

Drainage, Drainage, Drainage

David P. Orr, PE, Director

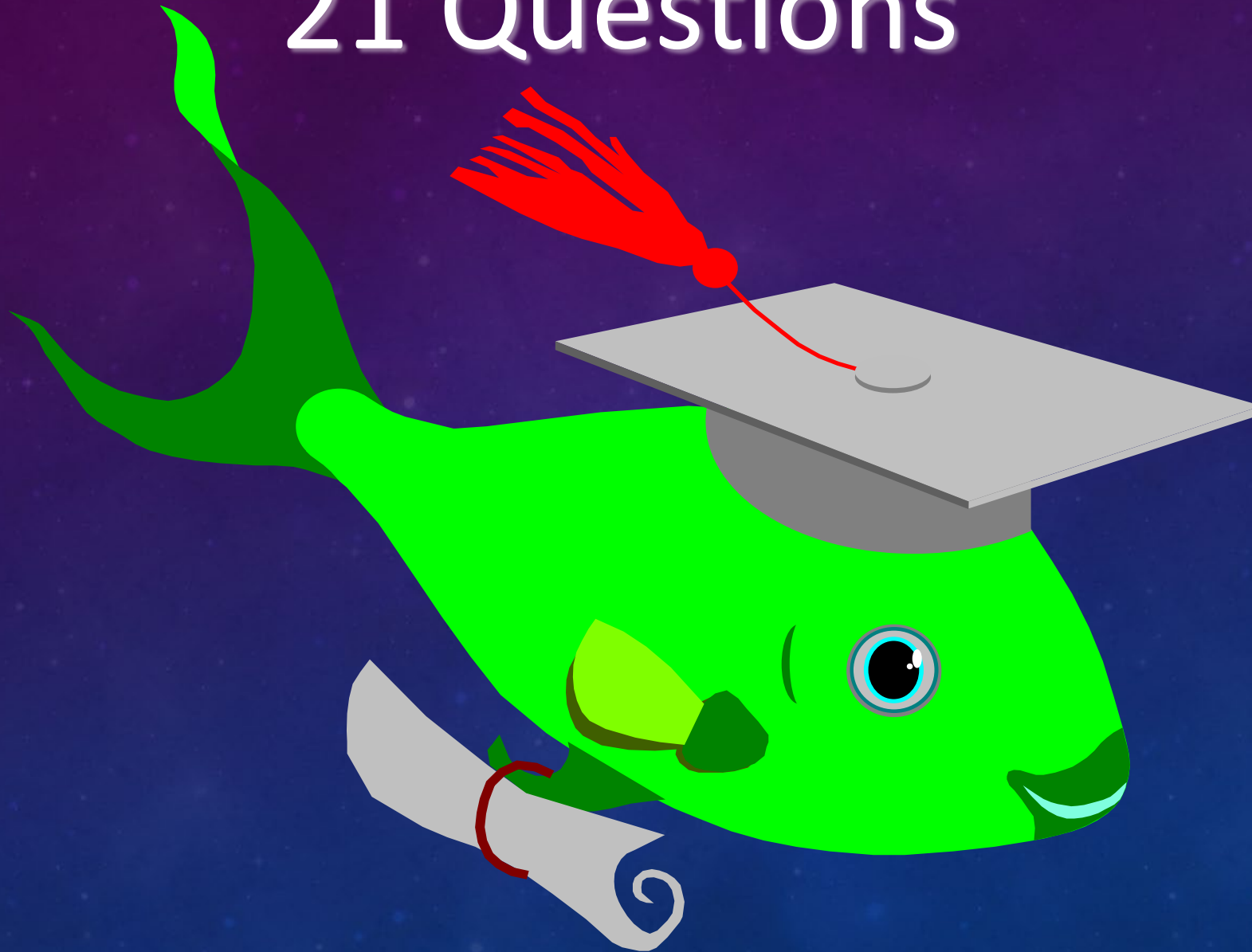








21 Questions



2
pts

1. Soil with more fines will hold more water.

- 1. True
- 2. False

2
pts





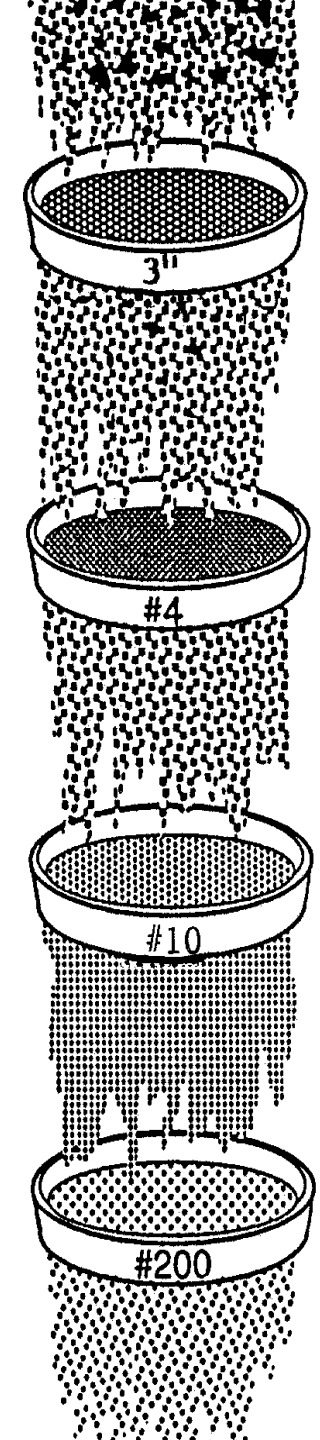




2. What is the maximum desirable maximum amount of fines in a base gravel?

- A. 5%
- B. 8%
- C. 12%
- D. 15%









3. What is the maximum width for crack repairs (filling and sealing)?

- A. $\frac{1}{2}$ "
- B. $\frac{3}{4}$ "
- C. 1"
- D. $1\frac{1}{2}$ "

2
pts









4. What are the primary purposes of shoulders?

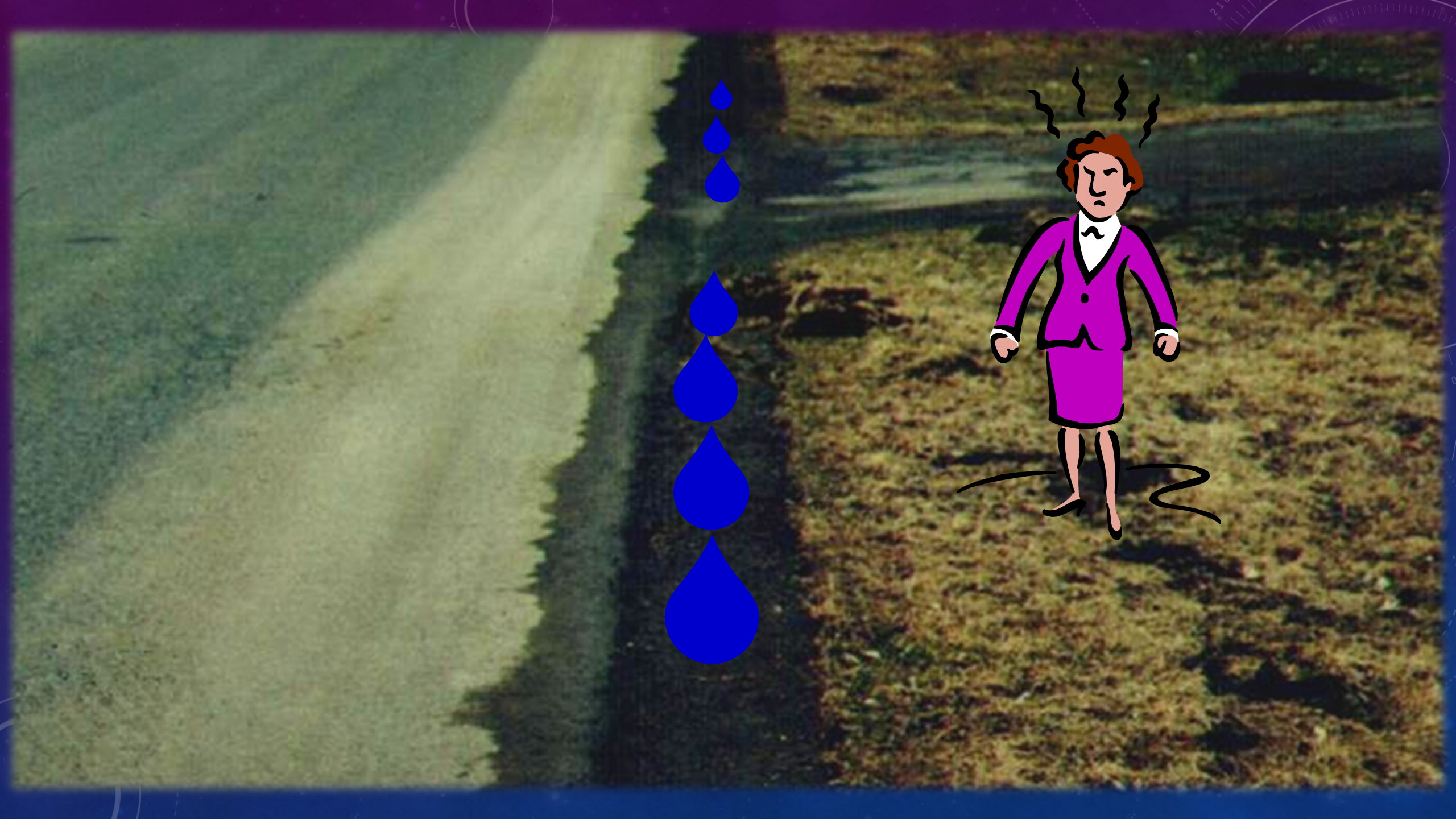
- A. Provide lateral support
- B. Carry water to ditches
- C. Place for errant vehicles
- D. Store Snow

