MURRAY STATE UNIVERSITY

Hutson School of Agriculture

NACTA Judging Conference 2019

2-Year Soils Contest Official Rules

Friday, April 12th
Location and Time to Be Determined

Contest Directors:

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CONTEST RULES – TWO YEAR DIVISION

1. Each team will consist of four (4) members judging four (4) sites. Four (4) alternates may accompany the team and compete for individual awards only. The top three (3) scores per site will be used to tabulate team scores.

2. A tiebreaker system for individuals will involve estimates of the percent sand and clay for the surface horizon. Ties will be broken using the estimates in the order of clay then sand. Individual total score ties will be broken by using site scores in pit order (i.e. pit 1, then pit 2, etc.) Tabulating all four (4) members' cumulative scores will break team ties.

3. Contestants will be allowed sixty (60) minutes to judge each site. The time in and out of the pit will be as follows: 5 minutes in/out, 5 minutes out/in, 10 minutes in/out, 10 minutes out/in, 5 minutes in/out, 5 minutes out/in, and 20 minutes free time for all to finish. The contestants who are first "in" and "out" will switch for the next pit to allow equal opportunity for all contestants to be first in or first out. NOTE: This timing schedule may be modified depending on the number of teams and contestants participating. However, each individual will have at minimum 60 minutes at each site.

4. Contestants may use a clipboard, hand level, containers for soil samples, pencil (no ink pens), knife, water and acid bottles, Munsell color book (Hue 1OR to Hue 5Y, Gley 1 & 2), simple calculator, and ruler or tape (metric preferred since all depths will be in cm). A textural triangle may be used to assist contestants in completing the percent sand, silt and clay tiebreaker. Triangles will be supplied at the contest. One is enclosed for your use prior to the contest in Attachment 1. A 2 mm sieve for estimating rock fragments may be used. Rating charts, but not their written explanations, for use in the interpretations section of the scorecard will be supplied at each site. You do not have to memorize the charts, but you should know how to use them.

5. In each pit, a control zone will be clearly marked and is to be used only for the measurement of horizon depths/boundaries. This area will be the officially scored profile and must not be disturbed. The profile depth to be considered, number of layers to be described, and any other relevant data, will be provided at each site. A marker will be placed somewhere in the third horizon to assist contestants in keeping in line with the official description. The depth in centimeters from the surface to the marker will be given on the site card. Since 2-year colleges focus on different aspects of soil science than their 4-year counterparts, there have historically been two different rule books for the NACTA Soils Contest. Consequently, the host institution is strongly encouraged to provide a separate control zone for 2-year judgers in the contest pits; these control zones should be scored by contest officials using the 2-year rule book.

6. Stakes with flagging will be set near each site for slope measurement. Slopes will be measured between the stakes that are set at approximately the same height.

7. Contestants will not be allowed to communicate with other contestants or coaches during the contest. No cell phones are allowed to be used at any time during the contest

8. Pit monitors will be present to enforce rules and keep time. The official judges for the contest will be NRCS soil scientists.

9. Each contestant must give his or her score card to the pit monitor before moving to the next site. Write your name, contestant number, college, and site number on each card. Use abbreviations for all columns except depth.

SCORE CARD INSTRUCTIONS

I. SOIL MORPHOLOGY: In each pit, you will be asked to evaluate up to six horizons, and describe them using standard terminology. The number of horizons to be judged will be on a card at each pit. For each horizon, evaluate layer depth, boundary distinctness, texture, rock fragments, color, structure, moist consistency, and accumulations. Be sure to write clearly. Then, based on your understanding of soils, your description, and these instructions, complete the back side of the score card (Parts II and III). A complete list of acceptable abbreviations is in these instructions.

1. HORIZON: (See SSM 3-117-122) Students should label each layer with the abbreviation for <u>one</u> mineral genetic horizon/layer (A, B, C, E, or R). If a horizon is a transitional horizon (e.g. AB, BA) or a combination horizon (e.g. A/B, B/A), students should record the genetic horizon whose properties dominate the layer (e.g. an AB or A/B would be A, a BA or B/A would be B). Official judges may decide to allow more than one correct answer for such horizons.

