Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

VEGETATED TREATMENT AREA

CODE 635

(ac)

INITIAL REVIEW DRAFT
COMMENTS AND RESPONSES

Drafted technical standard text is in black font.

Comments are in red, preceded by comment number (**C#**).
To find a specific comment number, search for that number using "Ctrl + F" (Windows) or "Command + F" (Mac).

*Responses to comments are in green italics, preceded by **RESPONSE**.*

Suggested minor changes to standard text are in tracked changes and highlighted.

General Comments

C70: Since the companion document is referenced four times in the standard, consider having it available for the public comment period.

***RESPONSE**: Noted. Current intent is to eliminate the companion document.*

C52: From the examples that we compared the size of the VTA has not really changed from the designs of old. Even in some cases the size could even be reduced unless we are missing a big component or step that would restrict any discharge from a feedlot when the vegetation is not actively growing?

Evaluated 4 VTAs installed in the County to determine modifications needed to meet proposed standard. I attached Waste Treatment Strip sheet from the original design and printout from WinSRFR for reference. For each site I ran the VTA through the WinSRFR with the Q from a 25 yr storm and 1 yr storm. In general I needed to shrink the orifice size of the sediment basin outlet, and I could make the VTA significantly smaller. Due to the VTA size potentially decreasing I modeled the new VTA in BARNY to determine if there is still an acceptable level of Phosphorus reduction to 5 lbs P per year. For half of the barnyards I would need additional VTA.

***RESPONSE**: The submitted examples were reviewed (and team had reviewed other modelling throughout the process). Submitted examples addressed orifice size in a gravity flow configuration to achieve the proposed duration range of 4 to 12 hours. This duration range was selected to optimize infiltration for noted soil types and associated NRCS intake families. See response to Comment 49 for additional information.*

C39: The following is from the Wastewater Treatment-Milkhouse:

> Vegetative Treatment: If vegetative treatment is used for the final wastewater treatment component, require year-round plant growth. Vegetation must be dense to provide effective treatment. Use criteria from Vegetated Treatment Area (Code 635).

We are not sure how the "require year-round plant growth" could apply in Wisconsin?

***RESPONSE**: Noted. As team scope is limited to CPS 635, intent is to coordinate with current version of CPS 627.*

C47: Require a model like BARNY to ensure that a minimum amount of Phosphorus reduction is obtained at the end of the VTA.

***RESPONSE**: BARNY is considered subjective and more applicable as a ranking tool. Designers can certainly use BARNY to evaluate phosphorus treatment, but it is not proposed as a requirement for the updated standard.*

DEFINITION

An area of permanent vegetation used for agricultural wastewater treatment.

PURPOSE

This practice is used to accomplish one or more of the following purposes–

- Improve water quality by using vegetation to reduce the loading of nutrients, organics, pathogens, and other contaminants associated with livestock, poultry, and other agricultural operations.

C1: Suggested edit to: "Improve surface water quality and reduce the risk for groundwater contamination, including drinking water sources by using source control and vegetation treatment to reduce the loading of nutrients, organics, pathogens, and other contaminants associated with livestock, poultry, and other agricultural operations."

***RESPONSE**: Indicated text is from national standard. Updates will be proposed regarding surface/groundwater impacts and need for source control.*

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- A vegetated treatment area (VTA) can be constructed, operated and maintained to treat contaminated runoff from a feedlot, feed storage area, or manure stacking area. Final treatment of milk house wastewater is acceptable as provided in NRCS CPS Code 627, Wastewater Treatment, Milk House.

C2: Suggest adding "…during the growing season" to first sentence. A VTA cannot maintain a Nutrient Balance during non-growing season. Some nutrient loss below the VTA root zone will occur when plants are not active.

***RESPONSE**: Agreed. Indicated language will be included in revised draft.*

C54: I like that manure stacking areas were added, a lot of the smaller farms stack manure on their lots until conditions are right for field application.

***RESPONSE**: Noted.*

- A VTA is a component of a planned agricultural waste management system meant to improve surface and/or groundwater quality including drinking water sources.

  C59: Could this inadvertently insinuate that a VTA could be used to treat drinking water? Suggest removing ["including downstream drinking water sources"] or reword this bullet.

  ***RESPONSE**: Indicated text is from national standard. Removal of drinking water reference will be proposed to eliminate concern.*

- Paved feedlots, feed storage areas, or manure stacking areas do not exceed 2/3 acre.

  C3: As in 0.66 acre? I think it would be best to use the same format as the bullet below.

  ***RESPONSE**: Format will be revised.*

- Earthen feedlots do not exceed 1.0 acre.

  C60: Curious as to how these cutoff acres were determined [in above 2 bullets]?

  ***RESPONSE**: Proposed feedlot size limits were selected to provide a cap on VTA sizing. The runoff volume from 0.66 acre at CN=98 is roughly equal to the runoff volume of 1 acre at CN=90 on average for 1-year, 24-hour rainfall event in WI.*

C4: Suggest additional bullet "Contributing feedlot, feed storage or manure stacking areas receive frequent manure and feed removal to reduce nutrient and pathogen loads being treated by the VTA". Source Control is critical to reduce nutrient and pathogen loading into the VTA and will help improve VTA performance.

