Demonstration of Real-Time Monitoring Systems to Increase the Intensity of Lagoon Management and to Reduce Water Pollution From Overflows and Illegal Discharges.

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Project Needs, Description and Expected Outcomes

Overtopping of lagoons that store and treat animal manure and wastewater is thought to contribute to water quality impairment in the Upper North Bosque River Watershed. The Bosque River watershed houses nearly 165 dairies with 41,000 cows. The Texas Commission on Environmental Quality (TCEQ) records document instances of lagoon overtopping and illegal discharges from the permitted dairy operations in the watershed. Segments 1226 and 1255, North Bosque River and Upper North Bosque River, respectively, are on the State of Texas Clean Water Act Section 303(d) list for bacteria, elevated levels of chlorophyll a, and excessive nutrients. A TMDL project for nutrients is underway for both segments. The TCEQ has recently mandated large reductions in manure loadings within the Bosque River watershed.

For the prevention of discharges from properly maintained structures on concentrated animal feeding operations (CAFOs), the current TCEQ design standards include lagoon to contain rainfall and rainfall runoff from a 25-year, 24-hour event. The design also includes an estimated storage volume for a minimum one year of sludge accumulation. In addition, the design of these facilities includes a top freeboard of no less than two feet to protect the structure from wave action, erosion and overtopping. Despite inclusion of these design parameters to prevent pollution from these structures, overflows and illegal discharges have occurred from CAFOs in the state of Texas. Our central hypothesis is that illegal discharges and overflows from lagoons result from poor management and improper design and are not necessarily the result of any inadequacies in the current design standards. Like any hypothesis, however, it needs to be validated with experimental data that documents the changes in liquid level of lagoons and holding ponds in response to direct precipitation, runoff from open lots, evaporation and dewatering (i. e., irrigation) activities.

The problem of overflows and illegal discharges may stem from owner's/operator's lack of knowledge about the nature and amount of runoff resulting from catastrophic or chronic rainfall (series of rainfall events hindering the opportunity to dewater structures; may be equivalent to or greater than the 25-year, 24-hour rainfall event), and antecedent moisture conditions of the surfaces contributing runoff to the runoff control structure (RCS). For example, during chronic rains, reduced soil water infiltration or depression storage due to high antecedent moisture content of the surfaces may contribute much larger volumes of runoff to the structures as compared to a single design storm event (25-yr, 24-hr) on dry surfaces with higher infiltration and depression storage. This unexpected volume may cause the structure to fill to capacity resulting in overtopping even if the design storm was not exceeded.

A real time monitoring system that alerts operators to the critical levels of liquid and sludge in a lagoon is needed. At these critical levels, the structure must be dewatered and/or sludge must be removed to avoid overflows and illegal discharges. In addition, a warning

system that relies on the real time critical liquid and sludge levels and weather data that predict rainfalls in the immediate vicinity of a CAFO can be developed for individual CAFOs to manage lagoons. We propose to install two automatic monitoring and alarm systems at a dairy in the Bosque river watershed to collect real-time data on the elevation of the free water surface and the rate of accumulation of sludge.

The goal of this project is to demonstrate the viability of a network of a real-time monitoring and alarm system to alert the CAFO operator to imminent (a) encroachment on design runoff volumes in lagoon and (b) overtopping of lagoon. Specific water-quality objectives of this on-farm demonstration project are:

1. Reduce the probability of illegal discharges by providing facility managers with real-time notice of critical water levels in anaerobic lagoons, levels requiring management attention to prevent overtopping or emergency-spillway use.
2. Assess the sufficiency of the current catastrophic-event pond-design standard (i. e., the 25-year, 24-hour storm) to prevent discharges from a properly maintained and operated RCS.

Work Plan:

1. Purchase real-time sludge and liquid level monitoring equipment by June 15, 2003
2. Install the equipment at a cooperator's lagoon by July 15, 2003
3. Monitor and gather sludge and lagoon liquid level data continuously
4. Report the system performance and interim data results by October 31, 2003
5. Continue monitoring and summarizing data beyond project termination
6. Leverage demonstration results with grants supporting broader implementation of the real-time monitoring system in the Upper North Bosque River and Leon River watersheds

Expected Outcomes:

The measure of success of the project will be the reduction in illegal discharges and lagoon overtopping at the demonstration site as a result of the warning system, a BMP that aids in proper management of lagoons. The information gathered from the demonstration of this real time monitoring system will allow us to seek additional funding through grants from federal and state agencies so similar demonstration can be carried out at several dairy operations in this and other watersheds. In the long-run, the BMP will be ready for adoption by all permitted facilities in the Dairy Outreach Program Area that includes the Bosque and Leon River watersheds. Reduction of illegal discharges of waste effluent reduces delivery of nutrients (nitrogen and phosphorus etc.) and bacteria to the 305(b) segments of concern, which is consistent with the goals of the Bosque River TMDL.