Student Instructions and Data Sheet for Rio Grande Case Study:
Physical Measurement of River Health

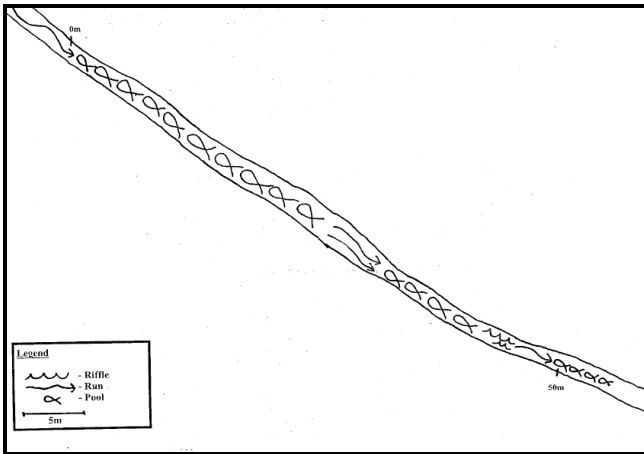A. **Habitat diversity**

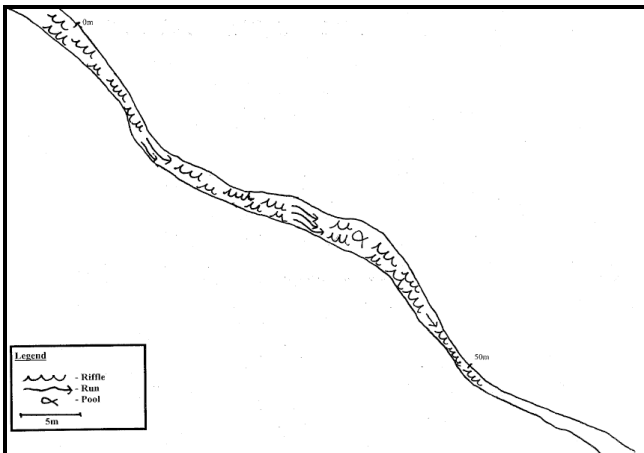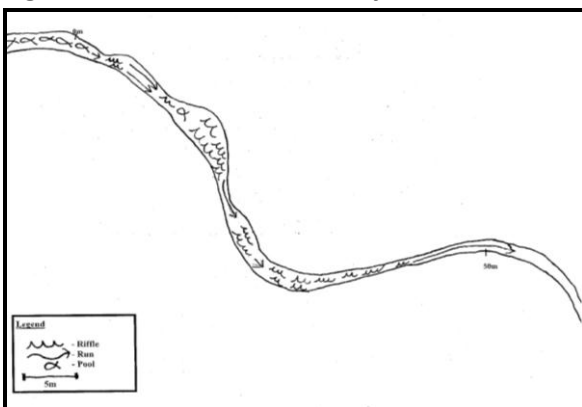**Figure 1.0 Upper Rio Grande**

Figure 2.0 Lower Rio Grande

Figure 3.0 Rio Grande Tributary

a. Examine the map of habitat types for your site.
b. Fill in the data table below to record the habitat types (riffle, run, or pool) encountered at your site. Stop recording once you get to the end of the image. (There might be extra space on your data sheet that you don't use.)
c. Count the number of times the habitat changes from one type to another. This is called the number of habitat transitions. Record the number of habitat transitions below.

Habitat type:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	
Next habitat type encountered:	