- A Horizon – Horizon formed at the surface that exhibits either an accumulation of humified organic matter, or properties resulting from cultivation or pasturing.
- E Horizon – Horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these, leaving a concentration of sand and silt particles.
- B Horizon – Horizon formed below an A or E, that shows one or more of the following: illuvial concentration of silicate clay, iron, aluminum, humus, carbonates, gypsum, or silica; evidence of removal of carbonates; residual concentration of sesquioxides; coatings of sesquioxides; alteration that forms silicate clay or liberates oxides and forms granular, blocky, or prismatic structure; or brittleness.
- C Horizon – Horizons, excluding hard bedrock, that are little affected by pedogenesis and lack properties of A, B, or E horizons.
- R Layer – Hard bedrock. The layer is sufficiently coherent when moist to make hand digging with a spade impractical.

2. BOUNDARY - DEPTH: (see SSM 3-134-135) Horizon depths often cause problems. In order for the students and judges to have a common base, we will use the following guidelines.

Up to six horizons will be described within a specified depth. You should determine the depth in cm, from the soil surface to the lower boundary of each layer. Thus, for a layer that occurs 23-37 cm below the surface, you should enter 37. To receive credit for the last horizon's lower boundary, students are to write down the lower depth given on the site card. Depth measurements should be made in the control zone. The allowed range for answers will depend on the distinctness, and to a lesser degree, the topography of the boundary, as determined by the judges.

Please note the following: In the past, if a lithic or paralithic contact (hard or soft bedrock) occurs anywhere in the exposed control zone (within 150 cm) you needed to consider it in answering several sections in Part II as well as in any rating charts used in Part III. This is no longer the case. We will only describe features that occur within the specified judging depth. If a lithic or paralithic contact occurs below the specified judging depth, it should be ignored and considered to not be exposed.

If the contact is within the specified description depth, it should be indicated on the score card. Morphological features need not be recorded for Cr or R horizons. If they are, graders will ignore them and no points will be deducted (only the first three boxes in the row will be graded, for a total of 6 points possible for that row.

3. BOUNDARY - DISTINCTNESS: The distinctness of horizon boundaries is to be evaluated as described in SSM 3-133. The distinctness of the lower boundary of the last layer is not to be determined and the contestant is to mark none (-) as the boundary distinctness to receive credit. The topography, or shape, of the boundaries will not be directly considered, but it could influence contest officials.

As a guide, the following system will relate distinctness of boundary for full credit.

Distinctness	Abbreviation	Lower Depth Range	
Abrupt	A	+/-	1 cm
Clear	C	+/-	3 cm
Gradual	G	+/-	8 cm
Diffuse	D	+/-	15 cm

This method of determining full credit may be modified on a given site by contest officials.

4. COLOR: (See SMM 3-146-154)

Munsell soil color charts are used to determine the moist soil matrix color for each horizon described. Color must be designated by hue, value, and chroma. Space is provided to enter the hue, value, and chroma for each horizon separately on the scorecard. At the discretion of the official judges, more than one color may be given full credit. Color is to be judged for each horizon by selecting soil material to represent that horizon. The color of the surface horizon will be determined on a moist, rubbed (mixed) sample. For lower horizons (in some soils this will also include the lower portion of the epipedon), selected peds should be collected from near the central part of the horizon and broken to expose the matrix. If peds are dry, they should be moistened before the matrix color is determined. Moist color is that color when there is no further change in soil color when additional water is added. For Bt horizons with continuous clay films, care should be taken to ensure that the color of a ped interior rather than a clay film is described for the matrix color.

5. MOIST CONSISTENCE: (see SSM 3-172-177)

Soil consistence refers to the resistance of the soil to deformation or rupture at a specified moisture level and is a measure of internal soil strength. Consistence is largely a function of soil moisture, texture, structure, organic matter content, and type of clay, as well as adsorbed cations. As field moisture will affect consistence, contestants should use their personal judgment to correct for either wet or dry conditions on the day of the contest. These corrections also will be made by the official judges. Contestants should judge the consistence of moist soil (midway between air-dry and field-capacity) for a ped or soil fragment from each horizon as outlined in the *Field Book for Sampling and Describing Soils, 2012* and modified in Table 1.

Table 1. Soil moist consistencies, symbols and descriptions.

