Nutrient and Sediment Loses from Wisconsin Agricultural Practices

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How Much and When Does Surface-Water Runoff Occur?

- Development of risk assessments during potential surface-water & tile runoff periods
- Determination of when alternative management decisions should be utilized/maintained
- Knowledge of when to expect to see surface-water/tile losses

Kewaunee County

- Soil Type: Hortonville Silt Loam
- Silt loam surface followed by a silty clay loam subsurface
- 3.5 to 2.8% organic matter
- 4% Slope

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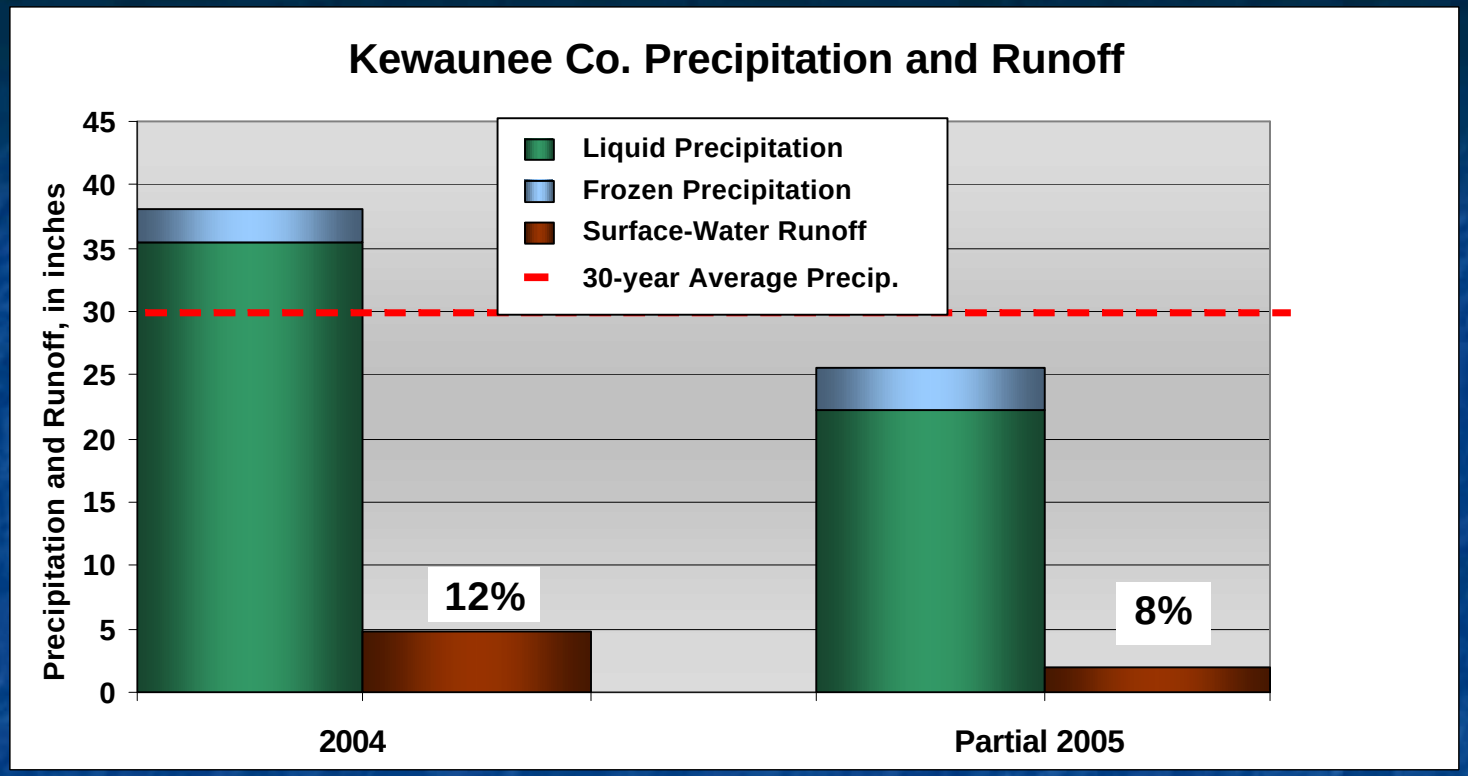
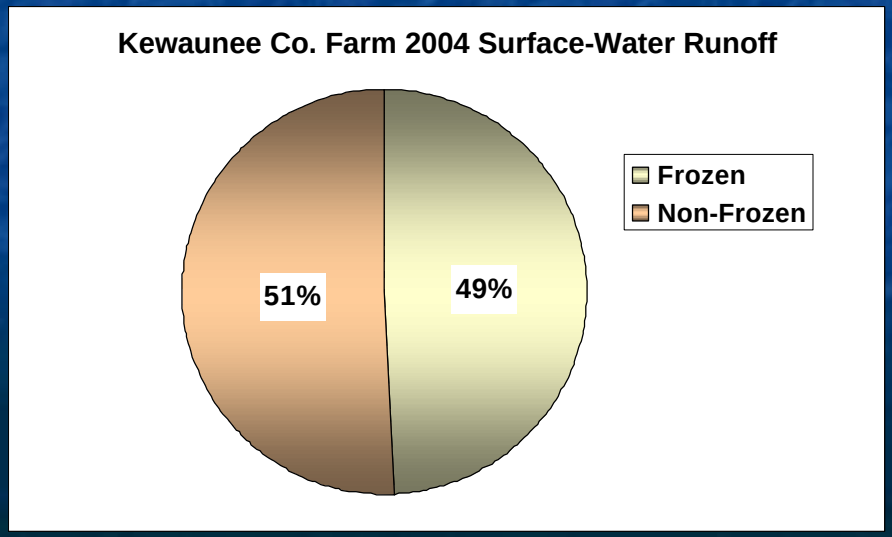
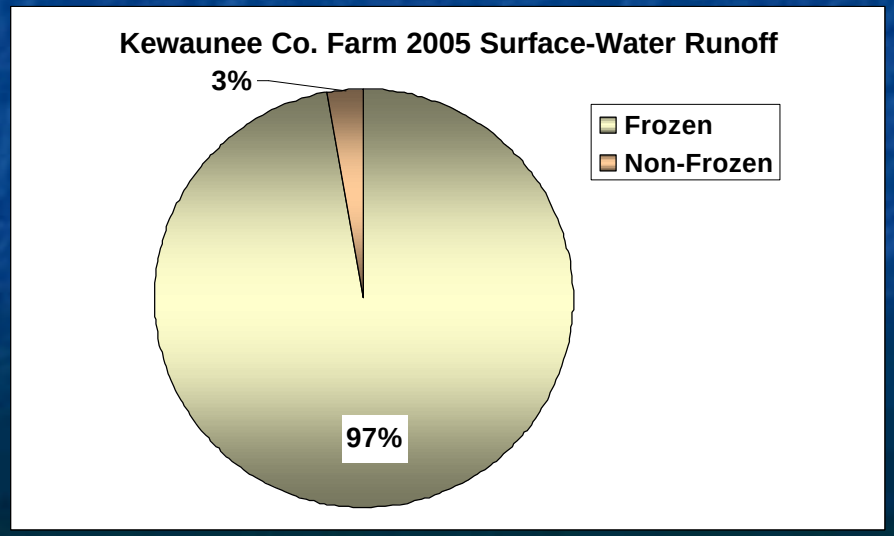
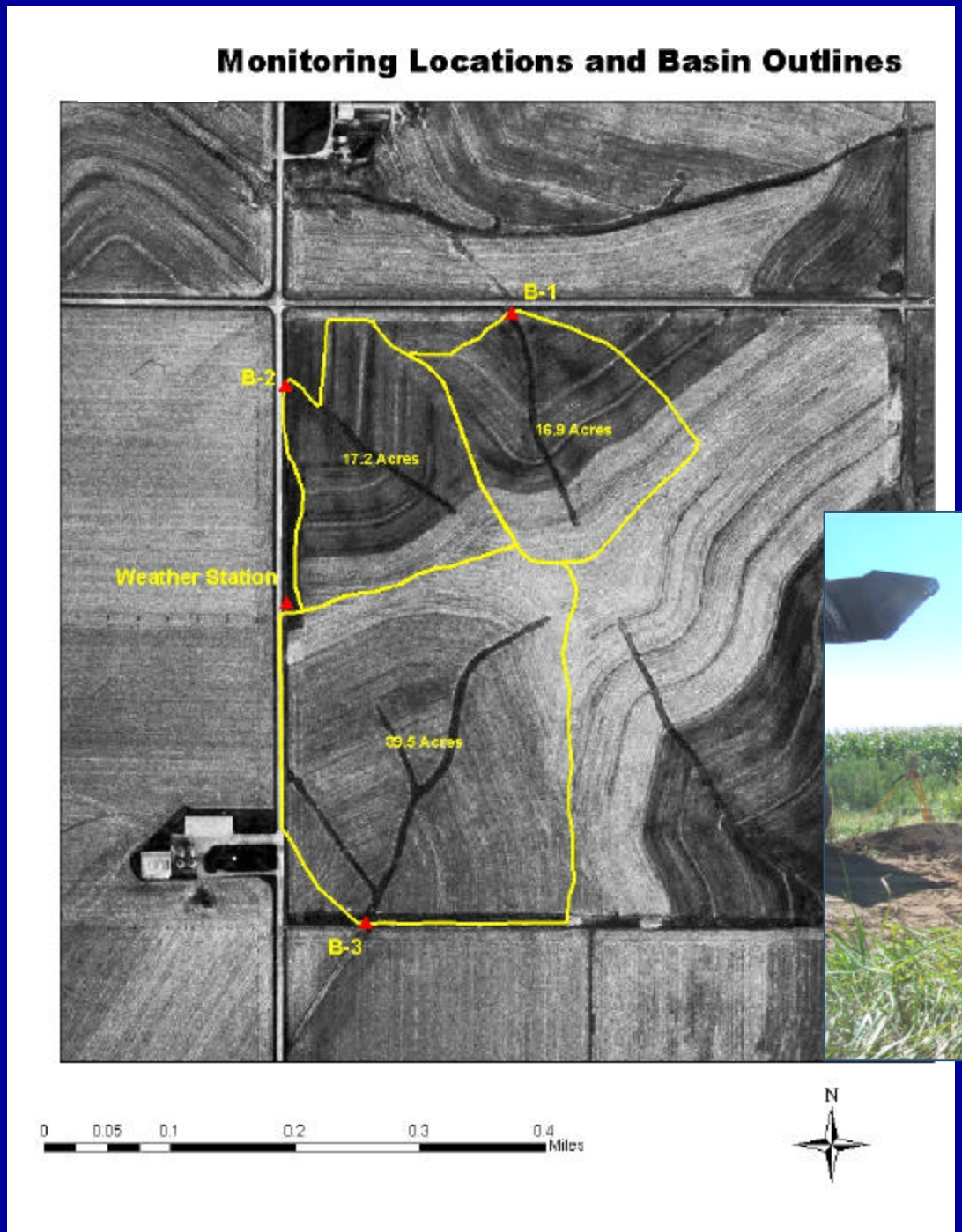
- Sites completed November 2003


Kewaunee Co. Precipitation and Runoff
Precipitation and Runoff, in inches
45
40
35
30
25
20
15
10
5
0
Liquid Precipitation
Frozen Precipitation
Surface-Water Runoff
30-year Average Precip.
12%
8%
2004
Partial 2005

