

# Collegiate Soils Contest

## Guidelines Excerpt

**West Texas A&M University Canyon, TX**

**Department of Agricultural Sciences**

**USDA Natural Resources Conservation Service**

### **SASES**

<https://www.agronomy.org/students/>



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## II. Scorecard Instructions.

The scorecard consists of four parts: I. Soil Morphology; II. Site Characteristics; III. Soil Taxonomy; and IV. Interpretations (refer to the attached example). The Soil Survey Manual (Chap. 3, 1993), and Field Book for Describing and Sampling Soils, Ver. 2.0 (Schoeneberger, P. J. et al., 2002) and Keys to Soil Taxonomy (10<sup>th</sup> ed., 2006) will be used as guides. These publications are available on the Internet for downloading at the USDA-NRCS website, <http://soils.usda.gov/technical/>.

Profile Description (I. Soil Morphology). The student describes the color, texture, structure, depth, and other characteristics of each horizon in the soil profile revealed in the pit.

A. *Horizon designations* (Chapter 18, pp. 311-316, Keys to Soil Taxonomy, 2006)

Horizon designation will follow standard procedures, including a master, transitional or combination horizon symbol in the "Master" column, and when needed, a lower case symbol in the suffix column, and an Arabic numeral in the "No." column. All B horizons must have a suffix. Arabic numerals indicating lithologic discontinuities and prime symbols to distinguish otherwise identical designations should be placed in the "Master" column. If no designation is necessary, contestants must place a dash in that position to receive credit.

The most common suffixes used in the Texas High Plains soils descriptions are b, k, kk, m, p, ss, t, and w. Soils of lesser extent may use g, n, r, y, and z. As described in Part III B of this document, Stage V and VI petrocalcic horizons will be considered buried soils. In all other cases, the suffix b will be used only when a buried solum, including an A horizon, is clearly expressed.

B. *Depth*

The depth of the lower boundary as measured from the soil surface should be recorded (cm). Alternately, the depth of 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" or "30-45 cm". The last horizon boundary should be the specified judging depth with a "+" added. Thus, if asked to evaluate five horizons to a depth of 140 cm, the fifth depth would 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 flagged area on the pit wall. A range for the depth considered correct will be established based on distinctness and topography of the boundary. No horizon less than 8 cm thick will be described. If a horizon less than 8 cm thick occurs, it should be combined with the adjacent horizon that is most similar for 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 a lithic or paralithic contact occurs at or above the specified depth on the site card, the contact should be considered in evaluating the water retention difference, effective soil depth, and hydraulic conductivity. Otherwise, the last horizon should be assumed to extend to 150 cm for making all relevant evaluations. If a lithic or 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. R or Cr). However, morphological features need not be provided and dashes should be used on the scorecard. If the contestant gives morphological information, it will be ignored by the graders and it will not count against the total score. If in doubt concerning the nature of the horizon, the contestant would be advised to provide all of the normal data.

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

Distinctness refers to the thickness of the zone within which the boundary can be located. The distinctness of a boundary depends partly on the degree of contrast between the adjacent layers and partly on the thickness of the transitional zone between them. The topography of the boundary will not be required for this contest. The boundary distinctness of the lowest horizon will not be determined and will not be graded. Distinctness classes are

- Abrupt: < 2 cm thick
- Clear: 2-5 cm thick
- Gradual: 5-15 cm thick
- Diffuse: >15 cm thick

D. *Clay Percentage and Texture* (Chap. 3, pp. 136 –143, Soil Survey Manual)

Estimates of the clay percent should be placed in the space provided. Credit will be given for estimates within 4% of the lab-determined clay content. **All** horizons have been sampled and laboratory data will be used to determine the percent clay and textural classes. Soil textural classes as defined in Chapter 3 will be used. Deviation from standard nomenclature will be incorrect (i.e. silty loam, clayey sand). Credit for sand, loamy sand and sandy loam textures will not be given if sand modifiers are needed (i.e. very fine, fine or coarse). Modifiers will be required for loamy sands and sandy loams, such as loamy fine sand and fine sandy loam.

Modification of the textural class will be required if the horizon contains more than 15% by volume coarse fragments (>2mm), which includes carbonate nodules. Sieves will be allowed during the contest. For the purpose of this contest, only the following terms will be used to describe coarse fragments:

Gravelly – fragments 2 mm to 75 mm in diameter of any lithology and shape.

