Contest Guidelines

Region IV
Soil Judging Contest
October 7 - 11, 2019

Fayetteville, Arkansas

University of Arkansas

Dale Bumpers College of Agricultural, Food and Life Sciences

Department of Crop, Soil, and Environmental Science

University of Arkansas System Division of Agriculture

Arkansas Association of Professional Soil Classifiers

United States Department of Agriculture

Natural Resources Conservation Service

Guidelines

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Hosted by:

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CONTEST RULES

Team Composition

A team is composed of three or four undergraduate students who are enrolled in a full-time, four-year curriculum in the institution they are representing. Each institution may enter only one team in the contest. Additionally, alternate competitors from each team are allowed to compete in the contest activities, but their individual-pit-judged scores will not count towards the sweepstakes (i.e., overall) total. However, alternate competitors are eligible for individual awards. All students must be eligible to represent their institution according to the rules and regulations governing eligibility at their institution. Team and alternate students should be designated by **9:00 pm Tuesday night, October 8, 2019.**

Contest Format

This contest will be a mostly “closed book" contest, with the exception that, on the day of the contest, all contestants will be provided a copy of the textural triangle (included at the end of this packet), the abbreviations page (included at the end of this packet), and the Soil Use Interpretations Tables (listed on page 18 of this packet). Cell phones are prohibited. Each contest pit to judge will have its own scorecard indicated by a unique color and alphanumeric code. Each individual contestant will be given colored scorecards corresponding to each contest pit. Students must enter their contestant ID code on each of their scorecards. Scorecard entries must be made according to the instructions for each specific feature to be judged (see following sections of this guidelines packet). Only one response should be entered in each blank, unless told otherwise.

The contest will consist of three parts: a) four, individually judged pits (Thursday morning October 10), b) one, team-judged pit (Thursday afternoon October 10), and c) the sweepstakes (overall) score, a combination of both team and individual results. The sweepstakes placings will be used to select which teams advance to the National Collegiate Soil Judging Contest in Spring 2020.

This regional contest is also meant to expose and prepare students to the additional rigor of the national contest. Therefore, several additional scorecard items have been included for this regional contest that have not routinely been included on the Region IV scorecard.

The team scores from the individually judged pits will be the sum of the top three individual scores for each pit. Therefore, the sum of 13 scorecards (3 individuals x 4 individual pits + 1 team-judged pit) will determine the overall sweepstakes score per team. All alternate students from an institution may participate in the one team-judged pit. Students from institutions having less than three team members may compete, but they are only eligible for individual awards.

The clay content of the third horizon will be used to break ties in both the individual and team competitions. In order to break a tie, the actual clay content for the third horizon of individually judged Pit 1 will be used. If this does not break the tie, the next pit in order (i.e., Pit 2) will be used in the same manner, and so on, if necessary, will be compared to that estimated by the individual in order to break a tie between individuals. For the team-judged pit, the team estimate of the clay content of the third horizon will be compared to the actual value. The team with the estimate closest to the actual value will receive the higher placing. If this does not break the tie, the next deepest horizon will be used.

Results will be announced Friday morning October 11 and will be final. Awards will be given to the top three overall sweepstakes teams, the top three teams in the team-judged-pit portion of the contest, and the top five individuals in the individual-pit-judged portion of the contest.

At each practice and contest site, a pit will be excavated and a restricted area will be designated on one of the pit walls for the measurement of horizon depth and determination of boundary distinctness and coarse fragment concentration. The restricted area will be clearly outlined and a nail will be placed somewhere in the third horizon. A tape measure will also be attached to the restricted area. THE RESTRICTED AREA IS TO BE UNDISTURBED! Picking, taking samples, or other disturbances within the restricted area will not be permitted for practice or contest pits. The pit ID #, number of horizons to describe, depth to be considered, percent base saturation (% BS), and percent organic carbon (% OC) for each horizon and other relevant information will be displayed on a sign at each pit such as the example provided in Figure 1. Contestants should expect to evaluate between four and six horizons per pit. Slope stakes will be placed along the grade for determination of slope and to facilitate the determination of the landform and hill slope profile.

Pit 1

Describe five (5) mineral horizons to a depth of 112 cm.

The nail is in the third horizon at 36 cm.

Horizon	Base Saturation (%)	Organic Carbon (%)
1	100	0.9
2	100	0.7
3	100	0.3
4	100	0.1
5	100	0.1
6	100	0.1

Figure 1. Example of information provided at each contest pit.

Fifty (50) minutes will be allowed for judging of each contest pit. The morning of the individually judged pit portion of the contest, each contestant will be provided an assigned number-letter combination corresponding to team-group designations. This will uniquely identify each contestant and will be used to facilitate rotations at the pit according to the schedule provided in Table 1.

Table 1. Contestant rotations for individually judged pits.