Total number of habitat transitions: _____

B. **Channel shape**

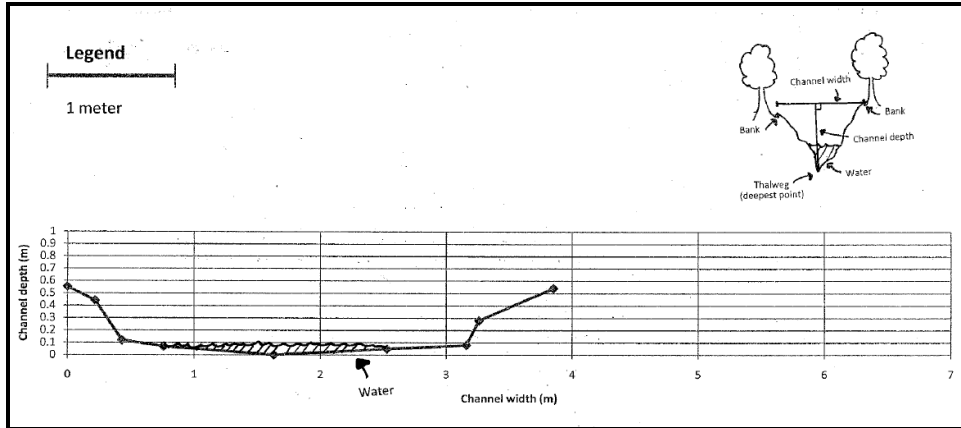**Figure 1.0 Tributary Channel Shape**
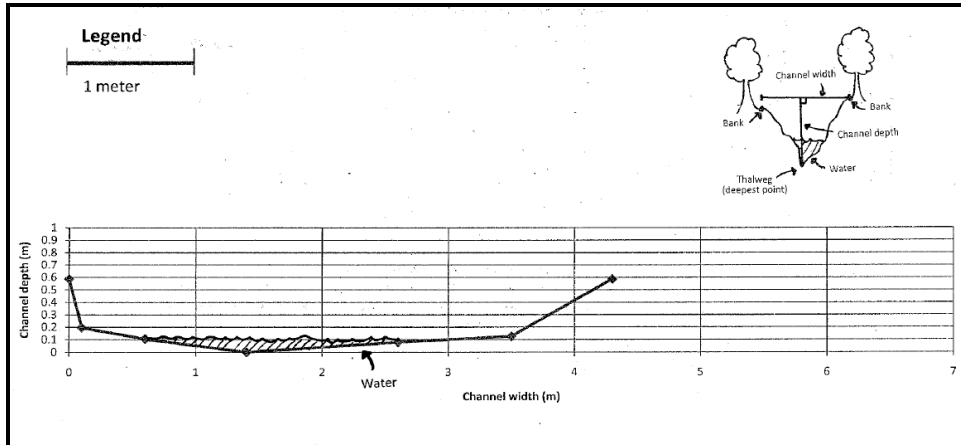

Figure 2.0 Lower Rio Grande Channel Shape

Figure 3.0 Upper Rio Grande Channel Shape
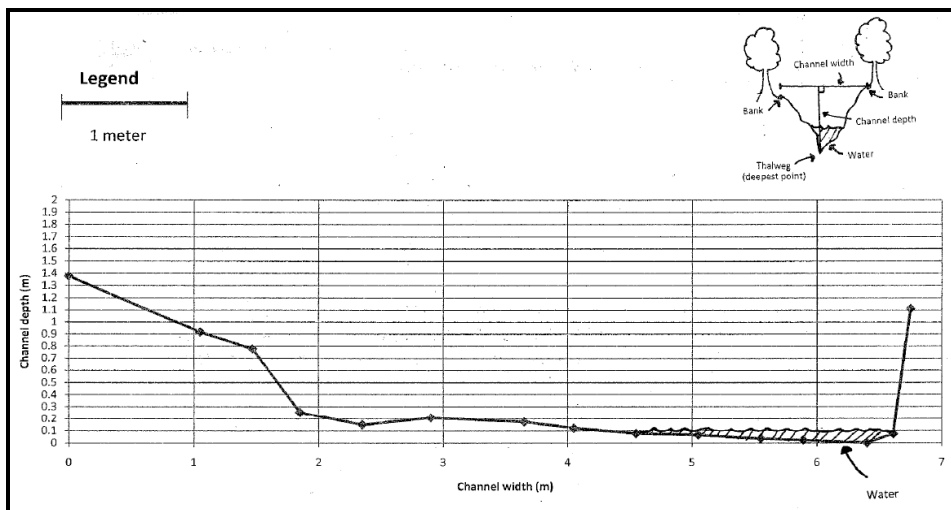
1. Measure channel width for your site- Examine the map of river cross sectional area at your site. Find the two river banks, and draw a line connecting them. If the line is horizontal, simply measure the distance between the banks along the line connecting them to determine the width of the stream channel. If the line is diagonal, you will need to make a horizontal line that connects the taller bank to a location just above the shorter bank. Then measure the length of this horizontal line to determine the width of the stream channel. Record the channel width on the data sheet below.
2. Measure channel depth for your site- Find the lowest point in the river bed. This point is called the thalweg. Draw a vertical line connecting the thalweg to the horizontal line you drew above when measuring channel width. Measure the length of this vertical line to determine the depth of the stream channel. Record the channel depth on the data sheet below.
3. Calculate incision ratio (depth:width ratio) for your site- Divide the channel depth that you measured by the channel width that you measured. This is called the incision ratio. Record the incision ratio for your site on the data sheet below.

