Investigating Hydroelectric Power Dams with My World GIS

Hydropower is energy that comes from the force of moving water. Most hydroelectric power plants are developed at dams. In this activity, you will use My World GIS to study and analyze hydroelectric power dams. You will

1. Query and analyze features of US hydroelectric power dams.
2. Query and analyze features of the 10 most powerful US hydroelectric power dams.
3. Create a new layer containing Pennsylvania hydroelectric power dams.
4. Query and analyze features of Pennsylvania hydroelectric power dams.

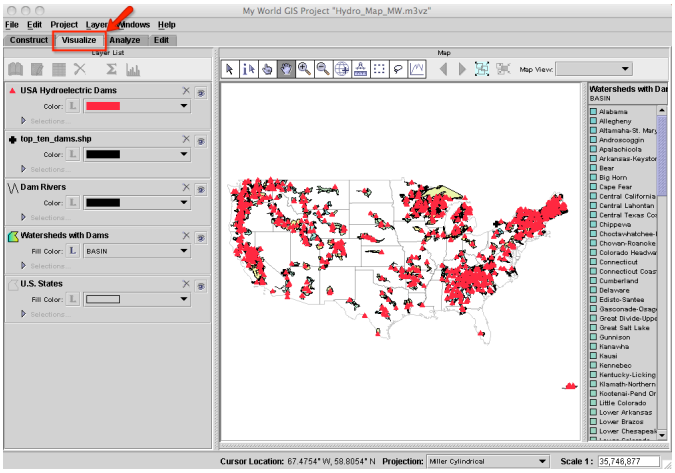
Read **all** instructions and answer **each** question on your worksheet.

Step 1: Download data.

a. Open your Web browser. Go to **www.ei.lehigh.edu/learners/energy/**

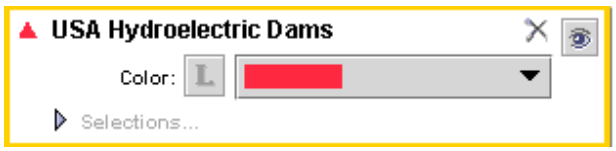
b. Click on **Investigating Hydroelectric Power Dams with My World GIS.**

Step 2: Load data in My World GIS.

a. **Double click** on the **Hydro_Map_MW.m3vz** icon.	
b. Check to make sure you are in the **visualize** mode (see arrow).	

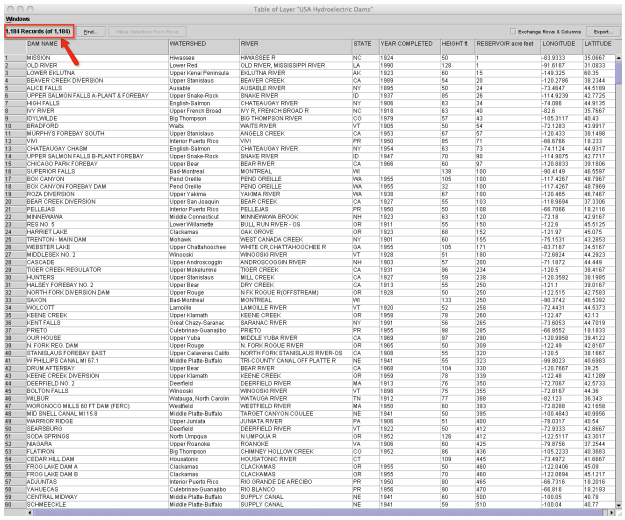
Step 3: Query and analyze US hydroelectric dams.

a. Click on the **USA Hydroelectric Dams** layer to make it active.

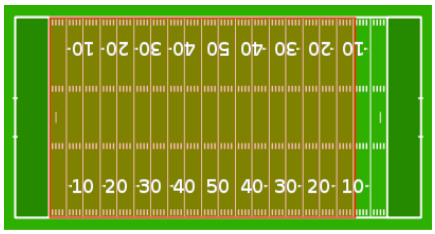


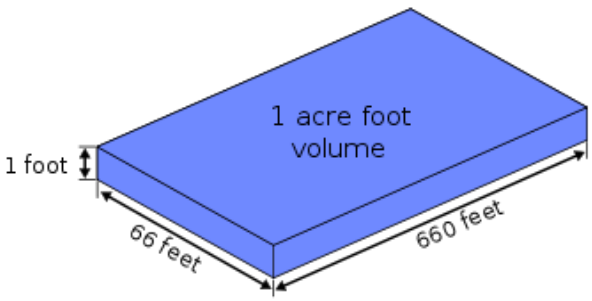
b. Click on the **table** icon on the **Layer List tool bar** (see arrow).

