Fact sheet 2

Improving water quality at the edge of block.
A guide to help extension and NRM officers identify edge of block water quality management initiatives and how to implement them.

NUTRIENT, SEDIMENT AND PESTICIDE REDUCTION ON FARMS: PROCESSES AND EXAMPLES.

Key "pollutants" of concern in relation to the Great Barrier Reef include Dissolved Inorganic Nitrogen (DIN), Sediment and Pesticides.

Elevated levels of DIN, sediment and pesticides in water leaving intensive agriculture can be reduced via two broad methods:

- Reducing the **concentration** of DIN, sediment and pesticides within the water leaving the paddock or drainage,
- Managing the **volume** of water leaving the paddock

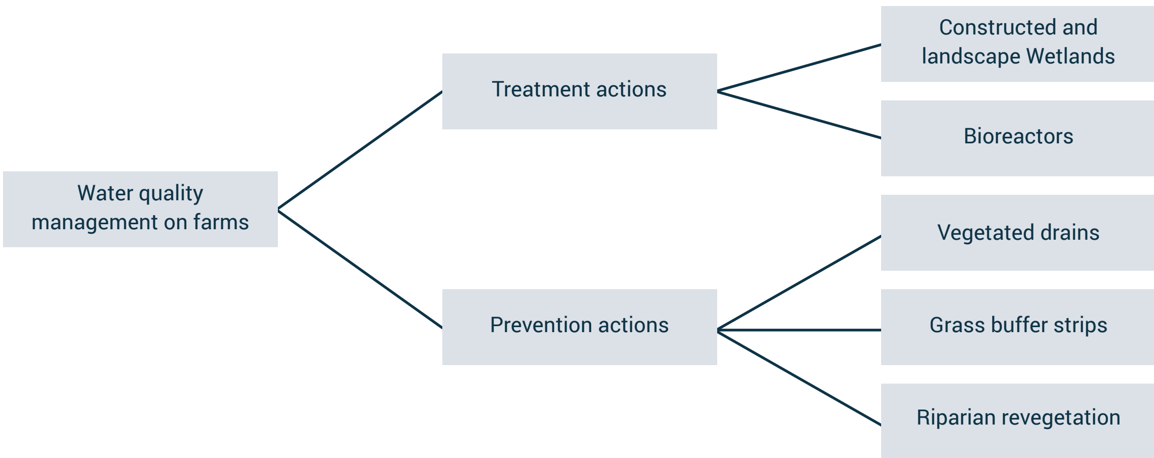
To reduce the actual amount (load) of DIN, sediment and pesticides entering our creeks and rivers requires either reducing the concentration of these pollutants, reduce the volume of runoff, or both.

*Managing water **volume*** →

Increase the opportunity for water to move through and be retained longer within the soil (good soil management) and/or captured by crops or vegetation. Effective management will reduce the volume, speed and energy of water leaving farms.

*Reducing DIN, sediment and pesticide **concentration*** →

Provide opportunities within the farming/drainage system to intercept water and remove contaminants



Nitrate, in the presence of organic matter in low oxygen environments, is biologically converted to nitrogen gas by a suite of anaerobic bacteria that are naturally present in all soils and water.

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Key pollutant removal processes and examples of actions designed to promote these processes

	Dominant form on farm	Primary removal process		Conditions on farm for process/es to occur	On farm example of where removal processes occur	
					On-farm prevention	Edge of block treatment
DIN	Nitrate (NO3)	Biological denitrification	Nitrate, in the presence of organic matter in low oxygen environments, is biologically converted to Nitrogen gas by a suite of anaerobic bacteria that are naturally present in all soils and water.	Slow moving water that interacts with a high carbon source (eg, plants/sediment).	 *Vegetated drain – directing shallow groundwater downstream*	 *Wetland at edge of block, receiving runoff from cane blocks*
Pesticides	Diuron, atrazine and imidacloprid	Chemical physical and biological	Some pesticides bind with the outside of clay/silt/sand and organic matter particles within the soil profile. Controlling and managing sediment export from farms can also reduce pesticide export. Biologically active areas on the farm can help promote the breakdown of some pesticides.	Both active and passively managed vegetated areas, including riparian zones, buffer strips, swales and wetlands. Deep water sediment basins.	 *Grassed buffer strips and swale drains, located at the edge of block*	 *Wetlands with deep water zones and shallow vegetated areas at end of farm*
Sediment	Sand, silt and/or clay particles	Physical	Sand, silt and clay particles are highly mobile in any water leaving a farm. Concentrations of these can be reduced by slowing water down in large silt traps (*sedimentation*) and/or passing water through thick stands of vegetation (*filtration*).	An area where the flow of water slows down. These can be large flat areas (buffer strips and swales) or smaller deep areas (basins).	 *Grassed interrow, reducing erosion*	 *Recycle pit / sediment basin collecting runoff from farm upstream*

For detailed information on a range of different treatment systems or wetland rehabilitation, please refer to wetlandInfo.des.qld.gov.au and search treatment systems or wetland rehabilitation or go to http://bit.ly/TreatmentSystemOptions

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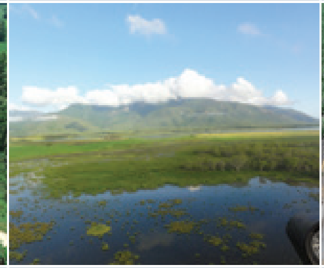
NUTRIENT, SEDIMENT AND PESTICIDE REDUCTION ON FARMS: PROCESSES AND EXAMPLES.

