Stream Channel

Enquiry Skills Approach, Version 2.0

A. Planning and Preparation

Module

Managing river environment

Enquiry Question

Hypothesis 1 : ***The lower the river course, the larger the river discharge.***
Hypothesis 2 : ***The lower the river course, the smaller the channel gradient.***
Hypothesis 3 : ***The lower the river course, the smaller the channel friction.***

Key Concepts

River courses	River energy	River discharge	River velocity	Channel gradient
Channel shape	Wetted perimeter	Hydraulic radius	Channel efficiency	Load

Scope of the Study

Tai Tso Stream in Tai Mo Shan

Time of the Study

Date: _____ Season: _____ Rainfall in the past 24 hours: _____

Think About

Is this an appropriate time for fieldwork? Explain your answer.

List the safety risks when conducting stream channel fieldwork.

Field Work Plan

At each site (A & B), choose a straight reach of stream. Avoid, as far as possible, pools or eddies.

Channel Shape

Use measuring tapes to measure the width, depth and wetted perimeter of the stream shown in Fig. 1, and record the data in Table 6.1.

a) Hold the tape taut across the stream (perpendicular to the river bank), set up a transect and measure the channel width.
b) Measure, with a tape, water depth at 10cm intervals across the transect, and ensure it is measured vertically on the river bed and not affected by water splash. In case of encountering any boulder, measure the depth of water upstream or downstream of the boulder.
c) At the river bank, starting from the point of measuring channel width, carefully lay a measuring tape along wetted perimeter, till you reach another side of the river.

Roundness of Pebbles

a) Collect pebble samples with diameter ranging from 4 mm to 64 mm.
b) Measure its longest diameter (*L*) with caliper, shown in Fig. 2.
c) Measure the radius of a pebble's sharpest angle (*r*) by the Cailleux Roundness Chart, with its (*L*), calculate the average roundness and record the data in Table 6.2.

Channel Gradient

Use an abney level, ranging poles and level meters to measure stream gradient, shown Fig.3.

a) Two groups wading into the stream and stand 10 m apart. Each group holds a ranging pole perpendicularly to the river bed with a level meter.
b) The person upstream can hold the abney level against the first ranging pole at a suitable height, and sight the corresponding point on the second pole. Read the angle of depression.
c) Then take the angle of elevation from the downstream pole towards the first pole. Calculate the average gradient and enter all data on Table 6.3.

Stream Velocity

1. Along the transect, measure the stream velocity for 3 times, by a stream flow meter, or a timer with a float.
2. Calculate the average velocity and discharge of the stream, and enter all data into Table 6.4.

Think About

List the merits and demerits of measuring stream velocity with a stream flow meter.

Fig. 1 - Measuring channel shape

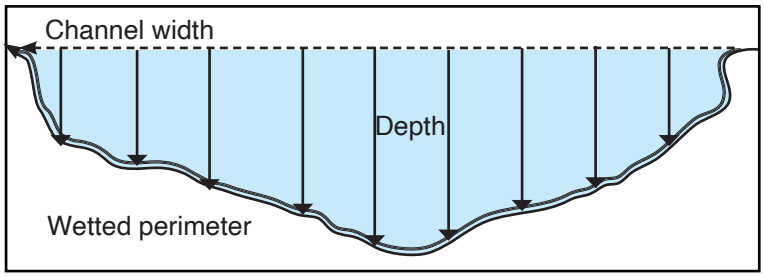


Fig. 2 - Measuring pebble size and roundness

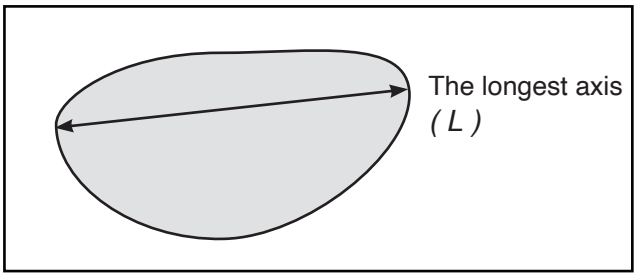
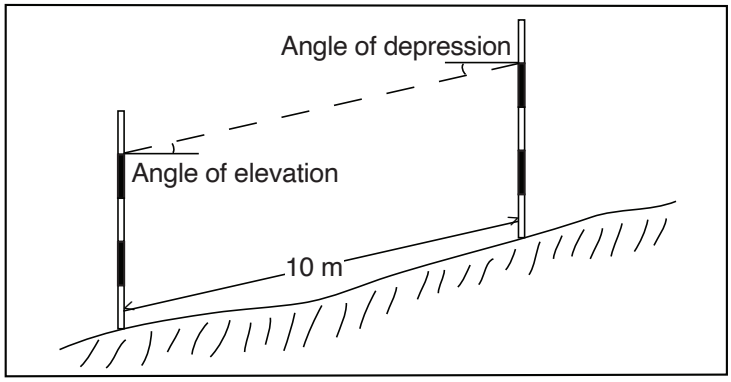


Fig. 3 - Measuring stream gradient



B. Data Collection

Complete the following table.