The data table contains 1,184 records (see arrow).



The information on the data table includes the location of the dam, the height of the dam (in feet), and the area of the reservoir behind the dam. The area behind the dam is measured in units of acre feet. One acre is about the size of a football field. One acre foot is about the size of a football field that is one foot deep (see figures below).





The figure on the left shows the area of one acre overlaid on an American football field. The figure on the right shows the volume of one acre foot.

c. Click on the **YEAR COMPLETED** column **once.** What happens to the column?

You should notice that the column title box is highlighed in white and the years are sorted in **ascending** order. The dam completed at the earliest date is at the top of the list.

Scroll down the table to row 1147. Note that this dam and the 37 records below it do not have a year listed. The completion date of these dams are not in the data table.

d. Click on the **YEAR COMPLETED** column **a second** time. What happens to the coulmn?

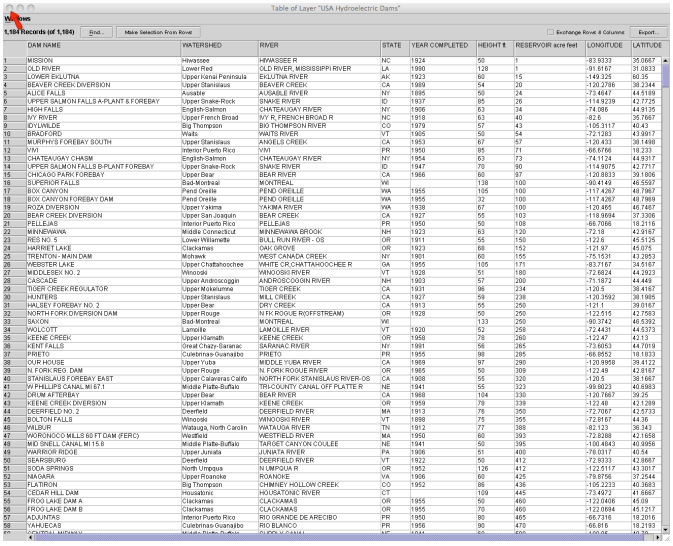
You should notice that the years are sorted in **descending** order. The dam most recently completed is at the top of the list.

e. Click on the **YEAR COMPLETED** column **a third** time. What happens to the column?

You should notice that the column title box is grey like the others in the table and the years are neither in ascending nor descending order. The years go back to their original order.

Use the USA Hydroelectric Dams data table to answer **questions 1 - 7** on your worksheet.

f. Close the data table for the **USA Hydroelectric Dams** (see arrow).

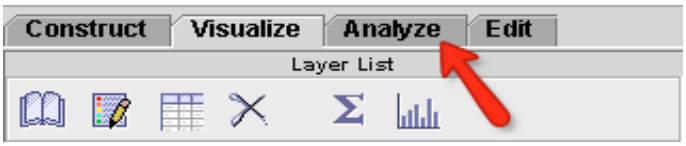
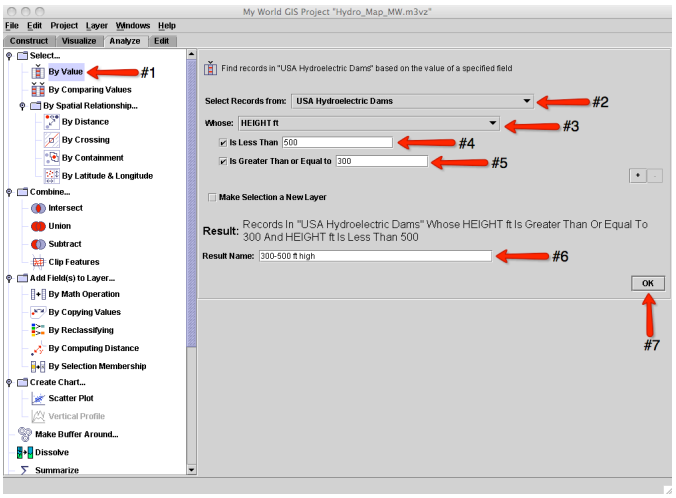
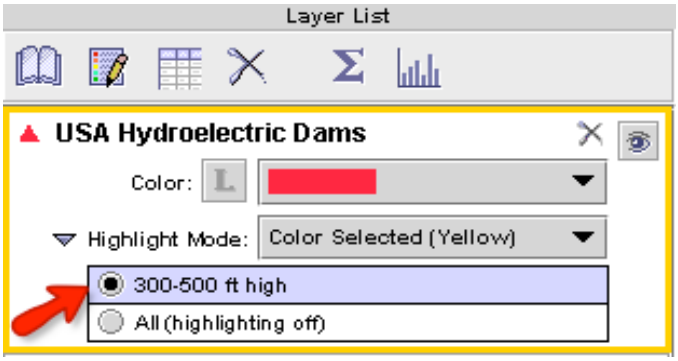
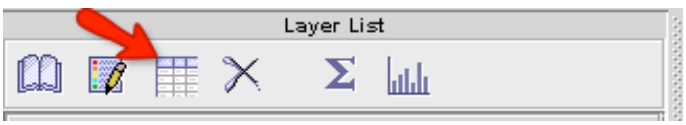