Cobbly – fragments of any shape and lithology that are greater than 75 mm diameter by their long axis.

If gravel and cobbles occur in the same horizon, the dominant condition should be described.

Coarse fragment modifiers are required as follows:

<u>Coarse fragment</u> (vol/vol)	<u>Modifier</u>
0-15%	none
15-35%	gravelly or cobbly
36-60%	very gravelly or cobbly
≥60%	extremely gravelly or cobbly

To serve as an example, if the soil fines have a texture of clay loam and 40% gravel-sized fragments exist, the texture would be ‘very gravelly clay loam’ or ‘VGR CL’.

E. *Color* (Chapter 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 mollic epipedon in Soil Taxonomy (pp. 15). For all other horizons, the color recorded should be the dominant color of the matrix (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 2000 revised edition of Munsell color charts will be used for the contest.

F. *Redoximorphic Features (RMF)* (Keys to Soil Taxonomy, 10<sup>th</sup> ed., p. 23-24)

Redoximorphic features are soil morphological features caused by alternating reduction/oxidation 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 a major determinate of color patterns within or across entire 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 (Fe<sup>2+</sup>) is comparatively much more soluble and mobile than oxidized iron (Fe<sup>3+</sup>), 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.

Report the moist abundance (few, common, many) of the most dominant RMF. Indicate if it is a concentration or depletion (Con/Dep). If no secondary colors due to wetness are present, mark both “Abundance” and “Con/Dep” with “-”.

A reduced matrix will not be included in the contest due to the required identification time and the need for  $\alpha,\alpha$ -dipyridyl solution to determine the presence of reduced Fe.

Redoximorphic features in the Texas High Plains are transient, but when present generally are associated with playas. Playas are subject to episaturation during runoff events, and may retain water for a few days to a few months in any given year. Playas are not a reliable surface water source, as they may be dry for years between runoff events.

*G. Structure* (Chapter 3, pp. 157 – 163, Soil Survey Manual)

The ability to observe the grade (strength of expression) of structure in the Texas High Plains depends strongly on the water content at observation time. Prismatic structure is common in the B horizon, but difficult to observe in wet conditions. Also, there is a dispute about whether prismatic structure should ever have a strong grade. Prisms commonly subdivide into blocks.

Therefore, for this contest, describe only type (shape) of structure, and not the grade, though it will be identified in the practice pit descriptions. If more than one type is present, describe both. For example, if prisms are observed that divide into subangular blocks, note PR/SBK. The practice pit descriptions will include the grade, as well, and for the same horizon, might indicate 1 PR/2 SBK.

Acceptable natural soil structural unit types include: angular blocky, columnar, granular, platy, prismatic, subangular blocky, and wedge. Structureless types include single grain and massive.

*H. Effervescence* (Chapter 3, pp. 192 – 193, Soil Survey Manual)

Effervescence is useful in arid and semiarid region soils to identify the presence of free carbonates. As water moves through the soil with time, the depth to free carbonates increases. When the wetting depth is consistent through long time periods, carbonates may begin to accumulate at that depth. It is likely that all original eolian materials had free carbonates. This test is often useful in determining horizons and boundaries. Four effervescence classes are used:

No Effervescence	
Very slightly effervescent	few bubbles seen
Slightly effervescent	bubbles readily seen
Strongly effervescent	bubbles form low foam
Violently effervescent	thick foam forms quickly

Part II – Site Characteristics. The students describe the external features of the site surrounding the profile.

*A. Site position*

The Texas High Plains, a component of the High Plains in the Great Plains Province of the Interior Plains, represent a geologically young landscape that is not highly dissected. Traditional, hillslope profile positions (backslope, footslope, shoulder, summit, and toeslope) make little sense, and are rarely found on most of the High Plains, due to subdued relief. When found, typically they are associated with intermittent drainageways and erosional remnants. The sites and likely landscape associations are provided.

**Backslope:** All hillslope positions between the shoulder and the toeslope. It will be associated with intermittent, incising drainageways and erosional remnants.

**Depression:** For the purpose of this contest, these are shallow depressions less than 1 ha in size showing no visible signs of developed surface outlets for runoff. This site position could be used for areas between sand dunes, but may occur on plains, as well. Eolian should be marked as the parent material.

