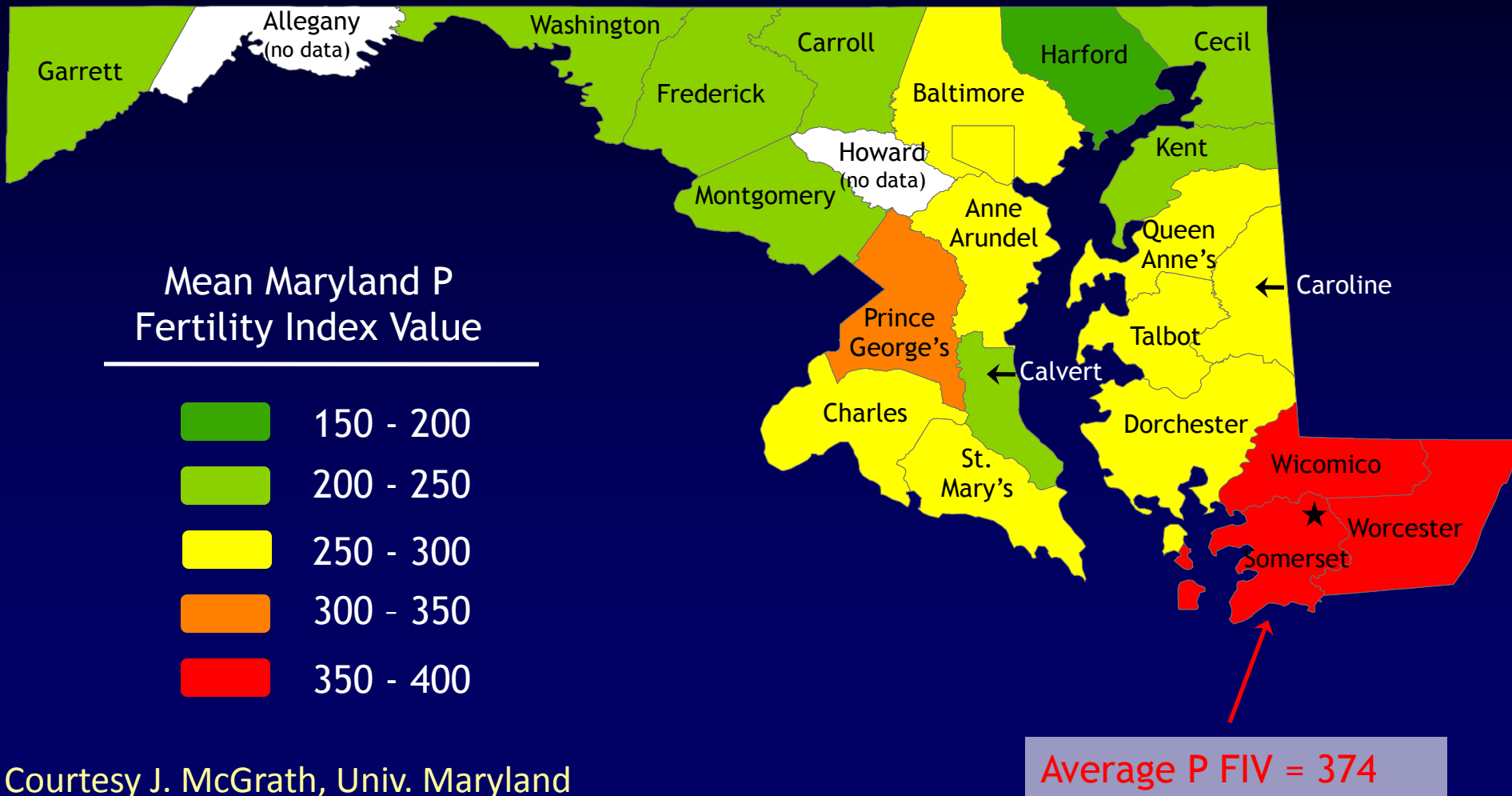


# Using FGD gypsum “curtains” to treat phosphorus in groundwater

Anthony Buda, Ray Bryant, Pete Kleinman,  
Gary Felton, Gordon Folmar, Art Allen, Salil Bose

