

I. SOIL PROPERTIES

A. PARENT MATERIAL

1A. **Weathered bedrock** (page 8) – has **one or more** of the following:

- > 80% of material in diagnostic zone is so hard that roots will not grow into it (qualifies as bedrock limiting layer)
- < 80% of the material is hard, but sedimentary rock fragments are mainly angular, flat, or both
- Parent material does not meet the definition of another parent material

1B. **Till** (pages 8-9) – has **all** of these characteristics:

- Mixture of sand, silt, clay, and coarser material. There is no stratification/layering.
- Pebbles, if present, are mainly igneous, but in some areas, there is a mixture of underlying sedimentary rocks incorporated.
- Pebbles are usually rounded and randomly distributed.
- Can be weathered (non-calcareous) or unweathered (calcareous).
- Unweathered till may have platy structure; weathered till does not.
- Common texture and color combinations found in unweathered till:
 - Medium texture (loam) and brownish color (10YR 5/4, 5/6, 5/3) **or**
 - Moderately clayey texture (clay loam, silty clay loam) and near the brownish/gray color boundary (10Y 5/3, 5/4, 5/2)

1C. **Outwash/Lacustrine deposits** (page 9) – have **all** of these characteristics:

- Pebbles, if present, are mainly rounded and occur in layers (stratified)
- Material is **either**:
 - In the sandy texture group, and the sands are mainly > 0.5 mm in diameter (qualifies as a coarse sand & gravel limiting layer if it is thick enough), **or**
 - In any texture group and is stratified (consists of layers that are clearly visible)
- If official judges determine the parent material is outwash or lacustrine material, but the profile does not show clear stratification, or the material is not coarse sand & gravel, officials should give the parent material on the site card

1D. **Eolian sand** (pages 9 -10) – has **all** of these characteristics:

- Sandy or moderately sandy texture at the surface
- No gravel or pebbles present in the profile
- Sand grains are mainly fine and medium sand, 0.1 to 0.5 mm in diameter (between 150-grit and 40-grit sandpaper)
- Not stratified, but may have lamellae that are sandy or moderately sandy in the subsoil. Some soils formed in eolian sand may have moderately clayey subsoil texture

1E. **Loess** (page 10) – has **all** of these characteristics:

- Silty textures with little or no sand-size particles (silt, silt loam, or silty clay loam) in the topsoil that could extend into the subsoil
- No pebbles or, if present, very few, caused by animal activities or weathering processes
- May or may not be calcareous, but is never dense
- Not stratified, in contrast to water-deposited material

2A. **Alluvium** (page 10) – has **both** characteristics:

- The site is low in the landscape (on a flood plain)
- The soil has at least **one** of the following:
 - Distinct layers of light- and dark-colored soil material in the parent material zone
 - Calcareous material above 20 inches
 - On the site card, “Weak soil development” is circled “Yes”

2B. **Local overwash** (page 11) – has **all** of these characteristics:

- > 20 inches thick (but parent material identification zone may not include all 20”)
- Buries a darker horizon
- Soil horizons in and above the parent material zone have weak development
- Not on a floodplain

B. SLOPE (page 11)

- Measure the slope between two stakes near the soil pit
- The stakes are to be set 25 to 100 feet apart whenever possible

C. LANDFORMS

If landform does not meet any of the guidelines below, officials should write name of the landform on site card

Upland Landforms (pages 11-13) – has **both** characteristics:

- Parent material is weathered bedrock, till, or loess
- Soil has normal development

5A. **Upland hillslope** – slope is $\geq 3\%$

5B. **Upland swell** – slope is $\leq 2\%$ **and** surface is convex

5C. **Upland flat** – slope is $\leq 2\%$ **and** surface is flat (“Yes” is circled for “Flat landscape” on the site card)

5D. **Upland depression** – slope is $\leq 2\%$ **and** surface is concave

Outwash/Lacustrine Landforms (pages 11-13) – have both characteristics:

