

Name: _____ Hour: _____

Activity 1 Make Your Own Island

Purpose: The shape of the land governs the direction that water flows. However, it is sometimes hard to see this in relatively flat areas, like Michigan. Build your own island to see how the shape of the land directs the water flow.

Background:

Watersheds are identified by surface water movement. A watershed is an area of land drained by a river. It is the land area from which surface runoff drains into a river system, channel, lake, reservoir, or other body of water. If you follow a river from its headwaters up to its mouth and include all of the tributaries (the little rivers that flow into it), you can get an idea of the size of the watershed. The river and all of its smaller tributaries is called a river system. In this activity you will construct your own island and identify its watersheds.

Materials:

- 1 bar of modeling clay
- A piece of waxed paper
- Blue Sharpie marker
- Red Sharpie marker
- A medicine dropper
- A small cup or beaker with water
- A ruler
- Scissors
- A zip lock bag

Directions:

- 1 In this activity you will work with **one** other person from your group. You may work with two if you have an odd number of people in your group. Place the name of your partner(s) here: _____
- 2 Obtain all the materials listed above.
- 3 Place the modeling clay on the wax paper.
- 4 Your island can look like anything you want, but you must follow the rules listed below. Discuss the rules with your partner. Together decide how you want to build your island.
 - A. Avoid cone shapes. Do not make your island as one big peak.
 - B. Avoid deep valleys or lakes in the middle of the island. Most of the water should drain off your island.
 - C. Avoid overhangs and cliffs.
 - D. You should have at least 2 different rivers that do not connect.
- 5 Once you both agree on how to build your island and what you may want it to look like, you may begin building.
- 6 When you have finished building, use the medicine dropper to drop water on different places on your island. Watch where the water goes, doing this will help you to identify the major rivers and tributaries in your watersheds. If you find that the water does not drain off your island, you may need to make modifications.

Name: _____ Hour: _____

- 7 Once you think you can identify the river systems, take the tip of a pencil or the corner of a ruler and gently trace the major rivers and tributaries. Only make a gentle line, do not dig into the clay.
- 8 Test your tracing by dropping water on the island again. Does the water go down the pencil marks? If so, you have identified the rivers. If not, you might not have identified all of the rivers.
- 9 When you think you have identified all the river systems. Wipe up all the water on the wax paper and gently dab the island dry.
- 10 Use the blue Sharpie marker to mark the location of the island's major rivers.
- 11 Using a pencil or the tip of a ruler, trace the watershed boundaries. The watershed boundaries are like a big circle around the river systems. Watershed boundaries touch. The majority of your island will be covered with watersheds.
- 12 When you think you have correctly identified the watershed boundaries ask your teacher to check your work. Teacher initials: _____
- 13 If your teacher has initialed step 12, use the red Sharpie marker to draw the boundaries of the watershed.
- 14 Give your island a name and write it on the zip-lock bag along with your group members' names. Gently place the island in the bag and take out as much air as possible. Your teacher will tell you where to store it for safe keeping.

Question:

With your group devise a way to explain to someone else what a watershed is and how to identify the boundaries. Write your explanation here.

Name: _____ Hour: _____

Activity 2 Make a Map of Your Island

Purpose:

In this activity you will translate your 3-dimensional island model to a 2-dimensional map of the watersheds.

Materials:

Your island

A ruler

A piece of graph paper

Red, green, and blue colored pencils

Directions:

1. Obtain the materials above. You will be working with the same person(s) with whom you built the island.
2. Remove the island from the waxed paper and place it in the middle of the graph paper.
3. Use the green colored pencil to trace the outline of your island.
4. Remove the island from the graph paper and set it next to the graph paper in the same orientation as traced on the map. This will help you to draw your map.
5. Use the blue colored pencil to draw the major rivers onto the graph paper. Try your best to make the map on the graph paper look like your model.
6. Draw in the tributaries with the blue colored pencil.
7. Use the red colored pencil to draw the watershed boundaries. You have now created a map of your island!
8. Write the name of your island at the top of the map and designate which direction is North.
9. Name the major rivers of each watershed.
10. Place a green H (for high) somewhere at the highest portion of EACH watershed.
11. Place a green L (for low) somewhere at the lowest portion of EACH watershed.
12. Draw arrows next to the rivers and tributaries to show the direction of water flow
13. At the headwaters (beginning) of your longest river, near the H, put a town and name it.
14. Put another town on one of the tributaries of your longest river.
15. Put one last town near the mouth (bottom, near the L). Do not put it on a tributary.
16. Answer the questions with your group members (questions 2 and 3 are on the back, don't forget it) and staple your map to this sheet.
17. Ask your teacher if your island is to be kept for the next day, if so put it back in the bag. If not clean up your materials and return them to the proper areas.
18. Answer the questions on the back of this page.