Consistence	Symbol	Description
Loose	**L**	Soil is non-coherent (e.g., loose sand).
Very friable	**VFR**	Soil crushes very easily under very slight force (gentle pressure) between thumb and finger but is coherent when pressed.
Friable	**FR**	Soil crushes easily under slight force (gentle to moderate pressure) between thumb and forefinger and is coherent when
Firm	**FI**	Soil crushes under moderate force (moderate pressure) between thumb and forefinger, but resistance to crushing is distinctly noticeable.
Very firm	**VFI**	Soil crushes or breaks only when strong force is applied between thumb and all fingers on one hand.
Extremely firm	**EFI**	Soil cannot be crushed or broken by strong force between thumb and all fingers but can be by applying moderate force between hands.

6. TEXTURE - ROCK FRAGMENTS: (see SSM 3-141-144)

Rock Fragment modifiers should be used if a layer's rock fragment content is > = 15% by volume. This modifier should be listed on the score card. Do not enter your numerical volume estimate. The following abbreviations should be used:

Volume	Modifier	Abbreviation
0 - <15%	None	-
15 - <35%	Gravelly	GR
35 - <60%	Very Gravelly	VGR
≥ 60%	Extremely Gravelly	EGR

7. TEXTURE -CLASS: Texture for each horizon should be designated as one of the 12 basic textural classes, listed in SMM 3-136-140. Textural class names are to be abbreviated. The following are the correct abbreviations for textural classes:

S	Sand	CL	Clay Loam
LS	Loamy Sand	SICL	Silty Clay Loam
SL	Sandy Loam	SCL	Sandy Clay Loam
L	Loam	SC	Sandy Clay
SI	Silt	SIC	Silty Clay
SIL	Silt Loam	C	Clay

8. STRUCTURE: (See SMM 3-157-163) Record the dominant type (shape) of structure for each layer. Single grain and massive are terms for structureless soils, but they are included under shape. If different types of structure occur in different parts of the layer, give the type of the one that is most prevalent. If a horizon has compound structure (i.e., prismatic parting to angular blocky), give the primary structure; if both are equivalent, give the structure with the larger units. Table 2 contains a list of structure types and their abbreviations:

Table 2. Soil structure types, symbols and descriptions.

Type	Symbol	Description
Granular	**GR**	Spheroids or polyhedrons bounded by curved planes or very irregular surfaces, which have slight or no accommodation to the faces of surrounding peds. For the purposes of this contest crumb structure is included with granular structure.
Subangular blocky	**SBK**	Polyhedron-like structural units that are approximately the same size in all dimensions. Peds have mixed rounded and flattened faces with many rounded vertices. These structural units are casts of the molds formed by the faces of the surrounding peds.
Angular blocky	**ABK**	Similar to subangular blocky but block-like units have flattened faces and many sharply angular vertices.
Platy	**PL**	Plate-like with the horizontal dimensions significantly greater than the vertical dimension. Plates are approximately parallel to the soil surface**. Note: this does not apply to weathered rock structure.**
Wedge	**WEG**	Elliptical, interlocking lenses that terminate in acute angles, bounded by slickensides. Wedges are not limited to vertic materials.
Prismatic	**PR**	Prism-like with the two horizontal dimensions considerably less than the vertical. Vertical faces are well defined and arranged around a vertical line with angular vertices. The structural units have angular tops.
Columnar	**COL**	Same as prismatic but with rounded tops or caps.
Massive	**MA**	No structure is apparent and the material is coherent. The individual units that break out of a profile have no natural planes of weakness.
Single grain	**SGR**	No structure is apparent. Soil fragments and single mineral grains do not cohere (e.g., loose sand). In some cases where weak cohesive/adhesive forces with water exist, some seemingly cohesive units can be removed. However, under very slight force, they fall apart into individual particles.

