in Wye River and Separation Creek are only used on a limited basis and that the effluent trenches will last longer than those used on a daily basis. This may be the case if the flow rates were similar between limited and daily use. However, in many instances this is not the case. Seasonally used homes can have very high flow rates. This can cause solids being transferred from the septic tank to the effluent trenches, thereby causing premature clogging of the walls and floor of the trenches.

Table 3 shows all wastewater systems. In the majority of cases, systems installed with in the last 15 years have been package plants or sand filters that discharge to either on-site trenches or off-site.

Table 3 – Age of Septic Systems

District /Township	<15 yrs	15 – 24 yrs	>24 yrs
Separation Creek	25	37	15
Wye River	67	105	65
Total	**92**	**142**	**80**

5. Optimum Standard for Waste Water Disposal

This report has outlined the physical constraints and the built environment characteristics for Wye River and Separation Creek. The wastewater treatment systems have been detailed and concerns have been raised.

It is important to use this information to understand the differences between what has been installed in the past and how these would comply under today's guidelines and standards. Table 3 contains guidelines to consider when assessing site suitability Many properties in Wye River and Separation Creek would only comply with 1 of the 7 guidelines.

Table 4 – Guidelines for Septic Systems

Guideline	Minimal Standard	Generally, Do Properties Comply?
Physical Factor:		
- Lot Size	Greater than $1000m^2$	No
- Slope of Land	Less than 20%	No
- Soil Percolation Rate	Greater than 15mm/hr	Yes
- Depth to Water Table	Greater than 1500mm	?
- Annual Rain	Less than 900mm	No
Social Factor:		
- Population	Less than 1000	No (during holiday season)
- Density	Less than 10 dwellings/Ha	No

Effluent disposal tenches need to be of a specific length and width to ensure sufficient on-site effluent disposal for the development. To demonstrate an appropriately sized system with those that have been installed in Wye River and Separation Creek, the requirements for two, three and four bedroom houses will be calculated (calculations and design rates are from the Code of Practice – Septic Tanks 1996). Constants to be considered are:

- Each bedroom equates to a daily flow rate of 300 litres (ie. 150/d/person);
- A typical percolation rate for Wye River and Separation Creek is 30mm/hour; and
- Width of trench is 700mm (corresponds to a "2 foot bucket" on a backhoe).

Table 4 shows the length of effluent trench required on a block to ensure sufficient effluent absorption and transpiration for a two, three and four bedroom house.

Table 5 – Length of Trench

No. of bedrooms	Length of trench (metres)
2	71
3	107
4	142

Council's survey of all-waste effluent disposal trenches shows that 69 properties have trenches of about 30 metres in length. Another 45 properties have trenches about 60 metres in length. Combined, these properties make up over 35% of the Wye River and Separation Creek wastewater systems. These trench lengths are well below that of what is required for a standard residence.

It would be expected that systems that are under-designed will have a high failure rate. To understand why this does not occur to the extent that is expected there are physical and social factors that need to be noted. Firstly, maximum usage is over the warmest months of the year when absorption, evaporation and transpiration rates are high. Secondly, usage during other times of the year occurs on weekends and during other limited time periods. Trenches have a chance to empty prior to the following weekend or holiday period. Thirdly, it has become apparent that some systems that are under-designed are connected to the stormwater system to provide relief for the septic system. This is an illegal practice that cannot be detected unless specific tests are conducted on the property or a nuisance is reported.

If the trend of people retiring to, working from, or using their dwelling for bed and breakfast and other rental uses continues the factors that worked in favour for many of the current wastewater systems will be cancelled out. This would overburden the existing systems and increase the chance of effluent ponding or illegal discharging of effluent to stormwater drains.

6. Restriction on Future Development

Due to changes in Council's Planning Scheme, subdivisions and building developments must be capable of treating and retaining effluent on-site. In the case of a proposed building development a planning permit will not be issued unless sufficient land is available for effluent disposal. For example, if a five bedroom house is proposed on a $750m^2$ block there will be little chance to treat and retain effluent on-site, subsequently the application would be refused. If the applicant decided to amend the application to a two bedroom house then there is a chance that approval would be given, with a number of conditions.

This has created restriction to a number of proposed developments and redevelopments. The applicant must decide whether to reduce the development, delay the project until sewer or other decentralised wastewater systems are available or attempt to sell the property.

There are about 180 vacant properties in Wye River and Separation Creek that may be restricted in their future development.

Development restriction is not only a problem for undeveloped blocks. Restrictions may also apply to residential extensions/additions, and site redevelopments (due to building demolition and upgrade, or the need to rebuild due to destruction of the building by fire, flood or other occurrence). There are 482 (96.8%) properties in Wye River and Separation Creek that due to their physical constraints may restrict development/redevelopment.

An extreme, but possible, example is the case where more than 50% of a dwelling is destroyed by fire. A planning permit would be required before any works commence. If the dwelling had 3 or more bedrooms and discharged effluent off-site a planning permit for a similar sized dwelling would not be issued unless it could be demonstrated that effluent could be treated and retained on-site. Again, the applicant would need to decide whether to amend the application to a smaller dwelling, delay the project until sewer or a decentralised wastewater system is available or attempt to sell the property.

7. Water Testing

Council officers have taken water samples from stormwater discharge points and the Wye River and Separation Creek watercourses for the purpose of identifying the extent of contamination. The results of these tests are provided in Table 5.

It should be noted that only one sample of water was taken from each site. The normal practice for water sampling is to take five samples at each site, especially if the results may lead to litigation. Therefore, the results in Table 5 should only be considered as indicative.

E.coli

It also should be noted when reading the results that the following standards apply to drinking, swimming and other recreational waters:

- The presence of E.coli indicates faecal pollution and Standard Plate Counts indicate the level of all bacteria, whether they are harmful or not.
- Drinking water is not allowed to contain any E.coli/100mL.
- Swimming water is considered satisfactory if the median sample contains <150 E.coli/100mL. Allowance is provided for one of the 5 samples to reach 600 E.coli/100mL.
- Water is considered safe for non-contact activities, including canoeing and yachting, if the median sample is <1,000 E.coli/100mL. Allowance is provided for one of the 5 samples to reach 4,000 E.coli/100mL.

Faecal Streptococcus

This bacteria is present in all warm blooded animals and tends to be more resilient in the environment than E. coli. It is useful to determine past contamination of a source by a warm blooded animal.

There are no specific levels that relate to its concentration apart from the fact that it shouldn't be there. E. coli is the preferred indicator as it is the more immediate result and gives a better picture on what's happening on a day to day basis.

E. coli appears in greater numbers in warm-blooded animals, which probably accounts for the lower concentrations of Faecal Streptococcus.

Table 6– Water samples

Location	Standard Plate Count/ml	Faecal Strep./ml	E.coli/ 100ml
Separation Creek			
Upstream of Great Ocean Rd			
13/12/99	4,700	-	130
18/01/00	4,500	-	35
12/12/00	2,700	-	74
20/09/01	270	n/d	10
13/12/01	520	<1	30
16/01/02	11,000	<2	60
Wye River			
Beach Stormwater outlet below hotel			
13/12/99	38,000	-	>1,000
18/01/00	60,000	-	35
12/12/00	61,000	-	20
18/12/00	55	-	n/d
04/10/01	>25,000	<8	51
Hotel outlet			
04/01/01	-	-	10
20/09/01	>25,000	n/d	10
Lagoon downstream of Great Ocean Road			
13/12/99	2,900	-	n/d
18/01/00	3,400	-	181
12/12/00	34,000	-	63
11/01/01	-	-	20
20/09/01	370	<1	20
Stormwater drain to Lagoon (below caravan park)			
18/01/00	>60,000	-	181
11/01/01	-	-	130
20/09/01	550	n/d	n/d
13/12/01	14,000	<1	30
16/01/02	380,000	<6	n/d

n/d denotes non-detected.

Although the test results are only indicative, they do show that water sources sampled were generally suitable for swimming or direct contact. The lagoon was marginally unsuitable for swimming on 18 January 2000 and the stormwater outlet was unsuitable for contact on 13 December 1999.

8. Public Health Warnings

Council has taken a number of water samples over the past few years. These have included samples from drinking water supplies that have come from the Wye River, stormwater drain samples and watercourses and lagoons.

If water sample results are unsatisfactory, Council may need to erect warning signs for the public. This may be along the lines of "Contaminated water do not drink", "This water course is closed to bathing and water collection purposes until further notice" or "Contaminated water do not contact" (these signs have been permanently erected at 2 stormwater outlets in Skenes Creek). In the case of unsafe drinking water supplies the users have been notified of the risks.

Water samples need to be collected on a routine basis to monitor the quality of these water sources and risks to public health.

9. Summary of Waste Water Disposal Risks

- Man made factors, including continual saturation of steep slopes by wastewater, can increase the potential for landslide.
- Over 20% of developed properties discharge wastewater off-site into earth drains. There is no data on the quality of this discharge.
- There is no uniform method of wastewater disposal. Instead, there are a wide variety of systems that have varying levels of effectives and compliance.
- Over 30% of systems have defects.
- Within 10 years 70% of effluent trench disposal systems will have reached their life expectancy.
- The vast majority of effluent disposal trenches are insufficient in length (under current guidelines).
- The trend of retiring, permanently residing or the tourism potential in coastal towns is likely to create increased failure rates in septic systems.
- There are restrictions that will limit or stop both development and re-development. This may occur for over 96% of blocks.
- Water sampling has indicated that bathing in the Wye River lagoon and direct contact with stormwater discharge may pose a public health risk.
- Warning signs may need to be erected on in Wye River advising of public health risks.

10. Assessing Community Values

Before the options for future wastewater systems can be discussed it is important that the values of the Wye River and Separation Creek community are understood when considering the impact of any proposed wastewater system.

The Wye River Structure Plan, March 1996, which was based on public consultation, defined the following vision.

"Wye River and Separation Creek should develop as hamlets which offer the opportunity to for visitors, part-time residents and residents to enjoy the attributes of the area to the fullest, without impacting on the natural environment".

With the large increase in visitor numbers, changing house occupancy characteristics and increasing levels of environmental consciousness it has been recognised that:

- the delicate environmental balance of the hamlets should be monitored and environmental enhancements should occur (this should also be true for public health enhancements);
- a partnership between a number of state and local agencies and the local community committees is the best way to achieve community goals;
- The area has a role to perform in relation to the Great Ocean Road visitation; and
- Where environmentally sustainable, further development should be permitted.

The Structure report called for clarification of landslip information, no further development over the ridgelines and no further inclusion of private land holdings in township boundaries. Servicing of the hamlets should be limited. This can be achieved by not providing engineering services and by prohibiting the range of uses that are normally associated with a permanent urban area. This means:

- No reticulated water supply;
- Septics should be improved before enhanced schemes are considered.
- Drainage schemes should be maintained but not necessarily improved by underground drainage networks.

An important outcome from the first round of community consultation is to reassess these community goals and vision in light of new information, the progress of time and possible changes to community opinion.

There are other values, specific to the most appropriate type of proposed wastewater system, that need to be developed and considered by the community. These include:

- Environmental values: flora and fauna, coastal and estuarine, landslide, land degradation, erosion, reuse of wastewater, reduction of water use.
- Social values: development, amenity, township growth, tourism
- Economic values: cost of wastewater improvements, property value increases.

Plate 2: A view of steep blocks at Separation Creek

11. Wastewater Options

Earlier in the report the different existing types of wastewater systems were discussed. There are a number of options that can be considered for upgrading existing systems for providing a medium to long term solution.

This section describes a set of treatment processes that introduce the functional issues associated with various wastewater technologies. The processes are then coupled together to form a scenario so that the risk of wastewater treatment can be discussed on a site-by-site basis. The wastewater scenarios are then merged into strategies to consider the application of the wastewater systems for sites within Wye River and Separation Creek.

11.1 Wastewater Processes

There are a number of wastewater processes that may be considered for installation. These include:

- **Domestic On-site Process.** Where the effluent is collected, treated and disposed of on-site.
- **Domestic Off-site Process.** Where effluent is collected and treated on-site and disposed off-site.
- **Decentralised Off-site Process.** Where effluent is collected and partially treated on-site, then disposed to a common neighbourhood system for further treatment and disposal.
- **Low Cost Sewerage Process.** Where effluent is collected and undergoes primary treatment on-site, then disposed to a centralised township system for further treatment and disposal.
- **Sewerage Process.** Where effluent is disposed to a centralised township system for treatment and disposal.

Within each of these different wastewater processes there are a number of systems, especially for domestic on-site systems.

Potential functional advantages and disadvantages are provided, based largely on (Martens 1998). This helps identify the limitations of each process and the possible need to use a number of processes to achieve acceptable risk. The potential advantage or disadvantage highlights that the process must be operated in a way

that increases the likelihood of achieving the advantages while minimizing the likelihood of disadvantages. When a number of processes are combined together it behaves as the collection of processes and is referred to as a scenario. The description of the processes does not attempt to give design detail but highlights functional issues that need to be considered for the design of a wastewater system.

11.1.1 Domestic On-site/Off-site Processes

All domestic on-site and off-site wastewater systems need to be issued with a Certificate of Approval by the EPA before they are permitted to be installed in Victoria. At the moment there are around 55 different types of systems that have been approved by the EPA. A full description of the approved wastewater system can be found at www.epa.voc.gov.au under the 'For Local Government' section.

These include:

- 12 composting units (dwellings require a separate sullage system)
- 2 waterless composting systems (dwellings require a separate sullage system)
- 2 all waste composting systems
- 2 incineration systems (dwellings require a separate sullage system)
- 20 Aerated Wastewater treatment Systems (dispose to land only)
- 11 Aerated Wastewater treatment Systems (dispose to land and water)
- 8 other types of systems

Some of these processes will be mentioned in this section.

Reduce Water Use

The reduction of water use is applicable to sites that do not have water efficient fixtures. This is where a retrofit of fixtures and appliances takes place.

A strategy to reduce water use includes the installation of water efficient fixtures/appliances and a maintenance program to reduce the base load of water consumption from leaking fixtures. The strategy also requires an education campaign and commitment from both Colac Otway Shire Council and the local residents to reduce water use. This commitment could take the form of a memorandum of understanding between the council and the resident as a condition of the upgrade of the water fixtures. An additional benefit of retrofits in Wye River and Separation Creek is the reduced use of tank water, thereby limiting the need to buy water during the dry season or high use times.

The fixtures need to be viewed as part of the infrastructure of the effluent treatment system. Each household needs to have "full water reduction facilities" as outlined by AS 1547:2000 that includes *"the combined use of reduced flush 6/3 litre water closets, shower-flow restrictors, aerator faucets, front-loading washing machines and flow/pressure control valves on all water-use outlets. Additionally, water reduction may be achieved by treatment of greywater and recycling for water closet flushing (reclaimed water cycling)".*

Composting Toilet

The compost toilet reduces the volume of wastewater that either needs to be treated on-site or off site. The composting toilet treats black-water (toilet waste only) and putrescible household garbage and needs to be coupled with a greywater system to provide full treatment of household wastewater. The use of the compost toilet is especially applicable to sites that have steep slopes and can easily accommodate the composting toilet underneath or beside an existing structure.

An additional advantage of the composting toilet is the reduced greenhouse gas emissions from the aerobic decomposition of sewage. A fan is included as part of the composting toilet to ensure the degradation of sewage is aerobic and to remove any odours that may arise. Depending on the type of system the compost can be buried on-site at a minimum depth of 30cm or disposed off-site to the satisfaction of Council.

Table 7 Functional Advantages and Disadvantages of Compost Toilets

Potential Advantages	Potential Disadvantages
• Reduced wastewater volume (up to 30%) • Less stress on land application areas, especially on landslip risk sites. • Increased longevity of land application areas. • Several options available for land application. • Low energy use. • Aerobic decomposition of sewage reduces greenhouse gas production. • Compost may be buried on-site. • Septic tank used for greywater treatment may be desludged less often.	• Installation is often below house and if not possible requires a housing system to be constructed (this is simpler on a steep slope). • Compost must be periodically removed. • User is responsible for the maintenance. • Susceptible to shock loads of water and chemicals. • A separate system is required for greywater. • Requires a dedicated land area on the residential block.

Upgrade Existing Septic Tank Absorption/Transpiration Systems

Failing septic tanks need to be either replaced or upgraded to improve the performance to acceptable levels. This may not be achievable on allotments less than $1000m^2$.

Filters and flow baffles are suggested for all structurally sound septic tanks that do discharge effluent on-site. The EPA requires the desludging of a septic tank every 3 years.

Table 8 Functional Advantages and Disadvantages of Upgraded Septic Tanks

Potential Advantages	Potential Disadvantages
• Produce higher quality effluent than conventional (and current) septic tanks. • Provides additional treatment for other processes while releasing the effluent to the receiving environment. • Accommodates both black and grey water. • No energy required to operate. • Simple technology	• System requires desludging every 3 years. • Filters need desludging every 2 years. • User is responsible for maintenance. • Effluent is likely to require further treatment before disposal. • Requires a large dedicated area of land ($400m^2$ or larger) for disposal. • An alternative disposal field may be required. • Has a limited life. • Can fail if upstream processes such as a septic tank fails. • Continued stress on land application areas, especially on landslip risk sites.

Irrigation - Surface/Sub-surface

Where effluent is treated to a satisfactory standard, either by a sand filter or Aerated Wastewater Treatment System it may be disposed of through an irrigation system (Code of Practice – Septic Tanks 1996).

There are two types of irrigation. One above ground, which requires disinfection of the treated effluent and one sub-surface.

Table 9 Functional Advantages and Disadvantages of Irrigation

Potential Advantages	Potential Disadvantages
• Can provide an even distribution of wastewater across the site. • Can distribute wastewater to irregular and isolated disposal fields. • Provides comparatively shallower and narrower trenches to install pipework than for absorption trenches and transpiration fields. • Simple technology. • Is useful for maintaining a nutrient enriched liquid for plants.	• Is a pressurised system that requires a pump system. • Dripper head are subject to damage and require ongoing replacement. • Filter heads may become blocked and require cleaning. • Can fail if upstream processes such as a septic tank fails. • User is responsible for maintenance. • Requires a relatively large area of land for disposal. • Surface irrigation can cause run-off on steep sites.

Wetland Reed Bed System

A small Wetland Reed Bed system provides additional treatment after the septic tank. A filter on the septic tank would ensure that the wetland does not become clogged.

Table 10 Functional Advantages and Disadvantages of Wetlands

Potential Advantages	Potential Disadvantages
• Provides removal of carbon, nutrients and pathogens and higher quality effluent when coupled with other treatment systems. • No odours. • Accommodates combined wastewater or just greywater. • No energy required to operate. • Required less area than an absorption or transpiration system.	• User is responsible for maintenance. • Requires a dedicated land area on the residential block. • System may fail over time if coupled with a failing septic tank. • Limited usage may cause the wetland/reed bed to dry-out. • Difficult to site on steep slopes.

Sand Filter

A sand filter is only required for sites where there is an opportunity to discharge off-site or there is little or no scope for absorption/transpiration trenches. Treated effluent from the sand filter can be disposed of by surface or sub-surface irrigation. The sand filter provides additional treatment to reduce the risk for extreme locations.

Table 11 Functional Advantages and Disadvantages of Sand Filters

Potential Advantages	Potential Disadvantages
• Produces high quality effluent. • No odours. • Accommodates both grey and black water. • Requires less area of land for effluent disposal.	• May have a limited life and need periodic replacement (10-15 years). Alternatively larger beds could be used. • User is responsible for maintenance. • Requires a dedicated land area on the residential block. • System may fail over time if coupled with a failing septic tank.

Pump-out

Pump-out is the mechanism of taking the sewage or effluent off-site for treatment at either sewerage treatment plant. This process is potentially very costly especially for isolated townships such as Wye River and Separation Creek.

This system is currently not approved by the EPA and would need to undergo critical assessment on compliance, monitoring and other criteria prior to approval being given.

Table 12 Functional Advantages and Disadvantages of Pump-out

Potential Advantages	Potential Disadvantages
• Provides a service that can be applied to all sites. • Keeps wastewater out of the soil.	• May require a certain number of households to be viable. • Siting another tank on the property. • Holding tanks, whether communal or individual need to be accessible for pump out tankers.

Holding Tanks for Wet Weather/Intermittent Usage Storage

Between May and September, when rainfall exceeds evaporation, or at times of high usage some domestic on-site systems may need to store a percentage of treated effluent in a sealed holding tank until the ground is capable of absorbing the wastewater.

This process is ideally suited to dwellings that are used on a seasonal or limited basis. A percentage of wastewater can be held while the dwelling is occupied, then allowed to automatically dose the wetland, absorption or transpiration fields during periods when the dwelling is unoccupied.

