

SASES Soils Contest Guidbook

Spring 2026

Purdue University

West Lafayette, IN



ASA

American Society of Agronomy



CSSA

Crop Science Society of America



SSSA

Soil Science Society of America

PREFACE

This handbook provides information about the 2026 SASES Soils Contest

2026 Pedology Contest Committee

Kyra Kiel
Senior in Agronomy, Crop & Soil Management
Department of Agronomy
Purdue University
E: kkiel@purdue.edu

Jeff Bradford
Agronomy Faculty & Purdue Soil Judging Coach
Department of Agronomy
Purdue University
E: bradfoj@purdue.edu

INTRODUCTION

This Soils Contest provides opportunities for contestants to test and apply their knowledge and skills in pedology, soil morphology, and geomorphology. Contestants answer questions and name horizons based on soil properties, identify different kinds of soils and associated landscape features, and interpret soil information for agriculture and other land uses. These skills are developed by studying a variety of soils formed from a wide range of parent materials and vegetation in different topographic settings. We all depend on soil for growing plants, crops, and range for livestock; building materials; replenishing water supplies; and waste disposal. If we do not care for our soils, loss of productivity and environmental degradation will follow. By understanding more about soils and their management, we stand a better chance of conserving soil and other natural resources for future generations. Each contest is an opportunity to learn more about the soils of the host region. The contest host and/or committee bases the contest questions and material on a combination of general soils knowledge and local soil properties.

CONTEST OVERVIEW

Eligibility of Contestants

This Soil Contest is open to all undergraduate students and any other participants at the SASES Spring Meeting.

Contest Components

The Soils Contest provides opportunities for students (and others) to apply their knowledge of soil. The contest will consist of 2 parts, a written exam and practical exam. For the written exam, contestants will answer 30 multiple choice questions on soil formation and pedogenic processes, label horizons, identify diagnostic horizons and taxonomic classifications, and interpret soils. For the practical portion of the exam, contestants will estimate soil texture classes, determine textural component percentages, as well as identify soil structure, soil features and horizon color. The practical exam has 15 total questions. The practical exam will have a series of stations setup for each question, with some stations having multiple questions. Such as textural class and clay %.

Contest location, date, and registration

The contest information can be found with the Spring SASES registration. Information on the Spring meeting can be found here:

Awards

Recognition and awards will be given to the top 3 overall individuals in the contest along with the top team. Only undergraduate students are eligible for awards.

Official Scoring and Team Scores

The contest has a maximum value of 60 points for an individual. 30 points are possible for each exam component. Each multiple-choice written question is worth 1 point, and each of the practical questions is worth 2 points. Each school team consists of up to 4 people. The top three scores from each team will be counted as the team score, with a maximum of 180 points.

Breaking a Tie

In the case of a tie for individual awards, the tiebreaker will be the estimates of clay % on the practical exam. If that fails to break a tie, the silt % and sand % will then be used in that order. If a tie still persists, the score of the practical portion of the exam will be used to break a tie. If that does not result in breaking the tie, then all contestants will share that contest placement. In the case of a cash prize, the contestants should receive equal portions of the combined prizes. I.e., if 2 people tie for 1st, the combined 1st and 2nd prizes are shared evenly; if 3 people tie for 1st, they share the even distribution of 1st, 2nd, and 3rd place prizes. In the case of a team tie, the clay % of the highest scoring team members will be used as the tiebreaker. If that fails to break a tie, then the clay % of the next highest scoring members will be used in order, then the silt % and sand % of the members in descending order of score.

Timing of the Contest

The contest has a maximum time of 2 hours. Each host is allowed to create their own timing schedule but the general format of the contest is a split start to maximize time efficiency. Approximately half of the contestants will start on the written portion and half on the practical portion. Students in the practical exam may change stations as they complete each station on their own time and move to a new unoccupied station. Only 1 contestant is allowed at each station at any one time. Some practical stations, such as texture, will be set up for multiple people as they tend to take much longer than other stations. No talking is allowed at or between stations. Contestants caught talking will be given a single warning before being disqualified from the contest.

Once students complete on component of the exam, they may switch to the other component at will, as long as there are empty stations available for the practical exam or seats for the written exam. The contest host will identify acceptable areas to stand and wait for stations to open up.

