

## Profile a Lake Handout

Students practice for the FCAT while studying lake depth, area, volume and water clarity.

### Introduction:

The Orange Water Atlas Website provides information about lakes, rivers, and watersheds in Orange County. Researchers, government officials, educators, and interested citizens can use this resource to learn more about the water bodies in their area. The website includes basic information like the lake’s size and location, as well as technical data like chemical analysis of the water and lists of the plants and aquatic insects that live there. A sample of data for five Orange County lakes is listed in the table below.

*Lake Size and Clarity*

<b>Name of Water Body</b>	<b>Lake Size (Surface area in acres)</b>	<b>Approximate Volume (gallons)</b>	<b>Maximum Lake Depth (feet)</b>	<b>Water Clarity (feet)</b>	<b>Water Quality</b>
Lake Baldwin	202	987,327,257	25	5.2	Good
Bay Lake	37	92,834,830	19	1.2	Fair
Lake Carlton	384	1,639,158,758	15	1.7	Fair
Lake Mary Jane	1,135	2,551,898,817	25	6.9	Good
Lake Condel	3	3,812,452	10 (?)	1.5	Poor

Homeowners are interested in lake size and clarity because they enjoy using their lakes for recreation, including swimming, boating, fishing and water skiing. Large, clear neighborhood lakes can also increase the property value of their homes. But how are lakes measured? The surface area of a lake can be measured in square feet or acres. One acre equals 43,560 square feet. If you compare this value to the area of a professional football field (57,600 square feet or roughly 1.3 acres), you can get a feel for the sizes of the lakes in this table. For example, Lake Kathryn’s surface area is equivalent to the size of 60 football fields.

Homeowners often become interested in lake volume during droughts, when the water level in their lake starts to drop. Lake volume is a measure of how much water each lake holds. A good comparison to use when thinking about lake volume is a tanker truck. The tanker trucks you see on the highway carry 9,000 gallons of gasoline. So Island Pond’s volume is equivalent to the amount of liquid that could fill 6,760 tanker trucks. And Island Pond is the smallest water body in the table. That’s a lot of water!

“Maximum Depth” shows how deep the lake is at its deepest point. To get a feel for the depths of these lakes, imagine that basketball player Shaquille O’Neal, is standing on the bottom of the lake in SCUBA gear. Shaq is 7 feet and 1 inch tall, so we’ll round that off to 7 feet to do our estimating. Rock

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Lake's depth (14 feet) is equivalent to approximately 2 Shaquille O'Neals, one standing on top of the other.

"Water Clarity" is also a measurement of depth, showing how far sunlight can penetrate through lake water. If the light can penetrate to the bottom, plants that are important to the lake's health can grow. Scientists assess water clarity using a tool called a "Secchi disk" (pronounced SEH-kee). This tool is a flat disk painted black and white in pie-shaped quarters. It hangs by a rope attached to the center of the disk. Scientists lower the disk down into the water, watching it as it descends. When they can no longer see the disk they know that light cannot travel beyond that depth. They stop lowering the disk and pull it up slowly. When they can see the disk's white and dark sections, they mark the rope, then pull up the disk. To get the actual clarity reading, they measure the distance between the mark on the rope (representing the water's surface) and the disk (which was at the deepest level light can reach). This is the distance light was able to travel through the water (in feet and tenths of feet). Since the water clarity value depends on a scientist's judgment and eyesight, it is considered an estimate.

Water clarity is important for more than just lake beauty. Algae or cloudiness in the water block sunlight causing problems for underwater plants and animals. Water clarity is an important factor in a lake's health. However, in Florida, it is not used to determine a water quality score because harmless leaves can also reduce clarity. The fallen leaves of cypress, oak, and other trees produce brown tannic acid, which darkens Florida's waters. This natural tea color can skew the water quality score, making it useless as an indicator. As a result, water *clarity* is not generally used to calculate water *quality* in Florida lakes.

Instead, water quality is based on amounts of plant nutrients, like nitrogen and phosphorous, as well as other factors including dissolved oxygen and the plants, animals, and bacteria that live in the waters. To learn more, read the FCAT-Friendly activity titled "Measuring Lake Quality" found on this website.

