George Washington's Vest, circa 1780–1800
Source: New Hampshire Historical Society

George Washington's Vest (inside), circa 1780–1800
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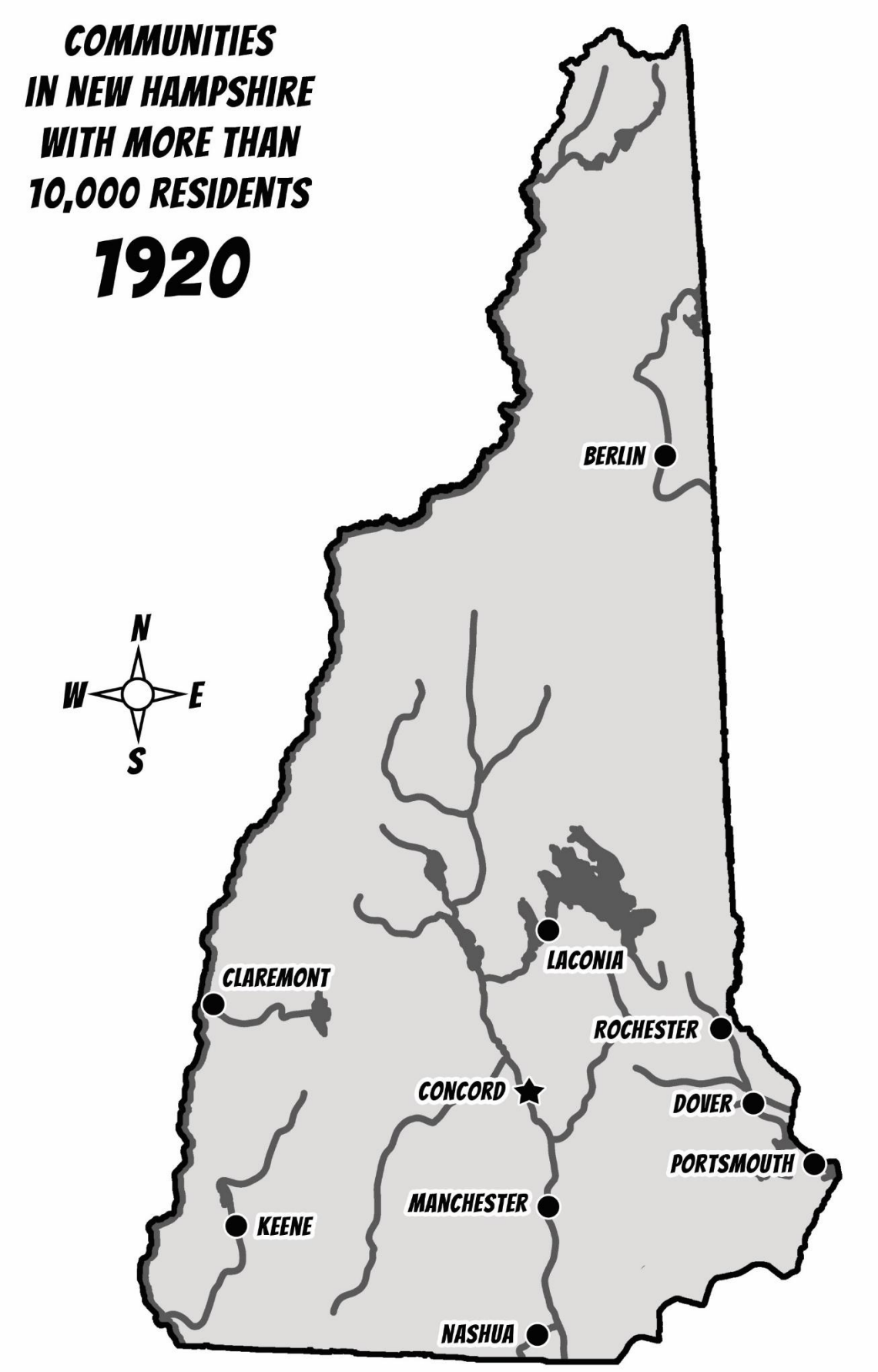
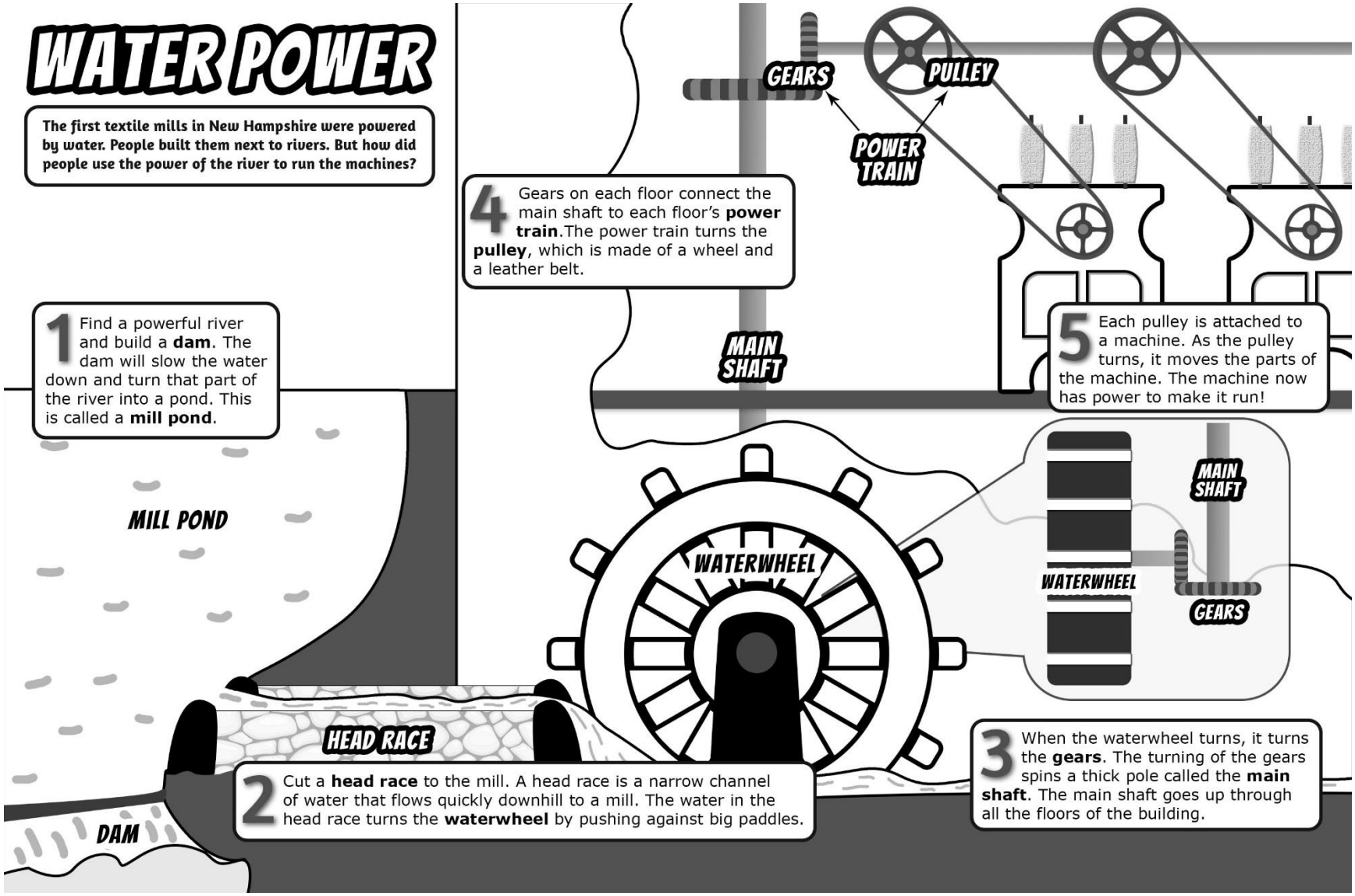

