

**WE CARE ABOUT WATER.  
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AMERICAN WATER



# The Only Thing Constant is Change

The Waters of Oak Hill

- **Grade Level:** 9-12
- **Objective:** Students will explore land use maps of a region over a period of decades to assess how trends in water use can impact the availability and quality of freshwater resources.
- **Subjects:** History, Mathematics, Environmental Science

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## INTRODUCTION

Throughout history, water resources have played a pivotal role in the settlement, distribution and activity of populations. Through the tribal era, colonial period and industrial age to modern day, access to fresh water has always been imperative for domestic use, industrial applications, agriculture, economic development and transportation.

Initial settlement locations were based on a reliable source of clean drinking water. Additionally, waterways were the main transport routes for people, goods and services. As resources were harvested from the landscape, water was needed for additional purposes. Flowing water provided the power needed to process iron, timber and grain. Industrial facilities would require water for heating and cooling and a variety of chemical applications. All the while, agricultural regions supporting these growing communities, towns and cities required large volumes of water for irrigation.

Unfortunately, in many regions, early development did not occur in parallel with a sustainable plan for fresh water access and use. For decades, many communities tapped water resources without quantifying use and pollution in many forms spilled unchecked into streams, rivers and lakes around the country.

By examining the history of settlement, resource use, agriculture and economic development, we can begin to understand how trends in water use have impacted the availability and quality of fresh water.

Today, towns and cities employ a more dynamic approach to help ensure that water continues to be available to residents, farmers, business and industry.

Lessons learned from history have been and continue to be useful in making recommendations for future development of technologies and strategies for managing an increasingly strained resource.

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## DID YOU KNOW?

The average person in the U.S. uses 100 gallons of water per day. The average residence uses more than 100,000 gallons during the year.

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## MATERIALS NEEDED

- Piece of paper
- Pen or pencil
- Calculator
- Enclosed data sheets



### EXERCISE

The bullets below outline the developments that have occurred in Oak Hill from the mid-1800s to current day.

- **Mid-1800s:** Oak Hill, Wisconsin, was settled by a small number of fur trappers in the mid 19th century. Setting up camp along the Grey Birch River in the newly formed Mill County, 10 residents trapped mammals in the surrounding wetlands and forests and used the river to transport their pelts to surrounding towns and cities.
- **1890:** The quality and abundance of local forests soon attracted the attention of a logging outfit, and a timber mill was established not far from the original Oak Hill camp. As settlers moved to the area to work in the mill, a town was created and farms (680 acres) were established to supply food to the mill workers. The population of Oak Hill quickly increased to 575 residents in 1890. Large tracts of land were cleared for farming and to supply the timber industry with a continuous supply of trees. During this period, three wells were drilled to supply drinking water to Oak Hill residents and the Timber Mill. Roads were cut and paved connecting the activities of the region.
- **1920:** Thirty years later the population increased again to 1,200 and another 200 acres of agricultural land was added to the region's farms. The success of the timber mill attracted additional industry, and timber products from the forestry operations were processed at a local paper manufacturing facility, which was located on the river. Suburban development from a nearby city reached the eastern part of Oak Hill, and the state university opened a research facility focused on forestry and agriculture.
- **1960:** By this time, the total acres being developed or used for forestry operations and research fields reached 1,350 acres and the population rose to 2,600.
- **1985:** A modern sewage treatment plant was constructed, the number of water wells doubled and a sanitary landfill was established at the north end of town. A population census reported 8,000 residents.
- **Current Day:** The growing affluence of the region prompted the development of a 700-acre golf course and the construction of a shopping mall. Highways were expanded to allow for increased traffic to and from the city. Today, the population reached its highest to date with 8,500 residents.

### TASKS

1. The following series of maps provide landscape views of the changes in Oak Hill from 1850 through 2005. For each map, describe the uses of water by the residents, activities and industry. Highlight the changes from one map to the next. Indicate how the water is being used and identify potential environmental threats to drinking water and/or surface water supplies. Use content from the watershed lesson From Here to There to help you identify impact. Wells on the map indicate the access of groundwater from aquifers.
2. Graph the population increase in Oak Hill during the period from 1850 to the present day.\*
3. Graph the total water use over time. Conversions are provided for calculating use.\*
4. In 1970, the established wells began to run dry and were re-drilled, increasing their depth by another 30 meters. What does this say about water use in the region? What activities may have caused this?
5. Despite increases in population from 1985 through the current day, an adequate supply water was provided for the community's residents and industry. What measures were taken to make this happen?

\* If students do not have access to Excel to create the graphs, they can use the provided graph templates on the following pages.

