Water Quality Impacts of Bunker Silos

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Area Soil and Soil & Water Meetings

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Overview

- Water quality concerns.
- Bunker runoff sources.
- Runoff management and disposal.

Overview

- **Who will be impacted ?**
- **Design help and additional information.**

Silage Leachate Runoff

Silage Leachate Characteristics

Waste Type	BOD_5 (mg/L)	P (mg/L)	N (mg/L)
Silage leachate	12,000 – 90,000	100 - 850	2,000 – 4,400
Milking center	400 – 10,000	25 - 170	80 – 900
Barnyard runoff	1,000 – 10,000	5 - 500	50 – 2,100
Manure Slurry	~20,000	25 - 900	450 – 5,600
Domestic Sewage	150 - 250	5 - 10	20 – 30

Water Quality Concerns

BOD - O_2 depletion, fish kills

NH_3 – (low flow effluent ~ 280 mg/l), kills fish

- supports “sewage fungi”
- converts to NO_3

pH ~ 4 - corrodes pipes & concrete

Bad odor !

Discharge may occur during low stream flow & warm conditions

Bunker Runoff Sources

- Leaching from silage.
- Percolation through silage.
- Runoff from rainfall on plastic covering and bunker floor.

Leachate = Effluent = Silage Juice = Silage Liquor = Seepage:

Liquid expressed from forage when placed under pressure.

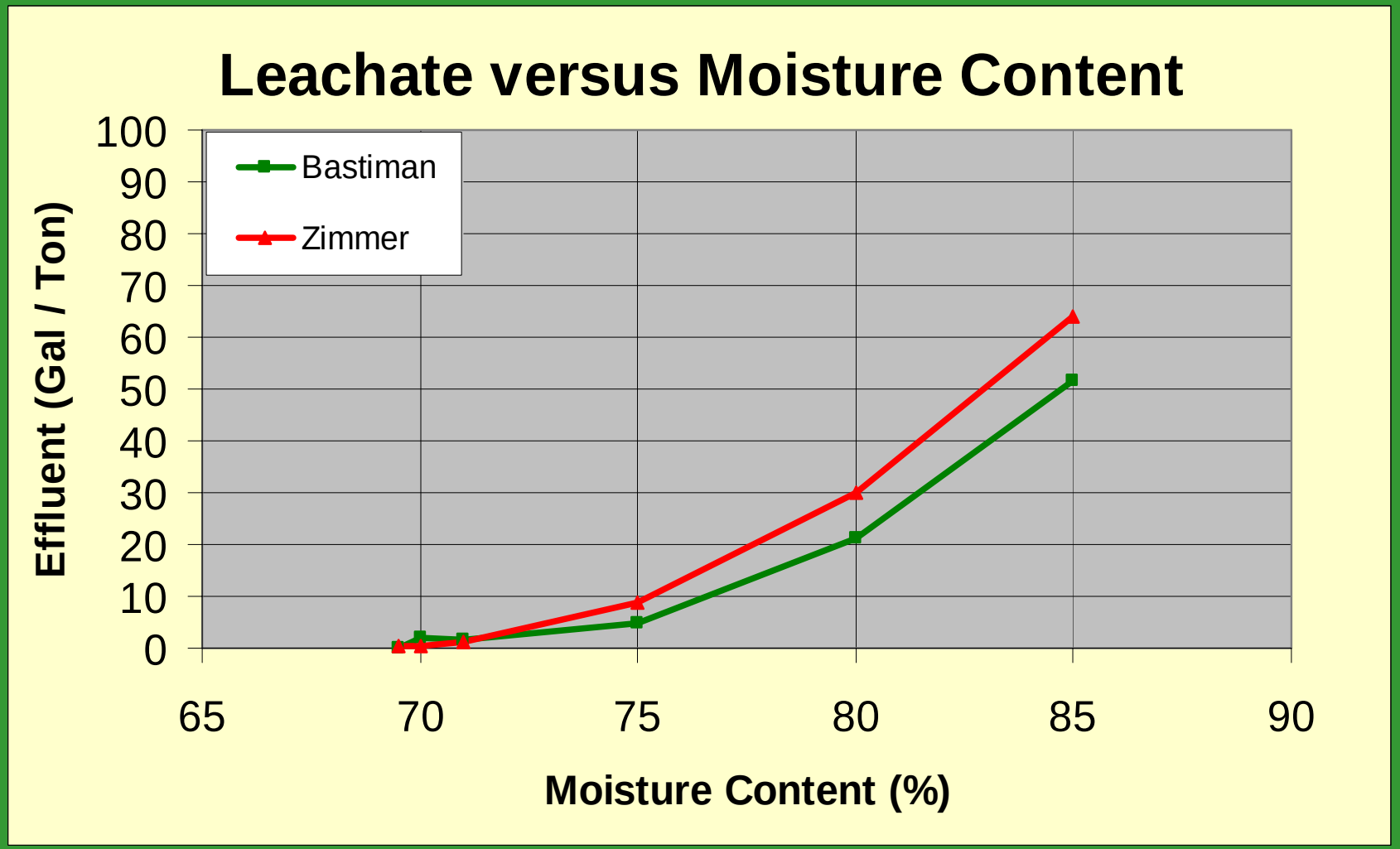
Cell contents and fermentation byproducts (sugars, protein, minerals, acids, ammonia and water).