***RESPONSE**: Agreed. Adjusted language will be included in revised draft.*

C51: Develop a waiver checklist for difficult sites. If a VTA can't be sited the only options left are a roof or relocation. In some cases this is cost prohibitive. Some guidance to develop a VTA that still functions to substantially meet the intent of the standard and NR 151 requirements would be helpful for difficult sites.

***RESPONSE**: Purposes for a waiver vary. Potential variance needs should be discussed with NRCS on a case-by-case basis.*

This practice does not apply on CAFOs.

CRITERIA

C61: The current standard has a fairly robust Management and Site Assessment section. I'm guessing not all that criteria is necessary for the proposed standard; however, consider whether these sections should be added back in to support documentation of the planning phase and to assist with gathering data to be entered into the WinSRFR model and design calculations.

***RESPONSE**: The various restrictions included in the revised standard were intended to simplify the planning process.*

General Criteria Applicable to All Purposes

C62: Suggest adding "VTAs shall comply with all federal, state, and local laws, rules, or regulations. The operator is responsible for securing required permits. This standard does not contain the text of the federal, tribal, state, or local laws." Does this fairly standard disclaimer language need to be added back in, or was it removed because it was determined that it really doesn't apply to VTAs?

***RESPONSE**: Agreed. Adjusted language will be included in revised draft.*

Size the total treatment area for the VTA on both the contributing site water runoff and vegetation nutrient balances.

C5: Suggest adding "…to treat contaminated runoff from feedlot, feed storage area, or manure stacking area(s) to maintain a water balance and minimize nutrient imbalance". The VTA cannot maintain a nutrient balance during the non-growing season. Some nutrient loss to groundwater will occur during this time period. This is main reason for the "minimize nutrient imbalance" comment to replace vegetation nutrient balance language.

In addition, it is also unlikely the VTA will achieve a nutrient balance during the growing season, due to uneven distribution of nutrients across the full area of the VTA and the low annual nutrient uptake rates of the perennial grasses when compared to the annual nutrient loading from animal lots and feed storage areas.

Nitrogen is the nutrient of most concern since excess nitrogen can mobilize and enter the groundwater while a large percentage of the phosphorus is likely to be bound up in the soil profile.

Even during the growing season it is unlikely that the VTA will maintain a nutrient balance for reasons described in comments below.

***RESPONSE**: Indicated text is from national standard. Revisions will be made to address nutrient evaluation.*

C63: I assume this means the VTA size would have to be based on whichever of these two criteria resulted in the larger VTA? If so, consider making this more explicit either here and/or in the specific criteria sections.

***RESPONSE**: Indicated text is from national standard. Revisions will be made to address nutrient evaluation.*

- Water balance requires evaluating the soil's capacity to infiltrate and retain runoff within the root zone. Base the runoff determination on the most restrictive soil layer within the root zone regardless of its thickness. Use the soil's water holding capacity in the root zone, infiltration rate, permeability, and hydraulic conductivity to determine its ability to absorb and retain runoff.
- Nutrient balance utilizes the nutrients from the waste runoff to meet the nutrient removal requirements in the harvested vegetation during the growing season. Base the nutrient balance on the most limiting nutrient (i.e., nitrogen or phosphorus).

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.

C6: Suggest adding "Remove manure, uncovered feed or other nutrient sources from feedlot, feed storage, or manure stacking areas weekly to reduce nutrient and pathogen loads entering the VTA; land apply removed materials per approved nutrient management plan." Source Control is critical to reduce nutrient and pathogen loading into the VTA and will help improve VTA performance.

***RESPONSE**: Noted. Indicated requirements will be included in "O&M" section of revised draft.*

Establish and maintain permanent vegetation in the treatment area. Use a grass mixture adapted to the soil and climate. Select species to meet the current site conditions and intended use. Selected species will have the capacity to achieve adequate density, vigor, and yield within an appropriate time frame to treat contaminated runoff during the growing season. Complete site preparation and seeding at a time and in a manner that best ensures survival and growth of the selected species.

C55: Might be helpful to reference the practice standard for seeding.

***RESPONSE**: Agreed. Reference to CPS 342 will be included in revised draft.*

Select vegetation that will withstand anticipated wetting or submerged conditions. Remove vegetation at least three times during the growing season to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue.

Exclude all livestock, including grazing, from the VTA.

Use NRCS Conservation Practice Standard (CPS) Code 632, Waste Separation Facility, to pretreat influent with waste separation (i.e., settling basin) to reduce nutrient loading to the VTA and to prevent excessive accumulation of solids in the treatment area.

C7: Suggest moving this paragraph up, after "Divert uncontaminated water…."

***RESPONSE**: Noted.*

C8: Suggest adding to above "Empty settling basin as necessary and land apply per approved nutrient management plan."

***RESPONSE**: Agreed. Adjusted language will be included in revised draft.*

Apply discharge into and through vegetated treatment area as sheet flow. To encourage sheet flow across the treatment area, provide a means to disperse concentrated flow, such as a ditch, curb, gated pipe, level spreader, fiberglass reinforced plastic V-notch weir/baffle assembly (see detail in CPS 635 companion document), or a sprinkler system. Complete land grading and install structural components necessary to maintain sheet flow throughout the treatment area. Do not apply contaminated runoff to the VTA using a concentrated point of discharge, such as a pipe outlet.