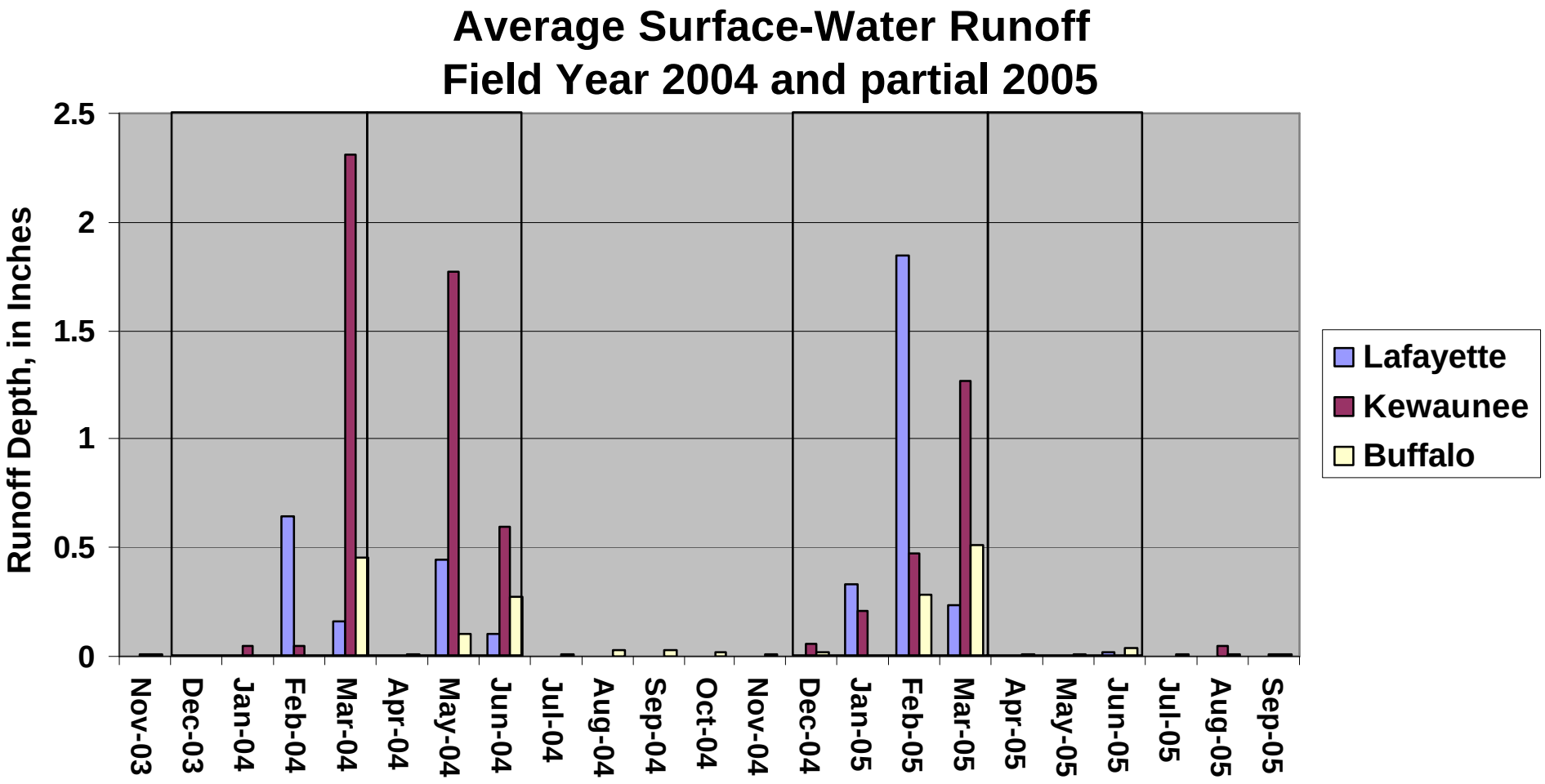

Kewaunee Co. Farm 2004 Surface-Water Runoff
Frozen
Non-Frozen
51%
49%


Kewaunee Co. Farm 2005 Surface-Water Runoff
3%
Frozen
Non-Frozen
97%

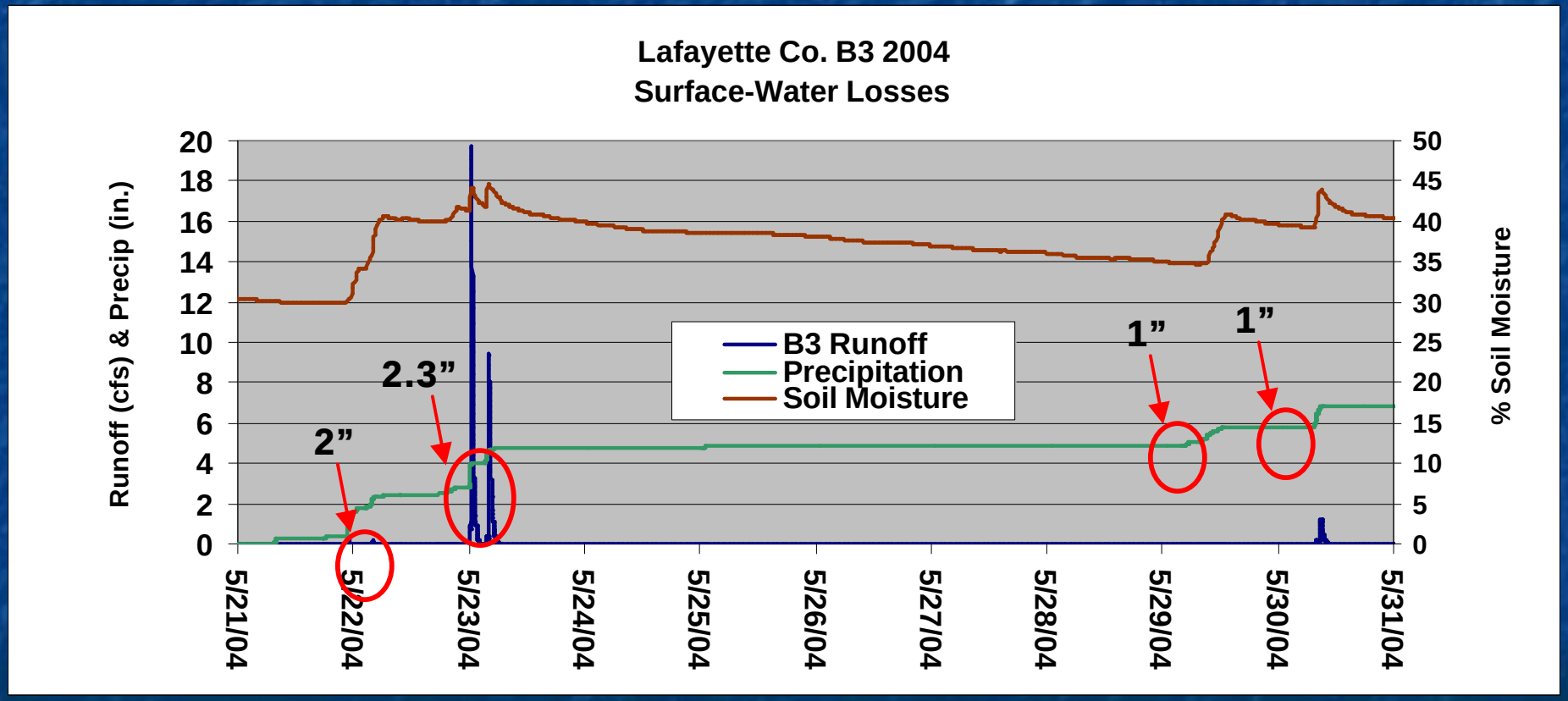


- Sites completed December 2003

Avoid High Risk Periods



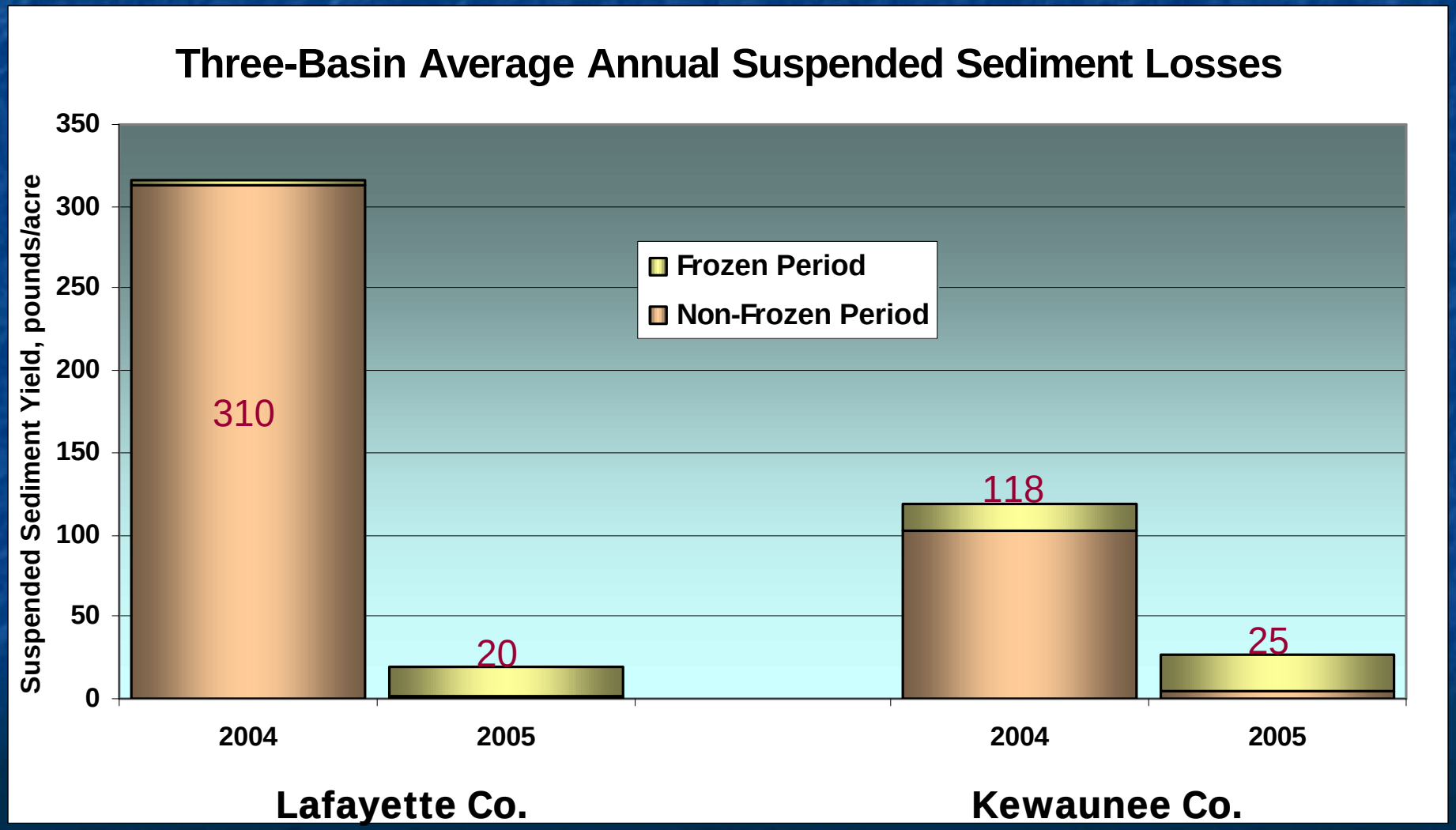
Timing/Field Conditions



Sediment Losses

- Sediment losses occur primarily during non-frozen ground runoff events.
- Sediment losses are found in tiles.