1 pt
each

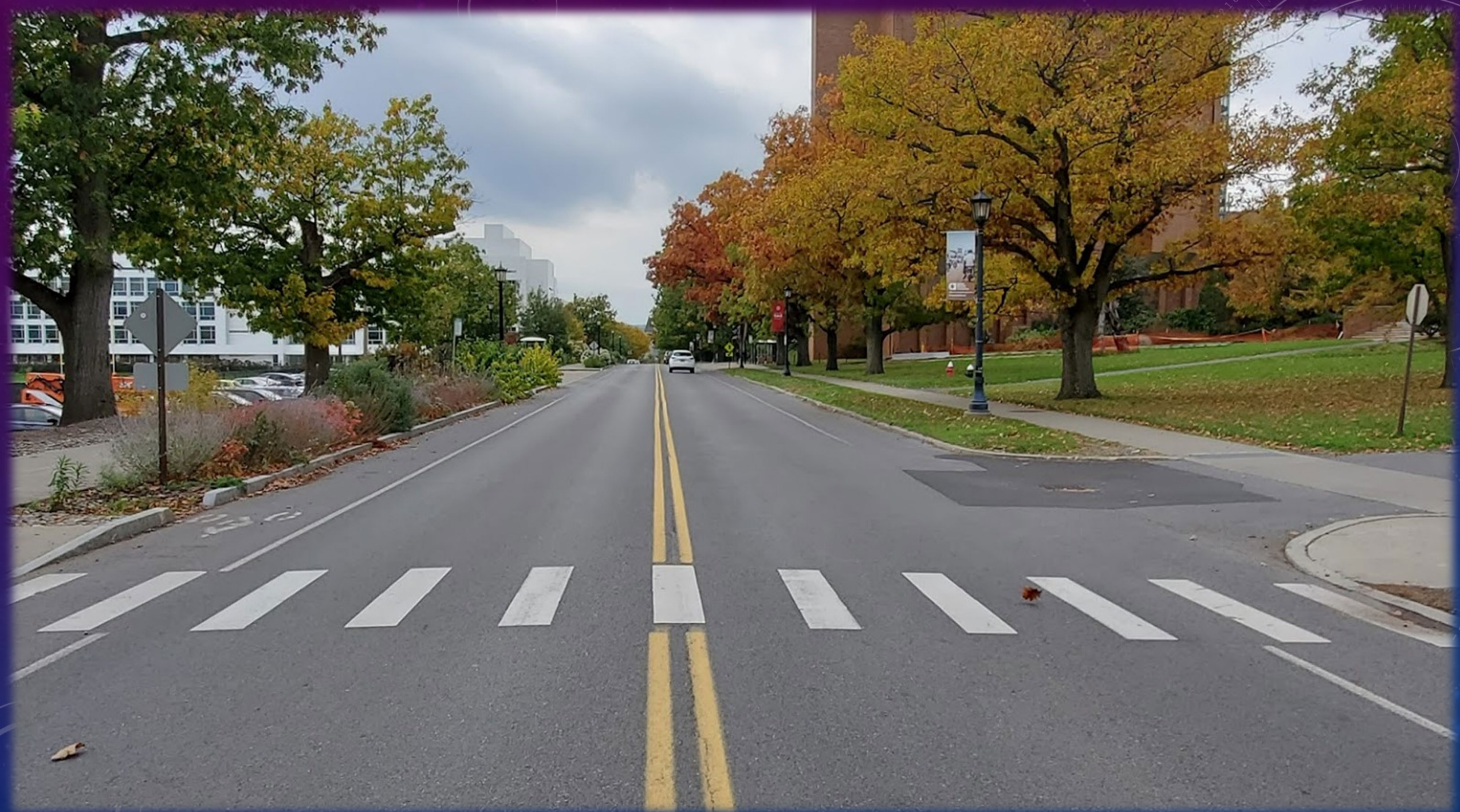












5a. What soil type is most frost susceptible?

- A. Gravels
- B. Sands
- C. Silts
- D. Clays



2
pts

5b. What soil type is most likely to be expansive ?

