

**2010 California Envirothon**  
**Soils Station Test**  
**Total = 100 points**  
**Suggested time is 35 minutes**

**Introduction:** You manage Alliance Redwood Camp, but does what you do really matter to the estuary on the lower Russian River. Dutch Bill Creek flow through your camp into the Russian River, past Fremont Creek and then empties into the Pacific Ocean at the town of Jenner. The upper reach of the estuary at Fremont Creek is 6 miles down-stream from your camp, and the mouth of the estuary is 12 miles down-stream. Could what you do at your camp affect the life of the estuary?

All Questions are worth **3 POINTS** unless marked otherwise. **For multiple choice answers, circle the correct letter.**

**Describe Soil Properties** Answer the following questions by making observations in the soil pit.

1. What is the thickness of the surface layer?
  - A. 0 to 4 inches
  - B. 5 to 9 inches
  - C. 10 to 19 inches
  - D. more than 20 inches
  
2. What is the MOI ST color of the surface layer?
  - A. very dark
  - B. medium or bright
  - C. very light
  - D. drab or mottles
  
3. What is the texture of the surface layer?
  - A. sand or loamy sand
  - B. sandy loam or fine sandy loam
  - C. loam or silt loam
  - D. clay loam or sandy clay loam
  - E. clay, silty clay or sandy clay
  
4. What is the saturated hydraulic conductivity (permeability) of the surface layer?
  - A. extremely slow or very slow
  - B. slow or moderately slow
  - C. moderate or moderately rapid
  - D. rapid or very rapid

5. Other than soil texture what other soil property influences hydraulic conductivity? Name the property and describe the visual evidence (if any) from the surface layer of the soil pit. Evidence may include width and spacing of a feature.

Property: **(3 points)** \_\_\_\_\_

Evidence: **(3 points)** \_\_\_\_\_

6. What is the dominant structure of the surface layer?

- A. massive or no structure
- B. subangular blocky or blocky
- C. prismatic
- D. granular or crumb
- E. platy

7. How thick is the subsoil?

- A. 0 to 4 inches
- B. 5 to 9 inches
- C. 10 to 19 inches
- D. more than 20 inches

8. What is the MOI ST color of the subsoil?

- A. very dark
- B. medium or bright
- C. very light
- D. drab or mottles

9. What is the texture of the subsoil?

- A. sand or loamy sand
- B. sandy loam or fine sandy loam
- C. loam or silt loam
- D. clay loam or sandy clay loam
- E. clay, silty clay or sandy clay

10. What is the dominant structure of the subsoil?

- A. massive or no structure
- B. subangular blocky or blocky
- C. prismatic
- D. granular or crumb
- E. platy

11. Based on your observations in the pit what differences do you think there would be in the saturated hydraulic conductivity (permeability) of the surface layer and subsoil?

- A. subsoil more rapid than surface layer
- B. surface layer more rapid than subsoil
- C. no difference
- D. more information needed to determine

12. Is there a root or water restrictive layer evident in the pit? Write down the depth at which it is observable. If no restrictive layer is evident, what type of restrictive layer would you expect to find if we dug deeper?

Depth: (3 points) \_\_\_\_\_

Type of Restrictive Layer: (3 points)

- A. Bedrock
- B. Dense or hardened material
- C. Extremely gravelly material
- D. Clay-pan with abrupt upper boundary

13. What is the type of parent material the soil at the pit location formed in?

- A. residuum (from the underlying soft or hard bedrock)
- B. eolian (brought by wind)
- C. colluvium (brought by gravity) and alluvium
- D. alluvium (brought by water)
- E. alluvium and eolian

### Describe Site Properties

Answer the following questions by making observations of the visible area surrounding the soil pit and soils station.

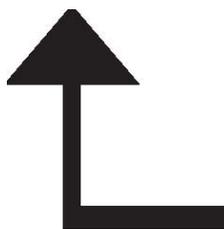
14. Using the provided **clinometer**, measure the percent slope of the land between the marked stakes. Percent slope is the vertical feet of rise or fall for every 100 feet of horizontal run divided by 100.