Permitted Equipment

Students should bring their own writing implement to complete the exam. Pencils are highly encouraged, as there will be no additional answer sheets provided. This guidebook is allowed, as well as a personal hand lens. Water bottles, color books, and towels will be provided by the contest hosts. Cellular phones are not allowed at any time during the competition. Use of cell phones will result in an immediate disqualification from the competition. If you need to access your cell phone during the competition for emergency use, please tell the contest hosts ahead of time.

REFERENCES

General soils knowledge and information can be found in a variety of soils textbooks. Information on soil morphology and taxonomy reference the following documents:

Schoenberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. (editors), 2012. Field Book for Describing and Sampling Soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Soil Survey Staff-NRCS. 1996. National Soil Survey Handbook (title 430-VI). US Government Printing Office, Washington, DC 20402.

Soil Survey Staff-NRCS. 1999. Soil Taxonomy, 2nd edition. USDA Agricultural Handbook 436. Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

Soil Survey Staff -USDA-NRCS. 2014. Keys to Soil Taxonomy, 13th Edition. US Government Printing Office, Washington, DC 20402.

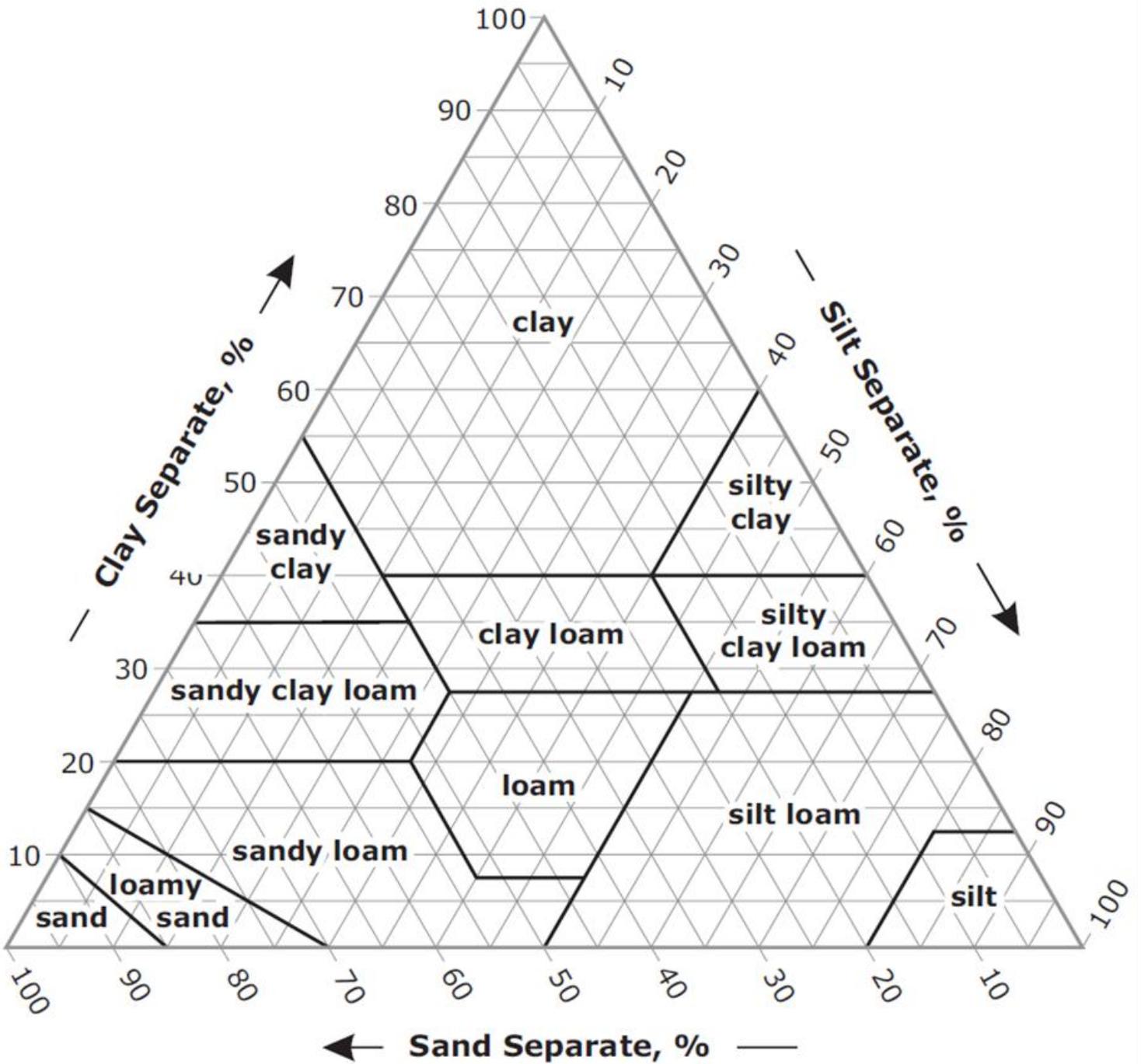
USDA-Soil Survey Division Staff. 1993. Soil Survey Manual. USDA Agricultural Handbook 18. Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