C9: The "bubbler" type VTA is out then? Multiple distribution points.

***RESPONSE**: Due to maintenance issues encountered at previous installations, the "bubbler" distribution configuration is not considered acceptable.*

C10: Suggest moving last two sentences (starting with "Complete land grading…" to be the first two sentences of this paragraph.

***RESPONSE**: Noted.*

C11: Recommend two entry points for the VTA because smaller precip events will not flow across the entire VTA and nutrient/pathogen loads will concentrate. More distribution will help improve VTA performance/nutrient uptake over the growing season. Suggest adding: "Provide at least two entry points, one at the head of the VTA and the other at the mid-point, to evenly distribute flow and nutrients across the entire vegetated treatment area."

***RESPONSE**: Multiple distribution points will be included as a Consideration in revised draft. However, the additional management involved to optimize this approach will not be considered acceptable for all applications.*

Utilize inlet control structures to control the rate and timing of inflow during normal operations and to control inflow as necessary for operation and maintenance.

Design the VTA for full infiltration of a 1-year frequency, 24-hour duration runoff event with no discharge from the end and less than 10% deep percolation. Use a Runoff Curve Number (CN) = 98 for the paved condition and CN = 90 for the earthen condition (Ref: National Engineering Handbook, Part 630, Chapter 10).

C12: Will the VTA discharge if/when storm event(s) exceed the 1yr-24 hr event?

***RESPONSE**: If the flow rate applied to the VTA exceeds the infiltration capacity, discharge will occur via runoff travelling over the end berm. Flow leaving the settling basin in excess of the design application rate may or may not enter the VTA.*

C40: Other standards reference Minimum [CN] of 95 for paved lots, thinking it would nice to have consistent language.

***RESPONSE**: Noted, the team scope of review is limited to CPS 635.*

VTA and settling basin (CPS Code 632, Waste Separation Facility) must be designed concurrently to ensure a feasible basin size and inflow rate onto the VTA.

Use a 12-inch tall earthen berm (end block) on the downstream end of the VTA to increase infiltration time and inhibit formation of ephemeral gullies which can circumvent uniform flow.

Use an entrance slope of 1 percent for the first 25 feet of the VTA. Design a uniform slope of 0.5 to 3 percent for the remaining length.

C41: Some of our better looking VTA, even from back in the priority watershed days have 2-4% slopes, I would recommend this and then design slopes after from 0.5-4%.

***RESPONSE**: WinSRFR modeling indicates instability at slopes above 3% (Verr value becomes excessive, water moving too fast toward end block). Intent is to get runoff directed downstream of the initial application point. Language will be modified to indicate that initial 25 feet shall be 1% if downstream segment is less than 1%.*

Use a flow width between 20 feet and 40 feet. Use a flow length between 100 feet and 400 feet.

C48 // C64: Barnyard VTAs can be difficult to site. My predecessors fixed all the "easy" sites and we are now left with the difficult farms. Eliminate design parameters like width, length, and slope. Let WinSRFR, BARNY, and Nutrient Balance Calculations determine if a VTA is appropriate. // I can see setting a minimum width and length, but why restrict the maximums as well? If a geometry wider than 40 feet and/or longer than 400 feet works following the WinSRFR requirements for hydraulic design or the nutrient balance below, why not allow it?

***RESPONSE**: Application uniformity at a VTA width greater than 40 feet was a concern (assuming no sprinkler system), and the length restrictions were added to keep VTA size in a reasonable range. The team evaluated a variety of modeling results with different constructed scenarios to evaluate performance and the results were less accurate in larger size VTAs. Variances could be sought for larger designs.*

Use earthen side berms with a minimum height of 12 inches to define the VTA perimeter and exclude uncontaminated runoff from adjacent areas. Minimum height applies to adjacent ground surface within and outside of VTA.

Use a Manning's n-value of 0.3 to model surface roughness and sheet flow through the vegetation.

Use a managed rooting depth of 3.0 feet for grass.

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

Install VTAs where subsurface saturation is naturally deep so that the infiltrated runoff does not mingle with the groundwater at the bottom of the root zone. Subsurface drainage within the VTA is not allowed. Do not use drainage tile to artificially lower the subsurface saturation elevation.

C13: This is an important section. Agree, no drain tiles/subsurface drainage.

***RESPONSE**: Thank you for confirmation; the team agrees!*

C65: Since the separation distance to subsurface saturation is specified in the standard as 3', consider moving this sentence to the "Considerations" section since "naturally deep" is subjective.

***RESPONSE**: Noted, language will be revised.*

Unless soil moisture can be maintained to prevent drying and cracking, do not plan infiltration areas where soil features such as cracking will result in preferential flow paths that transport untreated runoff from the surface to below the root zone.

C66: This is also fairly subjective if specific soil types are not going to be listed. Should this be moved to the Considerations section?

