Name_____

Lab Day _____

LAB 1: TOPOGRAPHIC MAPS AND AERIAL PHOTOS

Learning Objectives:

- Understand how to read and interpret topographic maps and aerial photos
- Start thinking critically about landforms and the processes that create them
- Learn to use aerial photographs to identify and interpret landforms

Complete the following exercises using the topographic maps and aerial photos provided. Correct answers that appear out of nowhere will not earn full credit; **be sure to show your work!** Note that questions 1 through 7 can be completed without a specific map or photo. Stereoscopes are available for checkout in the department office during the week; the maps and photos will be in the back of the lab room. This lab is due at the beginning of the field trip next week.

Full sentences are not required unless asked for! Keep answers as concise as possible while still showing work!

Part One: Topographic Maps

1. Convert the following commonly used fractional map scales to the scales shown.

1:24,000 1 inch = _____feet

1:24,000 1 inch = _____miles

1:62,500 1 inch = _____miles

1:100,000 1 inch = _____km

1:100,000 1 cm = _____km

2. What is the typical scale used for a USGS 7.5' quad? Express it using two different types of scale.

3. What does "7.5 minute" refer to on these maps?

4. Express the following as a fractional scale (round to a reasonable scale [nearest hundreds]).

1 inch = 4 miles

5. Using a ruler, what are the fractional scales that correspond to the following graphic scales (round to reasonable scale [nearest hundreds])?

1 mile
_____

1 km
_____

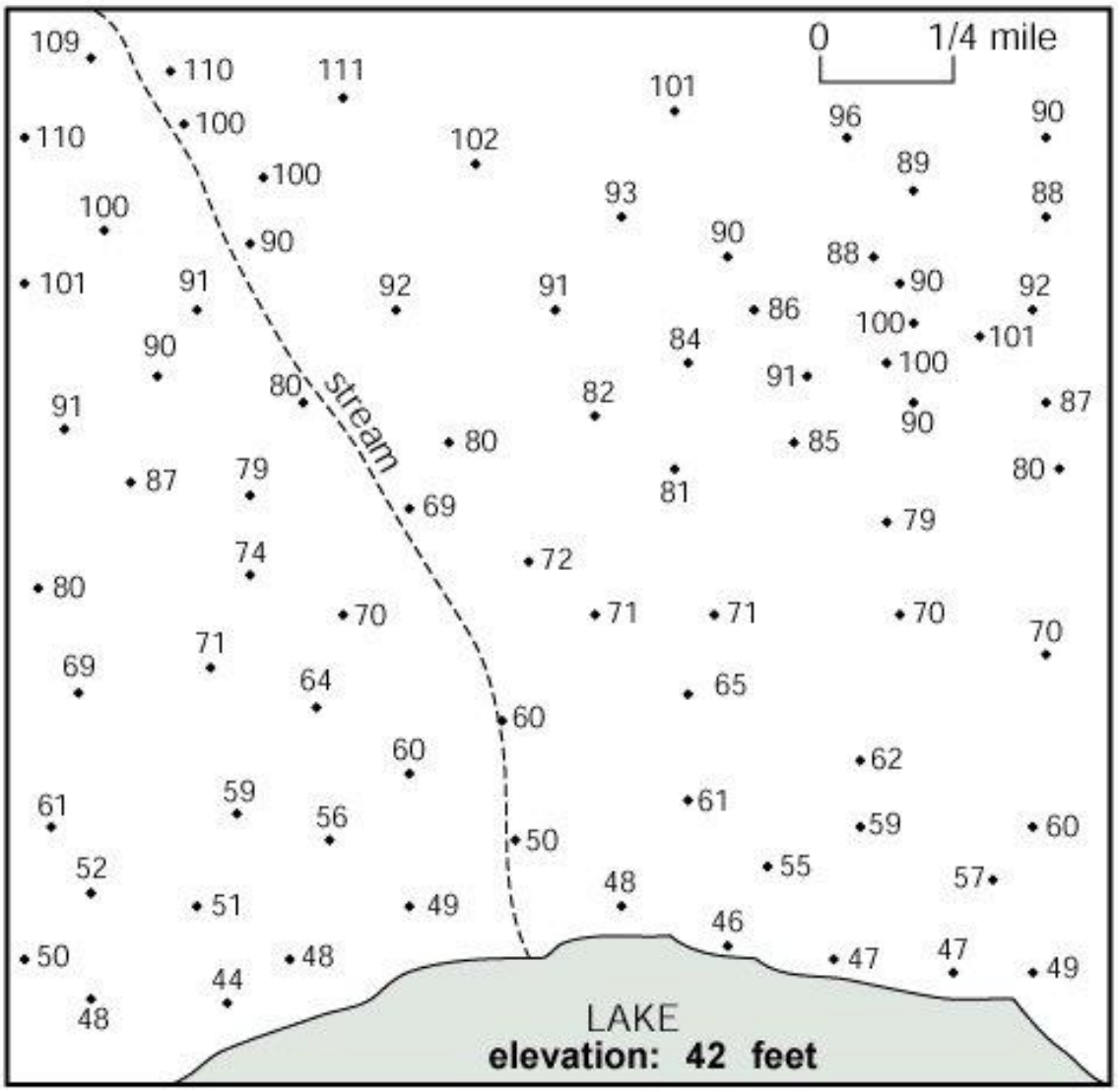
6. The scale of map A is 1/125,000 and that of map B is 1/62,500.