Table 13 Functional Advantages and Disadvantages of Holding Tanks

Potential Advantages	Potential Disadvantages
• Doses the wetland, absorption or transpiration field on a regular basis. • Reduces saturation of soil. • Accommodates grey water and grey/black water. • For high treated wastewater can be considered a resource.	• Limited to seasonal or limited usage of dwelling. • Complex management and monitoring for owner. • Siting another tank on the property.

Aerated Wastewater Treatment Systems (AWTS)

This strategy is only applicable to permanent or regularly used residents, as the AWTS systems require relatively constant operation to sustain the biological media. The AWTS system treats the sewage and disinfects the effluent for disposal to a irrigation or absorption/transpiration fields.

There are a number of AWTS units that are permitted to discharge off-site provided they comply with the State Environment Protection Authority (SEPP) – Waters of Victoria.

Table 14 Functional Advantages and Disadvantages of AWTS

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Low odours. • Less stress on land application areas. • Increased longevity of land application areas. • Several options available for land application.	• Higher energy use (than most on-site systems especially). • On-going maintenance costs. • Septic tanks require desludging. • User is responsible for the maintenance. • Highly susceptible to shock loads and irregular usage. • Susceptible to failure. • Requires a dedicated land area on the residential block. • Continued stress on land application areas, especially on landslip risk sites.

11.1.2 Decentralised Off-site Process

The US Environment Protection Agency describes a decentralised system as *"An on-site or cluster wastewater system that is used to treat and dispose of relatively small volumes of wastewater, generally from an individual or group of dwellings and businesses".*

The US EPA concludes in a report on decentralised systems that *"Adequately managed decentralised wastewater systems are a cost-effective and tong-term option for meeting public and water quality goals".*

Table 15 Functional Advantages and Disadvantages of Decentralised Systems

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed by contractor or authority. • Is designed for an actual number of properties. • Installation cost is claimed to be less than conventional sewerage. • Reuse option for toilet flushing. • Long term solution. • Diameter of pressurised main sewer line is much smaller than conventional sewer drain.	• Is new technology to Australia. • Need to find one or more sites for common treatment fields and disposal. • Relatively high installation and ongoing costs. • Required the majority of properties to commit to the system to be economically viable.

11.1.3 Low Cost Sewerage Process

There are a number of methods to reduce the cost for sewerage in smaller townships that have existing on-site wastewater disposal systems. One such option is to retain structurally sound septic tanks, sandfilters or AWTS's and discharge the effluent to a common gravity fed sewer drain.

Primary or secondary treatment on-site would reduce the extent of solids removal at the point of treatment.

Table 16 Functional Advantages and Disadvantages of Low Cost Sewerage

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed authority. • Is designed for an actual number of properties. • Treatment cost is claimed to be less than conventional sewerage. • Long term solution.	• Need to find one or more sites for common treatment fields and disposal. • Relatively high installation and ongoing costs. • Will require all properties to commit to the system. • Larger common drain than in decentralised system may impact on slope stability.

11.1.4 Sewerage Process

This is the conventional sewerage system that requires no on-site collection or treatment. All property wastewater is gravity fed to the main sewer drain.

Table 17 Functional Advantages and Disadvantages of Sewerage

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed authority. • Is designed for an actual number of properties. • No management or maintenance by property owner • Long term solution.	• Need to find a site for treatment plant and disposal field/point. • High installation costs. • Will require all properties to commit to the system. • Larger common drains that will need to dug deeply into ground. May impact on slope stability

11.2 Combined Options

On-site and off-site wastewater treatment processes are compiled to give a number of wastewater treatment scenarios. Each wastewater scenario also includes the responsibilities and management required to operate the processes to achieve acceptable risk.

In general, off-site wastewater disposal has lower health and environmental risks than on-site effluent disposal. This is largely due to the mechanism of pollutant transport to the surrounding environment and the historically poor management of on-site effluent disposal. If effluent for on-site disposal is of poor quality due to poor design or management then the effluent will carry the pollutants into the on-site and surrounding environments. By definition, on-site effluent will be close to the household and presents an obvious health risk if not correctly managed. Off-site effluent disposal has generally been well maintained and monitored and disposed away from population centres.

Within each category of on-site or off-site effluent disposal, the risk of effluent disposal is greater for some options. For on-site systems this is largely dependent upon the site conditions and the permanency of the resident. For site conditions that have limited capacity for treatment using an absorption or transpiration field or requiring high quality effluent due to the location, a number of treatment processes may be required to achieve acceptable risk for effluent disposal. However, the greater the number of processes the greater the cost and the risk of impacts from effluent disposal will obviously be weighed against the cost of the system. A range of on-site disposal scenarios is presented to capture the diversity of needs in Wye River and Separation Creek.

A selection of wastewater scenarios is summarised in the table below.

Table18 Wastewater Treatment Scenarios

Scenario No.	Processes	Scenario Type by Effluent Disposal
1	Water efficiency retrofit, upgraded septic tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
2	Water efficiency retrofit, upgraded septic tank, holding tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
3	Water efficiency retrofit, compost toilet, upgraded septic tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
4	Water efficiency retrofit, compost toilet, upgraded septic tank, holding tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
5	Water efficiency retrofit, upgraded septic tank, sand filter, (a) absorption field or transpiration field, (b) irrigation	On-site
6	Water efficiency retrofit, upgraded septic tank, sand filter, holding tank, (a) absorption field or transpiration field, (b) irrigation	On-site
7	Water efficiency retrofit, upgraded septic tank, AWTS, (a) absorption field or transpiration field, (b) irrigation	On-site
8	Water efficiency retrofit, upgraded septic tank, AWTS, holding tank, (a) absorption field or transpiration field, (b) irrigation	On-site
9	Water efficiency retrofit, upgraded septic tank, pump-out, truck to sewerage treatment plant	Off-site
10	Water efficiency retrofit, upgraded septic tank/AWTS, decentralised sewerage system	Off-site
11	Upgraded septic tank/AWTS, centralised sewerage system	Off-site
12	Installation of centralised sewerage system	Off-site

Inadequate maintenance will lead to failure regardless of how well the infrastructure of the system was designed. The number of processes that are required for an on-site system depends upon the risk of physical, environmental, health and social impact presented by the type of site.

11.3 Wastewater Strategies

The wastewater processes can be assembled into wastewater scenarios to treat wastewater for sites within Wye River and Separation Creek. The scenarios introduce the concept of risk and management for the construction, operation and demolition of the wastewater systems for individual sites. However, when all sites are considered there are a number of strategic wastewater issues that arise concerning the optimisation of wastewater scenarios to obtain the least risk.

The wastewater scenarios can be combined to form two types of strategies.

- Strategy 1: On-site effluent disposal
- Strategy 2: Off-site effluent disposal

Strategy 1: Onsite Effluent Disposal requires that sites are assessed for the application of on-site wastewater disposal. A selection of on-site effluent disposal scenarios may be required to meet the variety of site conditions and risks for the area. For example, there may be 25% high-risk sites, 50% medium risk sites and 25% low risks sites in Wye River and Separation Creek. The three risk classifications may require three different configurations of on-site processes to control the risk.

Strategy 2: Off-site Effluent Disposal requires further investigation of services and costs for effluent pump-out, decentralised, low cost and sewerage processes. The point of discharge also needs to be determined. Questions that need to be answered include "Is discharge to be to land, ocean, through reuse or a combination of these?", "Where will land or ocean discharge occur?" and "What will be the impact of this discharge?".

11.3.1 Strategic Advantage of Decentralised Wastewater Treatment

The strategic advantages of centralized systems have been widely promoted over the past century as reflected in the choice of wastewater infrastructure across Australia. The strategic advantages of decentralized systems are less well known and the following list describes some of these benefits.

- "Closer matching of capacity growth to the demand curve through incremental implementation of smaller units. "Build-as-you-need, pay-as-you go" ties up less capital, reduces forecasting risk, and creates "option value" by allowing future changes in technology, management, and service strategy not possible with large-scale systems.

- Targeting of treatment upgrades to smaller, problematic units within a watershed.
- Greater control over the waste stream, and thereby increased biosolids useability and value.
- Localised water reuse, which reduces or avoids water purchases or ground water pumping, and may increase property values in water-short areas.
- Reduced costs in very steep or rocky areas as opposed to sewerage costs.

11.3.2 Monitoring of On-site Systems

From the risk management process there is a need to monitor and review risk on an ongoing basis. This applies to both on-site and off-site scenarios. With off-site scenarios an authority or agency manages the risk. With on-site scenarios there is currently no agency that monitors the systems on a regular basis.

With proposed changes to the Code of Practice for Septic Tanks and other guidelines produced by the EPA it may well become a function of local government to ensure that this monitoring is undertaken.

The Colac Otway Shire Wastewater Management Strategy, February 2002 (section 6.2.6), indicated that an annual fee of $30 to $40 was required to provide a monitoring program across the shire. If there is a random distribution of townships opting for on-site scenarios the annual fee may be slightly higher. This fee has been included in Figure 2 on page 52.

11.3.3 Other Future Considerations

It is necessary to point out that future legislation, guidelines, codes of practice and discharge conditions will impact on wastewater disposal. This will be for both on-site and off-site processes.

In essence, the changes will be to continually improve the quality of discharge and ensure sustainability. For off-site systems this will look at the treatment and mixing zone methods prior to discharge to the environment. For on-site systems this means ensuring that a property can, over the lifetime of the development, safely and in an environmentally sustainable manner treat and dispose of wastewater on-site.

As an example of this trend at the moment, future subdivisions on unsewered land may be deemed sustainable for on-site disposal if they are greater than 0.4 hectare and have a favourable land capability.

The scenarios for on-site wastewater systems mentioned in this Issues Paper provide an improvement on current conditions. There is no guarantee that the system will provide an sustainable wastewater process for the lifetime of the development. Ultimately, the only way of ensuring a long-term environmentally sustainable method of wastewater management in Wye River and Separation Creek is to introduce the most appropriate off-site process that satisfies community values and minimises the risks of slope instability and environmental sustainability.

Plate 3: Nitrogen and phosphorus levels in wastewater increase algal growth

12. Risk Analysis

12.1 Risk Management

The Australian Standards of *AS 4360: 1999 Risk Management* and *AS 3931:1998 Risk analysis of technological systems – Application guide* were the main documents used to formulate the risk management approach. This process is described in the Standards as follows:

"Risk management is an iterative process consisting of well-defined steps, which, taken in sequence, support better decision-making by contributing a greater insight into risks and their impacts. The risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. Decision makers need to know about possible outcomes and steps to control their impact."

General steps in the risk management process are outlined in Figure 1.

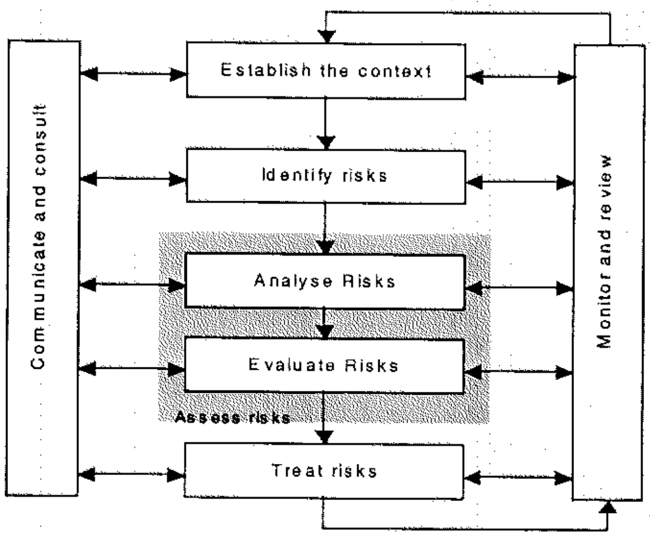


Figure 1 Risk Management Overview
Standards Australia AS 4360:1999

This study addresses each of the Risk Management steps presented in the above figure. However, the study does not attempt to fully analyse and evaluate risk as this requires communication with all stakeholders and is beyond the scope of this study.

Instead this study presents information that is useful for the assessment of risk and presents a framework for how the assessment can be conducted.

12.2 Identified Risks

Australian Standard 4360:1999 Risk Management states that

"Comprehensive identification using a well-structured systematic process is critical, because a potential risk not identified at this stage is excluded from further analysis. Identification should include all risks whether or not they are under the control of the organisation."

The potential risks associated with wastewater processes in Wye River and Separation Creek can impact are physical, environmental, health and social values.

Potential Physical Impacts

These potential impacts include:

- Increased landslip potential
- Increased erosion potential
- Site run-off
- Water logging of sites

Potential Environmental Impacts

These potential impact include:

- Degradation of land
- Degradation of watercourses, estuarine and coastal waters
- Algal blooms

Potential Health Impacts

These potential impacts include:

- Contamination of water recreation areas
- Odour
- Mosquito breeding

Potential Social Impacts

These potential impacts include:

- Cost of system

- Unable to develop a property
- Conditions detriment to the amenity of the townships
- Increase/decrease in population
- Increased wastewater with an increase in permanent residents

12.3 Risk Controls

There are controls that can be introduced to minimise the risk for on-site processes to an acceptable level. The determinant of an acceptable level requires the assessment of community values, and legislative requirements on health and environmental issues.

Physical Risks

Control of increased landslip potential

- The assessment of landslip risk for new on-site wastewater treatment systems will be considered with each planning application development.
- Owners of developed properties, where risk of potential landslip due to increased water content in the soil, should consider reducing wastewater into the soil.

Control of increased erosion potential

- Reduce or regulate the volume of wastewater entering the soil and introduce disposal methods that minimise erosion.

Control of site run-off

- Reduce or regulate the volume of wastewater entering the soil.

Control of water logging of sites

- Reduce or regulate the volume of wastewater entering the soil.

Environmental Risks

Control of degradation of land

- Introduce wastewater onto land in a manner that is sustainable.

Control of degradation of watercourses, estuarine and coastal waters

- Provide a high level of treatment for effluent that cannot be retained on-site.
- Reduce the volume of wastewater being generated.

- Provision of mixing or filtration zones such as wetlands.

Control of algal blooms

- Provide a high level of treatment for effluent that cannot be retained on-site.

Health Risks

Control of contamination of water recreation areas

- Provide a high level of treatment for effluent that cannot be retained on-site.

Control of odour

- Provide a high level of treatment for effluent.

Control of mosquito breeding

- Reduce or regulate the volume of wastewater being generated so that it can be satisfactorily disposed of to land.

Social Risks

Control of the cost of a system

- The introduction of any future wastewater system will need to consider the terms and conditions of payment and the ability of property owners to pay.
- Analysis of the ongoing costs to best understand the overall long term costs.
- To determine the life expectancy of systems.
- Management of assets and designing systems that are flexible for changing requirements.

Control of inability to develop a property

- May not be possible if site constraints are too restrictive. Would need to Introduce off-site disposal.

Control of conditions detriment to the amenity of the townships

- Provide a high level of treatment for effluent.
- Reduce or regulate the volume of wastewater being generated so that it can be satisfactorily disposed of to land.

Control of increase/decrease in population

- Introduce a wastewater system that supports the development values of the community.

Control of increasing wastewater with an increase in permanent residents

- May ultimately require the introduction of off-site disposal.

13 Costs

The following table shows the costs for each wastewater treatment process. The data is based upon cost estimates provided by local plumbers, product manufacturers, research into reports on retrofitting and operation and maintenance costs. The estimates for off-site systems are indicative only. Until these options are fully costed an accurate cost cannot be determined.

The installation costs are again indicative. Site conditions at Wye River and Separation Creek vary considerably. Accessibility, existing plumbing standards, slope, vegetation, climate condition at the time of installation and other site constraints will impact on the final cost.

The error in the costs relates to the degree of certainty and experience the source had with the activity. The greatest error is in the pump-out data because this is a service that has not been installed and is based on indicative costs in other states. The costs presented in the table show:

- The operation and maintenance costs are extremely high for pumpout and indicates it will be an important issue over the life of the system. Perhaps just as importantly it emphasises the need for more accurate data for annual costs for pump-out as it may lead to a commitment to high operating costs.
- The installation cost is very high for the sandfilter and also high for the absorption trenches/transpiration fields and AWTS.
- The capital cost of the AWTS, wetland and composting toilet are all high. The septic tank and absorption trenches/transpiration fields have low capital costs.
- Some systems are likely to need a financial program to spread the upfront capital costs across the life of the system. This will need to be researched in further detail once a short list of systems has been determined.

The individual processes are now assembled to create the wastewater scenarios in the following table.

Table 19 Annual Financial Costs for Wastewater Treatment Processes

Wastewater Treatment Process	Capital Cost	Installation Cost	O&M cost per year (a)	Water Samples Year (b)	25 Year Cost
Septic tank	$800	$500	$100	-	$3,800
Absorption/Transpiration fields	$800	$4,000	$0	-	$4,800
Irrigation – Surface	$1,000	$2,000	$200	$146	$11,650
Irrigation – Sub-surface	$1,000	$2,000	$200	-	$8,000
Sand Filter On-site disposal (b)	$2,000	$7,000	$300	$146	$20,150
Sand Filter Off-site disposal (b)	$2,000	$7,000	$300	$584	$31,100
Composting Toilet	$3,000	$500	$400	-	$13,500
Wetland	$2,000	$2,500	$450	-	$15,700
AWTS On-site disposal (b)	$5,000	$3,000	$500	$146	$24,150
AWTS Off-site disposal (b)	$5,000	$3,000	$500	$584	$35,100
Holding tank & pump	$3,000	$500	$200	-	$8,500
Water efficiency retrofit	$500 (c)	$300	-	-	$800
Pumpout, Truck to Sewerage Plant and treatment	$2,000	$500	$5,400 (d)	-	$137,500
Water efficiency retrofit, upgraded septic tank, pump into decentralised sewerage system	$12,000 (f)	$3,000 (f)	$500	-	$27,500
Upgraded septic tank, pump into sewerage plant drain (e)	$14,000 (f)	$3,000 (f)	$500	-	$29,500
Installation of a sewerage system (e)	$17,000	$3,000 (f)	$500	-	$32,500

(a) Operating and maintenance costs can include a number of factors including:

- the costing of time required for household maintenance. The property owner may need or wish to contract in these maintenance tasks;
- service of AWTS and sand filter by an experienced person;
- replacement of parts over the lifetime of the unit (does not include full replacement);
- desludging of septic tank every 3 years; and
- an indicative cost of pumping out and treating effluent at a Sewerage Plant.

(b) The EPA sets out the frequency and testing requirements of wastewater.

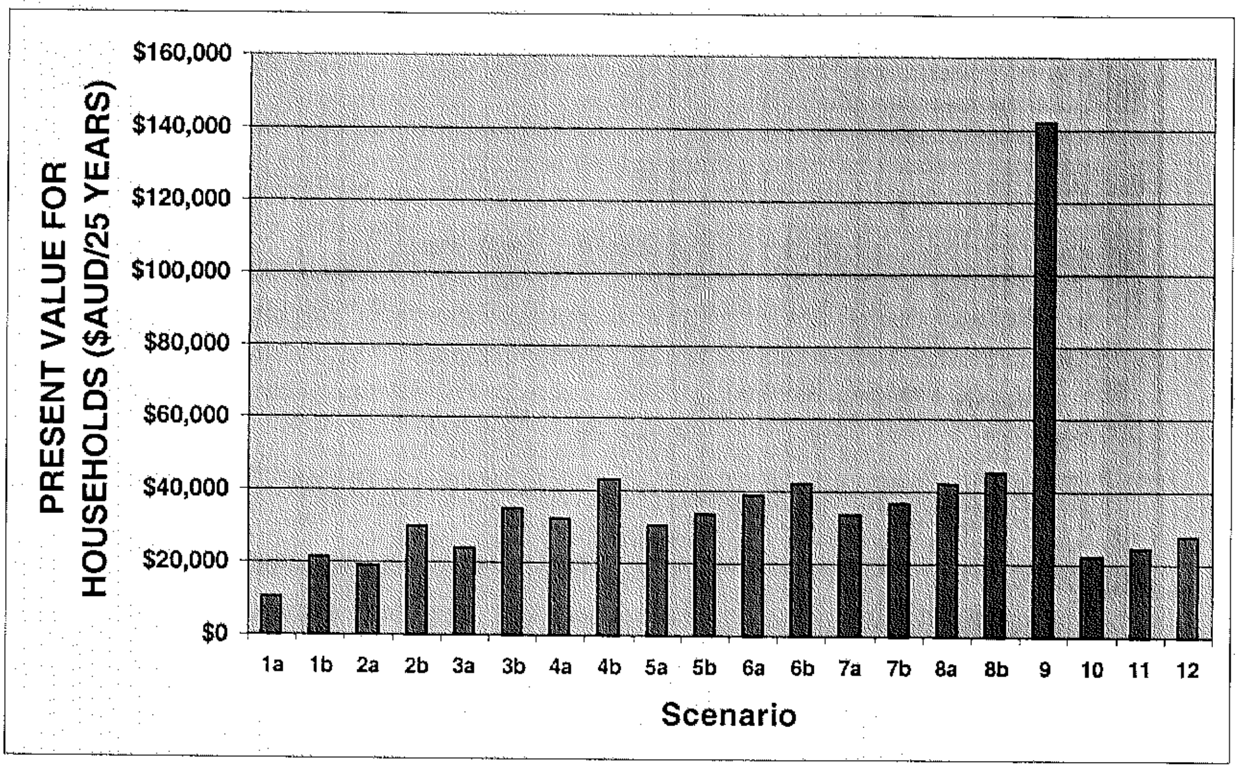
(c) Does not include the cost of a front loading washing machine. This cost needs to be added to the total.