**Dune:** A ridge of sand created by the wind.

**Footslope:** The hillslope position that forms the concave surface at the base of a hillslope. It is a transition zone between upslope sites of erosion and transport (shoulder, backslope) and downslope sites of deposition (toeslope). Colluvium is the most likely parent material.

Flood plain: The nearly level plain that borders a stream and is subject to inundation under flood conditions unless protected artificially. Parent material is alluvium. In the High Plains, these are associated with intermittent streams incising into the existing plain that may flood for short durations at least once every one to five years.

Plain: This site position accounts for the majority of the landscape, which is essentially planar with slight slopes (0 to 3%). The parent material includes Pleistocene (Blackwater Draw Formation or cover sands) and Holocene eolian sediments.

Playa: An enclosed basin subject to episaturation in Dallam County (and throughout the High Plains). Wetland that occurs primarily in semi-arid and arid environments. The correct parent material is lacustrine. Most playas on the High Plains likely formed as a result of dissolution and/or deflation. In playas farther to the south, wind-blown sediments are deposited on the eastern to southeastern (leeward) side of the playa forming a playa dune. Playa dunes are uncommon in the northern portion of the Texas High Plains due to finer-textured, surface materials.

Playa step: The nearly level bench within a large playa basin that flanks, and is topographically higher than, the playa floor. Earlier terms were playa terrace and playa bench. Lacustrine should be marked as the parent material when the surface texture is clay. Eolian should be marked as the parent material when the surface texture is clay loam or coarser.

Shoulder: The hillslope position that forms the convex, erosional surface near the top of a hillslope. If present, it comprises the transition zone from the plain to the backslope into the drainageway. Eolian is the most common parent material.

Stream terrace: One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the dissected remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of erosion or deposition. Parent material is alluvium.

Summit: The topographically highest position of a hillslope profile with a nearly level (planar or only slightly convex) surface. These positions are rare throughout much of the High Plains, but are associated with erosional remnants.

Toeslope: The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes commonly have a linear slope shape with gentler slopes, and are constructional surfaces forming the lower part of a hillslope continuum.

#### B. *Parent Material* (Glossary of Soil Science Terms, 2001, SSSA, modified to fit the region)

Parent material kind is a term describing the general physical, chemical and mineralogical composition of the material, mineral or organic, from which the soil develops. Mode of deposition and/or weathering may be implied or implicit.

Alluvium: Sediments deposited by running water of streams and rivers. It may occur on terraces well above present streams, on flood plains, or as fans at the base of a slope. Most streams in Dallam County do not have terraces, though the Canadian River in Potter County has terraces.

Colluvium: Unconsolidated, unsorted earth material being transported or deposited on sideslopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff. Examples are Berda and Mobeetie soils which are associated with the Canadian River Breaks and Caprock Escarpment, but not typically found in Dallam County.

Eolian: Pertaining to earth material transported and deposited by the wind including dune sands, sand sheets, and loess (<5% sand). The eolian materials in the High Plains generally have more than 5% sand, thus are not loess. In Dallam County, Pleistocene (Blackwater Draw Formation) sediments were deposited, that, in places, were later covered with Holocene sediments.

Lacustrine deposit: Clastic sediments and chemical precipitates deposited in lakes and playas. (Clastic – Transported fragments of rock or sediment mainly derived from preexisting rocks or minerals.)

Residuum: Unconsolidated, weathered, or partly weathered mineral material that accumulates by disintegration of bedrock in place. These exposures are rare in the High Plains, but are more common in the Rolling Plains, associated with sedimentary rocks of the Trujillo, Tecovas, and Quartermaster Formations. In the High Plains, residuum is most commonly associated with the Canadian River Breaks, or the formations below the Caprock Escarpment.

### *C. Slope Classes*

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. The stakes will be of equal height. However, each student is responsible for checking the stakes, in case they are moved during the contest.

### *D. Erosion Classes* (Chapter 3, pp. 86-89, Soil Survey Manual)

The degree to which accelerated erosion has modified the soil may be estimated during soil examinations. The conditions of eroded soil are based on a comparison of the suitability for use and the management needs of the eroded soil with those of the uneroded soil. The eroded soil is identified and classified on the basis of the properties of the soil that remains. Original depth of topsoil will not be provided because it is not known. Base determinations on existing conditions.