- A. 0 to 2 percent
- B. 2 to 4 percent
- C. 4 to 8 percent
- D. 8 to 15 percent
- E. 15 to 25 percent
- F. 25 to 50 percent

15. What is your assessment of the type and severity of erosion that has occurred in the area surrounding the soil pit?

- A. no erosion apparent (less than 1 centimeter)
- B. slight erosion (1 to 3 centimeters), mostly sheet erosion
- C. slight erosion (1 to 3 centimeters), mostly rills
- D. moderate erosion (3 to 10 centimeters), mostly sheet erosion
- E. moderate erosion (3 to 10 centimeters), mostly rills
- F. severe erosion (more than 10 centimeters), mostly rills with some gullies

16. Rate the soil in the pit using the USDA Land Capability Classification System, the answers you obtained from your observations above, and the following information. Use the following table to assign a Land Capability Class to the soil. Choose the Land Capability Class for the single most limiting item. Limitations increase as you move from the top to the bottom of the table. Write your answer in the box to the left. **(7 points)**



Effective rooting depth: answers from Questions 12  
 Surface layer texture: answer from Question 3  
 Permeability: answers from Questions 4 and 5  
 Depth to water table: greater than 10 feet  
 Available water capacity: use texture from Question 9 and table below  
 Slope: answer from Question 14  
 Erosion hazard: answer from Question 15  
**Your answer here**

Class	Effective soil depth <sup>1</sup> (inches)	Surface layer texture <sup>2</sup>	Permeability	Drainage Class <sup>3</sup>	Available water capacity <sup>4</sup> (inches)	Slope (%)	Erosion Hazard
I	• 40	Sandy loam to clay loam (0 to 15%)	Moderate	Well or moderately well >60	• 7.5	< 2	None or slight
II	• 40	Loamy sand through clay (0 to 15%)	Rapid through slow	Somewhat poorly to somewhat excessively >36	• 5.0	< 5	None to moderate
III	• 20	Sandy loam to clay (0 to 35%)	Rapid through slow	Poorly to excessively >20	• 3.5	< 15	None to severe
IV	• 10	Loamy sand to clay (0 to 60%)	Any	Poorly to excessively >20	• 2.5	< 25	Any
V	• 20	Any	Any	Any	• 3.0	< 2	None or slight
VI	• 10	Any	Any	Any	• 2.0	< 50	Any
VII	Any	Any	Any	Any	1	< 75	Any
VIII	Any	Any	Any	Any	Any	Any	Any

<sup>1</sup>Clay-pans with slow permeability will be treated as limiting the effective depth. <sup>2</sup>Percentage of gravel and rock fragments on the surface within 10,000 ft<sup>2</sup> area. <sup>3</sup>Depth to water table during the growing season. <sup>4</sup>Available moisture between field capacity and wilting point.

Texture	Bulk Density (g/cm <sup>3</sup> )	Porosity (%)	Available Soil Water (inches/foot of soil depth)	
			Range	Average
<b>Coarse</b>				
Sand	1.65	38	0.5-0.8	0.7
Fine Sand	1.6	40	0.6-1.0	0.8
Loamy Sand	1.6	40	0.7-1.1	0.9
Gravel/Cobble in Coarse Texture	—	—	0.6-0.8	0.7
<b>Moderately Coarse</b>				
Loamy Fine Sand	1.55	42	1.0-1.3	1.2
Sandy Loam	1.5	43	1.2-1.6	1.4
Fine Sandy Loam	1.5	43	1.2-1.7	1.5
<b>Medium</b>				
Gravel/Cobble in Medium Texture	—	—	1.1-1.3	1.2
Very Fine Sandy Loam	1.45	45	1.6-2.2	1.9
Loam	1.4	47	1.6-2.3	2
<b>Moderately Fine</b>				
Sandy Clay Loam	1.35	49	1.7-2.4	2.1
Silt Loam	1.35	49	1.8-2.5	2.2
Clay Loam	1.35	49	1.8-2.5	2.2
<b>Fine</b>				
Sandy Clay	1.3	51	1.9-2.5	2.3
Silty Clay	1.25	53	1.9-2.5	2.3
Clay	1.2	55	2.0-2.5	2.3
<b>Peats and Mucks</b>				
	—	—	2.0-3.0	2.5

Representative values of soil bulk density, total porosity, and available soil water for various generalized soil textures.

**Don't forget you may have to make a conversion from feet to inches!!**

17. Placing soils in a Land Capability Class is most often done for agricultural purposes. Livestock grazing may be the dominant agriculture here. Often a subclass is attached to a LCC rating to indicate additional limitations. Which of the following limitations do you think might be most appropriate to attach to your rating from Question 17 above? (4 points)

- A. Subclass 'e' for erosion susceptibility or past erosion damage
- B. Subclass 'w' for poor soil drainage or wetness
- C. Subclass 's' for soils with root zone limitations (shallowness, stones, low moisture-holding capacity, salt problems, or low fertility that is hard to correct)
- D. Subclass 'c' for soils where climate is limiting (temperature or lack of moisture)

Use these tables to help you answer the following questions.