9. SOIL FEATURES (REDOX CONCENTRATIONS AND DEPLETIONS AND MATRIX CONCENTRATIONS)**:** (see SSM 3-154-157): For this contest, soil features will be considered as subdominant colors (high or low chroma) on ped interiors or surfaces that are the results of oxidation - reduction. The following items will not be considered as soil features; clay skins, skeletans (sand or silt coats) or other ped coatings, krotovinas, rock fragment colors, roots, and mechanical mixtures of horizons such as B materials in the Ap. More than one answer is possible in each layer; all applicable colors must be listed to receive credit. If no features are present, a "-" should be entered on the scorecard to receive credit. The score card choices are as follows:

A. Redox concentrations – These are zones of apparent pedogenic accumulation of Fe-Mn oxides, and include: nodules and concretions (firm, irregular shaped bodies with diffuse to sharp boundaries; masses (soft bodies of variable shapes in the soil matrix; zones of high chroma color ("red" for Fe and "black" for Mn); and pore linings (zones of accumulation along pores). Dominant processes involved are chemical dissolution and precipitation; oxidation and reduction; and physical and/or biological removal, transport and accrual.
Presence: C RMF concentrations are present

B. Redox depletions – These are zones of low chroma (2 or less) and normally high value (4 or more) where either Fe-Mn oxides alone or Fe-Mn oxides and clays have been removed by eluviation.
Presence: D RMF depletions are present

C. Other Matrix Concentrations
These are visible pedogenic concentrations that can occur in the soil matrix (including soft, non-cemented masses or other bodies; excluding soft rock fragments) for each horizon. Concentrations are identifiable bodies found in the soil matrix. They contrast sharply with surrounding soil material in terms of color and composition. Water movement and the extent of soil formation can be related to concentration location and abundance within the soil profile as well as orientation within a horizon. In the contest area, three main types of concentrations (based on composition) can occur: carbonates, gypsum, or other salts.
Presence: W Other matrix concentrations are present

II. SITE AND SOIL CHARACTERISTICS

1. LOCAL LAND FORM: **(May be modified by Host Institution)** Select the local land form of the site from the choices on the score card. In a situation where two parent materials are present, the land form will be selected on the basis of the process that controls the shape of the landscape. In most cases, this will be the lower parent material. For example, if alluvium is underlain by residuum which is exposed in the pit, then an upland land form should be used. Only one land form is to be identified at each site. Select the one that best describes the situation. Dual credit may be awarded by the contest officials.

Table 3. Landforms and their descriptions.

Landform	Description
Floodplain	A nearly level alluvial plain bordering an active stream, built up of sediment from overflow of a stream. Although flooding may or may not occur frequently, this landform is subject to inundation when the stream is at flood stage. Parent material is alluvium.

Stream terrace	A step-like surface or platform along a stream valley that represents a remnant of an abandoned floodplain. Where occurring in valley floors, this landform is commonly smooth, having low relief, and may or may not be dissected by an under-fitted stream. It consists of a relatively level surface, cut or built by a stream and a steeper descending slope (scarp or riser). Parent materials may include alluvium, glacial outwash, and lacustrine deposit.
Outwash plain	A low-relief area, when considered regionally, composed of glacio-fluvial debris spread away from glacier margins by melt waters that were not confined to a river valley. The topography of a pitted outwash plain can be very irregular. At least one parent material is glacial outwash.
Kame/esker	A conical hill (kame) or a sinuous ridge (esker) composed of stratified sand and gravel deposited by melt waters in contact with glacial ice. Parent material is glacial outwash.
Till plain/ drumlin/ moraine	An extensive, flat to undulating area underlain by glacial till. For our purposes till plains are considered to include ground, recessional, end or terminal moraines, and drumlins. A till plain may be covered by loess, but it is still considered a till plain if the general shape of the landform is controlled by the till surface and soil development extends into the till or till is present within the depth described. Parent material is glacial till.
Beach ridge	An essentially continuous ridge of sandy material along the present or former shoreline of a lake. Parent material is beach deposit.
Alluvial fan	A body of alluvium whose surface forms a segment of a cone (fan-shaped in plan view) that radiates downslope from the point where a stream emerges from a narrow valley into a broader valley. At least one parent material is colluvium.
Loess plain/ hillslope	Landforms consisting of windblown silt deposits that are thick enough for an entire solum to develop in loess. Parent material is loess.
Lake plain	A level landform located on the bed of a former lake or pond and underlain by stratified lacustrine sediments. Parent material is lacustrine deposit.
Sand dune	A hill or ridge of wind-blown sand. Parent material is eolian sand.
Upland	Erosional land forms, which are generally well above a stream valley and on which residuum or colluvium is the lowest parent material exposed in the soil profile.
Base slope	A base slope is a linear or concave landform downhill from an inflection point where the slope angle decreases and upslope eroding sediment collects. Older or highly dissected base slopes may be found in steep or in mountainous terrain on uplands. Weak to strong subsoil development is usually evident, depending on the upslope stability and age of the deposit.
Depression	A depression refers to the nearly level bottom of a closed basin landform which has no visible external surface drainage. Ponding of water may occur following periods of heavy rainfall. If the soil pit occurs in the bottom of a closed basin that is within an upland or floodplain site, the students should check only the "depression" position on the scorecard. Depressions may include such features as limestone sinks and sink holes, or low closed basins on floodplains or coastal plains. A depression should be a natural feature, and may be altered by but not be formed as the result of some man-made structure. For example, if an embankment crosses a drainageway and creates a closed basin, or if humans excavate a pond, they are not considered natural features. Parent material is variable. Need confirmation of ponding frequency on the pit information (e.g., "This site ponds rarely.").