Deposition. There is evidence that the soil has received additional sediments. The thickness of the A and E horizon (if present) currently at the site is greater than the original thickness of the A and E horizons. Holocene depositions may bury a previous solum, and include a buried A.

Class 1. This class consists of soils that have lost some, but on the average less than 25 percent, of the original A and/or E horizons, or of the uppermost 20 cm if the original A and/or E horizons were less than 20 cm thick. Evidence for Class 1 erosion includes 1) a few rills, 2) an accumulation of sediment at the base of slopes or in depression, 3) scattered small areas where the plow layer contains material from below, and 4) evidence of the formation of widely spaced, deep rills or shallow gullies without consistently measurable reduction in thickness or other change in properties between rills or gullies.

Class 2. This class consists of soils that have lost, on the average, 25 to 75 percent of the original A and/or E horizons or of the uppermost 20 cm if the original A and/or E horizons were less than 20 cm thick. The surface layer consists of the original A and/or E horizons mixed with material from below. There may be small, uneroded areas and small, severely eroded areas.

Class 3. This class consists of soils that have lost, on the average, 75 percent or more of the original A and/or E horizons or of the uppermost 20 cm if the original A and/or E horizons were less than 20 cm thick. In most areas, material below the original A and/or E horizons is exposed at the surface; the plow layer consists entirely or largely of this material.

Class 4. This class consists of soils that have lost all of the original A and/or E horizons or the uppermost 20 cm if the original A and/or E horizons were less than 20 cm thick. These include some or all of the deeper horizons throughout most of the area. Most areas have an intricate pattern of gullies.

Soil Classification (Part III – Soil Taxonomy). The student uses the information in the profile description and a system of soil classification to identify each horizon and classify the soil (Put it into the correct category.).

#### *A. Diagnostic Epipedons, Subsurface Horizons and Features, and Order*

Keys to Soil Taxonomy (2006) should be used for details on soil classification. Only the diagnostic horizons, features, and orders possible for mineral soils in this area are included on the scorecard. Percent organic carbon (OC), calcium carbonate percentage, will be given on a sign at each pit. If deemed appropriate, gypsum content and/or sodium adsorption ratio will be provided. The basic cation saturation percentage (BCSP) will not be provided because it is essentially 100% in most High Plains soils. In some intensively cropped, sandy soils, BCSP as low as 85% have been observed.

### B. Stages of Carbonate Accumulation

Pedogenic carbonate is closely linked to soil age based on the observation that soils of progressively older geomorphic surfaces contain soils with progressively greater amounts of carbonate. The sequential increase of carbonate is ordered into four stages based on gravel content<sup>1</sup> (Attachment 2). Soils formed in gravelly parent materials progress from stage I pebble coatings to stage II interpebble fillings; a stage III plugged horizon, and eventually a stage IV laminar horizon atop the plugged horizon. Soils formed in nongravelly material progress from stage I filaments to stage II nodules, a stage III plugged horizon, and eventually a stage IV laminar horizon atop the plugged horizon. For older, more developed carbonate accumulations, two additional stages are added<sup>2,3</sup>. Stage V is characterized by laminae > 1cm thick and may contain pisoliths as well as vertical faces and fractures coated with laminated carbonate. Stage VI contains multiple generations of recemented laminae, breccia, and pisoliths. Stages V and VI petrocalcic horizons will be considered buried, but a lithological discontinuity **will not** be assigned.

Part IV – Interpretations. The student uses the information in the profile description, e.g., texture, structure, slope, etc., to estimate soil water characteristics, and determine how well-suited a soil is for a certain use.

A & B. *Hydraulic conductivity* (Classes simplified from p. 2-70, Field Book, v. 2.0, 2002)

Estimate the saturated hydraulic conductivity of the surface horizon (Hydraulic Conductivity/Surface) and the most limiting horizon (Hydraulic Conductivity/Soil) within the depth specified for judging. Should a lithic or paralithic contact occur at the specified judging depth, it should not be considered in evaluating conductivity. A petrocalcic horizon **will not be** considered as paralithic, but is both root and water restrictive.

High – Greater than 3.6 cm/hr. This class includes sands and loamy sands. 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. Normally, low hydraulic conductivity is associated with clay, silty clay, and sandy clay horizons. Massive, silt and silt loam E horizons, natric horizons and stage III (or greater) carbonate developed horizons will be included in this class.