COMMUNITIES
IN NEW HAMPSHIRE
WITH MORE THAN
10,000 RESIDENTS
1920
N
W
E
S
BERLIN
LACONIA
CLAREMONT
ROCHESTER
CONCORD
DOVER
PORTSMOUTH
MANCHESTER
KEENE
NASHUA

Lesson 11.1: Water Power



Lesson 11.1: Water Power

Name_____

Water Power in Action

Complete the tasks below to build a waterwheel and test the power of water, also called **hydropower**. You need: an aluminum pie plate, a pair of scissors, a pencil, a piece of masking tape, a permanent marker, a basin, and a pitcher of water.

Build

1. Use the scissors to make eight (8) equally spaced cuts on the side of the pie plate. The cuts should go from the rim, down the side, to the base. Mark your planned cuts before you cut.

2. Fold each cut section backward so that it sticks out over the base of the pie plate. Be careful! The edges of the flaps may be sharp. You should have eight flaps that slightly overlap each other.

3. Use the point of the pencil to poke a small hole in the center of the pie plate's base. If the pencil doesn't work, ask an adult to use the point of the scissors to make the small hole.

4. Fold a piece of masking tape around the pencil near the eraser end to make a tab. Use the marker to draw an "X" on one side of the tab.

Observe

1. First, experiment with human power. Hold the pencil horizontally and use both hands to turn it in one direction continuously. Have a partner count the number of times you are able to turn it in one minute by counting each time the X" returns to the top. Record that number here:_____

2. Now, experiment with hydropower. You have a model of a waterwheel with a main shaft. Hold your water wheel and shaft over the basin. Make sure you hold the shaft loosely so that it can rotate. One partner should pour the pitcher of water in a constant stream onto the water wheel so that it rotates in one direction and spins the shaft. The tape tab will rotate as the wheel rotates. This may take a few attempts to work.