When Is Sediment Lost To Surface-Water?

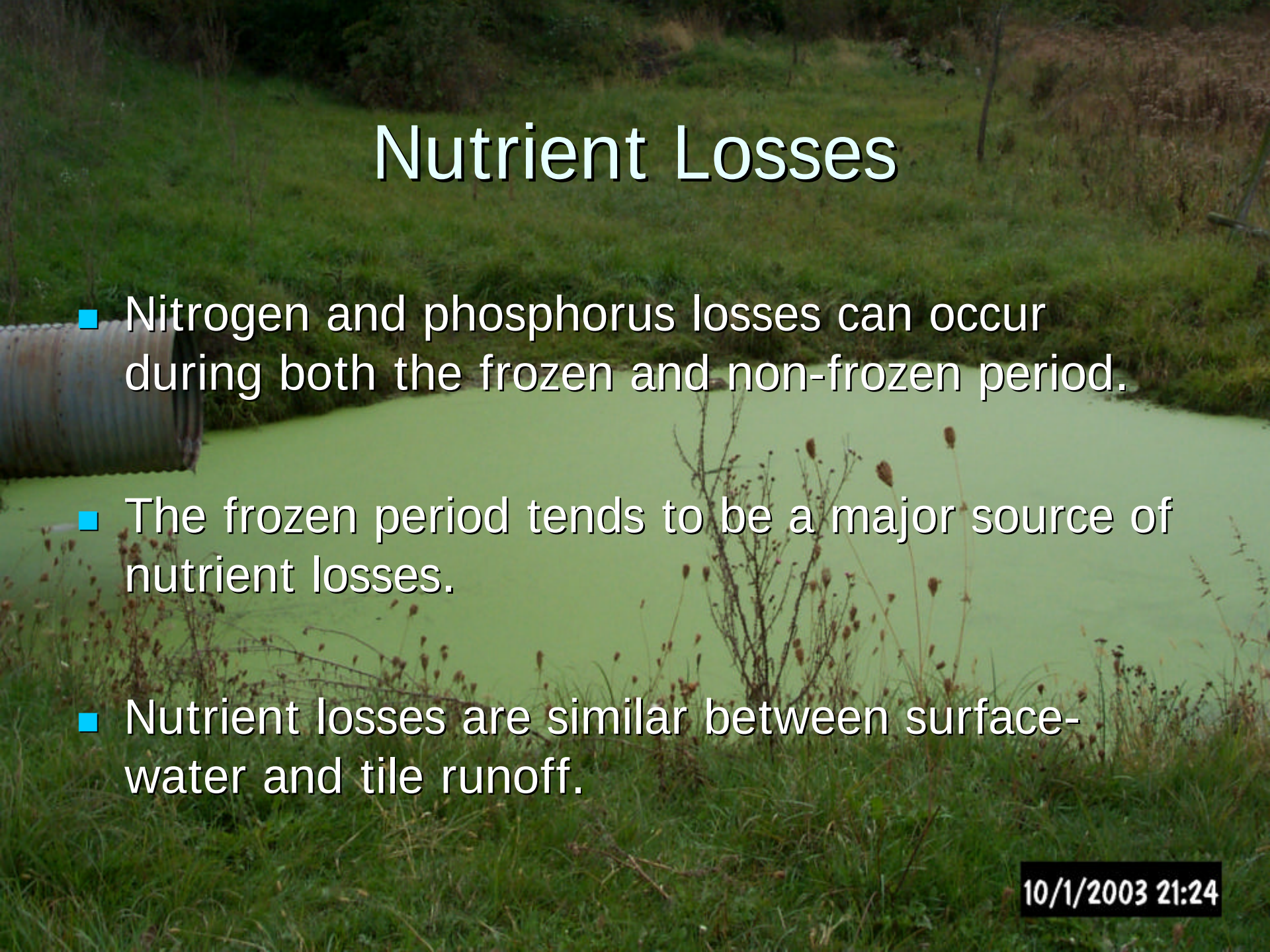


Soil Erosion Control

- The farms we are monitoring:
  - Some fields exceed T based on RUSLE 2,
  - Grass waterways are in areas of concentrated flow,
  - Maintain adequate residue rates

Nutrient Losses

- Nitrogen and phosphorus losses can occur during both the frozen and non-frozen period.
- The frozen period tends to be a major source of nutrient losses.
- Nutrient losses are similar between surface-water and tile runoff.



Nitrogen Losses:

- 5 Lafayette
- 4 – 7.5 Kewaunee

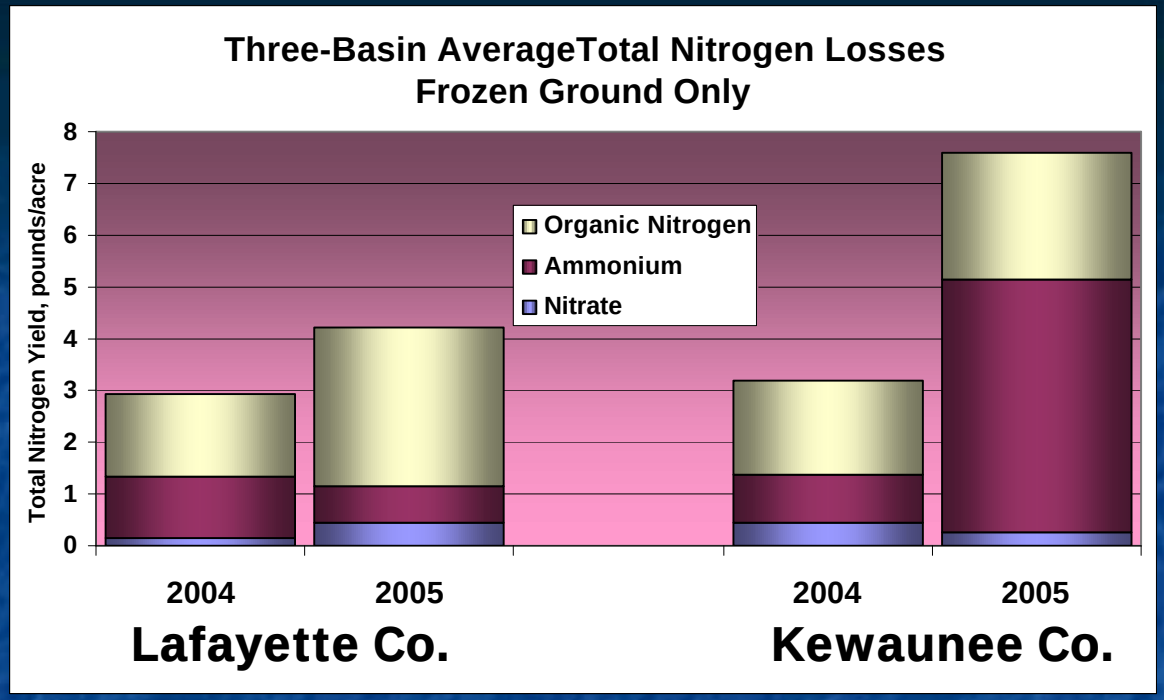
•Lafayette

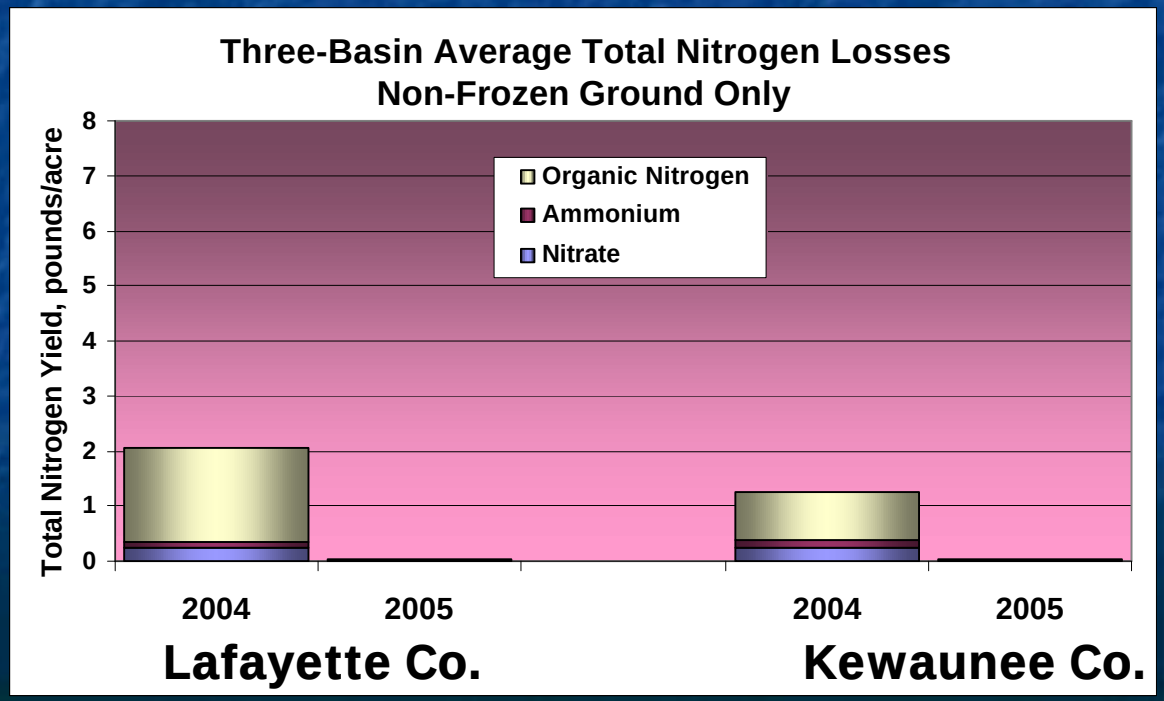
Basins in corn and soybeans

Manure and fertilizer applied for 200+ bu. corn

Manure is surface applied

Direct plant system





Total Phosphorus Losses:

Lafayette

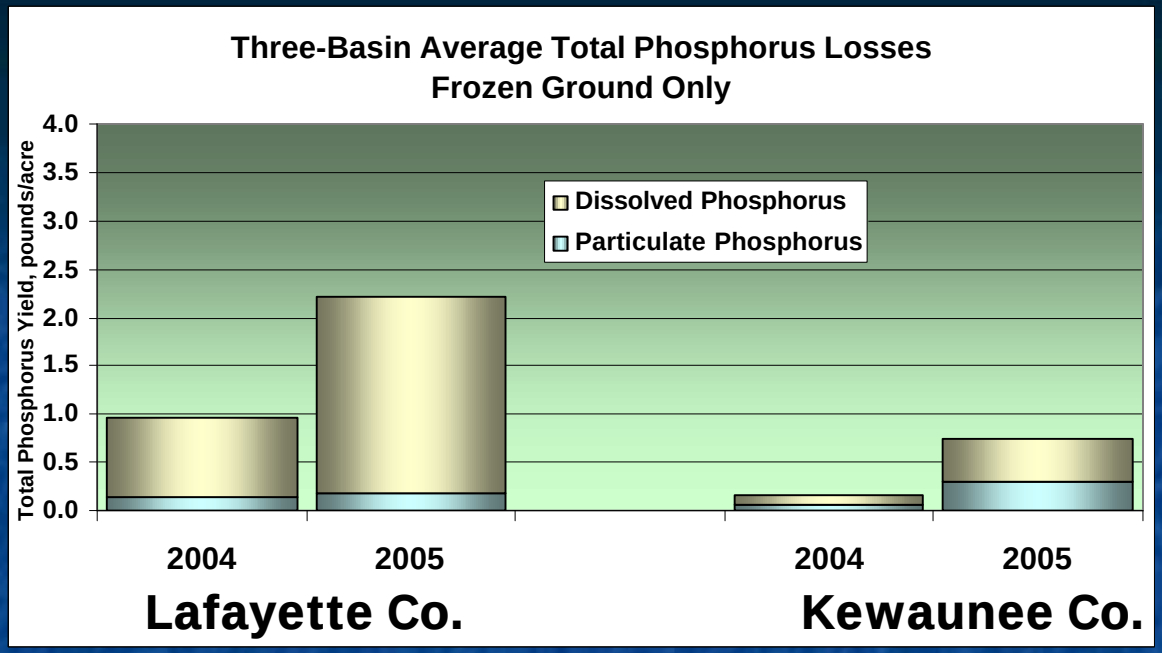
1.8 lbs 2004

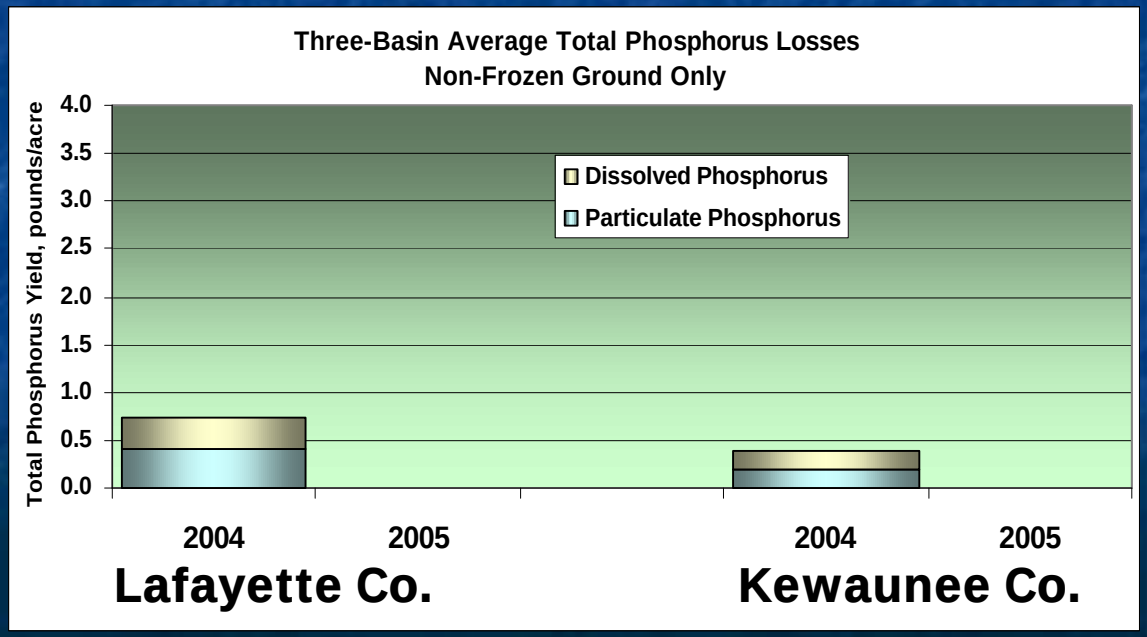
2.3 lbs 2005

Kewaunee

0.6 lbs 2004

0.7 lbs 2005

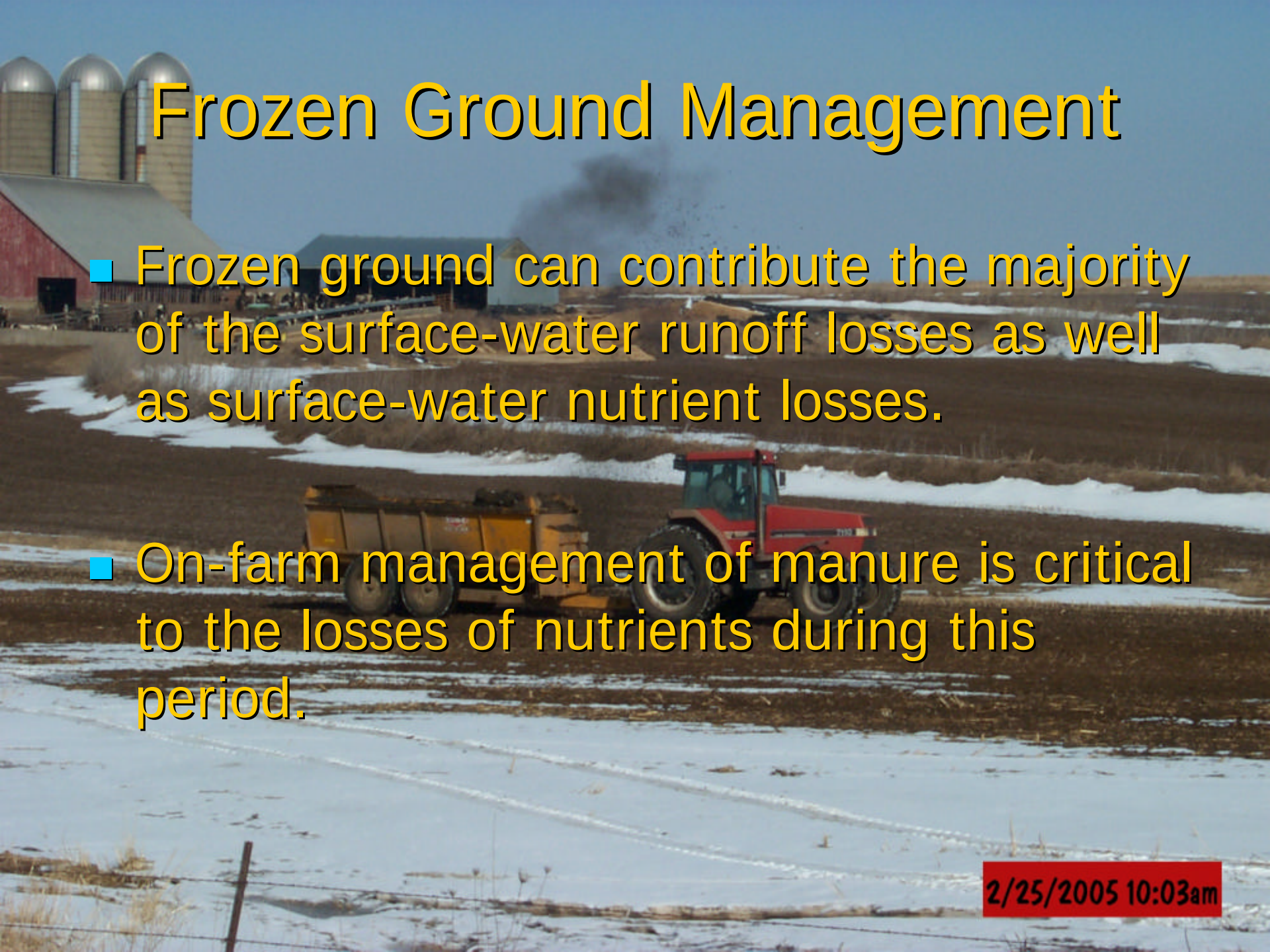


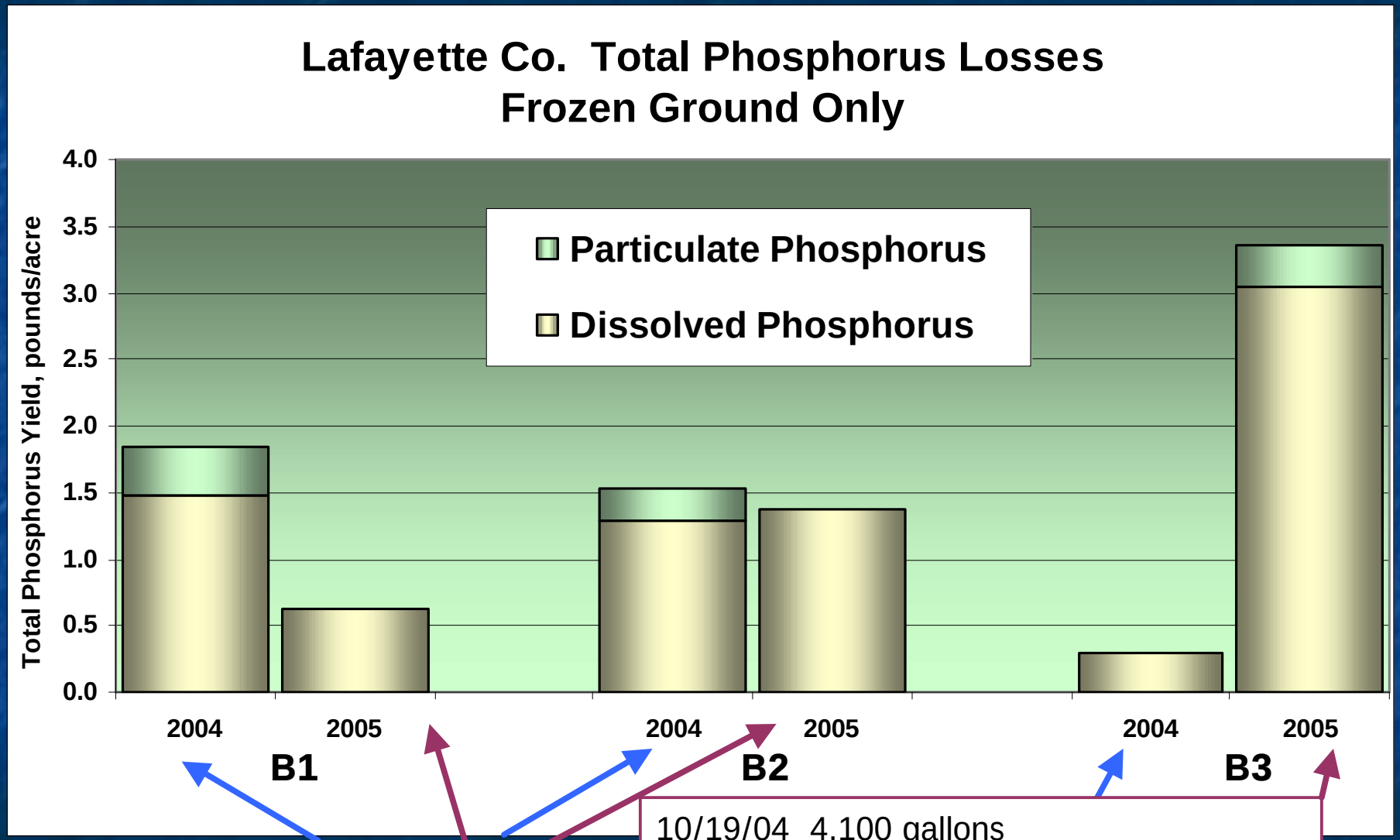


Frozen Ground Management

- Frozen ground can contribute the majority of the surface-water runoff losses as well as surface-water nutrient losses.