C. *Water Retention Difference* (Chapter 5, p. 292-293, Soil Survey Manual).

The amount of water that a soil can hold between 33kPa (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 centimeters of water per centimeter of soil. Classes are based on the amount of water retention difference in the upper 1.5m of soil, or above a root-limiting layer, such as a lithic or paralithic contact, or a petrocalcic horizon. The five classes recognized are:

Very High	≥ 30 cm
High	22.50 – 29.99 cm
Medium	15.00 – 22.49 cm
Low	7.50 – 14.99 cm
Very Low	< 7.50 cm

<sup>1</sup>Gile, L.H., F.F. Peterson, and R.B. Grossman. 1966. Morphological and genetic sequences of carbonate accumulation in desert soil. *Soil Science* 101:347-360.

<sup>2</sup>Bachman, G.O. and M.N. Machette. 1977. Calcic soils and calcretes in the southwestern United States. U.S. Geol. Surv. Open-File Rep. 77-794. U.S. Gov. Print. Office, Washington, DC.

<sup>3</sup>Machette, M.N. 1985. Calcic soils of the southwestern United States. p. 1-21. *Soils and Quaternary geology of the southwestern United States. Spec. Pap. Geol. Soc. Am.* 203.

Many factors affect the water retention difference of individual horizons, including texture, mineralogy, soil structure, coarse fragments, organic carbon content and bulk density. For the contest, only texture and volume of coarse fragments will be used to estimate the water retention difference of individual horizons above 1.5 m. (Soils with water retention differences on a class boundary should be included in the next higher class).

Estimated relationships of water retention difference to texture are as follows:

<u>Textural Class of Soil Fines</u>	<u>cm H<sub>2</sub>O/cm soil</u>
Silt, silt loam, silty clay loam, loam, clay loam, very fine sandy loam	0.20
Sandy loam, loamy very fine sand, very fine sand, fine sand, fine sandy loam, sandy clay loam, sandy clay, clay, silty clay	0.15
Coarse sandy loam, loamy fine sand, loamy sand	0.10
Loamy coarse sand, all sands	0.05

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 a lithic or paralithic contact, or a petrocalcic horizon. Since lithic and paralithic contacts, and petrocalcic horizons are considered root-restricting layers, contestants are to assume no water retention difference occurs below the contacts. Coarse fragments are considered to have negligible (assume zero) moisture retention so estimates must reflect the coarse fragment content (subtract the percentage of coarse fragment volume, see example below). The following is a sample calculation of water retention difference:

Table 4. Example of water retention calculation.

Horizon	Depth	Texture	Coarse Fragments	Calculation	Water Retention
	- cm -		- % -		- cm -
Ap	0-15	vfs1	0	(15 cm)(0.20 cm/cm) =	3.0
A	15-28	vfs1	0	(13 cm)(0.20 cm/cm) =	2.6
Bt	28-54	scl	0	(26cm) (0.15 cm/cm) =	3.9
Btk1	54-105	sc	5	(51 cm) (0.15 cm/cm) (0.95) =	7.3
Btk2	105-122	sc	15	(17 cm) (0.15 cm/cm) (0.85) =	2.2
Bkkm	122+	-	-	NA due to petrocalcic	0.0
Total Water Retention Difference:					19.0

The example problem has a water retention class of medium.

#### D. *Wetness Class* (Chapter 3, pp. 98-100, Soil Survey Manual).

The soil wetness classes to be utilized in the contest are those that define the “depth to a wet state”. They are:

- Class 1. Not wet above 150cm.
- Class 2. Wet in some part between 100 and 149.9cm
- Class 3. Wet in some part between 50 and 99.9cm.
- Class 4. Wet in some part between 25 and 49.9 cm.
- Class 5. Wet above 25 cm.

The “wet state” shall be understood to mean saturation with reduction. Soil morphology shall be used to estimate the occurrence of saturation with reduction. Soil materials indicating the wet state would be those that have gray (chroma ≤ 2, value ≥ 4) matrix colors (RMF). (This is the criterion of the NRCS, other agencies use other colors.) If no evidence of wetness exists within the specified depth for characterization and that depth is less than 150cm, assume Class 1.

