GS407 / 507 River Environments – Summer 2003
Day 2 Lab Exercise 2 at Lower Paulina Creek, Newberry Volcano

Read over the field hydrology procedures outlined on p. 53-65 of the field trip guide. Use these directions to help you complete questions 1-6 below.

1. Divide the width of Paulina Creek into about 6-8 subsections. Establish 6-8 measuring points from stream bank left. At each station measure and record the depth (meters) and flow velocity at about 2/3'rds the total depth from the top of the stream surface. Record data for each section in meters and seconds. A diagrammatic sketch is illustrated on p. 42 of the field guide.

2. Using the graph paper provide on p. 73 of the field guide, draw a scaled profile of the stream surface and bottom using the depth information recorded above. Use a vertical exaggeration of x1 on your profile. Choose and appropriate scale that allows you to use the full width of the graph paper.a

3. Based on your vertical and horizontal scale, determine the area covered by 1 "grid square" on your graph / profile. Answer in sq. meters.

4. For each subsection of Paulina Creek, calculate and record flow depth, flow velocity, subsection area, and subsection discharge (use units of meters and seconds).

5. Sum the discharge for each subsection, determine the total stream discharge in cubic meters per second.

6. Perform a traverse from one side of Paulina Creek to the other, note the presence or absence of Mazama ash in the valley bottom. Determine the highest elevations on each side of Paulina Creek, where Mazama ash is present / absent. Assuming this is a high-water scour mark, determine the discharge in Paulina Creek at the time the Mazama Ash was scoured away.

    A. Plot the high water marks at the appropriate elevation on the topo sheet provided on p. 165 of the field guide. You may use a combination of GPS, altimetery, and topographic position to plot your points.

    B. Using graph paper on p. 73, draw a scaled topographic profile perpendicular to Paulina Creek, through the two high-water points. Use a vertical exaggeration of x1. Mark the position of the points on your profile.

    C. How much area is covered by 1 "grid square" on your graph, according to your vertical and horizontal scales (answer in sq. meters).

    D. Using your scaled profile, calculate the cross-sectional area of the channel flow necessary to scour the Mazama ash from the valley bottom (i.e. count the no. of squares in the channel cross-section and multiply by the area covered by each square). Answer in square meters.

    E. Using your scaled profile, determine the wetted perimeter of Paulina Creek that was necessary to scour Mazama Ash from the valley bottom (see figure 6.1 on the bottom right of p. 44 for definitions of wetted perimeter and hydraulic radius).

F. Calculate the hydraulic radius of Paulina Creek that was necessary to scour Mazama Ash form the valley bottom.

G. Using the topo map on p. 165, calculate the approximate gradient of Paulina Creek at the field station. Answer in m/m (i.e. diminsionless ratio).

H. Using the table on p. 37 of your field notes, determine the approximate roughness of the Paulina Creek valley bottom at the field station.

I. Using Manning's Equation from p. 35 of your field guide, estimate the velocity of Paulina Creek that was present at the time that Mazama Ash was scoured from the valley bottom.

J. Finally, using the continuity equation, and your answers from 6D, 6F, and 6H above, estimate the discharge in Paulina Creek at the time that Mazama Ash was scoured at the two high-water points.

7. Based on our field observations of terraces along Paulina Creek, answer the following questions:

A. What is a river terrace, how is it defined?

B. What diagnostic materials are river terraces comprised of that provide definitive confirmation that it is a terrace as opposed to some other geomorphic surface?

C. Will these terrace materials likely be well sorted or poorly sorted? Will they likely be rounded or angular?

D. Given that the terrace examined along Paulina Creek was covered in Mazama Ash, what is the maximum age of the terrace (i.e. when was the last time that Paulina Creek was depositing sediment at that level?)?

E. What do the presence of terraces imply about the river system, is it eroding or depositing? Aggrading or degrading? Incising or back-filling?

8. Define a knickpoint. What process is occurring at knickpoints, erosion or deposition?

A. What is headward erosion and how does it apply to river knickpoints?

B. In which direction do knickpoints migrate over time? Upstream or downstream?

9. Read over the stream classification notes in your field guide on p. 80-89.

   A. Using the parameters outlined for the Rosgen classification shown on p. 83-85, classify Paulina Creek according to Rosgen stream type. Provide your data and answer below.

   B. Using the parameters outlined for the Montgomery and Buffington classification shown on p. 85-89, classify Paulina Creek according to this criteria. Provide your observations and answer below.