***RESPONSE**: Noted, language will be moved to "Considerations" section.*

Ensure that appropriate erosion control measures and sheet flow control measures (gravel spreaders, or similar) are adequately addressed over the entire length of the VTA. Space gravel spreaders (see detail in CPS 635 companion document) evenly over the VTA length with a maximum separation of 100 feet to the upstream and downstream ends of the VTA and other gravel spreaders. At least one gravel spreader is required for a VTA.

C42: It would appear that "Gravel Spreader" is our only option since that term is used 4-times in this paragraph alone. Maybe [use] gravel spreader or other effective level spreader device.

***RESPONSE**: Gravel spreader is typically used as a more cost-effective and maintainable method; however, language will be added for possibility for equivalent flow control measure.*

Additional Criteria for Site Suitability

Perform a soils investigation every 100 feet along the VTA length. Include one test hole at the upstream and downstream end. Log the soil profile using the USDA Soil Classification System.

C67: Consider adding a soil boring proximity criteria such as "borings must be within 50 feet of the VTA footprint." Or make the requirement that they have to be within the footprint if that was the intention. This question could come up if the VTA shifts slightly from planning to design, and whether the borings are still considered usable.

***RESPONSE**: Agreed, additional language will be added for clarification.*

C68: Suggest adding to previous sentence "…to a minimum depth below the planned VTA to ensure the required separation distance to bedrock and saturation is met as identified below." Consider some type of language like this to indicate at a minimum how deep investigations should go.

***RESPONSE**: Noted, language will be added for clarification.*

Do not construct a VTA in sand, loamy sand, or sandy loam.

C14: Suggest clarifying the above: "Do not construct a VTA when the soils investigation confirms sand, loamy sand, or sandy loam soil units within the soil profile (i.e., within 60 inches of surface)."

***RESPONSE**: Agreed, additional language will be added for clarification.*

C56: I feel this will restrict some areas based on soil types. In the old standard soil P200 greater than or equal to 20% was allowed. This criteria could be met with some sandy loam soils, which with the update would not be allowed.

***RESPONSE**: Based on WinSRFR modeling using the referenced NRCS intake families, soil coarser than silt loam significantly increases the infiltration potential at the upstream end of the*

VTA. Considering the 10% deep percolation threshold, the indicated soils were excluded from further analysis.

Maintain the minimum setbacks from the VTA listed below:

- 3 feet to bedrock. Do not excavate bedrock and backfill with soil.

  C15: Recommend increasing distance to Bedrock [to 5'] to reduce risk for VTA causing groundwater contamination; will provide more wq and public health protection from pathogen and nutrient loads.

  ***RESPONSE**: Noted.*

- 3 feet to subsurface saturation as defined in CPS 313, Waste Storage Facility.
- 50 feet from the perimeter to drainage tile.
- 10 feet from the sides to property lines and rights-of-way.
- 100 feet from the downstream end to property lines and rights-of-way.

  C57: Most smaller farms are within a couple hundred feet of the right-of-way, will be difficult to site a VTA on these farms. Is this to address runoff entering road ditches? If so current standard allows as long as drainage area to end of VTA is less than 5 ac may address the issue.

  ***RESPONSE**: Noted. Yes, the intent was to reduce potential for off-site impacts. Current standard language is based on potential for channelized flow not for property ownership considerations.*

- 50 feet from the perimeter to private wells.

  C16: Recommend increasing distance to private wells [to 100'] to reduce risk for VTA causing well contamination; will provide more wq and public health protection from pathogen and nutrient loads.

  ***RESPONSE**: Noted.*

- 1,000 feet from the perimeter to public wells.
- 300 feet from the perimeter to sinkholes and quarries.
- 100 feet from the downstream end to wetlands and artificial ponds.
- 300 feet from the downstream end to streams, gullies, ditches that discharge to surface waters, and surface inlets.
- 1,000 feet from the downstream end to lakes and flowages.

Additional Criteria for Hydraulic Design

Use WinSRFR program developed by the USDA-Agricultural Research Service for VTA design (see CPS 635 companion document for walk-through). Version 5.1.1 is available on the national NRCS website (Resources > Tech Tools).

C69: Could not comment on this Hydraulic Design section since this is a program I am not familiar with yet. Because this is not a commonly used program, recommend providing training on how to use the software.

***RESPONSE**: Agreed, training is anticipated.*

C58: I compared the last VTA design I did by running through WinSRFR program. Assuming I entered everything correctly the sizes were comparable. My design was 35' x 143' and this calculated out to 35' x 190'.

***RESPONSE**: Noted.*

Use the following software input conditions:

1. Select a basin/border system in the "Simulation World" tab.
2. Select the applicable NRCS Intake Family on the "Soil / Crop Properties" tab (Ref: National Engineering Handbook, Part 623, Chapter 4):
   - Silt Loam – NRCS Intake Family = 0.8
   - Clay Loam – NRCS Intake Family = 0.5
   - Sandy Clay – NRCS Intake Family = 0.3
   - Clay – NRCS Intake Family = 0.1
3. Enter a 12-inch basin depth on the "System Geometry" tab to establish an end block. Select the blocked downstream condition on the "Inflow / Runoff" tab.

