FFA LAND JUDGING SCORECARD INSTRUCTIONS

By the staff of the Department of Soil Science
University of Minnesota-St. Paul - 2005
With Assistance from Lauren Klement (GFW FFA)

Introduction

A. Physical and chemical properties of soil affect plant growth and, therefore, crop production. They affect the amount of water and nutrients available to the plant, the aeration, temperature, and drainage of the root zone. Fortunately, many important soil physical properties can be estimated with reasonable accuracy through observation.

These soil-judging instructions go with the scorecard to be used in the field. The instructor needs to give the student advance preparation before judging in the field.

To judge the soil, its physical features must be investigated.

Part 1. SURFACE SOIL
Part 2. SUBSOIL
Part 3. UNDERLYING MATERIAL

A. Soil Horizons (Layers Of Soil)

Observe the **soil profile** in the judging pit or in the judging **Tray**. Determine the depth of the dark colored surface soil (called the **A horizon**). This is the depth of the horizon with greatest **organic matter** accumulation and generally the darkest colored horizon. Plowing may have mixed the surface (**topsoil**) soil of the A horizon (if it is a shallow horizon) with the soil from the horizon below the A Horizon which is known as **subsoil**. If there is erosion potential on these mixed shallow horizons, severe erosion may actually remove the A horizon.

Under these shallow conditions, record the depth of the tillage layer. This is called **Ap.** A Horizon with a **plow** layer.

Next determine the depth of the bottom boundary of the subsoil horizons. In a forest soil, there will be a **leached** gray horizon or a horizon that is lighter in color then the A horizon and lighter then the B-horizon. It is not a deep horizon. This lighter colored horizon is called the **E Horizon**. The E Horizon is found not in all soil profiles so you will not always see this horizon. The E horizon is to be included in the **subsoil** for depth measurement purposes. Tillage may have mixed the soil layers.

The subsoil, which is called the **B-horizon**, will be present below the A or the E horizon. It is lower in organic matter so it will be a lighter color then the surface soil in the A horizon. There can be an accumulation of iron and aluminum compounds or clay in the B Horizon. The **soil structure** and **color** of this soil is distinctly different from the soil structure and color in the A horizon and the horizon below it.

The underlying material is called the **C Horizon**. Weathering has occurred to some extent but is has not been subjected to biological (plant/animal) activity. The C Horizon may be like or it may be different than the **parent material** which is what the surface and subsoil were formed from. Underlying material may include **bedrock** and would be called an **R Horizon**. Cementation may be present.

- Use a tape measure to indicate depths in the pit or soil tray and horizon boundaries may be marked in some training contests. Record the depth of each layer.

Bedrock, very gravelly sand, dense glacial till with platy structure, and **fragipan** layers are considered unfavorable to root growth. The depth of each of these layers should be entered (Depth to the top of the pan layer) Part 6-C. A fluctuating or temporary **water table** is not a layer unfavorable to root growth. However, a water table permanently maintained at some depth forms a layer unfavorable to root growth. This is why a permanent water table will be noted on the placard.

B. SOIL COLOR

The surface soil color should be judged when the soil is moist, as the color is usually darker when the soil is wet and lighter in color when it is dry. Determine the color from soil crushed and well mixed in your hand. Color descriptions are as follows:

- Dark: Black, very dark brown or very dark gray.
- Medium: Dark Gray, very dark grayish brown or dark grayish brown or dark brown.
- Light: Gray, light gray, or grayish brown or dark yellowish brown.

SUBSOIL COLOR AND INTERNAL DRAINAGE

Scorecard Notation	Subsoil Color	Internal Drainage
Bright	Uniformly brown, dark brown, yellowish brown, dark yellowish brown or reddish brown throughout the subsoil. (See R,YR, and Y pages in Munsell Color Manual)	Well Drained
Mottled	Mottled upper subsoil, the lower subsoil will be gray or mottled. (Gley pages in Munsell Color Chart show gray for Poorly Drained)	Somewhat Poorly Drained
Dull	Dull gray or olive color subsoil, some mottles may be present (See Gley page in Munsell Color Chart)	Poor or Very Poorly Drained

Surface or subsurface drainage is often required for the last two classes if crop and land values permit. Very fine textured soils require close tile spacing that may not be economical.
Check Internal Drainage in Part 5-F.

C. SOIL TEXTURE

(Soil Texture is closely related to Available Water Capacity in Part 6)
The individual soil particles vary greatly in size. Soil particles are classified as **clay, silt, sand** and **gravel** on the basis of increasing size. Gravel is greater than 2mm in diameter.
Soil Texture refers to the relative proportions of the various size groups of individual soil particles (clay, silt, and sand). A loam soil contains appreciable amounts of two or more particle sizes. Specifically, loam contains 7-27 % clay, 28-50% silt and less than 52% sand. The textural triangle shows the composition of soil and the percentages of sand, silt and clay.

It is very important to accurately describe the soil texture because if affects so many other items on the scorecard such as drainage, landform, and evaluation for community development.

Descriptions:

Very Fine: Clay, silty clay, and sandy clay

Fine: Sandy clay loam, silty clay loam, and clay loam

Medium: Silt, silt loam, loam,

Moderately Coarse: sandy loam

Coarse: Sands and loamy sand

To identify a soil's textural group, moisten a small amount of soil to the consistency of putty. Make a small ball of soil and squeeze it between your thumb and forefinger, pressing the thumb forward to form the sample into a ribbon.

Very fine textured soils form a long, pliable ribbon. These soils feel smooth and sticky when wet due to their high clay content.

Fine textured soils form a much shorter ribbon which breaks rather easily under its own weight. These soils are less sticky but usually smooth when moist.

Medium textured soils may and may not form a ribbon depending on clay content. If the soils feel smooth with a slight gritty feeling, it is a loam. If it is very smooth, like flour, and has no grittiness, it is a silt loam.

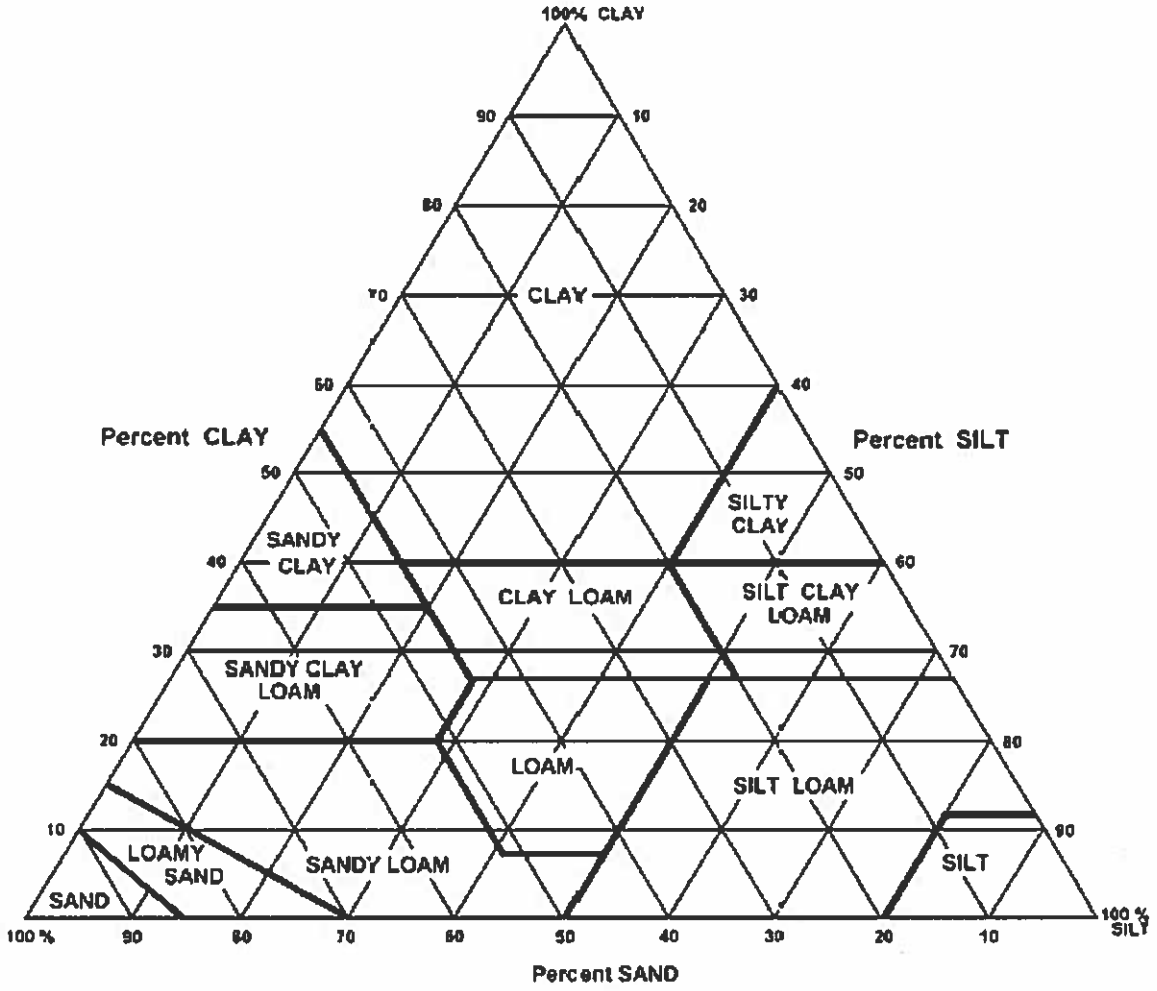
Moderately coarse soils may and may not form a ribbon depending on clay content. If the soils feel smooth with a very gritty feeling it is a sandy loam.