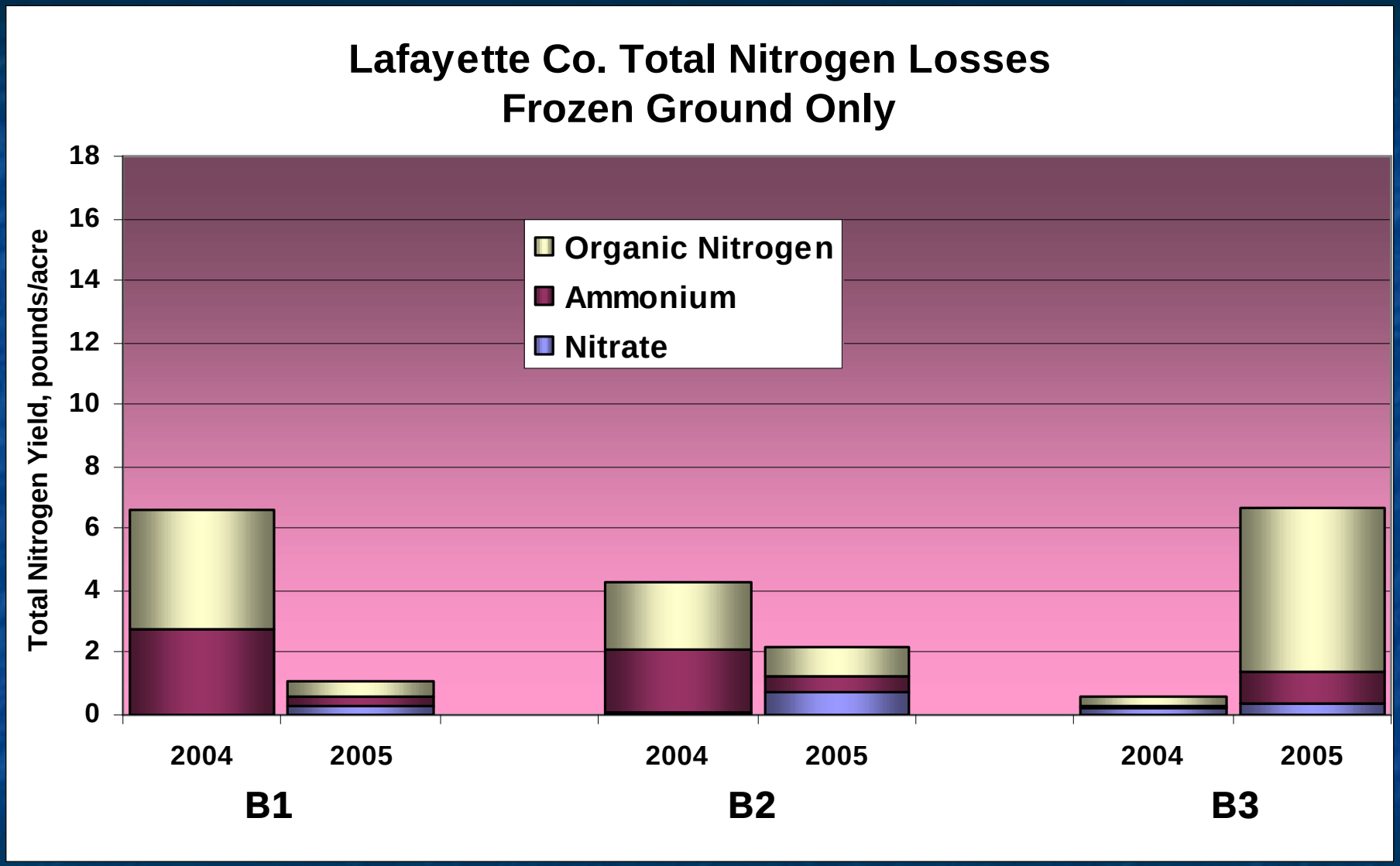
- On-farm management of manure is critical to the losses of nutrients during this period.



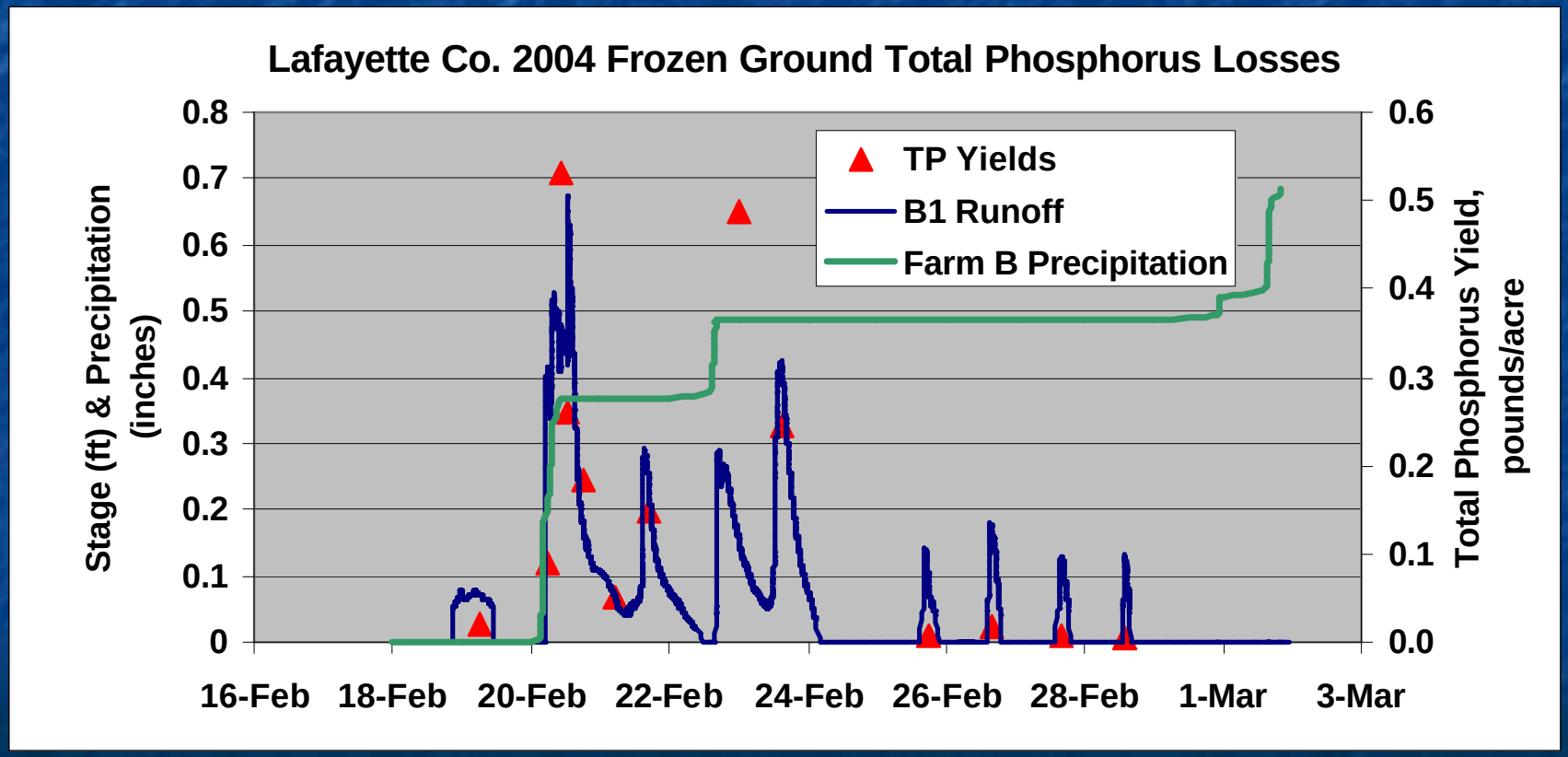


10/6/04~ 3.7 T pen manure

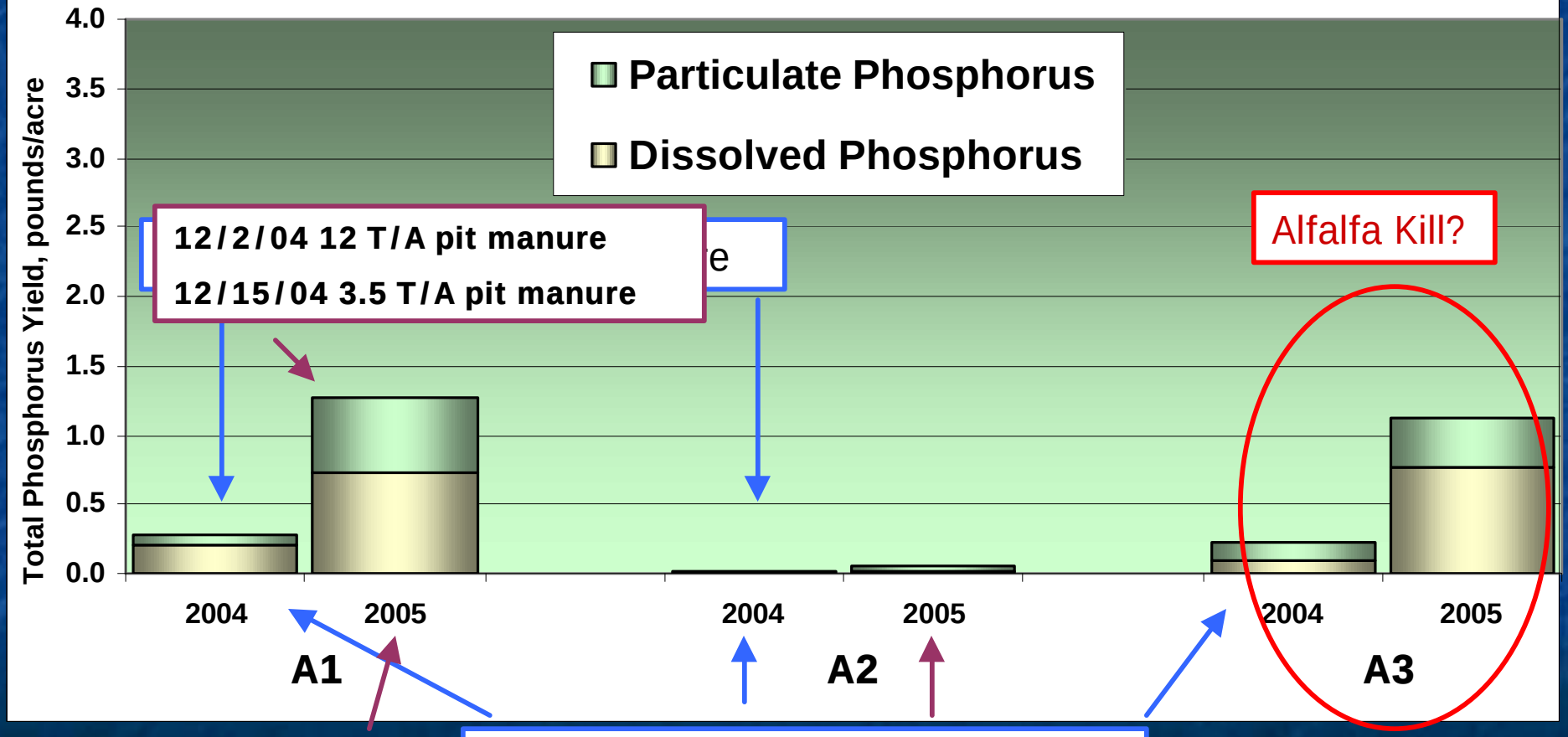
10/19/04 4,100 gallons
10/29/04~ 143 T pen manure
1/5/05~ 39 T, 1/28/05~ 52T,
2/12/05~ 65T, 2/19/05~ 78 T pen manure