3. When you are ready, have another partner count the number of times the "X" returns to the top during one minute of constantly pouring water onto the water wheel. Record that number here: _____

Lesson 11.1: Water Power

Adjust

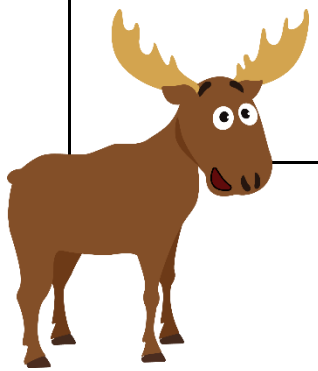
1. Extra rainfall and melting snow make rivers move faster. What happens to the rotation if you pour the water out of the pitcher more quickly? Record the number of "X" rotations in one minute during a fast stream of water:_____

2. More mills on a river meant more dams, which slowed down the movement of the river. Try pouring the water slowly. Record the number of "X" rotations in one minute during a slow stream of water:_____

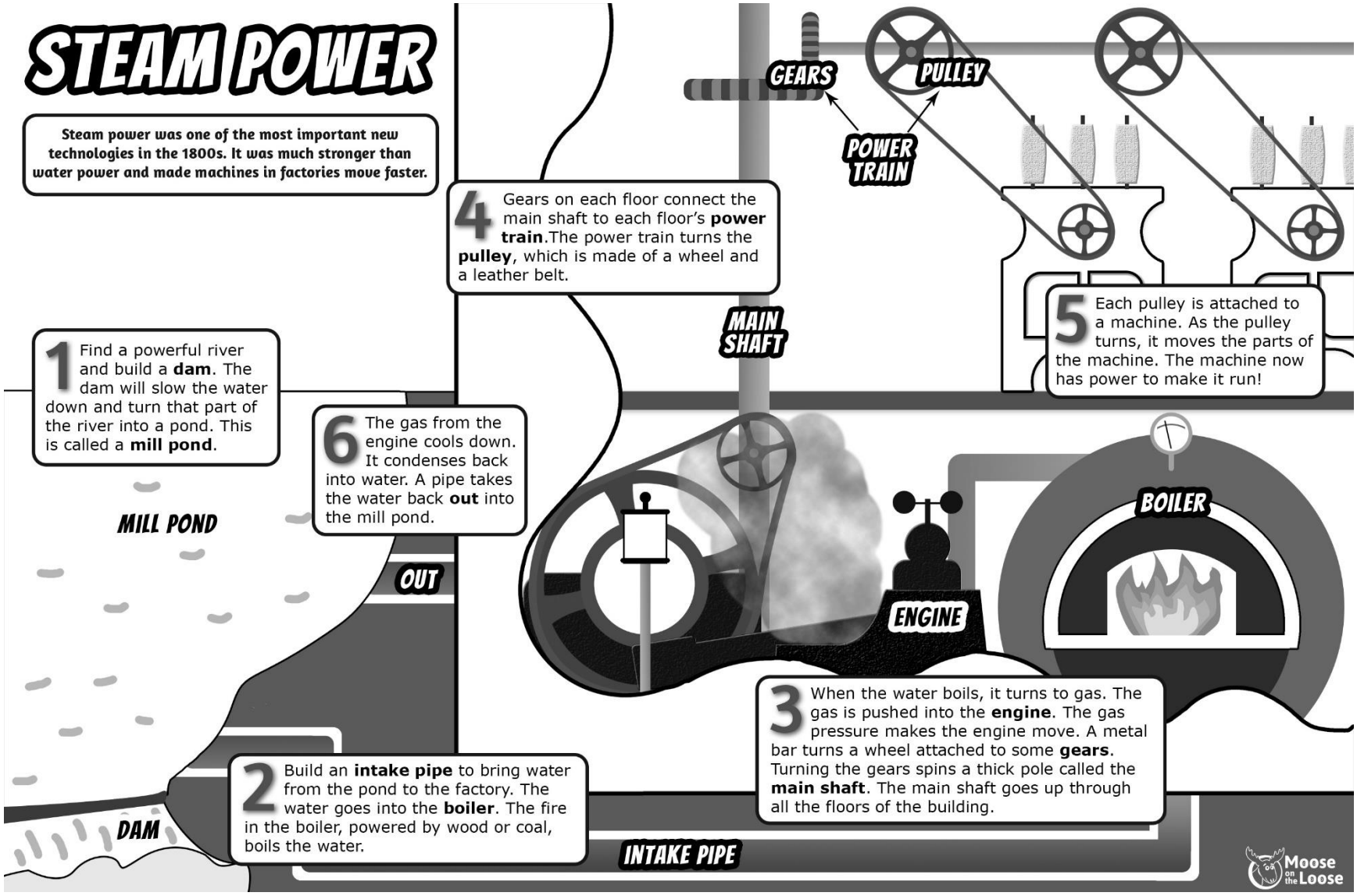
Reflect

Compare your experience using human power and hydropower to rotate the pencil, especially, which method resulted in more rotations per minute?