Coarse textured soils feel gritty and lack smoothness. Loamy sands hold together but fall apart easily, and feel very gritty. Coarse textured soils feel very gritty and lack smoothness or slickness. Sands are only held together when moist, yet fall apart when bounced in the hand.

D. Gravel

The amount of gravel (rock fragments > 2mm) in a soil will greatly influence the soil properties. This is especially important for water holding capacity. Estimate the amount of gravel in the soil by comparing a volume of soil to the volume of gravel it contains. A 2 mm sieve may be necessary to accurately determine this when soils approach 50% gravel.

None to few	less than 15% by volume gravel
Gravelly	15 - 34% by volume gravel
Very gravelly	35 – 59% by volume gravel
Extremely gravelly	greater than 50% by volume gravel



Part 4. TOPOGRAPHY

Stakes at the site will specify the area in which the associated features are judged.

A. Steepness of Slope

The percent (feet of drop per 100 feet of horizontal distance) and length of slope affect the amount and speed which water runs off the land, which in turn, affects the amount of soil carried off by the water.

The amount of soil loss from a given area increases faster than the percent of slope:

- if the slope percentage is doubled, the soil loss is increased about 2 ½ times
- long slopes are subject to more erosion than short slopes; thus, if the slope length is doubled, the soil loss is increased about 1½ times.

The slope groups commonly used in Minnesota follow:

Slope Type	Description	Percent slope
A	Nearly level	0-2%
B	Gently sloping	3-6%
C	Moderately sloping	7-12%
D	Strongly sloping	13-18%
E	Steep	18+%

Slope Length is given on the placard.

B. Landscape Position:

The soil profile is located in one of the following landforms depending on its place in the landscape.

- ***Uplands*** occupy the higher parts of the landscape in relation to old flood plains and may be either level, rolling (uneven), or sloping (long, regular slopes).
- ***Terrace*** is formed by soil deposited adjacent to a stream valley. It represents the remnant of an old flood plain that is no longer subjected to flooding. Footslopes and adjacent to steep hills and contain materials deposited from upslope by water or gravity.
- ***Bottomland*** is flat, and may be subjected to flooding and is in the bottom of a stream valley.
- ***Depressional areas***, with no outlet, may be located on any part of the landscape.

Part 5. LAND USE CAPABILITY CLASSES

This refers to the degree and kind of hazard for land use. The definitions of the 8 Land Use Capability Classes are:

1. **Class I** land is *very good land, nearly level, and does not wash or blow readily*. The soil is deep and easy to work. It holds water well and is at least fairly well supplied with plant nutrients. It can be used safely in almost any way you choose. Of course, it should be managed to maintain plant nutrients and good physical conditions. Slopes are Type A (0-2%).

2. **Class II** land is *good land* from every standpoint, but certain *physical conditions make it inferior to Class I.* The slope may be just enough to create an erosion hazard. Some Class II land is naturally wet and can drain slowly. Some lack the water capacity of a Class I and is slightly droughty. These deficiencies either limit the use of the land or require special attention year after year. Since Class II land has some moderate, natural use limitation, special treatment is needed, such as easily applied conservation practices like *contouring, cover crops, simple water management, crop rotations, and fertilizers*. Slopes do not exceed Type A and B slopes (0-6%).

3. **Class III** land is moderately good land for cultivation and more *limited in use than Class II because of natural features*. It can be used regularly for crops, but intensive treatment of some kind is needed. *Some Class III land is moderately sloping* and must have intensive use of erosion control practices if cropped in a regular crop rotation. Another variation of Class III land is that *it may be poorly drained and require drainage*. Slopes do not exceed Type C (12%)

4. **Class IV** land is good enough for occasional cultivation under careful management, but not for regular production of cultivated crops. *A large part of it is too steep for regular cultivation* primarily because of the danger of erosion. *A large part of it may be flat, sandy lands*, which are droughty. Five out of six years its best use if for pasture or hay. Slopes do not exceed Type D (18%).

5. **Class V** land is *nearly level and not subject to erosion. Because of wetness, flooding, climate, or some permanent obstruction like stones and boulders,* it is not suited for cultivation. The soil is deep, however, and is suited for *grazing or forestry*. Slopes are Type A (0-2%)

6. **Class VI** land is unsuited to cultivation, and somewhat limited for grazing or forestry by *shallow soil, steep slopes, or excessive stream bank cutting that cannot be corrected* to permit use for crops. Slopes do not exceed 30%.

7. **Class VII** land is *unsuited for cultivation and has severe limitations for grazing or forestry.* It requires extreme care to prevent erosion. In rough areas its use for either grazing or woodland requires special care. Slopes do not exceed 60%.

8. **Class VIII** land is suited only for *wildlife or recreation* purposes. Usually it is extremely dry, rough, steep, stony, sandy, wet or severely eroded.

Part 6. INTERPRETATION OF SOIL FEATURES

A. **Type of Material that limits rooting depth.** –
Determine the type of soil material that is unfavorable for plant roots.

None –	No limiting material
Bedrock –	Hard or Soft
Hard Pan –	Soil is cemented – this is called a Fragipan, or the glacial till is compacted and this is a Densipan (a Bt horizon is not a hard pan).
Very gravelly sand or high water table.	Where sandy soil textures are very gravelly roots will not enter. Soils with a permanent high water table that do not have tile drainage will also limit roots.

B. **Parent Material**.
Determine the material the soil formed from. More than one can be checked where soils have two or more parent materials.

Bedrock	Hard or Soft – soil forms from the bedrock.
Alluvium/Outwash/Lacustrine	Soil forms from water deposited materials.
Till/Loess/Aeolian Sand	Materials derived from glacial action or wind.
Organic Materials	Peat or muck from decayed plant remains.

C. **Depth of Soil Favorable for Root and Water Penetration**.
Determine the depth of the material from Part 5-A. If no unfavorable material is evident in the pit face or soil tray assume the last horizon goes to 60 inches.

Very Deep	greater than 60 inches
Deep	40-59 inches
Moderately Deep	20-39 inches
Shallow	less than 20 inches

D. **Air and Water Movement**
Both texture and structure play a role in this determination. Use the subsoil for this determination.