	DAM NAME	WATERSHED	RIVER	STATE	YEAR COMPLETED	HEIGHT ft	RESERVOIR acre feet	LONGITUDE	LATITUDE
1	MISSION	Hiwassee	HIWASSEE R	NC	1924	50	1	-83.9333	35.0667
2	OLD RIVER	Lower Red	OLD RIVER, MISSISSIPPI RIVER	LA	1990	128	1	-91.8167	31.0833
3	LOWER EKLUTNA	Upper Kenai Peninsula	EKLUTNA RIVER	AK	1923	60	15	-149.326	60.35
4	BEAVER CREEK DIVERSION	Upper Stanislaus	BEAVER CREEK	CA	1989	54	20	-120.2786	38.2344
5	ALICE FALLS	Ausable	AUSABLE RIVER	NY	1895	50	24	-73.4647	44.5189
6	UPPER SALMON FALLS A-PLANT & FOREBAY	Upper Snake-Rock	SNAKE RIVER	ID	1937	95	26	-114.9239	42.7725
7	HIGH FALLS	English-Salmon	CHATEAUGAY RIVER	NY	1906	63	34	-74.086	44.9135
8	IVY RIVER	Upper French Broad	IVY R. FRENCH BROAD R	NC	1918	63	40	-82.6	35.7667
9	IDYLWILDE	Big Thompson	BIG THOMPSON RIVER	CO	1979	57	43	-105.3117	40.43
10	BRADFORD	Waits	WAITS RIVER	VT	1905	50	54	-72.1283	43.9917
11	MURPHYS FOREBAY SOUTH	Upper Stanislaus	ANGELS CREEK	CA	1953	67	57	-120.433	38.1498
12	VIVI	Interior Puerto Rico	VIVI	PR	1950	95	71	-66.6766	18.233
13	CHATEAUGAY CHASM	English-Salmon	CHATEAUGAY RIVER	NY	1954	63	73	-74.1124	44.9317
14	UPPER SALMON FALLS B-PLANT FOREBAY	Upper Snake-Rock	SNAKE RIVER	ID	1947	70	90	-114.9075	42.7717
15	CHICAGO PARK FOREBAY	Upper Bear	BEAR RIVER	CA	1966	60	97	-120.8833	39.1806
16	SUPERIOR FALLS	Bad-Montreal	MONTREAL	WI		138	100	-90.4149	46.5597
17	BOX CANYON	Pend Oreille	PEND OREILLE	WA	1955	105	100	-117.4267	48.7967
18	BOX CANYON FOREBAY DAM	Pend Oreille	PEND OREILLE	WA	1955	32	100	-117.4267	48.7969
19	ROZA DIVERSION	Upper Yakima	YAKIMA RIVER	WA	1938	67	100	-120.465	46.7467
20	BEAR CREEK DIVERSION	Upper San Joaquin	BEAR CREEK	CA	1927	55	103	-119.9694	37.3306
21	PELLEJAS	Interior Puerto Rico	PELLEJAS	PR	1950	50	108	-66.7066	18.2116
22	MINNEWAWA	Middle Connecticut	MINNEWAWA BROOK	NH	1923	63	120	-72.18	42.9167
23	RES NO. 5	Lower Willamette	BULL RUN RIVER - OS	OR	1911	55	150	-122.8	45.5125
24	HARRIET LAKE	Clackamas	OAK GROVE	OR	1923	68	152	-121.97	45.075
25	TRENTON - MAIN DAM	Mohawk	WEST CANADA CREEK	NY	1901	60	155	-75.1531	43.2953
26	WEBSTER LAKE	Upper Chattahoochee	WHITE CR,CHATTAHOOCHEE R	GA	1955	105	171	-83.7167	34.5167
27	MIDDLESEX NO. 2	Winooski	WINOOSKI RIVER	VT	1928	51	180	-72.8824	44.2923
28	CASCADE	Upper Androscoggin	ANDROSCOGGIN RIVER	NH	1903	57	200	-71.1872	44.449