Supplemental Information

The following information may be useful as a reference for the exam. Abbreviations used below are acceptable as answers and may also be used in questions. If you use an abbreviation, make sure it is correct and not ambiguous to be perceived as another answer. I.e. 'P' is not an acceptable answer for soil structure, as it could imply platy or prismatic.

Soil Texture Triangle

(Soil) Textural Triangle:
Fine Earth Texture Classes (——)



Soil Judging Contest Accepted Abbreviations

Distinctness of Boundary: Abrupt = A Clear = C Gradual = G Diffuse = D

Texture:

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

Coarse fragment modifiers:

Gravelly	=	GR	Channery	=	CH
Very gravelly	=	VGR	Very channery	=	VCH
Extremely gravelly	=	EGR	Extremely channery	=	ECH
Cobbly	=	CB	Flaggy	=	FL
Very cobbly	=	VCB	Very flaggy	=	VFL
Extremely cobbly	=	ECB	Extremely flaggy	=	EFL

Sand modifiers:

Very Fine	=	VF
Fine	=	F
Coarse	=	CO

Structure, Grade:

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

Structure, Shape:

Granular	=	GR	Angular blocky	=	ABK
Platy	=	PL	Subangular blocky	=	SBK
Prismatic	=	PR	Single grain	=	SGR
Columnar	=	COL	Massive	=	MA
Rock-controlled fabric	=	RCF			

Consistence:

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

Mottles:**Concentrations**

Yes	=	Y
No	=	---

Depletions

Yes	=	Y
No	=	---

Effervescence:

None	=	---	Strongly	=	ST
Very slightly	=	VS	Violently	=	VE
Slightly	=	SL			

Onsite Wastewater Loading Rates at 75 cm (gal/day/ft ²)										
Structure shape →		SGR PL RS*	GR, SBK, ABK, WEG, PR				MA (Massive)			
Structure grade →		any	Weak (Grade 1)		Moderate or Strong (Grade 2 or 3)		None (Grade = 0)			
Moist consistence →		any	L VFR FR	FI VFI EFI	VFR FR	FI VFI EFI	VFR	FR	FI VFI EFI	
Row Reference ↓	Column Reference →	1	2	3	4	5	6	7	8	
	Texture ↓	NR = <i>not recommended or not applicable</i>								
A	Organic materials Densic materials Fragipan Cr horizon R horizon Continuous cemented horizons (B...m) Permafrost > 35% RF ^t									NR = <i>not recommended or not applicable</i>
B	S COS VCOS LCOS LS	1	1	NR	NR	NR	1	NR	NR	
C	FS LFS COSL	0.84	0.91	NR	NR	NR	0.91	0.84	NR	
D	SL FSL	0.75	0.75	NR	0.84	NR	0.84	0.75	0.69	
E	L SIL VFSL SCL SI VFS LVFS	0.62	0.69	0.62	0.75	0.52	0.62	0.52	0.45	
F	SICL (≤ 35% clay) CL (≤ 35% clay)	0.52	0.52	0.45	0.62	0.52	0.52	0.45	0.27	
G	SICL (> 35% clay) CL (> 35% clay)	NR	NR	0.4	0.45	0.4	NR	0.2	NR	
H	SC, SIC, C	NR	NR	NR	NR	0.2	NR	NR	NR	

*Rock structure ^tRock fragments

Water Retention

Water retention difference <i>(in cm water per cm soil)</i>	Textures
0.05	All sands, loamy coarse sand, and loamy sand
0.10	Loamy fine sand, loamy very fine sand, and coarse sandy loam
0.15	Sandy loam, fine sandy loam, sandy clay loam, sandy clay, clay, and silty clay
0.20	Very fine sandy loam, loam, silt loam, silt, silty clay loam, and clay loam