2. PARENT MATERIAL: **(May be modified by Host Institution)** Mark the appropriate parent material from the list on the scorecard. Contestants must identify the parent material with each profile. If more than one parent material is present, all should be recorded, partial credit may be given. However, at least 25 cm. of a parent material must be present to be recognized in the parent material section of the scorecard. Parent material, like soils, do not always lend themselves to easy classification, so the contest officials may need to take the complexity of the situation into account in scoring alternative interpretations. The following are definitions of parent materials.

Table 4. Parent materials and their descriptions.

Parent Material	Description
Alluvium	Alluvium consists of sediment transported and deposited by running water and is associated with landforms such as floodplains and stream terraces. As running water sorts sediment by particle size, these materials are often stratified. Rock fragments are often rounded in shape. Alluvium may occur on terraces above present streams (old alluvium) or in the normally flooded bottomland of existing streams (recent alluvium). The sediments may be of either a general or local origin. For this contest, contestants will not differentiate between old and recent alluvium.
Glacial outwash	A type of Pleistocene age fluvial deposit characteristic of heavily loaded streams with highly variable discharge that were fed by glacial meltwaters. Glacial outwash is stratified and may be highly variable in texture. Glacial outwash has been in place long enough for development of a soil profile. Strata containing sand (medium sand or coarser) and/or gravel often are present. This feature distinguishes glacial outwash from lacustrine deposits. Glacial outwash may occur as outwash plains, stream terraces, kames, eskers, or as a relatively coarse material separating loess from till. Abrupt changes in texture in outwash are not considered changes in parent material for purposes of the P.M. part of Soil Morphology.
Glacial till	Relatively compact, unsorted, unstratified Pleistocene-aged material, ranging in size from boulders to clay, deposited directly by ice without significant reworking by meltwater. Glacial till can be found with almost any texture.
Beach deposit	Sandy material deposited near the shore of a lake, primarily by wave action.
Colluvium	Poorly sorted, Holocene-aged material accumulated on and, especially, at the base of hillslopes. Colluvium results from the combined forces of gravity and water in the local movement and deposition of materials. According to the *Soil Survey Manual* (p. 79), "Colluvium is poorly sorted debris that has accumulated at the base of slopes, in depressions, or along small streams through gravity, soil creep, and local wash." Material deposited locally in the form of alluvial fans will also be considered colluvium.
Loess	Fine-grained, wind-deposited materials that are dominantly of silt size. Textures are usually loam, silt loam, silt, or silty clay loam. Where loess mantles are thin (<75 cm), there may be some larger mineral particles, particularly toward the base of the loess deposit. Larger particles can be incorporated into the loess through plant or animal activity or through colluvial action.
Lacustrine deposit	Relatively fine-textured (finer than medium sand), well-sorted, materials often stratified at depth, deposited in lake or slackwater environments.
Eolian sand	Primarily fine and medium sand that has accumulated through wind action, normally on dune topography.

Residuum	The unconsolidated and partially weathered mineral materials accumulated by disintegration of bedrock. This material has been thought of as weathered in place although some interpretations would call for significant movement of materials prior to the onset of soil formation.
Unconsolidated Coastal Plain Sediments	Unconsolidated Coastal Plain sediments include Tertiary-aged or younger materials deposited by wind and water in both marine and non-marine environments that have not undergone compaction to the extent that they would be classified as a rock. The sediments are usually stratified and may be any size. Some soils contain secondary precipitated minerals that cement horizons or layers such as ironstone, plinthite, or ortstein. Diagnostic evidence is needed to distinguish the unconsolidated Coastal Plain sediments from more recent alluvium found on floodplains and stream terraces.