	Individual Pits 1 and 3		Individual Pits 2 and 4	
Time	Odd team no.	Even team no.	Odd team no.	Even team no.
First 5 min.	In*	Out	Out	In
Next 5 min.	Out	In	In	Out
Next 10 min.	In	Out	In	Out
Next 10 min.	Out	In	In	Out
Next 20 min.	Free**	Free	Free	Free

*In and Out refer to contestants being allowed in the pit or out of the pit, respectively, to start.
**During free time, all contestants may be in or out of the pit.

Team-pit Judging

Two teams will be at the team-judged pit at the same time, but start times for each team will be staggered so that only one team has access in the pit at a time. Each team will have two 10-minute intervals in the pit and two 10-minute intervals out of the pit (i.e., 10 minutes in, 10 minutes out, 10 minutes in, 10 minutes out) with the last 10 minutes of the 50-minute total time as free time to be in or out of the pit if desired.

Restricted Pit Area, Allowable Items, and Other Rules

A restricted area on the pit wall will be outlined with flagging and a tape measure mounted for every practice and contest pit that is NOT to be disturbed, and a nail will be inserted somewhere in the third horizon of each pedon, similar to that pictured in Figure 2. Contestants should provide the following for their personal use: tape measure, clinometers (or Abney level), water bottle or sprayer, acid bottle, knife, pencils, Munsell color charts (10R to 5Y), hand towel, hand lens, and containers for soil samples. Calculators, 2-mm diameter sieves, and clipboards may also be used. No other materials other than those supplied by the host will be permitted during the contest. Cell phones, pagers, or other communication devices are prohibited during the contest. Talking is NOT permitted between contestants during the 50 minutes of pit judging. Pit monitors will be instructed to collect scorecards from contestants and they will receive a zero for that pit if any of the above rules are broken, particularly talking to other contestants during the judging period. Contestants should show respect for each other and avoid creating distractions during the competition.

Figure 2. Example of restricted area of pit wall.

Scoring and Abbreviations

Coaches and assistant coaches/graduate students from participating schools will be requested to help grade at the contest site. Additional graders competent in soil morphology and classification will also be recruited to assist in grading. Each grader will grade only one pit and each scorecard will be re-graded and scores tallied by a second individual for confirmation of accuracy. Point allocations vary among cells and are listed on the scorecard in parentheses. Where an answer is not needed or is inappropriate, a dash (-) may be used or the cell can be left blank.

Contestants may use the official abbreviations (preferred, see Attachment 1) or write out answers. Use of abbreviations other than official abbreviations is strongly discouraged, but graders shall give credit if, in their opinion, the meaning of an unofficial abbreviation is obvious.

For the individually judged portion of the contest, a team is composed of three or four undergraduate students. The team score will be the sum of the top three individual scores at each pit (see example in Table 2). This method maximizes the opportunity for all four team members to contribute to the final team score.

Table 2. Score tabulation example for the individual contest. Shaded scores represent those that are the low score for a pit among the team's contestants and are not included in the team's total score for that pit or overall.

Contestant	Pit 1	Pit 2	Pit 3	Pit 4	Total
A	132	130	110	144	516
B	146	116	141	138	541
C	130	112	160	158	560
D	125	114	129	145	513
Total score:	**408**	**360**	**430**	**447**	**1645**

The score from the team-judged pit will be added to the individual scores for the overall sweepstakes team totals and final rankings.

SCORECARD INSTRUCTIONS

The scorecard consists of five parts: I. Soil Morphology; II. Soil Profile Characteristics; III. Site Characteristics; IV. Soil Classification; and V. Interpretations (refer to the attached scorecard example at the back of this guidelines packet). The Soil Survey Manual (Chapter 3, 1993), Field Book for Describing and Sampling Soils, version 3.0 (Schoeneberger et al., 2012), and Keys to Soil Taxonomy (12th Edition, 2014) should be used as guides during practice. These publications are available at: https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/ref/.

Part I: Soil Morphology

A. Horizonation – (Chpt. 18, pp. 335-342, Keys to Soil Taxonomy, 2014)

Horizon designations will follow standard procedures, including a master, transitional or combination horizon symbol to be recorded in the "Master" column, and when needed, a lower case symbol in the suffix/subordinate distinction column labeled "Sub", and an Arabic numeral in the "No." column. Arabic numerals should be used in the "Prefix" column preceding the "Master" column to indicate lithologic discontinuities. Prime symbols to distinguish otherwise identical designations should be placed in the "Master" column. All B horizons must have a suffix/subordinate distinction. If no designation is necessary for a cell, contestants may leave the cell blank or record a dash (-) to indicate no designation. Only mineral horizons will be described for the contest, and students should be familiar with A, E, B, C and R horizon designations, plus transitional and combination horizons. Suffix symbols that could be used in the practice and contest areas are: b, c, d, g, k, n, p, r, ss, t, u, w, x, and y. However, denoting a horizon with fragic properties with the suffix "x" will not automatically mean "fragipan" should be marked in "Other Characteristics" under Part IV. Soil Classification.