(d) This cost is for 1/3 of a year. For longer or full time occupancy the figure will be around 2 –3 times higher.

(e) To ensure that sufficient water is available for the operation and maintenance of this system, a water reticulation system may need to be installed. This would have a significant impact on additional infrastructure and cost.

(f) Includes the capital cost of the main system, as well as, the cost of connecting to the main system and upgrades that may be required in the current plumbing of the dwelling.

Figure 2 Represents the Financial Value of Wastewater Treatment Scenarios Over a 25-Year Period



Note: An annual monitoring fee of $40 has been added to the scenarios from 1a to 6b inclusive

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Colac Otway
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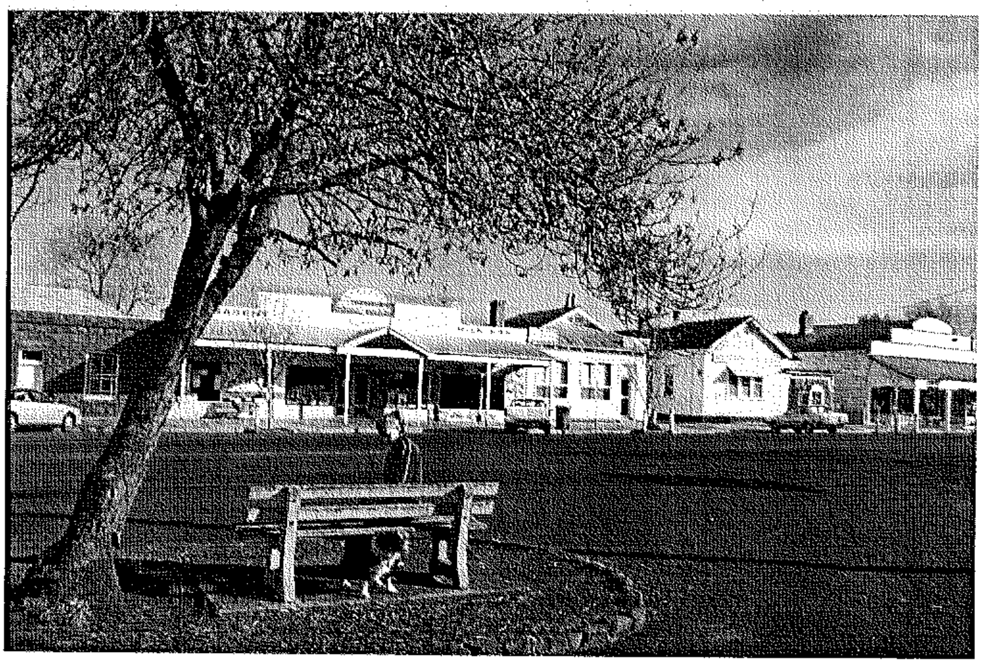

Issues Paper
Wastewater Management
Birregurra

May 2002

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Executive Summary

Colac Otway Shire is committed to assessing and facilitating the development of responsible domestic wastewater management practices in unsewered areas throughout the shire. In the Wastewater Management Strategy (WMS), adopted by Council on 27 February 2002, it was shown that the current practices of wastewater disposal are creating risks to public health, the environment and future development.

The WMS compared the collective risks associated with wastewater systems in 8 townships (Skenes Creek was not included, as it is due for sewerage in late 2004). Birregurra was considered at highest risk for impact of wastewater on the amenity of the township. This relates to areas of poor street drainage, slime and vigorous vegetation growth in drains, the potential for insect breeding and odour problems. Other concern factors were the age of wastewater systems, the off-site discharge of wastewater and the restriction on development.

This report is an Issues Paper to assist all stakeholders including property owners, policy makers, planners and regulatory and enforcement agencies in developing and implementing a long term, sustainable and manageable strategy for domestic wastewater systems.

This report will be used as a basis for stakeholders to understand and determine the most appropriate wastewater system to minimise risk. Community values will be articulated within the consultation process and then used as a determinant for the most suitable wastewater system options.

The outcome from this report will be to prepare a Strategic Plan for wastewater systems in Birregurra. This Strategic Plan will define the future direction of wastewater systems.

Findings from initial studies into the existing wastewater systems of Birregurra have identified the following risks:

- The volume of sullage and effluent being discharged off-site into street drains.
- Offensive conditions, such as odour, potential mosquito breeding areas, and the ponding of sullage and effluent.
- The wide variety and age of waste water disposal systems that operate at varying levels of effectives, treatment and compliance.

- Most systems, using effluent trench disposal, will have reached their life expectancy within the next ten years.
- Disposal trenches installed in the past are insufficient in length (under current guidelines).
- Future development and re-development may be limited for up to 70% of properties.
- Water testing has indicated that there are concerns regarding future public health safety.

This information will be used as background data to inform property owners of the risks associated with retaining existing wastewater disposal systems.

The scenarios for on-site wastewater systems, mentioned on page 48 of this Issues Paper, provide improvements on current conditions. There is no guarantee that the system will provide a sustainable wastewater process for the lifetime of the development. Ultimately, the only way of ensuring a long-term environmentally sustainable method of wastewater management in Birregurra is to introduce the most appropriate off-site process that satisfies community values and minimises the risks of slope instability and maximises environmental sustainability.

1. Introduction

This Issues Paper commences Phase 2 of the Colac Otway Shire strategy for reducing the risks associated with wastewater disposal in unsewered townships throughout the shire. Phase 1 was the adoption of *Colac Otway Shire Wastewater Management Strategy, February 2002*, which can be accessed on Colac Otway Shire's website: www.colacotway.vic.gov.au)

Aims

The aims of this Issues Paper are to:

- Inform stakeholders of the risks involved in unsewered areas;
- Outline the process of performing an environmental and social assessment of centralised, decentralised and on-site wastewater systems over their whole life.
- Consider wastewater options that result in low environmental, public health and social impact risks for the community of Birregurra.

Objectives

This Issues Paper is prepared to give property owners and other stakeholders an opportunity to:

- Understand current wastewater treatment and disposal systems.
- Understand the future risks of these systems.
- Reassess and define stakeholder values.
- Understand options for the upgrade of existing systems and/or the installation of new wastewater technology.
- Participate in developing a wastewater plan for the future.

Research

The preparation of this report involved:

- investigation of current waste water disposal practices in Birregurra and their risks on public health, the environment and development;
- research of legislation, guidelines, stakeholders, previous and proposed strategies; and
- research of options for long term sustainable wastewater systems.

Consultation Process

The proposed consultation process is to develop outcomes from this Issues Paper, which draws background information from *the Colac Otway Shire Wastewater Management Strategy, February 2002*, as well as, provide information on alternative systems of wastewater treatment and disposal. The Issues Paper will be made available a minimum of 4 weeks prior to the community forums. Comments regarding community values, the preferred options for wastewater disposal and any other comments relevant to the Issues Paper will be received in writing until **Friday 19 July 2002**. Comments, discussion and preferred options identified at the community forums will be recorded and used as part of the feedback process. It is hoped that many of the property owners and townsfolk can attend the forums and contribute or listen to the discussions.

Copies of the Issues Paper will be distributed within the community. The paper will also be available for viewing on Colac Otway Shire's Internet Website www.colacotway.vic.gov.au. A pamphlet advising of the contents of this Issues Paper will be forwarded to each property owner of Birregurra.

At the end of this period a community forum will be held. The objectives of these forums are to:

- Present background information.
- Determine values that are important to the community (the final wastewater option must match these values).
- Determine the most appropriate wastewater options to consider.

These community values and wastewater options will be developed into a Strategic Plan for further community discussion. Professionals in the respective fields of the wastewater options chosen will provide input into this Strategic Plan. The Strategic Plan will be distributed similarly to the Issues Paper mentioned earlier.

A community forum will again be held to discuss the information and options. Professionals for the respective wastewater options will be in attendance to answer questions.

Following these meetings a survey will be distributed to all township property owners to vote on a preferred option. The results of this survey will determine the next course of action. If the vast majority approve one option then the relevant organisation/authority will be notified and requested to make provisions for the installation of that system or systems. If there is inconclusiveness then the results will be recorded and reported back to Council with recommendations for future action.

2. Background

2.1 Natural Environment

A fundamental consideration when designing a domestic on-site wasterwater system is the natural environment and its potential impact on the system. These natural constraints include the physical characteristics of the site, its geology, soil type, the township topography, climate, ground water and water balance.

Physical Characteristics

When considering site suitability for wastewater disposal it is necessary to have suitable physical factors. These factors are influenced by lot size, slope of the land, the soil percolation rate, depth to the Winter/Spring water table, and the annual rainfall. If one or more of these factors are unsuitable an application for installation for a septic system may be refused.

Geology

Birregurra is located on two specific geological units. The northern, flat part of the township is located on Gellibrand Marl of the Miocene, Oligocene periods. This is a calcareous silty clay and clayey silt. The southern hill area is of the Colluvium unit from the Pleistocene, Holocene periods. It consists of colluvium and gully alluvium and comprises clay, silt, sand and gravel.

Soil Type

The soils in the Birregurra region are predominantly shallow loam, mostly of clay texture and underlain by a clay subsoil. The soils have a low moisture infiltration rate and high moisture capacity.

The parent material of the soil is calcareous clay. The soil type can be broadly classified as yellow brown calcareous duplex soils with yellow brown medium to heavy clay present at 300mm. The dispensable clay subsoils have a low permeability (saturated hydraulic conductivity) which encourages waterlogging and surfacing of applied waste water.

Permeability of the soil based upon soil characteristics is estimated to be between 0.05 – 0.1metres per day. This depicts moderate to poor drainage which is reflected in the soil structure ie clay loams with moderate to slow drainage and light clays with slow to poor drainage. Seasonally high water tables are present which leads to soil salting and waterlogging. The soil type is also characterised by containing low nutrient levels.

The electrical conductivity, which is used to estimate the concentration of soluble salts in the soil, is relatively high, which places moderate limitations for on the site for wastewater disposal. Dryland salinity is a serious threat to water and soil quality and has significant negative environmental impacts.

The township has an acceptably low potential for flooding, except for properties located in the Barwon River flood plain. It has an unacceptable proximity to surface water and to the water table and an acceptable depth to rock and impervious rock layers.

Topography

Birregurra falls within the catchment of the Barwon River. The Birregurra landscape is a flat plain bordering the present flood plain of the Barwon River. It has an elevation of between 110-160 metres and a moderate slope to the south of around 15%.

The native vegetation has been almost completely removed for agricultural pursuits, which surround the township. Agricultural activities include sheep and beef cattle grazing, dairy farming and cropping. The landscape and ecological values have therefore been altered dramatically and the land is not considered to be pristine.

Climate

The annual average temperature for Birregurra is 13°C, with the lowest average temperature experienced in July and the highest average temperature in February.

The area experiences an annual rainfall of between 650-700 mm, with the lowest rainfall occurring in January (35mm) and the highest in August (85mm). The precipitation is less than the potential evaporation from October till late April.

Climatic data is essential in being able to calculate the hydraulic loading capacity of the soil and the amount of wastewater that can be applied.

Groundwater

A Study of the Land in the Catchments of the Otway Range and Adjacent Plains, (Soil Conservation Authority 1981) indicate that a seasonally high water table does exist, although it direct depth has not be ascertained.

2.2 Built Environment

There are around 407 properties within the townships. A large number of properties are $2000m^2$ or greater. Over 80% of the properties have been developed. The vast majority of these are domestic properties which are used as permanent homes. There is a trend at the moment that properties are being purchased for rental or holiday purposes.

Birregurra is serviced with water, power and telephone. There is no sewerage or gas supply.

The road structure has both sealed and unsealed surfaces. There is a combination of constructed and earthen drains throughout the township. Dwellings that were previously permitted to discharge treated effluent off-site, discharge to these drains. The greater number of problems originate from the earthen drains. The natural draining lines are towards the Barwon River.

Septic systems have been installed for commercial and other non-domestic properties. These include the:

- Shops in the Main Street.
- Community Health Centre.
- Dining establishments include the Birregurra Royal Mail Hotel, Pauline's Coffee Shop and the general store.
- Centres that can attract a large number of people over a lengthy period include the Birregurra Bowls Club, kindergarten and the community hall.

3. Reports

Birregurra Township Structure Plan 1995

Council adopted the Birregurra Township Structure Plan in October 1995. The vision of the Plan is to present a positive and attractive image to all whom visit and live in the town. This can be reinforced by ongoing improvements to private and public investments in the town.

Birregurra will continue to act as a town providing a residential locality for people who will mostly be employed outside the town.

In the medium term (5 years), the community will act to make clear decisions about the need or otherwise for a reticulated sewerage system for the town. Without such infrastructure, the town's growth is limited and ongoing local environmental problems will prevail.

In Part 4.2, the Plan mentions that a study in the early 1980's was conducted by consultant for Barwon Water to determine the feasibility and priority of sewerage. At that time it was not found to be economically feasible.

Barwon Water carried out a further study in the late 1980's but again because of the large lot sizes and dispersed development it was not considered feasible. The residents were also strongly opposed to a scheme at the time of the later study.

The situation will need to be reassessed to address the need for an appropriate sewerage system which is affordable for the community, and meets public health and environmental requirements.

Birregurra Town Centre Urban Design Review 1999

This review identified the difficulties relating to soils and drainage and to sewage treatment and concluded that they were clearly limiting factors to growth.

Planning Controls

The Planning Scheme requires all new dwellings located in unsewered areas to treat and contain their wastewater on-site. For new subdivisions in unsewered areas, planning applications must include land assessments which demonstrates the capability of the lots to treat and retain all wastewater on site.

Therefore, the scheme requires Council to refuse any application for dwellings in unsewered areas where it cannot be demonstrated that wastewater can be treated and contained on-site. There are approximately 40 vacant properties in Birregurra that may restrict future development. Unless reticulated sewerage, decentralised wastewater systems or the consolidation of properties occur, these blocks may not be able to be developed.

Off site discharge

The condition to restrict off site discharge was defined in the EPA Guidelines for Domestic Wastewater Management 629 (November 1998). The principle guideline was that discharges of treated wastewater to streams or watercourses (this includes drains) of less than 1ML a day was not permitted. This document effectively stopped future off-site discharges.

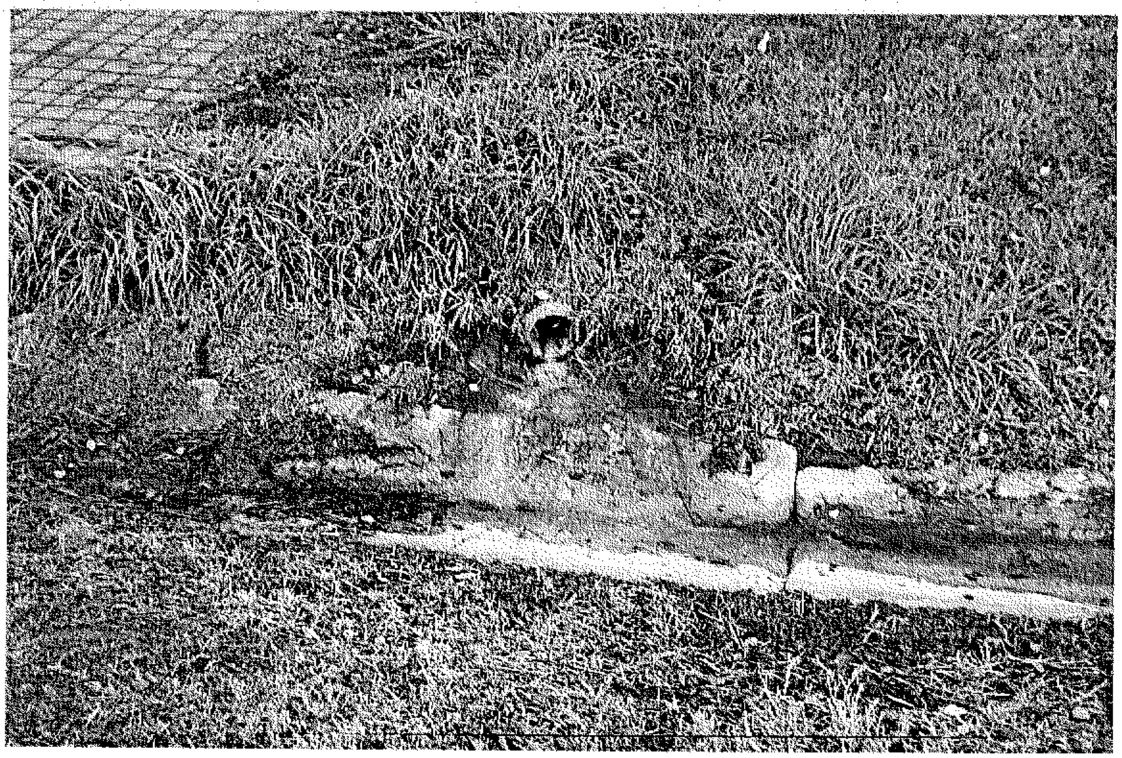


Plate 1: Discharge of grey water to street drain

4. Effluent Disposal in Birregurra

Effluent disposal has been the responsibility of property owners since the commencement of the township. Early disposal methods would have been drop toilets, wastewater wells and a pan closet collection.

These methods were superseded by split septic systems where only black water (toilet waste) was required to be treated and retained on site. Sullage or "grey water" which consisted of kitchen waste, laundry waste and bathroom waste was allowed to be discharged off-site to a stormwater drainage system, land or surface water. Over 25 % of properties still use this type of system.During the last 20 to 25 years all-waste septic systems were required to be installed to treat and retain effluent on site.

There was also the option to provide secondary treatment to effluent which may then be discharged off-site to the satisfaction of Council (this practice ceased in 1999 due to EPA guidelines and changes to statewide planning controls). This only occurred on properties that were too small for retaining effluent on-site.

A survey of septic tank systems was conducted in 2000. The results indicated that Birregurra has a cross-section of all types of systems.

From the field observations there were 65 (30%) of systems that discharged some or all wastewater off-site. This leaves 159 (70%) of systems that treat and dispose of wastewater on-site. Table 1 provides information on the number and variety of septic tank systems.

Table 1 – Septic Tank Systems

Township	No of properties assessed	Types of systems						
		ASFOff	ASFOn	AOS 90m	AON < 60m	Other	WC SOff	WC SOn
Birregurra	224	8	9	15	98	10	57	27

Legend – AWSFOff – All waste sandfilter with offsite discharge, ASFOn – Allwaste sand filter with on-site discharge, AOS 90m – Allwaste onsite to 90m drain, AON<60m – Allwaste onsite to less than 60m drain, Other – packaged treatment plants, bioloos and drop pits. WCSOff – Split system with sullage off site, WCSOn – Split system with sullage on -site

Note: Data in this table is from properties that could be accessed and septics were able to be located. This will create inconsistency with the number of properties mentioned earlier in the report.

4.1 Defective Systems

Table 2 provides data on the number of defective systems that were identified during the inspections. This table shows that over 30% of septics have defects. It should be noted that because of the large number of properties involved, officers were simply requested to identify any obvious defects. They were not instructed to conduct the time consuming tasks of testing sand filter and aerated wastewater treated effluent, to ensure that it complied with the standard, to trace the discharge of effluent off-site.

Table 2 – Types of defect

Type of defect	Birregurra
No of properties	224
Tank /sandfilter/effluent drains covered with inappropriate vegetation	7
Pooling effluent/blocked drains	2
Effluent discharging onto neighbouring properties	1
Distribution pit blocked	-
More soil required over drains/tanks	-
Septic tank not accessible	21
Damaged tanks/pits./pipes/effluent drains	4
System not complete	-
Driveways/other structure over sand filter/effluent drains	-
Total	**35**

Defects have included septic tanks that are not accessible. This is because septic systems are more than just tanks and pipes. The monitoring and maintenance of systems are critical to ensure that they are operating effectively. If not monitored, the risk of failure is significantly increased. On a number of site inspections property occupiers were unable to locate their septic tank. This provides the added risk where property development such as extensions, shedding and landscaping may negatively impact on the septic system.