- A. Gravels
- B. Sands
- C. Silts
- D. Clays



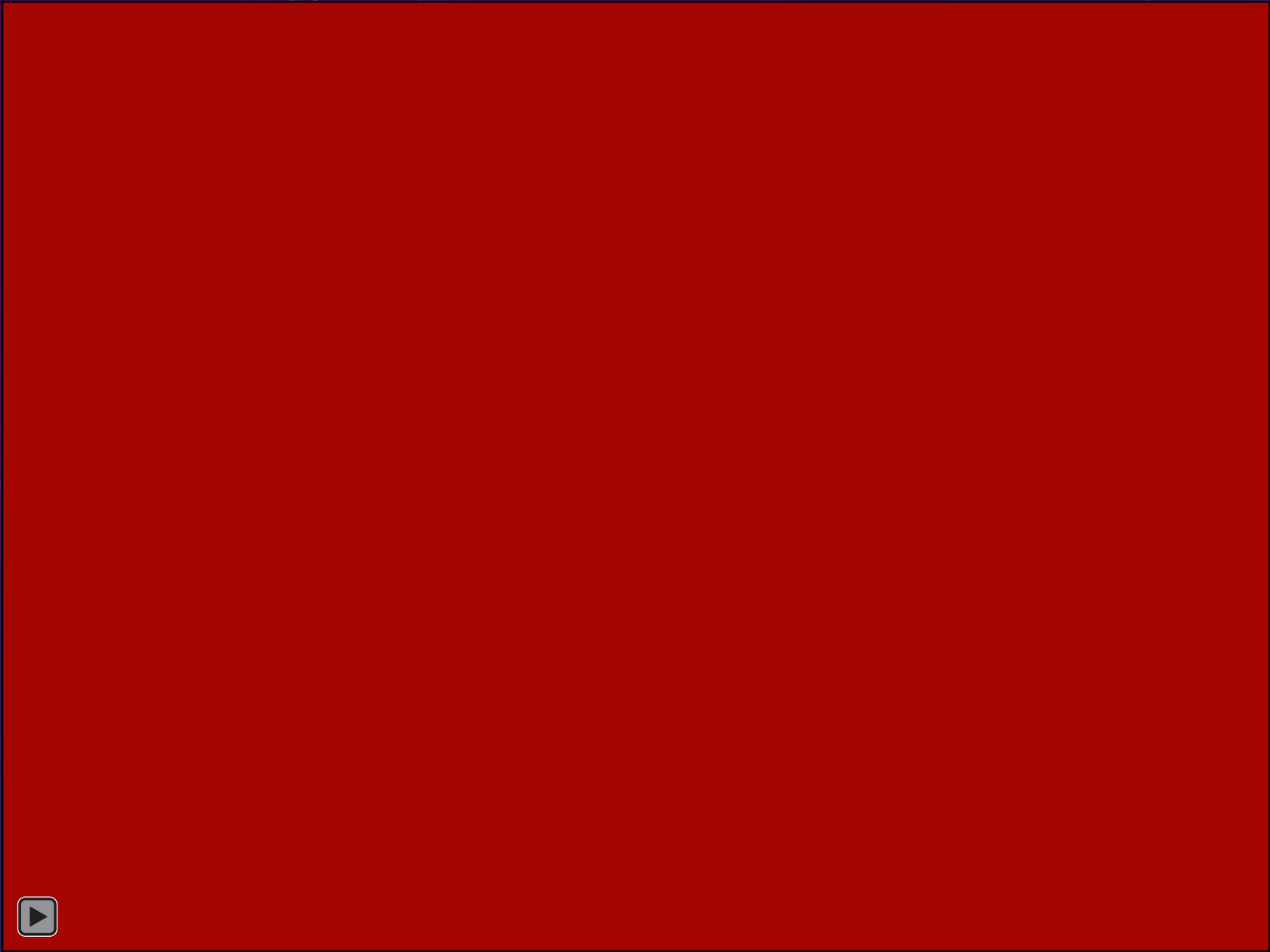
FROST ACTION IN SOILS

produced by

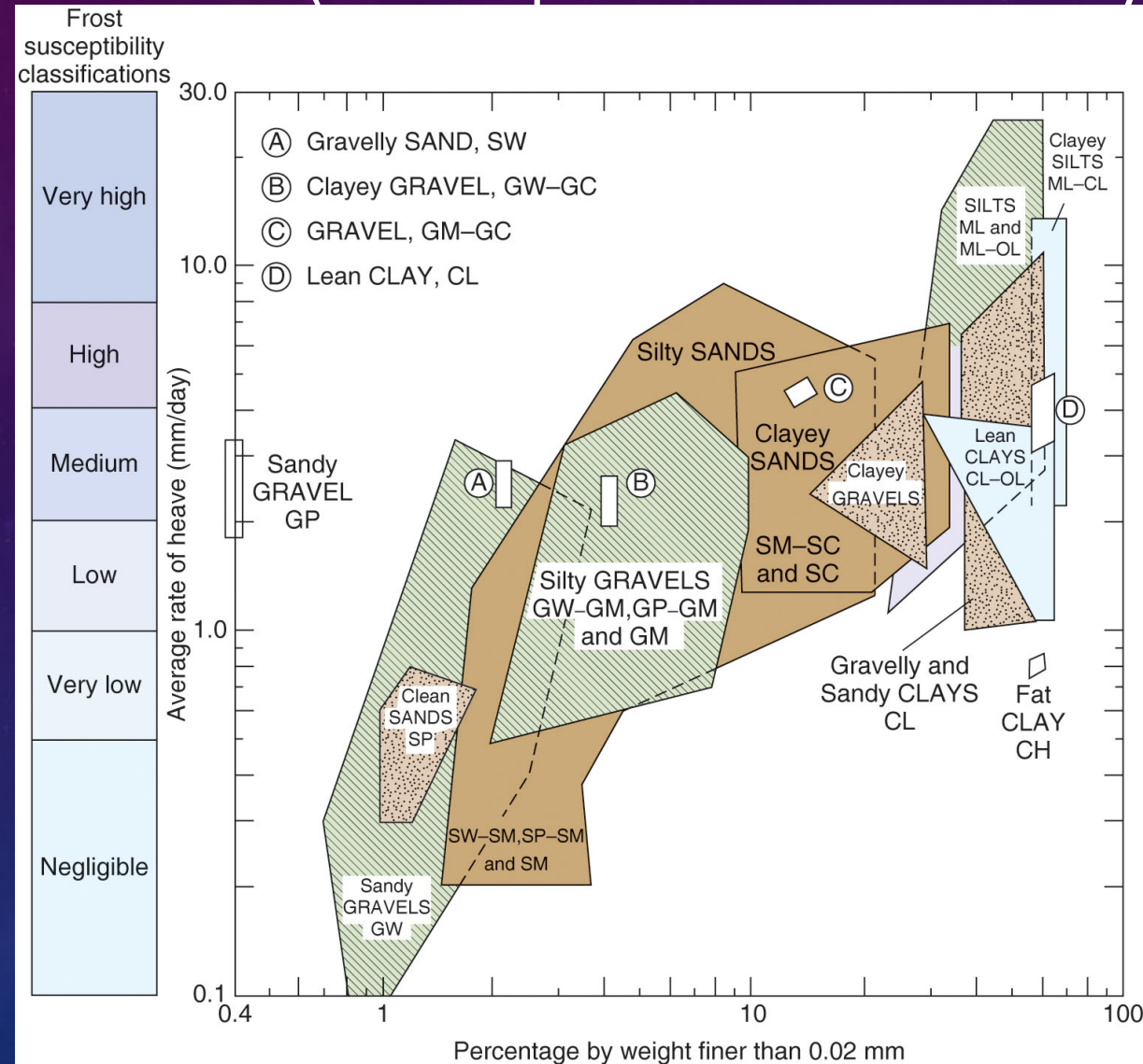


**US Army Corps
of Engineers**

**Cold Regions Research and
Engineering Laboratory**

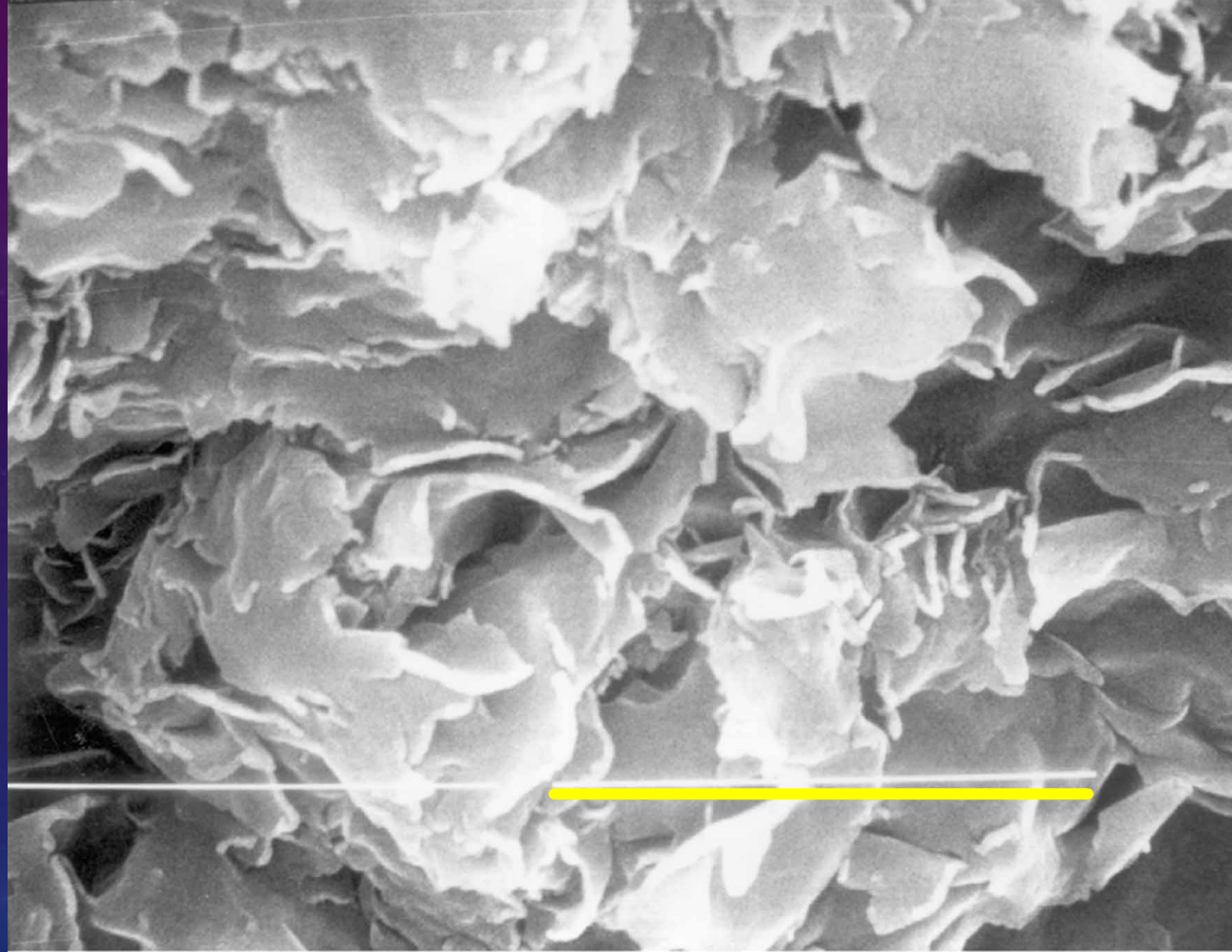


Rates of heave in laboratory freezing tests on remolded soils (U.S. Department of the Army, 1984).