B. Lower Depth

The depth of the lower boundary as measured from the soil surface should be recorded in centimeters (cm). Alternately, the depth of both the upper and lower boundary may be given, but only the depth to the lower boundary will be graded. For example, a Bt1 horizon occurring from 30-45 cm may be recorded as "45 cm" (preferred) or "30-45 cm". The last horizon boundary should be the specified judging depth with a "+" added. Thus, if the pit sign states "Describe 5 horizons to a depth of 140 cm", the fifth lower depth designation should be "140+". However, when the specified depth is at a lithic or paralithic contact, the "+" is dropped from the depth.

Depth measurements should be made between the tapes in the restricted area on the pit wall using the mounted tape measure provided. A range for the lower depth considered correct will be based on the boundary's distinctness according to the following table:

Distinctness of boundary	Range for grading
Abrupt (A)	± 1 cm
Clear (C)	± 3 cm
Gradual (G)	± 8 cm
Diffuse (D)	± 15 cm

With the exception of the A and E horizons, no sub-soil horizon less than 8 cm thick will be described. The A and/or E horizons may be described thinner than 8 cm if appropriate. If a horizon less than 8 cm thick occurs in the B horizon or lower, it should be combined with the adjacent horizon that is most similar for the depth measurement purposes. When two horizons combine to a total thickness of 8 cm or more, the properties of the thicker horizon should be described. If lamellae are encountered that are thinner than 8 cm, then the convention is to describe the eluvial and illuvial horizons as a unit (i.e., E & Bt) and the thickest horizon's morphology would be described.

If a lithic contact occurs at the specified depth to describe to on the site card, the contact should be considered in evaluating hydraulic conductivity, effective soil depth, and water retention difference. Otherwise, the last horizon should be assumed to extend to 150 cm for making all relevant evaluations. If a paralithic contact occurs within the specified depth, the contact should be considered as one of the horizons to be included in the description, and the appropriate horizon nomenclature should be applied (i.e., Cr).

C. Boundary Distinctness (Chpt. 3, pp. 133 - 134, Soil Survey Manual)

Distinctness refers to the thickness of the zone within which the horizon boundary can be located. The distinctness of a boundary depends partly on the degree of contrast between the adjacent horizons and partly on the thickness of the transitional zone between them. The topography of the boundary will not be described for this contest. The boundary distinctness of the deepest horizon will not be described and should be left blank or with a dash (-) recorded in the cell.

Distinctness classes that will be used for this contest are:

Abrupt (A):	< 2 cm thick
Clear (C):	2-5 cm thick
Gradual (G):	5-15 cm thick
Diffuse (D):	> 15 cm thick

D. Clay Percentage, Texture, and Coarse Fragments (Chpt. 3, pp. 136 - 144, Soil Survey Manual)

Estimates of the clay content as a weight percentage of the soil fines should be recorded in the "Clay%" column. A scaled range for correct answers compared to actual values will be used according to the following:

Actual %	Allowed Deviation
< 20	+/- 2
20-40	+/- 3
> 40	+/- 4

The % clay and textural class for each horizon will be determined by the judges and supported by laboratory data using a modified 12-hr hydrometer method. Soil textural classes as defined in Chapter 3 of the Soil Survey Manual and their official abbreviations (supplied to contestants as part of Attachments 1 and 2) will be used. Deviation from standard nomenclature will be incorrect (i.e., sandy silt or silty loam). Credit for sand, loamy sand, and sandy loam textures will NOT be given if sand modifiers are required (i.e.. very fine, fine, coarse, or very coarse). The textural class should be recorded in the "Class" column.

An estimate of the coarse fragment (i.e., > 2-mm sized particles, including carbonate and ironstone nodules) percentage should be recorded in the "CF%" column. A range of ± 5% from the judges' estimate will be given and considered correct for grading purposes. Sieves will be allowed during the contest. For the purpose of this contest, only the following terms will be used to describe coarse fragments, if coarse fragment modifiers are necessary:

"Gravelly" – generally rounded fragments 2-75 mm in diameter of any lithology and shape.
"Cobbly" – generally rounded fragments of any shape and lithology that are > 75 mm diameter by their long axis.
"Channery" – generally flat, rectangular fragments that have a 2-150 mm long axis

If more than one coarse fragment type occurs in the same horizon, the dominant condition should be described.

Coarse fragment modifiers are required as follows:

Coarse fragment (%, v/v)	Modifier
< 15%	none needed
15-34%	gravelly (GR) or cobbly (CB) or channery (CH)
35-60%	very gravelly (VGR) or very cobbly (VCB) or very channery (VCH)
> 60%	extremely gravelly (XGR) or extremely cobbly (ECB) or extremely channery (XCH)

Coarse fragment modifiers should be recorded in the column labeled "CF Mod." and should not be recorded in the "Class" column for the soil textural class.