29	TIGER CREEK REGULATOR	Upper Mokelumne	TIGER CREEK	CA	1931	96	234	-120.5	38.4167
30	HUNTERS	Upper Stanislaus	MILL CREEK	CA	1927	59	238	-120.3592	38.1905
31	HALSEY FOREBAY NO. 2	Upper Bear	DRY CREEK	CA	1913	55	250	-121.1	39.0167
32	NORTH FORK DIVERSION DAM	Upper Rouge	N FK ROGUE R(OFFSTREAM)	OR	1928	50	250	-122.515	42.7583
33	SAXON	Bad-Montreal	MONTREAL	WI		133	250	-90.3742	46.5392
34	WOLCOTT	Lamoille	LAMOILLE RIVER	VT	1920	52	258	-72.4431	44.6373
35	KEENE CREEK	Upper Klamath	KEENE CREEK	OR	1958	78	260	-122.47	42.13
36	KENT FALLS	Great Chazy-Saranac	SARANAC RIVER	NY	1991	56	265	-73.6053	44.7019
37	PRIETO	Cuatrimas-Guamaibo	PRIETO	PR	1955	98	285	-66.6952	18.1833
38	OUR HOUSE	Upper Yuba	MIDDLE YUBA RIVER	CA	1969	97	290	-120.9958	39.4122
39	N. FORK REG. DAM	Upper Rouge	N. FORK ROGUE RIVER	OR	1965	50	309	-122.49	42.8167
40	STANISLAUS FOREBAY EAST	Upper Calaveras Califo	NORTH FORK STANISLAUS RIVER-OS	CA	1908	55	320	-120.5	38.1667
41	W PHILLIPS CANAL MI 67.1	Middle Platte-Buffalo	TRI-COUNTY CANAL OFF PLATTE R	NE	1941	55	323	-99.8023	40.6983
42	DRUM AFTERBAY	Upper Bear	BEAR RIVER	CA	1968	104	330	-120.7667	39.25
43	KEENE CREEK DIVERSION	Upper Klamath	KEENE CREEK	OR	1959	78	339	-122.48	42.1289
44	DEERFIELD NO. 2	Deerfield	DEERFIELD RIVER	MA	1913	76	350	-72.7067	42.5733
45	BOLTON FALLS	Winooski	WINOOSKI RIVER	VT	1898	75	355	-72.8167	44.36
46	HALBUR	Watauga, North Carolin	WATAUGA RIVER	TN	1912	77	388	-82.123	36.343
47	WORONOCO MILLS 60 FT DAM (FERC)	Westfield	WESTFIELD RIVER	MA	1950	60	393	-72.8288	42.1658
48	MID SNELL CANAL MI 15.8	Middle Platte-Buffalo	TARGET CANYON COULEE	NE	1941	50	395	-100.4843	40.9956
49	WARRIOR RIDGE	Upper Juniata	JUNIATA RIVER	PA	1906	51	400	-78.0317	40.54
50	SEARSBURG	Deerfield	DEERFIELD RIVER	VT	1922	50	412	-72.9333	42.8667
51	SODA SPRINGS	North Umpqua	N UMPQUA R	OR	1952	126	412	-122.5117	43.3017
52	NIAGARA	Upper Roanoke	ROANOKE	VA	1906	60	425	-78.8756	37.2544
53	FLATIRON	Big Thompson	CHIMNEY HOLLOW CREEK	CO	1952	86	436	-105.2233	40.3683
54	CEDAR HILL DAM	Housatonic	HOUSATONIC RIVER	CT		109	445	-73.4072	41.6667
55	FROG LAKE DAM A	Clackamas	CLACKAMAS	OR	1955	50	460	-122.0406	45.09
56	FROG LAKE DAM B	Clackamas	CLACKAMAS	OR	1955	70	460	-122.0694	45.1217
57	ADJUNTAS	Interior Puerto Rico	RIO GRANDE DE ARECIBO	PR	1950	80	465	-66.7316	18.2016
58	YAHUECAS	Cuatrimas-Guamaibo	RIO BLANCO	PR	1956	90	470	-66.816	18.2183