   C43: I like the end block concept, caution should be placed on this especially with flat VTA, even at 1% will pond water 100 feet back which in some cases this could be the entire length. If this is the case, runoff from the yard needs to be controlled to provide sufficient rest time between loadings/flooding.

   ***RESPONSE**: Agreed.*

4. Enter the design slope on the "System Geometry" tab. Design slope shall be the uniform slope downstream of the initial 25 feet of VTA length. Adjust slope as necessary to keep the "Verr" value in the simulation results within ±0.5%.
5. Select standard hydrograph method. Enter the design discharge rate from the Settling Basin as the constant inflow rate on the "Inflow / Runoff" tab with no cutback. Calculate an inflow rate by dividing the 1-year, 24-hour runoff volume (see table in CPS 635 companion document) by a drawdown time of 4 to 12 hours.

   C49: 4-12 hour drawdown time. For smaller barnyards orifice size may become too small to meet the 4 hours. The old technician guidance is to have a minimum orifice size of 2.5" to avoid plugging. Either provide a drawdown time based on barnyard size or let WinSRFR determine what is appropriate for a drawdown time. For example, <5,000 sf ft barnyard 2-4 hr drawdown time, 5,000-10,000 sq ft 3-5 hr drawdown time, and >10,000 sq ft 4-12 hr drawdown time?

   ***RESPONSE**: Agreed on potential for plugging, though pumped delivery could be utilized ("pump-up", not necessarily sprinkler). The acceptable duration range is based on optimizing infiltration in WinSRFR for the referenced NRCS intake families and associated assumptions. For silt loam, the optimized duration is 4 hours. For clay loam and sandy clay, the optimized duration is 7 hours. For clay, the optimized duration is 12 hours. In other words, the optimized duration allows for all deep percolation associated with the design storm to occur as a result of the end block (per WinSRFR).*

6. Required depth on the "Start Simulation" tab is defined as the net available water holding capacity within the managed rooting depth minus direct precipitation on the VTA. Select the available water holding capacity per unit depth (Ref: National Engineering Handbook, Part 652, Chapter 2).
   - Silt Loam – Available Water Holding Capacity = 2.4 inches per foot
   - Clay Loam – Available Water Holding Capacity = 2.4 inches per foot
   - Sandy Clay – Available Water Holding Capacity = 1.9 inches per foot
   - Clay – Available Water Capacity = 1.8 inches per foot
7. Limit deep percolation ("DP" on WinSRFR results summary) to 10% of calculated design volume. Applied depth in excess of the required depth is considered deep percolation.

C44 // C50: From some of the example sites we analyzed, the 10% is tough to meet. Could there be a graduated scale based on size? // Is there anything significant with 10% deep percolation? With smaller barnyards meeting 10% may be difficult without too small of an orifice. Would it be possible to step the amount of acceptable deep percolation: <5,000 sf ft barnyard <20%, 5,000-10,000 sq ft <15%, and >10,000 sq ft <10%?

***RESPONSE**: Noted. See response to Comment C49 above regarding application rate.*

8. Given the selection of an end block as the downstream condition on the "Inflow / Runoff" tab, the only solution model option on the "Execution" tab will be zero-inertia.
9. Run the simulation to calculate VTA performance. Perform trial adjustments to the geometry and flow parameters to optimize infiltration, prevent VTA discharge, and keep deep percolation to less than or equal to 10%.

Additional Criteria for Feed Storage Area Runoff

Collect all leachate and the runoff volume from the initial 0.20 inches of each precipitation event in a reception structure designed in accordance with CPS 313 Waste Storage Facility or CPS 634 Waste Transfer. Do not apply feed storage area leachate/initial runoff to the VTA.

C17: Also an important section. Suggest adding "…with land application of the collected liquid per approved nutrient management plan." after standard list.

***RESPONSE**: Noted.*

C45: Any consideration about adding additional criteria for Milkhouse waste?

***RESPONSE**: Additional language will be included to address allowable application rate. Pretreatment requirements are covered in CPS 627.*

Additional Criteria for Nutrient Balance

C18: The provided calculations do not confirm the VTA nutrient uptake exceeds nutrients supplied. It appears the required VTA area needed to provide the needed uptake is greater than what is desired by NRCS to provide a practice which is implementable. We question including the nutrient balance calculation, since, if done correctly, it will confirm is NOT a balance unless the VTA size is greatly increased.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

The uptake of nitrogen by VTA vegetation during the growing season must exceed the available nitrogen supplied by the contaminated runoff from a feedlot, feed storage area, or manure stacking area.

C71: [Suggest above] language to be consistent with the language used in the "CONDITIONS WHERE PRACTICE APPLIES" section.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Use the following nitrogen content of feedlot runoff (AWMFH, NEH Part 651, Table 4-9)

- 60 lbs N / acre-in runoff Below Average Conditions
- 30 lbs N / acre-in runoff Average Conditions
- 15 lbs N / acre-in runoff Above Average Conditions

C19: How was the feedlot managed and what type of feedlot was this - dairy, beef, horse, other? Was lot cleaned frequently or not, such info will help confirm what conditions the nitrogen content estimate represents.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Use a nitrogen content of 60 lbs N / acre-in runoff for feed storage areas and manure stacking areas.