Why do you think mills decided to use hydropower instead of relying on human power to make machines move?



Lesson 11.1: Water Power



Lesson 11.1: Water Power

Steam Power Steps

Cut along the dotted lines and shuffle the cards before giving a set to students.

A pump brings water from a mill pond through a pipe and into a holding tank.	A coal-burning fire heats the water inside the holding tank.
The heated water transforms into a gas called steam.	The steam rises and moves through a system of pipes into an engine.

The pressure of the steam moves the engine's parts.

The movement of the engine makes the other machines in the mill work.

The steam cools back into a liquid.

This liquid water moves back through another system of pipes back out to the mill pond. The process begins again!

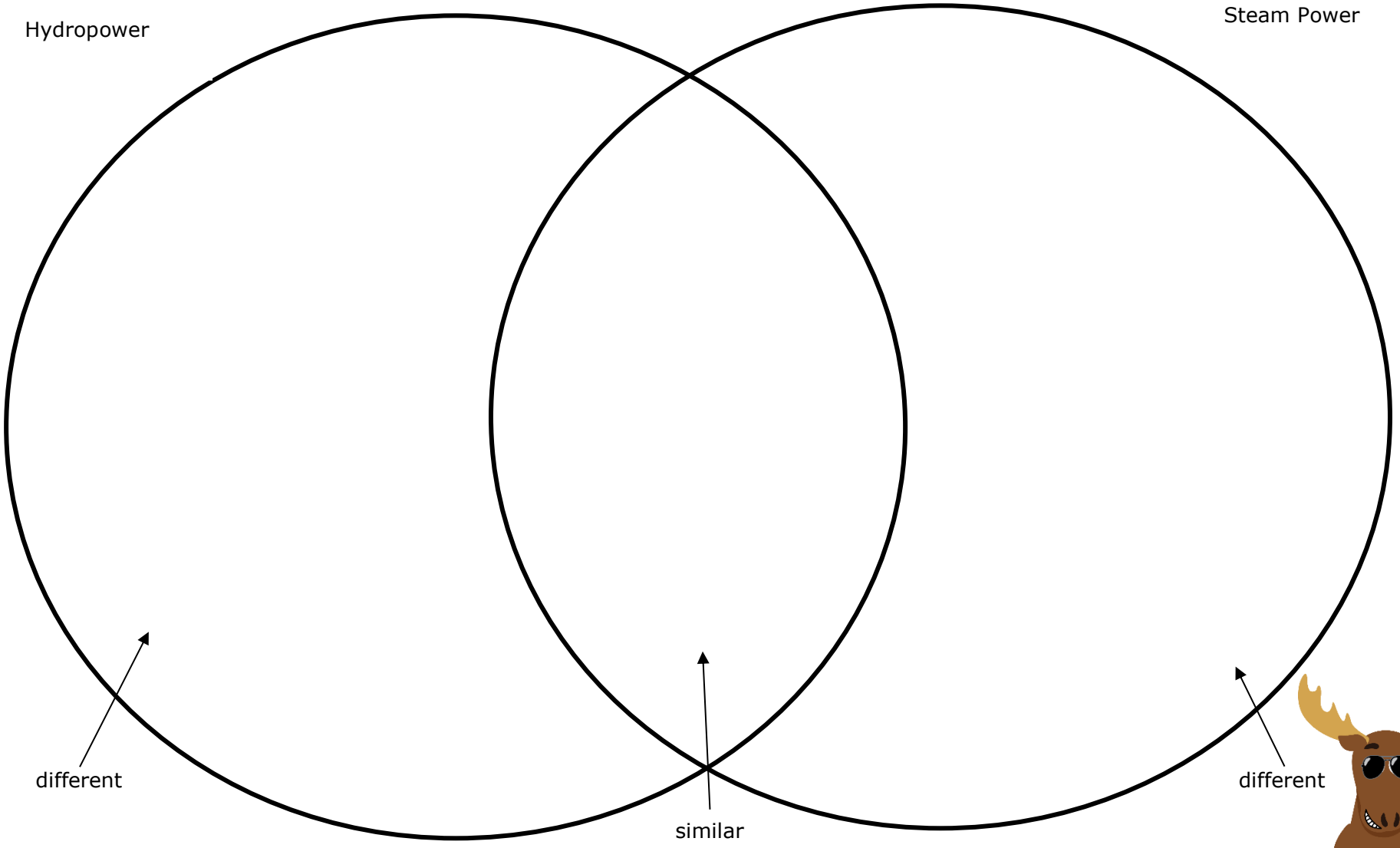
Steam Power Steps (in order)

