

# TALKING WITH YOUR TENANT ABOUT:



## DENITRIFYING PRACTICES WETLANDS, BIOREACTORS, AND SATURATED BUFFERS

**Denitrifying practices** like wetlands, bioreactors, and saturated buffers remove nitrates from tile drainage water through a process called denitrification - where microbes breathe in nitrate ( $\text{NO}_3$ ) and exhale inert  $\text{N}_2$  gas back into the atmosphere. These microbes require an anaerobic environment to ensure that they use the nitrate in the water, rather than oxygen, as part of their respiration process.

### WETLANDS

#### HOW THEY WORK

Wetlands are characterized as having water at or near the soil surface during at least part of the year, containing hydric soils, and containing plants that are adapted to wet conditions. These characteristics provide a great environment for denitrification. Wetlands are shallow in depth and allow the water to slow down and deposit sediment. On average, wetlands can remove 40-90% of nitrate.

#### WHERE SHOULD THEY BE INSTALLED?

Constructed wetlands are strategically located and designed to remove nitrate (N) from tile-drained water, and can treat drainage areas of 500-3,600 acres. The typical wetland is 0.5-2% of the drainage area. An easement area is established as a buffer to prevent sedimentation at a minimum of 2 acres of buffer to 1 acre of wetland, often requiring land to be taken out of production.

#### For a 1,000-acre watershed:

wetland area = 5-20 acres,  
easement buffer area = 10-40 acres



### WETLAND BENEFITS



IMPROVED  
WATER QUALITY



OPPORTUNITY TO  
SEED POLLINATOR  
HABITAT



MINIMAL COST  
AND MAINTENANCE  
OF BUFFER AREA



INCOME FROM  
HUNTING LEASES



CREATION OF WILDLIFE  
HABITAT AND MIGRATION  
CORRIDORS

### THE DOLLARS AND SENSE

Treating water with wetlands is affordable, with a cost of approximately \$1.32 per pound of N removed. The cost of installation can range between \$59,500 to \$280,500, but there are several sources of funding available to finance a wetland on your property through the Natural Resource Conservation Service (NRCS) and Iowa Department of Agriculture and Land Stewardship (IDALS).



## BIOREACTORS - HOW THEY WORK

Tile-drained water is routed to a woodchip filled trench located in a grassed buffer where the tile leaves the field. Once water enters the bioreactor, denitrification begins. Bacteria use the carbon from the woodchips as a food source, and the incoming nitrate for their respiration process. Bioreactors can reduce nitrate levels by 15-60%.



### WHERE SHOULD THEY BE INSTALLED?

Current designs can treat 30-80 acres of tile-drained fields. Typical bioreactors are 100-120 feet long and 10-25 feet wide. Typically no land is taken out of production, and because they are long and narrow, they fit well in edge-of-field buffer strips and grassed areas.

### THE DOLLARS AND SENSE

Bioreactor installation costs range from \$7,000-15,000, depending on size. Bioreactors can last for ~10-15 years with minimal maintenance. After that time, the woodchips in the bioreactor may need to be replaced.

### START SMALL

It is important to recognize that it takes time to learn new management techniques. Consider using the practice on a smaller portion of the land and increasing use each year, or suggest one change per year, so the tenant can learn new management skills to incorporate practices successfully. Working together to gather information about the practice, and addressing any concerns early, will help smooth the transition to the new practice and minimize conflicts.

Your local NRCS staff and Iowa State University Extension field specialists are available to meet with you and your tenants to help answer questions, and to provide resources and technical assistance.

## SATURATED BUFFERS - HOW THEY WORK

Tile-drained water is directed into a lateral tile that runs parallel to a riparian buffer. As the water moves across the buffer removing nitrate, the microbes living in the saturated zone use the nitrate in the water as part of their respiration process. Plants in the buffer also remove nitrate from drainage water through root uptake. Saturated buffers can remove, on average, 50% of the nitrate in subsurface flow.

### WHERE SHOULD THEY BE INSTALLED?

Existing buffers and existing tile drainage systems can be retrofitted for this practice if they meet specific site requirements. A good candidate site has the following:  $\geq$  30 feet wide buffer area, well-established vegetation, a flat area  $\geq$  300 feet along the waterway, and no more than a two-foot elevation change along the length of the buffer. Check with your local NRCS office to see if your site qualifies.

### THE DOLLARS AND SENSE

Saturated buffer installation costs for existing buffers and tile systems range from \$2,000-4,000 with minimal maintenance and costs.

### BIOREACTOR/SATURATED BUFFER BENEFITS



IMPROVED  
WATER QUALITY



MINIMAL COST  
AND MAINTENANCE  
AFTER INSTALLATION



OPPORTUNITY TO  
SEED POLLINATOR  
HABITAT



EDGE OF FIELD  
PRACTICE = NO  
IMPACT ON YIELD

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