Septic system complaints for Birregurra show that the general amenity rates as the highest issue. This includes odour, mosquitoes, unsightliness on drains and weed overgrowth.

4.2 Age of Systems

Under normal usage conditions, and if well maintained, the on-site effluent drains of a septic tank system are expected to last 25 or more years. After this period new effluent drains may need to be constructed on the property. The effluent drains can be used for the disposal of grey water, black water or both.

The survey showed that on-site effluent disposal via trench systems occurs in over 90% of properties in Birregurra. Of these 25% are over 24 years of age and 44% are between 15 and 24 years of age.

Using 25 years as the minimum expected life of effluent drains for a septic system these results indicate that in 10 years time nearly 70% of on-site effluent disposal drains may have reached their life expectancy. This suggests that the failure rate for septic systems will increase during the next 10 years.

When looking at all wastewater systems in Birregurra there are 27% less than 15 years of age, 45% between 15 and 24 years of age and 28% greater than 24 years of age.

It is a concern that within the next 10 years that 73% of wastewater systems will be over 24 years of age.

4.3 Cause Of Problems

From preliminary investigations into household waste water disposal it would be reasonable to state that Birregurra has outgrown its status as a septic tank district and requires either a reticulated sewerage scheme or an innovative approach to waste water disposal on a township or individual property basis.

Birregurra is experiencing problems with household drainage due to:

- The availability of a town water supply
- Relatively small areas of land available for absorption trenches
- Evolution of dwellings from small houses to substantial dwellings with all modern conveniences ie dishwashers, spa baths etc.
- The poor absorption capability of the soil structure in the area

- The initial design of many waste water disposal system which no longer meet the current Australian Standards or the EPA's Code of practice.
- The lack of appropriate care with usage and maintenance of the systems
- Lack of education relating to the correct use of the system.
- Overloading of systems through excessive water usage;
- Unapproved modifications/alterations of systems.
- Age of waste water disposal systems

5. Optimum Standard for Waste Water Disposal

This report has outlined the physical constraints and the built environment characteristics for Birregurra. The wastewater treatment systems have been detailed and concerns have been raised.

Numerous Codes of Practice, Regulations and Australian Standards exist for the design and installation of septic tank systems. This is an evolving process, as more information becomes known about the treatment of wastewater as well as the environmental and health implications of poorly designed and maintained systems.

It is important that information of the current wastewater disposal methods is analysed and compared with the current minium requirements which exist today. Table 4 contains the physical factors which are to be considered when assessing a site suitability for on site waste water disposal and compares them to the current legislative requirements.

Table 3 – Guidelines for Septic Systems

Guideline	Minimum Standard	Compliance
Lot Size	Greater than $1000m^2$	Majority Compliance – although it is now recommended 4000 - $5000m^2$
Slope of Land	Less than 20%	Yes
Soil Percolation Rate	Greater than 15 mm/hr	No
Depth to Water Table	Greater than 1500mm	Questionable as depth has not been ascertained – although soil characteristics indicate high water table
Annual rain fall	Less than 900mm	Yes

It may be appropriate to state that Birregurra only complies with 2 –3 out of the 5 physical factors which are required to determine site suitability for on site waste water disposal.

Effluent disposal tenches need to be of a specific length and width to ensure sufficient on-site effluent disposal for the development. To demonstrate an appropriately sized system with those that have been installed in Birregurra, the requirements for two and three bedroom houses will be calculated (calculations and design rates are from the Code of Practice – Septic Tanks 1996). Constants to be considered are:

- Each bedroom can cater for 2 persons and has a daily flow rate of 200 litres/person on town water using no water efficiency devices
- A sample percolation rate of 0.08m/day
- Trench width is 700mm

Table 4 shows the length of effluent trench required on a block to ensure sufficient effluent absorption and transpiration for a two, three and four bedroom house.

Table 4 – Length of Trench

No. of bedrooms	Length of trench - metres	Effluent Field Area - m^2
2	110	480
3	166	645

Council's survey of all-waste effluent disposal trenches shows that 98 properties have trenches less than 60 metres in length. Another 15 properties have trenches greater than 60 metres in length. Combined, these properties of those inspected make up over 50% of the Birregurra wastewater systems. These trench lengths are well below that of what is required for a standard residence.

It would be expected that systems that are under-designed will have a high failure rate. However, there are some systems that are under-designed that have been connected to the stormwater system to provide relief for the septic system. This is an illegal practice that cannot be detected unless specific tests are conducted on the property or a nuisance is reported.

6. Restriction on Future Development

Due to changes in Council's Planning Scheme, subdivisions and building developments must be capable of treating and retaining effluent on-site. In the case of a proposed building development a planning permit will not be issued unless sufficient land is available for effluent disposal. For example, if a five bedroom house is proposed on a 1000m^2 block there will be little chance to treat and retain effluent on-site, subsequently the application would be refused. If the applicant decided to amend the application to a two bedroom house then there is a chance that approval would be given, with a number of conditions.

This has created restriction to a number of proposed developments and redevelopments. The applicant must decide whether to reduce the development, delay the project until sewer or other decentralised wasterwater systems are available or attempt to sell the property.

There are about 40 vacant properties in Birregurra that may be restricted in their future development. This could be due to land size, proximity to a watercourse, of the groundwater height.

Development restriction is not only a problem for undeveloped blocks. Restrictions may also apply to residential extensions/additions, and site redevelopments (due to building demolition and upgrade, or the need to rebuild due to destruction of the building by fire, flood or other occurrence).

An extreme, but possible, example is the case where more than 50% of a dwelling is destroyed by fire. A planning permit would be required before any works commence. If the dwelling had 3 or more bedrooms and discharged effluent off-site a planning permit for a similar sized dwelling would not be issued unless it could be demonstrated that effluent could be treated and retained on-site. Again, the applicant would need to decide whether to amend the application to a smaller dwelling, delay the project until sewer or a decentralised wastewater system is available or attempt to sell the property.

7. Water Testing

Council officers have taken water samples from stormwater drains, open drainage channels and the Barwon River for the purpose of identifying the extent of contamination. The results of these tests are provided in Table 5.

It should be noted that only one sample of water was taken from each site. The normal practice for water sampling is to take five samples at each site, especially if the results may lead to litigation. Therefore, the results in Table 5 should only be considered as indicative.

E.coli

It also should be noted when reading the results that the following standards apply to drinking, swimming and other recreational waters:

- The presence of E.coli indicates faecal pollution and Standard Plate Counts indicate the level of all bacteria, whether they are harmful or not.
- Drinking water is not allowed to contain any E.coli/100mL.
- Swimming water is considered satisfactory if the median sample contains <150 E.coli/100mL. Allowance is provided for one of the 5 samples to reach 600 E.coli/100mL.
- Water is considered safe for non-contact activities, including canoeing and yachting, if the median sample is <1,000 E.coli/100mL. Allowance is provided for one of the 5 samples to reach 4,000 E.coli/100mL.

Faecal Streptococcus

This bacteria is present in all warm blooded animals and tends to be more resilient in the environment than E. coli. It is useful to determine past contamination of a source by a warm blooded animal.

There are no specific levels that relate to its concentration apart from the fact that it shouldn't be there. E. coli is the preferred indicator as it is the more immediate result and gives a better picture on what's happening on a day to day basis.

E. coli appears in greater numbers in warm-blooded animals, which probably accounts for the lower concentrations of Faecal Streptococcus.

Nitrogen and Phosphorus

The amount of nitrogen and phosphorus found in domestic wastewater is about 50mg/l and 12 mg/l respectively. Although domestic wastewater is not the only source of nitrogen and phosphorous it is reasonable to assume that in Birregurra the predominant catchment area for the stormwater drains is the township zone.

The acceptable level of nitrogen and phosphorous in water systems usually relates to the levels above which you will get algae growth.

For Nitrogen the level is 0.5 mg/l
For Phosphorus the level is 0.05 mg/l

The relevance of these levels depend on factors such as how fast the water is moving, temperature, pH etc. as to how much algae growth will occur.

Plate 2: Nitrogen and phosphorus levels in wastewater increase algal growth

Table 5– Water samples

Location	Standard Plate Count/ml	Faecal Strep./ml	E.coli/ 100ml	Nitrogen N Mg/l	Phosphorus P Mg/l
Birregurra					
Birregurra Creek at playground					
13/12/99	740	-	n/d		
18/01/00	2,800	-	35		
12/12/00	21,000	<2	120		
17/01/02	3,300	n/d	50		
Barry/Beal Street - drain					
18/10/01	14,000	<1	190	10	0.2
Barry/Strachan - drain					
18/10/01	380,000	<6	2,700	14	0.38
17/01/02	340,000	<5	270,000		
Main/Strachan Street – drain					
18/10/01	280,000	3	1,340	10	0.2
Kettle Creek (near Barwon River)					
18/10/01	4,000	2	440	10	0.04
Jenner Street - drain (rear of the shops) 24/04/02	2,500,000	80	270,000		
Barwon River					
Upstream of Birregurra Golf Club					
18/10/01	11,000	<1	400	14	0.05
17/01/02	6,300	<2	300		
Downstream of Birregurra (Yalloak Homestead)					
18/10/01	17,000	<1	270	10	0.03
17/01/02	3,700	<1	100		

n/d denotes non-detected.

Although the test results are only indicative, they do show that water sources sampled in the street drains in the township can have a high level of faecal contamination. This indicates a potential risk public health. Further sampling and investigation will be conducted to identify sources of contamination.

Water samples from the 2 creeks that flow through and adjacent to Birregurra indicate that any faecal contamination in the street drains has been broken down by the time it reaches the natural watercourses. This may be due to the contact of contaminated water with natural micro-organisms in the earthen drains. Other factors include, the length of time, if it occurs at all in dry conditions, for contaminated water to flow into the watercourses and possibly the relatively low number of dwellings that discharge wastewater off-site.

Water samples from the Barwon River upstream and downstream of Birregurra indicate that there is little if any impact of the faecal contamination reaching the river. Further samples at these sites are required to provide more meaningful data.

Nitrogen and Phosphorus levels in the street drains are at levels that can promote the growth of algae. Samples from Barwon River indicate little change between the Nitrogen and Phosphorus levels upstream and downstream of Birregurra.

8. Public Health Warnings

Council has taken a number of water samples over the past few years. The earlier samples at the main collector watercourses have indicated that there was minimal risk to public health. More recently the sampling program has been commenced the drainage systems upstream of these watercourses. This has identified more concerning levels of faecal contamination in the drains.

As mentioned previously in this Issues Paper, there will be continuing sampling and investigations to determine a more accurate level of drain contamination and the sources of this contamination.

Fortunately, these drains do not lead directly to recreation waters or sources of water for drinking purposes. However, there may be a more local risk to the immediate township with direct or indirect contact of this faecally contaminated water and the possible breeding of mosquitoes and other vectors in and around faecally contaminated water.

Plate 3: Open drain in Jenner Street

9. Summary of Waste Water Disposal Risks

- There is no uniform method of wastewater disposal. Instead, there are a wide variety of systems that have varying levels of effectives and compliance.
- Over 15% of systems have defects.
- Within 10 years 70% of effluent trench disposal systems will have reached their life expectancy.
- The vast majority of effluent disposal trenches are insufficient in length (under current guidelines).
- Soil quality in the lower, flat northern section of Birregurra is not conducive for good absorption of wastewater, especially in winter months.
- The opportunity to increase infill development in Birregurra is greatly reduced.
- There are restrictions that will limit or stop both development and re-development. This may occur for over 96% of blocks.
- Water sampling has indicated that faecal contamination in street drains may pose a public health risk.

10. Assessing Community Values

Before the options for future wastewater systems can be discussed it is important that the values of the Birregurra community are understood when considering the impact of any proposed wastewater system.

The Birregurra Structure Plan, October 1995, which was based on public consultation, defined the following in its vision.

- To present a positive and attractive image to all who visit and live in the town.
- To act as a town providing a residential locality for people who will mostly be employed outside the town.
- To make the most of growth in the local tourism industry.
- The attractive and important natural and built features of the town, such as the Barwon River, its public reserves and the heritage buildings shall be integral to the town's enhancement.
- In the medium term (5 years), the community will act to make clear decisions about the need or otherwise for a reticulated sewerage system for the town. Without such infrastructure, the town's growth is limited and ongoing local environmental problems will prevail.

An important outcome from the first round of community consultation is to reassess these components of the vision in light of new information, the progress of time and possible changes to community opinion.

There are other values, specific to the most appropriate type of proposed wasterwater system, that need to be developed and considered by the community. These include:

- Environmental values: flora and fauna, waterway management, land degradation, erosion, reuse of wastewater, reduction of water use.
- Social values: development, amenity, township growth, tourism.
- Economic values: cost of wastewater improvements, property value increases.

11. Wastewater Options

Earlier in the report the different existing types of wastewater systems were discussed. There are a number of options that can be considered for upgrading existing systems for providing a medium to long term solution.

This section describes a set of treatment processes that introduce the functional issues associated with various wastewater technologies. The processes are then coupled together to form a scenario so that the risk of wastewater treatment can be discussed on a site-by-site basis. The wastewater scenarios are then merged into strategies to consider the application of the wastewater systems for sites within Birregurra.

11.1 Wastewater Processes

There are a number of wastewater processes that may be considered for installation. These include:

- **Domestic On-site Process.** Where the effluent is collected, treated and disposed of on-site.
- **Domestic Off-site Process.** Where effluent is collected and treated on-site and disposed off-site.
- **Decentralised Off-site Process.** Where effluent is collected and partially treated on-site, then disposed to a common neighbourhood system for further treatment and disposal.
- **Low Cost Sewerage Process.** Where effluent is collected and undergoes primary treatment on-site, then disposed to a centralised township system for further treatment and disposal.
- **Sewerage Process.** Where effluent is disposed to a centralised township system for treatment and disposal.

Within each of these different wastewater processes there are a number of systems, especially for domestic on-site systems.

Potential functional advantages and disadvantages are provided, based largely on (Martens 1998). This helps identify the limitations of each process and the possible need to use a number of processes to achieve acceptable risk. The potential advantage or disadvantage highlights that the process must be operated in a way

that increases the likelihood of achieving the advantages while minimizing the likelihood of disadvantages. When a number of processes are combined together it behaves as the collection of processes and is referred to as a scenario. The description of the processes does not attempt to give design detail but highlights functional issues that need to be considered for the design of a wastewater system.

11.1.1 Domestic On-site/Off-site Processes

All domestic on-site and off-site wastewater systems need to be issued with a Certificate of Approval by the EPA before they are permitted to be installed in Victoria. At the moment there are around 55 different types of systems that have been approved by the EPA. A full description of the approved wastewater system can be found at www.epa.voc.gov.au under the 'For Local Government' section.

These include:

- 12 composting units (dwellings require a separate sullage system)
- 2 waterless composting systems (dwellings require a separate sullage system)
- 2 all waste composting systems
- 2 incineration systems (dwellings require a separate sullage system)
- 20 Aerated Wastewater treatment Systems (dispose to land only)
- 11 Aerated Wastewater treatment Systems (dispose to land and water)
- 8 other types of systems

Some of these processes will be mentioned in this section.

Reduce Water Use

The reduction of water use is applicable to sites that do not have water efficient fixtures. This is where a retrofit of fixtures and appliances takes place.

A strategy to reduce water use includes the installation of water efficient fixtures/appliances and a maintenance program to reduce the base load of water consumption from leaking fixtures. The strategy also requires an education campaign and commitment from both Colac Otway Shire Council and the local residents to reduce water use. This commitment could take the form of a memorandum of understanding between the council and the resident as a condition of the upgrade of the water fixtures. An additional benefit of retrofits in Birregurra is the reduced use of water, thereby reducing excess water rate charges.

The fixtures need to be viewed as part of the infrastructure of the effluent treatment system. Each household needs to have "full water reduction facilities" as outlined by AS 1547:2000 that includes *"the combined use of reduced flush 6/3 litre water closets, shower-flow restrictors, aerator faucets, front-loading washing machines and flow/pressure control valves on all water-use outlets. Additionally, water reduction may be achieved by treatment of greywater and recycling for water closet flushing (reclaimed water cycling)".*

Composting Toilet

The compost toilet reduces the volume of wastewater that either needs to be treated on-site or off site. The composting toilet treats black-water (toilet waste only) and putrescible household garbage and needs to be coupled with a greywater system to provide full treatment of household wastewater. The use of the compost toilet is especially applicable to sites that have steep slopes and can easily accommodate the composting toilet underneath or beside an existing structure.

An additional advantage of the composting toilet is the reduced greenhouse gas emissions from the aerobic decomposition of sewage. A fan is included as part of the composting toilet to ensure the degradation of sewage is aerobic and to remove any odours that may arise. Depending on the type of system the compost can be buried on-site at a minimum depth of 30cm or disposed off-site to the satisfaction of Council.

Table 6 Functional Advantages and Disadvantages of Compost Toilets

Potential Advantages	Potential Disadvantages
• Reduced wastewater volume (up to 30%) • Less stress on land application areas. • Increased longevity of land application areas. • Several options available for land application. • Low energy use. • Aerobic decomposition of sewage reduces greenhouse gas production. • Compost may be buried on-site. • Septic tank used for greywater treatment may be desludged less often.	• Installation is often below house and if not possible requires a housing system to be constructed (this is simpler on a steep slope). • Compost must be periodically removed. • User is responsible for the maintenance. • Susceptible to shock loads of water and chemicals. • A separate system is required for greywater. • Requires a dedicated land area on the residential block.

Upgrade Existing Septic Tank Absorption/Transpiration Systems

Failing septic tanks need to be either replaced or upgraded to improve the performance to acceptable levels. This may not be achievable on a number of lots in Birregurra.

Filters and flow baffles are suggested for all structurally sound septic tanks that do discharge effluent on-site. The EPA requires the desludging of a septic tank every 3 years.

Table 7 Functional Advantages and Disadvantages of Upgraded Septic Tanks

Potential Advantages	Potential Disadvantages
• Produce higher quality effluent than conventional (and current) septic tanks. • Provides additional treatment for other processes while releasing the effluent to the receiving environment. • Accommodates both black and grey water. • No energy required to operate. • Simple technology	• System requires desludging every 3 years. • Filters need desludging every 2 years. • User is responsible for maintenance. • Effluent is likely to require further treatment before disposal. • Requires a large dedicated area of land ($600m^2$ or larger) for disposal. • An alternative disposal field may be required. • Has a limited life. • Can fail if upstream processes such as a septic tank fails.

Irrigation - Surface/Sub-surface

Where effluent is treated to a satisfactory standard, either by a sand filter or Aerated Wastewater Treatment System it may be disposed of through an irrigation system (Code of Practice – Septic Tanks 1996).

There are two types of irrigation. One above ground, which requires disinfection of the treated effluent and one sub-surface.

Table 8 Functional Advantages and Disadvantages of Irrigation

Potential Advantages	Potential Disadvantages
• Can provide an even distribution of wastewater across the site. • Can distribute wastewater to irregular and isolated disposal fields. • Provides comparatively shallower and narrower trenches to install pipework than for absorption trenches and transpiration fields. • Simple technology. • Is useful for maintaining a nutrient enriched liquid for plants.	• Is a pressurised system that requires a pump system. • Dripper head are subject to damage and require ongoing replacement. • Filter heads may become blocked and require cleaning. • Can fail if upstream processes such as a septic tank fails. • User is responsible for maintenance. • Requires a relatively large area of land for disposal. • Surface irrigation can cause run-off on steep sites.

Wetland Reed Bed System

A small Wetland Reed Bed system provides additional treatment after the septic tank. A filter on the septic tank would ensure that the wetland does not become clogged.

Table 9 Functional Advantages and Disadvantages of Wetlands

Potential Advantages	Potential Disadvantages
• Provides removal of carbon, nutrients and pathogens and higher quality effluent when coupled with other treatment systems. • No odours. • Accommodates combined wastewater or just greywater. • No energy required to operate. • Required less area than an absorption or transpiration system.	• User is responsible for maintenance. • Requires a dedicated land area on the residential block. • System may fail over time if coupled with a failing septic tank. • Limited usage may cause the wetland/reed bed to dry-out. • Difficult to site on steep slopes.

Sand Filter

A sand filter is only required for sites where there is an opportunity to discharge off-site or there is little or no scope for absorption/transpiration trenches. Treated effluent from the sand filter can be disposed of by surface or sub-surface irrigation. The sand filter provides additional treatment to reduce the risk for extreme locations.