Surface Runoff

% Slope	Limiting hydraulic conductivity within 50 cm of the surface		
	High	Moderate	Low
Closed depression	Ponded	Ponded	Ponded
0 - <1	Very slow	Very slow	Slow
1-<2	Very slow	Slow	Medium
2 - < 6	Slow	Medium	Rapid
6 - < 12	Medium	Rapid	Very rapid
12+	Rapid	Very rapid	Very rapid

Erosion Potential

Surface Runoff	Surface Horizon Texture			
	S, LS	SCL, SC, MA	SL, CL, C, SIC	L, SI, SIL, SICL,
Ponded/Neg.	Low	Low	Low	Low
Very slow	Low	Low	Low	Medium
Slow	Low	Low	Medium	Medium
Medium	Low	Low	Medium	High
Rapid	Low	Medium	High	High
Very Rapid	Medium	High	High	High

- 1) **Mollisol** – Mollic epipedon **AND** BS > 50% in all horizons above a RLL, 180 cm, or 125 cm below the top of an argillic, whichever is shallowest
- a) **Alboll** – Albic horizon with redox concentrations **AND** argillic horizon **AND** gleyed matrix within 100 cm
 - ▶ **Argialboll**
 - b) **Aquoll** – gleyed matrix < 50 cm or immediately below mollic
 - ▶ **Calciquoll** – calcic horizon begins within 40 cm of surface and no argillic present unless buried
 - ▶ **Argiaquoll** – argillic horizon present
 - ▶ **Epiaquoll** – episaturation, gleyed horizons over non-gleyed horizons within judging depth
 - ▶ **Endoquoll** – other Aquolls
 - c) **Udoll** – other Mollisols
 - ▶ **Paleudoll** – 1) no RLL within 150 cm **AND**
 - 2) no clay decrease of 20% or more from clay maximum in argillic **AND**
 - 3) argillic hue 7.5YR or redder and chroma ≥ 5 in > ½ of argillic
 - ▶ **Argiudoll** – argillic horizon present
 - ▶ **Hapludoll** – other Udolls
- 2) **Spodosol** – Spodic present
- a) **Aquod** – redoximorphic features within albic or spodic and within 50 cm of soil surface
 - ▶ **Epiaquod** – episaturation, gleyed horizons over non-gleyed horizons within judging depth
 - ▶ **Endoquod** – other Aquods
 - b) **Orthod** – other Spodosols
 - ▶ **Haplorthod** – other Orthods
- 3) **Alfisol** – Argillic present
- a) **Aqualf** – redox features in all horizons between Ap or 25 cm (whichever is deeper) and 40 cm **AND** gleyed matrix in the upper 12.5 cm of argillic (Btg)
 - ▶ **Natraqualf** – natric horizon present
 - ▶ **Fragiaqualf** – fragipan present within 100 cm of the mineral soil surface
 - ▶ **Albaqualf** – albic horizon present **AND** clay % abruptly doubles from Albic into upper 7.5 cm of Argillic.
 - ▶ **Glossaqualf** – glossic horizon present
 - ▶ **Epiaqualf** - episaturation, gleyed horizons over non-gleyed horizons within judging depth
 - ▶ **Endoquaf** – other Aqualfs
 - b) **Udalf** – other Alfisols
 - ▶ **Natrudalf** – natric horizon present
 - ▶ **Fragiudalf** – fragipan present within 100 cm of the mineral soil surface
 - ▶ **Paleudalf** – 1) no RLL within 150 cm **AND** 2) no clay decrease of 20% or more from clay maximum in argillic **AND** 3) argillic hue 7.5YR or redder and chroma ≥ 5 in > ½ of argillic
 - ▶ **Glossudalf** – glossic horizon present
 - ▶ **Hapludalf** – other Udalfs
- 4) **Inceptisol** – Cambic and/or Mollic or Umbric present
- a) **Aquept** – gleyed matrix < 50 cm
 - ▶ **Epiaquept** - episaturation, gleyed horizons over non-gleyed horizons within judging depth
 - ▶ **Endoaquept** – other Aquepts
 - b) **Udept** – other Inceptisols
 - ▶ **Eutrudept** – free carbonates present **OR** BS $\geq 60\%$ in at least one horizon between 25 and 75 cm or directly above RLL if shallower
 - ▶ **Dystrudept** – other Udepts
- 5) **Entisol** – no diagnostic subsurface horizon present
- a) **Aquent** – gleyed matrix < 50 cm
 - ▶ **Psammaquent** - texture of loamy fine sand or coarser in all layers within particle size control section (sandy loam lamellae are permitted)
 - ▶ **Fluvaquent** - 0.2% OC at 125 cm **OR** irregular decrease in OC with depth
 - ▶ **Epiaquent** - episaturation, gleyed horizons over non-gleyed horizons within judging depth
 - ▶ **Endoquent** – other Aquents
 - b) **Psamment** – all horizons in control section S and/or LS textures
 - ▶ **Quartzipsamment** - > 90% resistant minerals (i.e. quartz)
 - ▶ **Udipsamment** – other Psamments
 - c) **Fluvent** – 0.2% OC at 125 cm **OR** irregular decrease in OC with depth
 - ▶ **Udifluent**
 - d) **Orthent** – other Entisols
 - ▶ **Udorthent**