Step 4: Use the analysis tools to create new layers.

Let's investigate

- How many hydroelectric power dams are between 300 and 500 feet tall?
- How many dams on the Columbia River generate electricity?

a. Click on the **Analyze** tab above the **Layer List** (see arrow).	
b. Click **By Value** (see arrow #1). Click the box to the right of **Select Records from** and select **USA Hydroelectric Dams** from the list if it is not already selected (see arrow #2). Click the box to the right of **Whose** and select **HEIGHT ft** from the list (see arrow #3). **Check** the box to the left of **Is Less Than,** and type **500** in the text box (see arrow #4). **Check** the box to the left of **Is Greater Than or Equal to,** and type **300** in the text box (see arrow #5). Type **300-500 ft high** in the **Result Name** text box (see arrow #6). Click **OK** (see arrow # 7).	
My World GIS will add a sublayer called **300-500 ft high** to the **USA Hydroelectric Dams** layer (see arrow). Look at the map display. These dams are highlighted in yellow.	
c. Click on the **table** icon on the **Layer List tool bar**.	

Use the data table to answer **question 8** on your worksheet.

d. Close the 300-500 ft high window.

e. Click on the **Analyze** tab above the **Layer List**.

Click **By Value** (see arrow #1).

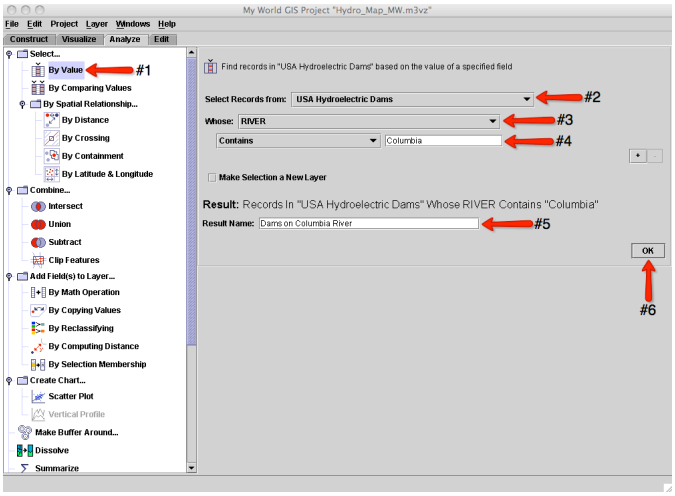
Click the box to the right of **Select Records from** and select **USA Hydroelectric Dams** from the list if it is not already selected (see arrow #2).

Click the box to the right of **Whose** and select **RIVER** from the list (see arrow #3).

Type **Columbia** in the text box to the right of **Contains** (see arrow #4).

Type **Dams on Columbia River** in the **Result Name** text box (see arrow #5).

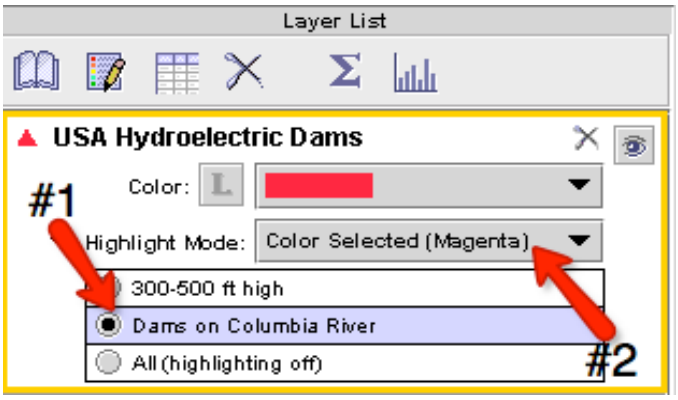
Click **OK** (see arrow #6).



My World GIS will add a sublayer called **Dams on Columbia River** to the **USA Hydroelectric Dams** layer (see arrow #1).

Click the box to the **right** of **Highlight Mode** and click on **Color Selected (Magenta)** (see arrow #2).

This will change the color of the dams on the Columbia River to Magenta.