# THE ONLY THING CONSTANT IS CHANGE

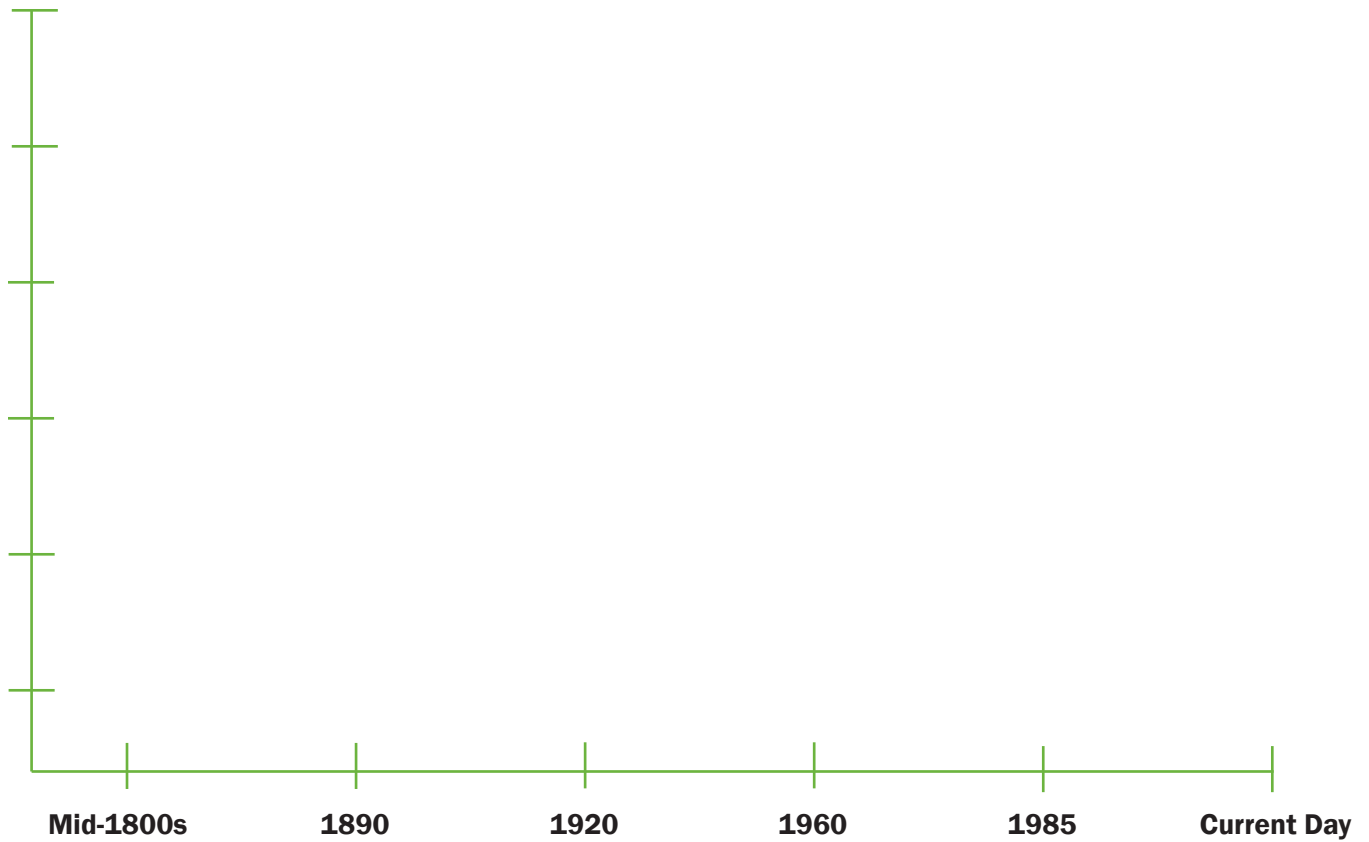
The Waters of Oak Hill



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## POPULATION GROWTH

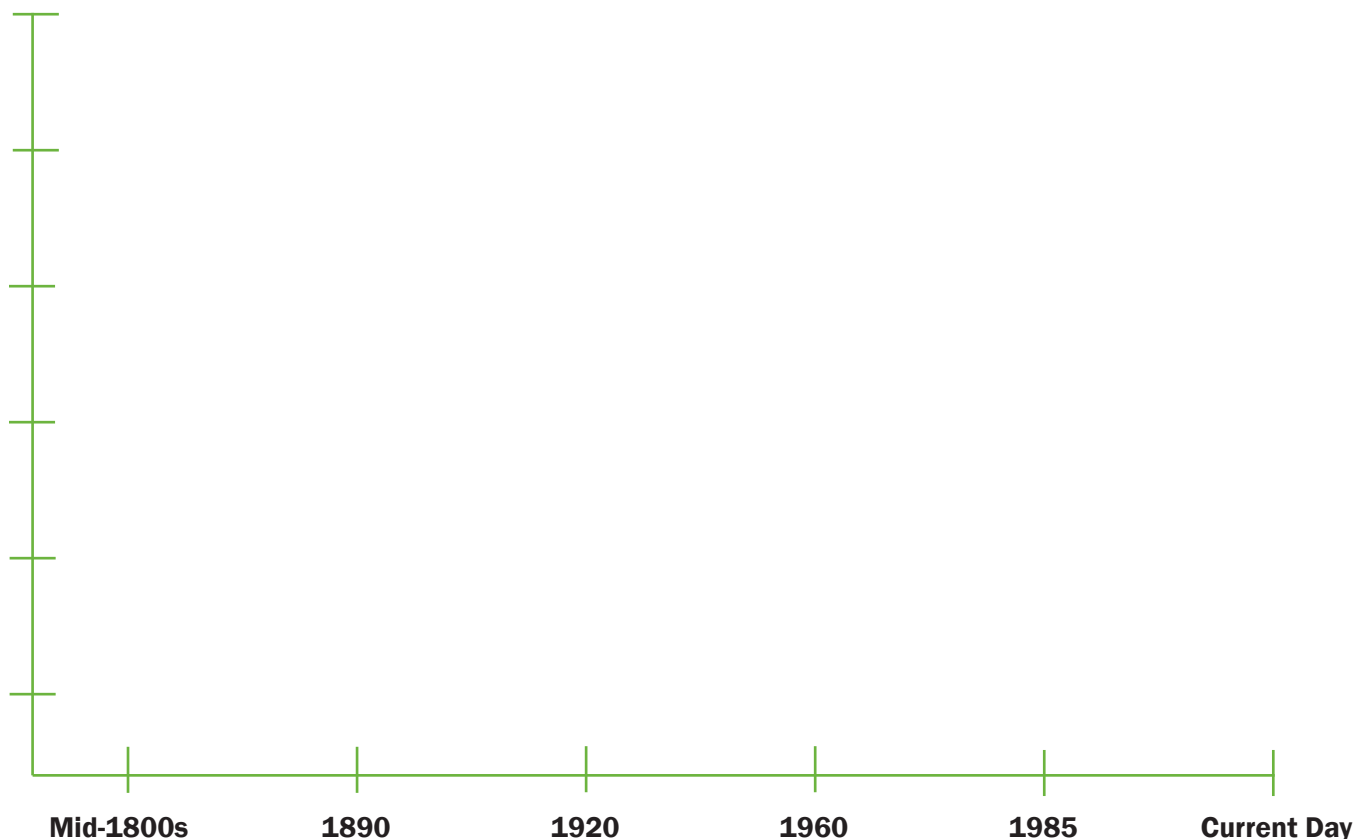
Use the blank graph below to trend the population increase over time in Oak Hill.





## WATER USE

Use the blank graph below to trend the increase in water use over time. Use the provided conversions below to calculate this.



### Domestic Water Use

- From 1850 through 1920, the average use of water per resident per year is 7,300 gallons.
- From 1960 through 1985 the average use of water per resident per year is 70,000 gallons.
- Present day, the average use of water per resident per year is 48,000 gallons.

### Agricultural Use

- All acreage under cultivation, except for the research fields, uses 250,000 gallons per acre per year for irrigation.
- The research fields require 180,000 gallons per acre per year for irrigation.

### Golf Course

- Irrigation on the golf course uses 300,000 gallons per acre per year.

