Practical Opportunities for Woodchip Bioreactors

Intercepting nitrate before it reaches the stream

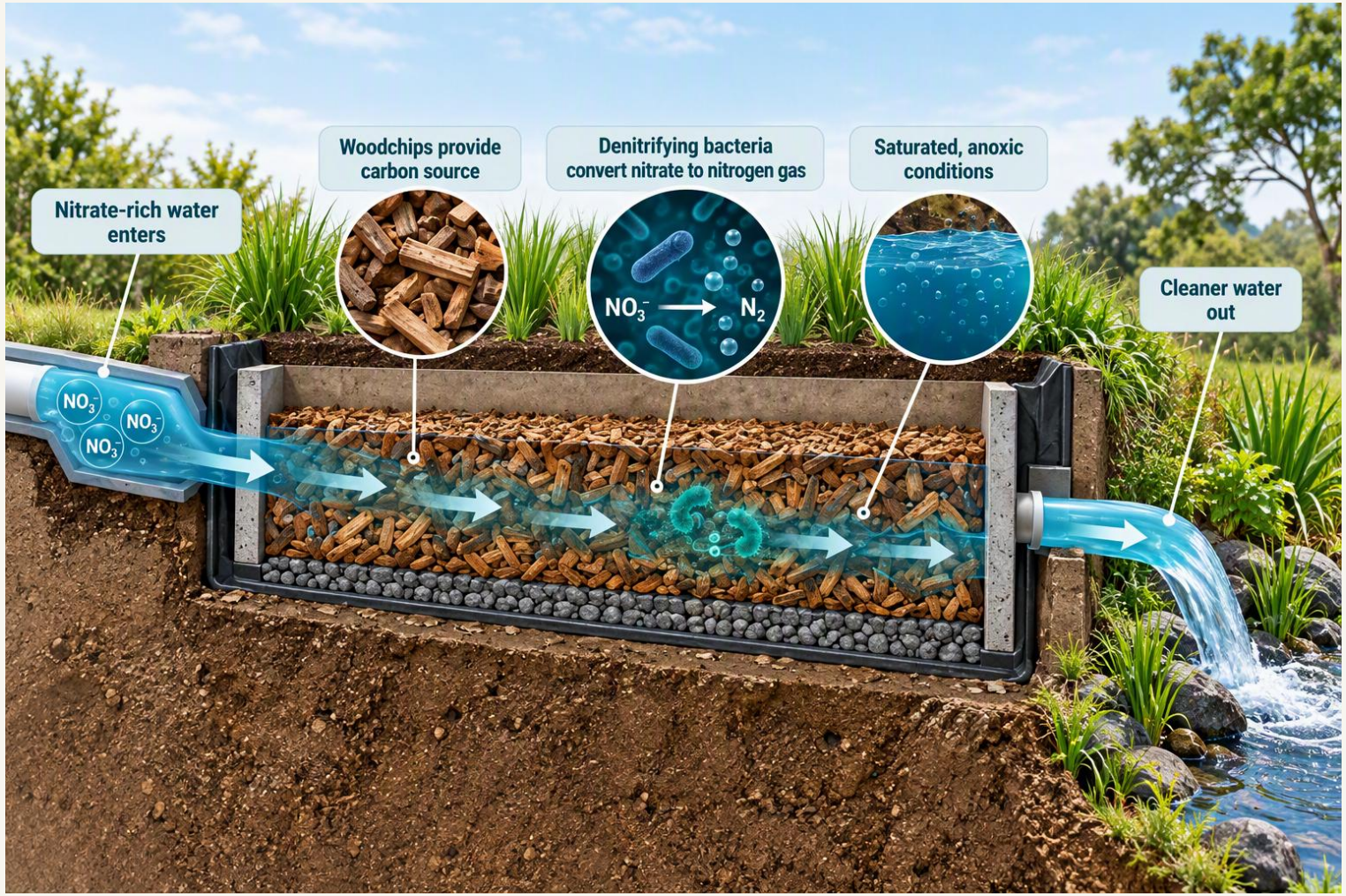
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THE PROCESS