Name: _____ Hour: _____

Questions:

1. If the town at the mouth of the river put a contaminant in the river, which of your other towns would be affected? Explain.

2. If the town at the headwaters of the river put a contaminant in the river, which of your other towns would be affected? Explain.

3. Write true or false next to each statement. Then explain how your island model helped you to answer the question.

_____ Rivers always flow North to South.

_____ Tributaries flow into the main river.

_____ A contaminant in a river system in one watershed can affect the rivers of a different watershed.

Name: _____ Hour: _____

Activity 3: Michigan Watersheds

Purpose: In activities 1 and 2, you built an island and outlined its watersheds. In this activity you will be given a map of Michigan river systems, your task is to identify the watersheds associated with the Michigan river systems. Remember that the watershed is actually all the area surrounding that river system. Watersheds touch – there should be no land not included in a watershed.

Directions:

- 1 You will work on this activity on your own.
- 2 Obtain a map of the Major Lower Michigan Rivers and a box of colored pencils.
- 3 Find the Grand River. Select a colored pencil (any color except black) that will represent the Grand River Watershed. Trace the Grand River from its headwaters to Lake Michigan.
- 4 Trace all of the tributaries to the Grand River in the same color.
- 5 Find the Muskegon River. Use a different color to trace it from its headwaters to its mouth (where it runs into a lake). Trace all of its tributaries too.
- 6 Find and trace the following river systems, using a different color for each river system
 - A. Manistee River
 - B. Au Sable River
 - C. Kalamazoo River
 - D. Saginaw River
 - E. Huron River
 - F. Raisin River
- 7 Once you have the rivers traced, it is time to outline the watersheds. Begin with the Grand River. Using the same color pencil as the color you chose for the Grand River, draw in the watershed boundaries around the Grand River. This is all of the area where the water will drain into the Grand River or its tributaries.
- 8 Continue drawing the watershed boundaries for all the other rivers you traced. Remember, watershed boundaries always touch. For example, the Grand River watershed boundary touches the Muskegon River watershed boundary in some places.
- 9 Lightly color the area of each watershed with the color of the river system it contains.
- 10 With a black colored pencil draw arrows in the direction that the water would flow for the Grand River system and the Saginaw River system.
- 11 Answer the questions on the back of this page.

Name: _____ Hour: _____

Questions:

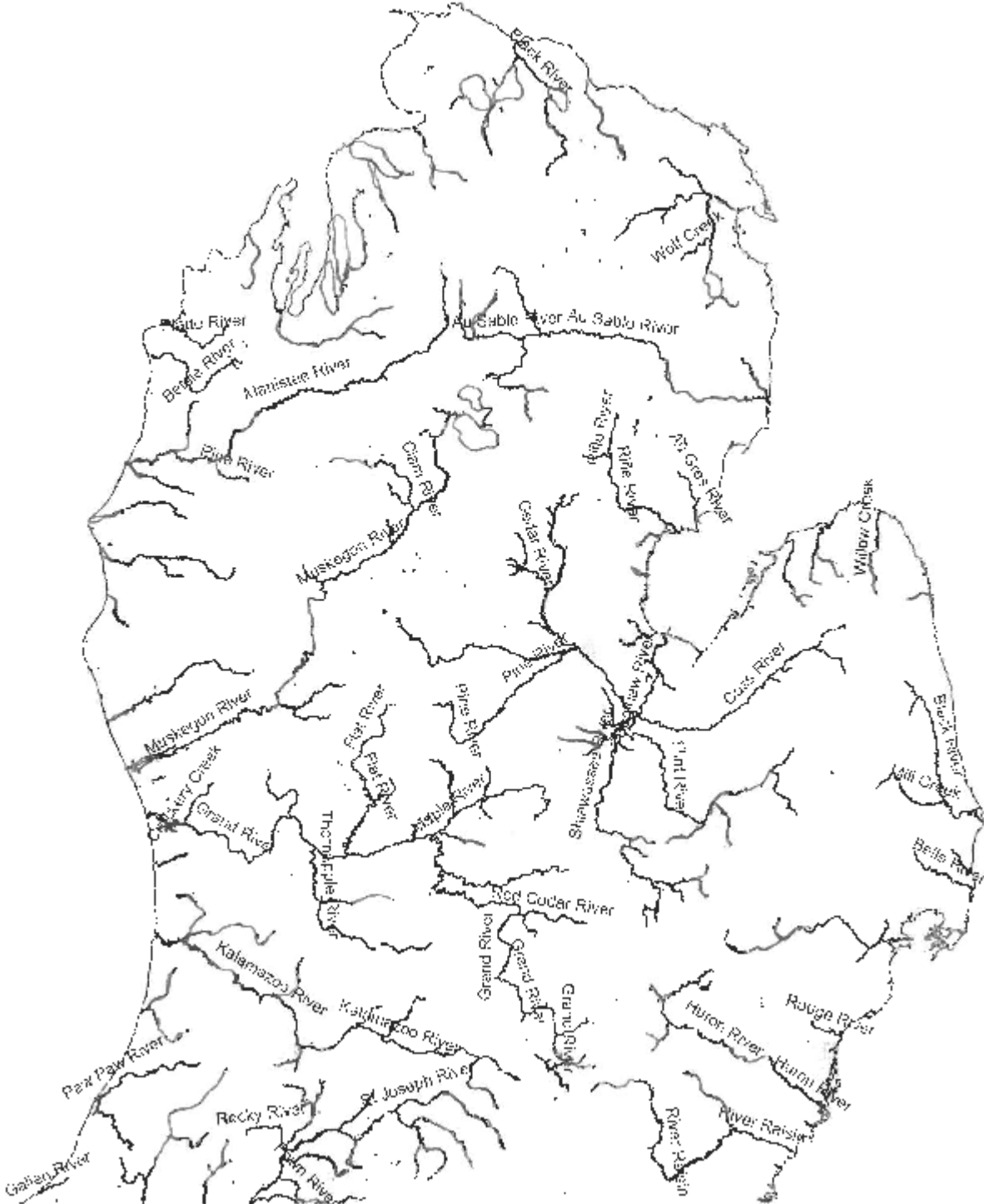
If the Red Cedar River becomes contaminated with a pollutant, will the pollutant affect the Au Sable River? Explain your answer.

If the Red Cedar is contaminated, will the pollutant affect the Flat River? Explain your answer.

If the Red Cedar is contaminated, will the pollutant affect the Grand River below where the Thornapple River comes in? Explain your answer.

Name: _____ Hour: _____

Major Lower Michigan Rivers



Adapted from <http://nationalmap.gov/>

Name: _____ Hour: _____

Activity 4 The Flood at Cottonwood Flats

Purpose: Now that you know what watersheds are, apply your knowledge to help the people of Cottonwood Flats

Directions: Read the following article.

Cottonwood Flats Times, Thursday

Cottonwood Flats Flooded, Residents Hold Meeting to Relay Concerns

By: Janice Nosey, staff writer

Continuous rain has devastated the Cottonwood Flats area since Thursday. Forecasters say the rain will taper off this afternoon, but the damage has already been done. The past five days have unfolded like a Hollywood disaster movie. The rain began Thursday, dumping 7 inches thus far. The sudden down pour of rain has caused considerable stress to the two dams on Cottonwood Creek. By Saturday the dams were near their capacity. To avoid a failure of the dam structure, officials at CFE (Cottonwood Flats Energy) the local power company, made the decision to release the water from the dams. CFE dam supervisor, Earl Waterman, stated, "The dams can only hold a certain amount of water. Once it has reached this point the water can cause structural damage to the dams. The dams may withstand this initial damage, but weakened points could fail in the future, causing considerable harm."

The release of the water from the dams caused the water in the river to rise to 8 feet above the flood stage in only 5 hours time. Many people were not prepared for the sudden change in the flood stage. Cars in driveways were covered halfway with the water. Even some squirrels, mice, and other small animals were reported drowned in the sudden flood. Many of the agricultural farms located along the river are under water. Joe Moody, owner of one of the local dairy farms stated, "My cows have only a small area to roam, since about 70% of my land is flooded." Leo Autobon, owner of Leo's Used Auto Parts reported a similar worry, "Many of the junked cars and parts I use are ruined due to the flooding."

Today, a boil alert has been issued to all residents of River Town, Cottonwood Flats, and Little Lake. Residents get their drinking water from the river. The sewage treatment plant and dairy farms in River Town have overflowed and contaminated Cottonwood Creek. Do not drink your water without boiling it. Bottled water is best. The boil alert will continue until further notice.