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. In order to give continuity to the evaluation of surface runoff, the following will be used. The Soil Survey Handbook has more classes than the following table. **Only the classes presented in the table will be used for this contest.** If a site is forested or in pasture, the surface runoff may be significantly decreased due to vegetative cover. When vegetative cover is dense, 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 and playas.**

Table 4. Hydraulic conductivity and surface runoff relationships.

Slope	Hydraulic Conductivity of the Surface Horizon		
	High	Moderate	Low
- % -	----- Surface Runoff -----		
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

Contestants will be expected to recognize soil limitations relative to homes with basements, traditional septic system absorption fields, and local roads and streets. The following tables are guides to making soil interpretations for these uses. When utilizing the following tables the overall degree of limitation is determined by the most restrictive soil property. 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, paralithic, petrocalcic, or petrogypsic contact occurs within the depth to be judged.

Table 5. Rating Guide for Houses With Basements

Property	Slight	Moderate	Severe
Flooding	none	-----	any
Ponding	no	-----	yes
Depth to high water table	> 180 cm	75 – 180 cm	< 75 cm
Depth to bedrock	> 180 cm	100 – 180 cm	< 100 cm
Depth to cemented pan	>150 cm	100 – 150 cm	<100 cm
Slope	< 8%	8 – 15%	> 15%
Shrink swell	< 8 cm clay	8 – 16 cm clay	> 16 cm clay
% >8 cm stones, 0 - 100 cm	< 25%	25 – 50%	> 50%

Table 6. Rating Guide for Septic Tank Absorption Fields

Property	Slight	Moderate	Severe
Flooding	none	-----	any
Depth to bedrock	> 180 cm	100 – 180 cm	< 100 cm
Depth to cemented pan	> 180 cm	100 – 180 cm	< 100 cm
Ponding	no	-----	yes
Depth to high water table	> 180 cm	120 – 180 cm	< 120 cm
Slow Perm. 60 – 150 cm	S, LS, SL	SCL, L, SIL, SI	all others
High Perm. 60 – 150 cm	all others	-----	S, LS
Slope	< 8%	8 – 15%	> 15%
% > 8 cm stones, 0 to 40 cm	< 25%	25 – 50%	> 50%

Table 7. Rating Guide for Local Roads and Streets

Property	Good	Fair	Poor
Depth to bedrock	> 150 cm	100 -150 cm	< 100 cm
Depth to cemented pan	> 150 cm	100 – 150 cm	< 100 cm
Shrink swell	< 8 cm clay	8 – 16 cm clay	> 16 cm clay
Strength (avg. 25 – 100 cm)	S, LS, SL	L, SCL	all others
Ponding	no	-----	yes
Depth to high water table	> 90 cm	30 – 90 cm	< 30 cm
Slope	< 15%	15 – 25%	> 25%
Flooding	none	-----	any
Frost action	S, LS	all others	SI, SIL, SICL
% >8 cm stones, 0 to 40 cm	< 25%	25 – 50%	> 50%

## Attachment 1: Official Abbreviations

### Course Fragments

Gravelly	- GR	Cobbly	- CB
Very Gravelly	- VGR	Very Cobbly	- VCB
Extremely Gravelly	- XGR	Extremely Cobbly	- XCB

### Texture

Course 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		

### Boundary

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

### RMF, Abundance/Concentration

<i>Abundance:</i>		<i>Concentration:</i>	
Few	- F	Concentration	- CON
Common	- C	Depletion	- DEP
Many	- M		

### Structure, Type

Granular	- GR	Angular blocky	- ABK
Platy	- PL	Subangular blocky	- SBK
Prismatic	- PR	Single grain	- SG
Columnar	- CPR	Massive	- M
Wedge	- WEG		