A passive carbon bed turns nitrate into nitrogen gas



1. **Nitrate-rich water**
   Enters from a collected drainage pathway

2. **Saturated woodchips**
   Provide carbon and anoxic conditions

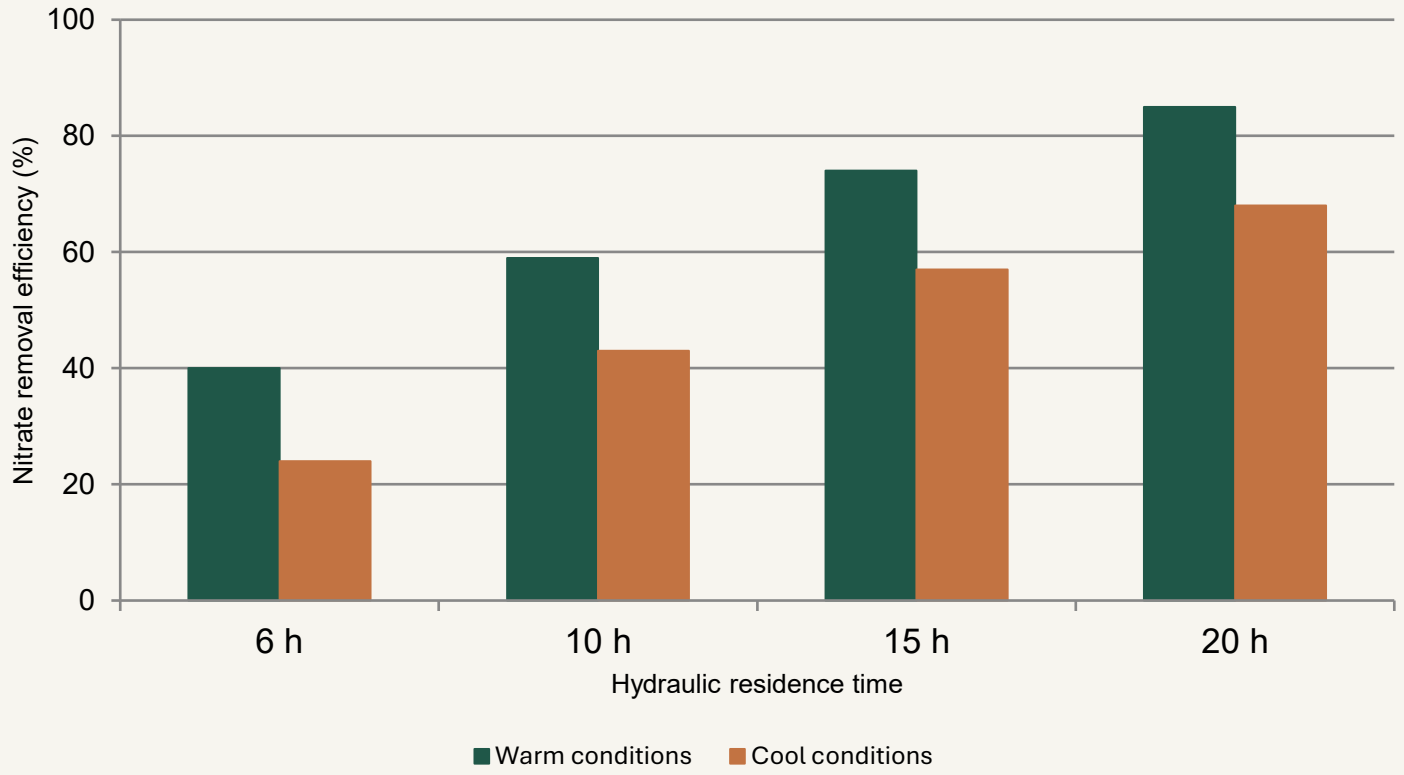
3. **Denitrifying bacteria**
   Convert nitrate to nitrogen gas

4. **Water with lower nitrate**
   Returns to the receiving environment

Bioreactors are a proven technology for nitrate removal

New Zealand field studies show that woodchip bioreactors can effectively remove nitrate-N from agricultural drainage, with **typical load reductions of around 10–61%** (Earth Sciences NZ, 2026).

Results from a bioreactor treating drainage water from a wastewater land treatment site



40–85%

warm-season removal efficiency

24–68%

cool-season removal efficiency

Design Implication

Size for treatment capacity and seasonal conditions, not maximum percentage removal alone.

Opportunities to reduce diffuse nitrate losses using woodchip bioreactors

Start with the pathway

Where does nitrate-rich drainage collect in the landscape?

1. **Is there a defined drain or outlet?**
   Drain, pipe, seep or spring that can be intercepted.

2. **Is there a worthwhile nitrate load to treat?**
   Sufficient nitrate concentration and flow to justify treatment.

3. **Is there enough space to install a bioreactor?**
   A practical footprint for retention, access and maintenance.

Putting woodchip bioreactors into practice

1. **Confirm the interception point** → Map where drainage, seepage or groundwater is already collected.
2. **Measure before designing** → Confirm seasonal flow, nitrate concentration and load.
3. **Size the bioreactor to suit water flow** → Choose retention time, bypass and capacity for real conditions.
4. **Plan for operation** → Plan for access, monitoring where feasible, and woodchip replacement when needed.

What would it take to make bioreactors work in your catchment?

Where do you see opportunities to intercept nitrate-rich drainage within your catchment?

What do you need to put one into practice?

Who needs to be involved?

Woodchip bioreactors can deliver significant outcomes when they are matched to a measurable nitrate load, a controllable flow path and a practical monitoring plan.