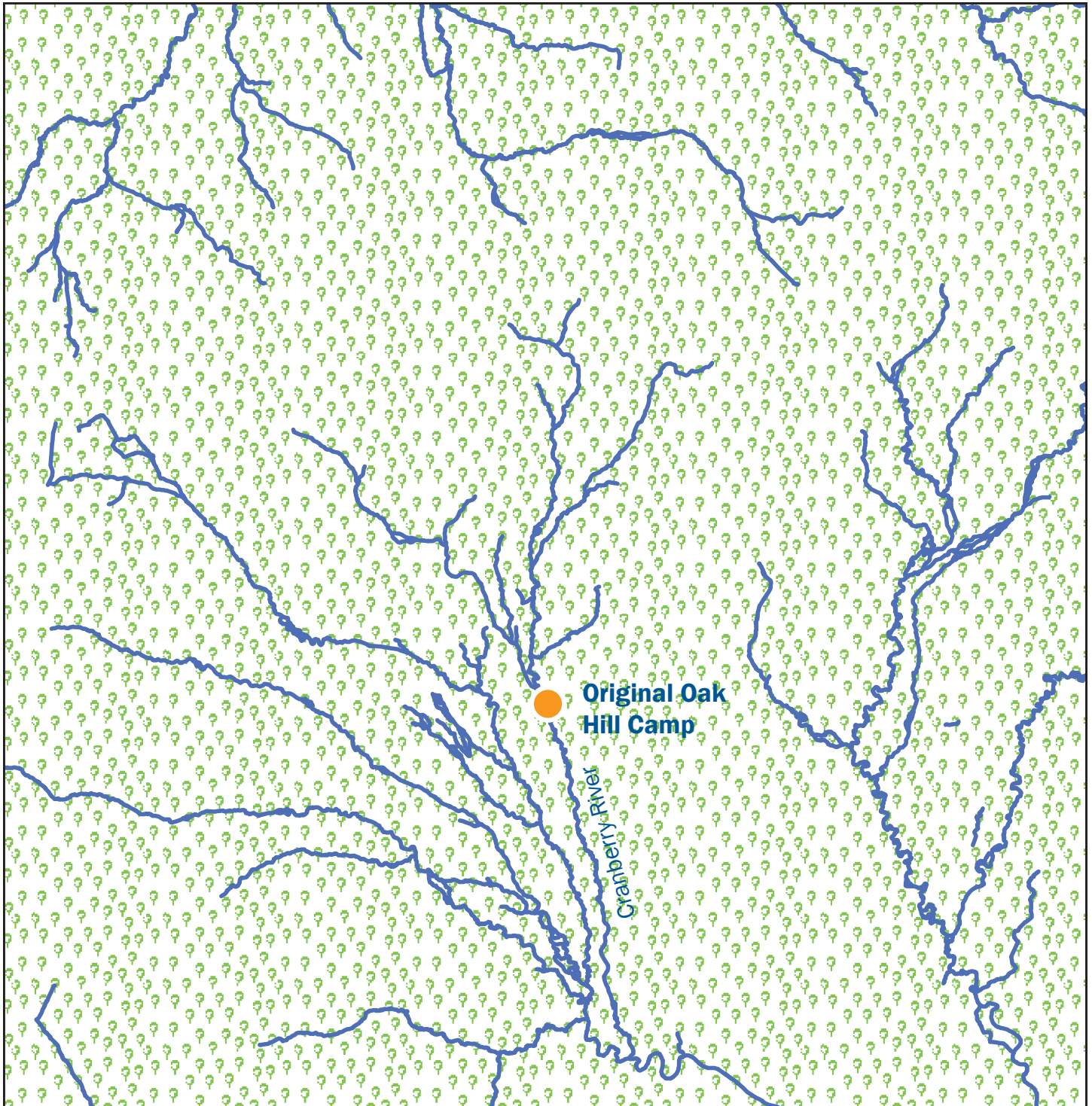
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## OAK HILL MAP: 1850



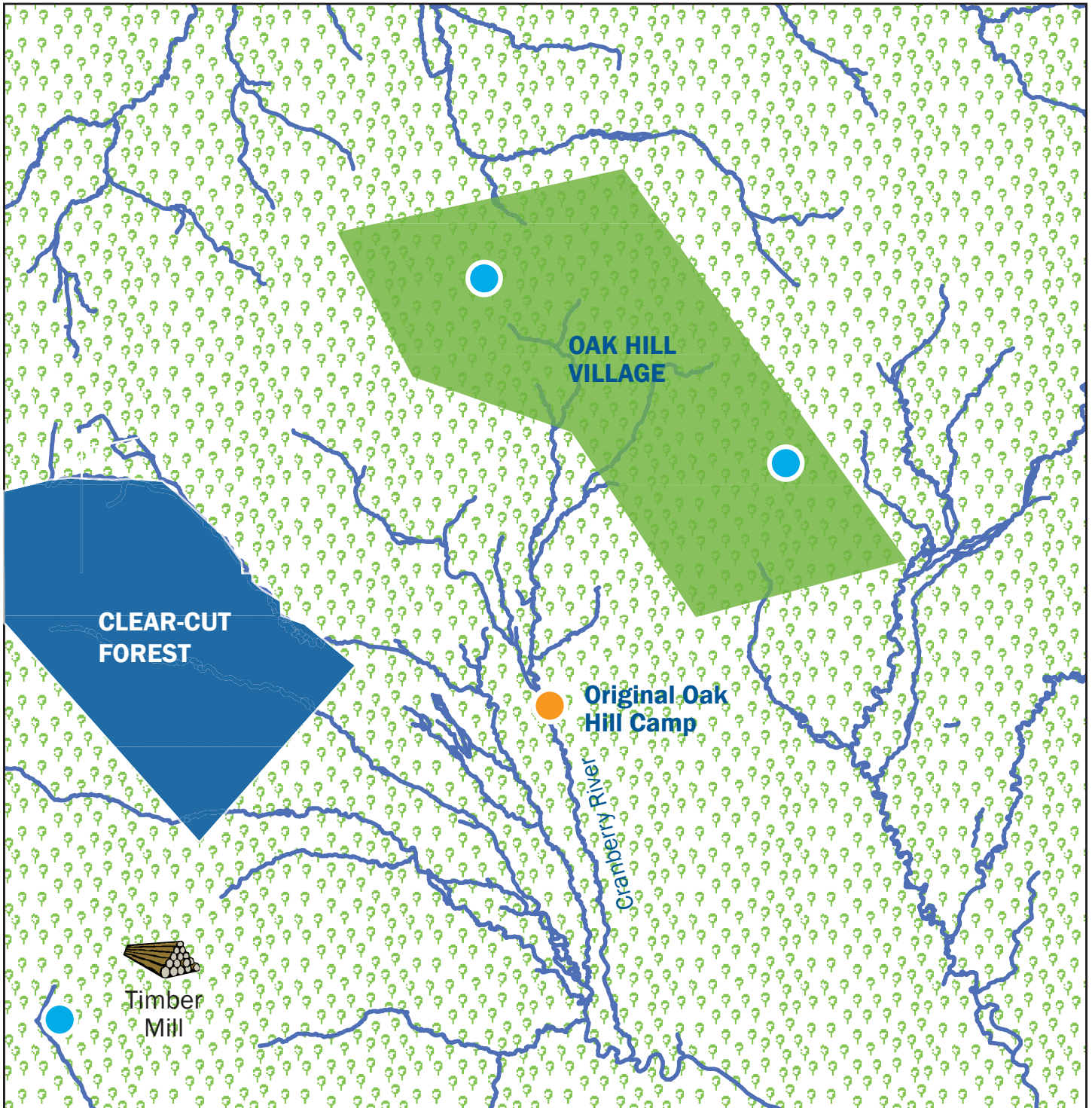
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## OAK HILL MAP: 1890



