

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD  
VEGETATED TREATMENT AREA**

(Ac.)

CODE 635

**DEFINITION**

An area of permanent vegetation used for agricultural wastewater treatment.

**PURPOSE**

To improve water quality by reducing loading of nutrients, organics, pathogens, and other contaminants associated with livestock, poultry, and other agricultural operations.

**CONDITIONS WHERE PRACTICE APPLIES**

- Where a Vegetated Treatment Area (VTA) can be constructed, operated and maintained to treat contaminated runoff from such areas as feedlots, compost areas, barnyards, and other livestock holding areas; or to treat process wastewater from agricultural operations.

**CRITERIA**

Vegetated treatment areas shall comply with all applicable laws, rules, regulations, and permit requirements including those applicable to the discharges of waters to the state.

Effluent applied to the VTA shall be pre-treated with solid/liquid separation to reduce organic loading, odor generation, and nutrients to levels that will be tolerated by the vegetation, and to prevent excessive accumulation of solids in the treatment area.

Application method shall be such that the effluent is uniformly applied and in a manner that no effluent will run off the VTA, unless measures are installed to recapture and recycle the effluent.

Use the soil's water holding capacity (AWC) in the root zone, infiltration rate, permeability, and hydraulic conductivity to determine its ability to absorb and retain runoff.

For treatment of feedlot runoff the minimum treatment area should be based on nutrient removal calculated by:

$$\text{Area} = (\text{AROV} \times \text{NC}) / \text{ACU}$$

Where:

AROV = Annual Runoff Volume, ac-in

NC = Nutrient (Nitrogen) content in Runoff, lb/ac-in

ACU = Annual Crop Uptake, lb/ac

For NC, use Figure 1 for sprinkler applications and Figure 2 for surface applications, unless local data is available. The annual uptake of nutrients by various grasses can be found using the NRCS Plants Database, Nutrient Tool.

The area of the VTA shall also be large enough to store the runoff from the 25-year, 24-hour storm event within the root zone.

A maximum of 50% of the Available Water Capacity in the root zone should be used to calculate the minimum treatment area, based on storage of the design runoff volume. For design, the root depth shall be limited to that portion that is a least 2 feet above the seasonal high water table or limited to bedrock depth. Infiltration rates and AWC values can be found in the National Irrigation Guide.

Divert uncontaminated water from the treatment area to the fullest extent possible unless additional moisture is needed to manage vegetation growth in the treatment area.

The VTA shall be designed to infiltrate a portion or the entire volume of the design storm runoff, based on management objectives. The portion of the design volume not infiltrated shall be stored for utilization or additional treatment unless discharge is permitted by applicable regulations.

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Figure 1 - NC in #/ac-in for sprinkler applied  
(Systems include settling basin and inline filter.)



Figure 2 - NC in #/ac-in for surface applied  
(Systems include settling basin and typically gated pipe.)

The VTA design for processed water shall be based on the nutrient contents of the processed water and the VTA's ability to hold and uptake the nutrients.

Nutrient loading of VTAs shall be based on crop removal of the vegetation used in the VTA.

- Permanent vegetation consisting of a single species or a mixture of grasses, legumes and/or other forbs adapted to the soil and climate shall be established in the treatment area according to 512 Forage and Biomass Planting. Selected species shall be suited to current site conditions and intended use. Selected species will have the capacity to achieve adequate density, vigor

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and yield within an appropriate time frame to treat contaminated runoff. Site preparation and seeding shall be done according to 550DP Herbaceous Design Procedures and at a time and in a manner that best ensures survival and growth of the selected species.

- Vegetation shall be able to withstand anticipated wetting and/or submerged conditions. Harvest VTA as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue

Exclude livestock access to the vegetated treatment area.

Effluent shall be applied to the VTA uniformly as either sheet flow or with a sprinkler system. Where sheet flow is planned, some means, such as a ditch, curb, gated pipe, or a level spreader shall be provided to disperse concentrated flow and ensure sheet flow across the treatment area. Land grading and structural components necessary to maintain sheet flow throughout the treatment area shall be provided as necessary. When effluent is planned to be applied as sheet flow, seeding operations shall be in a direction perpendicular to the flow direction to minimize the likelihood of small, concentrated flow channels developing while vegetation is being established.

Locate VTAs outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger if required by regulation.

