NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

SATURATED BUFFER

CODE 604
(FT.)

DEFINITION
A subsurface, perforated distribution pipe is used to divert and spread drainage system discharge to a vegetated area to increase soil saturation.

PURPOSE
Install the practice to achieve one or more of the following purposes:

- To reduce nitrate loading to surface water from subsurface drain outlets.
- To enhance or restore saturated soil conditions in riverine, lacustrine fringe, slope, or depression hydrogeomorphic landscape classes.

CONDITIONS WHERE PRACTICE APPLIES
This practice is applicable to crop land with a subsurface drainage system that can be adapted to discharge to a vegetated area.

Apply this practice where the soils and topography are capable of maintaining a raised water table without adverse effects to channel banks, shorelines, or adjacent land.

This practice does not apply to drainage systems or underground outlet systems that have surface inlets which allow entry of soil and debris capable of plugging the distribution pipe(s).

Do not use this practice to discharge septic system effluent or animal waste.

CRITERIA
General Criteria Applicable to All Purposes
Design and install measures according to a site-specific plan in accordance with all local, State, Tribal, and Federal laws and regulations. Apply measures that are compatible with improvements planned or being carried out by others.

Conduct geologic and soil investigations to confirm:

- Conditions, such as a restrictive layer or a water table, are present to create saturated conditions when water is diverted from the subsurface drainage system.
- The absence of pockets or layers of high conductivity soil which could provide preferential flow paths.

- A minimum of 0.75 percent organic carbon (1.2 percent organic matter) in the top 2.5 feet of soil.
- The absence of abandoned drain pipes or clay tile in the buffer area that could continue to drain the buffer.

The minimum width of the vegetated buffer zone is 30 feet.

Locate and design the system to maximize the amount of subsurface drainage water distributed to the potentially saturated soil zone. Ensure there are no adverse impacts to adjacent lands.

Avoid placing the distribution pipe along any channels incised deeper than 8 feet, unless a slope stability analysis shows an acceptable level of safety against saturated streambank failure.

Provide a minimum cover of 1 foot over the top of the distribution pipe.

Flow. Use an appropriate model, such as DRAINMOD, to estimate flow into and through the saturated buffer. If such a model is unavailable, use the following to calculate minimum buffer dimensions:

- Soil saturated hydraulic conductivity and average drain flow rate during the growing season to compute the length of distribution pipe required to provide adequate infiltration capacity for the required design flow.
- Soil drainable porosity, saturated hydraulic conductivity, and elevation difference along with the lateral distance that leached water will travel from the distribution pipe to reach an outlet, to determine the retention time in the buffer. Minimum hydraulic retention time for the drainage water in the saturated buffer is 3 hours.

Minimum design flow into the saturated buffer is 15 percent of the maximum capacity of the drainage system.

Water control structure. Design the water control structure using the criteria found in WI NRCS Conservation Practice Standard (WI NRCS CPS) Structure for Water Control (Code 587). Locate the water control structure where it is accessible for water table observation and for operation and maintenance.

Design the water control structure to maintain the design water table elevation over the distribution pipe during the management period based on expected flow rates from the subsurface drainage system.

Use nonperforated pipe for the overflow pipe for the greater of 20 feet or a distance sufficient to avoid draining the saturated soil zone around the water control structure.

Distribution pipe. Design the distribution pipe and overflow pipe according to the criteria found in WI NRCS CPS Subsurface Drain (Code 606). Ensure the capacity of the distribution pipe is larger than the available infiltration rate of the soil.

Situate the distribution pipes on a topographic contour or grade to facilitate uniform groundwater inflow to the saturated zone. Add additional water control structures as needed for flow uniformity. The maximum elevation difference between structures is three feet.

Vegetation. Vegetate the soil saturation area and any other disturbed areas to prevent erosion and to utilize nitrogen from the drain water.

Protect all disturbed areas from erosion within 14 days of construction by seeding or mulching. Refer to WI NRCS CPS Conservation Cover (Code 327), or Critical Area Planting (Code 342) for criteria on seed selection, seedbed preparation, fertilizing, and seeding. The area shall be planted to a mix of hydrophytic species suitable for wet soil conditions.

Additional Criteria to Reduce Nitrate Loading

To reduce nitrogen loading, the saturated buffer will create a shallow water table.

Ensure saturated conditions are within the high soil organic carbon region of the soil profile when adequate drain flows exist. Design the system to maintain a water table within 12 inches of the ground surface at the location of the distribution pipe.

Additional Criteria to Enhance or Restore Saturated Soil Conditions

Design the system to replicate groundwater levels shown in the "Water Features" section of the Soil Survey Report.

CONSIDERATIONS

Consider using other practices and management systems in conjunction with this practice to achieve a reduction of nitrate-nitrogen levels. Examples include WI NRCS CPS Nutrient Management (Code 590), Cover Crop (Code 340), Drainage Water Management (Code 554), Denitrifying Bioreactor (Code 605), and Constructed Wetland (Code 656).

Consider adding an envelope around the drain to improve exit flow. Refer to criteria in WI NRCS CPS Subsurface Drain (Code 606).

For cost-effectiveness, consider locating the saturated buffer where it will intercept a subsurface drain outlet draining at least 15 acres.

Consider installing observation wells in the buffer midway between the distribution pipe and the stream bank or shoreline to facilitate water table documentation and sampling.

A saturated buffer may infiltrate less overland flow than a nonsaturated buffer.

Consider measures to reduce the potential for root plugging of distribution lines by woody species. Set planted trees back far enough that distribution lines will not be under the drip line of mature tree canopies. Plant herbaceous species in areas over distribution lines. If the riparian area is currently in trees, either clear the trees or establish an herbaceous zone outside the tree line for the water distribution area.

PLANS AND SPECIFICATIONS

At a minimum, include the following in the plans:

- A plan view of the layout of the water distribution system.
- Profile(s) of the existing drain, distribution pipe, and outlet channel.
- Details of required structure(s) for water level control.
- Vegetation establishment requirements.
- Construction specifications that describe site-specific installation requirements.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan following the applicable criteria in WI NRCS CPS Drainage Water Management (Code 554). Review this plan with the land manager. Specified actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance). At a minimum, include a description of the following:

- Planned water level management and timing.
- Inspection and maintenance requirements of the water control structure(s), distribution pipe(s), and contributing drainage system, especially upstream surface inlets.
- Periodic removal of invasive trees or shrubs to reduce distribution line plugging.
- If the site is to be monitored, include the monitoring and reporting requirements designed to demonstrate system performance and provide information to improve the design and management of this practice. At a minimum, record water levels (elevations) at the control structure, observation ports, and if used, observation wells. Record water levels biweekly when a water table is present and following precipitation events that result in high flows.

REFERENCES

Jaynes, D.B. and T. Isenhart. 2011. Re-saturating Riparian Buffers in Tile Drained Landscapes. A Presentation of the 2011 IA-MN-SD Drainage Research Forum. November 22, 2011. Okoboji, IA.

Jaynes, D.B. and T. Isenhart. 2012. Re-saturating Riparian Buffers using Tile Drainage. Unpublished.

Jaynes, D.B. and T.M. Isenhart, 2014. Reconnecting Tile Drainage to Riparian Buffer Hydrology. Journal of Environmental Quality 43:631-638. doi: 10.2314/jeq2013.08.0331. Advances in Agronomy 92:75-162.