1. A pump brings water from a mill pond through a pipe and into a holding tank.
2. A coal-burning fire heats the water inside the holding tank.
3. The heated water transforms into a gas called steam.
4. The steam rises and moves through a system of pipes into an engine.
5. The pressure of the steam moves the engine's parts.
6. The movement of the engine makes the other machines in the mill work.
7. The steam cools back into a liquid.
8. This liquid water moves back through another system of pipes back out to the mill pond. The process begins again!

Lesson 11.1: Water Power

Name _____

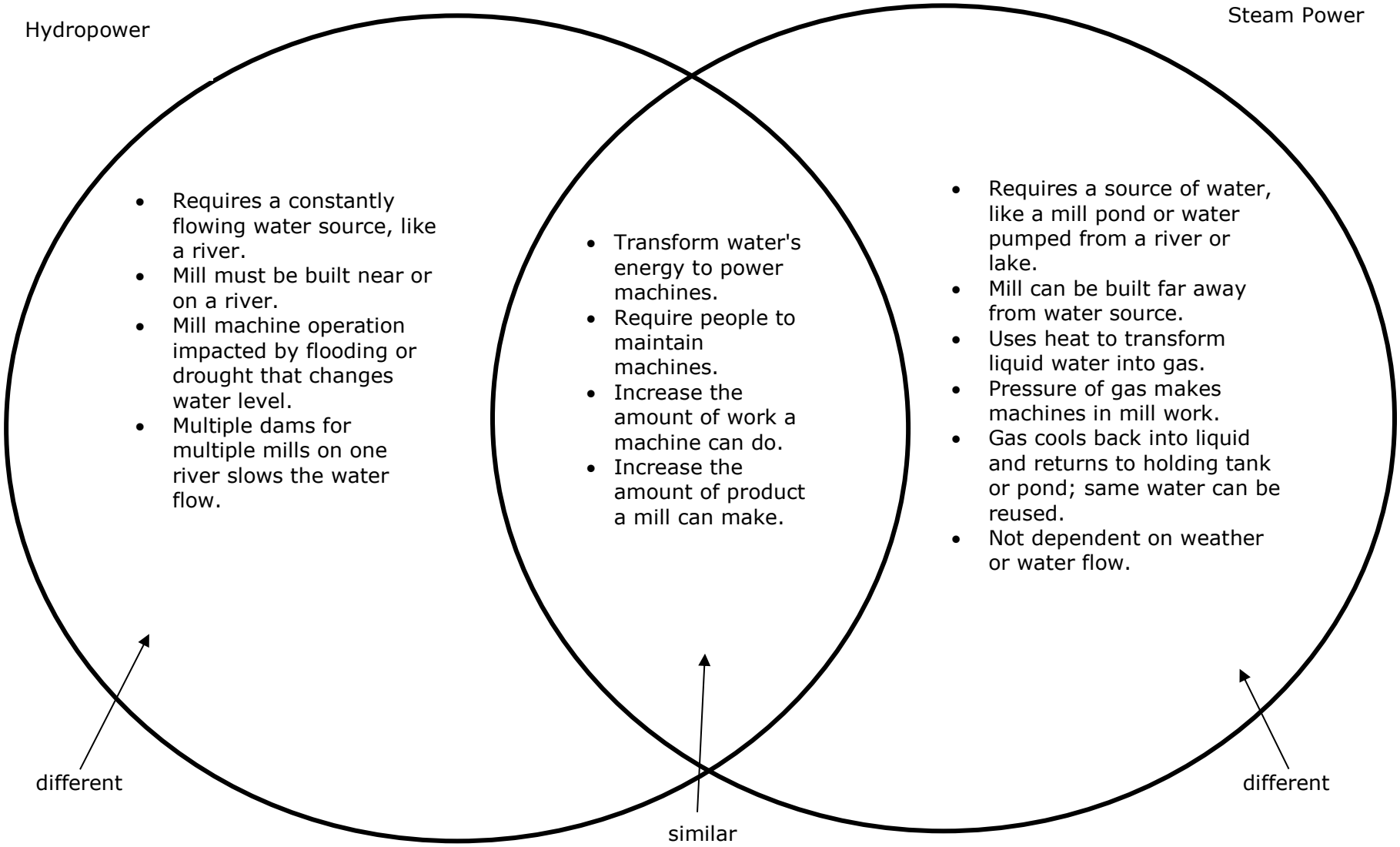
Venn Diagram: Hydropower vs. Steam Power



Lesson 11.1: Water Power

Name Answer Key

Venn Diagram: Hydropower vs. Steam Power



Lesson 11.1: Water Power

Name_____

Water Power Reflection

The tools we use to complete tasks (technology) are always changing. Think of an example of technology that your parents or grandparents used that was replaced by something you use today. Why do you think that change occurred?