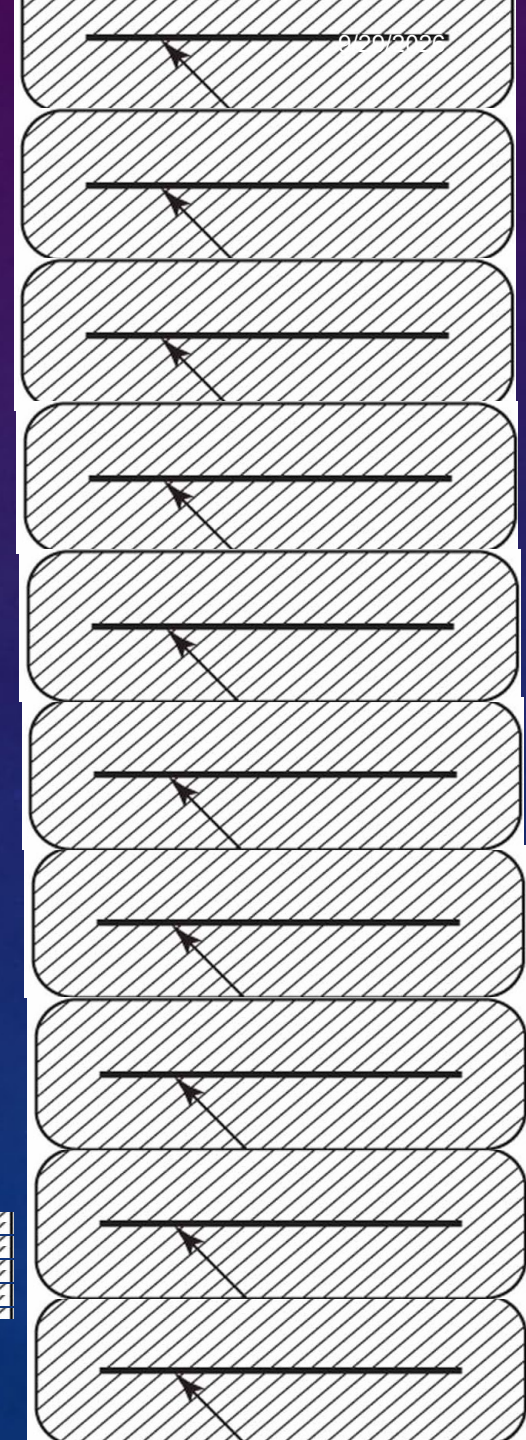
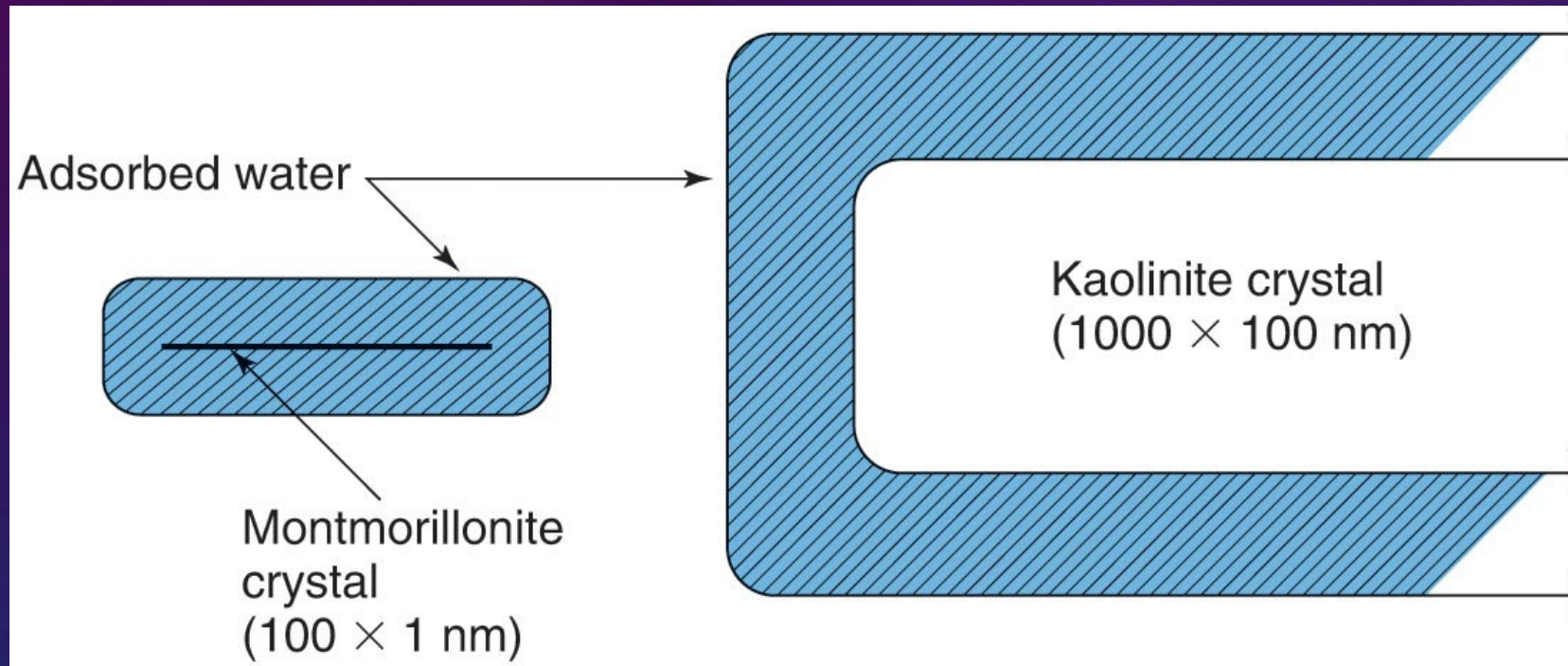


Scanning electron micrograph of Na-montmorillonite from Wyoming.
The length of the light bar is 5 μm (photograph by R. D. Holtz).

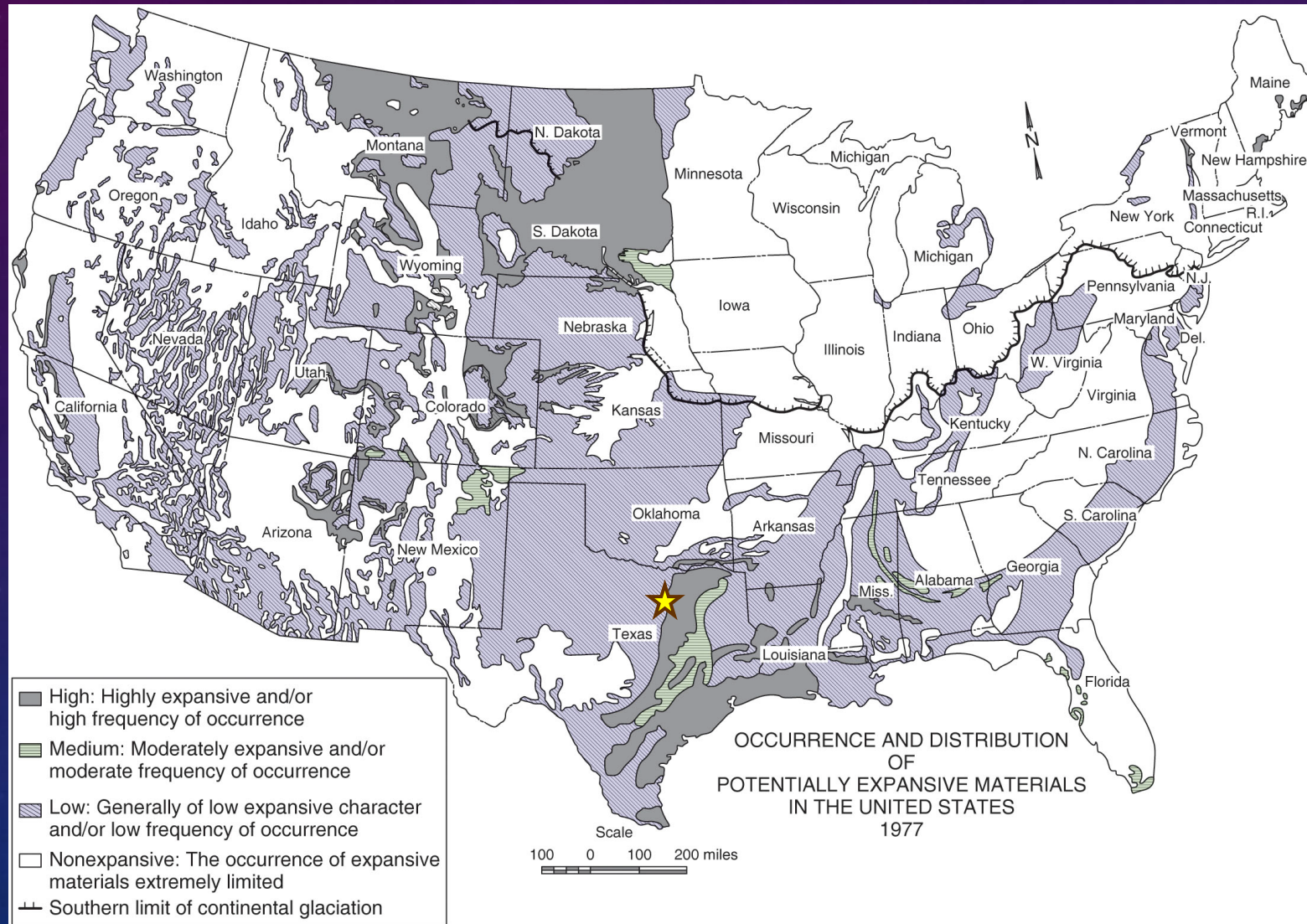


Copyright ©2011 Pearson Education, publishing as Prentice Hall

Relative sizes of adsorbed water layers on sodium montmorillonite and sodium kaolinite (after Lambe, 1958).



Occurrence and distribution of potentially expansive soils in the United States (after U.S. Army Engineer Waterways Experiment Station as presented by Nelson and Miller, 1992).