E. Color (Chpt. 3, pp. 146 – 157, Soil Survey Manual)

The Munsell color notation to include hue, value, and chroma will be used to describe the moist soil color of each horizon. For surface horizons, the moist color will be determined on briefly rubbed samples as directed in the discussions of a mollic epipedon in the Keys to Soil Taxonomy (Chpt. 3, p. 9, 2014). For all other horizons, the color recorded should be the dominant moist color of the matrix (i.e., the color that occupies the greatest volume of the horizon). Often the most noticeable color may be that of the ped surface, but the ped surface color may not constitute sufficient volume to be designated as the dominant color. The 2009 revised edition of the Munsell color charts (i.e., the brown covered book) will be used for color determinations for all practice and contest pits.

F. Structure (Chpt. 3, pp. 157 – 163, Soil Survey Manual)

Both grade (i.e., structureless, weak, moderate, or strong) and shape of structure should be recorded. Acceptable types of structure are restricted to the following: granular, platy, subangular blocky, angular blocky, wedge, prismatic, and columnar. If two structure types are present in a given horizon, describe the structure with the stronger grade. If the two structures are of equal grade, describe the one with the larger physical size. If there is no structure, indicate "structureless" (SL) in the grade column and either "massive" (MA) or "single-grained" (SG) in the shape column. Acceptable numeric abbreviations will be 0, 1, 2, and 3 for structureless, weak, moderate, and strong, respectively.

G. Consistency

The soil's moist consistency should be recorded in the column labeled "Moist Strength" at approximately field capacity for each horizon according to the options and criteria outlined in the table below. It is considered impractical to use the definitions in the 1993 Soil Survey Manual for contest purposes and therefore the following definition from the 1951 Soil Survey Manual (pp. 154-156) will be used:

> *Consistence when moist is determined at a moisture content approximately midway between air-dry and field capacity. At this moisture content most soil materials exhibit a form of consistence characterized by (a) tendency to break into small masses rather than into powder; (b) some deformation prior to rupture; (c) absence of brittleness; and (d) ability of the material after disturbance to cohere again when pressed together. The resistance decreases with moisture content, and accuracy of field descriptions of this consistence is limited by the accuracy of estimating moisture content. To evaluate this consistence, select and attempt to crush in the hand a mass that appears slightly moist.*

Moist Consistency (Abbreviation)	Criteria
Loose (L)	Non-coherent
Very friable (VFR)	Crushes under very gentle pressure, but coheres when pressed together
Friable (FR)	Crushes easily under gentle to moderate pressure between thumb and forefinger, and coheres when pressed together
Firm (FI)	Crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable
Very firm (VFI)	Crushes under strong pressure; barely crushable between thumb and forefinger
Extremely firm (EFI)	Crushes only under very strong pressure; cannot be crushed between thumb and forefinger and must be broken apart bit by bit

H. Redoximorphic Features (Chpt. 3, pp. 26-27, Keys to Soil Taxonomy, 2014).

Redoximorphic features (RMFs) are soil morphological features caused by alternating reduction/oxidation (redox) processes. The reduction/oxidation of iron (Fe), and to a lesser extent manganese (Mn), minerals result in most RMF features. Iron is a major pigment that influences soil color. The loss, accrual, and valence/mineral state of Fe are major determinates of color patterns within or across soil horizons. Iron or Mn reduction occurs when free oxygen is limited or excluded from a soil volume or horizon by water saturation for extended time. Reduced iron ($Fe2+$) is comparatively much more soluble and mobile than oxidized iron ($Fe3+$), and moves with water flow and by diffusion gradients. When soil is reduced, Fe and Mn in local zones can be removed, leaving uncoated mineral grains (depletions) of lighter color. Reduced Fe is oxidized and precipitates when water drains from soil (reentry of free oxygen), or where oxygen is present in, or along, soil pores, including root channels, or along roots. The re-oxidized Fe or Mn may form crystals, soft masses, or hard concretions or nodules (concentrations). Oxidized Fe will generally have a redder or yellower color than adjacent soil particles, while Mn often will have a darker color than adjacent soil particles.

Therefore, redox *concentrations* (Con) are defined as zones of Fe-Mn accumulation from:

1. Nodules and concentrations - Concentrations have internal rings and nodules do not.
2. Masses - Masses are non-cemented concentrations.
3. Pore linings - Pore linings may be either coatings on pore surfaces or impregnations from the matrix adjacent to pores.

Redox *depletions* (Dep) are defined as zones with chromas less than, or values higher than those in the matrix where either Fe, or Mn, or both Fe and Mn, have been removed through reduction and transport processes.