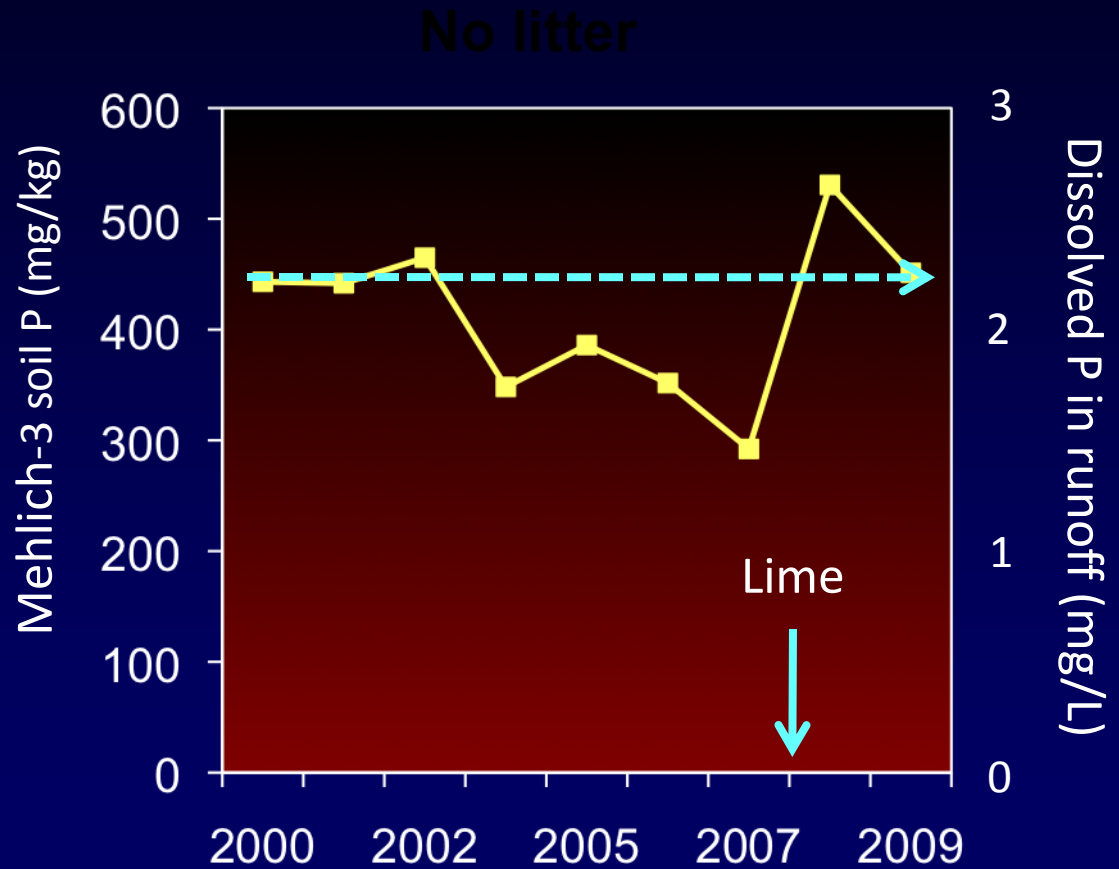
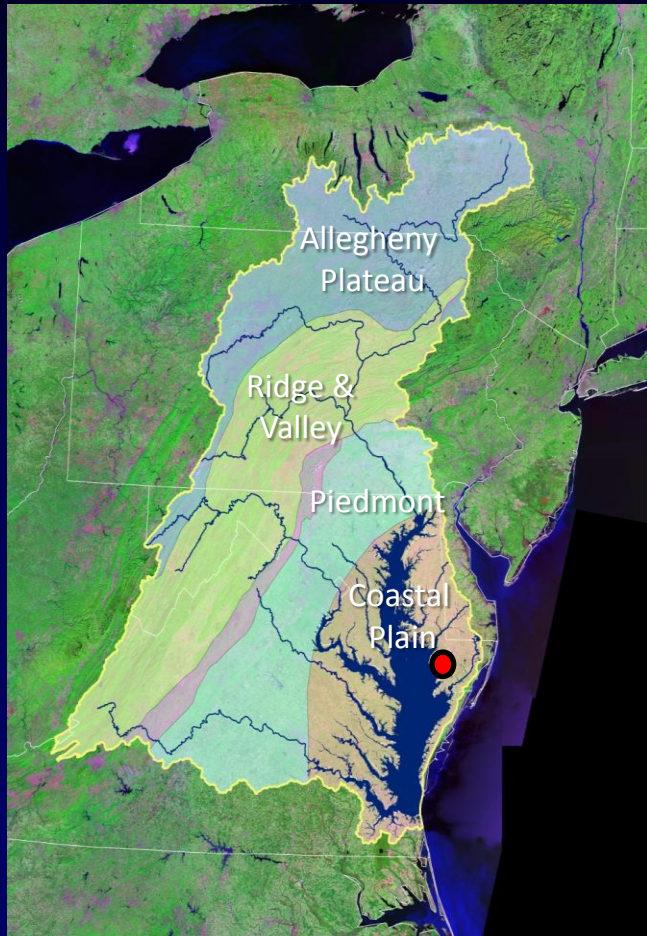
# Soil test P levels are high on the Eastern Shore of Maryland

