

# LAGOON AND HOLDING POND HYDRAULICS AND MAINTENANCE

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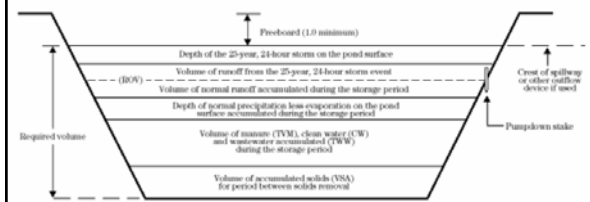
## TCEQ Rules Update (July 15, 2004)

- ✓ Revised to be consistent with new EPA rule
- ✓ Retains the 25-year, 24-hour design storm for dairies and feedlots
- ✓ Adopts the 100-year, 24-hour design storm for poultry, swine and veal CAFOs

## TCEQ Rules Update (July 15, 2004)

- ✓ New Voluntary Alternative Performance Standards (VAPS) provision
- ✓ Additional requirements for dairies in Major Sole-Source Impairment Zone - 30 TAC §321.42

Figure 1 Cross section of waste storage pond with watershed.



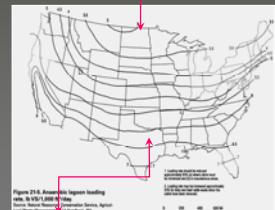
## Treatment Volume

- Lagoons perform dual functions of storing and treating manure
- Minimum permanent treatment volume required for dilution and bacterial digestion of manure solids
- Bacteria activity increases with temperature
- Treatment volume based on volatile solids (VS) loading rate (lb VS/1,000 ft<sup>3</sup>/day)

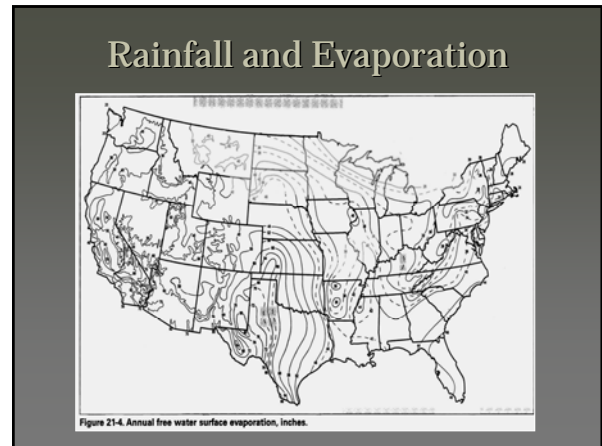
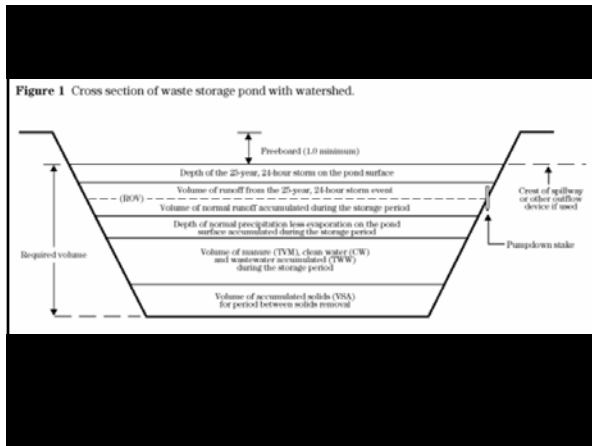
## Minimum Treatment Volume

- ◆ Treatment volume designed for a certain VS loading rate
- ◆ VS loading rate is selected according to climate

3.5 lb VS/day-1,000 ft<sup>3</sup> in central South Dakota



6-7 lb VS/day-1,000 ft<sup>3</sup> in East Texas



## 25 - Year, 24 - Hour Storm

- Depth of 25-yr, 24-hr storm is based on long-term rainfall data at a given location

**Figure 21-6.** 25-yr 24-hr rainfall, inches.

## TCEQ's "Chronic or Catastrophic Rainfall" Definition

30 TAC §321.32 (10)

A series of rainfall events that:

- Does not provide opportunity for dewatering a retention control structure; *and*
- Is equivalent to or greater than
  - the design rainfall event; or
  - any single rainfall event that is equivalent to or greater than the design rainfall event (e. g., a 36-hour storm whose cumulative rainfall depth exceeds the nominal depth of the 25-yr/24-hr event)