Very Rapid	Open – single grain – **Coarse Texture**
Rapid	Porous – granular or small subangular block, - **Medium or Moderately Coarse Texture**
Moderate	Slightly compact – blockly or prismatic structure – **Fine Texture**
Slow	Compact – blocky to massive – **Very Fine Texture**

E. Water Holding Capacity and Internal Drainage

1. Total Available Water Capacity

Available water Capacity is closely related to soil texture.

To determine the available water capacity of the surface layer, refer to the table, which follows.

a. Find the inches of water per inch of soil for the soil texture of the surface horizon and multiply by the depth of the surface horizon.
b. Find the available water capacity for each horizon to a depth of 60 inches (or the root zone if rooting is restricted to less than 60 inches).
c. Add these up to get total water capacity in 60 inches (or the root zone if rooting is restricted).

Example: The available water capacity of a medium textured subsoil with an upper boundary at 9 inches-depth and the lower boundary is at 20-inch depth. (Part 1) is calculated as follows:

	Subsoil (B-horizon)
a) Available water capacity per inch of each layer	*0.20 inches of H20 per inch of soil (from table)*
b) Thickness of layer in inches (20 less 9)	*11 inches*
c) Available water capacity in layer (a x b)	*0.20 x 11 = 2.2 inches*
Total each layer to 60 inches (5 feet) to arrive at the total available water capacity or to the depth favorable for rooting (Part C). If a soil texture has gravel, the % volume of gravel (Part 1-D must be subtracted from the total volume of soil.	

AVAILABLE WATER CAPACITY TABLE TO USE FOR CALCULATING AWC

Texture	Average inches of water per inch of soil
Very Fine- clay, silty clay, sandy clay	0.15
Fine – sandy clay loam, clay loam, silty clay loam	0.20
Medium – loam, silt loam, or silt	0.20
Moderately Coarse- sandy loam	0.15
Coarse- loamy sand and sand	0.05

The preceding values are approximate. For example, the available water capacity of moderately fine textured soils may range from at least 0.14 to 0.22 inches of water per inch of soil.

Drought results when plants exhaust the water supply in the soil. Soils with low available water capacity and crops with shallow root systems are much more susceptible to drought.

The following table relates total available water capacity and the possibility of drought on a soil.

3. Total Available Water Capacity

Available Water Capacity in 5 feet of soil (or layer to limiting root growth) Amount in inches	Available Water Capacity Class	Drought Susceptibility
Less than 3 inches	Very Low	Very High
3-6 inches	Low	High
6.1-9 inches	Moderate	Medium
Over 9.1 inches	High	Low

4. Internal Drainage

Scorecard Notation	Subsoil Color	Internal Drainage
Bright	Uniformly brown, dark brown, yellowish brown, dark yellowish brown or reddish brown throughout the subsoil. (See R,YR, and Y pages in Munsell Color Manual)	Well Drained
Bright	Same as well drained except the lower subsoil may be **mottled.**	Moderately Well Drained
Mottled	Mottled upper subsoil, the lower subsoil will be gray or mottled. (Gley pages in Munsell Color Chart show gray for Poorly Drained)	Somewhat Poorly Drained
Dull	Dull gray or olive color subsoil, some mottles may be present (See Gley page in Munsell Color Chart)	Poor or Very Poorly Drained

Part. 7 TYPE OF EROSION AND NEED FOR EROSION CONTROL

A. Amount of Erosion or Evidence of Deposition

Compare the present depth of surface soil or surface and subsurface with the original depth given on the placard. Rate the soil as to present degree of erosion. If the present depth of the soil is greater by **two** inches then what is on the placard, then **deposition** has occurred.

B. Kind of Erosion

None — No erosion was evident in part A. (none to slight)

If erosion was evident determine the kind of erosion most likely responsible.

Active Gully or stream bank	Where active gulleys or stream bank are eroding the soil
Wind erosion	Where soil areas are open to wind and soil texture are very fine or coarse
Sheet or Rill Erosion	Areas with slopes greater than 2% and Non-Permanent vegetation

Part 8-Need for Erosion Control

Determine if water or wind erosion would be the most pressing erosion problem. For Land Capability Class VII or VIII Wildlife Recreation is checked.

A. Water Erosion

The extent of water erosion is determined by following factors:

a) Erosion control practices
b) Rainfall factor (this depends on energy and intensity of the rainfall or how hard and fast the rain hits the ground (raindrop splash).
c) Erodibility of the soil (how readily the soil erodes)
d) Crop management system
e) Slope length and slope percent

Soil types vary in their resistance to loss by water erosion or erodibility. The intensity and duration of rainfall determines the rainfall factor. The steeper and longer the slope will increase the amount of erosion.

Erosion control practices and crop management are adjusted to keep soil loss within allowable limits (**T= Soil loss tolerance**, which is the amount of soil lost that does not affect the productivity of the soil, acceptable T levels are less than 3 or 5 tons/acre/year lost to erosion). It takes from approximately 500 to 1000 years for one inch of soil to develop. Without **Best Management Practices (BMPs)** soil structure can be broken down and runoff can carry particles off of the land into surface waters, making the soil less productive with each storm event. Intensity, storm water runoff and Best Management Practices (BMPs) are outside the bounds of this scorecard, so a simplified system is applied.

When the percent of slope is greater than 2%, and slope length approaches 100 feet, water erosion may be a hazard and erosion control practices are needed. If the topography is irregular (short, steep, slopes,), BMPs to control erosion include sod cover (pasture, hay field), and conservation tillage which leaves more crop residue on the surface.

When **regular** slopes are present examples of BMPs are: **contour farming** (crop rows follow the contour of the land); **strip cropping** (certain width of alfalfa or sod crop is planted between a certain width of row crop, this slows the water down and allows for more infiltration of water into the soil. Sediment carried by runoff water can be filtered out of the water by vegetation); the creation of **terraces** (breaking up the slope by creating long ridges and channels across the field to intercept and reduce the flow of surface runoff).

Conservation tillage is a general recommendation as a conservation practice. Conservation tillage decreases planting cost. This is done with a reduction in field passes with equipment. Conservation tillage also leaves more residue on the surface which reduces damage to soil structure by raindrop splash. Conservation tillage can decrease soil loss by 50% or more over **conventional tillage** (moldboard with spring tillage).

Grass waterways and gully control structures (water retention basins) are installed where infiltration rate is slow and runoff occurs, which can cause erosion and gully formation. Grass waterways are designed to handle specific flows and should be checked often for damage. Repairs are easy and cost less if they are taken care of right away. If a grass waterway becomes damaged and rill erosion (little channels) occurs and this leads to gully erosion (deep V shaped gullies) which is expensive to repair. When gully erosion in Part **7B** has been checked, Grass waterways should also be checked.

Permanent pastures are used with Land Use Capability Class V and VI. Wildlife or recreation is checked whenever the land use merits that use. (Class VII, VIII)

B. Wind Erosion

On coarse soils, peat (organic) soils, and fine soils, wind erosion and damage to plants by wind are erosion hazards. On peat and coarse soils both mulch tillage (residue management), and planting cover crops (small grain) in the fall, and field windbreaks or windstrips are generally needed. On fine soils cover crops are generally sufficient but field windbreaks may be desired.

The time of year to be concerned with wind erosion when the surface is exposed and the wind carries the soil particles. As the seedlings grow, their height will reduce the wind velocity. This happens during late fall, winter and into spring.

The most erodible soil particles are about 1/100 of an inch in diameter for sand and a little larger for aggregates of finer textured soils which are less dense. As a guide, when 2/3 of the dry weight of a soil is made up of soil particles and aggregates larger than 1/25 of an inch in diameter, the soil is resistant to wind erosion. Sands and often very fine textured soils are more erodible than the medium textured soils. Sands are singe grained and lack enough silt and clay to bind the particles together, which makes sand more susceptible to wind erosion. Fine textured soils may need protection during winter and early spring on fall plowed land. Peat soils are very susceptible to wind erosion.

The most successful control measure is to keep the soil covered with crops or crop residue. Field windbreaks/windstrips provide protection where wind erosion is a major problem. These shelterbelts of trees planted along field boundaries will provide some protection, but by themselves are adequate only on relatively small fields.