*Restricted to fields where the Maryland P Index was run (FIV > 150 only)*



# No change in soil test P after one decade of continuous corn : Zero P additions

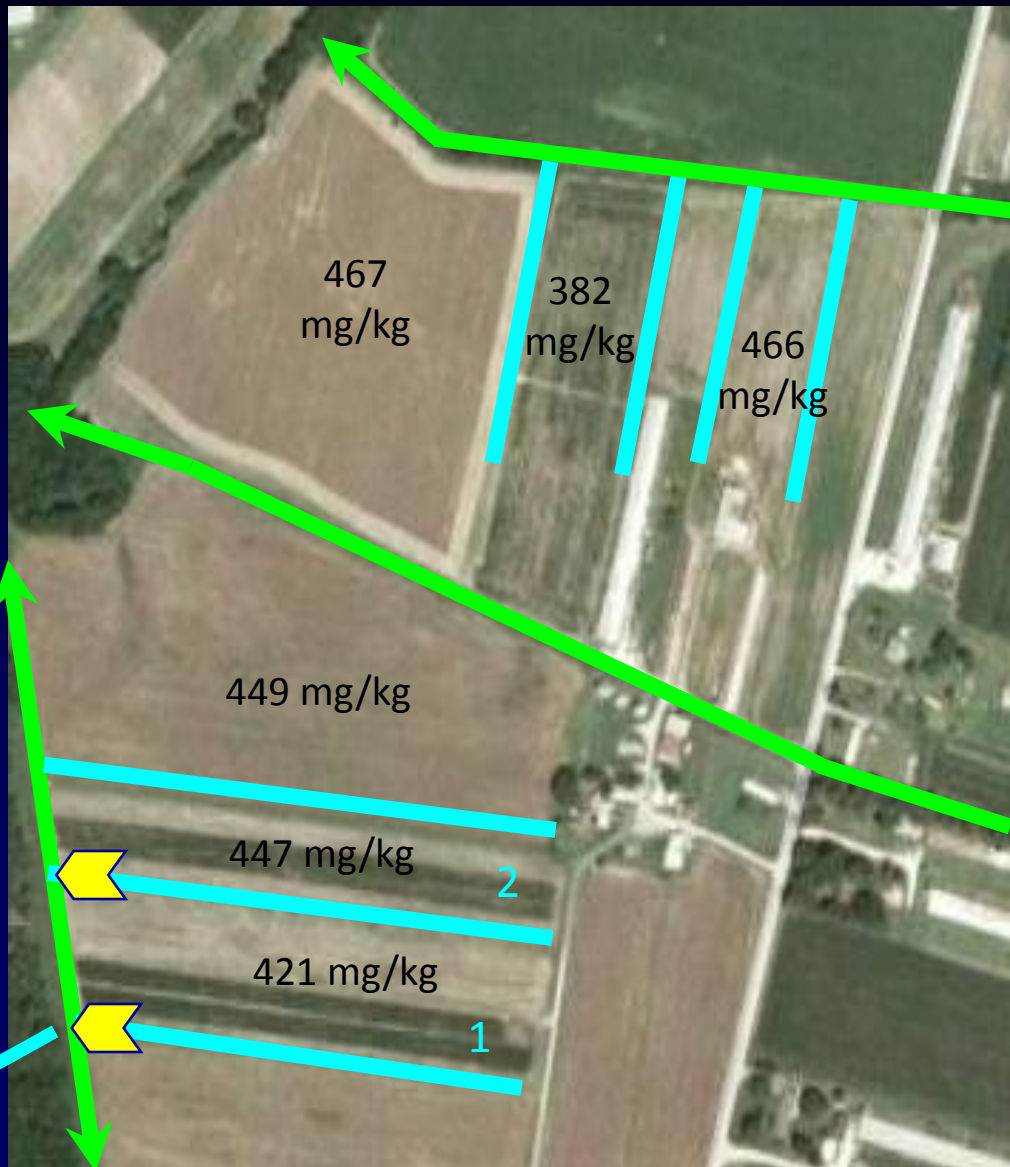
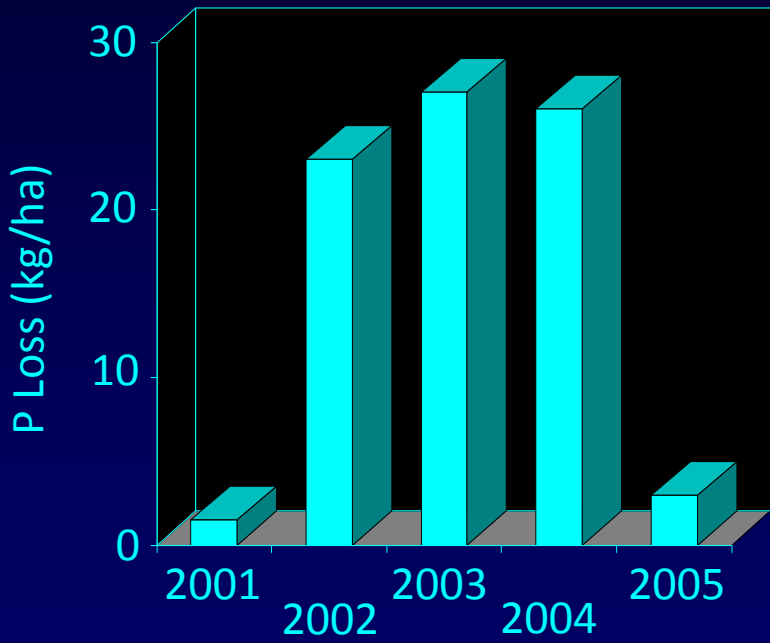
*This form of banking P has water quality consequences*