## "Water Balance" Requirement

- Average monthly precipitation (direct + runoff)
- Monthly consumptive use of the cropping system
- Wastewater irrigation shall not induce uncontrolled discharge
- 21-day storage of waste and process-generated wastewater

## "Imminent Overflow" Provision

30 TAC §321.39

If an RCS is in danger of imminent overflow from chronic or catastrophic rainfall or catastrophic conditions, then the CAFO operator shall take reasonable steps to irrigate wastewater to land management units (LMUs) only to the extent necessary to prevent overflow from the RCS

## “Imminent Discharge” Contingency Plan

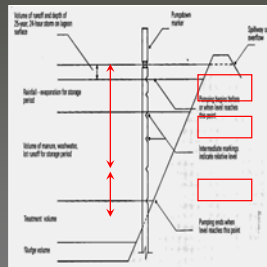
- ◆ Phone report to TCEQ regional office w/in 24h of preventive pumping
- ◆ Written report w/in 14 days
- ◆ Who will decide, and who will execute?
- ◆ Where/what fields?
- ◆ Does pumping capacity exist?

## Stage/Level Markers

- Management indicators so that fill rate can be observed and pumping can be started at the correct time
- Shows critical liquid elevations in storage facilities
- Possible to automate this for <\$3k

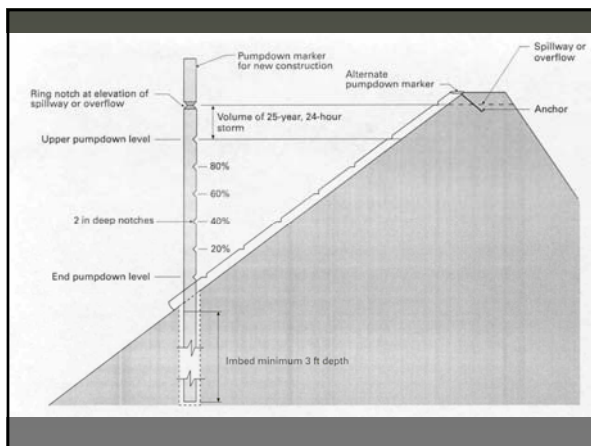
## Pumpdown Marker – Lagoon

- 25-yr, 24-hr storm runoff and surface accumulation
- Regular pumpdown volume includes manure, washwater, open-lot runoff and R-E



## Pumpdown Frequency

- The design storage period is realized only when conditions are similar to assumptions used in design
- What can change the pumpdown frequency?
  - Rainfall, runoff or evaporation different than design assumption
  - Animal numbers different than planned or assumed
  - Lot areas or size different than planned or assumed

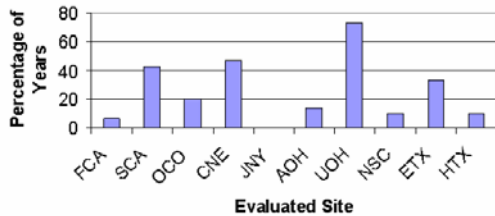


## Additional requirements for dairies in Major Sole-Source Impairment Zone 30 TAC §321.42

- ◆ Primary motivation: prevent RCS overtopping
- ◆ Hydrologic needs analysis (water balance)
  - Adds a chronic (10-day) rainfall design basis;
  - *OR*
  - Requires modeling certification of a 25-year *discharge* “return interval”
- ◆ Requires an RCS management plan

## Modeling by Moffitt et al. (2003)

Figure 2 Frequency of pumping during critical storage period to maintain storm volume - AWM Design



## Conclusions by Moffitt et al. (2003)

- Occasionally pond levels will need to be lowered in less than ideal conditions
- Dairy operators need both:
  - A *strategic* nutrient management plan AND
  - *Tactical* management options and procedures for wastewater application during what would normally be non-application periods

## Conclusions by Moffitt et al. (2003)

- Pond management is *critical*
  - Where the ponds are pumped down at the end of the critical storage period and kept lowered, there was little danger of overflow from design storms or chronic events
  - Where chronic rainfall events are more common, a combination of increased dewatering capability and lower maximum temporary storage level would prevent spills