Now think about the technology that changed the way people made products, like cloth. Why were the water wheel and hydropower an improvement over human power?

Why did mills change from simple hydropower to more complicated steam power? How did steam power affect industries in New Hampshire?

Why do you think technology is always changing? Why do we experiment with new ways of getting work done?

Lesson 11.1: Water Power

Next step: Use this space to organize your responses to the questions into an informational paragraph that explains how new technology changed industry in New Hampshire.

Lesson 11.1: Water Power

Name Answer Key: Sample Response

Water Power Reflection

The tools we use to complete tasks (technology) are always changing. Think of an example of technology that your parents or grandparents used that was replaced by something you use today. Why do you think that change occurred?

My mom used to have to wait to make a phone call until she was back at home because they only had land line telephones. Today, everyone has a mobile device that can make calls from anywhere. People travel more and want information faster, so they needed technology to communicate even if they weren't at home.

Now think about the technology that changed the way people made products, like cloth. Why were the waterwheel and hydropower an improvement over human power?

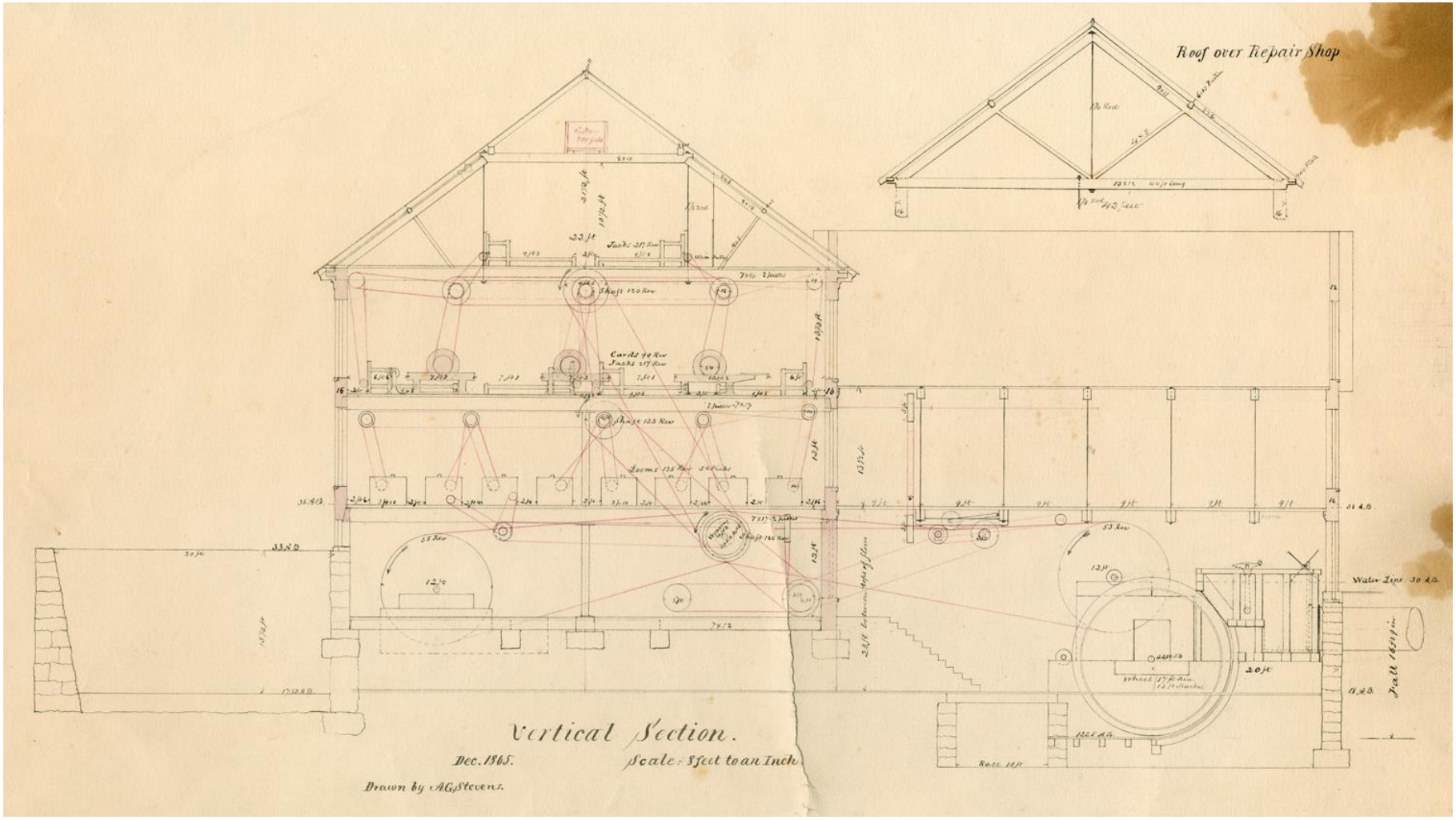
Before the waterwheel-powered mill, people had to power machines themselves to make the things they needed. Everything, from sawing lumber to grinding grain to weaving cloth took a long time. People realized they could make more of the products they needed in less time if they used power from another source to make their machines work.