Leachate Management

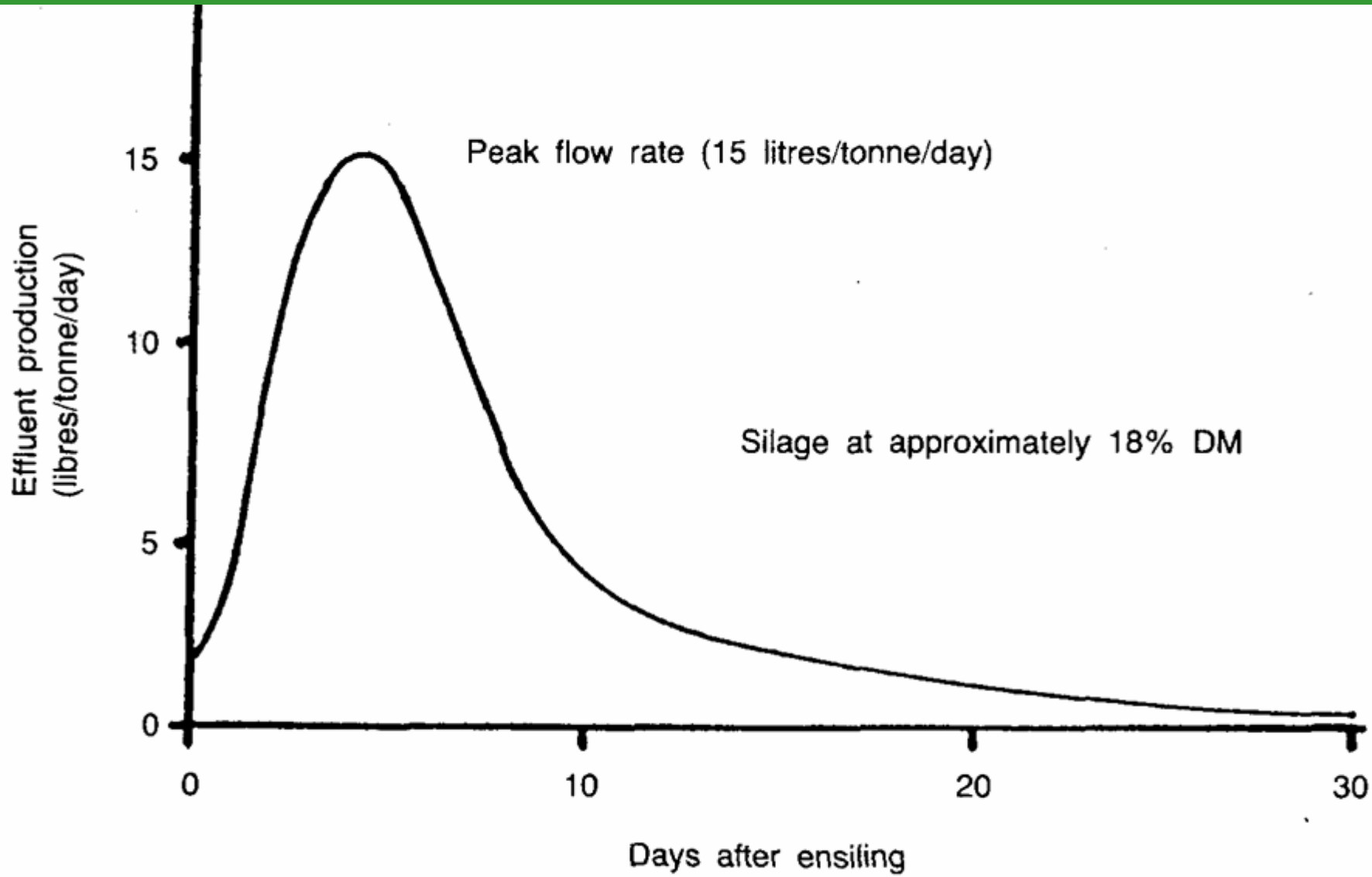
Harvest at Correct Moisture

65 - 70% Corn Silage

60 - 65% Hay Silage


Leachate versus Moisture Content
Effluent (Gal / Ton)
100
90
80
70
60
50
40
30
20
10
0
Bastiman
Zimmer
65
70
75
80
85
90
Moisture Content (%)

Effluent Production vs. Days After Ensiling



Mason 1988 Referencing Bastiman 1976

Percolation:

Precipitation falling on the silage, infiltrating and moving through the silage and exiting the silo.