3. SLOPE: (see SSM 3-64-66) Slope refers to the inclination of the ground surface and has length, shape, and gradient. Gradient is usually expressed in percent slope and is the difference in elevation, in length units, for each one hundred units of horizontal distance. Slope may be measured by an Abney level or by a clinometer. Slope classes are based on the gradient, with the exception of the "concave" class. Concave should be used when the site is located within an enclosed depression with no outlet. The percentage limits for slope classes are indicated on the scorecard and below in table 5. Stakes or markers will be provided at each site for determining slope and the slope should be measured between these two markers. The tops of the markers will be placed at approximately the same height, but it is the responsibility of the contestant to make sure that they have not been disturbed. If the slope measurement falls on the boundary between two slope classes, contestants should mark the steeper class on the scorecard. *Note: Contestants are encouraged to write the actual slope value in the space provided on the scorecard to aid in the completion of the interpretations section, but points will be awarded only for checking the correct class.*

Table 5. Slope classes used in this contest.

Concave
0% - <2%
2% - <5%
5% - <10%
10% - <15%
15% - 20%
>20%

4. HILLSLOPE PROFILE POSITION. Hillslope position (Figure 2, from R. V. Ruhe. 1969. *Quaternary Landscapes in Iowa,* p 130-133) represents the geomorphic segment of the topography on which the soil is located (Table 6). These slope components have characteristic geometries and greatly influence soils through differences in slope stability, water movement, and other slope processes. Not all profile elements may be present on a given hillslope. The landscape unit considered when evaluating hillslope profile position should be relatively large and include the soil pit and/or the area between the slope stakes. Minor topographic irregularities are not considered for this contest. Students and coaches should pay particular attention to how hillslope profile positions are described at the practice locations. Illustrations

of simple hillslope profile components can be found in Figure 2.

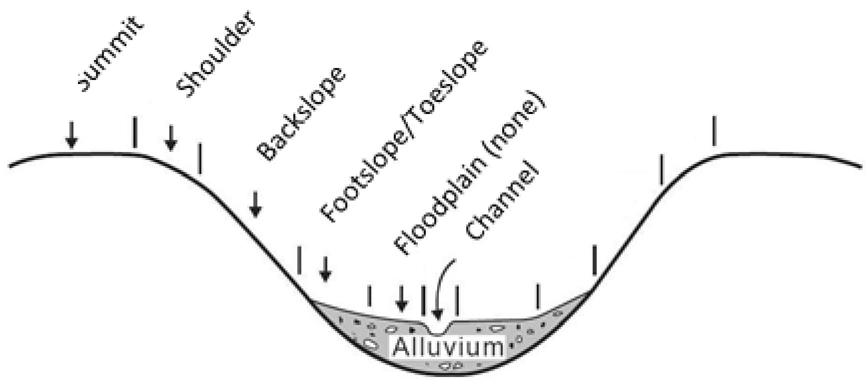

Figure 2. Hillslope profile components, as modified from Ruhe, 1969.

Table 6. Hillslope profile positions and their general descriptions.

Hillslope position	Description
Summit	Highest level of an upland landform with a relatively gentle, planar slope. The summit is often the most stable part of a landscape. If the site is on a summit and has a slope < 2%, the summit position on the scorecard should be selected. Not every hillslope has a summit, as some hillslopes have shoulders at the crest of the hill.
Shoulder	Rounded (convex-up) hillslope component below the summit. The shoulder is the transitional zone from the summit to the backslope and is erosional in origin.
Backslope	Steepest slope position that forms the principal segment of many hillslopes. The backslope is commonly linear along the slope, is erosional in origin, and is located between the shoulder and the footslope positions.
Footslope	Slope position at the base of a hillslope that is commonly rounded, concave-up along the slope. The footslope is transitional between the erosional backslope and depositional toeslope. Accumulation of sediments often occurs within this position.
Toeslope	Lowest landform component that extends away from the base of the hillslope. If the site is a toeslope and has a slope of < 2%, toeslope should be selected on the scorecard.
None (slope <2%)	This designation should only be used when the slope at the site is < 2%, and the site is not in a well-defined example of one of the slope positions given above (e.g., within a terrace or floodplain of large extent).