Why did mills change from simple hydropower to more complicated steam power? How did steam power affect industries in New Hampshire?

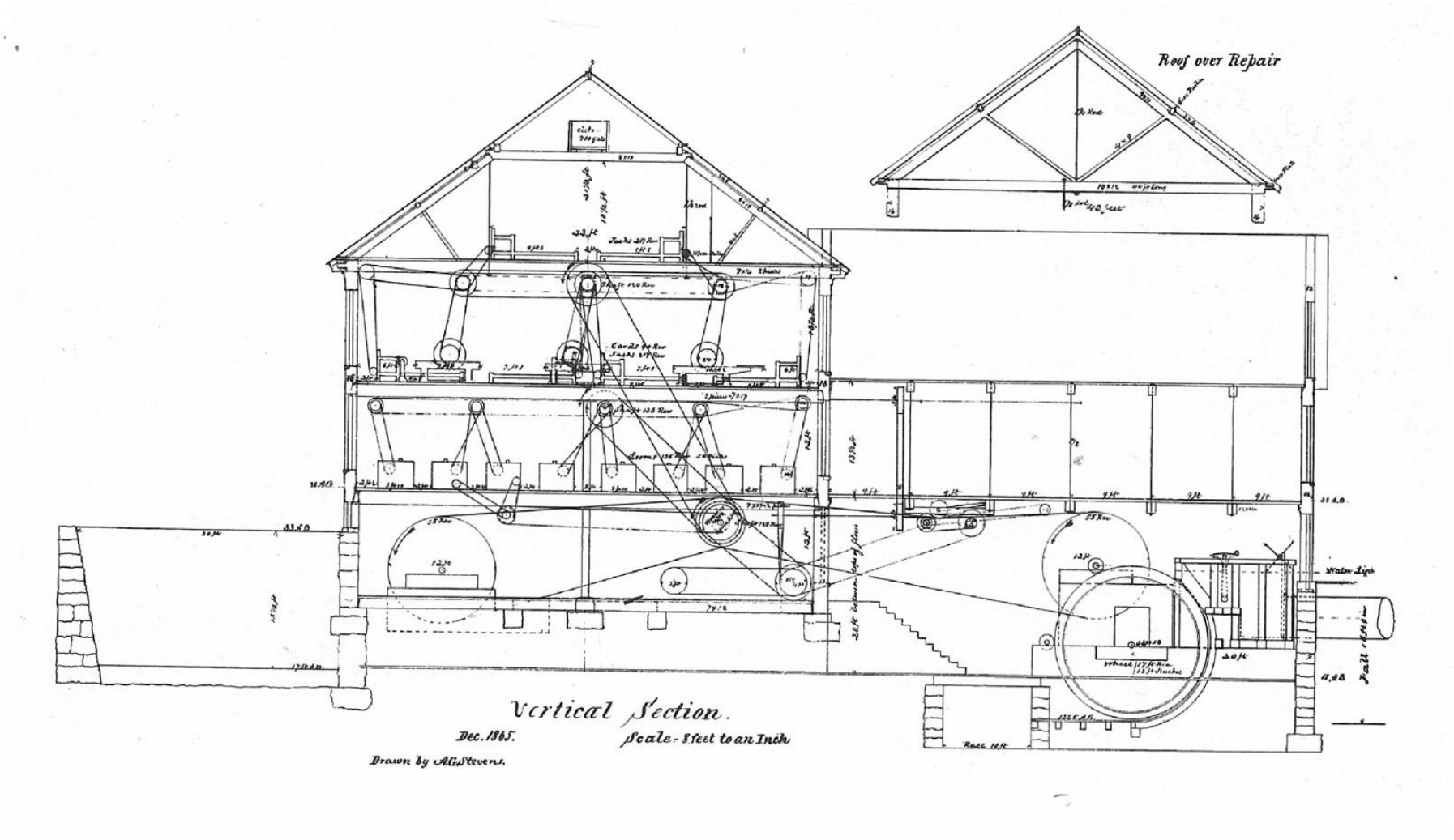
One of the biggest disadvantages of hydropower was that waterwheels were dependent on a steady flow of water. If the water level dropped because of drought or slowed because of other dams built by other mills, the wheel would not move as fast and the machines in the mill would not do as much work. Steam power eliminated that disadvantage. Steam power reuses the same source of water over and over, transforming it from a liquid to a gas in order to make an engine work. Mills could be built anywhere if they used steam power, not just along rivers. More mills meant more production. Industries in New Hampshire grew and more people worked in factories and bought more factory-made products.