The presence of redox concentrations and/or depletions should be recorded in the column labeled "Con/Dep". If only concentrations exist, record only "Con". If only depletions exist, record only "Dep". If both concentrations and depletions occur, record both "Con" and "Dep". If no RMFs exist, then leave the cell blank or record a dash (-) in the cell. If both concentrations and depletions occur in the same horizon, the abundance for each should be recorded.

Record the abundance of RMFs in the column labeled "Abund" as few (< 2%, F), common (2-20%, C), or many (> 20%, M) of the most abundant RMF present.

Part II: Soil Profile Characteristics

A. Hydraulic Conductivity

The saturated hydraulic conductivity of the surface horizon (Surface) and the most-limiting horizon (Limiting Layer) within the depth specified for judging will be estimated. Should a lithic, paralithic, or densic contact occur at or above the specified judging depth, the contact should be considered in evaluating hydraulic conductivity.

The three general categories for hydraulic conductivity to be used in this contest are the following:

High - Greater than 3.6 cm/hr. This class includes sands and loamy sands and some highly structured sandy loams. Horizons containing large quantities of coarse fragments with insufficient fines to fill many voids between the fragments are also included in this class.

Moderate - Between 0.036 and 3.6 cm/hr. This class includes materials excluded from the "Low" and "High" classes.

Low - Less than 0.036 cm/hr. Low hydraulic conductivity should be indicated based on the following criteria:

1) Clays, silty clays, or sandy clays that are structureless or have a structure grade of weak or moderate
2) Silty clay loams and clay loams that are structureless or have a structure grade of weak
3) Dense layers (i.e., that use "d" as a horizon suffix)
4) Bedrock layers (i.e., Cr or R horizons) where the horizon directly above contains redoximorphic depletions or a depleted matrix (i.e., color value ≥ 4 with chroma ≤ 2) due to prolonged wetness and indicative of restricted water flow

B. Effective Soil Depth

Effective soil depth classes are defined as the depth from the soil surface to the upper boundary of a root-restricting layer. Root-restricting layers include lithic and paralithic contacts, cemented layers, fragipans, and dense horizons. A sand and/or gravel layer with insufficient fines to fill the voids is also restrictive. If the lower depth of judging is less than 150 cm, and there is no restricting layer within or at the judging depth, the horizon encountered at the bottom of the judged profile is assumed to continue to at least 150 cm. Effective soil depth classes are:

Very Shallow…………root-restricting layer within < 25 cm of soil surface
Shallow……………….root-restricting layer from 25 to 49 cm
Moderately deep……...root-restricting layer from 50 to 99 cm
Deep…………………..root-restricting layer from 100 to 149 cm
Very deep……………..root-restricting layer at 150 cm or deeper

C. Water Retention Difference

The amount of water that a soil can hold between -33 kPa (-1/3 bar) and -1500 kPa (-15 bars) soil-water tension within the zone accessible to roots is the water retention difference of the soil. The water retention difference of the whole soil is calculated by estimating the amount of water each horizon can hold, determining which horizons are sufficiently accessible to plant roots to be significant sources of water, and summing the water retention differences of the accessible layers. Water retention difference is commonly expressed in cm water/cm soil. Classes are based on the amount of water retention difference in the upper 1.5 m of soil, or above a root-limiting layer, such as a lithic or paralithic contact. A number of factors are used to determine the water retention difference of individual horizons. These include texture, clay mineralogy, soil structure, volume of coarse fragments, organic matter content, and bulk density. For the contest, only texture and volume of coarse fragments will be used to estimate the water retention differences of individual horizons above 1.5 m. Estimated water retention coefficients in relation to texture are provided in Table 3. If the instructions for a pit require judging a profile that is less than 1.5 m deep, then assume the last horizon extends to a depth of 1.5 m unless it is directly underlain by or contains a lithic or paralithic contact. Contestants are to assume that plant roots are sufficiently restricted by these contacts that no water is available below the contact. Coarse fragments are considered to have negligible (assume zero) moisture retention so estimates must reflect the coarse fragment content (i.e., subtract the percentage of coarse fragment volume from the whole-soil volume). Table 4 is a sample calculation of water retention difference. The five classes for water retention difference recognized are:

Very Low:	< 7.50 cm
Low:	7.50-14.99 cm
Medium:	15.00-22.49 cm
High:	22.50-29.99 cm
Very High:	> 30 cm

Table 3. Estimated relationships among water retention difference coefficients and soil textural class.

Texture Class of Soil Horizon	cm H2O/cm soil
Silt, silt loam, silty clay loam, loam, clay loam, and very fine sandy loam	0.20
Sandy loam, fine sandy loam, sandy clay loam, sandy clay, clay, and silty clay	0.15
Coarse sandy loam, loamy fine sand, loamy very fine sand, and loamy sand	0.10
Loamy coarse sand and all sands	0.05

Table 4. Example calculation for water retention difference determination.