5. SURFACE RUNOFF (see SSM 3-113-115). The rate and amount of runoff are determined by soil characteristics, management practices, climatic factors, vegetative cover, and topography. In this contest we will use six (6) runoff classes and we will consider the combined effects of surface texture, vegetation, and slope on runoff rate. Where good vegetative cover is present, contestants should mark the next slower runoff class. (*NOTE: Attention should be paid to how the official judges handle vegetative cover at the practice sites*.) The following guidelines will be used:

Slope	**Surface Runoff -based on texture of the surface horizon**		
	S, LS	**SI, SIL, SICL, L, CL, SL, SCL**	**C, SIC, SC**
concave	negligible	negligible	negligible
0% - <2%	negligible	slow	moderate
2% - <5%	very slow	slow	rapid
5% – <10%	slow	moderate	very rapid
10% - <15%	slow	rapid	very rapid
15% - 20%	moderate	very rapid	very rapid
>20%	rapid	very rapid	very rapid

6. SOIL EROSION POTENTIAL: The erosion potential is dependent on the factors contributing to surface runoff, as well as organic matter content and physical properties of the surface horizon, including texture and structure. For the purposes of this contest, the following table (adapted from https://mepas.pnnl.gov/mepas/formulations/source_term/source_form.html) will be used to determine soil erosion potential. The table assumes typical organic matter contents for Midwestern agricultural soils and granular structure or structureless, single-grained in the surface horizon, although there is no adjustment if that is not the case. To simplify the determination of erosion potential, no adjustments will be made on the basis of sand size. However, students should be made aware that in reality sand size can have a significant impact on erosion potential.

Surface Runoff	**Surface Horizon Texture**		
	S, LS	**SL, SCL, CL, SC, C, SIC**	**L, SICL, SIL, SI**
Ponded/Negligible	Low	Low	Low
Very Slow	Low	Low	Medium
Slow	Low	Medium	Medium
Moderate	Low	Medium	High
Rapid	Low	High	High
Very Rapid	Medium	High	High

7. SOIL WETNESS CLASS (previously SOIL DRAINAGE CLASS): Soil drainage classes as defined in the *Soil Survey Manual* (1993) are difficult to define precisely across a wide geographical area and are best applied by someone with extensive experience in a local area. To simplify matters for the contest, we will instead use soil wetness class. Soil wetness is a reflection of the rate at which water is removed from the soil by both runoff and percolation. Position, slope, infiltration rate, surface runoff, hydraulic conductivity (permeability), and redoximorphic features are significant factors influencing the soil wetness class. The depth to chroma ≤ 2 and value ≥ 4 redox features (depletions) due to wetness will be used as the criterion to determine the depth of the wet state for this contest.

Class	Depth to wetness features (from soil surface)
1	>150 cm
2	50 to 150 cm
3	25 to <50 cm
4	<25 cm

8. EFFECTIVE SOIL DEPTH: (see SSM 3-134-135) For this contest effective soil depth is considered to be the depth of soil to a root limiting layer as defined in Soil Taxonomy (i.e., duripan, fragipan, dense glacial till, petrocalcic, lithic, or paralithic contact). If there are no limitations evident the soil will be classified as very deep. If the profile is not visible to a depth of 150 cm, or if you are requested to describe a soil only to a shallower depth, then you should assume that the conditions present in the last horizon described extend to 150 cm. The various depth classes are listed on the score card.

9. HYDRAULIC CONDUCTIVITY –SURFACE & LIMITING (formerly PERMEABILITY): In this contest we will estimate the hydraulic conductivity of both the surface horizon and the most limiting horizon. In some soils, the surface horizon is the limiting horizon with respect to saturated hydraulic conductivity. In this case, the surface hydraulic conductivity would be reported in two places on the scorecard. As previously stated under Part I – “Depth”, you will need to consider a root limiting layer if it is within your specific judging depth. Such a contact will be considered to have very slow hydraulic conductivity, and slow will have to be marked for “hydraulic conductivity/limiting”. "Limiting layer" refers to the horizon or layer with the slowest hydraulic conductivity. We will consider primarily texture, as it is the soil characteristic that exerts the greatest control on permeability. The SSM (3-106) lists the following classes of permeability:

CLASS	CM/HOUR	TEXTURES
Very Slow	<0.0036	R, Cr, Cd, Fragipan or Duripan Horizon
Slow	0.0036 - <0.036	Sandy clay, Silty clay, or Clay
Moderately Low	0.036 - <0.36	Silty clay loam, Clay loam, or Sandy clay loam
Moderately High	0.36 - <3.6	Very fine sandy loam, Loam, Silt loam, or Silt
High	3.6 – <36.0	Fine sand, Very fine sand, Loamy sand, Loamy fine sand, Loamy very fine sand, Sandy loam
Very High	≥36.0	Coarse Sand, Sand, or Loamy coarse sand

Rate any natric horizon as two (2) classes slower than texture indicates.

For this contest we will group very slow in with slow, moderately slow and moderately rapid into moderate, and very rapid with rapid.

10. WATER RETENTION DIFFERENCE: (see SSM 6-292-293) Water retention difference refers to the amount of water, in cm, a soil is capable of holding within the upper 1.5 m., or above a root limiting layer, whichever is shallower. We will use the following four classes which are listed on the score card.

Very Low	< 7.5 cm
Low	7.5 cm to< 15.0 cm
Moderate	15.0 cm to 22.5 cm
High	> 22.5 cm

Texture is an important factor influencing moisture retention and we will employ the following estimated relationships:

cm water/cm soil	Textures
0.05	all Sands, Loamy coarse sands, Loamy sands
0.10	Loamy fine sands, Loamy very fine sands, Coarse sandy loams
0.15	Sandy loams, Fine sandy loams, Sandy clay loams, Sandy clays, Silty clays, Clays
0.20	Very fine sandy loams, Loams, Silt loams, Silts, Silty clay loams, Clay loams

For a root limiting layer, you are to assume that no water retention occurs below the contact. If a profile is not exposed to 150 cm. and no root limiting layer is visible, assume the properties of the last layer extend to 150 cm. Rock fragments are considered to have negligible (assume zero) moisture retention and you will need to adjust your estimates accordingly (see example).

As an example:

Surface (A)	0 - 27 cm L 5% rock fragments
Subsoil (B)	27 - 99 cm SIC
Substratum (BC)	99 - 140 cm SICL
Cr	140 + weathered mudstone

Water Retention Calculations:

Surface (A)	27 cm x 0.20 cm/cm x .95*	= 5.1 cm
Subsoil (B)	72 cm x 0.15 cm/cm	= 10.8 cm
Substratum (BC)	41 cm x 0.20 cm/cm	= 8.2 cm
	10cm x 0.00 cm/cm	= 0.0 cm
	High	= 24.1 cm

* correction for the volume of rock fragments

PART III INTERPRETATIONS:

Copies of the rating charts for Roadfill, Septic Tank Absorption Fields, and Sewage Lagoons can be found in Attachment 2 and will be provided to contestants.

Guidelines for interpretations of Roadfill, Septic Tank Absorption Fields, and Sewage Lagoons are adapted from Part 620 of the revised National Soils Handbook (see attachment 2). In the contest you will be supplied with the rating tables, but not the written material. Therefore, you need to know how to use the tables, not memorize them. Attachment 4 is provided as a guide to assist coaches and contestants in using the rating charts and will not be provided at the contest.

Critical depths for each guideline are taken from the control zone. Soil properties and their restrictive features are listed in descending order of importance in the tables. On the scorecard, contestants should "x" or check the most severe limitation/worst suitability and write the first restrictive feature associated with that rating. For example, when two or more properties give a soil the same rating (for example a soil rated moderate – Seepage and moderate – Slope for Sewage Lagoons), identify the restrictive feature as the one listed closest to the top of the table (moderate – Seepage for our example). A severe (or poor) rating always takes precedence over a moderate (or fair) rating. If all the evaluations are "slight" or "good" then print "none" as the reason on the scorecard. There may be some instances where the pit does not extend to the necessary depth needed to make the interpretation. In these cases contestants must assume the lowest horizon of the pit extends to the interpretative depth unless a lithic or paralithic contact occurs within the depth to be judged. Each interpretation will be worth ten (10) points total; five (5) for the correct rating and five (5) for the correct feature.

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