Table 10 Functional Advantages and Disadvantages of Sand Filters

Potential Advantages	Potential Disadvantages
• Produces high quality effluent. • No odours. • Accommodates both grey and black water. • Requires less area of land for effluent disposal.	• May have a limited life and need periodic replacement (10-15 years). Alternatively larger beds could be used. • User is responsible for maintenance. • Requires a dedicated land area on the residential block. • System may fail over time if coupled with a failing septic tank.

Pump-out

Pump-out is the mechanism of taking the sewage or effluent off-site for treatment at either sewerage treatment plant. This process is potentially very costly especially for isolated townships as Wye River and Separation Creek.

This system is currently not approved by the EPA and would need to undergo critical assessment on compliance, monitoring and other criteria prior to approval being given.

Table 11 Functional Advantages and Disadvantages of Pump-out

Potential Advantages	Potential Disadvantages
• Provides a service that can be applied to all sites. • Keeps wastewater out of the soil.	• May require a certain number of households to be viable. • Siting another tank on the property. • Holding tanks, whether communal or individual need to be accessible for pump out tankers.

Holding Tanks for Wet Weather/Intermittent Usage Storage

Between May and September, when rainfall exceeds evaporation, or at times of high usage some domestic on-site systems may need to store a percentage of treated effluent in a sealed holding tank until the ground is capable of absorbing the wastewater.

This process is ideally suited to dwellings that are used on a seasonal or limited basis. A percentage of wastewater can be held while the dwelling is occupied, then allowed to automatically dose the wetland, absorption or transpiration fields during periods when the dwelling is unoccupied.

Table 12 Functional Advantages and Disadvantages of Holding Tanks

Potential Advantages	Potential Disadvantages
• Doses the wetland, absorption or transpiration field on a regular basis. • Reduces saturation of soil. • Accommodates grey water and grey/black water. • For high treated wastewater can be considered a resource.	• Limited to seasonal or limited usage of dwelling. • Complex management and monitoring for owner. • Siting another tank on the property.

Aerated Wastewater Treatment Systems (AWTS)

This strategy is only applicable to permanent or regularly used residents, as the AWTS systems require relatively constant operation to sustain the biological media. The AWTS system treats the sewage and disinfects the effluent for disposal to a irrigation or absorption/transpiration fields.

There are a number of AWTS units that are permitted to discharge off-site provided they comply with the State Environment Protection Authority (SEPP) – Waters of Victoria.

Table 13 Functional Advantages and Disadvantages of AWTS

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Low odours. • Less stress on land application areas. • Increased longevity of land application areas. • Several options available for land application.	• Higher energy use (than most on-site systems especially). • On-going maintenance costs. • Septic tanks require desludging. • User is responsible for the maintenance. • Highly susceptible to shock loads and irregular usage. • Susceptible to failure. • Requires a dedicated land area on the residential block. • Continued stress on land application areas.

11.1.2 Decentralised Off-site Process

The US Environment Protection Agency describes a decentralised system as *"An on-site or cluster wastewater system that is used to treat and dispose of relatively small volumes of wastewater, generally from an individual or group of dwellings and businesses".*

The US EPA concludes in a report on decentralised systems that *"Adequately managed decentralised wastewater systems are a cost-effective and tong-term option for meeting public and water quality goals".*

Table 14 Functional Advantages and Disadvantages of Decentralised Systems

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed by contractor or authority. • Is designed for an actual number of properties. • Installation cost is claimed to be less than conventional sewerage. • Reuse option for toilet flushing. • Long term solution. • Diameter of pressurised main sewer line is much smaller than conventional sewer drain.	• Is new technology to Australia. • Need to find one or more sites for common treatment fields and disposal. • Relatively high installation and ongoing costs. • Required the majority of properties to commit to the system to be economically viable.

11.1.3 Low Cost Sewerage Process

There are a number of methods to reduce the cost for sewerage in smaller townships that have existing on-site wastewater disposal systems. One such option is to retain structurally sound septic tanks, sandfilters or AWTS's and discharge the effluent to a common gravity fed sewer drain.

Primary and secondary treatment on-site would reduce the extent of solids removal at the point of treatment.

Table 15 Functional Advantages and Disadvantages of Low Cost Sewerage

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed authority. • Is designed for an actual number of properties. • Treatment cost is claimed to be less than conventional sewerage. • Long term solution.	• Need to find one or more sites for common treatment fields and disposal. • Relatively high installation and ongoing costs. • Will require all properties to commit to the system. • Larger common drain than in decentralised system may impact on slope stability.

11.1.4 Sewerage Process

This is the conventional sewerage system that requires no on-site collection or treatment. All property wastewater is gravity fed to the main sewer drain.

Table 16 Functional Advantages and Disadvantages of Sewerage

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed authority. • Is designed for an actual number of properties. • No management or maintenance by property owner • Long term solution.	• Need to find a site for treatment plant and disposal field/point. • High installation costs. • Will require all properties to commit to the system. • Larger common drains that will need to dug deeply into ground. May impact on slope stability

11.2 Combined Options

On-site and off-site wastewater treatment processes are compiled to give a number of wastewater treatment scenarios. Each wastewater scenario also includes the responsibilities and management required to operate the processes to achieve acceptable risk.

In general, off-site wastewater disposal has lower health and environmental risks than on-site effluent disposal. This is largely due to the mechanism of pollutant transport to the surrounding environment and the historically poor management of on-site effluent disposal. If effluent for on-site disposal is of poor quality due to poor design or management then the effluent will carry the pollutants into the on-site and surrounding environments. By definition, on-site effluent will be close to the household and presents an obvious health risk if not correctly managed. Off-site effluent disposal has generally been well maintained and monitored and disposed away from population centres.

Within each category of on-site or off-site effluent disposal, the risk of effluent disposal is greater for some options. For on-site systems this is largely dependent upon the site conditions and the permanency of the resident. For site conditions that have limited capacity for treatment using an absorption or transpiration field or requiring high quality effluent due to the location, a number of treatment processes may be required to achieve acceptable risk for effluent disposal. However, the greater the number of processes the greater the cost and the risk of impacts from effluent disposal will obviously be weighed against the cost of the system. A range of on-site disposal scenarios is presented to capture the diversity of needs in Birregurra.

A selection of wastewater scenarios is summarised in the table on the next page.

Table17 Wastewater Treatment Scenarios

Scenario No.	Processes	Scenario Type by Effluent Disposal
1	Water efficiency retrofit, upgraded septic tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
2	Water efficiency retrofit, upgraded septic tank, holding tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
3	Water efficiency retrofit, compost toilet, upgraded septic tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
4	Water efficiency retrofit, compost toilet, upgraded septic tank, holding tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
5	Water efficiency retrofit, upgraded septic tank, sand filter, (a) absorption field or transpiration field, (b) irrigation	On-site
6	Water efficiency retrofit, upgraded septic tank, sand filter, holding tank, (a) absorption field or transpiration field, (b) irrigation	On-site
7	Water efficiency retrofit, upgraded septic tank, AWTS, (a) absorption field or transpiration field, (b) irrigation	On-site
8	Water efficiency retrofit, upgraded septic tank, AWTS, holding tank, (a) absorption field or transpiration field, (b) irrigation	On-site
9	Water efficiency retrofit, upgraded septic tank, pump-out, truck to sewerage treatment plant	Off-site
10	Water efficiency retrofit, upgraded septic tank/AWTS, decentralised sewerage system	Off-site
11	Upgraded septic tank/AWTS, centralised sewerage system	Off-site
12	Installation of centralised sewerage system	Off-site

Inadequate maintenance will lead to failure regardless of how well the infrastructure of the system was designed. The number of processes that are required for an on-site system depends upon the risk of physical, environmental, health and social impact presented by the type of site.

11.3 Wastewater Strategies

The wastewater processes can be assembled into wastewater scenarios to treat wastewater for sites within Birregurra. The scenarios introduce the concept of risk and management for the construction, operation and demolition of the wastewater systems for individual sites. However, when all sites are considered there are a number of strategic wastewater issues that arise concerning the optimisation of wastewater scenarios to obtain the least risk.

The wastewater scenarios can be combined to form two types of strategies.

- Strategy 1: On-site effluent disposal
- Strategy 2: Off-site effluent disposal

Strategy 1: Onsite Effluent Disposal requires that sites are assessed for the application of on-site wastewater disposal. A selection of on-site effluent disposal scenarios may be required to meet the variety of site conditions and risks for the area.

Strategy 2: Off-site Effluent Disposal requires further investigation of services and costs for effluent pump-out, decentralised, low cost and sewerage processes. There is also the regional considerations regarding the discharge point for treated sewerage. This raises a number of questions that need to be assessed and answered on a local and regional level. These include, "Will disposal be to land or water?", "Is there suitable land for disposal?", "Are there reuse options for maintaining public and recreation reserves?" and "Is discharge to the Barwon River an option?".

11.3.1 Strategic Advantage of Decentralised Wastewater Treatment

The strategic advantages of centralized systems have been widely promoted over the past century as reflected in the choice of wastewater infrastructure across Australia. The strategic advantages of decentralized systems are less well known and the following list describes some of these benefits.

- "Closer matching of capacity growth to the demand curve through incremental implementation of smaller units. "Build-as-you-need, pay-as-you go" ties up less capital, reduces forecasting risk, and creates "option value" by allowing future changes in technology, management, and service strategy not possible with large-scale systems.

- Targeting of treatment upgrades to smaller, problematic units within a watershed.
- Greater control over the waste stream, and thereby increased biosolids useability and value.
- Localised water reuse, which reduces or avoids water purchases or ground water pumping, and may increase property values in water-short areas.

11.3.2 Monitoring of On-site Systems

From the risk management process there is a need to monitor and review risk on an ongoing basis. This applies to both on-site and off-site scenarios. With off-site scenarios an authority or agency manages the risk. With on-site scenarios there is currently no agency that monitors the systems on a regular basis.

With proposed changes to the Code of Practice for Septic Tanks and other guidelines produced by the EPA it may well become a function of local government to ensure that this monitoring is undertaken.

The Colac Otway Shire Wastewater Management Strategy, February 2002 (section 6.2.6), indicated that an annual fee of $30 to $40 was required to provide a monitoring program across the shire. If there is a random distribution of townships opting for on-site scenarios the annual fee may be slightly higher. This fee has been included in graph of figure 2 on page 48.

11.4 Other Future Considerations

It is necessary to point out that future legislation, guidelines, codes of practice and discharge conditions will impact on wastewater disposal. This will be for both on-site and off-site processes.

In essence, the changes will be to continually improve the quality of discharge and ensure sustainability. For off-site systems this will look at the treatment and mixing zone methods prior to discharge to the environment. For on-site systems this means ensuring that a property can, over the lifetime of the development, safely and in an environmentally sustainable manner treat and dispose of wastewater on-site.

As an example of this trend at the moment, future subdivisions on unsewered land may be deemed sustainable for on-site disposal if they are greater than 0.4 hectare and have a favourable land capability.

The scenarios for on-site wastewater systems mentioned in this Issues Paper provide an improvement on current conditions. There is no guarantee that the system will provide an sustainable wastewater process for the lifetime of the development. Ultimately, the only way of ensuring a long-term environmentally sustainable method of wastewater management in Birregurra is to introduce the most appropriate off-site process that satisfies community values and minimises the risks to public health.

12. Risk Analysis

12.1 Risk Management

The Australian Standards of *AS 4360: 1999 Risk Management* and *AS 3931:1998 Risk analysis of technological systems – Application guide* were the main documents used to formulate the risk management approach. This process is described in the Standards as follows:

"Risk management is an iterative process consisting of well-defined steps, which, taken in sequence, support better decision-making by contributing a greater insight into risks and their impacts. The risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. Decision makers need to know about possible outcomes and steps to control their impact."

General steps in the risk management process are outlined in Figure 1.

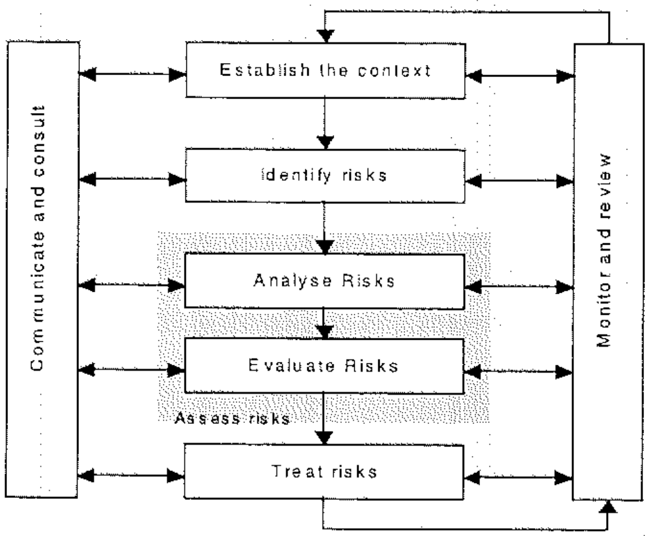


Figure 1 Risk Management Overview

Standards Australia AS 4360:1999

This study addresses each of the Risk Management steps presented in the above figure. However, the study does not attempt to fully analyse and evaluate risk as this requires communication with all stakeholders and is beyond the scope of this study.

Instead this study presents information that is useful for the assessment of risk and presents a framework for how the assessment can be conducted.

12.2 Identified Risks

Australian Standard 4360:1999 Risk Management states that

"Comprehensive identification using a well-structured systematic process is critical, because a potential risk not identified at this stage is excluded from further analysis. Identification should include all risks whether or not they are under the control of the organisation."

The potential risks associated with wastewater processes in Birregurra can impact are physical, environmental, health and social values.

Potential Physical Impacts

These potential impacts include:

- Site run-off
- Water logging of sites

Potential Environmental Impacts

These potential impact include:

- Degradation of land
- Degradation of drains and watercourses
- Algal blooms

Potential Health Impacts

These potential impacts include:

- Contamination of drains
- Odour
- Mosquito breeding
- Illegal discharges off-site

Potential Social Impacts

These potential impacts include:

- Cost of system
- Unable to develop a property

- Conditions detriment to the amenity of the townships
- Increase/decrease in population
- Increased wastewater with an increase in permanent residents

12.3 Risk Controls

There are controls that can be introduced to minimise the risk for on-site processes to an acceptable level. The determinant of an acceptable level requires the assessment of community values, and legislative requirements on health and environmental issues.

Physical Risks

Control of site run-off

- Reduce or regulate the volume of wastewater entering the soil.

Control of water logging of sites

- Reduce or regulate the volume of wastewater entering the soil.

Environmental Risks

Control of degradation of land

- Introduce wastewater onto land in a manner that is sustainable.

Control of degradation of drain and watercourses

- Provide a high level of treatment for effluent that cannot be retained on-site.
- Reduce the volume of wastewater being generated.
- Provision of mixing or filtration zones such as wetlands.

Control of algal blooms

- Provide a high level of treatment for effluent that cannot be retained on-site.

Health Risks

Control of contamination of water recreation areas

- Provide a high level of treatment for effluent that cannot be retained on-site.

Control of odour

- Provide a high level of treatment for effluent.

Control of mosquito breeding

- Reduce or regulate the volume of wastewater being generated so that it can be satisfactorily disposed of to land.

Control of illegal discharges

- Ensure that the site can sustainably treat effluent on-site.

Social Risks

Control of the cost of a system

- The introduction of any future wastewater system will need to consider the terms and conditions of payment and the ability of property owners to pay.
- Analysis of the ongoing costs to best understand the overall long term costs.
- To determine the life expectancy of systems.
- Management of assets and designing systems that are flexible for changing requirements.

Control of inability to develop a property

- May not be possible if site constraints are too restrictive. Would need to Introduce off-site disposal.

Control of conditions detriment to the amenity of the townships

- Provide a high level of treatment for effluent.
- Reduce or regulate the volume of wastewater being generated so that it can be satisfactorily disposed of to land.

Control of increase/decrease in population

- Introduce a wastewater system that supports the development values of the community.

Control of increasing wastewater with an increase in permanent residents

- May ultimately require the introduction of off-site disposal.

13 Costs

The following table shows the costs for each wastewater treatment process. The data is based upon cost estimates provided by local plumbers, product manufacturers, research into reports on retrofitting and operation and maintenance costs. The estimates for off-site systems are indicative only. Until these options are fully costed an accurate cost cannot be determined.

The installation costs are again indicative. Site conditions at Birregurra vary considerably. Accessibility, existing plumbing standards, slope, vegetation, climate condition at the time of installation and other site constraints will impact on the final cost.

The error in the costs relates to the degree of certainty and experience the source had with the activity. The greatest error is in the pump-out data because this is a service that has not been installed and is based on indicative costs in other states. The costs presented in the table show:

- The operation and maintenance costs are extremely high for pumpout and indicates it will be an important issue over the life of the system. Perhaps just as importantly it emphasises the need for more accurate data for annual costs for pump-out as it may lead to a commitment to high operating costs.
- The installation cost is very high for the sandfilter and also high for the absorption trenches/transpiration fields and AWTS.
- The capital cost of the AWTS, wetland and composting toilet are all high. The septic tank and absorption trenches/transpiration fields have low capital costs.
- Some systems are likely to need a financial program to spread the upfront capital costs across the life of the system. This will need to be researched in further detail once a short list of systems has been determined.

The individual processes are now assembled to create the wastewater scenarios in the following table.

Table 18 Annual Financial Costs for Wastewater Treatment Processes

Wastewater Treatment Process	Capital Cost	Installation Cost	O&M cost per year (a)	Water Samples Year (b)	25 Year Cost
Septic tank	$800	$500	$100	-	$3,800
Absorption/Transpiration fields	$800	$4,000	$0	-	$4,800
Irrigation – Surface	$1,000	$2,000	$200	$146	$11,650
Irrigation – Sub-surface	$1,000	$2,000	$200	-	$8,000
Sand Filter On-site disposal (b)	$2,000	$7,000	$300	$146	$20,150
Sand Filter Off-site disposal (b)	$2,000	$7,000	$300	$584	$31,100
Composting Toilet	$3,000	$500	$400	-	$13,500
Wetland	$2,000	$2,500	$450	-	$15,700
AWTS On-site disposal (b)	$5,000	$3,000	$500	$146	$24,150
AWTS Off-site disposal (b)	$5,000	$3,000	$500	$584	$35,100
Holding tank & pump	$3,000	$500	$200	-	$8,500
Water efficiency retrofit	$500 (c)	$300	-	-	$800
Pumpout, Truck to Sewerage Plant and treatment	$2,000	$500	$5,400 (d)	-	$137,500
Water efficiency retrofit, upgraded septic tank, pump into decentralised sewerage system	$12,000 (f)	$3,000 (f)	$500	-	$27,500
Upgraded septic tank, pump into sewerage plant drain (e)	$14,000 (f)	$3,000 (f)	$500	-	$29,500
Installation of a sewerage system (e)	$17,000	$3,000 (f)	$500	-	$32,500

(a) Operating and maintenance costs can include a number of factors including:

- the costing of time required for household maintenance. The property owner may need or wish to contract in these maintenance tasks;
- service of AWTS and sand filter by an experienced person;
- replacement of parts over the lifetime of the unit (does not include full replacement);
- desludging of septic tank every 3 years; and
- an indicative cost of pumping out and treating effluent at a Sewerage Plant.

(b) The EPA sets out the frequency and testing requirements of wastewater.