Horizon	Depth	Textural Class	Coarse Fragments (%)	Water Retention	
Ap	0-12	ls	0	(12cm)(0.10) =	1.2
Bt1	12-28	sc	0	(16cm)(0.15) =	2.4
Bt2	28-54	scl	0	(26cm)(0.15) =	3.9
2Bt3	54-105	l	5	(51cm)(0.20)(0.95) =	9.69
2Bt4	105-132	grl	20	(27cm)(0.20)(0.80) =	4.32
2R	132+	-	-	0	0.00

Total water retention difference = 21.51 cm
= MEDIUM

D. Soil Wetness Class

Soil wetness class is determined by the depth to specific redoximorphic features in the soil indicative of prolonged wetness, specifically depletions with a color chroma of 2 or less and a color value of 4 or more (i.e., gray depletions of at least common abundance as defined by the NRCS). Redox concentrations alone shall not be sufficient evidence for a state of wetness. The wetness classes to be used for this contest are:

Very Shallow:	< 25 cm
Shallow:	25 to 49 cm
Moderately Deep:	50 to 99 cm
Deep:	100 to 149 cm
Very Deep:	> 150 cm

If no evidence of wetness exists within the specified depth for characterization and that depth is less than 150 cm, assume the wetness class is "Very deep". These classes indicate free water and reduction occurs, but do not indicate the duration of occurrence of free water.

Part III: Site Characteristics

A. Parent Material

Parent material refers to unconsolidated organic and mineral material in which soils form. As parent material cannot be observed in its original state, inference from the properties of the soil and from other evidence must be used. Mode of deposition and/or weathering may be implied or implicit. The following parent materials will be used in this contest:

1. Alluvium – Alluvium is material transported and deposited by flowing water or in ponded depressions. Alluvium includes material on floodplains, stream terraces, alluvial fans, and at the base of slopes, drainage ways, and depressions. Water is the primary mechanism of transport. Evidence of sorting by flowing water (i.e., stratification) may occur in several forms, including irregular variations of particle size with depth, especially of sand and rock fragment sizes. For example, thin strata (i.e., layers) of sandy textures alternating with silty textures, or a change from non-gravelly to

extremely gravelly textures indicate irregular deposition due to variation in the velocity of flowing water. Rounded rock fragments sorted by size are also clues of movement by flowing water. In flooded areas, the soil may contain buried horizons and is coarser-textured nearest the active channel, becoming finer-textured away from the channel. Alluvium may occur on terraces well-above present streams or present floodplains or deltas.

2. Colluvium – Colluvium is unconsolidated, poorly sorted material accumulated on, and especially at the base of, hill slopes. Colluvium results from the combined forces of gravity and water in the local movement and deposition of materials. Colluvium may contain a mixture of rock fragment types with variable size and orientation within a horizon, or colluvium may contain a mismatch between rock fragments in upper horizons with those of horizons below that retaining rock-controlled structure or in-place rock fragments below. Recently transported colluvium can be present on backslope, footslope, or toeslope positions in a hill slope profile.

3. Residuum - Unconsolidated, weathered, or partly weathered mineral material that accumulates by the in-place disintegration of bedrock. Residuum has not been transported.

Sometimes two parent materials may be evident in a pedon, for example alluvium over residuum. If evident, indicate the transition with an Arabic numeral in the "Prefix" column beginning with the number 2 for the first transition. It is implied that the overlying parent material is number 1. For example, the following sequence may be found in a profile with two parent materials: A – E – Bt1 – 2Bt2 – 2Bt3 etc.

B. Landform

The landform on which the soil pit is located should be identified. If the pit is in an ambiguous position or the position is obscured by the spoil pile, the slope stakes will be placed in such a position and/or orientation to reinforce the identity of the landform upon which the pit resides.

1. Depression - Positions on the landscape where water and/or sediment accumulate. They have no free surface water drainage outlet.

2. Floodplain - The lowest geomorphic surface which is adjacent to the stream channel and which floods first when the stream goes into flood stage. A floodplain is formed by the deposition of alluvium. Each stream has only one floodplain.

3. Stream terrace - These are geomorphic surfaces formed by the deposition of alluvium, but are higher in elevation than the current floodplain. A stream may have one or more terraces. For the purpose of this contest, a landform will NOT be designated as a stream terrace unless its association with a present-day stream is reasonably apparent.

4. Mound – A rounded or oblong mound, where each mound is less than 0.1 ha (< 0.2 ac) in area and generally is less than 1 m (< 3 ft) higher in elevation than the immediately surrounding soil. The presence of a mound is generally indicative of an undisturbed surface (i.e., no cultivation).

5. Inter-mound - The lower-elevation area between adjacent mounds.

6. Uplands - Areas dominated by residual and colluvial parent materials and usually occur above floodplains and stream terraces. The bulk of soil material in uplands is produced by physical and chemical weathering of parent material in place and/or mass wasting, such as soil creep, debris and mud flows, slump, landslides, etc.