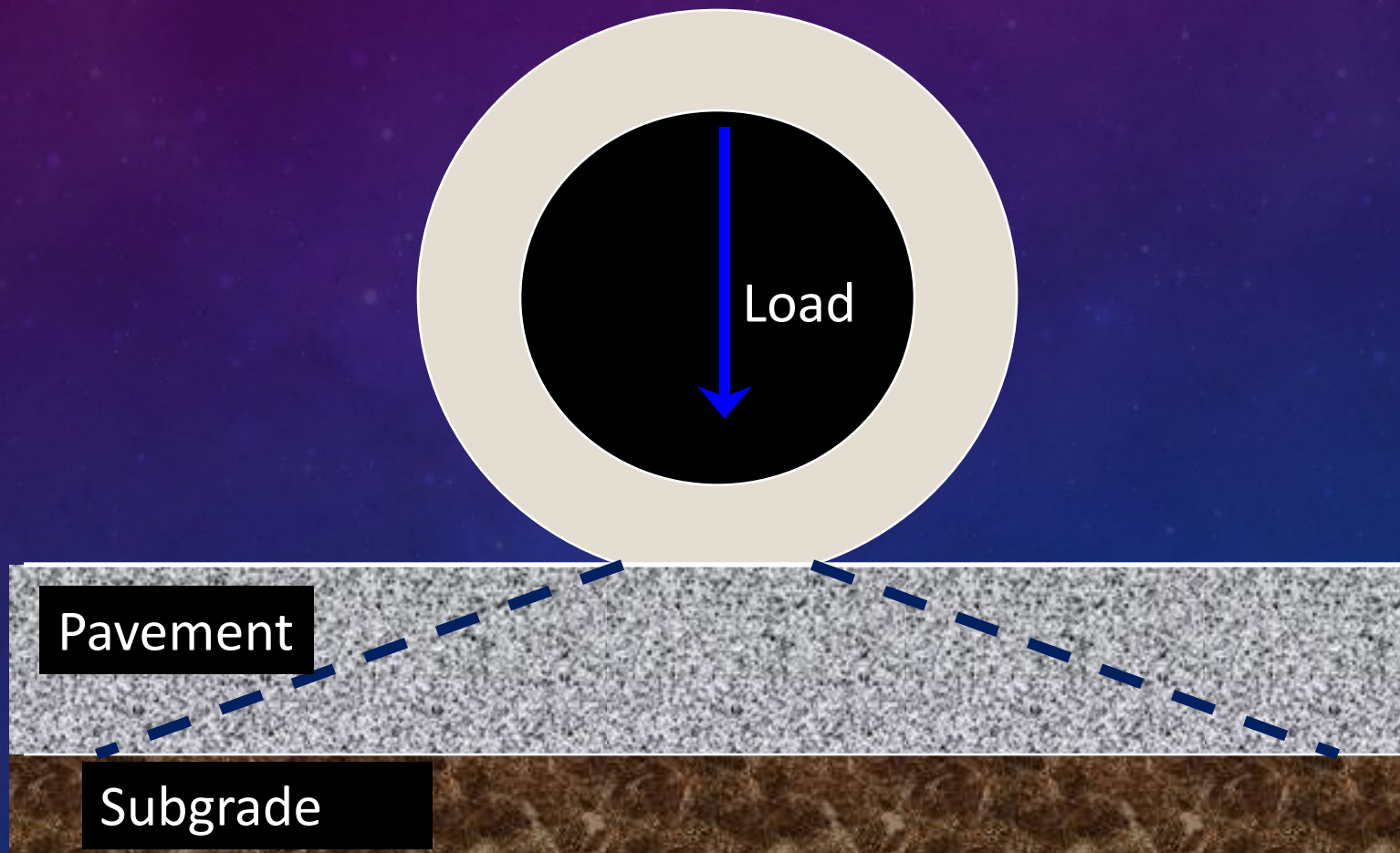
6. What is the effect of poor drainage on pavement life (typical county road)?

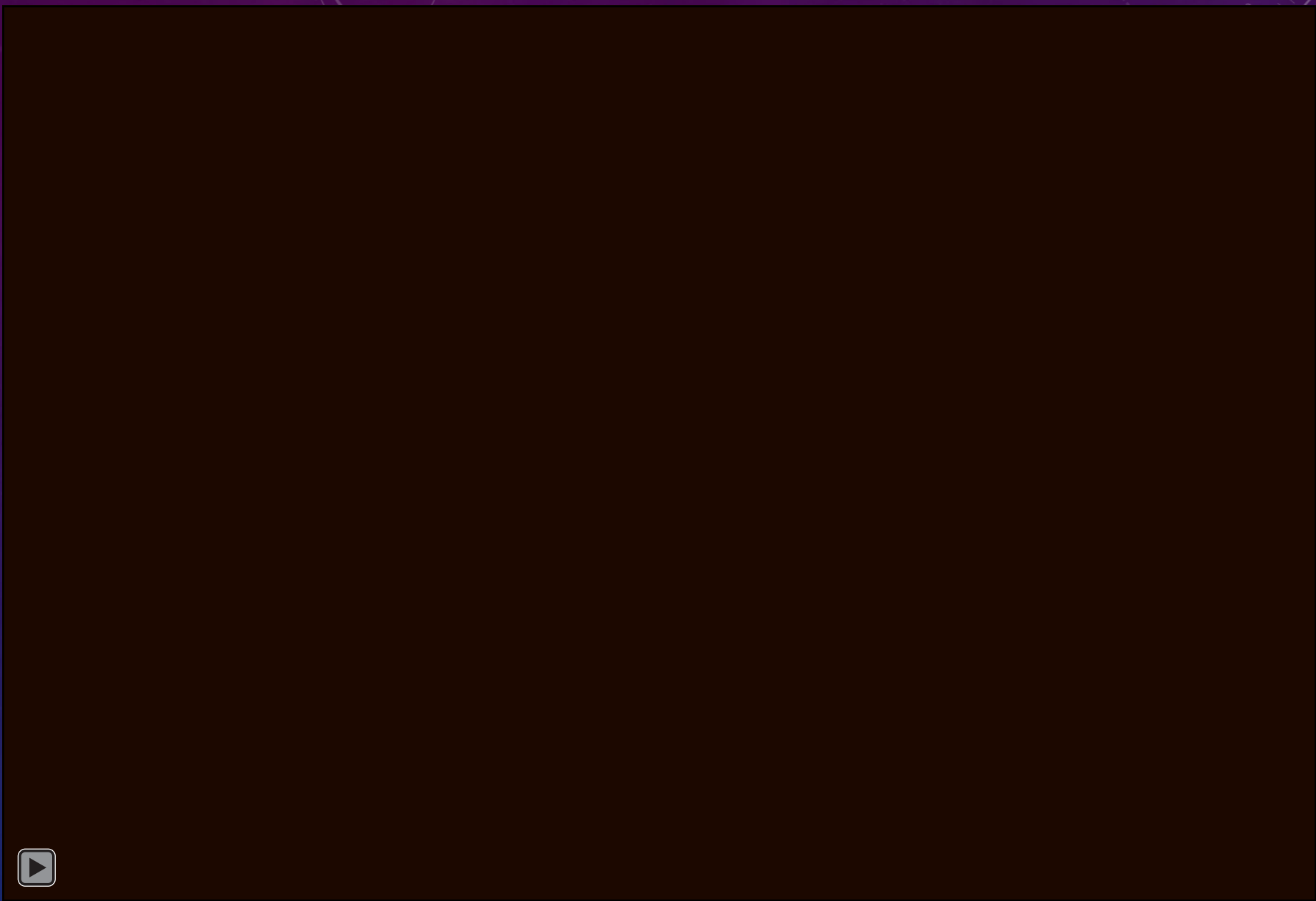
- A. No effect
- B. 10% reduction
- C. 25% reduction
- D. 50% reduction

2
pts



Why do we build pavements?