In light of the flood and the alert, the citizens of Cottonwood Flats and neighboring areas will hold a town meeting at the Cottonwood Flats Municipal Building tonight at 7:00pm. Experts from CFE, Department of Natural Resources (DNR), County Health Department, and Emergency Response Department will be on hand to answer all residents' questions.

Task:

1. Your group will receive a role card. You may be assigned to be one of the experts or a resident.
2. After all groups have had time to prepare, a town meeting will be held. Residents will have an opportunity to ask questions of the experts.

Name: _____ Hour: _____

Experts' Role Sheet

Directions:

Read the slip of paper given to you by your teacher. This is your assigned role. The paper will help you to think about who you are and what you might be concerned with. Use the questions below to help you think about how you can best answer the questions of the residents. The residents come from River Town, Cottonwood Flats, and the Little Lake area.

Write your assigned role here: _____

1. List some of the main responsibilities of the expert you are representing. What do they do?

2. Why might your role be important in the meeting? What information can you bring that is different from the other roles? Other roles: Emergency response director, power company/dam supervisor, DNR pollution assessment, Director of county health department.

3. The residents from River Town, Cottonwood Flats, and the Little Lake area have encountered different amounts of damage. Decide who experienced the most damage and least damage and why. Explain your reasoning here.

4. List some questions that you think the residents may ask. They might ask for advice or they might ask why you took certain actions. Circle the questions you think might pertain in particular to your group.

Name: _____ Hour: _____

5. Using the questions you thought of above, explain why you think the residents might ask this and what your answer would be. Be detailed, you need to satisfy the fears of the residents. Inadequate answers could frustrate them and make them angry. Also, use this space to answer the questions on your role sheet. You must come up with at least 2 of your own questions.

Question	Reason why this question might be asked	Answer to question

Name: _____ Hour: _____

**Residents' Role Sheet
Activity 4****Directions:**

1. You have been assigned the role of residents. Your job will be to run the town meeting which means asking the questions to the experts. Your task is to think of questions that may concern you that you could ask the experts.
2. Use the article and the map to help you identify these concerns. The questions below are designed to help you think about the concerns you may want to bring up.
3. There are 2 questions you must ask the experts. You will be asked to think about the answers to questions below.
4. You are the residents, it is your right to know and understand everything that is going on with your town!! You have the right to have the experts clarify anything that seems unclear or not a very good answer, this is especially true if the experts seem to disagree.

Hint: You are residents of River Town, Cottonwood Flats, and from the Little Lake area. The sewage plant is located in River Town and the dairy farms just south of River Town. Remember you have had considerable damage to your property and now cannot drink your water.

1. You must first decide which group of residents experienced the most damage: River Town, Cottonwood Flats, or the Little Lake residents? Which group experienced the least damage? Use the map to help you. Explain why you think this.

2. All the residents are advised to boil their water. Decide which group is most vulnerable to polluted water. Explain your reasoning below.

Name: _____ Hour: _____

Write out questions you may wish to ask the experts. Also list the reason you would want to ask this question.

Questions for individual experts:

Expert group	Questions	Reasons for asking this
Emergency response director – Responsible for deciding who to rescue first.		
Power company, dam supervisor – responsible for opening the dams.		
DNR pollution assessment - Responsible for determining where the pollution is greatest.		
Director of county health department – Responsible for the boil water alert.		

Name: _____ Hour: _____

Role Cards Activity 4**Emergency response director:**

Your job is to provide help to those affected by the flood. However, you cannot give help to everyone nor can you give help to everyone who needs it immediately. This means you may have to choose who is most in need. You will also need to think about the future, what other problems could arise because of the flood that may affect the residents.

Big Questions you will need to respond to:

Who will you give help to, in what order will you give help, who will not receive help, what type of help will you give? Make sure you explain why. An answer like, "We will start with the areas with the most damage," is not sufficient. Be specific as to which areas these are.

Power company/Dam supervisor

Your job is to monitor the dam. Your company was responsible for opening the dam and causing the sudden increase in flood stage.

Big questions you will need to respond to:

Why did you decide to open the dam? You need to defend yourself by explaining that before you made the decision to open the dam, you had thought about who would be affected and why.

DNR pollution assessment

You are responsible for assessing the pollution that could occur due to the flood. It may be a good idea for you to work with the director of the county health department. Together you may be asked about the boil water alert and the danger.

Big questions you will need to respond to:

Who will be affected most by pollutants? Why will these areas be affected? What are some of the major causes of the pollution? How long would you expect the pollution to be a problem?

Director of the county health department:

Your group authorized the boil water alert. You are the ones who decided when the water is safe to drink. You may want to work with the DNR to help you solve some of the problems.