Cell contents and fermentation byproducts (sugars, protein, minerals, acids, ammonia and water) transported by flow.

Runoff:

Precipitation falling on the plastic cover and silo floor and leaving the silo.

Water from plastic cover is relatively clean.

Water from floor may contain cell contents and fermentation byproducts (sugars, protein, minerals, acids, ammonia and water) as well as feed particles and soil transported by flow.

Management and Disposal Options

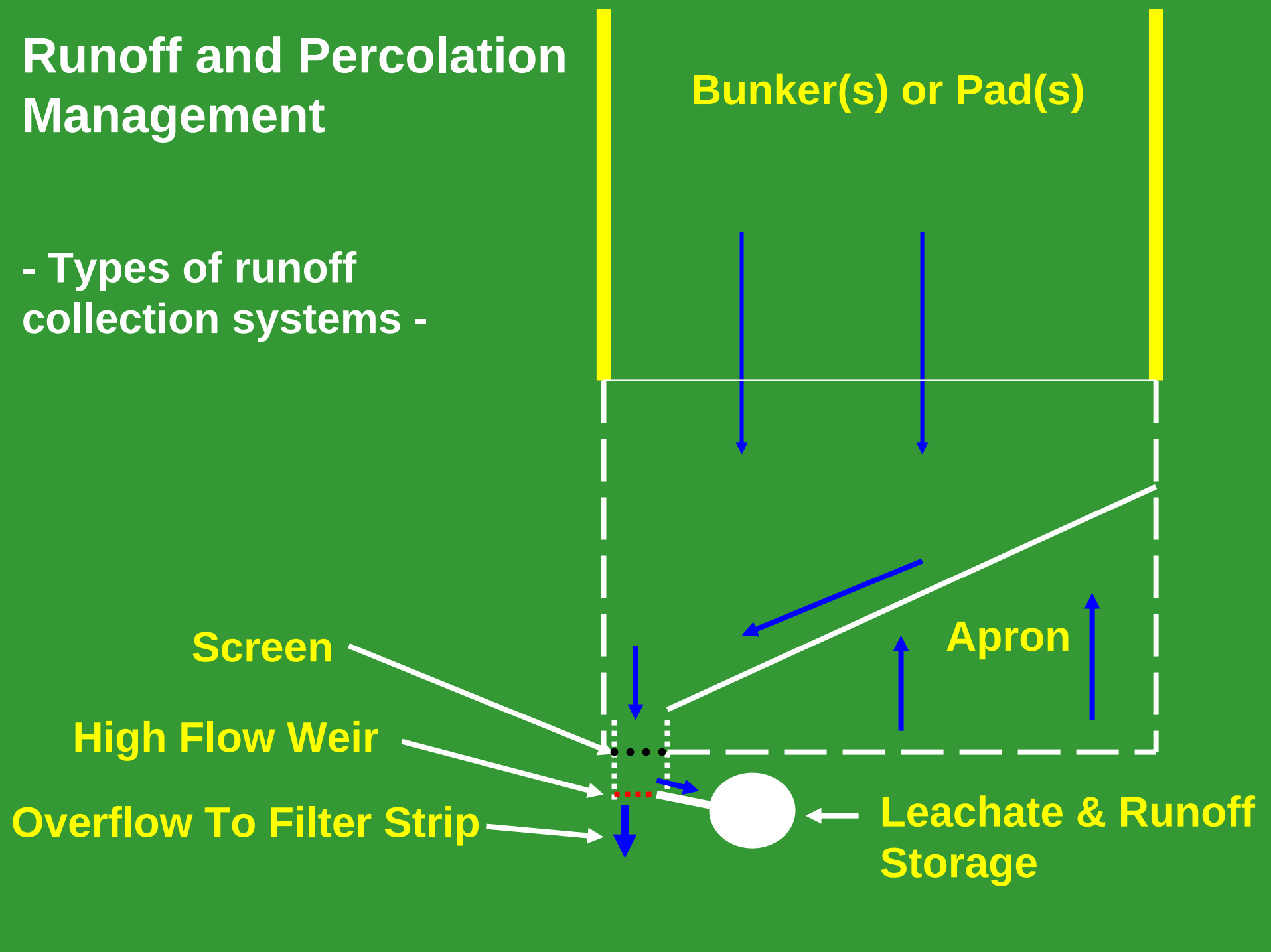
1. Leaching from and percolation through silage.