Simple Pavement

1,000 vpd

Drainage Quality	Design Life (years)
Good	14
Fair	10
Poor	7

Asphalt	4 inches
Base	12 inches
Subgrade	∞

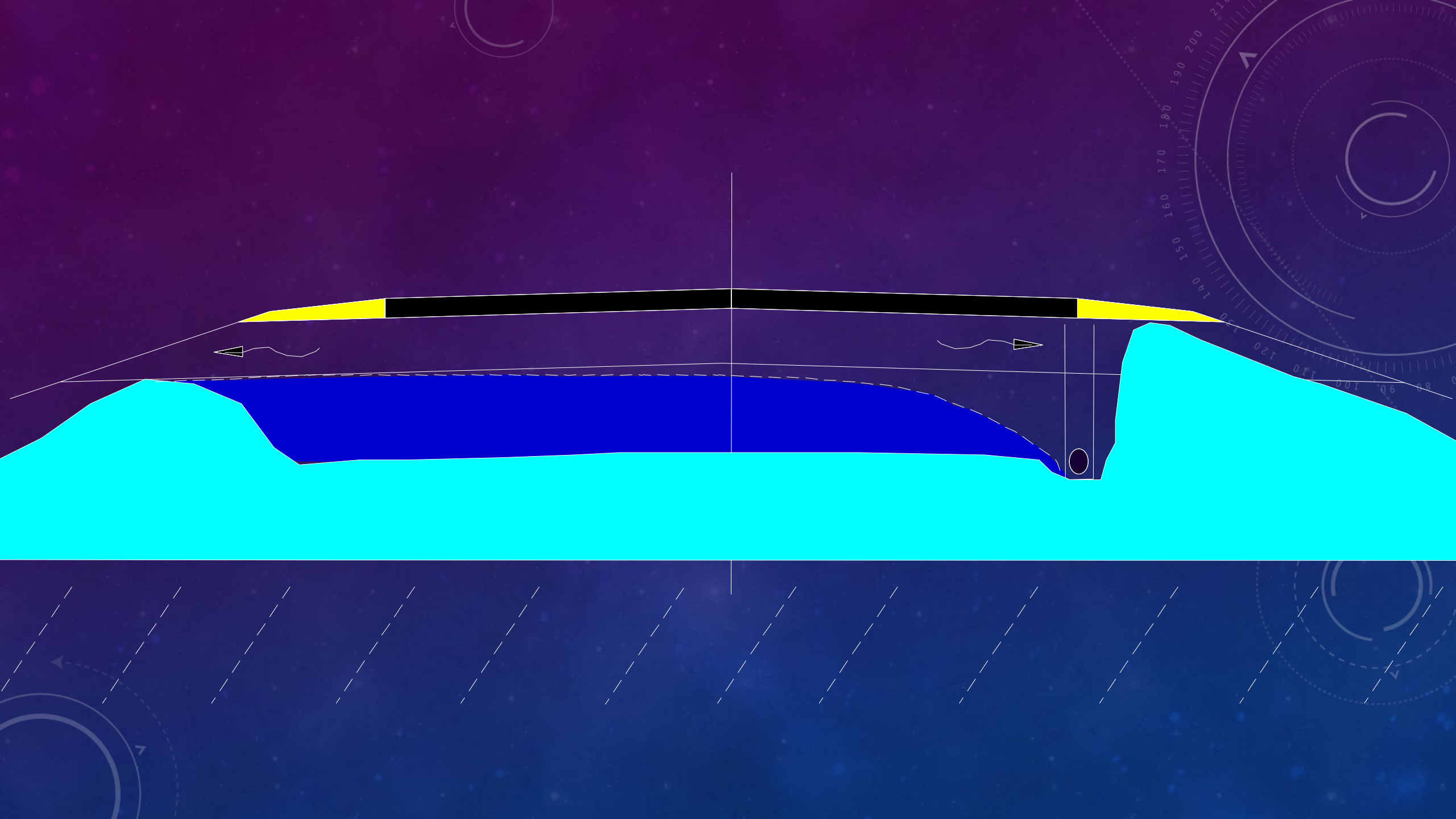


7. Subsurface drains can do all of the following except:

- A. Intercept subsurface water
- B. Lower water table
- C. Remove excess water
- D. Dry dirty subgrade

2
pts







8. Backfill around subsurface drains need to be:

- A. more permeable and act as a filter
- B. less permeable and act as a filter
- C. more permeable and not act as a filter
- D. less permeable and not act as a filter

2
pts





Backfill

Backfill	More Permeable?	Filter?	Use?
Existing Material	NO	NO	NO
Pea stone (no fabric)	YES	NO	NO
Pea stone (w/ fabric)	YES	YES	YES
Washed concrete sand	YES	YES	YES



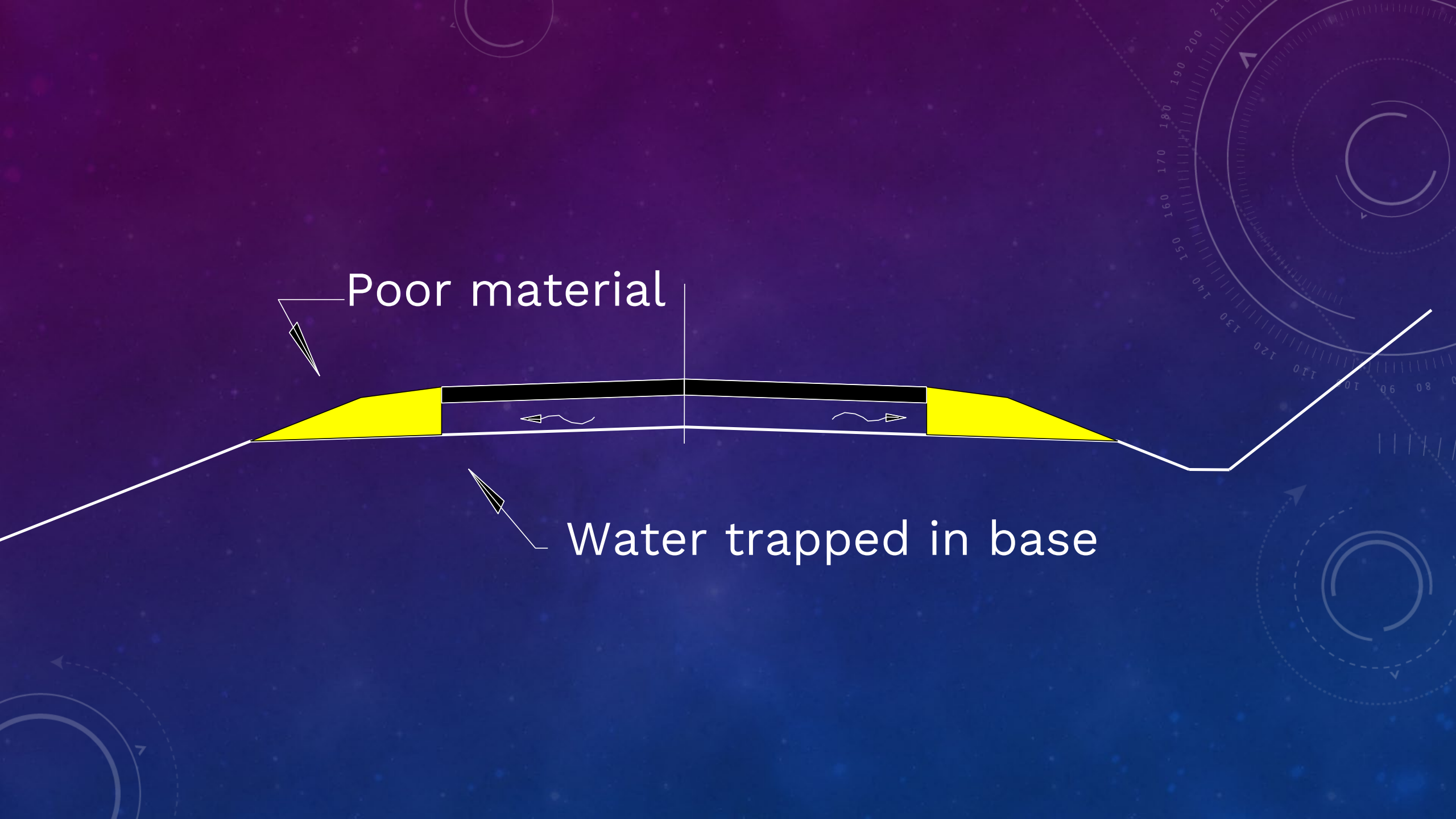


9. Chose two ways to fix a bathtub base problem:

1 pt
each

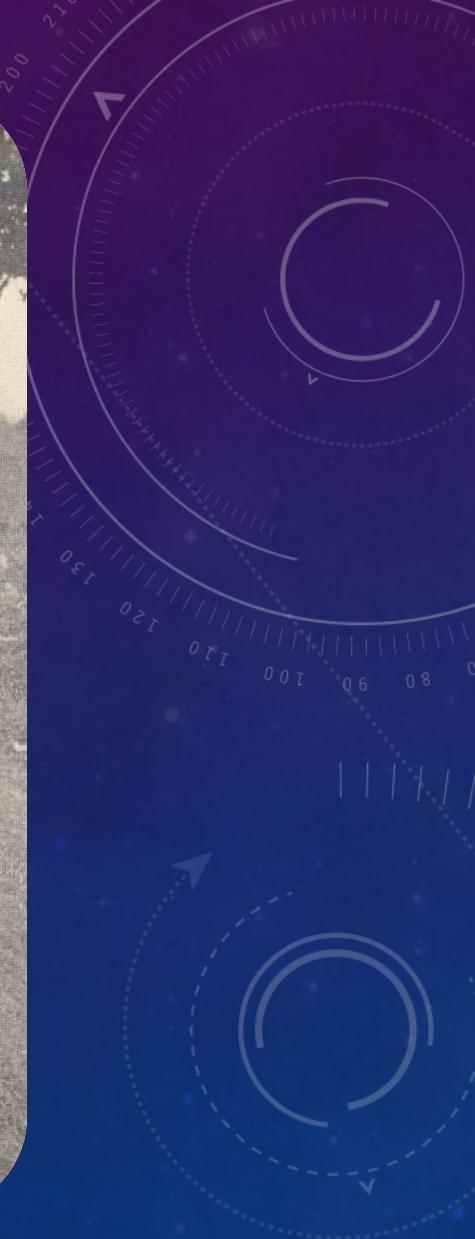
- A. install underdrain
- B. daylight base
- C. cut shoulders
- D. repave surface