In this key, gleyed means matrix colors having value ≥ 4 and chroma ≤ 2 because of saturation and reduction. (Bg, Btg, Cg, Eg...). This includes reduced, depleted, and gleyed matrix.

Simplified Family Particle Size Class & Control Section Criteria

CONTROL SECTION DEPTH

- 1) Soils < 36 cm to RLL (lithic, paralithic, densic)
 - a. 0 to RLL
- 2) Argillic horizon present
 - a. Strongly contrasting particle size classes within 100 cm of surface
 - i. Deepest of
 1. Upper 50 cm of argillic ***OR***
 2. Top of argillic to 100 cm (or RLL if shallower)
 - b. Upper 50 cm of argillic ***OR*** whole argillic if < 50 cm thick
- 3) All other soils
 - a. 25 or lower depth of Ap, whichever is deeper to 100 cm or RLL if RLL < 100 cm below surface

FAMILY PARTICLE SIZE CLASS

Control section weighted average contains:

- 1) > 90% coarse fragments
 - a. ***Fragmental***
- 2) > 35% coarse fragments
 - a. Sand and loamy sand textures
 - i. ***Sandy skeletal***
 - b. < 35% clay
 - i. ***Loamy skeletal***
 - c. $\geq 35\%$ clay
 - i. ***Clayey skeletal***
- 3) Sand or loamy sand textures
 - a. ***Sandy***
- 4) RLL (lithic, paralithic, or densic) contact < 50 cm
 - a. < 35% clay
 - i. ***Loamy***
 - b. $\geq 35\%$ clay
 - i. ***Clayey***
- 5) < 35% clay AND $\geq 15\%$ sand and rock fragments < 7.6 cm
 - a. < 18% clay
 - i. ***Coarse loamy***
 - b. 18 to < 35% clay
 - i. ***Fine loamy***
- 6) < 35% clay AND < 15% sand and rock fragments < 7.6 cm
 - a. < 18% clay
 - i. ***Coarse silty***
 - b. 18 to < 35% clay
 - i. ***Fine silty***
- 7) 35 - 60% clay
 - a. ***Fine*** (replace with ***Clayey*** if strongly contrasting)
- 8) > 60% clay
 - a. ***Very fine*** (replace with ***Clayey*** if strongly contrasting)

Rating Guide for Houses with Basements

Reason #	Property	Slight	Moderate	Severe
1	Flooding (floodplain landform)	none	-----	any
2	Ponding (closed depression)	no	-----	yes
3	Depth to high water table	> 180 cm	75 to 180 cm	< 75 cm
4	Depth to bedrock	> 180 cm	100 to 180 cm	< 100 cm
5	Depth to cemented pan	>150 cm	100 to 150 cm	< 100 cm
6	Slope	< 8%	8 to 15%	> 15%
7	Shrink swell	< 8 cm clay	8 to 16 cm clay	> 16 cm clay
8	% > 8 cm stones, 0 to 100 cm	< 25%	25 to 50%	> 50%

Rating Guide for Septic Tank Absorption Fields

Reason #	Property	Slight	Moderate	Severe
1	Flooding	None	-----	any
2	Depth to bedrock	> 180 cm	100 to 180 cm	< 100 cm
3	Depth to cemented pan	> 180 cm	100 to 180 cm	< 100 cm
4	Ponding	No	-----	yes
5	Depth to high water table	> 180 cm	120 to 180 cm	< 120 cm
6	Slow perm. 60 to 150 cm	S, LS, SL	SCL, L, SIL, SI	all other textures, Cd & Bx horizons
7	High perm. 60 to 150 cm	all others	-----	S, LS
8	Slope	< 8%	8 to 15%	> 15%
9	% > 8 cm stones, 0 to 40 cm	< 25%	25 to 50%	> 50%