Maryland, USA (Kleinman et al., 2010)

# Total P loads from drainage ditches

*Annual loads vary with precipitation*



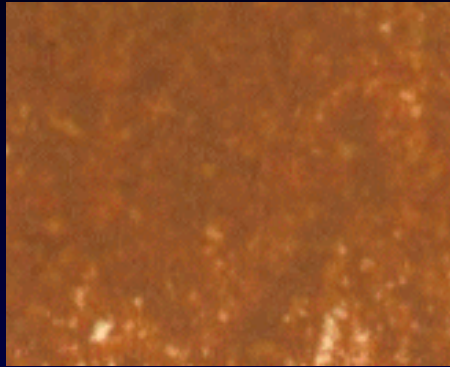
# BAY JOURNAL

## EPA finds flaws in most states' plans to clean up waterways

### Initial Findings: Agricultural

- Limited assurance that agricultural reductions will be met, given little to no detail on plan for building technical assistance, leveraging financial incentives and verifying implementation of practices
- Implementation rates of proposed conservation practices are unrealistic to achieve by 2025 unless incorporated into state technical standards or other regulatory programs
- No or limited commitment to improving phosphorus (P) management to address high P in soils and related excess manure
- Additional reductions may be possible through new technologies (e.g., manure incorporation)
- Compliance/enforcement strategies inadequate

# P sorbing byproducts



Acid mine drainage treatment residuals (Fe & Al oxides)



Drinking water treatment residuals (alum)



Bauxite mining and production waste (red mud)