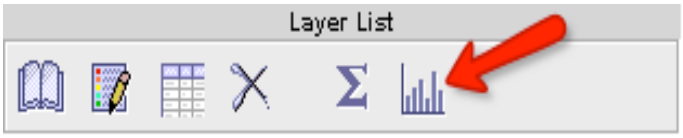


Use the GIS map and the Dams on Columbia River data table to answer **questions 9 - 13** on your worksheet.

Step 5: Query and analyze the 10 most powerful US hydroelectric dams.

a. Click on the **top_ten_dams.shp** layer to make it active.

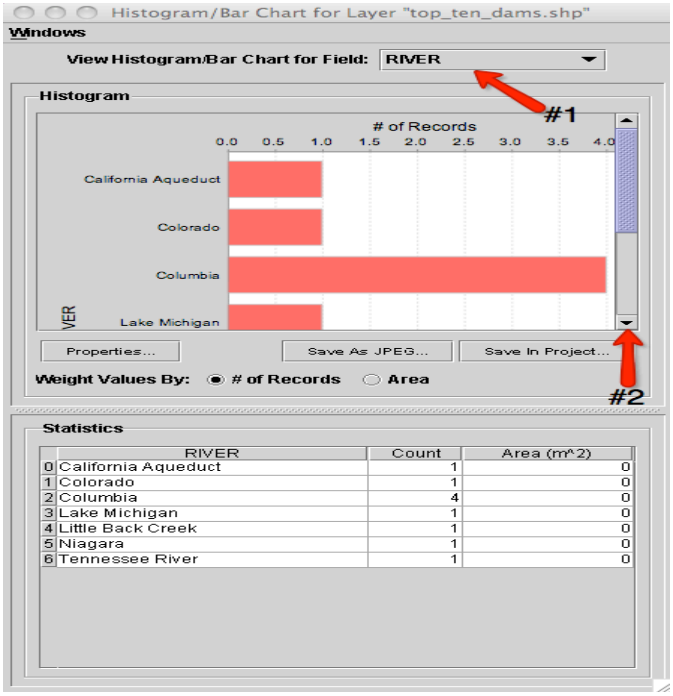
b. Click on the **histogram/bar chart** icon on the **Layer List tool bar** (see arrow).



c. Click on the box to the right of **View Histogram/Bar Chart for Field** and select **RIVER** (see arrow #1)**.**

The histogram/bar chart will display rivers that host the top 10 most powerful US hydroelectric power dams and the number of dams on each river.

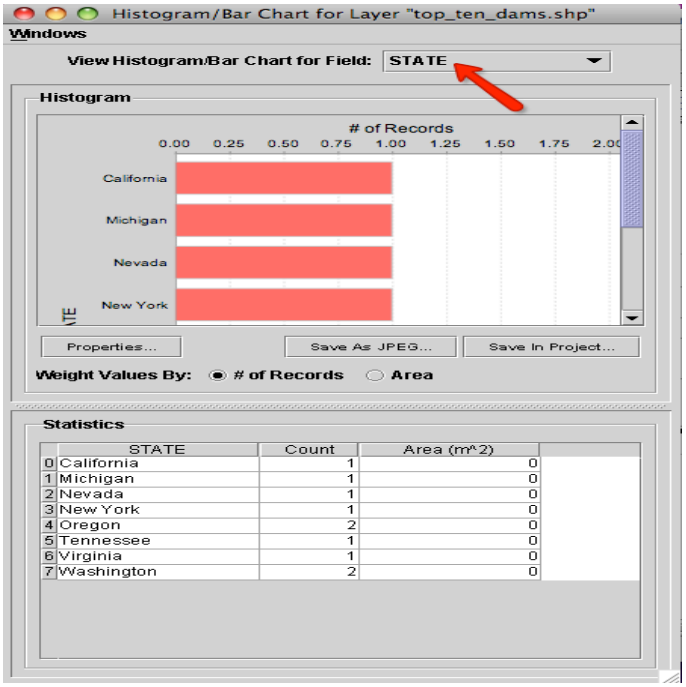
Scroll down to see the whole histogram/bar chart (see arrow #2).



Use the histogram/bar chart to answer **questions 14** and **15** on your worksheet.

d. Click on the box to the right of **View Histogram/Bar Chart for Field** and select **STATE** (see arrow).

The histogram/bar chart will display the states in which the top 10 most powerful US hydroelectric power dams are located and the number of dams in each state.