Lafayette Co. Total Nitrogen Losses
Frozen Ground Only
Total Nitrogen Yield, pounds/acre
18
16
14
12
10
8
6
4
2
0
Organic Nitrogen
Ammonium
Nitrate
2004
2005
2004
2005
2004
2005
B1
B2
B3

Timing/Rain Effect On Snow



Kewaunee Farm Frozen Ground Total Phosphorus Losses 2004 & 2005



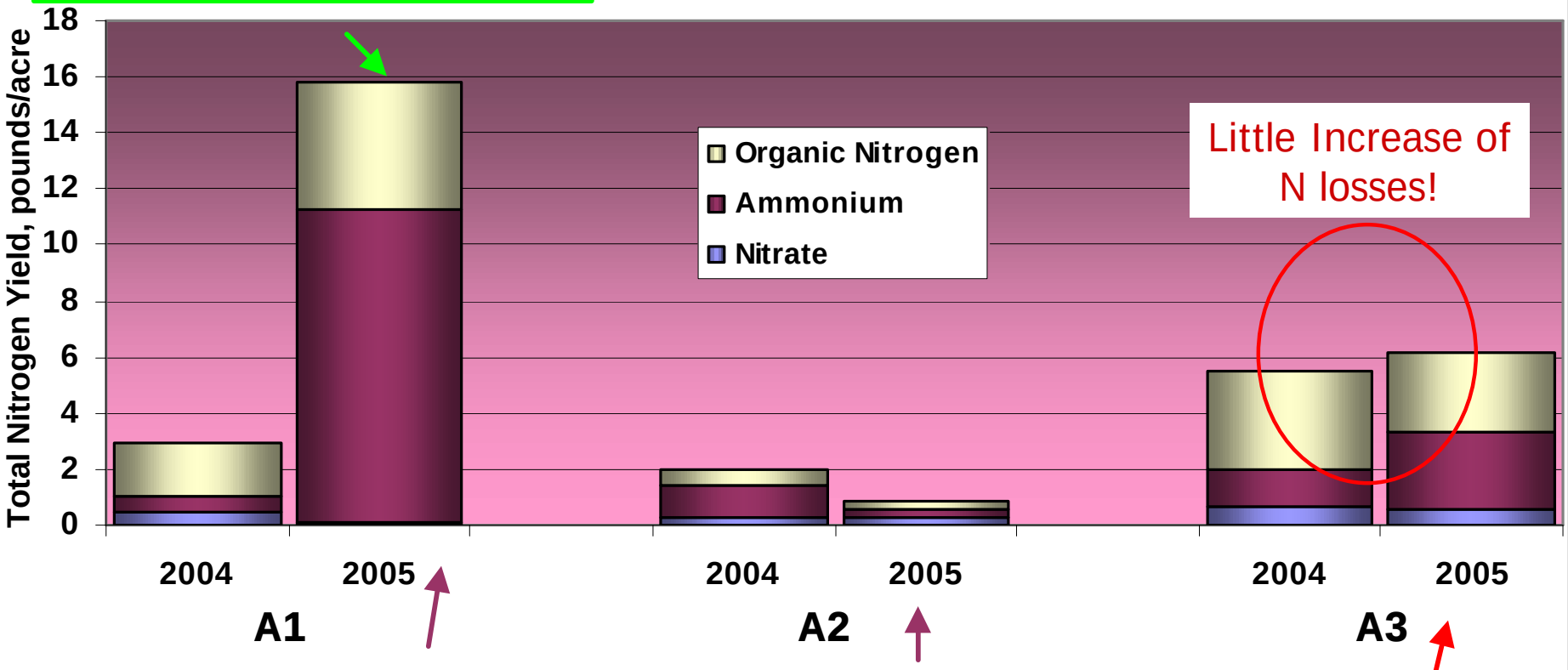
01/02/05 sand pack manure (unknown amount)

12/9/04 12,500 g/A injected liquid manure

Kewaunee Co. Total Nitrogen Losses
Frozen Ground Only

12/2/04 12 T/A pit manure

12/15/04 3.5 T/A pit manure

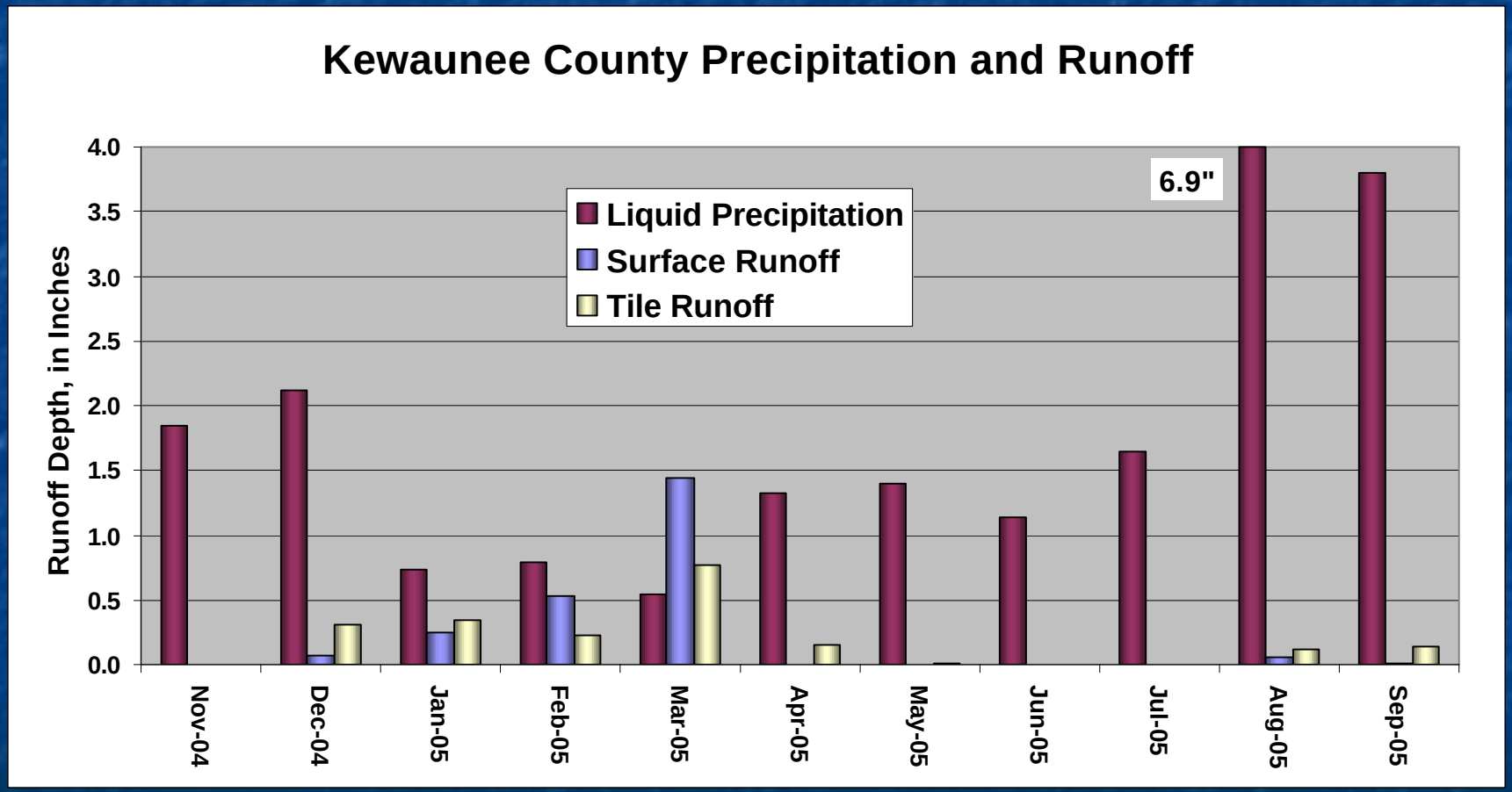


01/02/05 sand pack manure (unknown amount)

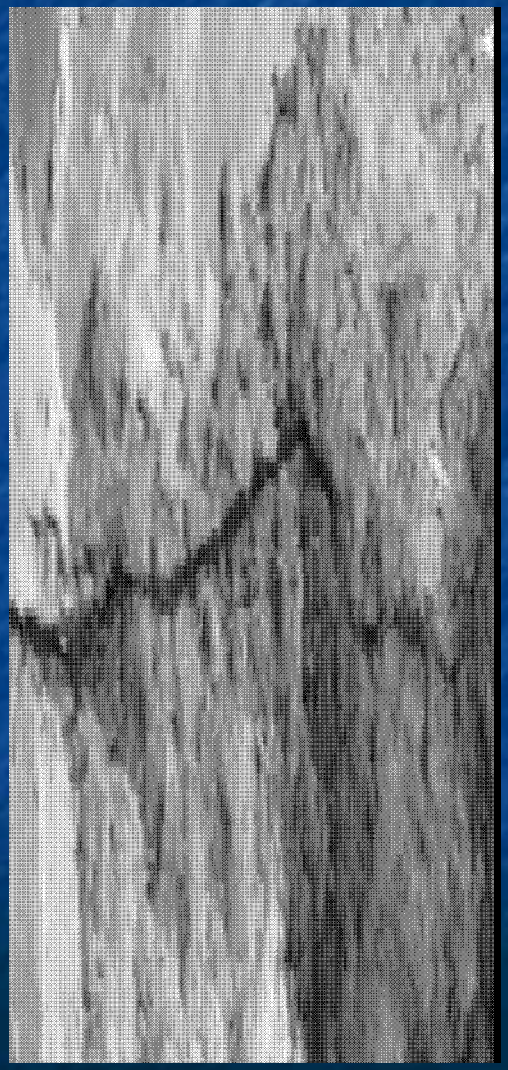
12/9/04 12,500 g/A injected liquid manure