Channel depth at your site: _____ m

Channel width at your site: _____ m

Incision ratio at your site: _____

C. Substrate size

1. You have been given an envelope containing 50 "pebbles" (pieces of stream substrate) from your site. Your goal is to measure these pebbles in order to determine how much variation there is in substrate size at your site. The pebbles are three dimensional, so each has three axes. The smallest axis is simply the thickness of the cardstock that the pebble is made out of. Then each pebble has two additional axes, what you might think of as length (the longest axis) and width (the intermediate axis). You should use a ruler to measure the length of the intermediate axis, or width, of each pebble and record your data on the data table below. If you encounter a piece of "sand," record its width as 4 mm. If you encounter a piece of "bedrock," record its width as 1000mm.

2. Once you have measured the width of your 50 pebbles, arrange your data in order from smallest to largest width.

3. Record the width of the smallest pebble and the largest pebble. The interval spanning these two values is called the range, a simple statistical measure of variation in your data set.

4. Determine how many pebbles you have in each of the size class categories below and record these numbers. (You might have zero pebbles in some categories.)

5. Shade in the graph to indicate how many pebbles you have in each size class category.

Pebble width measurements, recorded in the order that pebbles were measured

Width of pebble (mm)	Width of pebble (mm)

Pebble width measurements, ordered from smallest to largest

Width of pebble (mm)	**Width of pebble (mm)**

Range of pebble width values: _____ - _____ mm

(smallest value)   (largest value)

Pebble width category	Number of pebbles in category
0.1 - 4.0 mm	
4.1 - 8.0 mm	
8.1 - 16.0 mm	
16.1 - 32.0 mm	
32.1 - 64.0 mm	
64.1 - 128.0 mm	
128.1 – 256.0 mm	
256.1-512.0 mm	
Greater than 512.0 mm	

Number of pebbles
in width category

30

20

10

0.1-4.0   4.1-8.0   8.1-16.0   16.1-32.0   32.1-64.0   64.1-128.0   128.1-256.0   256.1-512.0   >512.0

Pebble width category (mm)

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D. Below summarize results from all three sites:

1. Number of habitat transitions:

Upper Rio Grande: _____   Lower Rio Grande: _____   River Tributary: _____

2. Incision ratio:

Upper Rio Grande: _____   Lower Rio Grande: _____   River Tributary: _____
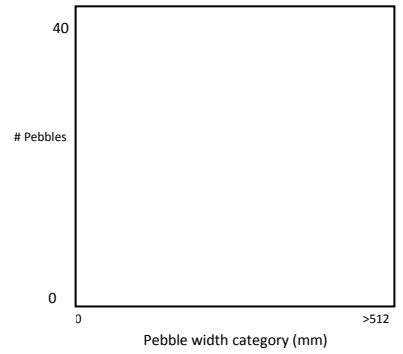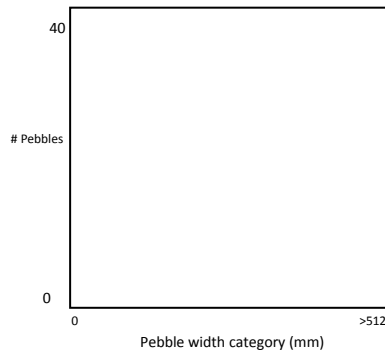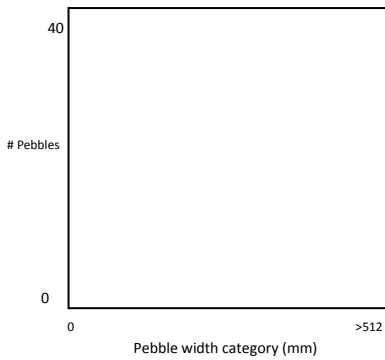
3. Range of substrate sizes (mm):

Upper Rio Grande: ___ - ___   Lower Rio Grande: ___ - ___   River Tributary: ___ - ___

4. Rough sketch of number of pebbles in each pebble width category:

Upper Rio Grande: Lower Rio Grande: River Tributary:

Upper Rio Grande	Lower Rio Grande	River Tributary
40 ─┐	40 ─┐	40 ─┐
# Pebbles	# Pebbles	# Pebbles
0 ─┘	0 ─┘	0 ─┘
0 ········ >512	0 ········ >512	0 ········ >512
Pebble width category (mm)	Pebble width category (mm)	Pebble width category (mm)

E. Interpret the class results.

1.	Why does measuring the number of habitat transitions provide information about river health?

2.	Why does measuring the incision ratio of the stream channel provide information about river health?

3.	Why does examining variation in substrate sizes provide information about river health?

4.	Based on these physical measurements, how does stream health compare between the three Rio Grande sites?

5.	What do these results tell us about the ability of the Rio Grande to recover from urbanization? Explain your answer.