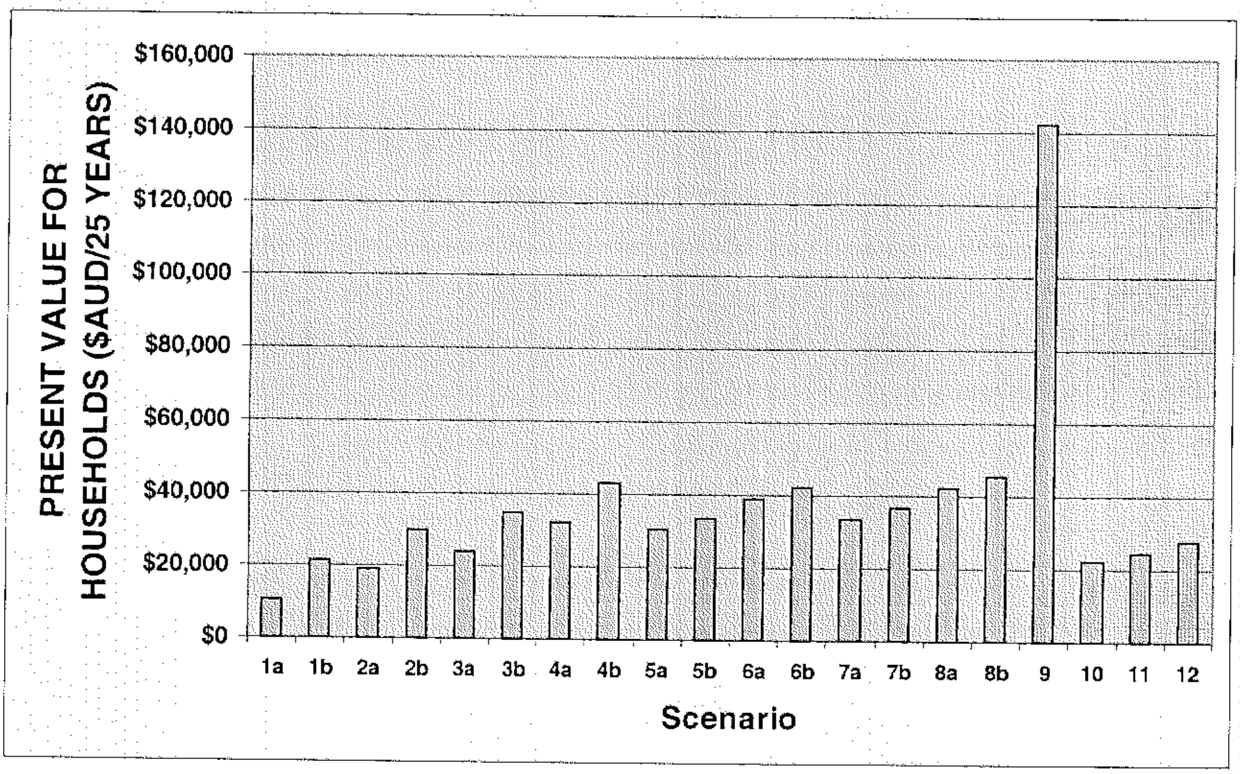
(c) Does not include the cost of a front loading washing machine. This cost needs to be added to the total.

(d) This cost is for 1/3 of a year. For longer or full time occupancy the figure will be around 2 –3 times higher.

(e) To ensure that sufficient water is available for the operation and maintenance of this system, a water reticulation system may need to be installed. This would have a significant impact on additional infrastructure and cost.

(f) Includes the capital cost of the main system, as well as, the cost of connecting to the main system and upgrades that may be required in the current plumbing of the dwelling.

Figure 2 Represents the Financial Value of Wastewater Treatment Scenarios Over a 25-Year Period



Note: An annual monitoring fee of $40 has been added to the scenarios from 1a to 6b inclusive

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Colac Otway
SHIRE

'Naturally Progressive'

Issues Paper

Wastewater Management

Kennett River

May 2002

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Executive Summary

Colac Otway Shire is committed to assessing and facilitating the development of responsible domestic wastewater management practices in unsewered areas throughout the shire. In the Wastewater Management Strategy (WMS), adopted by Council on 27 February 2002, it was shown that the current practices of wastewater disposal are creating risks to public health, the environment and future development.

The WMS compared the collective risks associated with wastewater systems in 8 townships (Skenes Creek was not included, as it is due for sewerage in late 2004). Kennett River was considered amongst the highest risk in regards to site conditions, climate, restricted development, the current condition of wastewater systems, township characteristics, public health and environmental concerns.

This report is an Issues Paper to assist all stakeholders including property owners, policy makers, planners and regulatory and enforcement agencies in developing and implementing a long term, sustainable and manageable strategy for domestic wastewater systems.

This report will be used as a basis for stakeholders to understand and determine the most appropriate wastewater system to minimise risk. Community values will be articulated within the consultation process and then used as a determinant for the most suitable wastewater system options.

The outcome from this report will be to prepare a Strategic Plan for wastewater systems in Kennett River. This Strategic Plan will define the future direction of wastewater systems.

Findings from initial studies into the existing wastewater systems of Kennett River have identified the following risks:

- Offensive conditions, such as odour, potential mosquito breeding areas, and the ponding of sullage and effluent.
- The wide variety and age of waste water disposal systems that operate at varying levels of effectives, treatment and compliance.
- Most systems, using effluent trench disposal, will have reached their life expectancy within the next ten years.

- Disposal trenches installed in the past are insufficient in length (under current guidelines).
- An increase in occupation rates is likely to create increased failures in septic systems.
- Future development and re-development may be limited, even stopped, on virtually all of the blocks.
- Water testing has indicated that there are concerns regarding future public health safety.

This information will be used as background data to inform property owners of the risks associated with retaining existing wastewater disposal systems.

The scenarios for on-site wastewater systems, mentioned on page 37 of this Issues Paper, provide improvements on current conditions. There is no guarantee that the system will provide a sustainable wastewater process for the lifetime of the development. Ultimately, the only way of ensuring a long-term environmentally sustainable method of wastewater management in Kennett River is to introduce the most appropriate off-site process that satisfies community values and minimises the risks of slope instability and maximises environmental sustainability.

1. Introduction

This Issues Paper commences Phase 2 of the Colac Otway Shire strategy for reducing the risks associated with wastewater disposal in unsewered townships throughout the shire. Phase 1 was the adoption *of Colac Otway Shire Wastewater Management Strategy, February 2002*, which can be accessed on Colac Otway Shire's website: www.colacotway.vic.gov.au)

Aims

The aims of this Issues Paper are to:

- Inform stakeholders of the risks involved in unsewered areas;
- Outline the process of performing an environmental and social assessment of centralised, decentralised and on-site wastewater systems over their whole life.
- Consider wastewater options that result in low environmental, public health and social impact risks for the community of Kennett River.

Objectives

This Issues Paper is prepared to give property owners and other stakeholders an opportunity to:

- Understand current wastewater treatment and disposal systems.
- Understand the future risks of these systems.
- Reassess and define stakeholder values.
- Understand options for the upgrade of existing systems and/or the installation of new wastewater technology.
- Participate in developing a wastewater plan for the future.

Research

The preparation of this report involved:

- investigation of current waste water disposal practices in Kennett River and their risks on public health, the environment and development;
- research of legislation, guidelines, stakeholders, previous and proposed strategies; and
- research of options for long term sustainable wastewater systems.

Consultation Process

The proposed consultation process is to develop outcomes from this Issues Paper, which draws background information from the *Colac Otway Shire Wastewater Management Strategy, February 2002*, as well as, provide information on alternative systems of wastewater treatment and disposal. The Issues Paper will be made available a minimum of 4 weeks prior to the community forums. Comments regarding community values, the preferred options for wastewater disposal and any other comments relevant to the Issues Paper will be received in writing until **Friday 19 July 2002**. Comments, discussion and preferred options identified at the community forums will be recorded and used as part of the feedback process. It is hoped that many of the property owners and townsfolk can attend the forums and contribute or listen to the discussions.

Copies of the Issues Paper will be distributed within the community. The paper will also be available for viewing on Colac Otway Shire's Internet Website www.colacotway.vic.gov.au. A pamphlet advising of the contents of this Issues Paper will be forwarded to each property owner in Kennett River.

At the end of this period two community forums will be held. One will be in Kennett River the other to be in Melbourne. The objectives of these forums are to:

- Present background information.
- Determine values that are important to the community (the final wastewater option must match these values).
- Determine the most appropriate wastewater options to consider.

These community values and wastewater options will be developed into a Strategic Plan for further community discussion. Professionals in the respective fields of the wastewater options will provide input into this Strategic Plan. The Strategic Plan will be distributed similarly to the Issues Paper mentioned earlier.

Community forums will again be held to discuss the information and options. Professionals for the respective wastewater options will be in attendance to answer questions.

Following these meetings a survey will be distributed to all township property owners to vote on a preferred option. The results of this survey will determine the next course of action. If the vast majority approve one option then the relevant organisation/authority will be notified and requested to make provisions for the installation of that system or systems. If there is inconclusiveness then the results will be recorded and reported back to Council with recommendations for future action.

2. Background

2.1 Natural Environment

A fundamental consideration when designing a domestic on-site wasterwater system is the natural environment and its potential impact on the system. These natural constraints include the physical characteristics of the site, its geology, soil type, the township topography, climate, ground water and water balance.

Physical Characteristics

When considering site suitability for wastewater disposal it is necessary to have suitable physical factors. These factors are influenced by lot size, slope of the land, the soil percolation rate, depth to the Winter/Spring water table, and the annual rainfall. If one or more of these factors are unsuitable an application for installation for a septic system may be refused.

Geology

Kennett River is located within deposits of rock known as the Otway Group which formed approximately 100 million years ago in the Lower Cretaceous period. The sedimentary composition of the Otway Group is sandstone, siltstone, mudstone and shale.

The Otway Group is regarded as the most landslide prone of the geological units within the Shire. Landslides occur in both the rock and the soil materials, even where the rock is not significantly weathered (Wood, 1982).

Soil Type

The hill slopes generally consist of two main soil types; brown gradational soils and brown duplex soils. North and west facing slopes and some upper slopes have brown gradational soils that consist of dark-brown loam surface soils which grade into brown or yellowish brown medium clays or silty clays occurs at a depth of around 20cm. Weathering parent material is encountered between 80cm and 130cm. Soil permeability is only moderate and considerable surface runoff occurs after heavy or prolonged rainfall.

South and east facing slopes may develop brown duplex soils. Surface soils are well-structured black loams to fine sandy clay loams, overlaying sporadically bleached loams or clay loams at approximately 15cm depth. At 30cm depth brown or yellowish brown medium to heavy silty clays with strongly developed structure and low dispersibility are encountered. Weathering sandstones and mudstones are found at a depth of about 1m (Pitt 1981).

Topography

Kennett River is located on moderately steep to very steep land, (many properties in the Ridge Road and Cassidy Drive with slopes over 20°). Kennett River rises from sea level to 140m. The Kennett River watercourse originates from an extensive catchment at 570m above sea level. These tributaries form east and west braches that eventually form the Kennett River, which winds for over 14km through the Otway State Forest.

There is extensive native vegetation with most developed properties making use of existing flora.

Climate

This coastal region has a temperate climate. Summers are warm and dry, most rain falls in winter. The warmest months are January and February where the mean daily maximum temperature is between 23°and 25°. July is the coldest month with a mean daily temperature of between 11°and 13°. Extreme temperatures above 40° rarely occur.

The average annual rainfall is around 1000mm. This varies from 40mm to 50mm in January and February up to 125mm in August. The Kennett River watercourse commences in rainfall catchment areas of around 1200mm/annum.

Groundwater

The sandstone and mudstone rocks, which underlie Kennett River, are regarded as fractured rock aquifer of relatively low permeability. Groundwater recharge occurs through the infiltration of rainfall and ponded surface water.

There is limited information on the depth of the watertable throughout the year but it is expected that due to the horizons of the soil perched watertables can be expected above the clay deposits in the wetter months.

The steep terrain ensures that the groundwater flows in local systems, discharging into nearby streams and ocean.

2.2 Built Environment

Kennett River is one settlement divided into two specific sectors. The southern sector consists of approximately 95 properties that rise a modest height of 70m above sea level. There has been considerable clearing of native vegetation on land adjacent to the Kennett River. Most of the blocks are $1000m^2$. The northern sector is sited on a steeper slope, rising 140 above sea level. There are around 85 relatively small properties, most being between $550m^2$ and $1000m^2$.

Around 75% of the blocks have been developed. The vast majority of these are domestic properties which are used as holiday homes. It is estimated that less than 15% of Kennett River dwellings are permanently occupied. Whereas, during the holiday season the population may increase to 800 people.

It is presumed that a number of properties are available for seasonal rental opportunities or used by people other than the owners.

Kennett River is serviced with power and telephone. There is no water, sewerage or gas supply.

The road structure is predominantly unsealed roads. There are limited networks of stormwater barrel drains. Most stormwater drainage is by open earth trench systems. Dwellings that were previously permitted to discharge treated effluent off-site, discharge to those open earth drains. Drainage outfall is to the ocean and the Kennett River watercourse.

Recreational activities in Kennett River are predominantly environment related and include swimming, surfing, fishing and bush walking. Passive recreation is keenly sought by holiday makers.

Septic systems have been installed for commercial and other non-domestic properties. These include the:

- The Kennett River general store, which provides for the local community and tourists.
- Kennett River Camping Ground Caravan with over 127 sites.

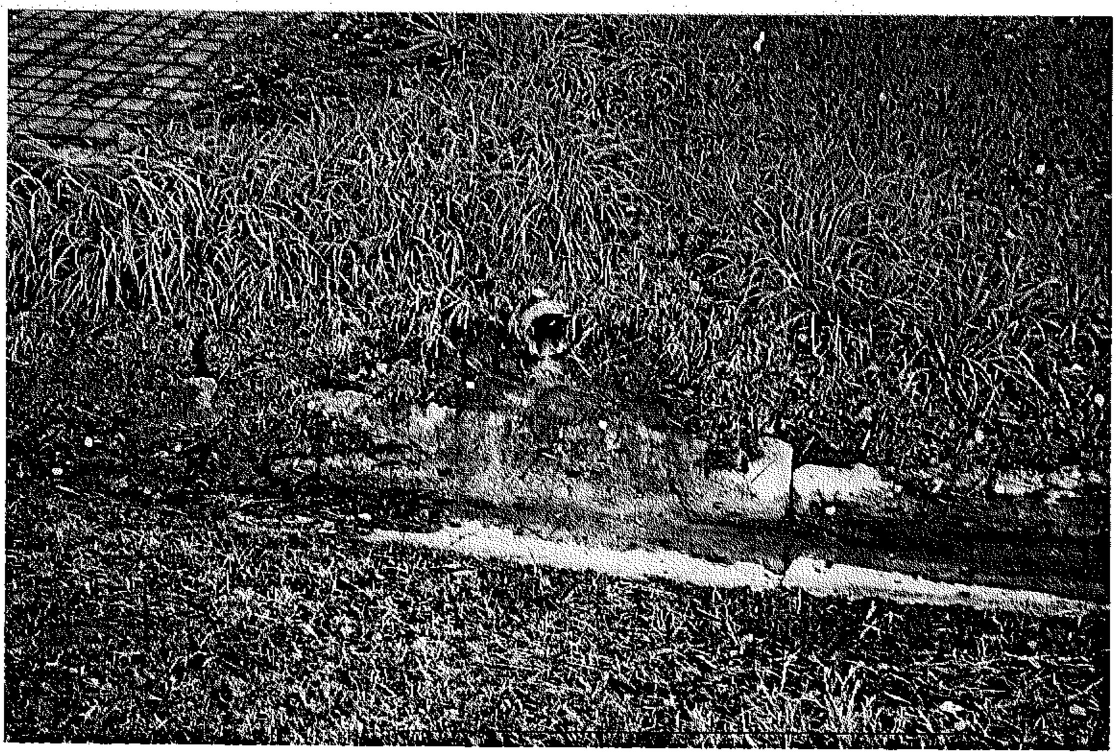


Plate 1: Discharge of grey water to street drain

3 Reports

Draft Coastal Action Plan

The guiding principles for coastal and estuarine planning and management are to protect significant environmental features, ensure sustainable use of natural coastal resources, provide a direction for the future, and use these principles to facilitate suitable development.

The draft *Central West Victoria Regional Coastal Action Plan, December 2001*, recognises in its Human Settlement Action Plan, page 31, the need to minimise the impact of effluent disposal in coastal settlements. This can be achieved by developing and encouraging the regional application of a septic management system, including the audit of all unsewered townships and improving current monitoring regimes.

Where effluent disposal is impacting on the local coastal marine values a regional forum should be convened on effluent management.

Draft Estuarine Action Plan

The draft *Central West Victoria Regional Estuaries Action Plan, December 2001*, recognises estuaries in Kennett River and the impact that septic tank systems can have through the leakage of potentially harmful bacteria and nutrients into these estuaries.

Geo-technical Report

A report, commissioned by Colac Otway Shire, on the physical elements and slope instability at Wye River, Separation Creek and Kennett River was completed by Dahlhaus Environmental Geology P/L in January 2002. Details from this report have been used when describing the physical characteristics and landslip risks in Kennett River.

A review of all previous landslip assessments in the shire was collected as part of the 2 year Landslip Risk Management study completed in June 2001. Since these previous assessments followed no standard format, interpretation of landslide risk was required. An adopted landslide risk in accordance with guidelines published by the Australian Geomechanics Society (AGS2000), was interpreted for all previous assessments.

Only a comparatively few landslip assessments have been conducted in Kennett River. They show that around 30% of properties had a moderate risk level classification, which is tolerable provided a treatment plan is implemented to maintain or reduce risks. Around 70% of assessments were classified as low risk, which means the risk is usually acceptable without significant treatment plans or remedial works. Until there is further work on risk classification in Kennett River the above estimates should be treated as indicative.

Dahlhaus Environmental Geology P/L concluded that although Kennett River has a relatively low potential for landslide it is still susceptible to some forms of landsliding.

As yet a detailed water balance has not been conducted for Kennett River.

Planning Controls

The Planning Scheme requires all new dwellings located in unsewered areas to treat and contain their wastewater on-site. For new subdivisions in unsewered areas, planning applications must include land assessments which demonstrates the capability of the lots to treat and retain all wastewater on site.

Therefore, the scheme requires Council to refuse any application for dwellings in unsewered areas where it cannot be demonstrated that wastewater can be treated and contained on-site. There are undoubtedly vacant sites in Kennett River which do not have this capacity. Unless reticulated sewerage, decentralised wastewater systems or the consolidation of properties occur, these blocks may not be able to be developed.

Off site discharge

The condition to restrict off site discharge was defined in the EPA Guidelines for Domestic Wastewater Management 629 (November 1998). The principle guideline was that discharges of treated wastewater to streams or watercourses (this includes drains) of less than 1ML a day was not permitted. This document effectively stopped future off-site discharges.

4. Effluent Disposal in Kennett River

Effluent disposal has been the responsibility of property owners since the commencement of the township. Early disposal methods would have been drop toilets and minimal length of pipework to take sullage away from the dwelling's foundations.

These methods were superseded by split septic systems where only toilet water was required to be treated and retained on site. Sullage or "grey water" which consisted of kitchen waste, laundry waste and bathroom waste was allowed to be discharged off-site to a stormwater drainage system, land or surface water. Over 35 % of properties still use this type of system.

During the last 20 to 25 years all-waste septic systems were required to be installed to treat and retain effluent on site. There was also the option to provide secondary treatment to effluent which may then be discharged off-site to the satisfaction of Council (this practice ceased in 1999 due to EPA guidelines and changes to statewide planning controls). This only occurred on properties that were too small for retaining effluent on-site.

A survey of septic tank systems was conducted in 1999 and 2000. The results indicated that Kennett River has a cross-section of all types of systems, from drop toilets to sand-filters/package plants that treat waste prior to discharging off-site.

From the field observations there were over 20% of systems that discharged some or all wastewater off-site. This leaves 80% of systems that treat and dispose of wastewater on-site.

Table 1 provides information on the number and varaition of septic tank systems.

Table 1 – Septic Tank Systems

Township	No of properties assessed	Types of systems						
		ASFOff	ASFOn	AOS 60m	AON 30m	Other	WC SOff	WC SOn
Kennett River	114	12	6	27	13	13	8	33

Legend – AWSFOff – All waste sandfilter with offsite discharge, ASFOn – Allwaste sand filter with on-site discharge, AOS 60m – Allwaste onsite to 60m drain, AON30m – Allwaste onsite to 30m drain, Other – packaged treatment plants, bioloos and drop pits. WCSOff – Split system with sullage off site, WCSOn – Split system with sullage on -site

Note: Data in this table is from properties that could be accessed and septics were able to be located. This will create inconsistency with the number of properties mentioned earlier in the report.

4.1 Defective Systems

Table 2 provides data on the number of defective systems that were identified during the inspections. This table shows that over 25% of septics have defects. It should be noted that because of the large number of properties involved, officers were simply requested to identify any obvious defects. They were not instructed to conduct the time consuming tasks of testing sand filter and aerated wastewater treated effluent, to ensure that it complied with the standard, or to trace the discharge of effluent off-site.

A review of septic system complaints for Kennett River indicates that properties on the lower side of each street are generally unable to discharge to the street drain. In these cases, when a septic system is unable of containing effluent on-site it is diverted or allowed to discharge onto a neighbour's property. Other complaints are about wastewater odours. These can be attributed to open drains in which wastewater is discharged to and the surfacing of wastewater in backyards.

Table 2 – Types of defect

Type of defect	Kennett River
No of properties	114
Tank /sandfilter/effluent drains covered with inappropriate vegetation	-
Pooling effluent/blocked drains	1
Effluent discharging onto neighbouring properties	1
Distribution pit blocked	1
More soil required over drains/tanks	6
Septic tank not accessible	16
Damaged tanks/pits./pipes/effluent drains	4
System not complete	-
Driveways/other structure over sand filter/effluent drains	-
Total	**29**

Defects have included septic tanks that are not accessible. This is because septic systems are more than just tanks and pipes. The monitoring and maintenance of systems are critical to ensure that they are operating effectively. If not monitored, the risk of failure is significantly increased. On a number of site inspections property occupiers were unable to locate their septic tank. This provides the added risk where property development such as extensions, shedding and landscaping may negatively impact on the septic system.