Use a denitrification rate of 10% for somewhat poorly drained soils (AWMFH, NEH Part 651, Table 11-8).

C72: Why was the most conservative 10% chosen, when Table 11-8 has a range of 10% to 25% for somewhat poorly drained soils?

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Use a mineralization rate of 57% for long-term nitrogen application (AWMFH, NEH Part 651, Table 11-9).

Example:

The 1-year, 24-hour precipitation depth for Crawford County is 2.59 inches with an associated runoff depth of 1.61 inches for a 1.0-acre earthen feedlot (CN = 90). Ineffective or below average settling basin.

C46: This example does not make sense since you are only using the N-loading in runoff from ONE 1-year, 24-hour rainfall, but the grass N-removal from three cuttings is throughout the entire growing season, or at least three cutting. This is why the previous VTA standard has +/- 5 acre areas.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

$$Nitrogen\ Content = \frac{60\ lbs\ N}{acre - in}\ x\ 1.0\ acre\ x\ 1.61\ inches = 96.6\ lbs\ N$$

C20: This is runoff from just one, 1-yr storm, not the annual runoff. Annual runoff would be 6.8" and 408 lbs N.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Denitrification of 10% assuming somewhat poorly drained soils (90% remaining):

$$Nitrogen\ Content = 96.6\ lbs\ N\ x\ 90\% = 86.9\ lbs\ N$$

Mineralization of 57% for long-term application (57% plant-available following denitrification):

$$Nitrogen\ Content = 86.9\ lbs\ N\ x\ 57\% = 49.6\ lbs\ N$$

C21: The N content calculation is based upon a 1yr, 24 hr event (2.59 in). Over a year, the VTA will receive more rainfall (and nutrient load) than a 1yr, 24 hr event. Nitrogen load after mineralization on an annual basis would be 209.3 lbs. N.

Accordingly, the amount annual N loading supplied by livestock or feed storage area runoff is underestimated using these calculations.

The calculations need to be based on annual runoff depth, not a single storm event. Making this change will help to accurately assess if N uptake by vegetation is > N supply (during the growing season). A VTA cannot maintain a Nutrient Balance during non-growing season. Some nutrient loss below the VTA root zone will occur when plants are not active.

Some nutrient loss will also likely occur during the growing season - due to N loading amounts and if loading is concentrated to limited sections of the VTA.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Nitrogen uptake will be dependent upon the type and growth of vegetation in the VTA. Calculate the nitrogen uptake for common grass species. Assume the seed mix includes bluegrass, ryegrass, and tall fescue in equal amounts unless another seed mix is desired. Associated nitrogen removal per ton of dry matter harvested is 58 lbs/ton, 33 lbs/ton, and 39 lbs/ton, respectively (Ref: 2006 Koelsch et al. collaborative report).

C22: Suggest adding "… during the growing season." A VTA cannot maintain a Nutrient Balance during non-growing season. Some nutrient loss below the VTA root zone will occur when plants are not active.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

$$Plant\ Nitrogen\ Uptake = \frac{58 + 33 + 39}{3} = 43\ lbs\ N/ton \quad (dry\ weight\ basis)$$

C23: This shows annual uptake of N.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Annual yield is likely within the range of 2 to 5 dry tons per acre. Calculate the nitrogen uptake per acre. Assume a yield of 4 dry tons per acre.

C73: Most of the variables are set based on above criteria. Is 4 dry tons required to be used, or is the designer allowed the flexibility of the 2 to 5 dry tons per acre?

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

$$Plant\ Nitrogen\ Uptake\ Rate = \frac{4\ tons}{acre}\ x\ \frac{43\ lb\ N}{ton} = 172\ \frac{lbs\ N}{acre}$$

Calculate minimum VTA area based on the nitrogen load and nutrient uptake by vegetation:

$$Minimum\ VTA\ Area = 49.6\ lbs\ N\ x\ \frac{acre}{172\ lbs\ N} = 0.29\ acre \ldots 0.29\ acre\ x\ \frac{43{,}560\ ft^2}{acre} = 12{,}561\ ft^2$$

C24: This divides the nutrient loading from one, 2.59" rainfall by the annual plant uptake. This does not represent an annual nutrient balance and is incorrect. If the annual loading of 209.3 lbs N is divided by the plant uptake the required VTA area would be 1.22 acres, not 0.29 acres.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Therefore, if the VTA design width is 40 feet, the VTA length would need be approximately 314 feet to satisfy the nitrogen balance.

C25: To provide a nitrogen balance on an annual basis the VTA would have to be 1329 ft long.

With only one release point to the VTA, annual runoff will not be evenly distributed across the entire length of the VTA. If most of the VTA will not receive very much, if at all, nutrients from feedlot source area, the extra length is unlikely to provide additional effective area for nutrient uptake.

The VTA design needs to distribute nutrients across the VTA to improve nutrient uptake.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

C26: Suggest adding "…during the growing season." A VTA cannot maintain a Nutrient Balance during non-growing season (soil temps fall below 50 degrees; plants growth slows or stops; snow/ice coverage). Some nutrient loss below the VTA root zone will occur when plants are in-active.