Soil Properties								
Soil Name	Depth to Bedrock or Cemented Pan (inches)	Depth to High Water Table (inches)	Permeability	Slope (%)	Flooding	Shrink-Swell	Runoff	Erosion Hazard
Atwell clay loam	> 80	> 80	Moderately low	50-75	None	Moderate	Very rapid	Very high
Cortina very gravelly loam	> 80	> 80	High	0-2	Common	Slight	Slow	Slight
Hugo very gravelly loam	40 to 60	> 60	Moderately high	50-75	None	Moderate	Very rapid	Very high
Yorkville clay loam	40 to 60	> 60	Very low	30-50	None	High	Rapid	High

Limitations for Septic Tank Filter Field					
	Property	Limits			Restrictive Feature
		Slight	Moderate	Severe	
1	Flooding	None, Protected	Rare	Common	Floods
2	Depth to Bedrock or cemented pan (inches)	> 72	40-72	< 40	Depth to Rock or cemented pan
3	Depth to High Water Table (inches)	> 72	48-72	< 48	Ponding, Wetness
4	Permeability 24-60 inches		Moderate	Slow	Percs Slowly
		Rapid	Rapid		Poor Filter
5	Slope (%)	0-8	8-15	> 15	Slope

18. Septic tank filter fields which are aging for under-sized may leak nutrients or fecal contaminants through the soil and into Dutch Bill Creek. Which of these soils around Alliance Redwood Camp has the least limitation for septic tank filter fields?

- A. Atwell clay loam
- B. Cortina very gravelly loam
- C. Hugo very gravelly loam
- D. Yorkville clay loam

19. How would you design the septic tank filter field to compensate for this soil's limitations?

- A. Construct filter field on summit of hill
- B. Construct filter field on side slope of hill
- C. Increase area of filter field
- D. Decrease filter field
- E. All of the above
- F. A and C
- G. B and D

20. What pollutant from dirt roads might enter Dutch Bill Creek and then flow into the Russian River and the estuary? This pollutant may increase the turbidity of the estuary.

- A. Nutrients
- B. Sediment
- C. Pesticides

21. Which soil has the greatest potential for contributing sediment to the creeks?

- A. Atwell clay loam
- B. Cortina very gravelly loam
- C. Hugo very gravelly loam
- D. Yorkville clay loam
- E. A and C
- F. B and D

22. How would you manage roads to prevent erosion that contributes to turbidity in the estuary?

- A. Close roads on steepest slopes
- B. Grade roads just before winter
- C. Winterize roads by planting grass on them
- D. Provide rocked outlets for culverts
- E. Construct water bars across road to slow runoff and direct off road
- F. Construct rolling dips in road to convey runoff across road
- G. Out-slope roads so runoff does not concentrate on road
- H. In-slope roads to concentrate runoff into culverts
- I. All of the above
- J. B, E and H
- K. A, C, F and G

23. The riparian corridor is on the Cortina very gravelly loam. Which pollutants would most likely pass through this soil?

- A. Nutrients
- B. Manure from cattle
- C. Sediment
- D. Pesticides
- E. Sewage from septic tanks
- F. B and E
- G. A and C

24. Which soil properties of the Cortina very gravelly loam allow it to conduct pollutants?

- A. High permeability
- B. Common flooding
- C. Steep slope
- D. Slow runoff
- E. Depth to bedrock
- F. All of the above
- G. A and B
- H. C and D

25. Runoff may carry manure into Dutch Bill Creek and then into the Russian River and the estuary. How would you manage the riparian corridor to protect this creek? Circle the letters of the best three answers.

- A. Provide trails for cattle away from the riparian corridor
- B. Fence cattle out of riparian corridor
- C. Allow cattle access to riparian corridor only in winter
- D. Allow cattle access to the riparian corridor only in summer
- E. Provide salt licks in the riparian corridor
- F. Provide water in troughs outside the riparian corridor
- G. Widen the riparian corridor and plant more local trees

26. During the spring, summer and fall, northwesterly winds build a beach barrier at the mouth of the Russian River that prevents it from flowing into the Pacific Ocean. This natural dam backs up water that may flood the lower estuary and the town of Jenner, while increasing the salinity of the lower estuary. In what two ways could excess sediment leaving your watershed affect the estuary?

(1) (3 points) \_\_\_\_\_

(2) (3 points) \_\_\_\_\_

27. How would you manage the (1) soils in the watershed, (2) camp buildings and parking lots, and (3) the beach barrier to reduce the problem of the beach barrier?

(1) (3 points)

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Team Name: \_\_\_\_\_

(2) (3 points)

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(3) (3 points)

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