

Non-Basin Technologies for Open Feedlot Runoff: Demonstration, Implementation and Modeling

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Summary and Implications

Rules released by EPA in 2003 require beef feedlots defined as Concentrated Animal Feeding Operations (CAFO) to control rainfall runoff from their feedlots. The rules included verbiage that allowed for the design and use of “Alternative Technologies” and require that any “Alternative Technology” be modeled to show they are at the least as effective as traditional storage systems. Currently, in Iowa, many feedlots do not have waste handling systems capable of sufficiently controlling discharges. The traditional system being accepted for permit in Iowa is an ELG storage basin. The two technologies in this study are Vegetated Treatment Areas (VTAs) and Vegetated Infiltration Basins (VIBs) followed by a VTA.

Introduction

A VTA consists of an area that is level in one dimension and has a slight slope (less than 5%) in the other;



it is planted and managed to maintain relatively dense vegetation. Operation of the system involves discharging settled feedlot effluent evenly across the top width of the strip and allowing the effluent to slowly flow down slope through the buffer. Pollutant removal may occur by several methods, including filtration as the runoff flows through the vegetation, attachment of pollutants to roots and soil as runoff waters infiltrate, and plant uptake of nutrients. Vegetation is maintained and harvested from the VTA.

The VIB-VTA system will involve discharge of settled feedlot effluent into relatively flat areas that have been bermed to prevent outflow of effluent and planted to permanent vegetation. Pollutant/nutrient removal from these systems would occur through filtration of runoff waters through the soil, plant uptake of nutrients, and pollutant degradation. Drainage tile lines ~ 4 ft below the soil surface will allow movement through the treatment system. This is meant to encourage movement through the soil profile and not meant to reduce treatment process. Determining soil suitability is essential. The filtered discharge from the infiltration basin is delivered to a secondary VTA for further treatment. Vegetation is maintained and harvested from both the VIB and the secondary VTA.

The objectives of this project are to evaluate, through field monitoring, performance of VIBs & VTAs on 5 sites in Iowa that were designed using the developed model, to assess the feasibility of VIBs and VTAs as alternative systems, and to assess the feasibility of model for design of future systems

Materials and Methods

Each of the five sites in Iowa will be monitored for a two year period following establishment of vegetation and will be equipped with automated sampling and monitoring equipment. Discharge sampling will occur on an event basis and will include flow measurement for calculation of pollutant mass. Monthly surface water and ground water samples will also be collected. Monitoring on each site will include collection of background and operational data, and will include upgrade and downgrade ground water monitoring, upstream and downstream surface water monitoring (when appropriate), treatment area soil sampling, and pollutant concentration and flow through the system.

The samples will be sent to a commercial laboratory to be tested for $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$, P_{total} , ortho P, COD, BOD_5 , fecal coliform, and chloride.

Vegetated Treatment Area (VTA) System Sampling

For each of the three VTA sites, two sampling points will be located within the treatment system. The points will be used to monitor flow volumes and collect samples for analyses. The points will allow monitoring of 1) feedlot runoff leaving the settling basin (entering the VTA) and 2) effluent leaving the VTA.

Vegetated Infiltration Basin – Vegetated Treatment Area (VIB-VTA) System Sampling

For each of the two VIB-VTA sites, three sampling points will be located within the treatment system. The points will be used to monitor flow volumes and collect samples for analyses. The points will allow monitoring of 1) feedlot runoff leaving the settling basin (feedlot runoff

entering the VIB), 2) effluent leaving the VIB via the tile lines (effluent entering the VTA), and 3) effluent leaving the VTA.

Results and Discussion

This specific project is still in progress, there are no final results at this time.

Table 1. Number of sampling points per research location.

Site Name	Groundwater	Surface water	Tile flow to Surface water	Soil Samples	Settling Basin Discharge	VIB Discharge	VTA Discharge
Site A VIB-VTA	5	0	1	1-2 per 2 acres	1	1	1
Site B VTA	4	3	2	1-2 per 2 acres	1	0	1
Site C VTA	4	3	0	1-2 per 2 acres	1	0	1
Site D VIB-VTA	5	0	0	1-2 per 2 acres	1	1	1
Site E VTA	4	3	0	1-2 per 2 acres	1	0	1

Figure 1. Example of site A, a VIB-VTA system being constructed. The design schematic overlaid with boxes highlighting and identifying pen, treatment, and sampling locations.