Big questions you will need to respond to:

When will the boil water alert be over? Who is most affected by the pollutants?

Ideas revisited

Name: _____ Hour: _____

Activity 4

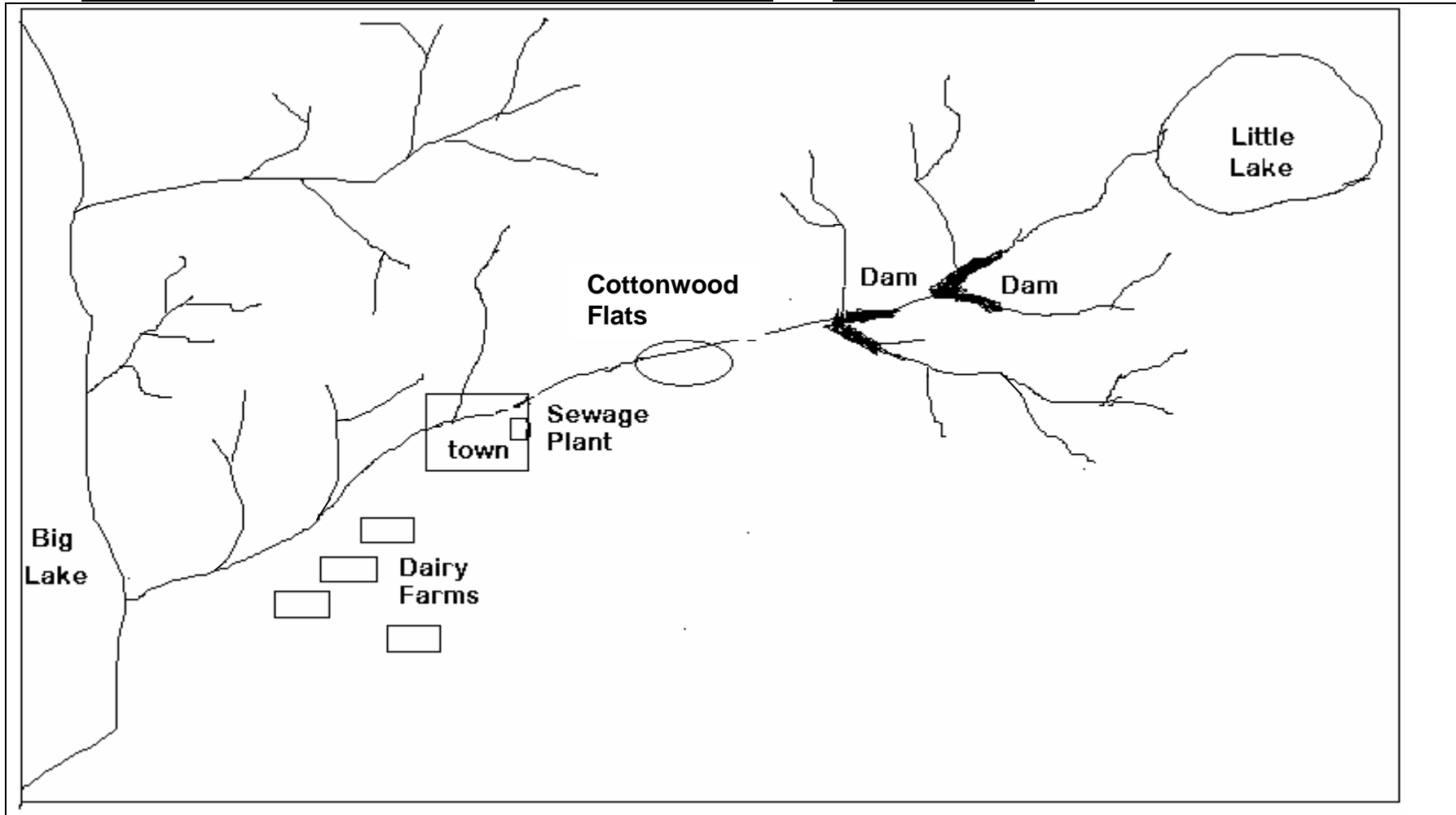
Conclusion of Town Meeting:

Now that you have heard all sides of the town meeting, go back to your own ideas and make any necessary corrections or additions to make your answers better.

Pick two answers you gave in the role sheet, explain how you can change these answers (correct or expand on them) based on what you learned from the town meeting.

Name: _____

Hour: _____



Map of Cottonwood Flats

Name: _____ Hour: _____