AGRISCIENCE EXERCISE

ENVIRONMENTAL RESOURCE SYSTEMS/STREAM STUDY

Key Concept: Water Resources

Agricultural Application: Water is a valuable component in many agriculture related industries and in many cases the volume of water available needs to be known.

Exercise: **Determining the Discharge of a Stream**

Applied Principle(s): Technique for determining discharge of the stream and the mathematical computations involved.

Goals:

1. Provide a useful application for the measurement of velocity.
2. Compute the discharge using the correct mathematical methods.
3. Discuss the stream profile for different parts of the stream channel.

Materials:

- 100 ft. tape measure
- yard stick
- clipboard
- student information sheet
- results from “Measuring the Velocity of a Stream”
- calculator

Teacher Preparation Notes:

- Locate a shallow stream in your area with a mild current.
- Make arrangements for a field trip - including permission slips and transportation.
- Discuss safety with students before going on the trip.
- Complete the activity “Measuring the Velocity of a Stream.”

Procedures for Conducting the Activity:

1. Divide the class into groups of four students, and provide each with a data sheet and the necessary materials for this exercise.

2. Instruct the students to complete the activity as directed on their data sheets. You may wish to monitor their progress as they work; however, it is suggested that the students be left to follow the instructions and complete the activity on their own.

3. Once all groups have completed the exercise, discuss the answers to the discussion questions as a class. Be sure to make note of the practical agricultural applications of the principles demonstrated.

AGRISCIENCE EXERCISE

Determining the Discharge of a Stream

STUDENT DATA SHEET

1. Using the section of stream that you measured in “Measuring the Velocity of a Stream,” measure and mark the center of the stream section. Mark the bank of the stream clearly so seeing your beginning, middle and end mark is easy for you.

2. Starting at the beginning section of the stream, measure the distance from one bank to the other.

   Divided that number by four.

   Beginning section
   Distance across the stream: _____ feet ÷ 4 = _____ feet

   Starting at one bank, measure the distance to the bottom of the channel using the yard stick. Continue by measuring the depth of the channel one fourth of the way across the stream one halfway across, three quarters of the way across, and at the far bank.

   Repeat the above procedure for the middle section and the end of the marked stream section. Record your measurements in the following table.

   Middle Section
   Distance across the stream: _____ feet ÷ 4 = _____ feet

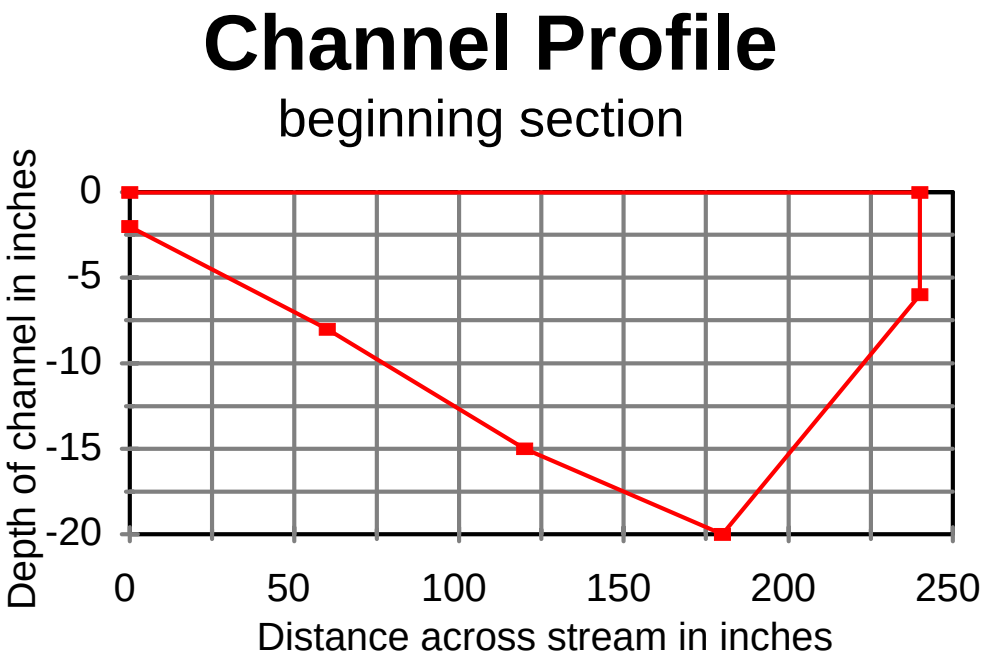
   End Section
   Distance across the stream: _____ feet ÷ 4 = _____ feet

