The Power of Water

Water power has been used for centuries as a source of energy, often to run mills, as it was at McKinney Falls. These mills may have ground corn or wheat, sawn lumber, or carded wool or cotton. Water power was even used to make ice on the San Marcos River. Today, there are hydroelectric plants, where water generates electricity to power lots of things.

Here in Texas, settlers were given an extra portion of land if they committed to building a mill. Since lumber was inexpensive, yet very heavy and costly to transport, often a sawmill was built just to provide boards for the immediate vicinity. Since saws didn't need speed, there weren't a lot of gears used to increase the turning of the water wheel; thus sawmills were relatively cheap to build and easy to maintain. In one day, a person could saw the equivalent of a week's worth of lumber made by hand in a sawmill.

Millers who ran the gristmills were often the well to do citizens. Besides being a farmer raising crops, the miller also received a portion of the grain brought in to be ground by neighbors. The gristmill ground the corn or wheat into flour for baking.

Today, individuals can install waterwheels to generate electricity. We can estimate the amount of power that a waterwheel installed at the dam at Barton Springs would generate. First we need to pick the best design.

Important things to consider in getting the most wattage from our waterwheel is the amount of water flow, the distance the water drops at the dam, or the head, and the efficiency of the wheel.

We can estimate the amount of flow by measuring the size of the opening the water moves through and the height of the water as it moves over the edge. This will give us the cubic feet per minute. The more flow, the more power is available.

Next, we will measure the distance from the top of the dam edge to the top of the water below. This is the head. The higher the head, the more power is available.

Lastly, we will consider the design of the water wheel. There are undershot wheels, overshot wheels, breast wheels, and tub wheels, each especially suited to a certain waterway and mill function.

<u>Estimating Horsepower</u>
The formula for estimating horsepower produced by a water wheel is this:
Constant x water flow x head or height of dam x efficiency of the wheel
The constant is what water contributes…its weight and acceleration, since that is what turns the wheel. It is always .1134

To estimate the water flow, measure the width of the dam opening and the height of the water flow over the top of the dam. Use the chart below to find the cubic feet per minute flow and multiply it times the width of the dam. To conert the cubic feet per second, divide by 60.

Depth on stake In inches	Cubic ft. per min. per inch in length
1.0	0.4
1.5	0.7
2.0	1.1
2.5	1.6
3.0	2.1
3.5	2.6
4.0	3.2
4.5	3.8
5.0	4.5
5.5	5.2
6.0	5.9
6.5	6.6
7.0	7.4
7.5	8.2
8.0	9.1
8.5	10.0
9.0	10.8
9.5	11.7

To find the Height of fall, measure the distance from the top of the dam opening to the top of the water below. This measurement needs to be in feet.

To estimate the efficiency of the wheel, a specific type of wheel needs to be chosen.

Type of Wheel	Efficiency
Overshot Wheel	75%
Undershot Wheel	40%
Breast Wheel	60%
Tub Wheel	30%
Cross Flow Turbine	60%

Horsepower = .1134 x ____________ cubic ft/sec x _________ft. x __________%
(constant) (flow) (height of fall) (efficiency)

1 Horsepower =740 watts
To convert the waterwheel power to electricity, the wheel will lose about half of its power. A single home needs 7000 watts for simple operation.