- “Weak soil development” is circled “No” on the site card
- The soil has one of the following:
 - Parent material is outwash or lacustrine deposit, with any slope
 - Parent material qualifies for eolian sand and slope is $\leq 2\%$

5E. **Outwash/Lacustrine hillslope** – slope is $\geq 3\%$

6A. **Outwash/Lacustrine swell** – slope is $\leq 2\%$ **and** surface is convex

6B. **Outwash/Lacustrine flat** – slope is $\leq 2\%$ **and** surface is flat (“Yes” is circled for “Flat landscape” on the site card)

6C. **Outwash/Lacustrine depression** – slope is $\leq 2\%$ **and** surface is concave

6D. **Dune** (page 13) – has both characteristics:

- Parent material is eolian sand
- Slope is $\geq 3\%$

6E. **Flood plain** (page 13) – has all of these characteristics:

- Parent material is alluvium
- Located low in the landscape
- “Weak soil development” is circled “Yes” on the site card

7A. **Filled depression** (page 13) – has all of these characteristics:

- Parent material is local overwash that is ≥ 20 inches thick
- Most nearby landforms are uplands or outwash landforms (not flood plains)
- “Weak soil development” is circled “Yes” on site card

D. SURFACE SOIL COLOR GROUP (pages 14 -15)

- Determine color from the center of the surface horizon, unless officials write a specific depth on site card
- Crush moist soil material
- Mark GRAY, BROWN or BLACK per chart on pg 14

E. PREVIOUS EROSION (pages 15 -16)

Examine the top eight inches of the soil. For soil plowed deeper than eight inches, examine the entire plow layer. Choose one of the following:

9A. **None to slight** if reference horizon:

- contains 76 to 100% topsoil material **or**
- underlain by an A or E horizon **or**
- site appears never to have been plowed

9B. **Moderate** –reference horizon contains 26 to 75% topsoil material

9C. **Severe** –reference horizon contains 0 to 25% topsoil material

F. SURFACE TEXTURE (pages 16 -18)

- Determine the texture group in the Ap horizon **or** the upper 8" of soil if the Ap is < 8" thick
- If conditions warrant, officials may write the depth on the site card at which students should obtain their soil sample, or officials may put samples in a bucket or box outside of the soil pit
- Soil groups contain the following standard texture classes:

10A. **Sandy** – S and LS

10B. **Moderately sandy** – SL

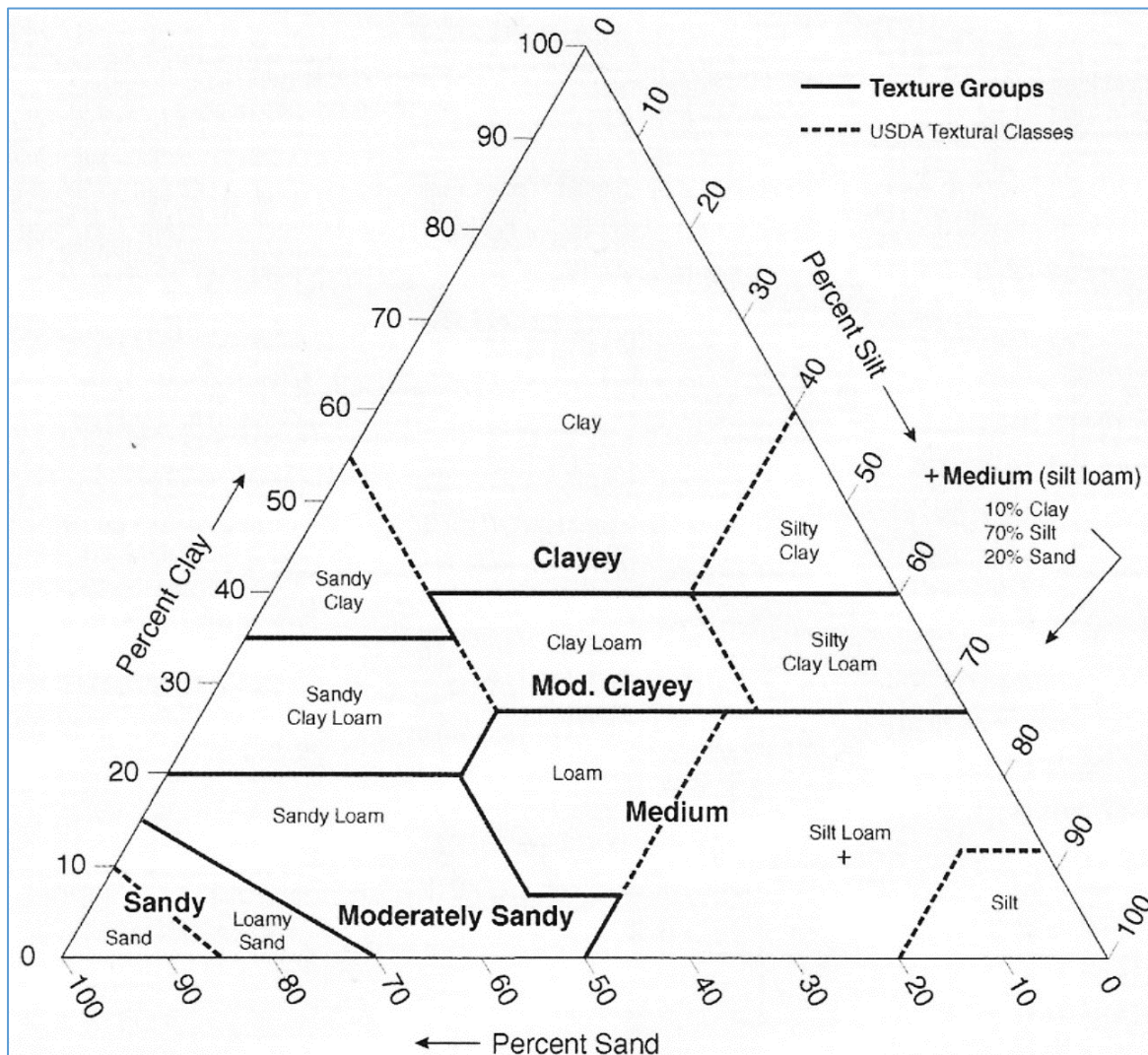
10C. **Medium** – L, SIL, SI

10D. **Moderately clayey** – SCL, CL, SICL

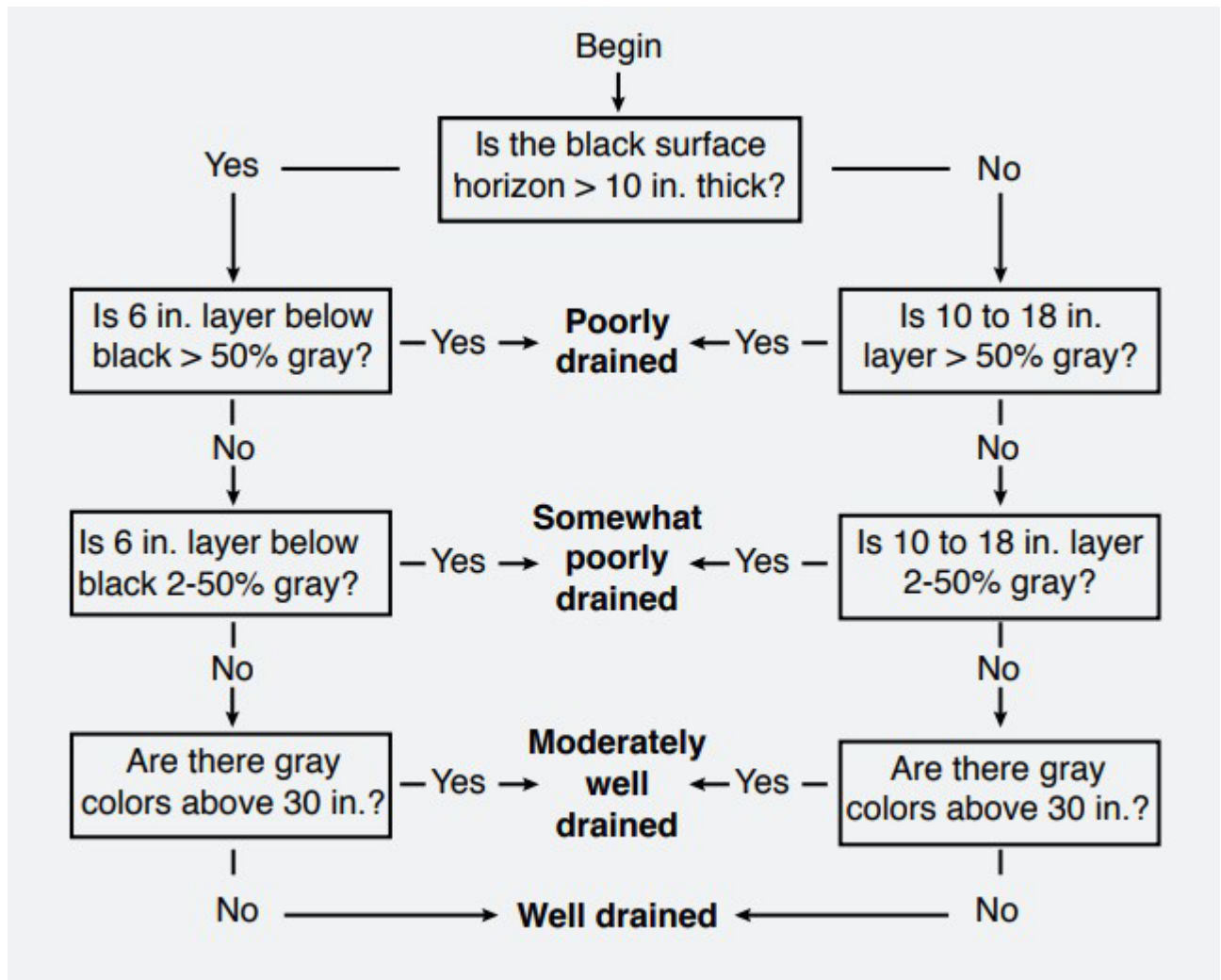
10E. **Clayey** – SC, C, SIC

G. SUBSOIL TEXTURE (pages 16 -18)

- Determine the texture group in the finest layer (contains the most clay) exposed below the surface horizon
- Soil groups are the same as for Surface Texture



H. NATURAL SOIL DRAINAGE (pages 18 -19)



I. LIMITING LAYER

- A layer must > 10” thick to be considered a limiting layer
- If the layer or material meets the requirements in an individual rule and extends to the bottom of the pit, assume it is > 10” thick, thus a limiting layer

13A & B. **Bedrock** (page 20) > 80% of the layer is rock material that meets one or both of the following:

- It can’t be cut with a spade or dug into with a knife *and/or*
- Roots can’t grow into it

13C & D. **Dense till** (page 20) – has **all** of these characteristics:

- Not all till is calcareous, but for this contest, all calcareous till is considered to be dense till
- Pebbles, if present, are mainly igneous, but in some areas, there is a mixture of underlying sedimentary rocks incorporated.
- Pebbles are usually rounded and randomly distributed.
- May have platy structure that is characteristic of unweathered till
- Common texture and color combinations found in dense till:
 - Medium texture (loam) and brownish color (10YR 5/4, 5/6, 5/3) **or**
 - Moderately clayey texture (clay loam, silty clay loam) and near the brownish/gray color boundary (10YR 5/3, 5/4, 5/2)

