

ES202 Lab 6: Fluvial Processes Lab Instructions *(updated Winter 2016)*

Uses AGI Lab Manual 10th Edition

PART 1. Thinking Questions. Using your lab book, complete the following exercises / answer the following questions:

1. Refer to **p. 285, Fig. 11.1** and answer the following questions:
 - a. Describe and sketch the difference between a meandering and braided river pattern.
 - b. Write the equation for “sinuosity” and describe what it means in terms of calculated ratios.
 - c. Draw a sketch of a meandering channel reach, identify zones of erosion and deposition, label important landforms.
 - d. Compare and contrast the gradient of a meandering stream channel vs. braided? Are they the same, or different? How so?

2. Refer to **p. 287, Fig. 11.2** and answer, match the following drainage patterns to geologic conditions:

___ Dendritic	a. channels eroding rock fractures
___ Radial	b. rivers flowing over folded rocks (anticlines and synclines)
___ Annular	c. river erosion on stratovolcanoes
___ Rectangular	d. leaf-like patterns formed on flay-lying or uniform rock material
___ Centripetal	e. patterns associated with concentric circular channels
___ Trellis	f. irregular streams, lakes, swamps and poorly drained areas
___ Deranged	g. river channels that flow to a central low elevation

3. Refer to Strasburg Virginia map on **p. 288, Fig. 11.3**; and **Fig. 11.6 on p. 292**.
 - a. Which direction is Passage Creek flowing (provide answer in azimuth degrees)
 - b. Calculate the stream gradient of the unnamed tributary between points E and F. Answer in both ft/mi and dimensionless ratio of ft/ft; show all of your math work.

E-F Gradient _____ ft / mi

E-F Gradient _____ ft/ft

4. Examine **Figure 14.7 on p. 365**, read the figure caption, and observe the landforms commonly found in arid to semi-arid (desert) landscape environments. Now examine the Ennis, MT topographic map on p. **291 Figure 11.5**; answer the following questions.
- What prominent desert landform is “Lawton Ranch” located on (compared to **Fig. 14.7**)
 - What type of earth material likely forms the landscape immediately to the west of Lawton Ranch (bedrock? Regolith? Alluvial? Sand vs. gravel? Round or angular?)?
 - What is the river channel pattern exemplified by the Madison River on the western edge of the map (meandering or braided?)
 - What is the contour interval of the map?

PART 2. LAB ACTIVITIES. Refer to your lab manual exercises and work on the following problems.

Activity 11.2, p. 299, Part A, Questions 1 and 2 Stream Patterns

Remember: gradient = elevation difference / distance along line of profile; **Refer to Fig. 11.4** to see how to calculate gradient. *Procedure:* Calculate stream gradient (rise / run) in ft / mile. Find points A and B, where the contour lines cross and you can determine the elevation. The change in elevation (relief) is the difference between the two elevations. Then determine the length of the straight line segment between the two points using the bar scale.

Activity 11.2, p. 302, Part D, Questions 1, 2, 3, 4 Montana Alluvial Fans

Explanation: An alluvial fan is a fan-shaped deposit of sediment occurring where steep mountain rivers exit narrow canyons, and splay out onto broad open areas. Lawton Ranch is at the head of the fan, near the mountain river exit point (flowing east to west). Bear Creek on the southwestern part of the map flows along the “toe” of the fan, down gradient from Lawton Ranch. The entire alluvial fan is sloping from east to west, as shown by the contour patterns.

Activity 11.3, p. 304 Part A, B, C, D, E River Terraces and Incision in North Dakota

Ideas for answering Questions: Discharge is the measure of volume of water that flows through a river channel (for e.g. measured in gallons per day). 12,000 years ago, the climate was dramatically different than it is today. It was the end of the last major glacial “ice age”, particularly in the northern Midwest states (e.g. North Dakota)... glaciers were rapidly melting and retreating. Glacial ice covered Canada and the upper Midwest of the U.S. 20,000 years ago. Think about where the melt water would have been flowing 12,000 years ago, and compare to the climate and hydrologic conditions present in North Dakota today.

Activity 11.4 (p. 305) Rio Grande River Evolution

Complete questions **11.2A through E**, inclusive.

Concepts to Consider: think about current meander loops that are so tightly closed that they may cut themselves off via erosion). The questions ask you to compare the 1936 river shape to the 1992 shape; think of meandering, cutbank erosion, and point bar deposition. The goal is to see historic changes in the river position over about 60 years)

ACTIVITY 11.5 (p. 306) Niagara Falls Erosion Rates

Complete questions **11.3 A through D**, inclusive.

(*hint:* use the distance from the Escarpment to the present falls position as the distance of erosion over the past 11,000 years: Rate of erosion = erosion distance / time of erosion.