4.2 Age of Systems

Under normal usage conditions, and if well maintained, the effluent drains of a septic tank system are expected to last 25 or more years. After this period new effluent drains may need to be constructed on the property.

The survey showed that some form of on-site effluent disposal via trench systems occurs in over 80% of properties.

Nearly 30% of systems are 25 years or older. A large proportion of these systems can be found on the Ridge Road/Cassidy Drive estate. Around 55% of trench systems are between 15 and 24 years of age.

Using 25 years as the minimum expected life of effluent drains for a septic system these results indicate that in 10 years time 85% of on-site effluent disposal drains will have reached their life expectancy. This suggests that the failure rate for septic systems will increase during the next 10 years.

It has been argued that septic systems in Kennett River are only used on a limited basis and that the effluent trenches will last longer than those used on a daily basis. This may be the case if the flow rates were similar between limited and daily use. However, in many instances this is not the case. Seasonally used homes can have very high flow rates. This can cause solids being transferred from the septic tank to the effluent trenches, thereby causing premature clogging of the walls and floor of the trenches.

5. Optimum Standard for Waste Water Disposal

This report has outlined the physical constraints and the built environment characteristics for Kennett River. The wastewater treatment systems have been detailed and concerns have been raised.

It is important to use this information to understand the differences between what has been installed in the past and how these would comply under today's guidelines and standards. Table 3 contains guidelines to consider when assessing site suitability. Many properties in Kennett River would only comply with 2 of the 7 guidelines.

Table 3 – Guidelines for Septic Systems

Guideline	Minimal Standard	Generally, Do Properties Comply?
Physical Factor:		
- Lot Size	Greater than $1000m^2$	No
- Slope of Land	Less than 20%	No
- Soil Percolation Rate	Greater than 15mm/hr	Yes
- Depth to Water Table	Greater than 1500mm	?
- Annual Rain	Less than 900mm	No
Social Factor:		
- Population	Less than 1000	Yes
- Density	Less than 10 dwellings/Ha	No

Effluent disposal tenches need to be of a specific length and width to ensure sufficient on-site effluent disposal for the development. To demonstrate an appropriately sized system with those that have been installed Kennett River, the requirements for two, three and four bedroom houses will be calculated (calculations and design rates are from the Code of Practice – Septic Tanks 1996). Constants to be considered are:

- Each bedroom equates to a daily flow rate of 300 litres (ie. 150/d/person);
- A typical percolation rate for Kennett River is 40mm/hour; and
- Width of trench is 700mm (corresponds to a "2 foot bucket" on a backhoe).

Table 4 shows the length of effluent trench required on a block to ensure sufficient effluent absorption and transpiration for a two, three and four bedroom house.

Table 4 – Length of Trench

No. of bedrooms	Length of trench (metres)
2	66
3	100
4	133

Council's survey of all-waste effluent disposal trenches shows that 13 properties have trenches of about 30 metres in length. Another 27 properties have trenches about 60 metres in length. Combined, these properties make up over 35% of the Kennett River wastewater systems. These trench lengths are well below that of what is required for a standard residence.

It would be expected that systems that are under-designed would have a high failure rate. To understand why this does not occur to the extent that is expected there are physical and social factors that need to be noted. Firstly, maximum usage is over the warmest months of the year when absorption, evaporation and transpiration rates are high. Secondly, usage during other times of the year occurs on weekends and during other limited time periods. Trenches have a chance to empty prior to the following weekend or holiday period. Thirdly, it has become apparent that some systems that are under-designed are connected to the stormwater system to provide relief for the septic system. This is an illegal practice that cannot be detected unless specific tests are conducted on the property or a nuisance is reported.

If the trend of people retiring to, working from, or using their dwelling for rental uses continues, the factors that worked in favour for many of the current wastewater systems will be cancelled out. This would overburden the existing systems and increase the chance of effluent ponding or illegal discharging of effluent to stormwater drains.

6. Restriction on Future Development

Due to changes in Council's Planning Scheme, subdivisions and building developments must be capable of treating and retaining effluent on-site. In the case of a proposed building development a planning permit will not be issued unless sufficient land is available for effluent disposal. For example, if a five bedroom house is proposed on a 750m^2 block there will be little chance to treat and retain effluent on-site, subsequently the application would be refused. If the applicant decided to amend the application to a two bedroom house then there is a chance that approval would be given, with a number of conditions.

This has created restriction to a number of proposed developments and redevelopments. The applicant must decide whether to reduce the development, delay the project until sewer or other decentralised wasterwater systems are available or attempt to sell the property.

There are over 40 vacant properties in Kennett River that may be restricted in their future development.

Development restriction is not only a problem for undeveloped blocks. Restrictions may also apply to residential extensions/additions, and site redevelopments (due to building demolition and upgrade, or the need to be rebuild due to destruction of the building by fire, flood or other occurrence). Nearly all of the blocks in Kennett River, due to their physical constraints, may restrict development/redevelopment.

An extreme, but possible, example is the case where more than 50% of a dwelling is destroyed by fire. A planning permit would be required before any works commence. If the dwelling had 3 or more bedrooms and discharged effluent off-site a planning permit for a similar sized dwelling would not be issued unless it could be demonstrated that effluent could be treated and retained on-site. Again, the applicant would need to decide whether to amend the application to a smaller dwelling, delay the project until sewer or a decentralised wastewater system is available or attempt to sell the property.

7. Water Testing

Council officers have taken water samples from stormwater discharge points and the Skenes Creek watercourse for the purpose of identifying the extent of contamination. The results of these tests are provided in Table 5.

It should be noted that only one sample of water was taken from each site. The normal practice for water sampling is to take five samples at each site, especially if the results may lead to litigation. Therefore, the results in Table 5 should only be considered as indicative.

E.coli

It also should be noted when reading the results that the following standards apply to drinking, swimming and other recreational waters:

- The presence of E.coli indicates faecal pollution and Standard Plate Counts indicate the level of all bacteria, whether they are harmful or not.
- Drinking water is not allowed to contain any E.coli/100mL.
- Swimming water is considered satisfactory if the median sample contains <150 E.coli/100mL. Allowance is provided for one of the 5 samples to reach 600 E.coli/100mL.
- Water is considered safe for non-contact activities, including canoeing and yachting, if the median sample is <1,000 E.coli/100mL. Allowance is provided for one of the 5 samples to reach 4,000 E.coli/100mL.

Faecal Streptococcus

This bacteria is present in all warm blooded animals and tends to be more resilient in the environment than E. coli. It is useful to determine past contamination of a source by a warm blooded animal.

There are no specific levels that relate to its concentration apart from the fact that it shouldn't be there. E. coli is the preferred indicator as it is the more immediate result and gives a better picture on what's happening on a day to day basis.

E. coli appears in greater numbers in warm-blooded animals, which probably accounts for the lower concentrations of Faecal Streptococcus.

Table 5– Water samples

Location	Standard Plate Count/ml	Faecal Strep./ml	E.coli/ 100ml
Kennett River			
Wetlands			
18/12/00	49,000	-	1
Wetlands System - outlet			
13/12/99	1,200	-	160
18/01/00	1,800	-	35
12/12/00	23,000	-	280
13/12/01	300	<1	40
16/01/02	950	<1	20
Kennett River – downstream of Hazel Court drain			
18/01/00	6,600	-	28
20/09/01	280	<1	10
13/12/01	1,000	n/d	20
16/01/02	900	<1	60
Kennett River – upstream of Hazel Court drain			
18/12/00	2,400	-	21
13/12/01	1,000	n/d	50
16/01/02	730	<1	70
Road Drain			
18/12/00	15,000	-	1,100
Kennett River at Great Ocean Road			
13/12/01	3,500	<1	20
16/01/02	840	<1	50

n/d denotes non-detected.

Although the test results are only indicative, they do show that water sources sampled were generally suitable for swimming or direct contact, except for the wetland system outlet and the street drain. Although the wetlands were set up for stormwater management an added bonus is its capacity to filter faecally contaminated wastewater and reduce the bacterial load.

8. Public Health Warnings

Council has taken a number of water samples over the past few years from various sources in Kennett River. These have included samples from stormwater drains, the wetlands and a number of sites along the Kennett River.

If water sample results are unsatisfactory, Council may need to erect warning signs for the public. This may be along the lines of "Contaminated water do not drink", "This water course is closed to bathing and water collection purposes until further notice" or "Contaminated water do not contact" (these signs have been permanently erected at 2 stormwater outlets in Skenes Creek).

Water samples need to be collected on a routine basis to monitor the quality of these water sources and risks to public health.

9. Summary of Waste Water Disposal Risks

- Man made factors, including continual saturation of steep slopes by wastewater, can increase the potential for landslide.
- Over 20% of developed properties discharge wastewater off-site into earth drains. There is no data on the quality of this discharge.
- There is no uniform method of wastewater disposal. Instead, there is a wide variety of systems that have varying levels of effectives and compliance.
- Over 25% of systems have defects.
- Within 10 years 85% of effluent trench disposal systems will have reached their life expectancy.
- The vast majority of effluent disposal trenches are insufficient in length (under current guidelines).
- The trend of retiring, permanently residing or the tourism potential in coastal towns is likely to create increased failure rates in septic systems.
- There are restrictions that will limit or stop both development and re-development. This may occur for virtually all blocks.

10. Assessing Community Values

Before the options for future wastewater systems can be discussed it is important that the values of the Kennett River community are understood when considering the impact of any proposed wastewater system. Unlike some other townships Kennett River does not have a structure plan that identifies the community vision.

An important outcome from the first round of community consultation is to define the community values for a number of criteria. These may include:

- Environmental values: flora and fauna, coastal and estuarine, landslide, land degradation, erosion, reuse of wastewater, reduction of water use.
- Social values: development, amenity, township growth, tourism
- Economic values: cost of wastewater improvements, property value increases.

11. Wastewater Options

Earlier in the report the different existing types of wastewater systems were discussed. There are a number of options that can be considered for upgrading existing systems or providing a medium to long term solution.

This section describes a set of treatment processes that introduce the functional issues associated with various wastewater technologies. The processes are then coupled together to form a scenario so that the risk of wastewater treatment can be discussed on a site-by-site basis. The wastewater scenarios are then merged into strategies to consider the application of the wastewater systems for sites within Kennett River.

11.1 Wastewater Processes

There are a number of wastewater processes that may be considered for installation. These include:

- **Domestic On-site Process.** Where the effluent is collected, treated and disposed of on-site.
- **Domestic Off-site Process.** Where effluent is collected and treated on-site and disposed off-site.
- **Decentralised Off-site Process.** Where effluent is collected and partially treated on-site, then disposed to a common neighbourhood system for further treatment and disposal.
- **Low Cost Sewerage Process.** Where effluent is collected and undergoes primary treatment on-site, then disposed to a centralised township system for further treatment and disposal.
- **Sewerage Process.** Where effluent is disposed to a centralised township system for treatment and disposal.

Within each of these different wastewater processes there are a number of systems, especially for domestic on-site systems.

Potential functional advantages and disadvantages are provided, based largely on (Martens 1998). This helps identify the limitations of each process and the possible need to use a number of processes to achieve acceptable risk. The potential advantage or disadvantage highlights that the process must be operated in a way

that increases the likelihood of achieving the advantages while minimizing the likelihood of disadvantages. When a number of processes are combined together it behaves as the collection of processes and is referred to as a scenario. The description of the processes does not attempt to give design detail but highlights functional issues that need to be considered for the design of a wastewater system.

11.1.1 Domestic On-site/Off-site Processes

All domestic on-site and off-site wastewater systems need to be issued with a Certificate of Approval by the EPA before they are permitted to be installed in Victoria. At the moment there are around 55 different types of systems that have been approved by the EPA. A full description of the approved wastewater system can be found at www.epa.voc.gov.au under the 'For Local Government' section.

These include:

- 12 composting units (dwellings require a separate sullage system)
- 2 waterless composting systems (dwellings require a separate sullage system)
- 2 all waste composting systems
- 2 incineration systems (dwellings require a separate sullage system)
- 20 Aerated Wastewater treatment Systems (dispose to land only)
- 11 Aerated Wastewater treatment Systems (dispose to land and water)
- 8 other types of systems

Some of these processes will be mentioned in this section.

Reduce Water Use

The reduction of water use is applicable to sites that do not have water efficient fixtures. This is where a retrofit of fixtures and appliances takes place.

A strategy to reduce water use includes the installation of water efficient fixtures/appliances and a maintenance program to reduce the base load of water consumption from leaking fixtures. The strategy also requires an education campaign and commitment from both Colac Otway Shire Council and the local residents to reduce water use. This commitment could take the form of a memorandum of understanding between the council and the resident as a condition of the upgrade of the water fixtures. An additional benefit of retrofits in Kennett River is the reduced use of tank water, thereby limiting the need to buy water during the dry season or high use times.

The fixtures need to be viewed as part of the infrastructure of the effluent treatment system. Each household needs to have "full water reduction facilities" as outlined by AS 1547:2000 that includes *"the combined use of reduced flush 6/3 litre water closets, shower-flow restrictors, aerator faucets, front-loading washing machines and flow/pressure control valves on all water-use outlets. Additionally, water reduction may be achieved by treatment of greywater and recycling for water closet flushing (reclaimed water cycling)".*

Composting Toilet

The compost toilet reduces the volume of wastewater that either needs to be treated on-site or off site. The composting toilet treats black-water (toilet waste only) and putrescible household garbage and needs to be coupled with a greywater system to provide full treatment of household wastewater. The use of the compost toilet is especially applicable to sites that have steep slopes and can easily accommodate the composting toilet underneath or beside an existing structure.

An additional advantage of the composting toilet is the reduced greenhouse gas emissions from the aerobic decomposition of sewage. A fan is included as part of the composting toilet to ensure the degradation of sewage is aerobic and to remove any odours that may arise. Depending on the type of system the compost can be buried on-site at a minimum depth of 30cm or disposed off-site to the satisfaction of Council.

Table 6 Functional Advantages and Disadvantages of Compost Toilets

Potential Advantages	Potential Disadvantages
• Reduced wastewater volume (up to 30%) • Less stress on land application areas, especially on landslip risk sites. • Increased longevity of land application areas. • Several options available for land application. • Low energy use. • Aerobic decomposition of sewage reduces greenhouse gas production. • Compost may be buried on-site. • Septic tank used for greywater treatment may be desludged less often.	• Installation is often below house and if not possible requires a housing system to be constructed (this is simpler on a steep slope). • Compost must be periodically removed. • User is responsible for the maintenance. • Susceptible to shock loads of water and chemicals. • A separate system is required for greywater. • Requires a dedicated land area on the residential block.

Upgrade Existing Septic Tank Absorption/Transpiration Systems

Failing septic tanks need to be either replaced or upgraded to improve the performance to acceptable levels. This may not be achievable on allotments less than $1000m^2$.

Filters and flow baffles are suggested for all structurally sound septic tanks that do discharge effluent on-site. The EPA requires the desludging of a septic tank every 3 years.

Table 7 Functional Advantages and Disadvantages of Upgraded Septic Tanks

Potential Advantages	Potential Disadvantages
• Produce higher quality effluent than conventional (and current) septic tanks. • Provides additional treatment for other processes while releasing the effluent to the receiving environment. • Accommodates both black and grey water. • No energy required to operate. • Simple technology	• System requires desludging every 3 years. • Filters need desludging every 2 years. • User is responsible for maintenance. • Effluent is likely to require further treatment before disposal. • Requires a large dedicated area of land ($400m^2$ or larger) for disposal. • An alternative disposal field may be required. • Has a limited life. • Can fail if upstream processes such as a septic tank fails. • Continued stress on land application areas, especially on landslip risk sites.

Irrigation - Surface/Sub-surface

Where effluent is treated to a satisfactory standard, either by a sand filter or Aerated Wastewater Treatment System it may be disposed of through an irrigation system (Code of Practice – Septic Tanks 1996).

There are two types of irrigation. One above ground, which requires disinfection of the treated effluent and one sub-surface.

Table 8 Functional Advantages and Disadvantages of Irrigation

Potential Advantages	Potential Disadvantages
• Can provide an even distribution of wastewater across the site. • Can distribute wastewater to irregular and isolated disposal fields. • Provides comparatively shallower and narrower trenches to install pipework than for absorption trenches and transpiration fields. • Simple technology. • Is useful for maintaining a nutrient enriched liquid for plants.	• Is a pressurised system that requires a pump system. • Dripper head are subject to damage and require ongoing replacement. • Filter heads may become blocked and require cleaning. • Can fail if upstream processes such as a septic tank fails. • User is responsible for maintenance. • Requires a relatively large area of land for disposal. • Surface irrigation can cause run-off on steep sites.

Wetland Reed Bed System

A small Wetland Reed Bed system provides additional treatment after the septic tank. A filter on the septic tank would ensure that the wetland does not become clogged.

Table 9 Functional Advantages and Disadvantages of Wetlands

Potential Advantages	Potential Disadvantages
• Provides removal of carbon, nutrients and pathogens and higher quality effluent when coupled with other treatment systems. • No odours. • Accommodates combined wastewater or just greywater. • No energy required to operate. • Required less area than an absorption or transpiration system.	• User is responsible for maintenance. • Requires a dedicated land area on the residential block. • System may fail over time if coupled with a failing septic tank. • Limited usage may cause the wetland/reed bed to dry-out. • Difficult to site on steep slopes.

Sand Filter

A sand filter is only required for sites where there is an opportunity to discharge off-site or there is little or no scope for absorption/transpiration trenches. Treated effluent from the sand filter can be disposed of by surface or sub-surface irrigation. The sand filter provides additional treatment to reduce the risk for extreme locations.

Table 10 Functional Advantages and Disadvantages of Sand Filters

Potential Advantages	Potential Disadvantages
• Produces high quality effluent. • No odours. • Accommodates both grey and black water. • Requires less area of land for effluent disposal.	• May have a limited life and need periodic replacement (10-15 years). Alternatively larger beds could be used. • User is responsible for maintenance. • Requires a dedicated land area on the residential block. • System may fail over time if coupled with a failing septic tank.

Pump-out

Pump-out is the mechanism of taking the sewage or effluent off-site for treatment at either sewerage treatment plant. This process is potentially very costly especially for isolated townships such as Kennett River.

This system is currently not approved by the EPA and would need to undergo critical assessment on compliance, monitoring and other criteria prior to approval being given.

Table 11 Functional Advantages and Disadvantages of Pump-out

Potential Advantages	Potential Disadvantages
• Provides a service that can be applied to all sites. • Keeps wastewater out of the soil.	• May require a certain number of households to be viable. • Siting another tank on the property. • Holding tanks, whether communal or individual need to be accessible for pump out tankers.

Holding Tanks for Wet Weather/Intermittent Usage Storage

Between May and September, when rainfall exceeds evaporation, or at times of high usage some domestic on-site systems may need to store a percentage of treated effluent in a sealed holding tank until the ground is capable of absorbing the wastewater.

This process is ideally suited to dwellings that are used on a seasonal or limited basis. A percentage of wastewater can be held while the dwelling is occupied, then allowed to automatically dose the wetland, absorption or transpiration fields during periods when the dwelling is unoccupied.

Table 12 Functional Advantages and Disadvantages of Holding Tanks

Potential Advantages	Potential Disadvantages
• Doses the wetland, absorption or transpiration field on a regular basis. • Reduces saturation of soil. • Accommodates grey water and grey/black water. • For high treated wastewater can be considered a resource.	• Limited to seasonal or limited usage of dwelling. • Complex management and monitoring for owner. • Siting another tank on the property.

Aerated Wastewater Treatment Systems (AWTS)

This strategy is only applicable to permanent or regularly used residents, as the AWTS systems require relatively constant operation to sustain the biological media. The AWTS system treats the sewage and disinfects the effluent for disposal to a irrigation or absorption/transpiration fields.

There are a number of AWTS units that are permitted to discharge off-site provided they comply with the State Environment Protection Authority (SEPP) – Waters of Victoria.

Table 13 Functional Advantages and Disadvantages of AWTS

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Low odours. • Less stress on land application areas. • Increased longevity of land application areas. • Several options available for land application.	• Higher energy use (than most on-site systems especially). • On-going maintenance costs. • Septic tanks require desludging. • User is responsible for the maintenance. • Highly susceptible to shock loads and irregular usage. • Susceptible to failure. • Requires a dedicated land area on the residential block. • Continued stress on land application areas, especially on landslip risk sites.

