Domestic Reedbed Installation Lord Howe Island Board 2004

Introduction

The Lord Howe Island Board is seeking to adopt sustainable, cost effective alternatives to traditional on-site wastewater treatment, while ensuring the protection of public health and the Island's receiving environment. A reedbed system was recently installed at a Board-owned residence to provide an improved level of wastewater treatment and on- site reuse. This guide details the installation and operation of the reedbed system, and has been compiled to assist residents considering wastewater treatment alternatives at their own properties.

Primary Wastewater Treatment

Primary treatment involves the separation of suspended material from wastewater by settlement, traditionally achieved on the Island through the use of septic tanks. Septic systems generally consist of a tank followed by a sullage trench. Solids settle in the septic tank. Further inflow of wastewater to the tank displaces the liquid component of the wastewater (the effluent) to further treatment or a land application area.

Existing concrete septic tank prior to upgrade

Septic tanks have internal baffles to prevent short-circuiting of waste and limit hydraulic disturbance from the inflow. Primary treated effluent from septic tanks is prohibited from direct human contact.

At the project site a new polymer septic tank was installed to replace an ageing concrete tank. The new septic tank has an internal baffle and a capacity of 3900L. An effluent filter was inserted in the outlet of the septic tank. Effluent filters are commonly available and may reduce particulate matter passing through to the sullage trench. Please note that they will need to be cleaned every 3 months.

Secondary Wastewater Treatment

Secondary treatment involves aerobic biological processing and settling of effluent received from a primary treatment unit. The Board has recommended that all new on-site sewage system proposals include a minimum level of secondary treatment. It is important to ensure that all aerobic biological units are regularly and properly maintained in accordance with the manufacturer's instructions. There are a number of proprietary aerobic biological systems that can be installed; this paper is describing the installation of one specific type – Reedbeds.

A reedbed is a secondary treatment system that receives wastewater from septics, greywater tanks or other secondary treatment systems. One advantage of reedbeds is that they involve fewer maintainable parts than other proprietary devices available on the market. Reedbeds are constructed within solid, impermeable containers that contain gravel or other graded media, planted with reed species. The wastewater passes from one end of the reedbed to the other through this media. Suspended solids, nutrients and pathogens in the wastewater are taken up by the plants and by the action of micro-organisms on the gravel surface and roots. Maintenance of a reedbed is generally limited to annual harvesting of plant material. A minimum residence time of 7 days is required to ensure adequate treatment of wastewater in a reedbed. Please contact the Board for further reedbed design criteria.

Stormwater diversion along reedbed edge

Reedbed excavation

At the project site a series of three rectangular tanks were placed in the ground to contain the gravel and reeds, providing adequate residence time to treat the effluent from a family of 5-6 people. It is preferable for the effluent flow to be delivered to the reedbeds under gravity but because of site constraints a collection tank and pump was required for this installation. Stormwater diversion berms were built in the soil around the reedbeds to limit inflow during wet weather events. Reedbeds should always be planted in sunny, well-ventilated locations.

The reedbed tanks used are manufactured from black poly with the following dimensions: W 2m, L 3.1m, and H 0.6m. The three tanks were installed on a flat excavation, with the flow between each tank controlled by variation in inlet and outlet heights. The standing water level was designed to be 500mm for each tank, which is 100mm below the gravel surface. To ensure even distribution of effluent across the width of the tank a PVC T-junction was placed at each inlet and outlet. The inlet was positioned higher than the outlet on each tank.

Reedbed plumbing showing inlet T on left and outlet T on right

240mm perforated PVC was used for the inlet pipe, with an inspection port placed above each inlet T to allow monitoring of the effluent level and quality. The outlet T was constructed from 100mm perforated PVC.

Each outlet and inlet pipe was perforated with 10mm diameter holes. Perforations were drilled along all four axes of the pipe, spaced at 300mm intervals.

10mm perforations on outlet T

The ends of the inlet pipe were left uncovered, and the ends of the outlet T were covered with a geotextile fabric to prevent gravel intrusion.

Geotextile covered ends

Rocks of medium diameter (50-70mm) were placed along and above each inlet and outlet T to prevent gravel intrusion. Tanks were initially filled with gravel to a depth of 500mm to allow for reed planting. The media used in the middle part of the tank was 10-20mm river gravel. A temporary baffle was used while pouring gravel into the middle of the tanks, to limit gravel accumulating over the inlet and outlet ends. The reedbeds were planted with local species *Phragmites australis* (common reed). Reed rhizomes were collected with stems cut to a length of approximately 20cm. Reeds were planted at a density of at least 5 rhizomes per square metre (generally the more reeds planted, the better). The remaining gravel was then added to fill the reedbeds.

Reedbed fill of medium rocks and gravel

Land Application of Treated Effluent

After treatment, wastewater is distributed through a land application area for the uptake of remaining nutrients and destruction of pathogens. Adequate sizing, proper design and regular maintenance of land application areas are essential to protect public health and prevent contamination of the environment. Land application areas should be constructed away from natural drainage lines, with stormwater berms or diversion in place to reduce

run-on. Ideally, land application sites have low gradients and receive good light and ventilation. The size and design requirements of irrigation areas may vary according to water use, nutrient load, slope, soil type, depth to groundwater, presence of rocks and vegetation used.

Various types of land application include:

- Soil absorption: (eg. sullage trench from septic tank). Due to the likelihood of ground and surface water contamination, this method has limited application in the design of new systems.
- Sub-surface irrigation: Used for effluent that has undergone secondary treatment. Drip irrigation is achieved through perforated pipes covered in mulch or light soil. Effluent is applied along the root zone of plants to facilitate nutrient uptake, treatment and evaporation.
- Surface irrigation: Used for effluent that has been disinfected. Effluent is applied to the root zone of plant or distributed through the use of spray irrigation. Spray irrigation systems have limited application due to risks posed to public health, and potential contamination of the environment in the case of inadequate treatment of effluent.

At the project site, effluent passes through the reedbeds for treatment and then collects in a pump well for distribution through a pressurised drip irrigation grid. Drip lines were covered to a depth of 150mm with a light soil and mulch mix. The grid incorporates a device to prevent root intrusion and may be used as a subsurface irrigation system. Native Kentia Palms were planted along each line for additional nutrient uptake.

Laying irrigation grid

Operation of the reedbeds has only recently commenced. This guide has been compiled to provide information to people considering alternatives to mechanical aerated systems. The results of effluent monitoring will be posted as they become available!

Details of suppliers and approximate prices…

Supplier	Equipment	Price	Quantity	Subtotal
Everhard Industries	3900 L septic tank with partition	$1,318.10	1	$1318.10
	Septic tank filter	$59.50	1	$59.50
	450L Pump well	$290.60	2	$518.20
Duraplas	Reedbed tank	$390.00	3	$1170
Tradelink/VRM Environmental Solutions	Netafim E Flow Irrigation Grid	$610.00	1	$610
	Davey 42A sub.pump	$544.00	1	$544
	Onga KP 250 A sub.pump	$425.70	1	$425.70
Total Cost				**$4,645.50**

For further information contact the Lord Howe Island Board
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