Primary Data Items	To Examine Hypothesis			Data Collection Method		Equipment Required (Number on the Equipment Checklist)
	1	2	3	Observation	Measuring	
1. Channel width						
2. Channel depth						
3. Wetted perimeter						
4. Channel gradient						
5. Velocity						
6. Roundness of pebbles						

Sampling Method

1. Systematic sampling
2. Quota sampling

Think About

When collecting pebble samples in the stream, state the reasons of not using systematic sampling.

Equipment Checklist

Items	Quantity	Checked	Returned
1. Base map (Individual)	x 1	❑	❑
2. Clipboard (Individual)	x 1	❑	❑
3. Compass (Individual)	x 1	❑	❑
4. Cotton gloves	x 8	❑	❑
5. Measuring tape - 3.5m	x 2	❑	❑
6. Measuring tape - 30m	x 2	❑	❑
7. Abney level	x 2	❑	❑
8. Ranging pole	x 2	❑	❑
9. Level meter	x 2	❑	❑
10. Stream flow meter	x 1	❑	❑
11. Caliper	x 1	❑	❑
12. Cailleux Roundness Index	x 1	❑	❑
13. Timer	x 1	❑	❑
14. Bubble ball	x 1	❑	❑

Data Recording sheet

Table 6.1 - Channel Shape

a) Channel width = _____m

b) Channel depth = _____m

1._____	2._____	3._____	4._____	5._____	6._____
7._____	8._____	9._____	10._____	11._____	12._____
13._____	14._____	15._____	16._____	17._____	18._____
19._____	20._____	21._____	22._____	23._____	24._____
25._____	26._____	27._____	28._____	29._____	30._____

Average depth = _____m

c) Cross-sectional area = channel width x average depth

= _____m^2

d) Wetted perimeter = _____m

e) Hydraulic radius = cross-sectional area / wetted perimeter

= _____

Table 6.2 - Roundness of Pebbles

L Length of the longest axis (cm)
r The shapest angle (cm)

Cailleux Roundness Index *R*=

$\frac{2r}{L}$ x 1,000

1		2		3		4		5	
L	*r*	*L*	*r*	*L*	*r*	*L*	*r*	*L*	*r*
R =		*R* =		*R*=		*R*=		*R*=	

Average of the roundness index = _____

Table 6.3 - Channel Gradient

Stream gradient	angle of depression	=	_____	degrees
	angle of elevation	=	_____	degrees
	average	=	_____	degrees

Table 6.4 - Velocity and Discharge

Velocity 1._____ 2._____ 3._____

Average velocity = _____m/s

Discharge = velocity x cross-sectional area

= _____m^3/s

Think About

List the possible errors when collecting data.

C. Data Processing, Presentation and Analysis

1. Complete Tables 6.1, 6.2, 6.3 and 6.4.
2. With reference to the data from all the other groups, summarize and compare the following items and circle the correct answer.
3. Draw the most appropriate diagrams to present the collected data.

	Site A	Site B
a. Width	Wider / Narrower	Wider / Narrower
b. Average depth	Deeper / Shallower	Deeper / Shallower
c. Cross-sectional area	Bigger / Smaller	Bigger / Smaller
d. Wetted perimeter	Longer / shorter	Longer / shorter
e. Hydraulic radius	Higher / Lower	Higher / Lower
f. Stream gradient	Steeper / Gentler	Steeper / Gentler
g. Roundness of pebbles	More rounded/ More angular	More rounded/ More angular
h. Average velocity	Faster / Slower	Faster / Slower
i. Discharge	More / Less	More / Less

Think About

List the merits and demerits of the chosen graphs or diagrams.

D. Interpretation and Conclusion

1. Does the fieldwork result support the Hypothesis 1 ***the lower the river courses, the larger the river discharge***? Support your conclusion with the collected data and graphs.

2. Does the fieldwork result support the Hypothesis 2 ***the lower the river courses, the smaller the channel gradient***? Support your conclusion with the collected data and graphs.

3. Does the fieldwork result support the Hypothesis 3 ***the lower the river courses, the smaller the friction***? Support your conclusion with the collected data and graphs.

E. Evaluation

1. Other than the data collected in this course, suggest other enquiry question, data and information you might need for a field work in the field site. Explain your answer.

Further Reading

Rivers and Lakes

The Three Gorges Dam Project