Poor material

Water trapped in base





10. What is the number to call before you dig?

A. 811

2
pts







11. Culvert or Bridge?



Culvert

1 pt
each



Bridge



Bridge



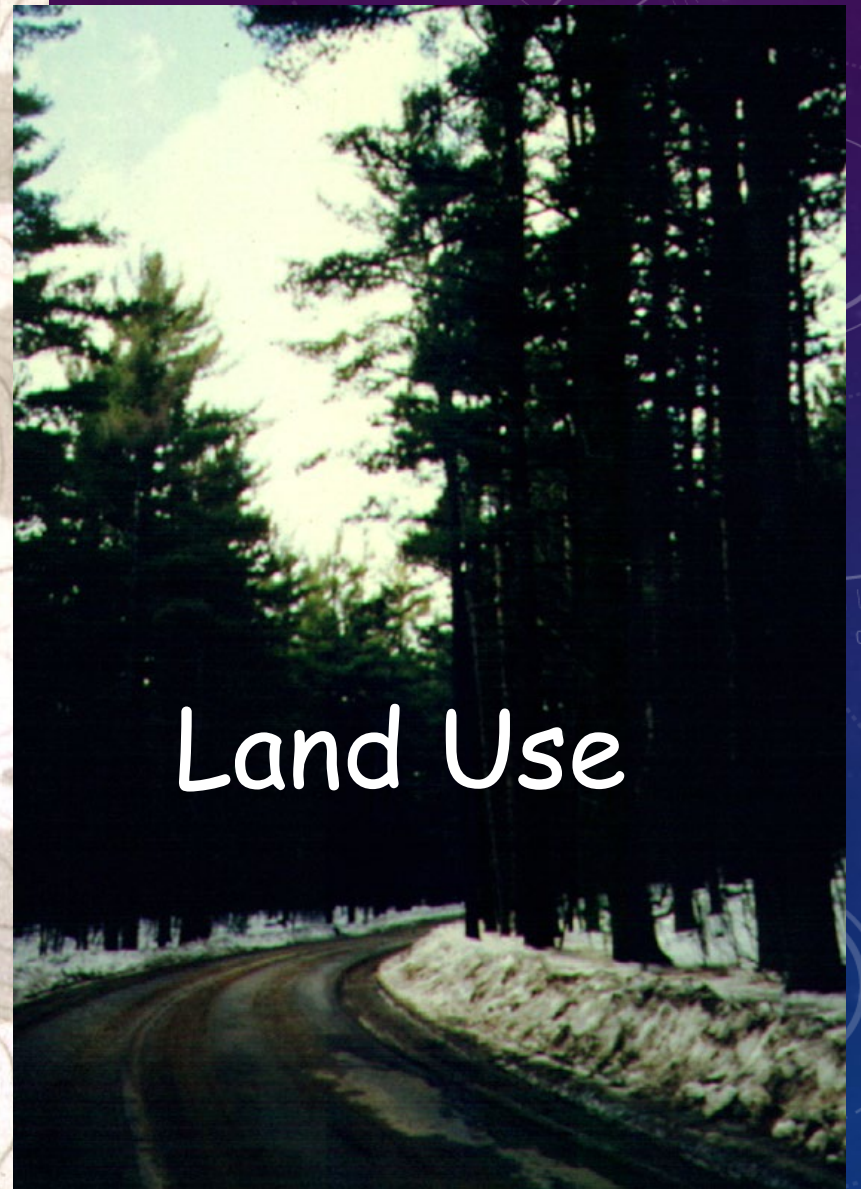
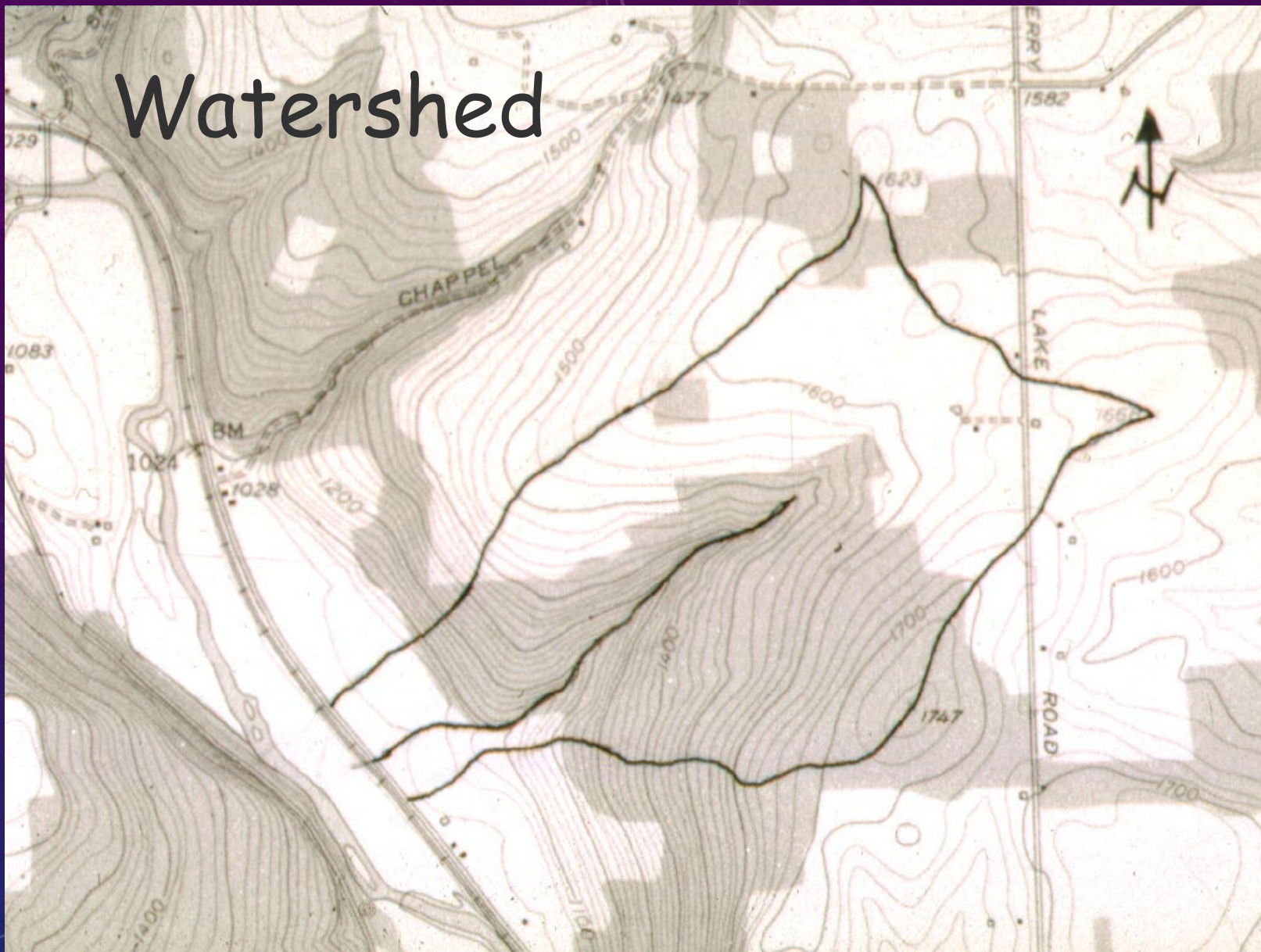
11. A 50-year storm?

- A. has 2% chance of occurring each year
- B. occurs every year
- C. occurs once every 50 years