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

C27: Impaired watersheds or aquifers do not have assimilative capacity for pollutants and require increased protection measures to minimize nutrient and pathogen loading and restore water quality/meet WQ standards. Recommend using DNR Surface Water data or Water Condition viewers to identify what HUC 12's have surface water nutrient impairments and those that do not.

With respect to HUC 12s with GW impairments, recommend using DNR's Nitrogen Restriction Area Map Viewer and/or recent county GW monitoring efforts -

https://shiny.theopenwaterlog.com/nitrate_trends/. DNRs N Restriction Area Map viewer allows users to view Nitrogen Restricted Areas, which show the portion of the proposed targeted area that is based on groundwater data. This information can be compared to HUC 12 watershed boundaries - to determine areas with GW impairments

Suggest adding:

"If VTA is constructed within a HUC 12 watershed with documented surface or groundwater impairments from nutrients or bacteria, provide more than one vegetated treatment area to allow for resting, harvesting vegetation, and maintenance, and minimize the potential for nutrient overloading."

***RESPONSE**: "Additional Criteria for Nutrient Balance" section will be removed.*

Additional Criteria for Pressure Dosing Systems

Distribute the effluent over the VTA through sprinkler irrigation or other pressure dosing system. Match the application rate of sprinkler nozzles to the peak consumptive use of the vegetation, most restrictive soil infiltration rate, or other factors to prevent effluent from discharging from the VTA.

CONSIDERATIONS

For the timeframe of January 1994 through July 2023 at eight weather stations across Wisconsin, 90 percent of the total rainfall volume occurred during rainfall events with depths less than or equal to 1.95 inches on average per data acquired from the Wisconsin State Climatology Office. For comparison, the 1-year frequency, 24-hour duration, MSE3/MSE4 precipitation depths range from 2.00 to 2.69 inches for Wisconsin counties with an average of 2.36 inches.

C74: This is interesting information that seems to support the choice of going with the 1-year, 24-hour storm event, but not sure it is a consideration as worded? Is there something to be considered in the design of the practice with this?

***RESPONSE**: Noted. This information was considered worth sharing, and the "Considerations" section was the best fit.*

Additional nutrient and infiltration design guidance in Vegetated Treatment Systems for Open Lot Runoff, (Koelsch, et. al., 2006).

When near sensitive areas such as impaired watersheds (nutrients and pathogens concerns) or close proximity to housing developments (odor concerns), consider adding additional screening or additional bedding management and manure solids removal from livestock areas in conjunction with the VTA to reduce nutrient and pathogen loads being treated by the VTA and thereby further reducing the likelihood of odor or water quality concerns.

C30: Source control needs to be a VTA mgmt requirement, not a consideration. Such mgmt will ensure the purpose of the std is met.

***RESPONSE**: This language/location is from the national standard. Team will include more specific language in the O&M section.*

Provide more than one vegetated treatment area to allow for resting, harvesting vegetation, and maintenance, and to minimize the potential for overloading.

Use harvested vegetation as animal feed as appropriate.

Provide additional storage in the basin collection area to minimize or eliminate discharge into the VTA during rainfall events. Delay application until rainfall has ended to improve infiltration and nutrient uptake.

To maximize nutrient uptake, use warm and cool season species in separate areas to ensure that plants are actively growing during different times of the year.

C28: This should not be a consideration. It is a critical design feature to ensure VTA performance.

***RESPONSE**: This language/location is from the national standard. Language will be moved to "General Criteria" section.*

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

C31: This needs to be a VTA mgmt requirement, not a consideration. Such mgmt will improve VTA performance and ensure the purpose of the std is met.

***RESPONSE**: This language/location is from the national standard. Additional language will be added to the "O&M" section.*

Direct contaminated effluent to a waste storage facility 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 vegetative treatment effectiveness throughout the growing season. Time the harvest of the VTA plants so vegetation can regrow to a sufficient height to effectively filter effluent late in the growing season.

C29: This should not be a consideration. It is a critical design feature to ensure VTA performance.

***RESPONSE**: This language/location is from the national standard. Maintenance criteria is also included in the O&M section.*

Install a berm around the lower end of the VTA to contain excess runoff that may occur.

C32: What is excess runoff? The general criteria of the DRAFT standard requires installing a berm at downstream end of the VTA. Why is this a consideration? This is confusing and contradictory. Recommend removal from considerations.

***RESPONSE**: This language/location is from the national standard and will be proposed for removal due to the 12-inch tall, earthen end berm requirement.*

C75: I assume this is an additional berm to the required 12" high end berm and side berms? If so, consider differentiating or rewording it so there is no confusion about whether the border berms are required.

***RESPONSE**: Correct. See response to Comment C32.*

Effluent from the VTA may be stored for land application, recycled through the wastewater management system, or otherwise used in the agricultural operation.

Install fences or other measures to exclude or minimize access of the VTA to humans or animals.

Install a pumping system at the bottom of the VTA to either recirculate the effluent to the top of the VTA or transfer to a waste storage facility.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use.

As a minimum include:

- Critical construction parameters, necessary construction sequence, vegetation establishment requirements, level spreader mechanism requirements, associated practices and agronomic nutrient removal.
- Plan view showing the location of the VTA.
- 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, seed selection, and seeding rates to accomplish the planned purpose.
- Planting dates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival.
- Site preparation sufficient to establish and grow selected species.