Which is the larger scale map? _____

Which map is likely to show greater detail?_____

Part Two: Contouring

The map below shows spot elevations, or actual elevations surveyed in the field. Using a contour interval of 10 feet, and beginning at 50 feet, construct a reasonable topographic map. Be sure to follow the requirements for contour lines in your handout.



What is the fractional scale of this map (round to nearest hundred)?

DO NOT WRITE ON THE TOPOGRAPHIC MAPS!

Part Three:

Questions using the Fort Collins, CO Quadrangle.

Reminder: Don't forget that many numbers require units with them (e.g. feet, mile) so that their value has meaning (e.g. on contour lines, elevations, distances).

1. What is the fractional scale of this map? _____
   What is the contour interval?_____

2. What is elevation of:
   Black Hollow Junction (northeast corner of map)?_____

   Intersection of Drake and College?_____

   Lindenmeier Lake?_____

3. a. Determine the straight-line distance from the center of the Oval (green) to Black Hollow Junction. Give your answer in **kilometers, miles, and feet**. Show your calculations.

4. a. Determine the longitude and latitude of Black Hollow Junction to the nearest second. Show your calculations.

   b. Determine the UTM coordinates of Black Hollow Junction (FoCo is in zone 13 T). Show your calculations.

   c. Determine the township and range position of Plummer School at Black Hollow Junction.

Questions using the Fall River Pass, CO Quadrangle.

5. What is the height of Specimen Mountain (near map center), as measured from Poudre Lake?

6. What is the relief of this map in feet (be careful to locate the highest point)? Would this value be considered low, moderate or high?

   When would you find a small contour interval (e.g. 10 ft) used on a map?

   When would you find a large contour interval (e.g. 80 ft) used on a map?

7. In which direction does the Cache la Poudre River flow?

8. The following questions concern the determination of stream gradients.
   a. What is the actual length of Beaver Creek as measured from its source in Milners Pass to Trail Ridge Road (use only the blue line)?

   b. What is the change in elevation of the creek from its source (end of blue line) to Trail Ridge Road?

   c. What is the gradient of the stream in feet/mile?

   d. What is the gradient of the stream in unitless dimensions?

   e. What is the gradient of the stream in degrees?

   f. What is the actual length of Cache la Poudre River as measured from its source in Milners Pass to the eastern edge of the map (use only the blue line, ignore small bends)?

   g. What is the change in elevation of the creek from its source (Poudre Lake) to the edge of the map?

   h. What is the gradient of the stream in unitless dimensions?

   i. Why do you suppose the two streams have such different gradients despite ‘heading' at the same spot?

9. a. What is the name of the quadrangle map directly adjacent to the south?

   b. What is the name of the quadrangle map directly adjacent to the northeast?

10. What is the magnetic declination of this map?

Questions using Laporte, CO Quadrangle

11. What is the original publication date of this map?_____

    When and how was it revised? _____

    Just prior to 1962, how far north did Hwy 287 extend (give answer in latitude)?

12. Using the section lines as a guide, estimate the length of the strip mine located west of Curtis Lake (south of Poudre Valley Canal) to the nearest 1/2 mile._____

    Using a ruler, determine the length and average width of the strip mine north of Poudre Valley Canal. Length_____ Width_____

    Assuming that the original elevation of the hogback was 5400 feet, estimate the volume of material removed from the strip mine in the area north of the Poudre Valley Canal in **cubic miles**. Show your calculations and your assumptions.

13. Study the landforms in the northwest and northeast portions of the map. Which area is dominated by metamorphic rocks? Which is dominated by sedimentary rocks? How can you tell?

Part Four: Think About the Landscape

Geomorphology is the study of how the land came to be and how it is changing. One essential skill in being a geomorphologist is asking keen, testable questions. In fact, the first thing you can do, with hardly any prior knowledge, is question what you see. A question, brought about by an observation, allows us to make hypotheses, which can be tested, advancing our understanding of the world. Below, I provide a research objective. I want you to **ask one (or more) question(s) that will lead to the successful achievement of the research objective**. The objective is purposely broad, to allow you to be creative, but make the question(s) as detailed as possible.