2. Runoff from rainfall on plastic covering and bunker floor.

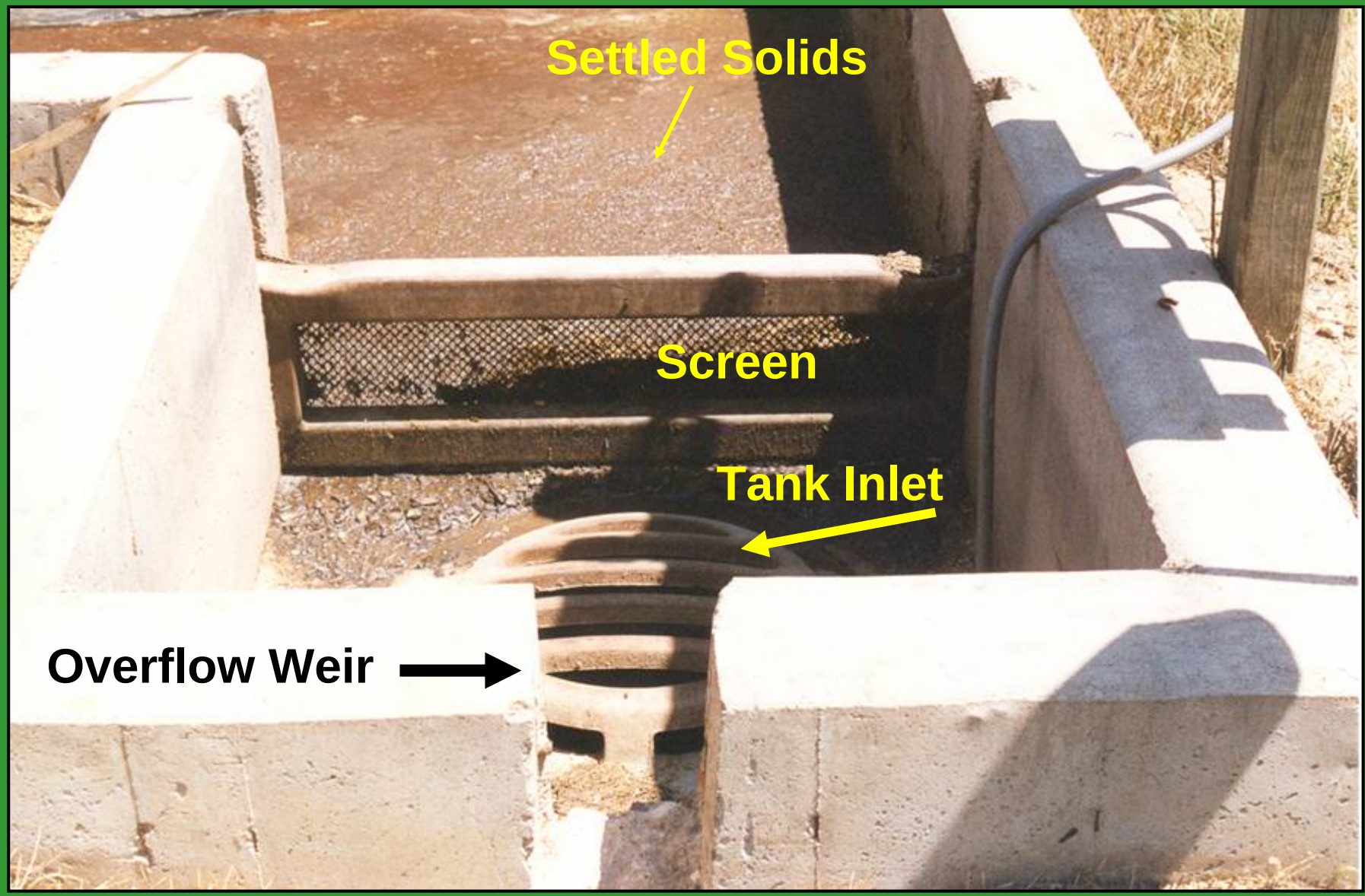
3. Flow through floor cracks.