Fly ash



Paper mill waste



Steel slag waste



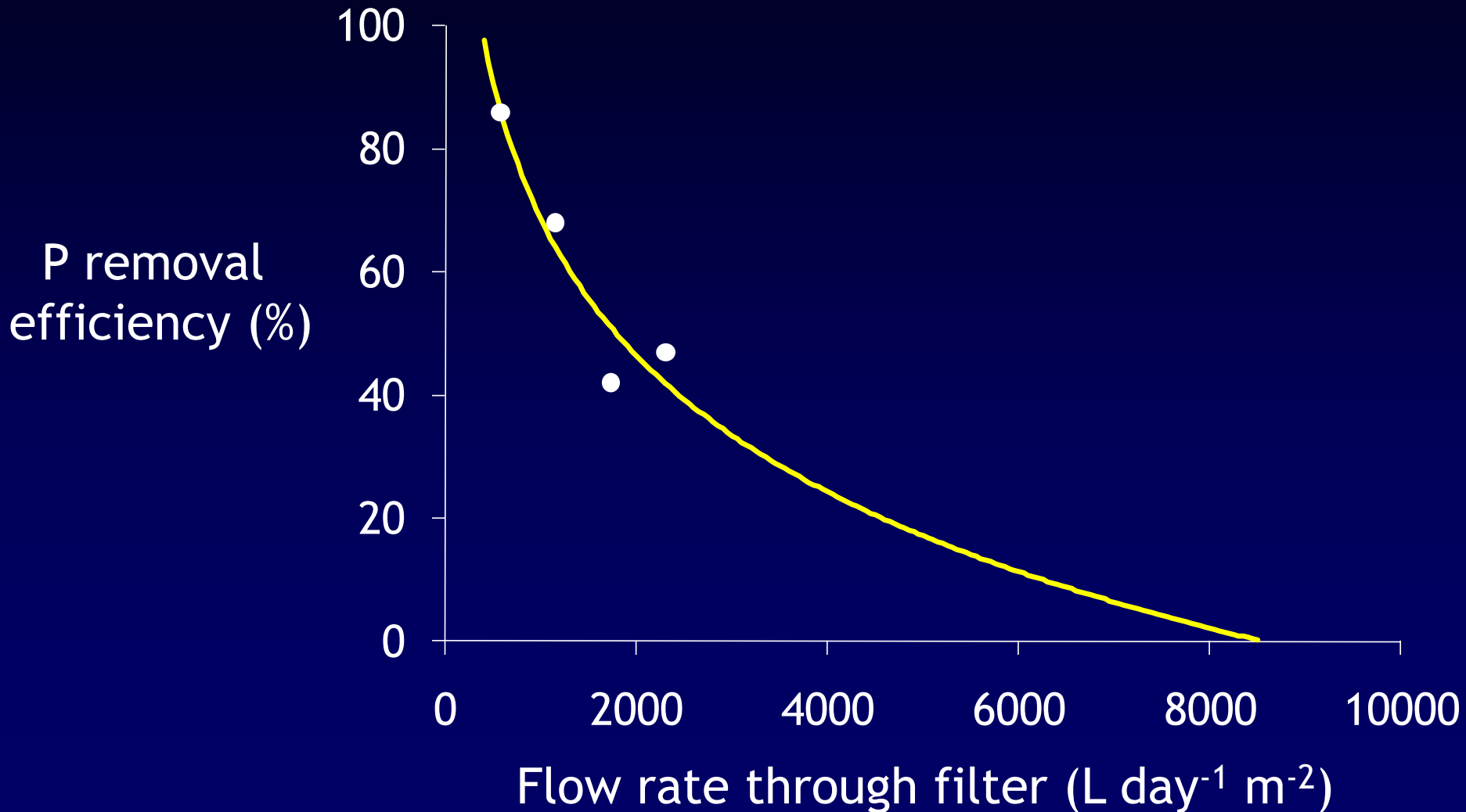
Recycled gypsum or FGD gypsum (calcium)