	Prevention			Treatment		
	Vegetated drains	Grass buffer strips / grassed swale	Riparian Buffer	Treatment wetlands	Landscape wetlands	Bioreactors
						
Target pollutants	Sediment, DIN & Pesticides	Sediment	Sediment, Nitrogen	Sediment, Nitrogen and Pesticides	Sediment, Nitrogen and Pesticides	Nitrogen
Dominant treatment process	**Biological and Physical** Denitrification and sedimentation	**Physical** Filtration	**Biological and physical** Denitrification Stabilisation	**Biological and Physical** Denitrification and sedimentation	**Biological and Physical** Denitrification and sedimentation	**Biological** Denitrification
Relative Size	Medium (50-1000m2)	Medium-Large (2000-5000m2)	Medium (100-1000m)	Large (0.5-2 ha)	Medium to Very Large (0.5 - 4 + ha)	Small (<100m2)
Target catchment	Paddock scale (<5ha)	Paddock scale (<2ha)	Paddock scale (1-10 ha)	Multiple paddock scale (20-50ha)	Multiple paddock to sub catchment size (50+ha)	Paddock scale (<5ha)
Construction timeframe	Zero for existing drain - 0.5 days maintenance	Zero for existing grass buffer or 3-5 days to enhance weedy buffer	1-3 days per ha	1-2 Months	1-2 Months	2-3 days
Key components	Any drain with elevated water levels that promotes the growth of aquatic vegetation.	At least 5m width of land between edge of paddock and drain/creek. Minimal slope land required (<10%) with small catchment size.	5-15m strip of land adjoining a small creek or river. Ideally, the groundwater in the area is shallow, and enters the creek/river laterally through the area proposed for revegetation.	Inlet deep water zone (sediment removal), followed by shallow vegetation zone (80% of surface area), followed by outlet deep water zone to aid in efficient hydraulics.	Often these sites require reinstatement of natural floodplain hydraulics. This may involve the manipulation of drains via installation of weirs, or the redirection of small catchment inflows.	0.5 - 1m deep trench filled with woodchip. Bioreactor beds are often covered with geotextile and rock placed on top and/or ends to prevent sediment intrusion. Some sites may require dedicated inlet/outlet structures.
Maintenance timeframe / activities	Assume 1 maintenance event per season – assuming normal practice is 2-3 maintenance events per year.	Regular slashing / mowing.	Regular weed control for 5 years, watering may be required in dry areas.	Weed control, monthly over wet season for 2-3 years. May require some modifications to water level during plant establishment.	Weed control, monthly over wet season for 2-3 years.	Minimal, 1-2 days per season clearing sediment from inlet zones.

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	Prevention			Treatment		
	Vegetated drains	Grass buffer strips / grassed swale	Riparian Buffer	Treatment wetlands	Landscape wetlands	Bioreactors
						
Pros	Possibly present at many sites (just needs altered management). Little effort could result in significant pollutant reductions.	Easily and quickly implemented as it may just require basic leveling and grass seeding.	Many additional benefits, like streambank protection (reduced erosion) and habitat provision.	The system can be designed and built to suit the farm, catchment and pollutant to be removed.	Able to treat large catchment and flows, good use of otherwise unproductive land. Significant habitat provision and can be cheaply and quickly built.	Quick to build, efficient and targeted at nitrate removal. Simple design which can intercept either surface or subsurface water and can fit adjacent to block without impacting production.
Cons	Drains still need to convey water from paddocks, so integrated and informed approach needed. Appropriate vegetation management is key (Weed management would need to be considered).	May not be worthwhile in catchment where the surface flow of rainwater is not dominant. Steep land and large catchment result in high flow rates and ineffective treatment.	Sediment export reduced via stabilisation of stream bank. Significant time required for DIN loss to occur (i.e. trees to grow), with the true benefit to water quality improvement not well understood.	Relatively expensive capital costs and likely difficult to find many suitable sites within a large catchment as the wetland will require a proportionately large site.	Not very many suitable sites. Areas too large for physical planting, thus weed management may be an issue.	Treatment effectiveness limited by nitrate concentration and water volume, best suited to regular, low volume water flows with consistent nitrate concentrations.
Should know	Native wetland vegetation is preferred, as this reduces weed pressure. Can be slashed grass or reeds /sedges.	Getting the water to flow evenly across the buffer strip so as not to cause erosion may require subtle earthworks.	Not all riparian planting will result in pollutant treatment – it depends on the behavior of the shallow groundwater in the subject area.	Planting costs are high, so natural plant colonization + weed control a good option. Need a site with an impervious (e.g. clay) subsoil or seasonally high water table.	Changing the movement of water within small creeks and floodplains may have impacts on ground and surface water levels/flows. This needs to be considered in light of the operation of the farm.	Best suited to concentrations of Nitrate >2mg/L, as efficiency is reduced at lower concentrations.

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