● Groundwater Well

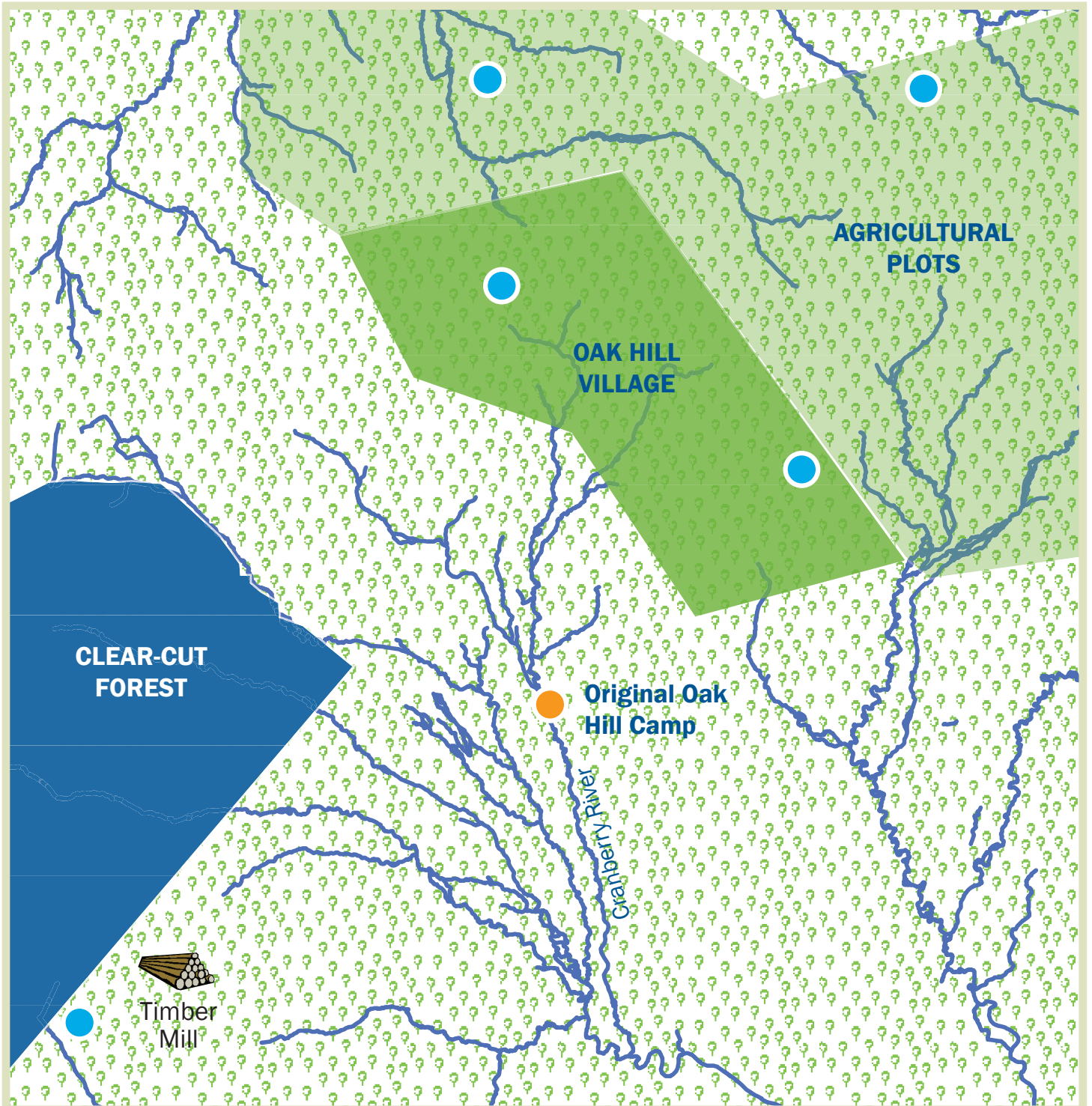
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## OAK HILL MAP: 1920