Part 9 Drainage Required

Surface Drainage and/or Tile Drainage

Plants need air as well as moisture in the root zone. Excess water in the soil fills the air pore space that the plants need for proper aeration. For maximum productivity of most crops, surface and/or internal drainage are recommended. The Wetland Conservation Act became law in 1991 and must be adhered to. Draining an existing wetland in an agricultural field can also force a landowner out of the federal farm programs. Check with your local conservation district before tiling.

Drainage is generally needed when internal drainage of the soil is poor or somewhat poorly drained on fine textured soil. There are two types of drainage: surface drainage and sub-surface drainage.

Sub-surface tile drainage is required for soils with poor internal drainage, moderately fine textured or coarser, and a high water table. Sub-surface tile drainage lowers the water table.

Crop yields are increased by ("Elementary Soil and Water Engineering"):

- Removing gravitational or free water that is not directly available to plants, allowing a larger, deeper root system;
- Increasing the volume of soil from which roots can obtain nutrients;
- Increasing the movement and quantity of air in the soil;
- Providing conditions that permit the soil to warm up faster in the spring, allowing tillage and planting schedules that allow full growth cycle to obtain the best yields and it provides;
- Increasing the bacterial activity in the soil, which improves soil structure and makes plant nutrients more readily available;
- Reduces soil erosion since a well-drained soil has more capacity to hold rainfall, resulting in less runoff. The open tile intakes of the system can be a direct line for sediment to surface waters, an environmental hazard. Blind intakes and slotted offset risers are recommended to reduce sedimentation to surface waters.

Surface drainage is the removal of excess water using constructed open ditches, field drains, land grading and related structures. Surface drainage is needed for flat or undulating topography to remove excess ponded water that is detrimental to plant growth after a certain period of time. Surface drainage does not lower the water table.

Part. 10-FERTILIZER and LIME RECOMMENDATIONS

Gauge the rate of fertilizer application on the following:

1. Soil Test
2. Crop to be grown (1-6 possible crops)
3. Yield goal
4. Previous crops (affects nitrogen available in the soil)
5. Subsoil phosphorus and potassium levels

The placard at the pit contains this information.

The yield goal of corn is affected by several climatic conditions including

- Air temperature,
- Solar radiation, and
- Length of growing season and
- Precipitation.

Generally lower yield goals are set where drought probability is high or where the growing season is short and air temperatures are low.

The computerized fertilizer recommendations now used in Minnesota and Wisconsin use many factors in making fertilizer recommendations. Subsoil fertility affects the phosphorus and potassium recommendations while "lime" subsoil in Western Minnesota decrease the lime requirements. **Acidic soils** need lime to bring the pH up to where plant growth is optimum. **Alkaline soils** do not need lime since alkaline soils have a higher pH than acidic soils.

(Note: Lime contains calcium and magnesium (cations) which raises pH; (cations have positive charges) and remember that a pH of 7 is neutral, a pH less than 7 is acidic (anions have negative charges) while a pH greater than 7 is alkaline). Of an interesting note that will not be included in the competition: If a soil has a high pH (alkaline) that is 7.5-9, the phosphorus bonds with the calcium and phosphorus becomes unavailable to the plant. This has a detrimental effect on plant growth.

The level of soil organic matter was not included in the contest, even though it affects the release of nitrogen (N) and the rate of nitrogen fertilizer applied. Nitrogen recommendations given for corn are for medium-low organic matter levels. Nitrogen recommendations for soils with high organic matter levels are 10 to 30 pounds/acre less than for soils with medium-low organic matter levels.

a) **Fertilizer Rates for Nitrogen (N), Phosphorus (P), and Potassium (K) Are Given for the Following Crops:**

1) Grass Legume Mixtures
2) Alfalfa (established stands)
3) Corn
4) Grass Pastures, non-leguminous hay, Sorghum Sudan and managed woodlots
5) Small Grain, wheat, barley, rye, oats
6) Soybeans

2. **To determine Phosphorus (P) and Potassium (K) Recommendations:**

Consider the soil test and present crop. For corn and alfalfa, also consider the subsoil P and K levels given on the placard. For corn, record only Broadcast Recommendations.

Nitrogen recommendations for corn depend on yield goal and previous crop given on the placard. The placard is used to indicate whether to use row or broadcast recommendations for small grain, P & K.

3. **To determine lime recommendations:**

For Lime, consider the lime area (see map on page 17), the SMP buffer index when pH is 5.9 or less and crop to be grown (see placard). When pH is 6.0 or higher, disregard the SMP buffer index and use the soil water pH.

4. **To determine nitrogen recommendations:**

1. Refer to Placard for the crop to be grown and its yield level. Note the previous crop grown.
2. For grass pastures and non-leguminous hay, the type of pasture, or non-leguminous hay will be written at the base of the placard and adequacy of rainfall will be written on the placard for nitrogen (N) recommendations.

1. Grass Legume Mixtures

Phosphorus (P)

Phosphorus (P) Soil Test (lbs/acre)	**Relative Subsoil Phosphorus Level****		
	Low	**Medium**	**High**
	Amount of P_2O_5 to be applied (lbs/acre)		
0-10	100	90	60
11-20	90	70	40
21-30	70	50	0
Over 30	30	15	0

*For each ton of manure applied, subtract 2 lbs. of phosphate (P2O5) from the above recommendation
**See Placard

Potassium (K)
*Potassium fertilizer recommendations for grass Legume Mixture

Potassium (K) Soil Test (lbs/acre)	**Relative Subsoil Potassium Level****		
	Low	**Medium**	**High**
	Amount of K_2O to be applied (lbs/acre)		
0-75	300	230	200
76-151	180	165	120
151-225	120	100	60
226-300	60	35	0
Over 300	0	0	0

*For each ton of manure applied, subtract 5 lbs. of potash (K_2O) from the above recommendations.
**See Placard

Nitrogen – 60 lbs/Early Spring

2. Alfalfa: Established Stands

Phosphorus (P)

Annual phosphorus fertilizer recommendations for established stands of alfalfa

Phosphate (P) Soil Test (lbs/acre)	**5-Tons/Acre Yield Amount of Phosphate (P_2O_5) to be applied annually**
0-10	100
11-20	80
21-30	55
Over 30	0

Potassium (K)

Potassium (K) Soil Test (lbs/acre)	**5-Tons/Acre Yield Amount of Potash (K_2O) Lbs/acre to be applied annually**
0-75	240
76-150	165
151-225	90
226-300	0

3. Corn

Phosphorus (P) Broadcast recommendations for Corn:
Yield Potential greater than 100 bu/acre

Phosphorus (P) Soil Test (lbs/acre)	**Relative Subsoil Phosphorus Level**		
	Low	**Medium**	**High**
	Amount of P_2O_5 to be applied (lbs/acre)		
0-10	100	85	70
11-20	80	60	50
21-40	60	35	30

For each ton of manure applied, subtract 5 lbs. of Phosphorous (P_2O_5) from the above recommendations

Potassium (K) Broadcast recommendations for Corn:

Potassium (K) Soil Test (lbs/acre)	**Relative Subsoil Potassium Level****		
	Low	**Medium**	**High**
	Amount of K_2O to be applied (lbs/acre)		
0-100	140	110	80
101-175	80	60	50
176-250	40	40	40
Over 250	0	0	0

Nitrogen recommendations for Corn

Amount of Nitrogen to apply when the previous crop was:				
Yield Goal	**Corn, Sugarbeets, Idle acres**	**Soybeans Small Grain**	**Poor Alfalfa or Clover or Black Fallow**	**Good Alfalfa Or Clover**
200+ Bushels/Acre or if irrigated	200 lbs/acre	160 lbs/acre	100 lbs/acre	50 lbs/acre
150-200 Bushels/Acre	170 lbs/acre	130 lbs/acre	70 lbs/acre	30 lbs/acre
125-149 Bushels/Acre	130 lbs/acre	90 lbs/acre	30 lbs/acre	0 lbs/acre
Less than 125 Bushels/Acre	70 lbs/acre	30 lbs/acre	0 lbs/acre	0 lbs/acre