# FGD gypsum filter - 1<sup>st</sup> generation

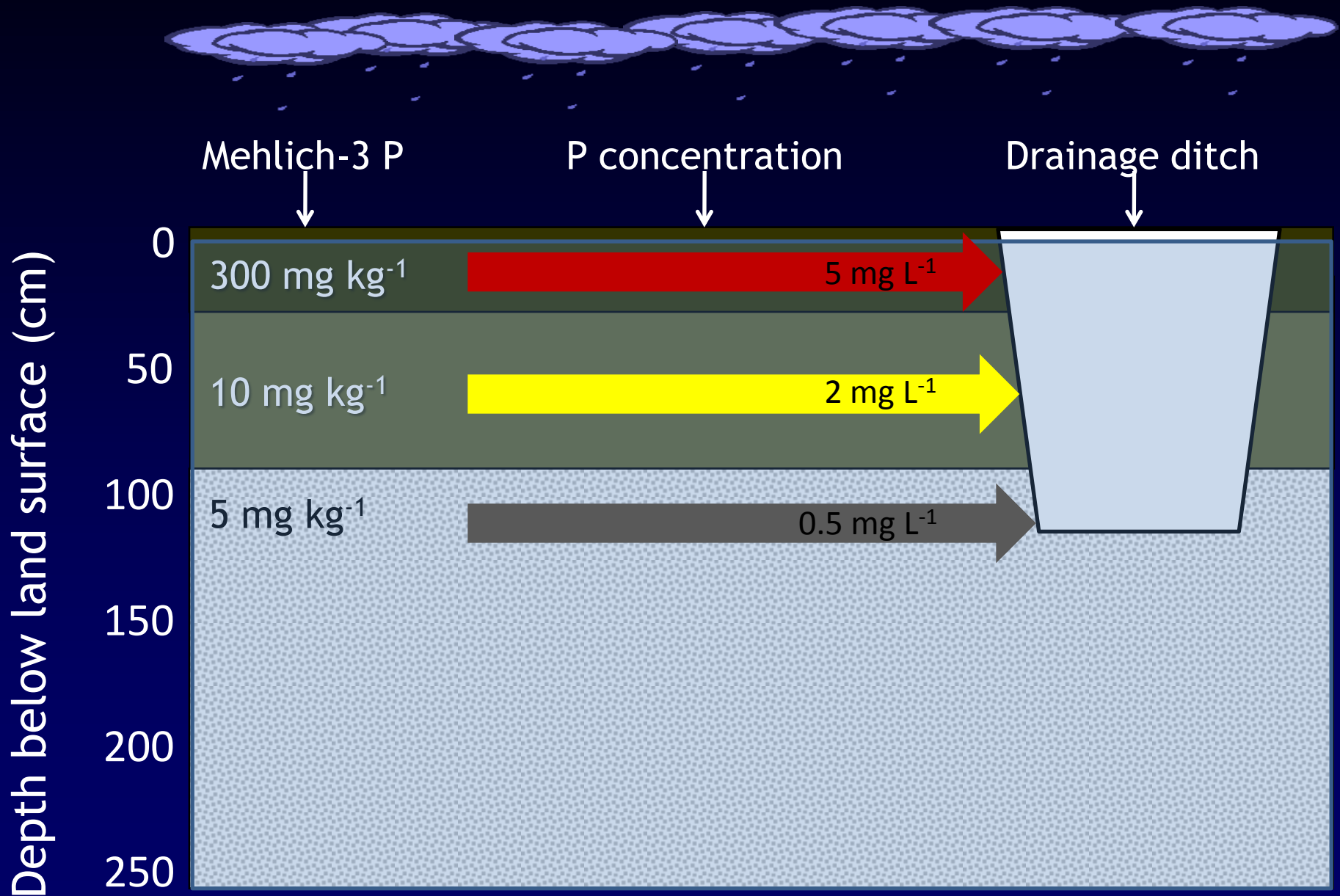
120 tons of synthetic gypsum (5 truck loads)