● Groundwater Well



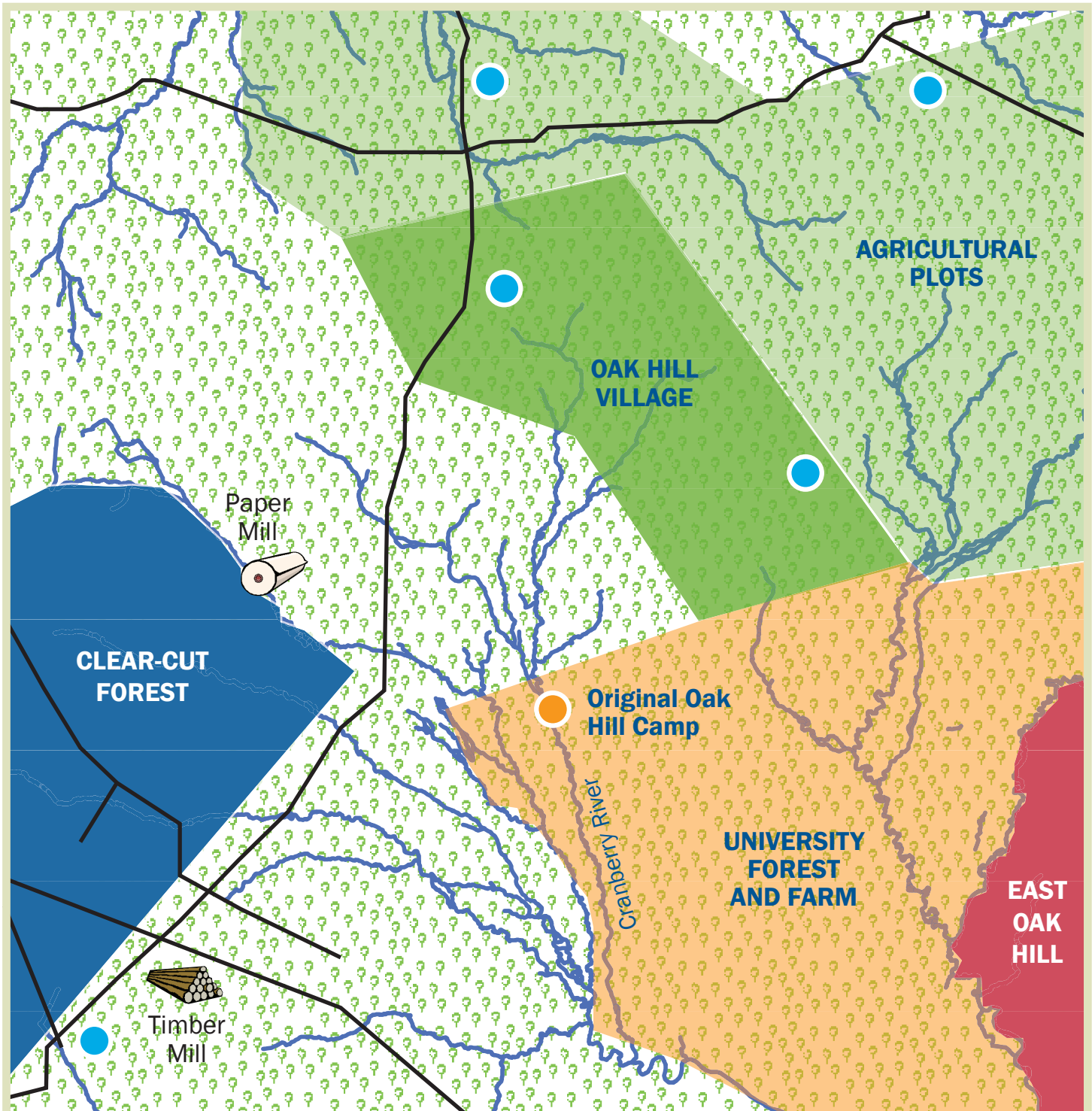
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## OAK HILL MAP: 1960