C. Slope Gradient

Slope classes to be used in the contest are listed on the scorecard. If a site falls on the boundary of two slope classes, mark the steeper class. The slope is to be determined between two stakes at each site designated for this purpose. The student is responsible for checking the heights of the stakes, but the heights of the slope stakes will be set equal upon initial establishment.

D. Hill Slope Profile

The following are the designations for hill slope profile that will be used in this contest with a brief description, which follow the adapted diagram below from Ruhe (1975):

1. Summit (SU) - The topographically highest, local position of a hill slope profile with a nearly level (planar or only slightly convex) surface. Ridge tops are included under summit since they are topographic highs and are usually planar in one direction.

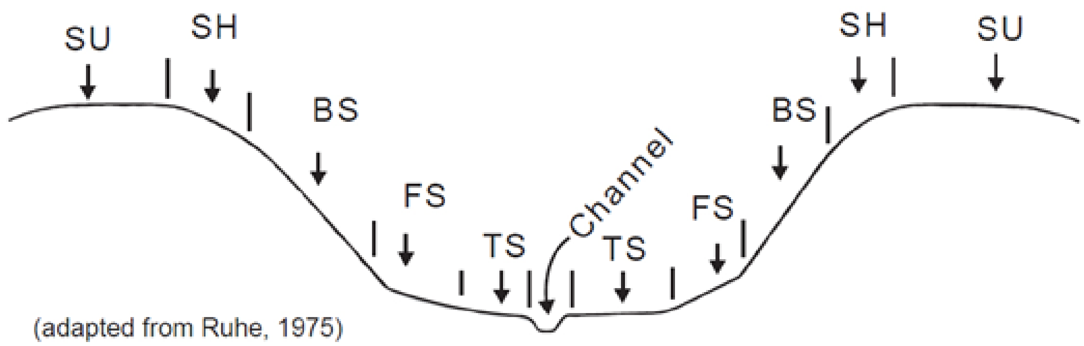
2. Shoulder (SH) - The hill slope profile position that forms the convex, erosional surface near the top of a hill slope. The shoulder comprises the transition zone from summit to backslope.

3. Backslope (BS) - This position includes all landscape positions between the shoulder and footslope.

3. Footslope (FS) - The position that forms the concave surface at the base of a hill slope. In some landscapes, the footslope may gradually transition into a toeslope.

5. Toeslope (TS) - The lowest component that extends away from the base of the hill slope. Toeslopes are typically linear in shape. The toeslope may gently transition to a floodplain or depression. If the pit located in a closed depression center that is linear in shape, toeslope should be marked.

6. None – This designation will be used when the slope at the site is < 2% AND the site is not in a well-defined example of one of the hill slope positions given above (e.g., within a nearly level stream terrace or floodplain).



(adapted from Ruhe, 1975)

E. Surface Runoff

Surface runoff refers to water that flows away from the soil over the land surface. Surface runoff is controlled by a number of factors including soil properties, climate, and plant cover. Runoff can be significantly altered by management (i.e., natural cover, cultivation, minimum tillage operations, etc.). For the purpose of this contest, only the runoff classes in Table 5 will be used.

Table 5. Surface runoff classes.

% Slope	Hydraulic Conductivity of the Surface Horizon: High	Moderate	Low
	------------ surface runoff class		----------------
0-1	Very Slow	Very slow	Very slow
1-3	Very slow	Slow	Slow
3-5	Slow	Medium	Medium
5-8	Medium	Medium	Rapid
8-12	Medium	Rapid	Very rapid
12-20	Rapid	Very rapid	Very rapid
> 20	Very rapid	Very rapid	Very rapid

If the measured slope falls exactly on a break between slope classes, select the steeper slope category. Should a site be forested or in pasture, the surface runoff may be significantly decreased due to vegetative or residue cover. When surface cover is dense (i.e., less than 10% bare soil visible, as determined between the slope stakes), the surface runoff class should be assigned one lower rate class to a minimum of "Very slow". "Ponded" shall be used to describe surface runoff in depressional areas only.

F. Erosion Potential

Soil erosion potential refers to the likelihood of soil erosion by water. The potential for future erosion losses is influenced mainly by the texture of the surface soil and the amount of surface runoff at a site. For the purpose of this contest, only the erosion potential classes in Table 6 will be used. It is assumed that granular structure or structureless - single grained exists for the surface horizon and that the soil is bare, although in this contest there is no adjustment if that is not the case.

Table 6. Erosion potential classes.