### Effervescence

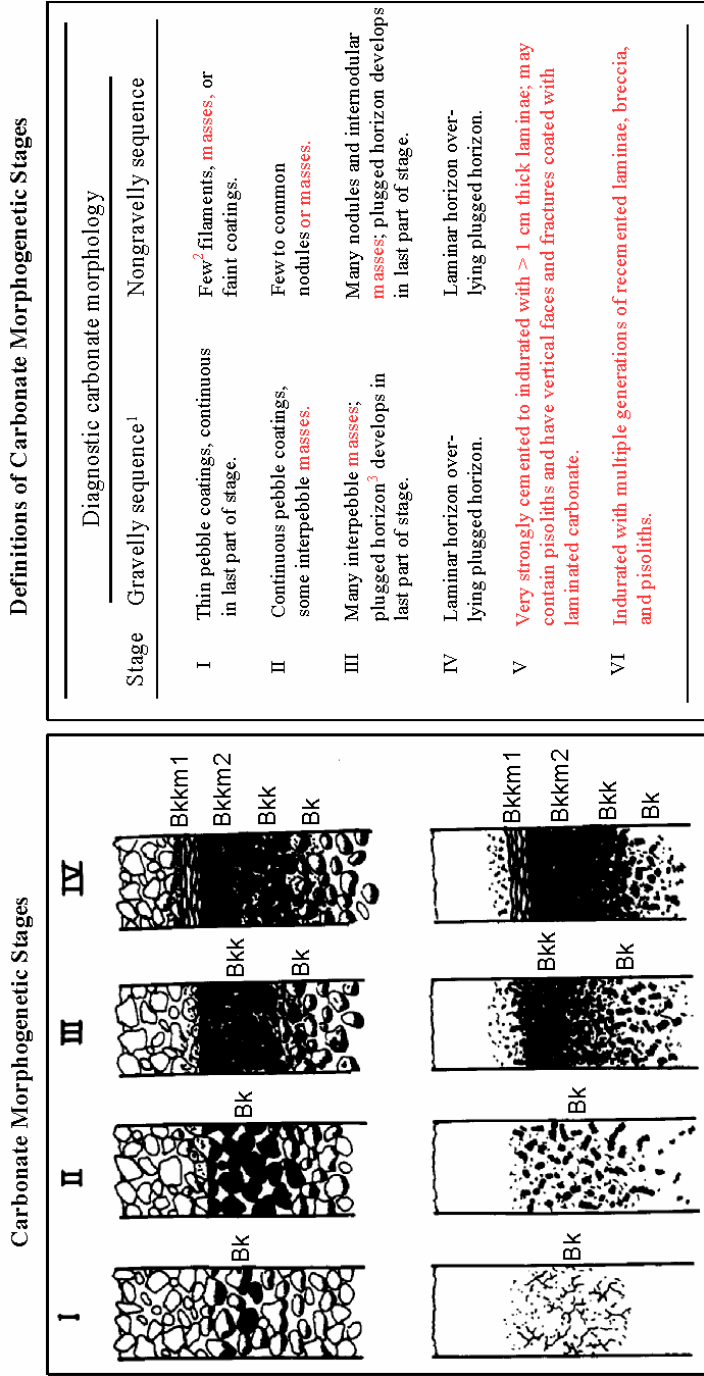
Noneffervescent	- NE
Very Slightly Effervescent	- VS
Slightly Effervescent	- SL
Strongly Effervescent	- ST
Violently Effervescent	- VE

### Limitations

Slight	- 1
Moderate	- 2
Severe	- 3

## Attachment 2 Stages of Carbonate Accumulation

Schematic diagram of diagnostic carbonate morphology for the stages of carbonate accumulation in the two morphogenetic sequences (left below). Stages are described (right below), including stages V and VI not shown in diagram.



<sup>1</sup> Morphologies are best expressed where "nongravelly" materials contain less than about 20 % by volume of rock fragments (fragments 2 mm or larger in diameter), and "gravelly" materials contain more than about 60 % by volume of rock fragments. Materials that have between 20 % and 60 % by volume of rock fragments have intermediate morphologies.

<sup>2</sup> Few < 2, common 2 to < 20, many = 20 or greater percent of area covered.

<sup>3</sup> Plugged horizon contains 50 percent or more pedogenic carbonate (by vol).

Site Number: \_\_\_\_\_

Contestant ID: \_\_\_\_\_

**Score Card**  
**SASES Region IV Collegiate Soils Contest**  
**West Texas A&M University**  
**Fall 2007**

Score: Part I \_\_\_\_\_  
 Part II \_\_\_\_\_  
 Part III \_\_\_\_\_  
 Part IV \_\_\_\_\_  
 Total \_\_\_\_\_

**Part I. Soil Morphology**

Describe \_\_\_\_\_ mineral horizons within a depth of \_\_\_\_\_ centimeters.