4. Grass Pastures
Non-Leguminous Hay
Sorghum Sudan
Managed Wood Lots or Forests

Phosphorus Recommendations for Grass Pastures, Non-Leguminous Hay, Sorghum Sudan and Managed Woodlots or forests:

Phosphorus (P) Soil Test (lbs/acre)	**Amount of phosphate (P_2O_5) to apply (lbs/acre)**
0-10	50
11-20	40
21-30	30
Over 30	0

Potassium recommendations for Grass Pastures, Non-Leguminous Hay, Sorghum Sudan and Managed Woodlots or forests:

Potassium (K) Soil Test (lbs/acre)	**Amount of Potash (K_2O) to apply (lbs/acre)**
0-100	110
101-200	80
201-300	50
Over 300	0

Nitrogen Recommendations for Grass Pastures, Non-Leguminous Hay, Sorghum Sudan and Managed Woodlots or forests:

Type of Pasture or non-leguminous hay	**Amount of Nitrogen (N) to apply (lbs/acre)**
Rotational Grazing with adequate rainfall	150
Areas of moderate rainfall	50
Coarse and moderately coarse textured soils, slopes over 18%, woodlots or low rainfall	30

5. Small Grain (Barley, Oats, Rye and Wheat

Phosphorus (P) Recommendations for Small Grain:

Phosphorus (P) Soil Test (lbs/acre)	Amount of phosphate (P2O5) to apply (lbs/acre)
0-10	50
11-20	35
21-30	20
Over 30	0

Potassium (K) Recommendations for Small Grain:

Potassium (K) Soil Test (lbs/acre)	Amount of Potash (K_2O) to apply (lbs/acre)
0-100	95
101-200	70
201-300	40
Over 300	0

Recommended rates are total amount to apply- broadcast +drill

Nitrogen (N) Recommendations for Small Grain

Nitrogen recommendations based On Previous Cropping History		
	Amount of Nitrogen (N) to Apply (lbs/acre)	
Previous Crops	Fine Textured Soils	Coarse Textured Soils
Corn Sugarbeets Idle Acres	60	80
Small Grain Soybeans Potatoes	40	60
Alfalfa, Black Fallow Sweetclover Fallow	20	40

6. Soybeans

Phosphorus (P) Recommendations for Soybeans:

Phosphorus (P) Soil Test (lbs/acre)	Amount of Phosphate (P2O5) to Apply (lbs/acre)
0-20	60
21-30	0
Over 30	0

Potassium Recommendations for Soybeans:

Potassium (K) Soil Test (lbs/acre)	Amount of Potash (K2O) to Apply (lbs/acre)
0-100	80
101-175	60
175-250	30

pH and Lime Recommendations

What liming does?
Lime improves crops principally by promoting desirable biological activity. Such benefits are realized through higher yields and better quality.

Bacteria in legume root nodules supply nitrogen to these crops in plentiful quantities if soil acidity is reduced sufficiently. Other types of bacteria step up their activity in rotting residues and soil organic matter if adequate lime is present.

In addition to stimulating biological activity, dolomitic lime (generally available in Minnesota) supplies calcium and magnesium. Addition of the latter is important advantage in soil areas, which tend to be low in magnesium. Liming acidic soils will also make soil phosphorus more available to plants as long as the pH is below 7.2 (it binds with calcium and becomes unavailable to the plant).

The SMP Buffer Test

Since January 1, 1968, an SMP buffer test has been used to determine lime needs in Minnesota. The SMP buffer test for lime determines total soil acidity and more accurately predicts lime needs. With one the soil-water pH, the total acidity could only be estimated. Two soils with exactly the same soil-water pH might vary quite widely in the amount of lime needed to raise the pH to 6.5, depending on the amount of organic matter and clay contents of each soil. The soil with the higher organic matter and/or clay content would require more lime to the higher reserve acidity.

The pH of the SMP buffer solution itself is 7.5. When the SMP is added to a soil, the original pH of the SMP buffer will go down. Since it is known how much acid is required to lower the SMP buffer to any given pH level, total soil acidity can be determined. For example, a soil with a soil-water pH of 5.4 might bring the SMP buffer pH index from 7.5 to 6.3. According to the following table, it would take 5.5 tons of lime to raise the soil-water pH from 5.4 to 6.5.

The buffer index is different from the soil pH. The buffer index is used only to determine lime needs and is in no other way connected with soil water pH.

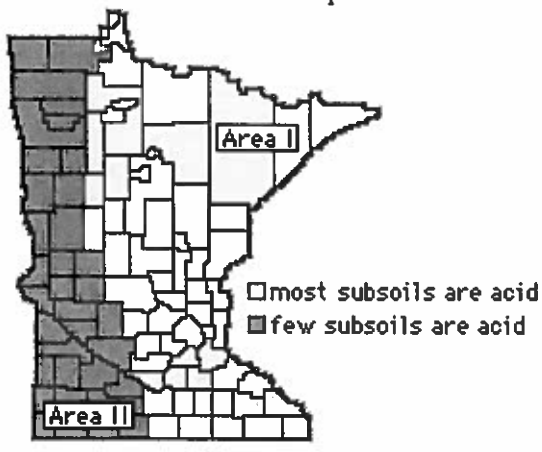
Lime Recommendations
See next page for Lime Recommendation Table

Lime Recommendations

Where SMP buffer Applies (Soil-water pH values **below** 6.0)	**Lime Required**		**(tons/acre)**
Mineral Soils	**To raise soil-water pH to 6.5**		**To raise soil-water pH to 6.9** ***for Alfalfa only***
SMP Buffer Index	**Area 1**	**Area 2**	**Area 1**
6.8	3.0	2.0	5.0
6.7	3.5	2.0	5.0
6.6	4.0	2.0	6.0
6.5	4.5	2.0	6.5
6.4	5.0	2.5	7.0
6.3	5.5	2.5	7.5
6.2	6.0	3.0	8.0
6.1	6.5	3.0	8.5
6.0	7.0	3.5	9.0
5.9	7.5	3.5	9.5
5.8	8.0	4.0	10.0
5.7	8.5	4.0	10.5
5.6	9.0	4.5	11.0

Where SMP buffer does not apply (Soil-water pH values **above** 6.0)	**Lime Required**		**(tons/acre)**
Mineral Soils	**To raise soil-water pH to 6.5**		**To raise soil-water pH to 6.9 for Alfalfa only**
Soil-water pH	**Area 1**	**Area 2**	**Area 1**
6.5	0	0	2.0
6.4	2.0	0	3.0
6.3	2.0	0	5.0
6.2	3.0	0	5.0
6.1	3.0	0	6.0
6.0	4.0	2.0	6.0

Map of Areas:



SMP buffer is not used above pH 5.9

If the soil-water pH (soil pH) is 6.0 or higher, the SMP buffer is not run. The relative error of the SMP buffer is too high in this soil pH range.

Recommendations (see table previous page)

1. Lime recommendations for corn and soybeans

   If alfalfa is not in the cropping system, pH levels of 6.0 or above are adequate without liming. If the soil pH is below 6.0, apply lime rates needed to reach a soil pH of 6.5. High nitrogen rates used for corn on **non-calcareous** soils will lower pH.

2. Lime recommendations for Alfalfa

   When alfalfa is in the rotation, the soil-water pH is raised to 6.9 in map area I. However, in map area II, it is not necessary to raise the pH above 6.1 due to the presence of lime in the subsoil.

3. "Limy" subsoils in western Minnesota (Area II) call for less lime.

***Notice*

Fertilizer tables are from Extension Bulletin BU06240, 2001, Fertilizer Rec. for Agronomic Crops in Minnesota. This report provides additional information on soil fertility and soil testing and is recommended for resource information. Since space in the Land Judging Instruction is limited, many important aspects of fertilizer use such as micronutrients, or limitations o the amounts of N and K which can safely be applied in the row, had to be eliminated. The Land Judging Instruction tables are not meant to make actual fertilizer recommendations, but to give pointers as to how such recommendations are made.