No Manure

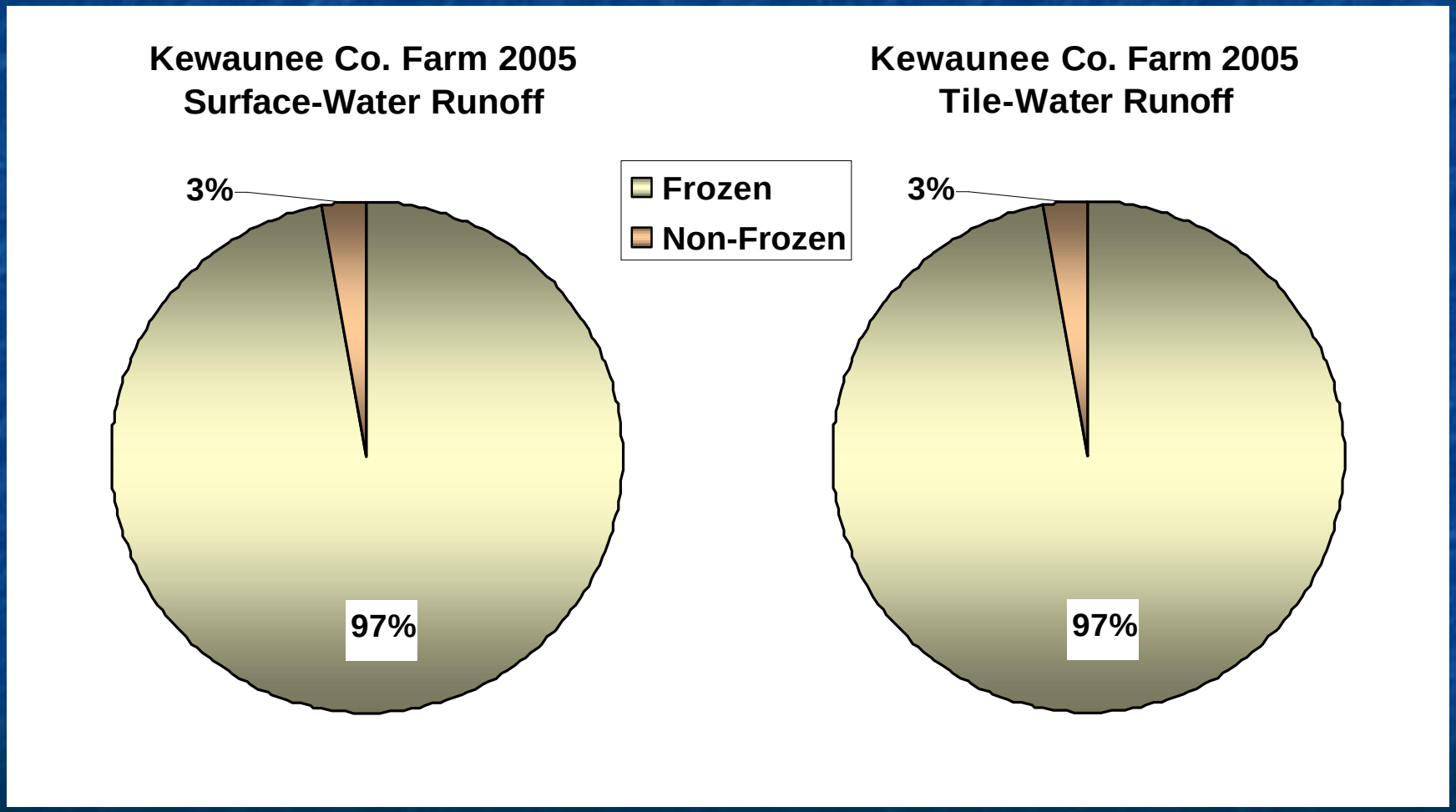
Precipitation and Surface and Tile Runoff in FY05 (Kewaunee County)



Preferential Flow Paths: Earthworm Burrows and Soil Cracks

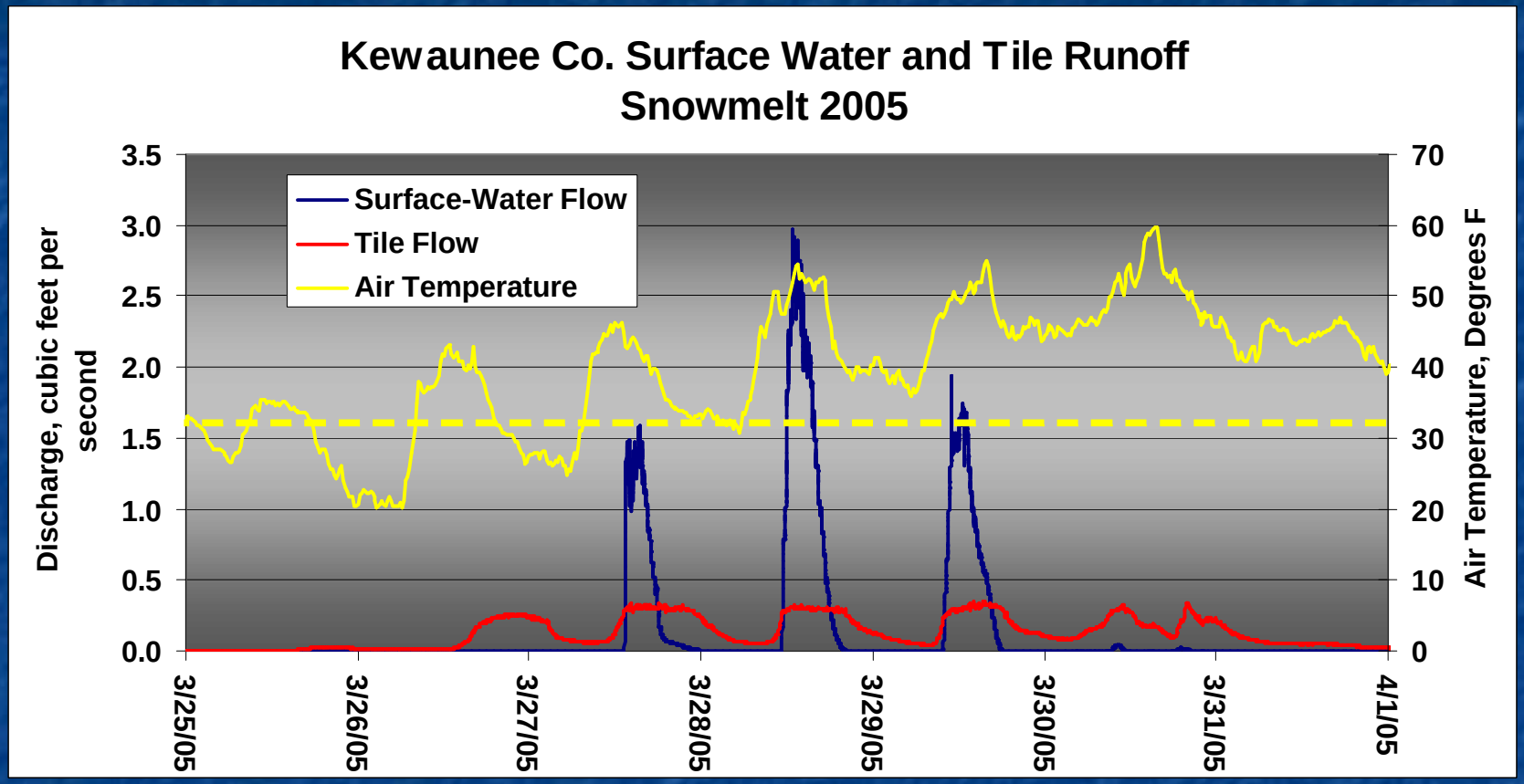


When did Runoff Occur in FY05? (Kewaunee County)