2
pts



Watershed



Land Use

Design Storm





12. What is the expected design life of your cross-road culvert pipes?

A. 50 years?

2
pts





14. Which pipe materials are considered rigid?

- A. CMP
- B. Plastic
- C. Concrete

2
pts



15. Placement of compacted backfill around culverts is not critical.

- A. True
- B. False

2
pts







16. How many 12" culvert pipes are needed to have the same capacity as one 24" culvert pipe?

A. 4

2
pts



Area



452 in²



452 in²

17. Which has the highest capacity to carry flow for a short driveway pipe?

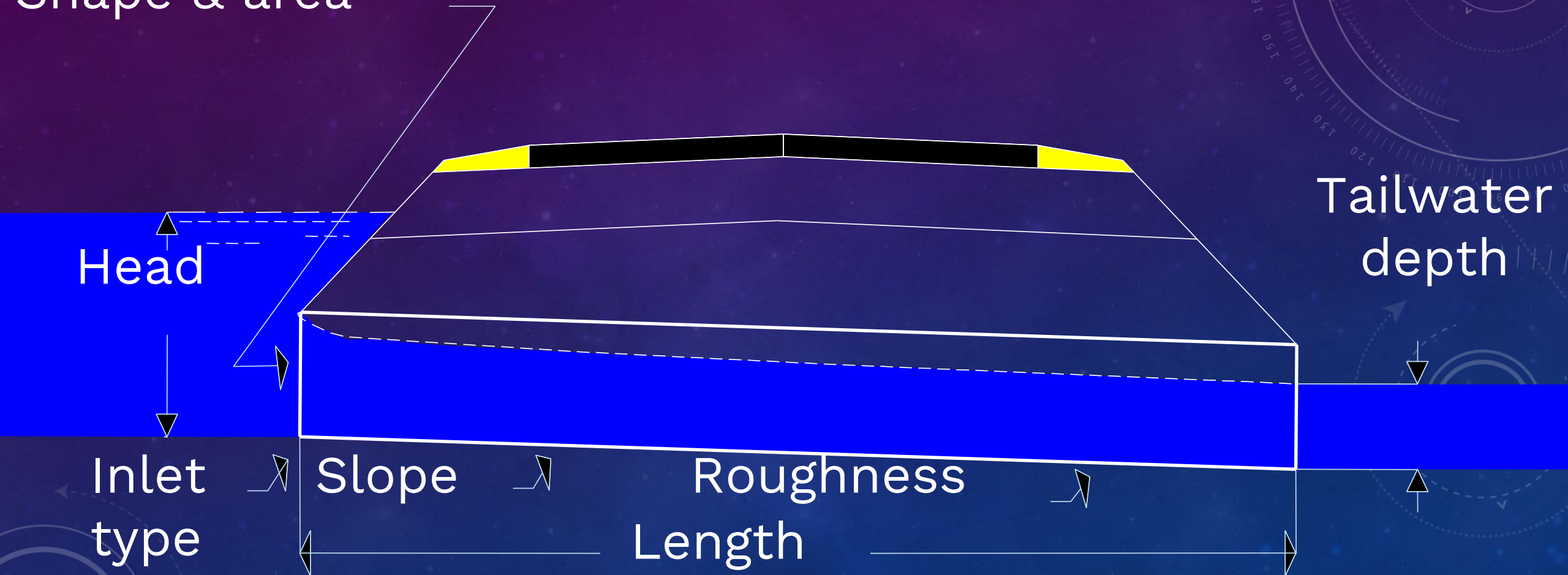
- A. 24" smooth-bore plastic
- B. 24" corrugated plastic
- C. 24" CMP

2
pts



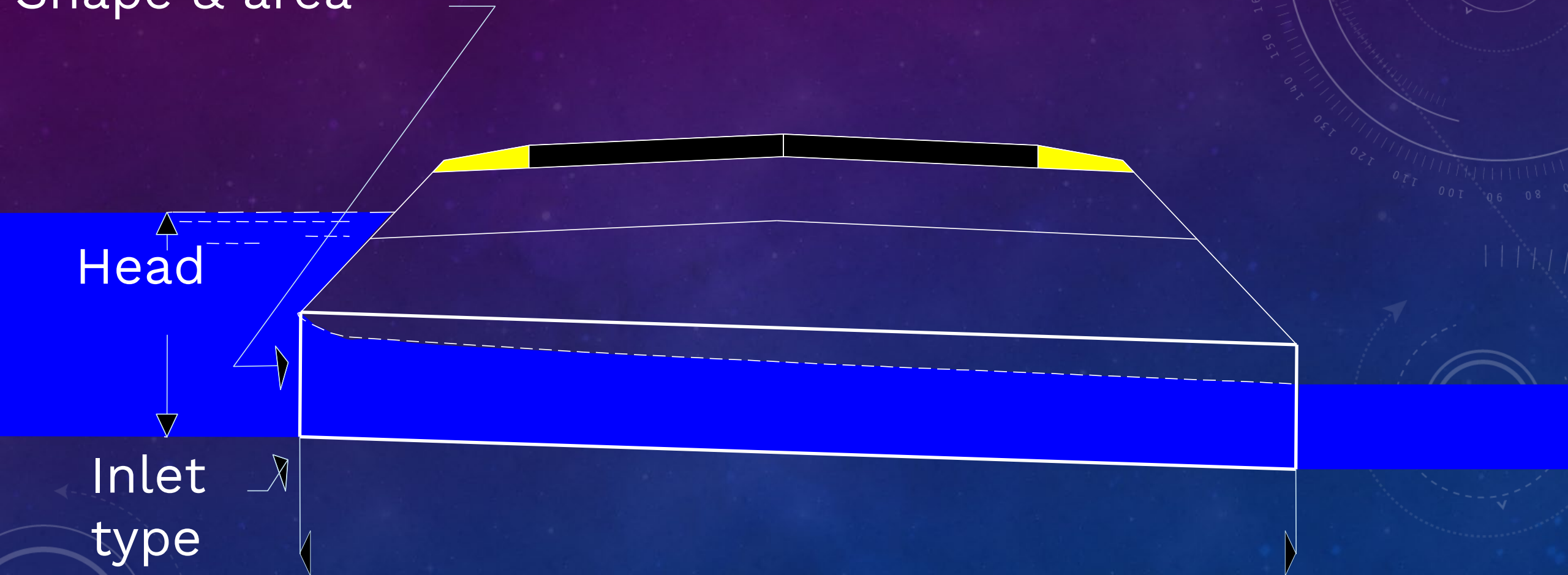
Outlet Control

Shape & area



Inlet Control

Shape & area





18. How much erosion occurs in one mile of ditch before you can detect it?

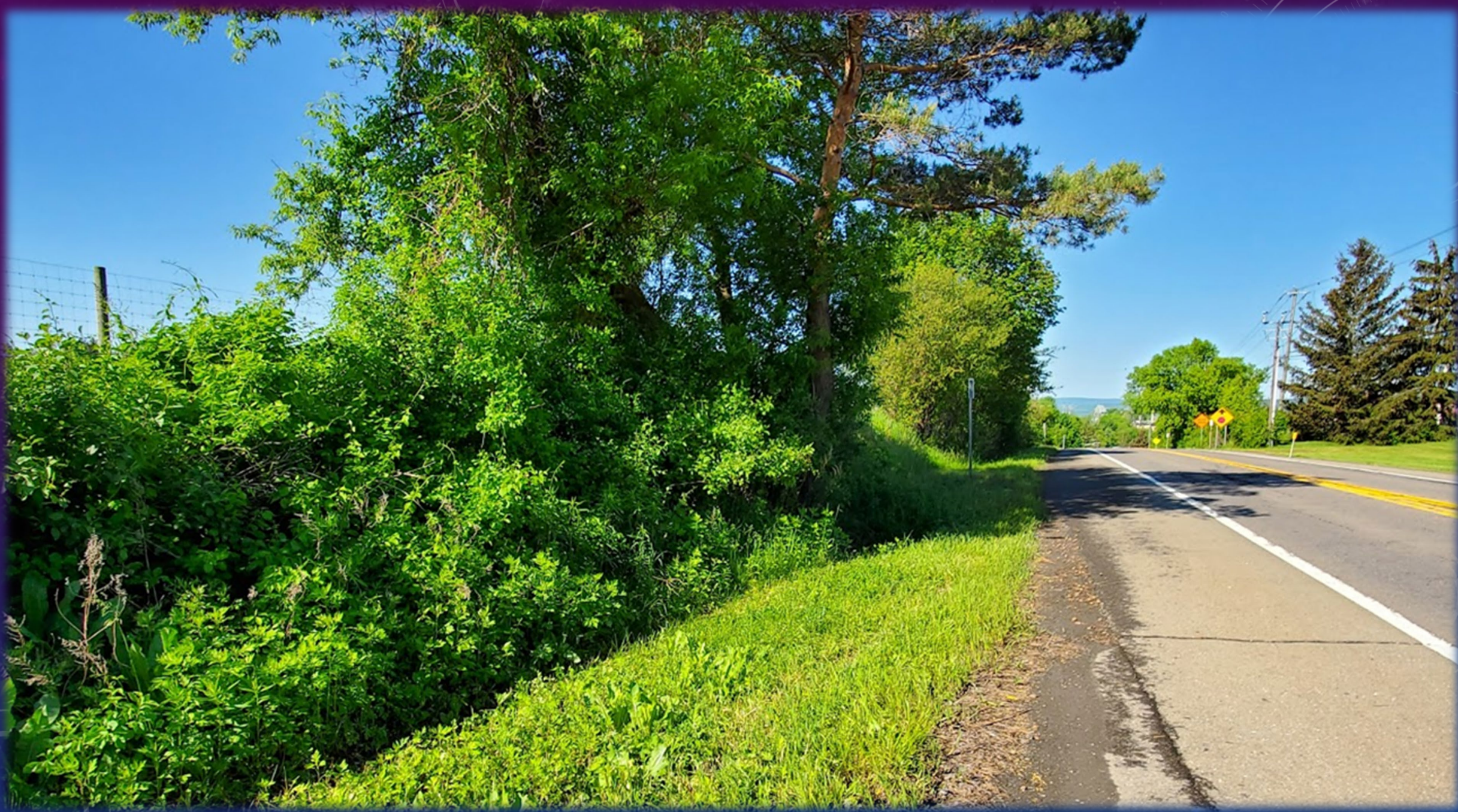
- A. 3 tons
- B. 30 tons
- C. 300 tons

2
pts









19. 3 critical components to a check dam?

- A. Constant slope
- B. Deep bedding
- C. Scour pad

1 pt
each







20. Of the three slope covers, which is best?

- A. Earth
- B. Vegetation
- C. Stone

2
pts





21. Landowner says you are dumping water on their property. Do you move the pipe?

- A. Yes
- B. No
- C. Maybe

2 pts





Max 50 pts

Total
Score?



New York State Local Technical Assistance Program

david.orr@cornell.edu



Department of Transportation
Local Technical Assistance Program