Note: Please tell me what landform on which map you are referring to (and provide the township and range location to appropriate resolution). Also, don't feel pressured to ask a very technical question. Even if you know next to nothing about geomorphology, think of the first thing you would want to know to start learning, and that will form your first question.

Research Objective: Determine how any landform (e.g., hill, mountain, plain, river, terrace, gulley, lake, hogback, etc.) on any one of the maps used in this lab formed.

Part Five: Aerial Photographs

Study the photographs listed, read the captions in the Atlas of Landforms and the lab handout, and think about how the landscapes shown express the geomorphic processes that formed them. The questions in the handout are intended to guide your interpretations - **turn in written answers for only two of the following photographs**. After you have looked at all the photos, choose two photographs of different locations and describe and/or interpret geomorphic aspects that were not explained in the captions (vegetation, landforms, etc). Be a good observer. You may choose to answer some of the questions below in your description. *Please type your descriptions. Descriptions should be no longer than 1 page, double spaced, 12 pt. Times New Roman font.* Proof read your answers to ensure that your writing is clear and grammatically correct.

The page numbers listed below refer to the Atlas of Landforms (large, black cover). Keep the age of this book in mind when you read the captions - it was published pre-plate tectonics and describes some concepts that are no longer in favor. The numbered stereopairs are loose photographs - look for the numbers on the photos themselves. Use the stereoscopes provided to view the photos in stereo. If you are having difficulty seeing in stereo, please ask for assistance.

1. **Mont-15-A through Mont-15-D** Hebgen Lake/Madison Slide Scale 1:10,000

   These photos were taken 5 days after a large landslide that left huge deposits of debris in the Madison River valley in Montana. Compare the photos with the map. Note similarities and differences in the features and in the level of detail obtainable by different media and different scales. How would you characterize the upper and lower boundaries of the slide? The surface of the slide material? What features in the photos tell you that the slide was recent? (Look at the lake and the slide margins.)

2. **pgs 6/7 (Zion National Park, UT) and pg 17 (Virginia, IL)**

   Compare the maps and photos on pages 6/7 with the map on pg 17. Observe the effect of vertical joints on drainage patterns.

3. **pgs 50/51 (Provo, UT)**

   Abruptly-rising mountains can suggest the presence of a fault. The fault along the base of the Wasatch is shown clearly in the oblique aerial photo. Look at the stereopair: why do you think these canyon streams have not formed significant alluvial fans at the base of the mountains?

4. **Pgs 124/125 (Mt. Toby, MA)**

   Before viewing the photos in fig IX-38 in stereo, look at them critically. Can you distinguish landforms without the help of an added dimension? Look for changes in vegetation, land use, and drainage, etc. that might provide clues. The delta kame (D on the map) shows up nicely on the stereopair. This depositional feature was formed in a

former glacial lake and was subsequently incised by a stream, Long Plain Brook. Features such as this stream valley, whose age is well constrained, can provide useful estimates of long-term stream erosion rates.

5. **pgs 128/129 (Pt. Reyes, CA)**

   Contrast the topography at the landslide at (R) with the remainder of the slopes in Drakes Bay. Note the effect of wave energy on the Drakes Bay slopes by comparing them to the ends of the ridges in Drakes Estero, which is protected from the waves. Also note how clearly the photo shows the extent of the sand dunes. Could you get the same information from the topo map without the stippled pattern? How do the contours appear in the sand dune areas?

6. **pg 91 (Anderson Mesa, CO) and 95 (Strasburg, VA)**

   The stereopairs on these pages both show entrenched meanders. How would you describe the difference between them? Some factors to consider might include sinuosity, radius of curvature, depth of entrenchment, etc. Compare the shape of the ridges between meanders between the two photos. Note that the captions for these photos follow Davis' concept of young, mature and old streams.

7. **pgs 106/107 Georgetown, CO and Mineral King, CA**

   Study the maps for these two locations before you look at the photos and try to envision how the landscapes look. Then match up features in the photos with the maps. How close were you? Now look back at the maps. Are there new features that you notice after looking at the photos? Repeat this process with the maps and photos on the following pages (pgs 108/109). Practice will improve your observational skills, but despite this fact, it is almost always useful to use multiple sources of information to gain insight into the geology/geomorphology of an area.

8. **pg 98 Ennis, Montana**

   The Cedar Creek Alluvial Fan displays the classic alluvial fan form. Can you determine the thickness of the fan? Describe the stream at B without using the word "braided".

9. **pgs 112/113 Yosemite Valley, CA**

   Find the talus cones and alluvial fans in the stereopair. Look at the broad, flat floor of the Yosemite valley. What is the relief of the valley? Does this help explain why the Merced River was able to flood much of this area in early 1997? Which geomorphic processes formed this valley? Which ones are still operating? How would you quantify or characterize the hazards that these processes present to repair/redevelopment of the valley?