Why do you think technology is always changing? Why do we experiment with new ways of getting work done?

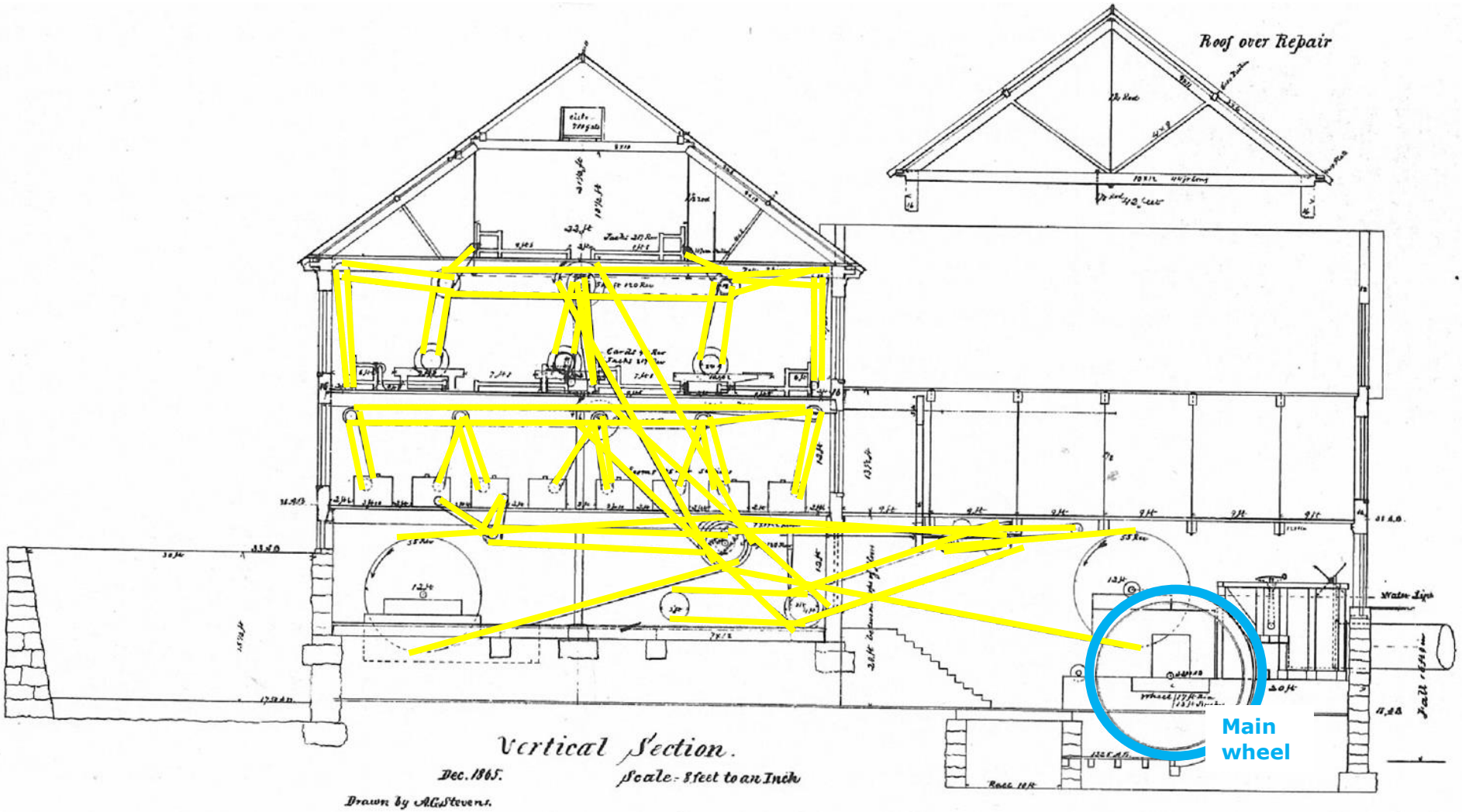
People's needs and wants change over time. As people change from lives on farms, where they make and grow everything they need, to lives spread out across cities and suburbs, they depend on others to make and grow the things they need. As populations grow, more products are needed and new technology helps make work happen faster and increases the number of products for people to buy.



Stevens Mill, 1865
Courtesy of the Kheel Center, Cornell University



Stevens Mill, 1865
Courtesy of the Kheel Center, Cornell University



Stevens Mill, 1865
Courtesy of the Kheel Center, Cornell University