Part 11. LAND USE LIMITATIONS: SOIL EVALUATION FOR COMMUNITY DEVELOPMENT

For more than 40 years, the procedure used to determine the proper use of soils in agriculture has been to evaluate soil resources and then develop a farm plan using the soils information. The evaluation of soils for non-agricultural uses is just as important. This section serves as an educational aid for the uses of soils for community development. All sites are determined for Community Development.

This section is based on technical information from the Soil Conservation Service, now called Natural Resources Conservation Service Guide for Interpreting Engineering Uses of Soils. It was necessary to introduce a few simplifications and omit one or two of the less important factors. For each use being evaluated, (1) mark the most likely description of each feature of the land area, (2) consider the relative importance of each feature you have circled, and (3) check the degree of limitation (slight, moderate, or severe) to indicate the appropriateness of a particular land use.

In the "Limitation" column, the terms slight, moderate, and severe, refer to the limitations of the area for the use being considered. The terms also apply individually to each feature as it is described on the same line to the right. For example, a slope of 0-6% has slight limitations for dwellings; a slope of 6.1-12%, dwellings has moderate limitations; slope >12%, dwellings has severe limitations. This reasoning applies to each feature. The limitation on use is determined by the greatest limitation noted for any feature. If all the features for the area are slight, the limitation of the area is "slight" for that use. If one or more of the features for the area are described as "severe", the limitations of the area are severe for that use. If one or more of the features for the area are described as "moderate", with none described as severe, the limitations are moderate for that use.

****There is one exception, for septic tank absorption fields, lagoons and holding basins:**
When both % slope and depth to bedrock are moderate, the limitation is severe. Since the farm lagoon surface will be level and the absorption field nearly level, bedrock is encountered at the upslope portion of any sizable lagoon or absorption field, which severely limits these uses.

Limitations:
(Level of Limitation for each use)

Slight: The area is physically well suited to the use being considered. None of the physical features described is a significant limitation. Existing limitations are easily reduced or corrected. The area is relatively free of hazards.

Moderate: There are one or two important limitations that cause this area to be only fairly suitable for the use being considered. The limitations are considered moderate. It is economical to correct the limitations or reduce their influence.

Severe: The area is poorly suited for the use being considered. The limitations (there may be only one) are severe and may be costly to overcome.

Explanation of a new term: Permeability
Permeability is the rate that water moves through a soil. The accepted measure used in soil surveys is saturated permeability, which is the rate of flow of water through a saturated soil under specified conditions. Permeability rates are the same as hydraulic conductivity. Permeability is determined for each soil in Part 6-D, for the subsoil.

	Permeability Class	**Inches per hour (movement of water through the soil)**
Slow	Very Slow	Less than 0.06 inches per hour
	Slow	0.06-0.2 inches per hour
Moderate	Moderately Slow	0.2-0.6 inches per hour
	Moderate	0.6-2.0 inches per hour
Rapid	Moderately Rapid	2.0-6.0 inches per hour
	Rapid	6.0-20.0 inches per hour
Very Rapid	Very Rapid	More than 20 inches per hour

A. Use for Dwellings
Soil properties affect house construction in several ways. Major emphasis in this section is on soil properties that affect foundations. The properties affecting the soil's bearing strength when wet and the shrink-swell potential (Clays have the ability to shrink and swell depending on moisture content) determine the size of the foundation required.

The properties affecting the cost of excavation and construction include:

- Drainage
- Slope
- Depth to bedrock

Soil properties, which have affects beyond those relating exclusively to foundations and are also considered, follow:

- Percent slope
- Susceptibility to flooding
- Seasonal high water table
- Depth to bedrock
- Surface texture

This discussion applies to undisturbed soils, which single family dwellings, or other structures with similar foundation requirements can be built.

Features for Dwellings:

Percent Slope Steeper slopes generally increases construction costs of the house, road, and water systems. Some soils given limitations of moderate or severe may still be good sites with an aesthetic value, but may require more preparation and/or maintenance.

Limitations of Percent Slope for dwellings:
- Slight: 0-6% slope
- Moderate: 6.1-12 %
- Severe: > 12%

Surface Soil Texture: Medium surface soil texture will have slight limitations for dwellings. They are most desirable for lawns because they hold moderate to high amounts of available water, require less frequent watering and suffer less damage from foot traffic when wet. Coarse, fine, and very fine-textured soils have moderate limitations. Coarse-textured soils hold little water and are droughty unless watered frequently. Fine or very fine-textured soils have poor workability and are more easily damaged by traffic when wet.

Limitations of Surface Soil Texture for dwellings:
- Slight: Medium and moderately coarse surface soil texture
- Moderate: Coarse and fine-textured soils
- Severe: None in this category

Flooding: State regulations prohibit building on flood plains. Look at landform (see Part 4-B)

Limitations of Flooding for dwellings:
- Slight: None in this category
- Moderate: None in this category
- Severe: any flooding

Internal Drainage Class: Wet basements and decreased soil bearing strength are associated with saturation of the soil due to high water table. Internal drainage class is used to determine whether a seasonal high water table exists.

Limitations of Internal Drainage Class for dwellings:
- Slight: Well drained to moderately well drained
- Moderate: For this competition: None (in actual practice, moderately well drained soils would be here, but it is not reasonable to expect students to distinguish moderately well-drained)
- Severe: Somewhat poorly drained, poorly drained

Depth to Bedrock: Bedrock at less than 60 inches is a limitation because it interferes with construction and placement of utility lines.

Limitations of Depth to Bedrock for dwellings:
- Slight: Greater than 60 inches depth
- Moderate: 40-60 inches depth
- Severe: Less than 40

Subsoil or underlying materials and shrink-swell potential: Coarse and medium-textured subsoil or underlying material have low shrink-swell potential and reduce the size and cost of foundations required. These textures have slight limitations. Fine-textured soils have moderate shrink-swell potential and require more extensive foundations; therefore, they have moderate limitations. Very fine-textured soils have high shrink-swell potential hence severe limitations.

Limitations of Subsoil, shrink-swell potential for dwellings:

Slight (Low shrink-swell potential): Coarse and medium texture
Moderate: Fine-textured
Severe (High shrink-swell potential): Very fine textured

B. Use for Septic Tank Absorption Fields

A septic tank absorption field is a soil absorption system for sewage disposal. It is a subsurface tile system laid so that effluent from the septic tank is distributed with reasonable uniformity into the natural soil. The soil is treated on its ability to absorb effluent. Soil areas considered in this section are those where tile lines will distribute effluent from sewage septic tanks. Local experience and record of performance for existing filter beds provide important guides where such information is available.

Features for Septic Tank Adsorption Fields:

Percent Slope: Soils with a 6% or less slope offer the best site for sewage disposal systems from the standpoint of construction and successful operation of an absorption field. Mechanical problems of layout and construction increase with slope steepness. Lateral seepage of downslope surface flow is a problem on sloping soils, especially where bands of material with slower **permeability** occur in the top 4 feet of the soil. With slopes over 12%, effluent frequently flows to the surface at low points so such soils have severe limitations for use as disposal fields. Large rocks, boulders and rock outcrops increase construction costs. The tile grade is difficult to maintain if the obstacle cannot be removed. Trench lines can be installed and that grade can be maintained around these obstacles on nearly level soils.

Limitations for Percent Slope for Septic Tank Adsorption Fields:

Slight: 0-6% slope
Moderate: 6-12% slope
Severe: Greater than 12%

Flooding: Soils subject to flooding have severe limitations, even if permeability is satisfactory and the ground water level is below 4 feet. Floodwater interferes with the functioning of the filter field and carries away unfiltered sewage (Health hazard). Areas subject to flooding should not be considered for onsite sewage disposal systems unless they are protected from flooding.