Runoff and Percolation Management

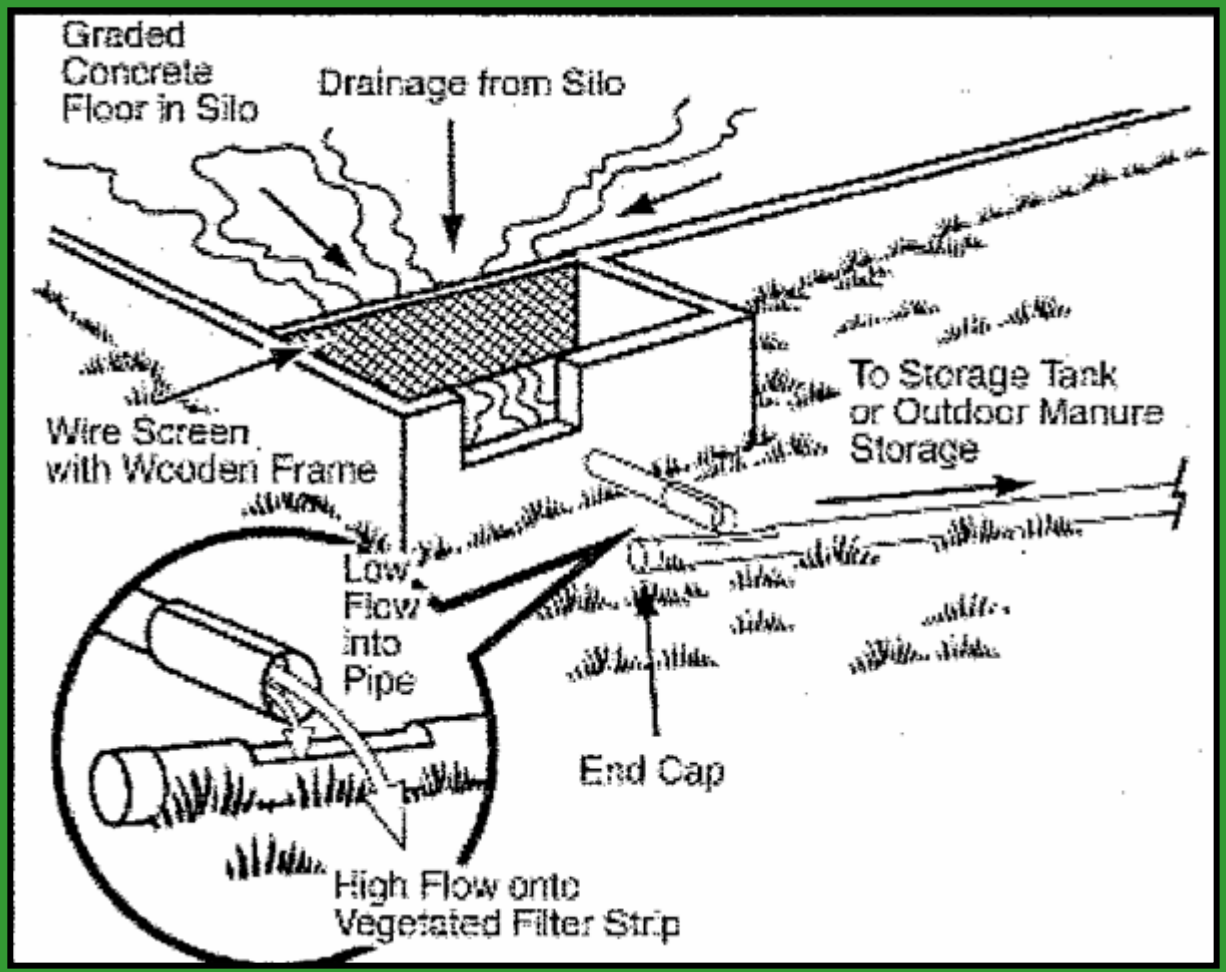
- Types of runoff collection systems -