11.1.2 Decentralised Off-site Process

The US Environment Protection Agency describes a decentralised system as *"An on-site or cluster wastewater system that is used to treat and dispose of relatively small volumes of wastewater, generally from an individual or group of dwellings and businesses".*

The US EPA concludes in a report on decentralised systems that *"Adequately managed decentralised wastewater systems are a cost-effective and tong-term option for meeting public and water quality goals".*

Table 14 Functional Advantages and Disadvantages of Decentralised Systems

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed by contractor or authority. • Is designed for an actual number of properties. • Installation cost is claimed to be less than conventional sewerage. • Reuse option for toilet flushing. • Long term solution. • Diameter of pressurised main sewer line is much smaller than conventional sewer drain.	• Is new technology to Australia. • Need to find one or more sites for common treatment fields and disposal. • Relatively high installation and ongoing costs. • Required the majority of properties to commit to the system to be economically viable.

11.1.3 Low Cost Sewerage Process

There are a number of methods to reduce the cost for sewerage in smaller townships that have existing on-site wastewater disposal systems. One such option is to retain structurally sound septic tanks, sandfilters or AWTS's install a pump pit and discharge the effluent to a common gravity fed sewer drain.

The primary and secondary treatment on-site would reduce the extent of solids removal at the point of treatment.

Table 15 Functional Advantages and Disadvantages of Low Cost Sewerage

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed authority. • Is designed for an actual number of properties. • Treatment cost is claimed to be less than conventional sewerage. • Long term solution.	• Need to find one or more sites for common treatment fields and disposal. • Relatively high installation and ongoing costs. • Will require all properties to commit to the system. • Larger common drain than in decentralised system may impact on slope stability.

11.1.4 Sewerage Process

This is the conventional sewerage system that requires no on-site collection or treatment. All property wastewater is gravity fed to the main sewer drain.

Table 16 Functional Advantages and Disadvantages of Sewerage

Potential Advantages	Potential Disadvantages
• High quality of effluent. • Keeps wastewater out of the soil. • Low odours. • Collection system managed authority. • Is designed for an actual number of properties. • No management or maintenance by property owner • Long term solution.	• Need to find a site for treatment plant and disposal field/point. • High installation costs. • Will require all properties to commit to the system. • Larger common drains that will need to dug deeply into ground. May impact on slope stability

11.2 Combined Options

On-site and off-site wastewater treatment processes are compiled to give a number of wastewater treatment scenarios. Each wastewater scenario also includes the responsibilities and management required to operate the processes to achieve acceptable risk.

In general, off-site wastewater disposal has lower health and environmental risks than on-site effluent disposal. This is largely due to the mechanism of pollutant transport to the surrounding environment and the historically poor management of on-site effluent disposal. If effluent for on-site disposal is of poor quality due to poor design or management then the effluent will carry the pollutants into the on-site and surrounding environments. By definition, on-site effluent will be close to the household and presents an obvious health risk if not correctly managed. Off-site effluent disposal has generally been well maintained and monitored and disposed away from population centres.

Within each category of on-site or off-site effluent disposal, the risk of effluent disposal is greater for some options. For on-site systems this is largely dependent upon the site conditions and the permanency of the resident. For site conditions that have limited capacity for treatment using an absorption or transpiration field or requiring high quality effluent due to the location, a number of treatment processes may be required to achieve acceptable risk for effluent disposal. However, the greater the number of processes the greater the cost and the risk of impacts from effluent disposal will obviously be weighed against the cost of the system. A range of on-site disposal scenarios is presented to capture the diversity of needs in Kennett River.

A selection of wastewater scenarios is summarised in the table below.

Table17 Wastewater Treatment Scenarios

Scenario No.	Processes	Scenario Type by Effluent Disposal
1	Water efficiency retrofit, upgraded septic tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
2	Water efficiency retrofit, upgraded septic tank, holding tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
3	Water efficiency retrofit, compost toilet, upgraded septic tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
4	Water efficiency retrofit, compost toilet, upgraded septic tank, holding tank, (a) absorption field or transpiration field, (b) subsurface wetland	On-site
5	Water efficiency retrofit, upgraded septic tank, sand filter, (a) absorption field or transpiration field, (b) irrigation	On-site
6	Water efficiency retrofit, upgraded septic tank, sand filter, holding tank, (a) absorption field or transpiration field, (b) irrigation	On-site
7	Water efficiency retrofit, upgraded septic tank, AWTS, (a) absorption field or transpiration field, (b) irrigation	On-site
8	Water efficiency retrofit, upgraded septic tank, AWTS, holding tank, (a) absorption field or transpiration field, (b) irrigation	On-site
9	Water efficiency retrofit, upgraded septic tank, pump-out, truck to sewerage treatment plant	Off-site
10	Water efficiency retrofit, upgraded septic tank/AWTS, decentralised sewerage system	Off-site
11	Upgraded septic tank/AWTS, centralised sewerage system	Off-site
12	Installation of centralised sewerage system	Off-site

Inadequate maintenance will lead to failure regardless of how well the infrastructure of the system was designed. The number of processes that are required for an on-site system depends upon the risk of physical, environmental, health and social impact presented by the type of site.

11.3 Wastewater Strategies

The wastewater processes can be assembled into wastewater scenarios to treat wastewater for sites within Kennett River. The scenarios introduce the concept of risk and management for the construction, operation and demolition of the wastewater systems for individual sites. However, when all sites are considered there are a number of strategic wastewater issues that arise concerning the optimisation of wastewater scenarios to obtain the least risk.

The wastewater scenarios can be combined to form two types of strategies.

- Strategy 1: On-site effluent disposal
- Strategy 2: Off-site effluent disposal

Strategy 1: Onsite Effluent Disposal requires that sites are assessed for the application of on-site wastewater disposal. A selection of on-site effluent disposal scenarios may be required to meet the variety of site conditions and risks for the area.

Strategy 2: Off-site Effluent Disposal requires further investigation of services and costs for effluent pump-out, decentralised, low cost and sewerage processes. The point of discharge also needs to be determined. Questions that need to be answered include, "Is discharge to be to land, ocean, through reuse or a combination of these?", 'Where will land or ocean discharge occur?" and "What will be the impact of this discharge?".

11.3.1 Strategic Advantage of Decentralised Wastewater Treatment

The strategic advantages of centralised systems have been widely promoted over the past century as reflected in the choice of wastewater infrastructure across Australia. The strategic advantages of decentralised systems are less well known and the following list describes some of these benefits.

- "Closer matching of capacity growth to the demand curve through incremental implementation of smaller units. "Build-as-you-need, pay-as-you go" ties up less capital, reduces forecasting risk, and creates "option value" by allowing future changes in technology, management, and service strategy not possible with large-scale systems.

- Targeting of treatment upgrades to smaller, problematic units within a watershed.
- Greater control over the waste stream, and thereby increased biosolids useability and value.
- Localised water reuse, which reduces or avoids water purchases or ground water pumping, and may increase property values in water-short areas.
- Reduced costs in very steep or rocky areas as opposed to sewerage costs.

11.3.2 Monitoring of On-site Systems

From the risk management process there is a need to monitor and review risk on an ongoing basis. This applies to both on-site and off-site scenarios. With off-site scenarios an authority or agency manages the risk. With on-site scenarios there is currently no agency that monitors the systems on a regular basis.

With proposed changes to the Code of Practice for Septic Tanks and other guidelines produced by the EPA it may well become a function of local government to ensure that this monitoring is undertaken.

The Colac Otway Shire Wastewater Management Strategy, February 2002 (section 6.2.6), indicated that an annual fee of $30 to $40 was required to provide a monitoring program across the shire. If there is a random distribution of townships opting for on-site scenarios the annual fee may be slightly higher. This fee has been included in graph of figure 2 on page 48.

11.4 Other Future Considerations

It is necessary to point out that future legislation, guidelines, codes of practice and discharge conditions will impact on wastewater disposal. This will be for both on-site and off-site processes.

In essence, the changes will be to continually improve the quality of discharge and ensure sustainability. For off-site systems this will look at the treatment and mixing zone methods prior to discharge to the environment. For on-site systems this means ensuring that a property can, over the lifetime of the development, safely and in an environmentally sustainable manner treat and dispose of wastewater on-site.

As an example of this trend at the moment, future subdivisions on unsewered land may be deemed sustainable for on-site disposal if they are greater than 0.4 hectare and have a favourable land capability.

The scenarios for on-site wastewater systems mentioned in this Issues Paper provide an improvement on current conditions. There is no guarantee that the system will provide an sustainable wastewater process for the lifetime of the development. Ultimately, the only way of ensuring a long-term environmentally sustainable method of wastewater management in Kennett River is to introduce the most appropriate off-site process that satisfies community values and minimises the risks of slope instability and environmental sustainability.

12. Risk Analysis

12.1 Risk Management

The Australian Standards of *AS 4360: 1999 Risk Management* and *AS 3931:1998 Risk analysis of technological systems – Application guide* were the main documents used to formulate the risk management approach. This process is described in the Standards as follows:

"Risk management is an iterative process consisting of well-defined steps, which, taken in sequence, support better decision-making by contributing a greater insight into risks and their impacts. The risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. Decision makers need to know about possible outcomes and steps to control their impact."

General steps in the risk management process are outlined in Figure 1.

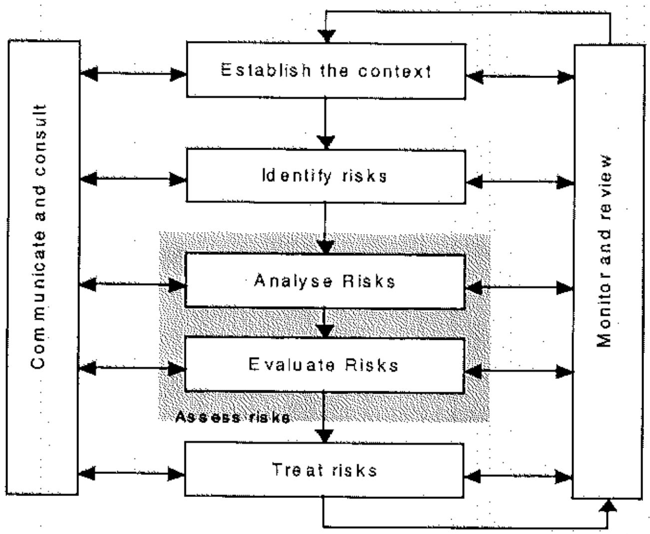


Figure 1 Risk Management Overview
Standards Australia AS 4360:1999

This study addresses each of the Risk Management steps presented in the above figure. However, the study does not attempt to fully analyse and evaluate risk as this requires communication with all stakeholders and is beyond the scope of this study.

Instead this study presents information that is useful for the assessment of risk and presents a framework for how the assessment can be conducted.

12.2 Identified Risks

Australian Standard 4360:1999 Risk Management states that

"Comprehensive identification using a well-structured systematic process is critical, because a potential risk not identified at this stage is excluded from further analysis. Identification should include all risks whether or not they are under the control of the organisation."

The potential risks associated with wastewater processes in Kennett River can impact are physical, environmental, health and social values.

Potential Physical Impacts

These potential impacts include:

- Increased landslip potential
- Increased erosion potential
- Site run-off
- Water logging of sites

Potential Environmental Impacts

These potential impact include:

- Degradation of land
- Degradation of watercourses, estuarine and coastal waters
- Algal blooms

Potential Health Impacts

These potential impacts include:

- Contamination of water recreation areas
- Odour
- Mosquito breeding

Potential Social Impacts

These potential impacts include:

- Cost of system

- Unable to develop a property
- Conditions detriment to the amenity of the townships
- Increase/decrease in population
- Increased wastewater with an increase in permanent residents

12.3 Risk Controls

There are controls that can be introduced to minimise the risk for on-site processes to an acceptable level. The determinant of an acceptable level requires the assessment of community values, and legislative requirements on health and environmental issues.

Physical Risks

Control of increased landslip potential

- The assessment of landslip risk for new on-site wastewater treatment systems will be considered with each planning application development.
- Owners of developed properties, where risk of potential landslip due to increased water content in the soil, should consider reducing wastewater into the soil.

Control of increased erosion potential

- Reduce or regulate the volume of wastewater entering the soil and introduce disposal methods that minimise erosion.

Control of site run-off

- Reduce or regulate the volume of wastewater entering the soil.

Control of water logging of sites

- Reduce or regulate the volume of wastewater entering the soil.

Environmental Risks

Control of degradation of land

- Introduce wastewater onto land in a manner that is sustainable.

Control of degradation of watercourses, estuarine and coastal waters

- Provide a high level of treatment for effluent that cannot be retained on-site.
- Reduce the volume of wastewater being generated.

- Provision of mixing or filtration zones such as wetlands.

Control of algal blooms

- Provide a high level of treatment for effluent that cannot be retained on-site.

Health Risks

Control of contamination of water recreation areas

- Provide a high level of treatment for effluent that cannot be retained on-site.

Control of odour

- Provide a high level of treatment for effluent.

Control of mosquito breeding

- Reduce or regulate the volume of wastewater being generated so that it can be satisfactorily disposed of to land.

Social Risks

Control of the cost of a system

- The introduction of any future wastewater system will need to consider the terms and conditions of payment and the ability of property owners to pay.
- Analysis of the ongoing costs to best understand the overall long term costs.
- To determine the life expectancy of systems.
- Management of assets and designing systems that are flexible for changing requirements.

Control of inability to develop a property

- May not be possible if site constraints are too restrictive. Would need to Introduce off-site disposal.

Control of conditions detriment to the amenity of the townships

- Provide a high level of treatment for effluent.
- Reduce or regulate the volume of wastewater being generated so that it can be satisfactorily disposed of to land.

Control of increase/decrease in population

- Introduce a wastewater system that supports the development values of the community.

Control of increasing wastewater with an increase in permanent residents

- May ultimately require the introduction of off-site disposal.

13 Costs

The following table shows the costs for each wastewater treatment process. The data is based upon cost estimates provided by local plumbers, product manufacturers, research into reports on retrofitting and operation and maintenance costs. The estimates for off-site systems are indicative only. Until these options are fully costed an accurate cost cannot be determined.

The installation costs are again indicative. Site conditions at Kennett River vary considerably. Accessibility, existing plumbing standards, slope, vegetation, climate condition at the time of installation and other site constraints will impact on the final cost.

The error in the costs relates to the degree of certainty and experience the source had with the activity. The greatest error is in the pump-out data because this is a service that has not been installed and is based on indicative costs in other states. The costs presented in the table show:

- The operation and maintenance costs are extremely high for pumpout and indicates it will be an important issue over the life of the system. Perhaps just as importantly it emphasises the need for more accurate data for annual costs for pump-out as it may lead to a commitment to high operating costs.
- The installation cost is very high for the sandfilter and also high for the absorption trenches/transpiration fields and AWTS.
- The capital cost of the AWTS, wetland and composting toilet are all high. The septic tank and absorption trenches/transpiration fields have low capital costs.
- Some systems are likely to need a financial program to spread the upfront capital costs across the life of the system. This will need to be researched in further detail once a short list of systems has been determined.

The individual processes are now assembled to create the wastewater scenarios in the following table.

Table 18 Annual Financial Costs for Wastewater Treatment Processes

Wastewater Treatment Process	Capital Cost	Installation Cost	O&M cost per year (a)	Water Samples Year (b)	25 Year Cost
Septic tank	$800	$500	$100	-	$3,800
Absorption/Transpiration fields	$800	$4,000	$0	-	$4,800
Irrigation – Surface	$1,000	$2,000	$200	$146	$11,650
Irrigation – Sub-surface	$1,000	$2,000	$200	-	$8,000
Sand Filter On-site disposal (b)	$2,000	$7,000	$300	$146	$20,150
Sand Filter Off-site disposal (b)	$2,000	$7,000	$300	$584	$31,100
Composting Toilet	$3,000	$500	$400	-	$13,500
Wetland	$2,000	$2,500	$450	-	$15,700
AWTS On-site disposal (b)	$5,000	$3,000	$500	$146	$24,150
AWTS Off-site disposal (b)	$5,000	$3,000	$500	$584	$35,100
Holding tank & pump	$3,000	$500	$200	-	$8,500
Water efficiency retrofit	$500 (c)	$300	-	-	$800
Pumpout, Truck to Sewerage Plant and treatment	$2,000	$500	$5,400 (d)	-	$137,500
Water efficiency retrofit, upgraded septic tank, pump into decentralised sewerage system	$12,000 (f)	$3,000 (f)	$500	-	$27,500
Upgraded septic tank, pump into sewerage plant drain (e)	$14,000 (f)	$3,000 (f)	$500	-	$29,500
Installation of a sewerage system (e)	$17,000	$3,000 (f)	$500	-	$32,500

(a) Operating and maintenance costs can include a number of factors including:

- the costing of time required for household maintenance. The property owner may need or wish to contract in these maintenance tasks;
- service of AWTS and sand filter by an experienced person;
- replacement of parts over the lifetime of the unit (does not include full replacement);
- desludging of septic tank every 3 years; and
- an indicative cost of pumping out and treating effluent at a Sewerage Plant.

(b) The EPA sets out the frequency and testing requirements of wastewater.

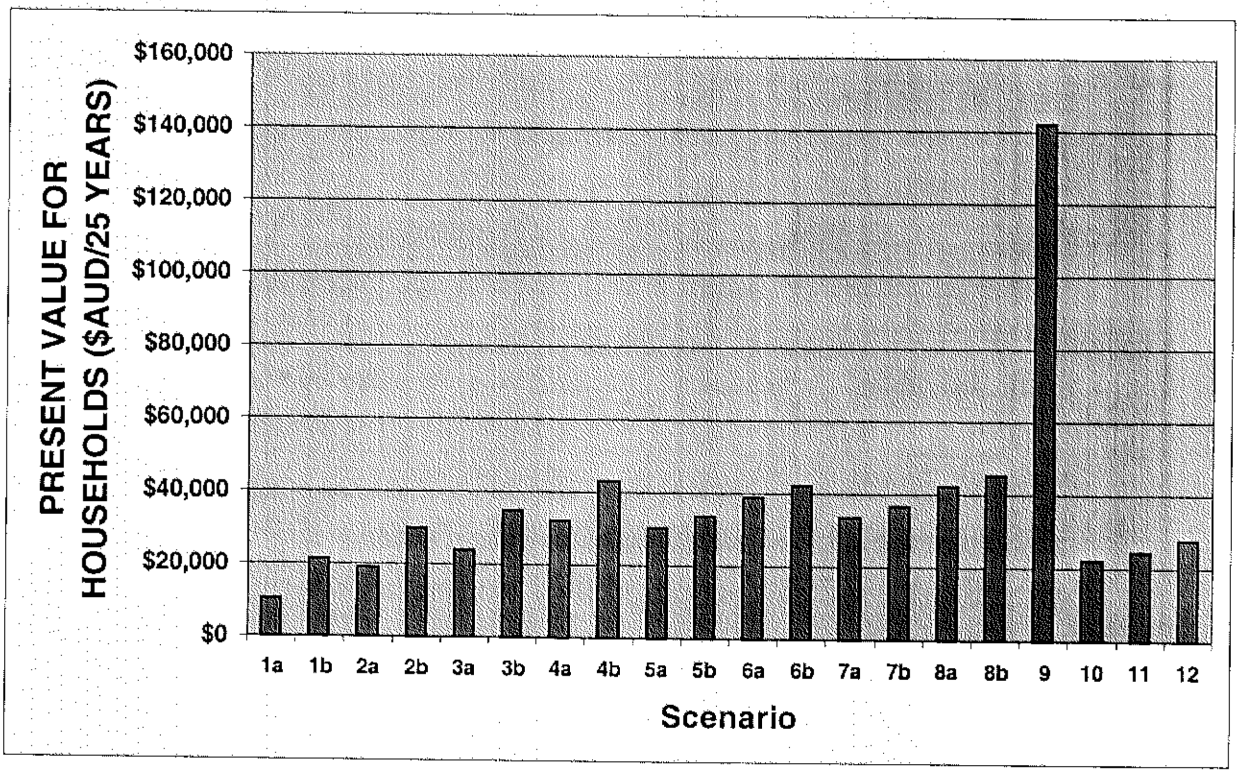
(c) Does not include the cost of a front loading washing machine. This cost needs to be added to the total.

(d) This cost is for 1/3 of a year. For longer or full time occupancy the figure will be around 2 –3 times higher.

(e) To ensure that sufficient water is available for the operation and maintenance of this system, a water reticulation system may need to be installed. This would have a significant impact on additional infrastructure and cost.

(f) Includes the capital cost of the main system, as well as, the cost of connecting to the main system and upgrades that may be required in the current plumbing of the dwelling.

Figure 2 Represents the Financial Value of Wastewater Treatment Scenarios Over a 25-Year Period



Note: An annual monitoring fee of $40 has been added to the scenarios from 1a to 6b inclusive

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