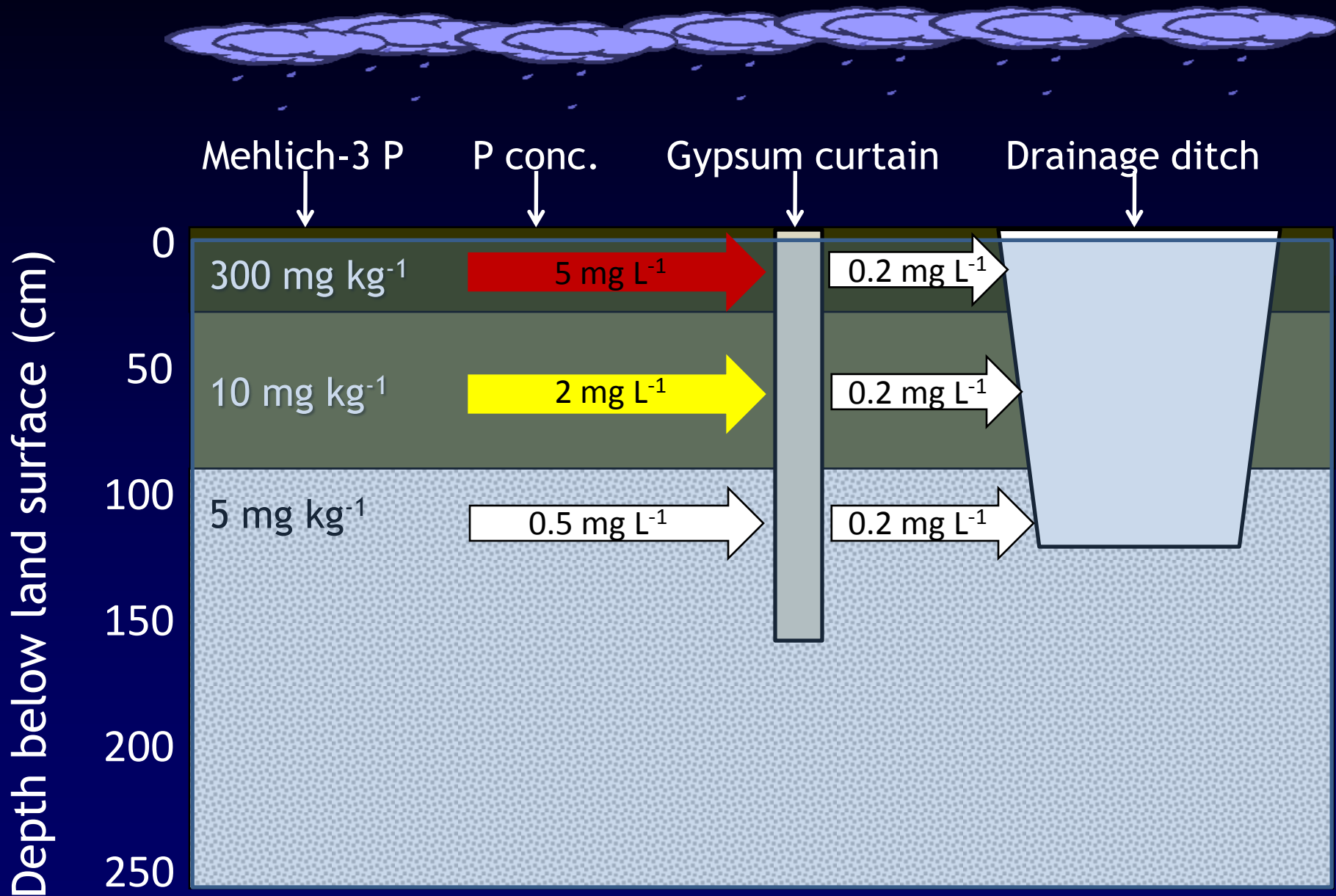
# P removal efficiency is greatest at low flow rates



# P transport processes in Coastal Plain soils



# FGD gypsum "curtain" - 2<sup>nd</sup> generation



# FGD gypsum "curtain" - 2<sup>nd</sup> generation



# FGD gypsum “curtain” - 2<sup>nd</sup> generation

*Applying the practice at a larger scale*



# FGD gypsum “curtain” - 2<sup>nd</sup> generation

Conservation Innovation Grant

UMES, ARS, UMCP, Constellation Energy

\$1 M Natural Resources Conservation Service

\$1 M Constellation Energy (donated gypsum)

GOAL: Develop standards for gypsum curtains

Establish eligibility for cost share

Evaluate cost effectiveness