On-line Collection System

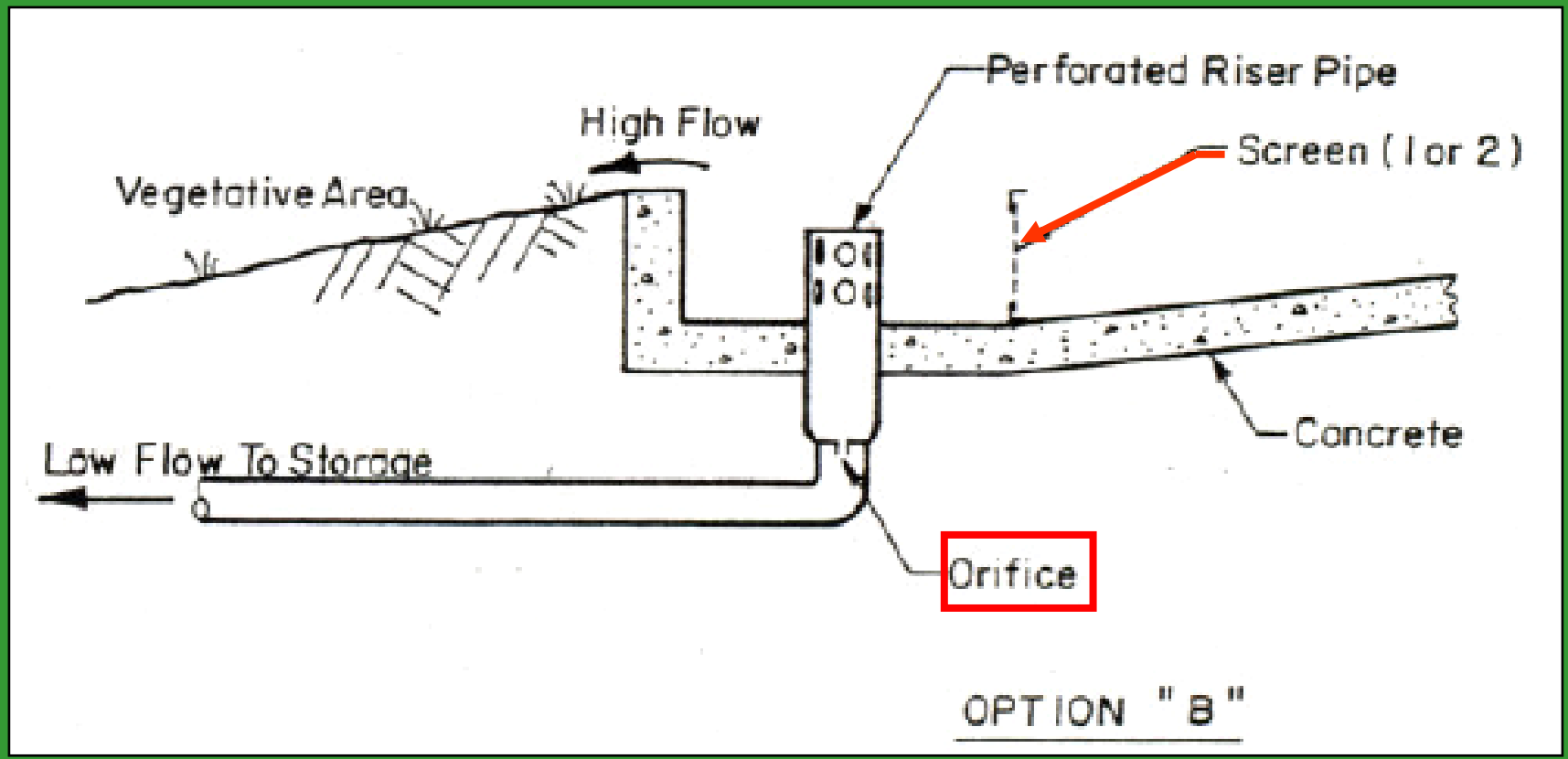


Off-line (low flow) Collection System



Clarke & Stone, 1995 (OMAF)

