Case study 5: Ag-pipe bioreactor bed Wet Tropics

Project leader and partnerships	Terrain NRM, Wet Tropics Major Integrated Project (WTMIP) collaborating with Australian Wetland Consulting (AWC)
Funding source	Department of Environment and Science (Queensland Government Reef Water Quality Program)
Project length	18 months of monitoring
Region	Wet Tropics (Johnstone)
Production system	Sugarcane
Date of installation	14th August 2019
Length of installation	Two working days for installation
Bioreactor type	Ag-pipe surrounded by woodchip (novel system)
Project objective	Trial to investigate nitrate removal efficiency.

Summary of the landscape

The bioreactor is a novel system installed beneath a sugar cane farm in the wet tropics, 17m above sea level. The outlet enters a farm drainage network at bottom of surrounding foothills and receives both high flow from storm events and base flow from groundwater seepage from the sugarcane paddocks and native vegetated hill sides (Figure 1).

The soil is classified as a Ferosol to a depth of 1.8 m and overlays weathered basalt. The soil is structured and freely draining and the ag-pipe bioreactor was installed in a particularly wet area of the field to increase drainage. The ag-pipe was installed overlaying the less permeable basalt layer at approximately 1.5 – 1.8 m deep and the wood chip was placed around the outside of the pipe.

Average rainfall and temperature

The area is in the Wet Tropics region with maximum and minimum average annual temperatures of 28.1 °C and 19.1 °C, respectively. The mean annual rainfall is 3200 mm (long term average) (BoM, 2017).

Sizing and volume capacity

175 m long, 0.4 m deep, and 0.6 – 1.1 m wide. Approximately 80 m^3 (softwood woodchip).

Figure 1 Aerial image of ag-pipe bioreactor under construction, showing cane crop and drainage line into which the bioreactor outlets. Source: WTMIP

Design features

Due to the lack of available space within this cane farm, this bioreactor was designed to be constructed around an ag-pipe that was installed to address in paddock drainage issues. An idea came up during discussions with the landholders, to install woodchip around the sub-surface drainage pipe, as an alternative to sand which is traditionally used. If proven effective, this design could be a cost- effective way to install bioreactors, as they can be integrated into sub-surface drainage systems.

Water source

Shallow groundwater, which flows year-round.

Construction methods and materials

A 175 m long trench was excavated with a V bucket in the sugar cane paddock. The trench was backfilled with 20 mm softwood woodchips and the ag-pipe placed on top (Figure 2). At the outlets (Figure 3), PVC pipe was installed approximately 6 m long to ensure a good sampling point and to avoid any damage caused from traffic on the headland. More woodchip was placed on top of the ag pipe and then backfilled with soil.

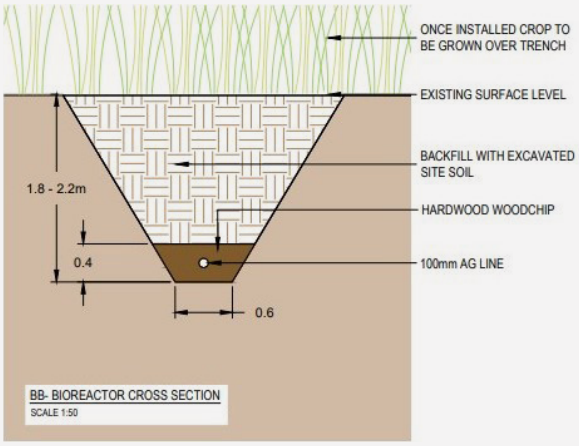

Figure 2 Cross-section plan of bioreactor showing V-shaped trench, woodchip and ag-pipe location. Source: WTMIP

Costs

Costs included woodchips, earth moving equipment, labour, ag-pipe, PVC pipe and other materials.

Performance

This system is currently being monitored and performance information is not yet publicly available.

Monitoring regime (intensity and frequency)

The bioreactor is monitored for temperature, pH, dissolved oxygen, total nitrogen, ammonia, nitrate and nitrite, conductivity, total phosphorus, phosphate and redox potential.

Samples are collected as grab samples fortnightly and during other rainfall events and has been monitored since installation in August 2019. The flow rate from the ag-pipe is calculated during monitoring.

Figure 3 Ag-pipe bioreactor outlet into drainage line. Source: WTMIP