	Surface Horizon Texture			
Surface Runoff	S, LS	SCL, SC	SL, CL, C, SiC	L, Si, SiL, SiCL
Ponded	Very low	Very low	Very low	Very low
Very slow	Very low	Very low	Low	Medium
Slow	Very low	Low	Medium	Medium
Medium	Very low	Low	Medium	High
Rapid	Low	Medium	High	Very high
Very Rapid	Medium	High	Very high	Very high

Part IV: Soil Classification

Keys to Soil Taxonomy, 12th Edition (2014) should be used for details on soil classification. Only the diagnostic horizons, features, and orders possible for mineral soils in the contest area are listed on the scorecard along with pertinent data displayed on the pit sign (i.e., percent base saturation and organic carbon).

Part V: Interpretations

Soil interpretations involve the determination of the degree of limitation for each soil at a site for a specified use. The most restrictive soil property determines the limitation rating. In cases where the base of the pit does not extend to the depth indicated in the following tables (e.g., 150 cm), one should assume that the lowest horizon in the pit extends to the depth of interest, unless a lithic or paralithic contact occurs within the depth to be judged. The following soil use interpretation tables are partially extracted and modified from the National Soil Survey Handbook (NSSH).

The depth to a seasonally high water table is based on the shallowest observed depth of redoximorphic depletions of color value ≥ 4 with chroma ≤ 2 or a depleted matrix.

The hydraulic conductivity criteria for the septic tank absorption field interpretation excludes the upper 50 cm of the soil profile, thus only the soil between the depths of 50 and 150 cm should be considered.

In addition to indicating the suitability rating for each soil use, contestants will record the number corresponding to the reason in the table used for the suitability rating selected on the scorecard. If all the evaluations are "slight", then record "none" as the reason on the scorecard or record a dash (-).

Soil Use Interpretations Tables

Dwellings with Basement

	Degree of Limitation		
Factors Affecting Use	Slight	Moderate	Severe
1. Flooding or ponding frequency	None	Not a choice	Rare to Frequent
2. Slope (%)	< 6	6 - 15	> 15
3. Depth to seasonally high water table (cm)	> 100	50 - 100	< 50
4. Depth to soft rock (Cr) (cm)	> 100	50 - 100	< 50
5. Depth to hard rock (R) (cm)	> 150	100 - 150	< 100

Septic Tank Absorption Field

	Degree of Limitation		
Factors Affecting Use	Slight	Moderate	Severe
1. Flooding or ponding frequency	None	Not a choice	Rare to Frequent
2. Slope (%)	< 6	6 - 15	> 15
3. Depth to seasonally high water table (cm)	> 150	100 - 150	< 100
4. Depth to High or Low hydraulic conductivity*	> 150	100- 150	< 100
5. Depth to rock (R or Cr) (cm)	> 150	100 - 150	< 100

* Excluding the upper 50 cm of the soil profile. Only evaluate soil horizons between 50 and 150 cm.

Local Roads and Streets

	Degree of Limitation		
Factors Affecting Use	Slight	Moderate	Severe
1. Flooding or ponding frequency	None	Not a choice	Rare to Frequent
2. Slope (%)	< 6	6 - 15	> 15
3. Depth to seasonally high water table (cm)	> 50	25 - 50	< 25
4. Depth to soft rock (Cr) (cm)	> 100	50 - 100	< 50
5. Depth to hard rock (R) (cm)	> 150	100 - 150	< 100

ATTACHMENT 1

Official Abbreviations

Boundary Distinctness

Abrupt - A	Clear - C	Gradual - G	Diffuse - D

Coarse Fragments

Gravelly	- GR	Cobbly	- CB	Channery	- CH
Very Gravelly	- VGR	Very Cobbly	- VCB	Very Channery	- VCH
Extremely Gravelly	- XGR	Extremely Cobbly	- XCB	Extremely Channery	- XCH

Texture

Coarse sand	- COS	Fine sandy loam	- FSL
Sand	- S	Very fine sandy loam	-VFSL
Fine sand	- FS	Loam	- L
Very fine sandy	- VFS	Clay loam	- CL
Loamy coarse sand	- LCOS	Silt	- SI
Loamy sand	- LS	Silt loam	- SIL
Loamy fine sand	- LFS	Silty clay loam	- SICL
Loamy very fine sand	- LVFS	Silty clay	- SIC
Coarse sandy loam	- COSL	Sandy clay loam	- SCL
Sandy loam	- SL	Sandy clay	- SC
Clay	- C		

Structure, Grade

Weak – 1	Moderate – 2	Strong – 3	Structureless – 0

Structure, Shape

Granular	- GR	Angular blocky	- ABK
Platy	- PL	Subangular blocky	- SBK
Prismatic	- PR	Single-grained	- SG
Columnar	- CO	Massive	- MA
Wedge	- W		

Consistency, Moist Strength

Loose	- L	Firm	- FI
Very friable	- VFR	Very firm	- VFI
Friable	- FR	Extremely firm	- EFI

Redox Features, Type and Abundance

RMF Type:	Concentration – CON		Depletion – DEP
Abundance:	Few - F	Common – C	Many – M

ATTACHMENT 2

Soil Textural Triangle