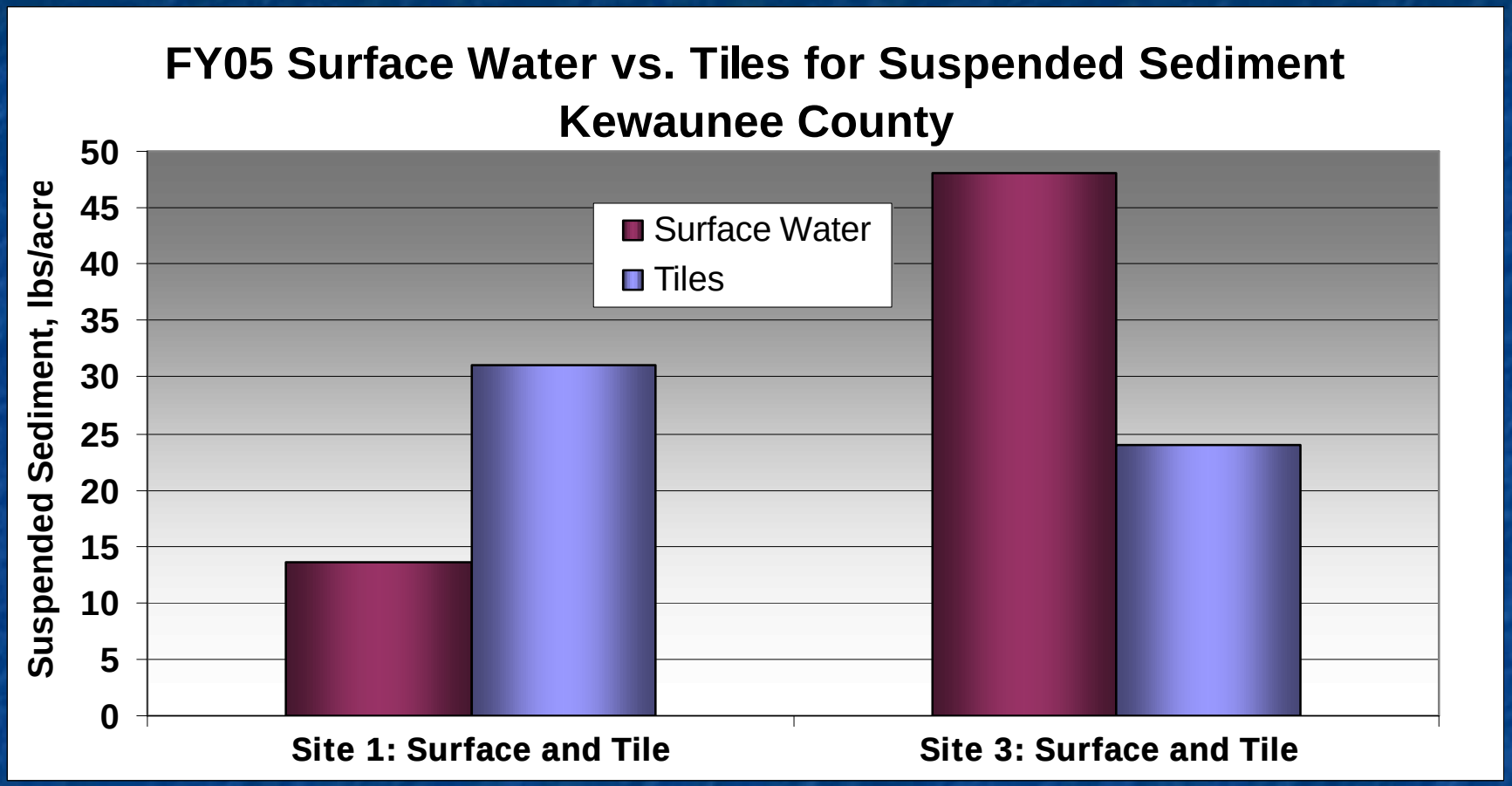
Lots of rain on snow/frozen ground

Surface and Tile Runoff Under Snowmelt Conditions



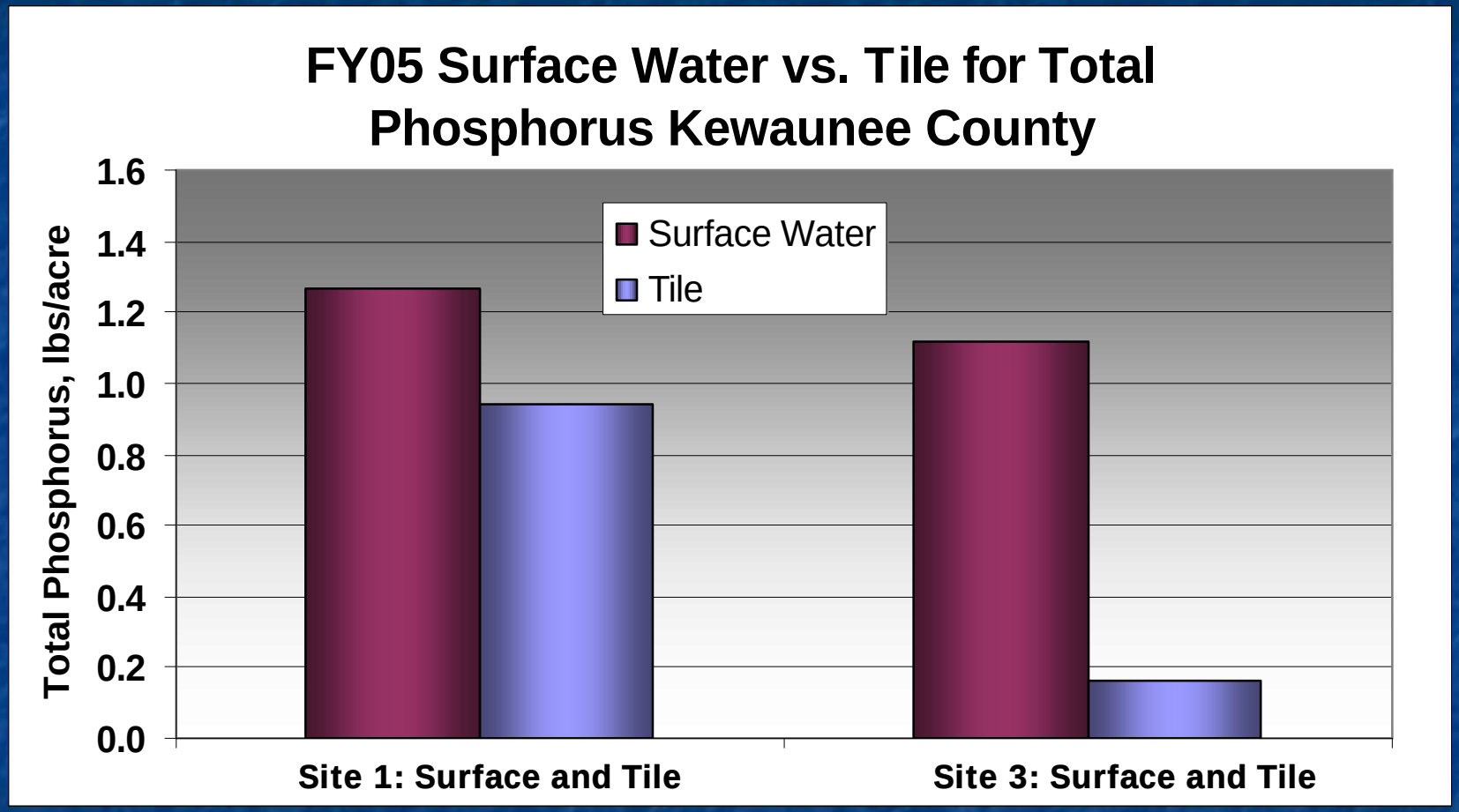
- Tile flow began before surface flow
- Relative volumes of water flowing in surface and tile were similar for this snowmelt period

Sediment Losses



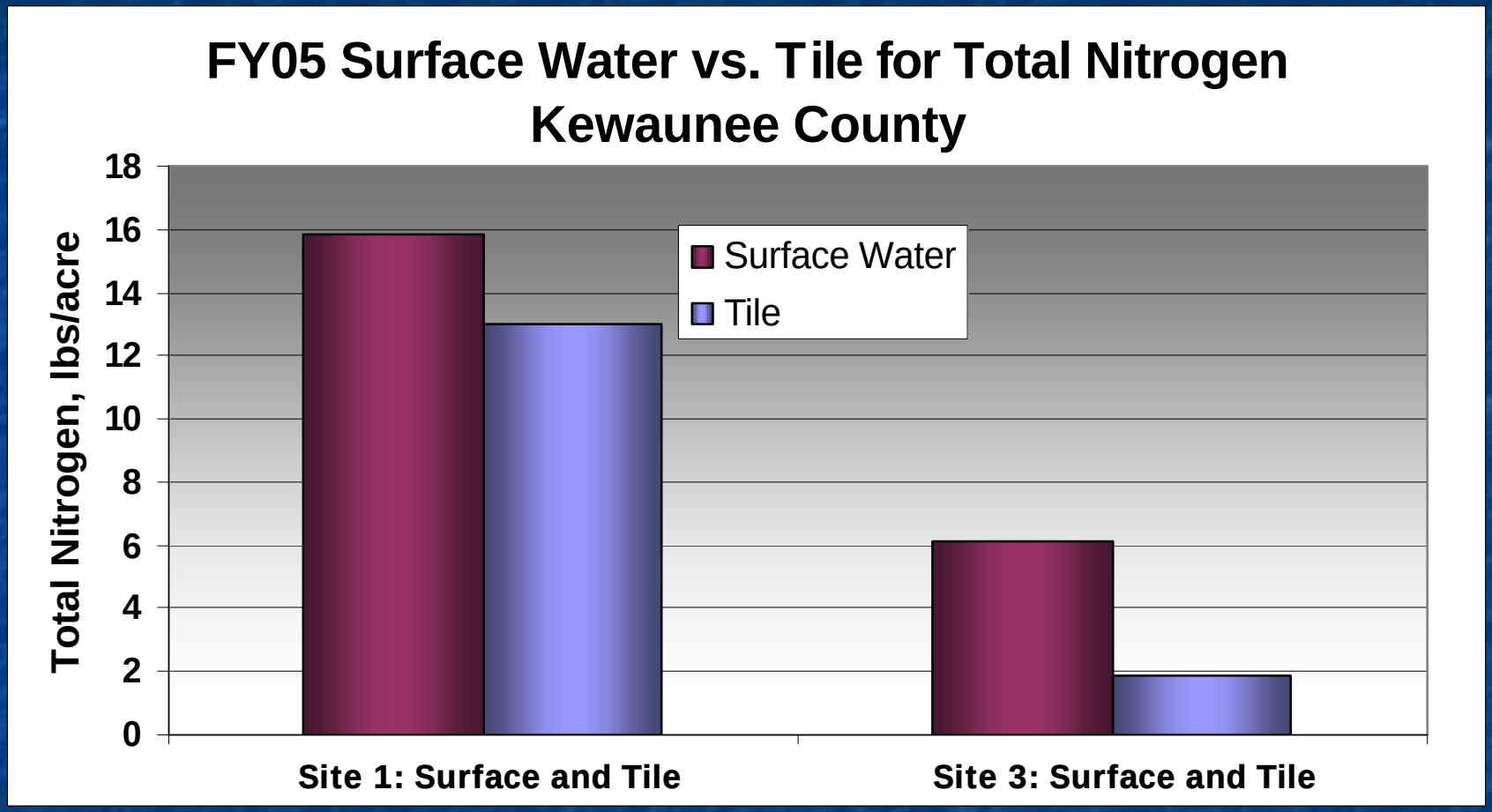
- Sediment losses can be higher in tiles than in surface-water runoff

Phosphorus Losses



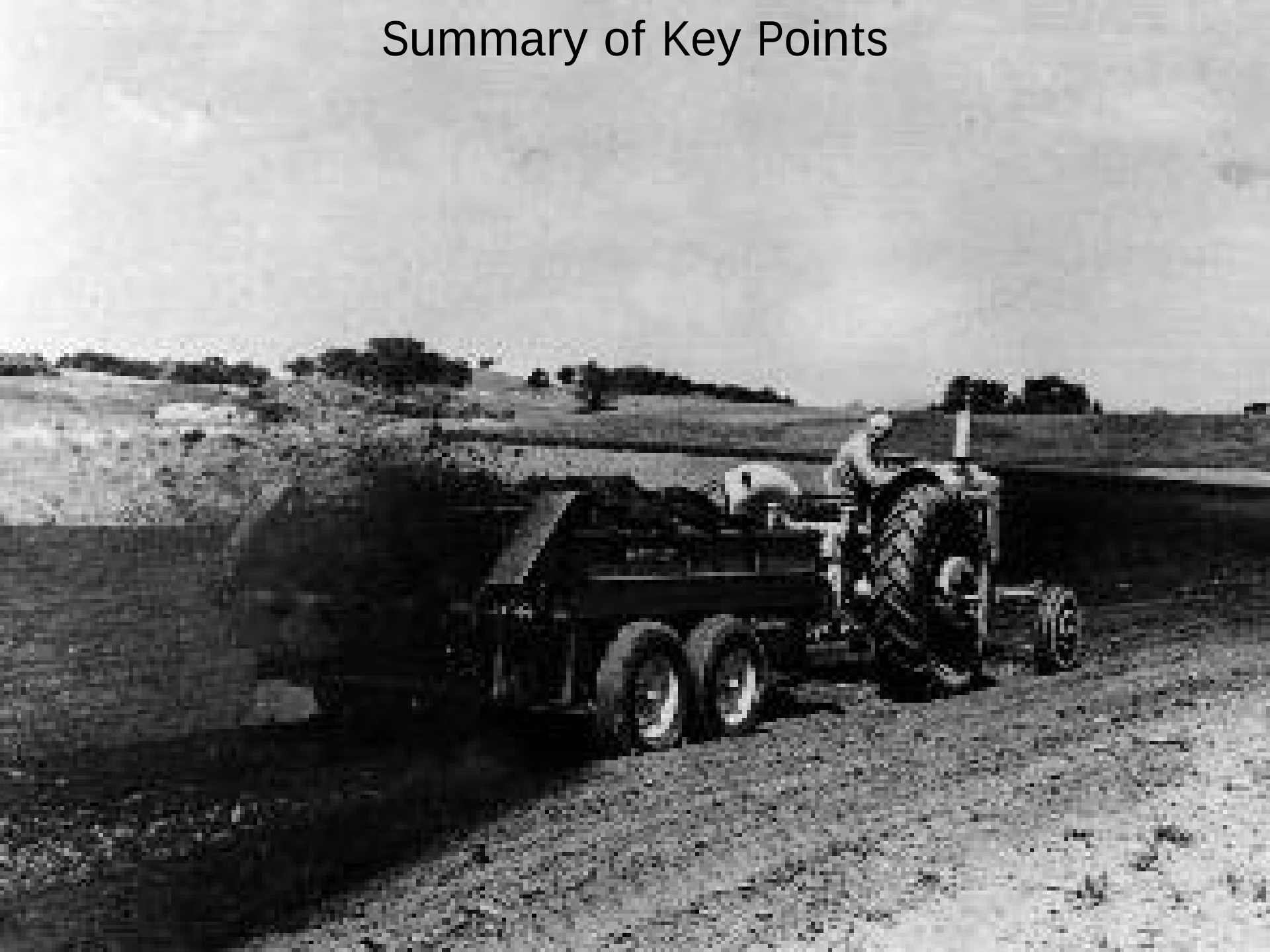
- Even on frozen ground the nutrient losses in a tile can be comparable to the surface water

Nitrogen Losses



- Even on frozen ground the nutrient losses in a tile can be comparable to surface-water losses

Summary of Key Points



Amount and Timing Of Runoff:

- Little precipitation runs off these farms (2%, 4% & 10%)
- Predicting runoff events is impossible, predicting runoff periods is possible.
  - Snowmelt
  - Saturated soils (by rain or through manure applications)
- If possible, avoid high risk periods (short term storage or stacking sites).
- If not possible to avoid, select fields with minimal chance of surface/tile/groundwater losses.
- During high risk periods, incorporate manure into the soil.

Soil Loss / Sediment Delivery

- Our Discovery Farms are doing an excellent job controlling sediment delivery.
  - Farms include minimum tillage, no-till and direct plant.
- Sediment delivery is lower for field sites, still low for stream sites.
- Install grass waterways in areas of concentrated flow.
- Identify problem fields/sites.

Nutrient Loss To Surface Water

- The relationships between nutrient loss (particularly phosphorus) and sediment is more clear in streams than edge-of-field.
  - Nutrient losses were greatly influenced by late winter manure applications.

Manure Applications & Nutrient Loss

- Nutrient losses from manure dominate our study farm losses.
- Key area for implementation of BMPs.
- Installation of manure storage will not guarantee improvements in water quality.

Don’t Make Bad Decisions
http://www.discoveryfarms.org/