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### FCAT-Friendly Reading Questions:

1. Based on the information in the table, which of the following statements is accurate for the selected lakes?
  - a. Lake surface area increases as the lake’s water quality decreases.
  - b. Water quality increases as the lake’s depth increases.
  - c. Lake water volume increases as the lake’s surface area increases.
  - d. Water clarity increases as the lake’s maximum depth increases.
  
2. The following statement is included in the article: “As a result, water *clarity* is not generally used to calculate water *quality* in Florida lakes.” Why do you think the author chose to use italics on the words “clarity” and “quality”?
  - a. So the reader will be sure to notice the word “not” that falls between them.
  - b. So the reader will recognize the difference between these two similar words.
  - c. To encourage the reader to look these words up in the dictionary.
  - d. To show the reader that these are the main topics of the article.
  
3. Which of the following would be a good comparison when estimating large volumes of water?
  - a. The square footage of a football field.
  - b. The gallons in a tanker truck.
  - c. The height of Shaquille O’Neal.
  - d. The cloudiness of tannic water.
  
4. The article lists three reasons that homeowners might be interested in the data found on the Water Atlas Website. Based on your reading of the article, discuss three ways that this data could assist potential homebuyers in finding the most attractive and valuable property.

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### **FCAT-Friendly Writing Prompts:**

1. Florida's dark tannic waters can create spectacular reflections of trees and sky. Imagine that you've just read an editorial complaining about the brownish hue in many Florida lakes. Write an editorial of your own to persuade readers that brown lakes can be just as beautiful as clear lakes.
2. Lakefront property tends to have a high property value. Imagine that you arrive to view a property next to a lake has green, murky waters. Write to explain how this might affect your decision to purchase the property.
3. Dust and sand blowing off construction sites can decrease a lake's water clarity. Imagine that your lakefront property is receiving lots of dust from a nearby construction area. Write to persuade the construction manager to improve his dust control measures.
4. Lakes are often created in new housing developments to capture rainwater that runs off roadways. Imagine that you are a builder scheduled to construct homes in 1/3 of the community. Write to persuade the community planner to create three small lakes instead of one large lake.

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### FCAT-Friendly Math Questions:

- The environmental club at your school gets permission to study a nearby lake. Your first goal is to estimate the lake's surface area. The pond is roughly circular. By stepping off the distance around the lake, you find that the pond's circumference is approximately 1,170 feet. What is the lake's approximate acreage? Use your calculator and the following formulas to answer this question.

$$\text{circumference} = 2 \times \pi \times \text{radius}$$

$$\text{area} = \pi \times \text{radius}^2$$

$$1 \text{ acre} = 43,560 \text{ ft}^2$$

- The school's science teacher rows out into the lake and researches water clarity by lowering a Secchi disk at 10 different locations. Based on the following list of data, which of the following pairs represents the mode and the mean for the lake's water clarity?

Data List: 4, 6, 8, 7, 5, 4, 7, 4, 3, 6

- 3.3, 8.5
  - 4.0, 5.4
  - 5.4, 7.4
  - 6.0, 5.5
- Your next goal is to estimate the volume of water in the lake. Years ago, the sides of the lake were reinforced with concrete, so you know that the lake sides are vertical, not slanted. While out on the lake, the science teacher measures the depth at 10 different locations. The average depth of the lake is 8 feet. Use your calculator and the following formulas to choose the range that includes the approximate volume of this cylindrical lake.
    - 460 ft<sup>3</sup> – 550 ft<sup>3</sup>
    - 4,500 ft<sup>3</sup> – 4,700 ft<sup>3</sup>
    - 108,000 ft<sup>3</sup> – 110,000 ft<sup>3</sup>
    - 870,000 ft<sup>3</sup> – 873,000 ft<sup>3</sup>
  - Use the table titled "Lake Size and Clarity" to answer this question. Which of the following represents a water volume in this table?
    - $1.64 \times 10^6$
    - $2.55 \times 10^7$
    - $9.87 \times 10^8$
    - $3.81 \times 10^9$
  - Use the table titled, "Lake Size and Clarity" to answer this question. Which lake's clarity value is the greatest percentage of its maximum depth?
    - Lake Baldwin
    - Bay Lake
    - Lake Carlton
    - Lake Mary Jane