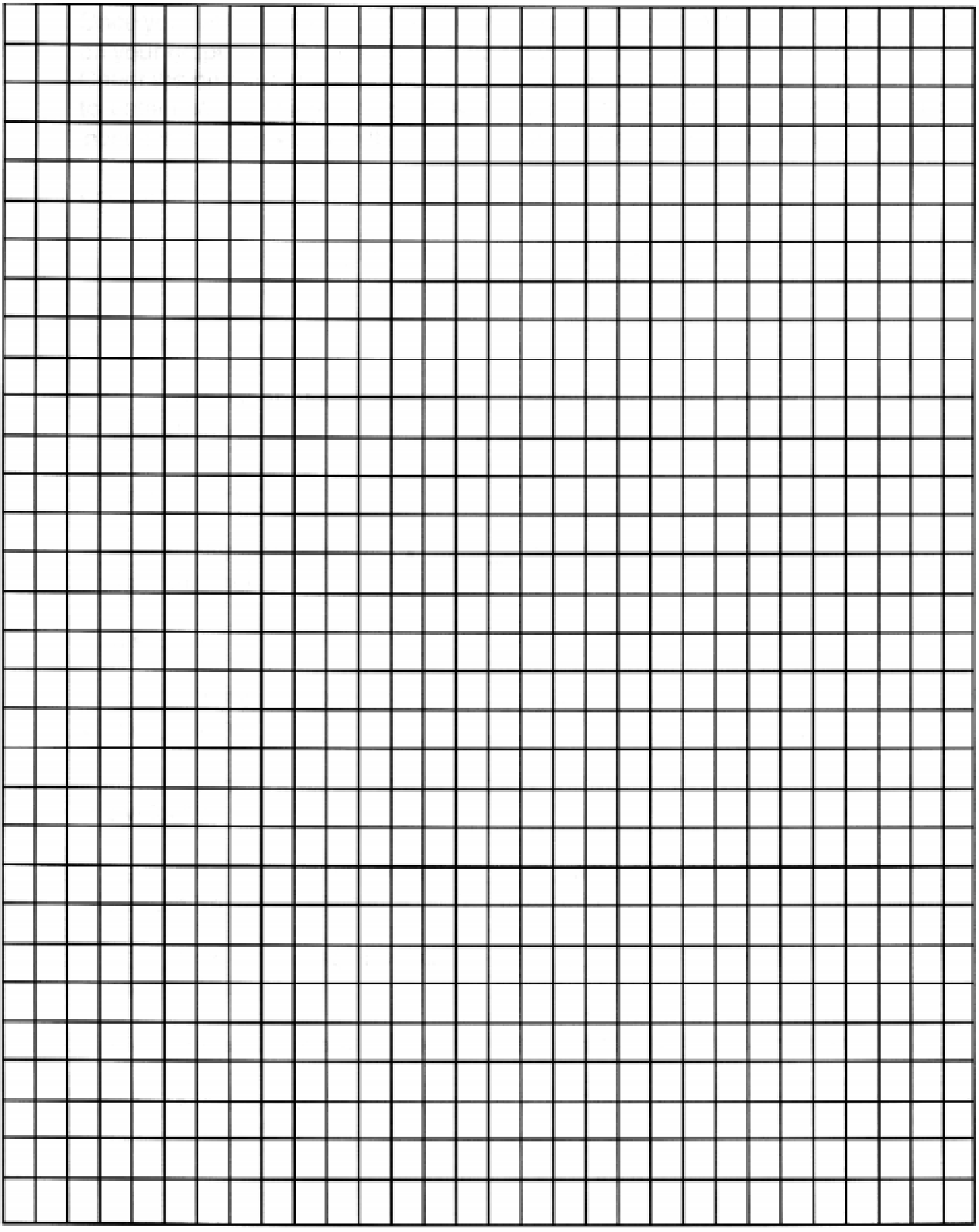
section of stream measured	distance to bottom of stream channel in inches				
	right bank	1/4	1/2	3/4	left bank
beginning section					
middle section					
end section					

3. Using the measurements you have obtained, draw a profile of the stream at each of the sections using the graph paper provided. A sample section has been included for you to follow, if needed.

Distance across the stream: __20___ feet ÷ 4 = __5___ feet

section of stream measured	distance to bottom of stream channel in inches				
	right bank	1/4	1/2	3/4	left bank
beginning section	2	8	15	20	6





4. Once you have graphed your three channel profiles, determine the area of each box on your graph. For this graph each box is 2.5" x 25" or 62.5 square inches in area. Count the number of boxes enclosed in your stream channel, adding partial boxes to obtain whole where practical. Multiply this number by the number of square inches in each box to find the area of your stream channel sections.

   Each graph box

   _____ inches x _____ inches = _____ square inches per box

   Beginning section

   _____ (Number of boxes) x _____ square inches per box = _____ area of stream channel

   Middle section

   _____ (Number of boxes) x _____ square inches per box = _____ area of stream channel

   End section

   _____ (Number of boxes) x _____ square inches per box = _____ area of stream channel

5. Find the average area of the total section of stream channel where you measured the velocity.

   _____ area of beginning section + _____ area of middle section + _____ area of end section = _____ total area

   _____ total area in square inches ÷ 3 = _____ average area of the channel in square inches

6. Convert the average area of the channel from square inches to square feet.

   _____ average area in square inches x .00694 square feet / square inch = _____ square feet

7. Using the velocity that you obtained for the stream section in “measuring the velocity of a stream,” convert the velocity measurement to feet per minute.

   _____ miles / hour x 5280 feet / mile = _____ feet / hour

   _____ feet / hour x .0166 hours / minute = _____ feet / minute

8. To obtain the discharge of the stream use your average area in square feet and multiply by the velocity.

   _____ average area in square feet x _____ feet / minute =_____ ft^3 / minute

9. Discharge is normally reported in gallons per minute. So, the final step will be to convert cubic feet to gallons.

   _____ ft^3 / minute x 7.48 gallons / ft^3 = _____ gallons / minute.

10. What will happen to the discharge of a stream during periods of heavy rainfall?

    During times of drought?

11. If you were planing on using the water from a stream for year round purposes, how would you determine the discharge of the stream accurately?

12. What are some of the effects of a rapid change in the discharge of a stream for people who live nearby?