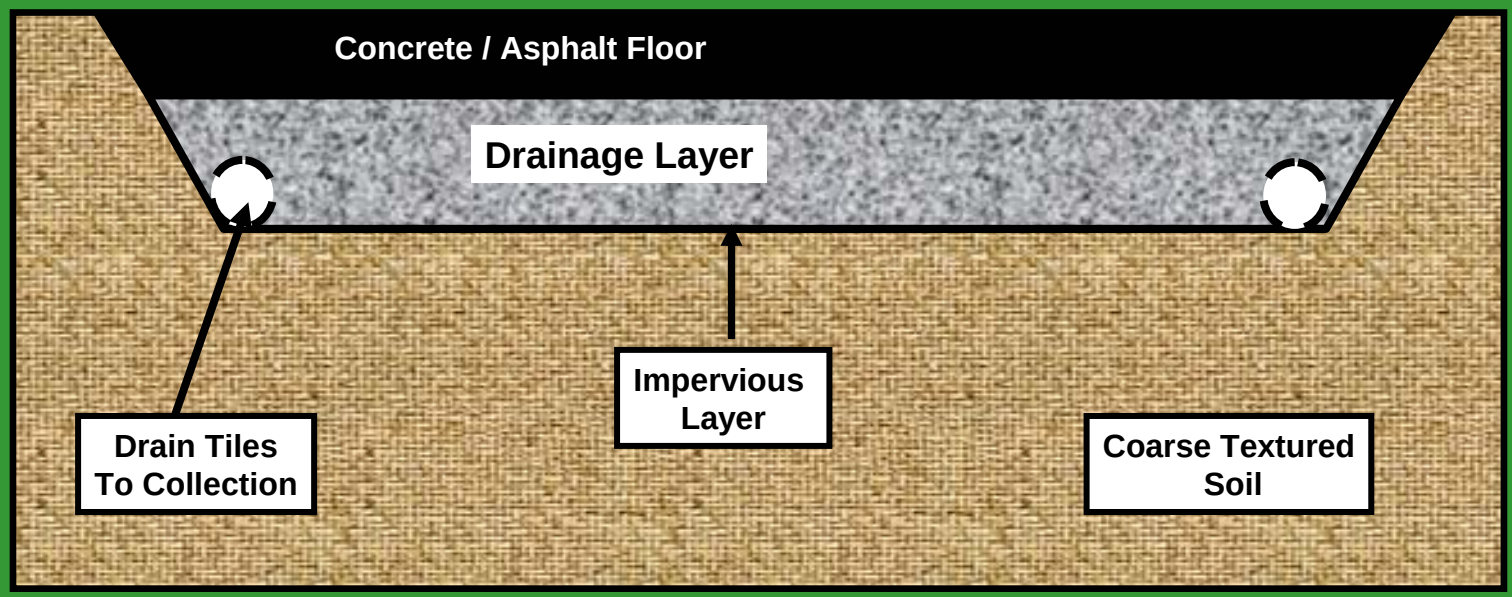
Off-line (low flow) Collection System



Graves & Vanderstappen, 1993

Seepage Through the Bunker Floor

Pad or Bunker Silo Floor with Subsurface Leachate Collection



Leachate Disposal

- Capture and field apply at a low rate.
- Dilute 1:1 with fresh water when applying to growing crops to avoid burn-out.
- Pump to manure pit and land spread.
- Due to the potential release of poisonous gas, leachate should NOT be placed in in-barn storages.

Divert Clean Water

Roof over silage
Plastic cover sealed at edges
Surface flow diversions
Tile away groundwater

Cover Silage Storage Areas

Roof Over Bunker Silos

Who will be impacted ?

- Operations with WPDES permits (> 1000 animal units), subject to WDNR review.
- Operations expanding beyond 500 animal units may have to comply with ATCP 51.20(3) - (Siting Law Rules).
- Producers storing > 150 tons of sweet corn silage as required by NR 213. Rule is intended for canning factory waste.

Design Help and Additional Information

- **County Land Conservation Offices.**
- **Consulting engineers familiar with facilities design.**
- **NRCS field offices – a design standard is currently under development.**

Questions ???