● Groundwater Well

— Mill County Roads

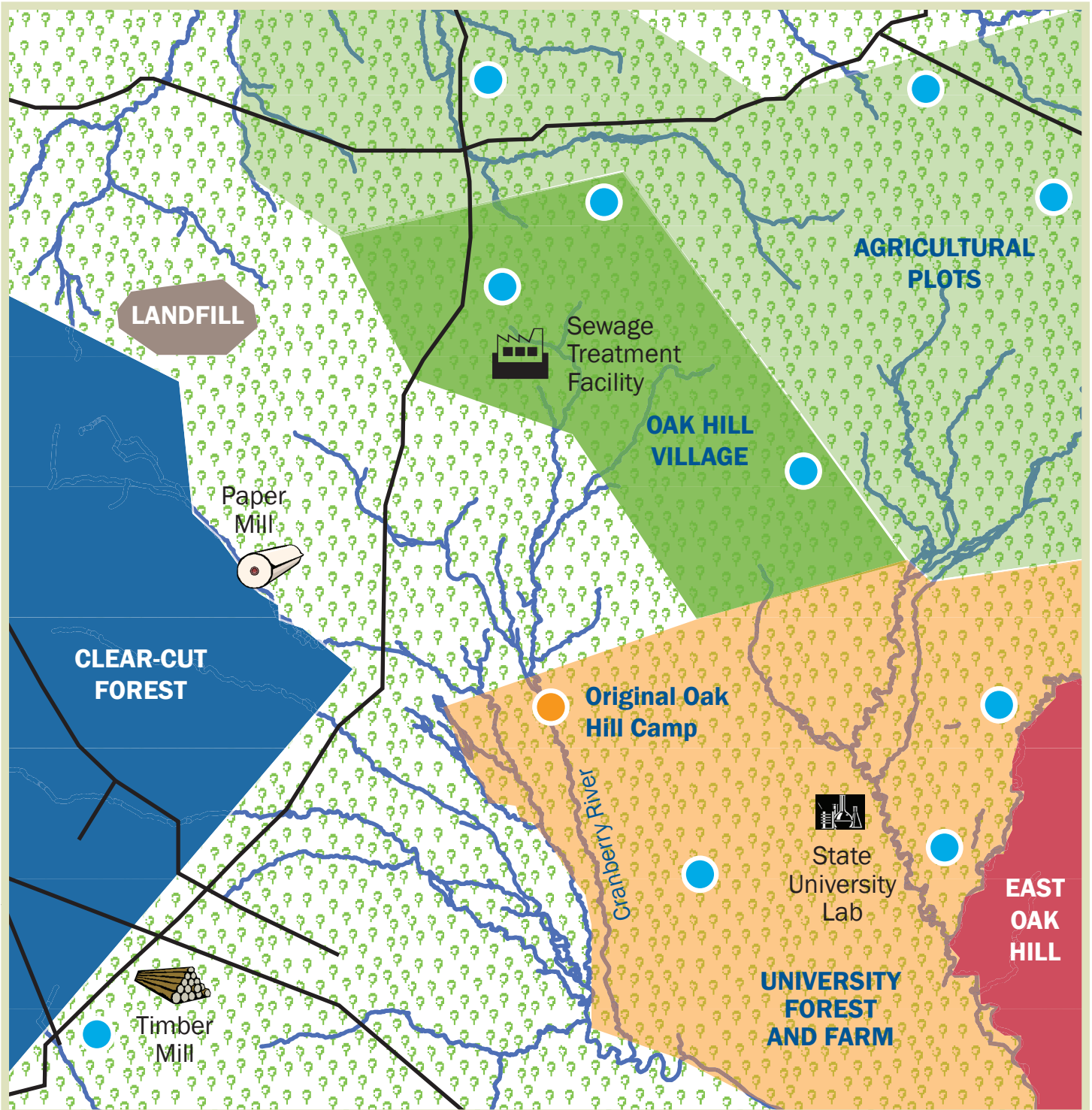
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## OAK HILL MAP: 1985