Horizon			Depth (cm) (2)	Distinctness of Boundary (2)	Clay % (2)	Texture (4)	Color			Redox Features		Structure	Effervescence (1)
Master (2)	Suffix (2)	No (1)					Hue (2)	Value (2)	Chroma (2)	Abundance (2)	Con/Dep (2)	Shape (2)	

(Possible score: 28 points for each horizon)

Part I Score: \_\_\_\_\_

**Part II. Site Characteristics**

- |                             |                                    |                              |                       |
|-----------------------------|------------------------------------|------------------------------|-----------------------|
| <b>A. Site Position (5)</b> | <b>B. Parent Material (5 each)</b> | <b>C. Slope Gradient (5)</b> | <b>D. Erosion (5)</b> |
| _____ Backslope             | _____ Alluvium                     | _____ 0-1%                   | _____ Class 1         |
| _____ Depression            | _____ Colluvium                    | _____ 1-3%                   | _____ Class 2         |
| _____ Dune                  | _____ Residuum                     | _____ 3-5%                   | _____ Class 3         |
| _____ Footslope             | _____ Eolian                       | _____ 5-8%                   | _____ Class 4         |
| _____ Flood plain           | _____ Lacustrine                   | _____ >45%                   |                       |
| _____ Plain                 |                                    |                              |                       |
| _____ Playa                 |                                    |                              |                       |
| _____ Playa step            |                                    |                              |                       |
| _____ Stream terrace        |                                    |                              |                       |
| _____ Shoulder              |                                    |                              |                       |
| _____ Summit                |                                    |                              |                       |
| _____ Toeslope              |                                    |                              |                       |

Part II Score: \_\_\_\_\_

### Part III. Soil Taxonomy

---

#### A. Diagnostic Surface Horizons (10)

- \_\_\_\_\_ Mollic
- \_\_\_\_\_ Ochric
- \_\_\_\_\_ None

#### B. Subsurface Horizons and features (10)

- \_\_\_\_\_ Argillic
- \_\_\_\_\_ Calcic
- \_\_\_\_\_ Cambic
- \_\_\_\_\_ Gypsic
- \_\_\_\_\_ Lithic contact
- \_\_\_\_\_ Natric
- \_\_\_\_\_ Paralithic contact
- \_\_\_\_\_ Petrocalcic
- \_\_\_\_\_ Salic
- \_\_\_\_\_ Slickensides
- \_\_\_\_\_ None

#### C. Order (10)

- \_\_\_\_\_ Alfisol
- \_\_\_\_\_ Aridisol
- \_\_\_\_\_ Entisol
- \_\_\_\_\_ Inceptisol
- \_\_\_\_\_ Mollisol
- \_\_\_\_\_ Vertisol

Part III Score: \_\_\_\_\_

### Part IV. Interpretations

---

#### A. Hydraulic Conductivity: Surface (5)

- \_\_\_\_\_ High
- \_\_\_\_\_ Moderate
- \_\_\_\_\_ Low

#### B. Hydraulic Conductivity: Soil (5)

- \_\_\_\_\_ High
- \_\_\_\_\_ Moderate
- \_\_\_\_\_ Low

#### C. Water Retention Difference (5)

- \_\_\_\_\_ Very High:  $\geq 30$  cm
- \_\_\_\_\_ High: 22.50-29.99 cm
- \_\_\_\_\_ Medium: 15-22.49 cm
- \_\_\_\_\_ Low: 7.5-14.99 cm
- \_\_\_\_\_ Very low:  $< 7.5$  cm

#### D. Wetness Class (5)

- \_\_\_\_\_ Class 1:  $\geq 150$  cm
- \_\_\_\_\_ Class 2: 100-149.9 cm
- \_\_\_\_\_ Class 3: 50-99.9 cm
- \_\_\_\_\_ Class 4: 25-49.9 cm
- \_\_\_\_\_ Class 5:  $< 25$  cm

#### E. Surface Runoff (5)

- \_\_\_\_\_ Ponded
- \_\_\_\_\_ Very Slow
- \_\_\_\_\_ Slow
- \_\_\_\_\_ Medium
- \_\_\_\_\_ Rapid
- \_\_\_\_\_ Very Rapid

#### F. Limitations

- \_\_\_\_\_ Houses with basements (5)
- \_\_\_\_\_ Septic tank leach fields (5)
- \_\_\_\_\_ Local roads and streets (5)

Part IV Score: \_\_\_\_\_