Rating Guide for Local Roads and Streets

Reason #	Property	Good	Fair	Poor
1	Depth to bedrock	> 150 cm	100 to 150 cm	< 100 cm
2	Depth to cemented pan	> 150 cm	100 to 150 cm	< 100 cm
3	Shrink swell	< 8 cm clay	8 to 16 cm clay	> 16 cm clay
4	Strength (avg. 25 to 100 cm)	S, LS, SL	L, SCL	all others
5	Ponding	No	-----	yes
6	Depth to high water table	> 90 cm	30 to 90 cm	< 30 cm
7	Slope	< 15%	15 to 25%	> 25%
8	Flooding (floodplain landform)	None	-----	any
9	Frost action	S, LS	all others	SI, SIL, SICL
10	% > 8 cm stones, 0 to 40 cm	< 25%	25 to 50%	> 50%

SIMPLIFIED FIELD INDICATORS OF HYDRIC SOILS

Use the list as a flowchart starting at the top. Once an indicator is met, the soil is hydric and that indicator letter and number should be written on the scorecard. For purposes of this contest, consider a depleted or gleyed matrix as any horizon fitting the criteria of having a “g” subordinate distinction. If color value and/or chroma is specified in within a depleted or gleyed matrix, then these criteria must be met in addition to having the “g” subordinate distinction.

A – Used for all soils

A4. Hydrogen Sulfide. A hydrogen sulfide odor (rotten egg smell) within 30 cm of the surface.

A11. Depleted Below Dark Surface. A layer with a depleted or gleyed matrix that has chroma 2 or less starting within 30 cm of the soil surface that has a minimum thickness of 15 cm.

- Loamy/clayey/silty material above the depleted or gleyed matrix must have value 3 or less and chroma 2 or less.
- Sandy material above the depleted or gleyed matrix must have value 3 or less, chroma 1 or less.

A12. Thick Dark Surface. A layer at least 15 cm thick with a depleted or gleyed matrix that has chroma 2 or less starting below 30 cm of the surface. The layer(s) above the depleted or gleyed matrix have a value 2.5 or less and chroma 1 or less to a depth of 30 cm and value 3 or less and chroma 1 or less in any remaining layer above the depleted or gleyed matrix.

S = Sandy soils only

S4. Sandy Gleyed Matrix. A gleyed matrix within 15 cm of the soil surface.

S5. Sandy Redox. A layer starting within 15 cm of the soil surface that is at least 10 cm thick and has a matrix chroma 2 or less with 2% or more distinct or prominent redox concentrations.

S6. Stripped Matrix. A layer within 15 cm of the surface in which iron/manganese oxides and/or organic matter have been stripped from the matrix exposing the primary base color of soil materials. The stripped areas and the translocated oxides and/or organic matter form a faint, diffuse splotchy pattern of two or more colors. The stripped zones are 10% or more of the volume and rounded and 1.2 to 2.5 cm in diameter.

F = Non-sandy soils

F2. Loamy Gleyed Matrix. A gleyed matrix occurs within 30 cm of the surface.

F3. Depleted Matrix. A layer that has a depleted matrix with 60% or more chroma 2 or less and that has a minimum thickness of either:

- a. 5 cm if it is entirely within the upper 15 cm of the soil, or
- b. 15 cm starting within 25 cm of the soil surface

F6. Redox Dark Surface. A layer at least 10 cm thick entirely within the upper 30 cm of the mineral soil that has:

- a. matrix value 3 or less and chroma 1 or less and 2% or more distinct or prominent redox concentrations as soft masses or pore linings,
- or**
- b. matrix value 3 or less and chroma 2 or less and 5% or more distinct or prominent redox concentrations as soft masses or pore linings.

F7. Depleted Dark Surface. Redox depletions, with value 5 or more and chroma 2 or less, in a layer at least 10 cm thick entirely within the upper 30 cm of the mineral soil and has:

- a. matrix value 3 or less and chroma 1 or less and 10% or more redox depletions, **or**
- b. matrix value 3 or less and chroma 2 or less and 20% or more redox depletions.

F8. Redox Depressions. In closed depressions subject to ponding, 5% or more distinct or prominent redox concentrations occurring as soft masses or pore linings in a layer that is 5 cm or more thick and is entirely within the upper 15 cm of the soil.