Limitations of Flooding for Septic Tank Adsorption Fields:

Slight: None
Moderate: None
Severe: Any flooding

Internal Drainage: A seasonal water table should be at least 4 feet below the bottom of the trench (6 feet below the soil surface) at all times for soils rated as having slight limitations. Soils with a water table less than 2 feet below the bottom of the trench (4 feet below the soil surface) for extended periods have severe limitations. Soil drainage class is used to estimate the depth of a seasonal water table. Well-drained and moderately well-drained soils have slight limitations. Somewhat poorly drained soils and poorly drained have severe limitations. Tile drainage may be used to lower the water table in some soils if state law permits it. Soils are rated on their natural undrained conditions.

Limitations of Internal Drainage for Septic Tank Adsorption Fields:

Slight: Well drained, moderately well drained
Moderate: None
Severe: Somewhat poorly and poorly drained

Permeability Class: Soil permeability is a very important feature in a soil absorption field. Soils with very rapid and rapid permeability are rated as having slight limitations. However, soils that have sand or sand and gravel within 4 feet of the surface will not provide proper filtration and may allow pollution of subsurface aquifers where we obtain our drinking water. Soils with moderate permeability have moderate limitations. In actual practice, soils have slight limitations; however, for contest purposes, we consider all soils with moderate permeability to have moderate limitations. Soils with slow to very slow permeability have severe limitations for use as septic tank absorption fields. Permeability class is rated for the most restrictive layer below the plow layer. (See Part 6-D)

The Soil permeability is determined from Part 6-D.

	Permeability Class	**Inches per hour (movement of water through the soil)**
Slow	Very Slow	Less than 0.06 inches per hour
	Slow	0.06-0.2 inches per hour
Moderate	Moderately Slow	0.2-0.6 inches per hour
	Moderate	0.6-2.0 inches per hour
Rapid	Moderately Rapid	2.0-6.0 inches per hour
	Rapid	6.0-20.0 inches per hour
Very Rapid	Very Rapid	More than 20 inches per hour

Limitations of Permeability for Septic Tank Adsorption Fields:

Slight: very rapid, rapid
Moderate: Moderate
Severe: Slow, to very slow

Depth to Bedrock: **Impervious** layers (compactions, resistant, water tight, where water or roots cannot pass through), including rock formations, must be 6 feet or more below the soil surface for slight limitation. Six feet of soil is also required over crevices or fractured rock for slight limitations because unless an adequate soil cover is present, unfiltered sewage may travel long distances through an aquifer where people draw their drinking water from, as in cracked limestone. When the depth to bedrock is over 48 inches but not more than 72 inches, limitations are moderate. When the depth to bedrock is less than 48 inches, limitations are severe.

Limitations of Depth to Bedrock for Septic Tank Adsorption Fields:

Slight: Bedrock depth is more than 60 inches.
Moderate: Bedrock depth is 40-60 inches.
Severe: Bedrock depth is less than 40 inches.

C. Use for Farm Lagoons and Holding Basins

A manure lagoon is a shallow pond used to hold livestock sewage for the time required for bacterial decomposition. Manure lagoon construction requires consideration of the soil for two functions:

- As a vessel or container for the impound area and;
- Soil material for the enclosing embankment.

The lagoon must be capable of holding water with minimum **seepage**.

Soil requirements for basin floors of farm lagoons are:

1. Slow rate of seepage
2. Even surface
3. Little or now organic matter

Official specifications for lagoons state that the depth of liquid should not be less than 2 feet and generally not more than 5 feet. Also, that the floor should be level or nearly level and that the materials for the basin floor should be so nearly impervious as to preclude excessive loss of liquid through seepage. The relatively impervious material should be at least 4 feet thick. This is especially important where the local water supply comes from shallow wells that may become contaminated. Contamination occurs when the pollutant enters the groundwater through seepage or through fractured limestone.

Important soil characteristics include:

Percent slope
Drainage Class
Flooding
Permeability Class
Depth to Bedrock
Type of Bedrock

Features:

Percent Slope: Percent slope is important because the liquid body of the lagoon must be between 2 and 5 feet deep. Slope must be level enough and soil material thick enough over bedrock to make it possible to smooth the bottom of the lagoon in order to have a uniform lagoon depth. Greater slope is allowable if the soil material is more than 6 feet deep, but generally smoothing is impractical where slopes exceed 6%. Zero to 2% slopes have slight limitations, 2-6% slopes have moderate limitations and slopes greater than 6 % have severe limitations.

Limitations for lagoons and holding basins:

Slight: 0-2 % slope
Moderate: 2-6% slope
Severe: Greater than 6 %

Flooding: Flooding is a severe limitation because floodwaters may overtop the embankment, interfere with the functioning of the lagoon and carry polluting sewage away before sufficient decomposition, through biological activity, has occurred.

Limitations for Flooding lagoons and holding basins:

Slight: None
Moderate: None
Severe: Any Flooding

Internal Drainage Class: The depth to water table is critical for evaluating sites for lagoons that have basin floors composed of material with moderate to very rapid permeability. However, depth to water table is disregarded if the lagoon floor consists of at least 2 feet of material with moderately slow to very slow permeability. Again, drainage class is used to judge depth to water table. Well and moderately well drained soils have slight limitations because the water table is always at a depth greater than 60 or more inches. Somewhat poorly drained soils are considered to have moderate limitations with a water table between 40-60 inches depth at some time during the year. Poorly drained soils have severe limitations with a water table less than 40 inches from the surface some time during the year.

Limitations for Internal Drainage Class lagoons and holding basins:

Slight: Well drained, moderately well drained
Moderate: Somewhat poorly drained
Severe: Poorly drained

Permeability Class: The greater the permeability (in its natural state) the greater the limitation on use as a lagoon. Soils with slow permeability have slight limitations; moderately permeable soils have moderate limitations, and soils with rapid to very rapid permeability such as gravelly, sandy and organic soils have severe limitations. Permeability class is rated for the most restrictive layer below the plow layer (subsoil).

Limitations for Permeability lagoons and holding basins:

Slight: Slow
Moderate: Moderate
Severe: Rapid to very rapid

Depth to Bedrock: A depth of at least 60 inches of relatively impervious soil material is required for the area to be classified as having slight limitations. This is especially important where the local water supply comes from shallow wells that may become contaminated. Where depth to bedrock is less than 40 inches, limitations are severe. Moderate limitations are between 40-60 inches depth to bedrock.

Limitations for Depth to Bedrock lagoons and holding basins:

Slight: Depth to bedrock is greater than 60 inches
Moderate: Depth to bedrock is between 40-60 inches
Severe: Depth to bedrock is less than 40 inches

Soils Contest

1. The soils contest can consist of judging 4 land areas using the "FFA Land Judging Scorecard" and instructions. The information in the "FFA Land Judging Scorecard Instructions" will be the subject matter guide.
2. Teams will normally be composed of four members with the top three scores counting..
3. The correct answers for each soil site used may be available after completion of the contest and will be posted on the FFA Web Site. The winners will be announced at the Awards Ceremony.
4. 1st Place team or alternate may represent Minnesota at the National Soil Contest in Oklahoma.
5. Materials available for FFA Land Judging are posted on the FFA Website(http://afee.coafes.umn.edu/ffacon/):
   a. Minnesota FFA Land Judging Score Card (2017)
   b. FFA Land Judging Instructions – (2006)
   c. Land Judging Placard – (2006)

GRADING THE SCORECARD

Several general rules apply to grading the scorecard. A master scorecard is used to indicate acceptable answers. Never record a minus score for any part.

Parts 1, 2, & 3

A. The point assignment is two points for correctly recording each depth with a range of 1" above and 1" below being correct. Where boundaries are indistinct or variable, the official judge will allow for appropriate variation in the answers.

B. – Allow four points for correctly identifying the correct color in parts 1 & 2.

C. - Allow 5 pts for identifying the correct texture in parts 1, 2 & 3.

D. - Allow 2 pts for identifying the correct gravel and rock.

Part 4

Allow 3 pts each for identifying the correct steepness and correct landscape position. If the wrong box is checked or if a correct answer is not marked, the score for that part is zero. Judges may allow an alternative choice or award partial credit if the choice is considered difficult or borderline.