The water table shall be either naturally deep enough or artificially lowered so that it is at least 2 feet lower than the bottom of the rooting depth used in the design. Subsurface drainage shall not be provided within the VTA. Subsurface drainage may be used to lower the seasonal high water table to an acceptable level provided the subsurface drain lines are at least 10 feet away from the VTA.

Infiltration areas shall not be planned where soil features such as cracking will result in preferential flow paths that transport untreated runoff from the surface to below the root zone,

unless the soil moisture can be maintained to prevent drying and cracking.

Application methods on a VTA in Nebraska are required to be designed with the appropriate irrigation practice standard.

### CONSIDERATIONS

- Provide more than one treatment area to allow for resting, harvesting vegetation, maintenance, and to minimize the potential for overloading.
- Use warm and cool season species in separate areas to ensure that plants are actively growing to maximize nutrient uptake during different times of the year.
- Use of cool season grasses is important to ensure moisture and nutrients are utilized early and late in the growing season to reduce the potential of off-season leaching.
- Use of legumes should be limited in areas susceptible to gopher infestation.

Utilize inlet control structures to prevent undesirable debris from entering the VTA, to control the rate and timing of inflow during normal operations and to control inflow as necessary for operation and maintenance.

Supplement water as necessary to maintain plants in a condition suitable for the treatment purpose.

Store seasonal contaminated water upstream of the VTA during excessively wet or cold climatic conditions.

- Consider suspension of application to treatment area when weather conditions are not favorable for aerobic activity or when soil temperatures are lower than 39° F. When soil temperatures are between 39° F and 50° F, consider reducing application rate and increasing application period while maintaining a constant hydraulic loading rate.

Manage the VTA to maintain effectiveness throughout the growing season. Time the harvest of the VTA plants according to 511 Forage Harvest Management so vegetation can maintain a healthy, vigorous stand and provide adequate regrowth to effectively filter effluent late in the growing season.

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Fences or other measures may be needed to exclude or minimize access of the VTA to humans or animals that would inhibit its function.

### PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard that describe the requirements for applying the practice to achieve its intended use. Include critical construction parameters, necessary construction sequence, vegetation establishment requirements, and nutrient removal.

Plans and Specifications will include:

- A plan view showing the location of the VTA and associated waste management components
- Details of the length, width, and slope of the treatment area to accomplish the planned purpose (length refers to flow length down the slope of the treatment area)
- Herbaceous species, varieties, seed selection, and seeding rates to accomplish the planned purpose. High quality seed that meets the seed source requirements listed in 550DP Herbaceous Design Procedures will be utilized
- Planting dates, care, and seed handling requirements to ensure that planted materials have an acceptable rate of survival according to 550DP Herbaceous Design Procedures and NRCS Practice Standard 512 Forage and Biomass Planting
- Site preparation sufficient to establish and grow selected species (refer to 550DP Herbaceous Design Procedures for requirements)

### OPERATION AND MAINTENANCE

- Develop an operation and maintenance plan that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design.

The plan shall include the following as appropriate:

- Control undesired weed species, especially state-listed noxious weeds, and other pests

that could inhibit proper functioning of the VTA

- Inspect and repair treatment areas after storm events to fill in gullies, remove flow disrupting sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow
- Apply supplemental nutrients and soil amendments as needed to maintain the desired species composition and stand density of herbaceous vegetation
- Maintain or restore the treatment area as necessary by periodically grading when deposition jeopardizes its function, and then reestablishing to herbaceous vegetation
- Routinely de-thatch and/or aerate treatment areas used for treating runoff from livestock holding areas in order to promote infiltration
- Conduct maintenance activities only when the surface layer of the VTA is dry enough to prohibit compaction
- Forage will be harvested annually according to 511 Forage Harvest Management in a manner that will maintain a healthy, vigorous stand of grasses

Treatment areas in arid or semiarid regions that potentially could be affected by high salinity and/or sodium content should be monitored for excessive salt and sodium buildup. If excessive salt or sodium is found, an appropriate corrective action shall be taken.

### REFERENCES

USDA/NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook.1992, Last revised, June 1999.

Koelsch, R., B. Kintzer, and D. Meyer. (ed.) 2006. Vegetated Treatment Systems for Open Lot Runoff - A Collaborative Report. USDA, NRCS.

<http://www.heartlandwq.iastate.edu/ManureManagement/AlternativeTech/Avtsguidance/>

NRCS Plants Database, Crop Nutrient Tool, [http://npk.nrcs.usda.gov/nutrient\\_body.html](http://npk.nrcs.usda.gov/nutrient_body.html)