OPERATION AND MAINTENANCE

C53: I also attached, what I would call is our poster child of a VTA that was installed back in 1993. I credit the farmer who continues to meticulously maintain this Filter Strip. The unfortunate part is that for every one good one, there are ten or more failures; I understand our challenge is "how do we ensure more look like this" and that I do not have the answer. But in comparing the photo's I would say it starts with a clean or frequently scrapped lot. [See PDF series of aerial photos.]

***RESPONSE**: Agreed, the team discussed and will add more detailed O&M language.*

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

Include the following items as appropriate:

C33: This language is confusing; makes the O and M items appear to be optional/discretionary, not requirements. Recommend removal [of "as appropriate"].

***RESPONSE**: Noted, language is from national standard and will be revised.*

- Control undesired weed species, especially state-listed noxious weeds, and other pests that could inhibit proper functioning of the VTA.
- Inspect and repair the VTA after storm events and during spring and early summer months to address gullies, excess materials or disturbed/waterkill areas. Regrade or reseed disturbed areas and remove excess/accumulated solids to prevent concentrated flow and maintain sheet flow across the VTA.
- 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 or removing excess material when deposition jeopardizes its function. Reestablish herbaceous vegetation.

C35: [Delete above bullet.]

***RESPONSE**: Noted, language is from national standard and will be proposed for removal.*

- Routinely detach or aerate the VTA from livestock holding areas in order to promote infiltration.

C76: Does this bullet not apply to feed storage areas and/or manure storage areas?

***RESPONSE**: Noted, language is from national standard and will be revised.*

- Conduct maintenance activities only when the surface layer of the VTA is dry enough to prohibit compaction.

C34: Source Control is critical to reduce nutrient and pathogen loading into the VTA and will help improve VTA performance. [Suggest adding bullets:]

- "On a weekly basis, remove manure, exposed feed or other materials within feedlot, feed storage, or manure stacking areas that discharge into the VTA to reduce nutrient source loading; land apply removed materials per approved nutrient management plan.
- Empty settling basin at least quarterly and land apply per approved nutrient management plan.
- Check and clean initial upstream flow spreader(s) after precipitation events to prevent clogging. Maintain as needed to provide even distribution of sheet flow into the VTA.
- Check and clean additional flow spreaders on a quarterly basis and rebuild as necessary to ensure sheet flow across the VTA.
- Maintain feed storage plastic cover. Minimize the amount of exposed feed on a daily basis. Repair tears and punctures in plastic cover on at least a monthly basis."

***RESPONSE**: Language will be adjusted in revised standard to include more specific O&M for paved areas.*

Monitor treatment areas in arid or semiarid regions that potentially could be affected by high salinity or sodium content for excessive salt and sodium buildup. Take corrective action if excessive salt or sodium is found.

Monitor all treatment areas to maintain optimal crop growth and environmental protection. Ensure that neither phosphorus is accumulating in the soil profile, nor nitrogen is leaching below the root zone.

Additional Requirements for Non-Growing Season Operation

C36: VTAs really shouldn't be used during this time period. Even if it's not resulting in discharges, it's going to damage vegetation for the growing season.

A statement like, "Even a properly designed and maintained VTA may be insufficient to prevent significant discharges of pollutants to waters of the state during the non-growing season."

***RESPONSE**: Noted.*

Remove accumulated snow, manure, and spilled feed from contributing areas to the VTA weekly and before anticipated precipitation events. Stack materials or land apply per approved nutrient management plan.

Empty settling basin at least annually with land application per approved nutrient management plan.

C38: I don't think annual is enough, but there's probably quite a bit a variability between system needs. Suggest "….quarterly or when solids have filed 50% of the basin's storage volume."

***RESPONSE**: Noted, language will be revised.*

C37: Suggest adding: "Minimize or prevent animal use of contributing VTA areas to reduce nutrient and pathogen loads the VTA during the non-growing season."

***RESPONSE**: Noted, language will be revised.*

REFERENCES

USDA/NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook.

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

Koelsch, R., J. C. Lorimor, and K. R. Mankin. 2006. Vegetative Treatment Systems for Management of Open Lot Runoff: Review of Literature. Applied Engineering in Agriculture, Volume 22, pages 141-153.

Federal Emergency Management Agency, National Flood Hazard Layer. https://www.fema.gov/flood-maps/national-flood-hazard-layer

USDA/NRCS Website, WinSRFR 5.1.1 in Tech Tools. https://www.nrcs.usda.gov/resources?title=&resource_type=1970

USDA/NRCS, National Engineering Handbook, Part 623, Chapter 4 – Surface Irrigation (September 2012), https://directives.sc.egov.usda.gov/

USDA/NRCS, National Engineering Handbook, Part 630, Chapter 10 – Estimation of Direct Runoff from Storm Rainfall (July 2004), https://directives.sc.egov.usda.gov/

USDA/NRCS, National Engineering Handbook, Part 652, Chapter 2 – Soils (September 1997), https://directives.sc.egov.usda.gov/