13E & 14A. **Fragipan** (page 21) – has **all** of these characteristics:

- Prisms that on average are $\geq 4''$
- Material inside the prisms is brittle
- Prisms contain few or no roots

14B & 14C. **Coarse sand & gravel** (page 21) – has **both** characteristics:

- Qualifies for the sandy texture group, and the sands are mainly > 0.5 mm in diameter (the size of 40-grit sandpaper)
- Gravel is usually present, but may be lacking

II. AGRICULTURE PRACTICES

A. LAND USE OVERVIEW

15. **Restore original vegetation** (page 23). Choose one:

- A. **Wetland** – if soil is poorly drained
- B. **Prairie** – has both characteristics:
 - SWP, MWD, or WD *and*
 - Black surface horizon > 10” thick
- C. **Mesic forest** - soil does not qualify for wetland or prairie

16. **Prime farmland** (page 23-24). Mark “YES” if soil has all of these properties:

- Subsoil texture is moderately sandy or finer *and*
- > 20” to bedrock or coarse sand & gravel limiting layer *and*
- Slope \leq 6% *and*
- Land form is NOT floodplain

B. EROSION AND COMPACTION POTENTIALS

17. **High potential for water erosion** (page 24). Mark “YES” if soil has one of these properties:

- \leq 20” to any limiting layer and slope is > 2% *or*
- > 20” to any limiting layer and slope is > 6%

18. **High potential for wind erosion** (page 24). Mark “YES” if soil has:

- Sandy or moderately sandy surface texture

19. **High potential for soil compaction** (page 24). Mark “YES” if soil has both properties:

- Natural drainage is somewhat poor *or* poor *and*
- Surface texture is moderately sandy *or* finer

C. BUFFERS AND COVER CROPS

20. **Grassed waterways** (page 25). Mark “YES” if soil has:

- 3 to 18% slope

21. **Windbreaks** (page 25). Mark “YES” if soil has:

- Sandy or moderately sandy surface texture

22. **Consider Filter strips** (page 25). Mark “YES” if soil has:

- \leq 18% slope

23. **Most significant benefit of cover crops** (page 25 - 26). Mark one of the following:
- A. **Scavenge nitrogen** if soil has either of these properties:
- 0 to 2% slope *or*
 - 3 to 6% slope *and*:
 - Sandy subsoil texture *or*
 - Coarse sand & gravel limiting layer
- B. **No need** to consider cover crop if
- > 18% slope (the soil should not be tilled)
- C. **Erosion control** - for all other soils

D. CROPPING PRACTICES

24. **Timber stand improvement (TSI)** (page 26). Mark “YES” for:
- All soils

25. **Permanent pasture** (page 26). Mark “YES” for soils with:
- $\leq 25\%$ slope

26. **Crop rotation** (page 26 - 27). Mark “YES” for soils with:
- $\leq 18\%$ slope

E. TILLAGE PRACTICES.

27. **No-till** (page 27). Mark “YES” for soils that have both properties:
- $\leq 6\%$ slope *and*
 - *Either*:
 - WD or MWD with any surface texture *or*
 - PD or SWP *with* moderately clayey or coarser surface texture

28. **Moldboard or chisel plowing** (page 27). Mark “YES” for soils that have all these properties:
- $\leq 2\%$ slope *and*
 - Medium or finer surface texture *and*
 - PD or SWD

F. WATER MANAGEMENT

29. **Drainage** (page 28). Mark “YES” for soils that have both properties:
- PD or SWP *and*
 - Landform is NOT a floodplain

30. **Irrigation** (page 28 - 29). Mark “YES” for soils that have **both** properties:

- $\leq 6\%$ slope **and**
- **Either:**
 - Subsoil texture is sandy or moderately sandy **or**
 - Coarse sand & gravel limiting layer < 40 inches from surface

31. **Terraces** (page 29). Mark “YES” for soils that have **all** these properties:

- WD, MWD, or SWP drained **and**
- $> 40''$ to any limiting layer **and**
- 3 to 12% slope **and**
- Subsoil texture is medium or finer

G. PLANT NUTRIENT APPLICATION

32. **Nitrogen** (page 29 - 30). Choose one:

- **High** – if soil has **all** these properties:
 - $> 40''$ to any limiting layer **and**
 - Subsoil **and** surface soil textures are medium or moderately clayey **and**
 - PD or SWP drained **and**
 - Surface color is black
- **Medium** – if soil has **all** these properties:
 - $> 20''$ to any limiting layer **and**
 - Subsoil **and** surface soil textures are moderately sandy or finer **and**
 - $\leq 12\%$ slope
- **Low** (or no nitrogen) – for soil that do not qualify for high or medium N application

33. **Phosphorus** (page 30). Choose one:

- **Add** – if available P is < 15 ppm
- **None** – if available P is 15 to 100 ppm
- **Deplete** – if available P is > 100 ppm

34. **Potassium** (page 30). Choose one:

- **Add** – if available K is < 100 ppm
- **None** – if available K is 100 to 250 ppm
- **Deplete** – if available K is > 250 ppm

35. **Lime** (page 30). Use pH indicated on site card

- **Add** – if soil pH ≤ 6.4
- **None** – if soil pH ≥ 6.5

H. NUTRIENT POLLUTION POTENTIAL

36. **Nitrogen pollution potential** (page 31). Choose one:

- **High for groundwater** – if soil has *both* these properties:
 - Sandy *subsoil* *and/or* coarse sand & gravel limiting layer *and*
 - MWD or WD drained
- **High for surface water** – if soil has *both* these properties:
 - PD or SWP drained *and*
 - Any landform BUT floodplain
- **Medium** – for all other soils

37. **Phosphorus pollution potential** (page 31). Choose one:

- **High** – soils with > 12% slope
- **Medium** – for soils with:
 - 7 to 12% slope *or*
 - 3 to 6% slope with medium or moderately clayey *surface* texture
- **Low** – for all other soils

III. HOME SITE PRACTICES

A. SITE SELECTION AND CONSTRUCTION PRACTICES

15. **Is the soil suitable for a homesite?** (page 33). Choose one:

A. **YES** – if the landform IS NOT a floodplain or a filled depression

B. **NO** – if the landform is a flood plain or a filled depression

NOTE: if you mark “NO” to this question, then questions 16 - 38 should also be marked NO.

16. **Preserve existing trees and plant new ones?** (page 33). Mark “YES” for

- All sites

17. **Maintain soil cover during construction?** (page 34). Mark “YES” if

- > 2% slope *or*
- Any slope if surface texture is sandy or moderately sandy

18. **Improve surface drainage?** (page 34). Mark “YES” for soils that have both properties:

- PD or SWP drained *and*
- 0 to 2% slope

19. **Is the soil suitable for a basement?** (page 34). Mark “YES” for soils that have all these properties:

- Well drained *and*
- Bedrock > 40” from soil surface *and*
- ≤ 12% slope

20. **Design for high-clay subsoils?** (page 34 - 35). Mark “YES” if

- Subsoil texture is clayey

21. **Potential construction hazards on slopes?** (page 35). Mark “YES” if

- > 12% slope

22. **Install diversion structures and drains?** (page 35). Mark “YES” for soils that have both properties:

- > 2% slope *and*
- *Either:*
 - Bedrock, dense till, or fragipan limiting layer < 40” from soil surface *or*
 - Subsoil texture is moderately clayey or clayey

23. **Provide foundation drainage?** (page 35-36). Mark “YES” for soils with these properties:

- MWD, SWP, or PD, regardless of other properties *or*
- WD soils that do NOT have:
 - Sandy subsoil texture *and/or*
 - Coarse sand and gravel limiting layer < 40” from the soil surface

24. **High risk for cave-in during construction?** (page 36). Mark “YES” for soils that have one or both properties:

- Landform is Dune, Outwash/Lacustrine, or Floodplain, *and/or*
- Any PD soil, regardless of landform

B. LANDSCAPE AND LAWN PRACTICES

25. **Manage soil reaction for acid-loving shrubs** (page 36). Choose one:

- A. **No application** – if soil pH is ≤ 5.6
- B. **Apply sulphur** – if soil pH is 5.7 to 7.9
- C. **Plant other species** - if soil pH is ≥ 8.0

26. **Manage soil reaction for lawns** (page 36). Choose one:

- A. **Apply lime** – if soil pH is ≤ 5.9
- B. **No application** – if soil pH is 6.0 to 7.5
- C. **Plant other species** - if soil pH is ≥ 7.6

27. **Apply phosphorus to lawn** (page 36 - 37). Mark “YES” if

- available P is < 25 ppm

28. **Apply potassium to lawn** (page 36 - 37). Mark “YES” if

- available K is < 75 ppm

C. ON-SITE SEWAGE DISPOSAL SUITABILITY

29. **Is the soil suitable for an absorption field?** (page 37). Mark “YES” for all soils **EXCEPT** those with one or more of these properties:

- Bedrock, fragipan, sand and gravel, or dense till limiting layer < 20” from the soil surface
- Slope > 25%
- Upland depression or outwash depression landform

NOTE:

- *If you mark “NO” to this question, then questions 30-38 should also be marked “NO” or “N/A”*

D. SEPTIC TANK CARE PRACTICES

30. **Septic tank outlet filter cleaning interval** (page 38). Choose one:

- A. **6 months** – if 4 or more people live in the home
- B. **1 year** – if 1 to 3 people live in the home
- C. **N/A** - if #29 was marked NO

31. **Septic tank pumping interval** (page 38).

A. **1 to 2 years**

B. **3 years**

C. **4 years**

D. **≥ 5 years**

E. **N/A** – if # 29 was marked NO

$$PI = \frac{(10 \text{ or } 7)^* \times (\text{tank capacity in gallons})}{\# \text{ residents living in home}}$$

* If NO garbage disposer use 10

If YES garbage disposer use 7

Round 0.5 DOWN to nearest whole number!

E. SOIL ABSORPTION FIELD PRACTICES

32. **Subsurface trench, gravity flow system** (page 39-40). Mark “YES” if soil has **all** these properties:

- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 40” from soil surface ***and***
- WD ***and***
- Subsoil texture is medium or moderately sandy ***and***
- ≤ 12% slope

33. **Subsurface trench, flood dose system** (page 40). Mark “YES” if soil has **all** these properties:

- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 40” from soil surface **and**
- WD **and**
- *Subsoil* texture is moderately clayey or clayey **and**
- $\leq 12\%$ slope

34. **Subsurface trench, pressure distribution system** (page 40). Mark “YES” if soil has **all** these properties:

- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 40” from soil surface **and**
- WD **and**
- *Subsoil* texture is sandy **and**
- $\leq 12\%$ slope

35. **Elevated sand mound system** (page 40 - 41). Mark “YES” if soil has **all** these properties:

- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 20” from surface **and**
- WD or MWD **and**
- $\leq 6\%$ slope

36. **Elevated sand mound system & perimeter drainage** (page 41 - 42). Mark “YES” if soil has **all** these properties:

- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 20” from soil surface **and**
- SWP or PD **and**
- $\leq 6\%$ slope

37. **Drip distribution system and secondary treatment** (page 42).

Please assume a Perimeter Drain is installed with this sewage treatment system.

Mark “YES” if soil has **all** these properties:

- No bedrock limiting layer < 20” from soil surface **and**
- WD or MWD if a perimeter drainage is installed **or**
- $\leq 25\%$ slope

38. **Secondary treatment** (page 42). Mark “YES” if:

- At least one soil absorption field practice is marked “YES”