Part 5

Allow six points if the correct class number is circled. If more than one number is circled, the score is zero. If the circle is one class from the correct answer, allow three points credit. No credit allowed between classes IV and V and between V and VI. Three points is allowed between class IV and VI.

Part 6

A. thru D. Allow 2 pts each for identifying the correct answer. If the wrong box is checked or if a correct answer is not marked, the score for that part is zero.

E. – Allow 1 pt. For each correct answer in 1-a.b.c; and 2-a.b.c. Allow 4 pts. for 3 and 6 pts for 4. If the wrong box is checked or if a correct answer is not marked, the score for that part is zero

Part 7

Allow two points each for parts A. Amount of erosion and B. Kind of erosion. If the wrong box is checked or if a correct answer is not marked, the score for that part is zero.

Part 8

Allow 3 pts each for A. Water Erosion and 3 pts for B. Wind Erosion. Only one answer is allowed in each section. If the wrong box is checked , if two boxes are checked, or if a correct answer is not marked, the score for that part is zero.

Part 9

Allow 5 pts. for identifying the correct Drainage Required. If the wrong box is checked or if a correct answer is not marked, the score for that part is zero.

Part 10

Allow two pts each for identifying the correct fertilizer and lime recommendations. If the wrong box is checked or if a correct answer is not marked, the score for that part is zero.

Part 11

<u>Land Use Limitations</u>

Each USE will be scored and totaled individually as follows:

Limitations - Allow three points for correct answers.

Land Features - Allow one point for every correct answer in each column.

If the wrong box is checked or if a correct answer is not marked, the score for that part is zero.

FFA LAND JUDGING PLACARD – MINNESOTA – FFA

Pit Number _

Lime Area _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ **Flooding** _ _ _ _ _ _ _ _ _ _ _ _ _

pH _ _ _ _ _ **SMP Buffer Index** _ _ _ _ **Assumed Field Size** _ _ _ _ **Acres**

P Test _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ **lb./acres available phosphorus**

Subsoil Phosphorus Level _

K Test _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ **lb./acres exchangeable potassium**

Subsoil Potassium Level _ _ _ _ _ _ _ _ **Manure Applied** _ _ _ _ **Tons/Acre**

Corn Yield Goal _ **bu./acres**

Crop to be planted _

Past Crop _

Original Surface Soil Depth _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ **inches**

Slope Length _ **feet**

Depth to permanent water table _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Minnesota FFA Soils Scorecard

Name School Number 9/17

Part 1: Surface Soil -

A. Thickness in Inches — 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36>

Allow 1 inch either way on thickness

B. Color — 4
- Dark
- Medium
- Light

C. Texture — 5
- Coarse
- Moderately Coarse
- Medium
- Fine
- Very Fine

D. Gravel and Rock — 2
- None to Few
- Gravelly
- Very Gravelly
- Extremely Gravelly

Part 2: Subsurface Soil

A. Thickness in Inches — 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36>

Allow 1 inch either way on thickness

B. Color — 4
- Bright
- Mottled
- Dull

C. Texture — 5
- Coarse
- Moderately Coarse
- Medium
- Fine
- Very Fine

D. Gravel and Rock — 2
- None to Few
- Gravelly
- Very Gravelly
- Extremely Gravelly

Part 3: Underlying Material

A. Thickness in Inches — 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36>

Allow 1 inch either way on thickness

Part 3 Parent Material - Continued

B. Texture — 5
- Coarse
- Moderately Coarse
- Medium
- Fine
- Very Fine

C. Gravel — 2
- None to Few
- Gravelly
- Very Gravelly
- Extremely Gravelly

Part 4 Topography

A. Steepness of Slope — 3
- Nearly level - 2% or less
- Gently sloping - 3 - 6 %
- Moderately sloping - 7-12%
- Strongly sloping - 13 to 18 %
- Steep - Greater than 18 %

B. Landscape Position — 3
- Upland
- Terrace - Footslope
- Bottom land - Flood Plains
- Depressional Area - No Outlet

Part 5 - Land Capability Classification — 6

Land suitable for Cultivated Crops
- Class I
- Class II
- Class III
- Class IV

Land suitable for Permanent Vegetation
- Class V
- Class VI
- Class VII
- Class VIII

Score 6 points for correct answer - 3 points for 1 class off except for class 5. Allow 3points between Class IV and VI.

Part 6 Interpretation of Soil Features

A. Type of Material that Lim its Depth — 2
- None- No limiting materials
- Bedrock - Soft or hard
- Hardpan - Cemented
- Very gravelly sand or high water table

B. Parent Material — 2
- Bedrock - Soft or hard
- Alluvium /Outwash/Lacustrine
- Till/Loess/Aeolian Sand
- Organic materials - Peat or muck

C. Depth Favorable for Roots & Water Penetration — 2
- Very Deep - 60 inches or more
- Deep - 40 through 59 inches
- Moderately Deep - 20 through 39 inches
- Shallow - less than 20 inches

D. Air and Water Movement (Subsoil Permeability) — 2
- Very Rapid
- Rapid
- Moderate
- Slow

E. Total Available Water capacity

1. Available water in horizon per inch of soil

1	0.05 0.15 0.20	a. Surface Horizon	Calculation Area
1	0.05 0.15 0.20	b. Subsoil	
1	0.05 0.15 0.20	C. Underlying Material	

2. Available Water Capacity per Horizon

a. Surface Horizon

	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7.1-8.0	8.1>
1									

b. Subsoil

	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7.1-8.0	8.1>
1									

c. Underlying Material

	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7.1-8.0	8.1>
1									

3. Total available water capacity in five feet of soil

4
- Very low - Less than 3 inches
- Low - 3.1 to 6.0 inches
- Moderate - 6.1 to 9.0 inches
- High - over 9.0 inches

4. Internal Drainage

4
- Well Drained
- Moderately well drained
- Somewhat poorly drained
- Poorly or very poorly drained

Part 7 Accelerated Erosion

A. Amount of Erosion

2
- No erosion evident (less than 2 inches)
- Deposition (2 inches or greater)
- Erosion present (2 inches or greater)

B. Kind of Erosion

2
- None
- Active gully
- Wind erosion
- Sheet or rill

Part 8 - Need for Erosion Control

A. Water Erosion

3
- None to slight
- Crop cover, sod cover, and conservation tillage
- Contour, strip crop and conservation tillage
- Grass waterways and gully control
- Woodland or permanent pasture
- Wildlife or recreation

B. Wind Erosion

3
- None to slight
- Mulch tillage, cover crop

Part 9 Drainage Required

5
- None required
- Surface and/or tile

Part 10 - Fertilizer and Lime Recommendations

2		Nitrogen pounds per acre
2		Phosphorous pounds per acre
2		Potassium pounds per acre
2		Lime tons per acres

Part 11 - Land use Limitation (Points are for each section)

		3 Pts Each		1 Point Each						
	Use	Limitation	% Slope	Surface Soil Texture	Flooding	Internal Drainage Class	Permeability Class	Depth to Bedrock (inches)	Underlying Material (Shrink Swell Potential)
9	Dwellings (lawns), foundations, basements	Slight	0 to 6.0	medium, moderate, coarse	None	well drained, mod. well drained		more than 60	coarse, mod.coarse, medium
		Moderate	6.1 to 12.0	coarse, fine, very fine				40 to 60	fine texture
		Severe	More than 12.0		Any flooding	somewhat poorly to poorly drained		less than 40	very fine texture
8	Septic tank absorption fields	Slight	0 to 6.0		None	well to mod well drained	very rapid to rapid	more than 60	
		Moderate	6.1 to 12.0				Moderate	40 to 60	
		Severe	More than 12.0		Any flooding	somewhat poorly to poorly drained	slow to very slow	less than 40	
8	Farm lagoons and holding basins	Slight	0 - 2.0		None	well to mod well drained	Slow	more than 60	
		Moderate	2.1 - 6.0			somewhat poorly drained	Moderate	40 to 60	
		Severe	More than 6.0		Any Flooding	poorly drained	Rapid to very rapid	less than 40	