● Groundwater Well

— Mill County Roads

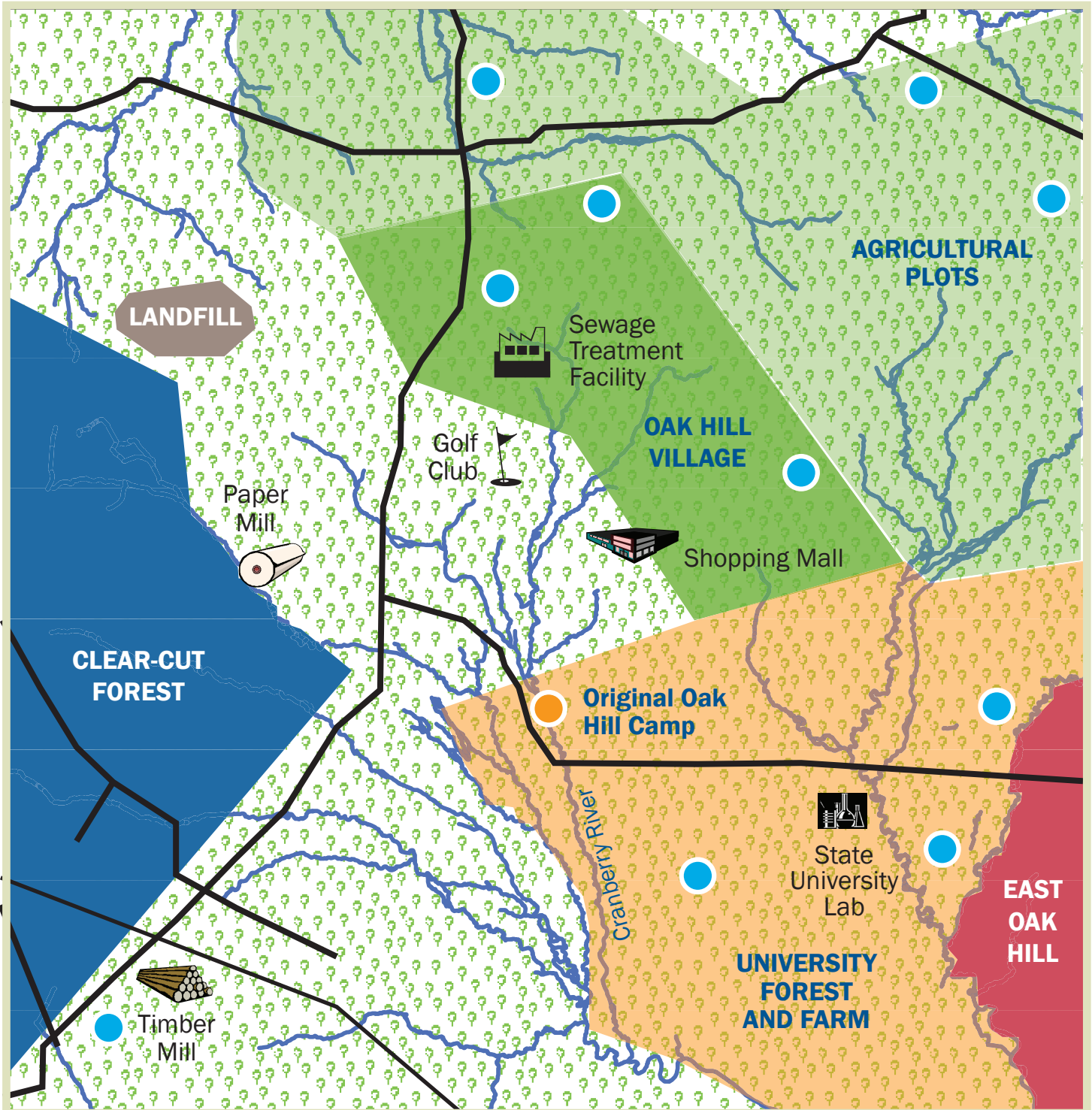
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## OAK HILL MAP: PRESENT DAY



● Groundwater Well

— Mill County Roads

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## QUESTIONS

1. What were the major contributors to the increase in water use in Oak Hill? Could any of these be avoided or mitigated?
2. What key lessons can we learn from this example?
3. What may be some of the reasons water use declined in the current day in Oak Hill when compared to the average use from 1960 and 1985?
4. What are some examples of best practices in water use management today?
5. Are there regulations related to how much water can be drawn by utilities and industry to help manage or protect the quantity of water that is available?

## EXTENSIONS

- Research the history of your town. Determine the activities and industries that were part of the region's economy. Document and graph the population growth, and describe how various human activities affected water availability and quality.

## RESOURCES

- [http://www.nationalatlas.gov/articles/water/a\\_wateruse.html](http://www.nationalatlas.gov/articles/water/a_wateruse.html)
- <http://www.epa.gov/history/topics/fwpc/05.htm>
- Water Use, Management and Planning in the United States (Chapter 2) by Stephen A. Thompson

## NOTES

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## DEFINITIONS

- **Aquifer:** Porous, water-saturated layers of sand, gravel or bedrock that can yield an economically significant amount of water.
- **Municipal Water Supply:** A system of engineered hydrologic and hydraulic components that provide water supply to municipalities and residents.
- **Renewable Resources:** A resource is deemed renewable if it can be replaced by natural processes. Currently, renewable resources must be carefully managed to avoid exceeding the natural world's capacity to replenish them. Fresh water, trees, soil and fish are examples.
- **Sanitary Landfill:** Waste disposal site on land where waste is spread in thin layers, compacted and covered with a fresh layer of clay or plastic foam each day.
- **Sewage Treatment Plant:** A facility that treats municipal sewage using processes that remove contaminants from the wastewater. Physical, chemical and/or biological processes are used to remove physical, chemical and biological contaminants.
- **Suburban Sprawl:** The spreading outwards of a city and its suburbs to its outskirts. These low-density developments on rural land are often segregated by use (i.e., stores and residential) and design features that encourage car dependency.

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In a world where everything we touch frequently changes, water is our constant. We've never stopped needing it to drink, to cook, to clean, to live. We'll always need it for sanitation, for fire protection, for watering our lawns and washing our cars.

It's easy to take water for granted. And because so many do, we don't.

We are scientists, environmentalists, innovators, and protectors. We are also residents and employees in the communities we serve. We understand how important, how precious, and how critical water is to daily life.

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## LEARN MORE

Visit [www.amwater.com](http://www.amwater.com) to learn more about our company and our years of tradition of reliability, responsibility, service, innovation and excellence.

**A special thanks** to Ron Smith for developing the core content of this lesson plan. Ron Smith, a science educator from NJ, has been teaching biology, environmental science and interdisciplinary studies in the classroom, lab and field for 18 years. It was important for us that our lesson plans be crafted by an educator for educators. We appreciate his hard work.

Last updated: 12-2010