Use the histogram/bar chart to answer **question 16** on your worksheet.

e. Close the **Histogram/Bar Chart** window**.**

f. Click on the **table** icon on the **Layer List tool bar**.

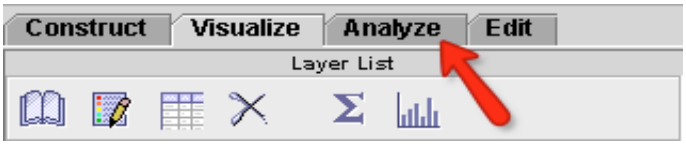
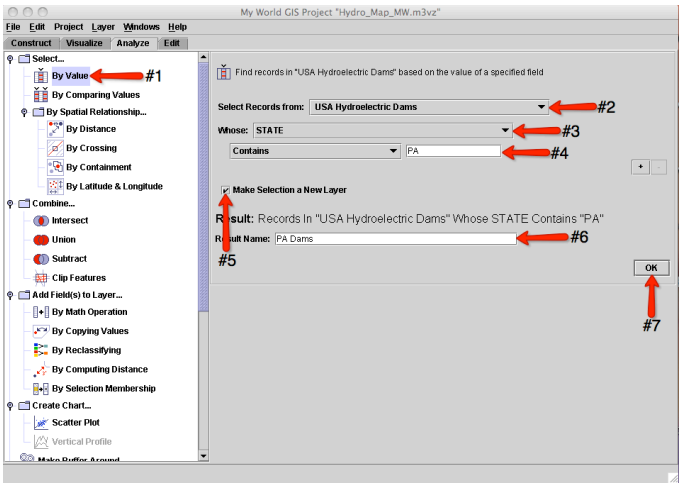
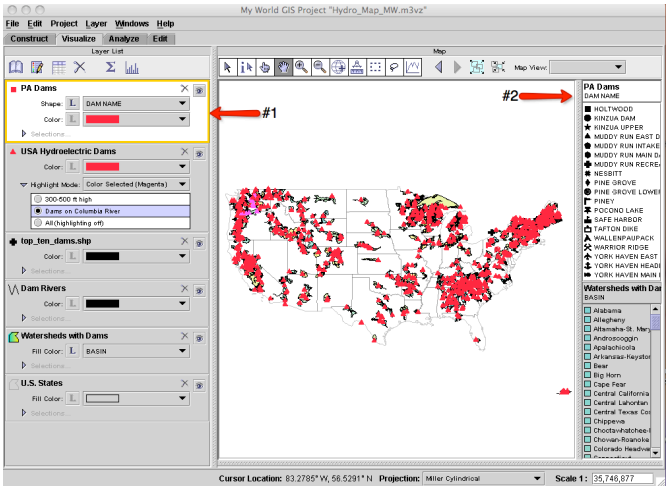
A data table for the **top ten dams** layer will open. This table includes a new field for these dams: CAPACITY MW.

This is the amount of energy production that the dam generates. The units are megawatts.
1 megawatt = 1,000,000 watts.

Recall that when your television is on, it uses about **150 Watts** of electricity each second it is on.

Use the table data to answer **questions 17 - 18** on your worksheet.

Step 6: Create a new GIS layer for Pennsylvania dams.

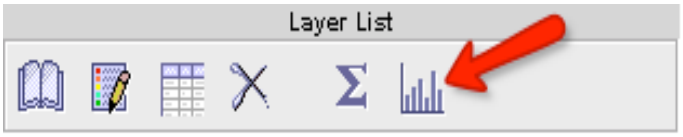
a. Click on the **Analyze** tab above the **Layer List** (see arrow).	
b. Click **By Value** (see arrow #1). Click the box to the right of **Select Records from** and select **USA Hydroelectric Dams** from the list (see arrow #2). Click the box to the right of **Whose** and select **STATE** from the list (see arrow #3). Type **PA** in the text box to the right of **Contains** (see arrow #4). **Check** the box to the left of **Make Selection a New Layer** (see arrow #5). Type **PA Dams** in the **Result Name** text box (see arrow #6). Click **OK** (see arrow #7).	
c. My World GIS will add a new layer called **PA Dams** to the Layer List (see arrow #1) and the names of the PA Dams in the panel on the right (see arrow #2).	

Step 7: Query and analyze hydroelectric power dams in Pennsylvania.

a. Click on the **table** icon on the **Layer List tool bar** (see arrow).

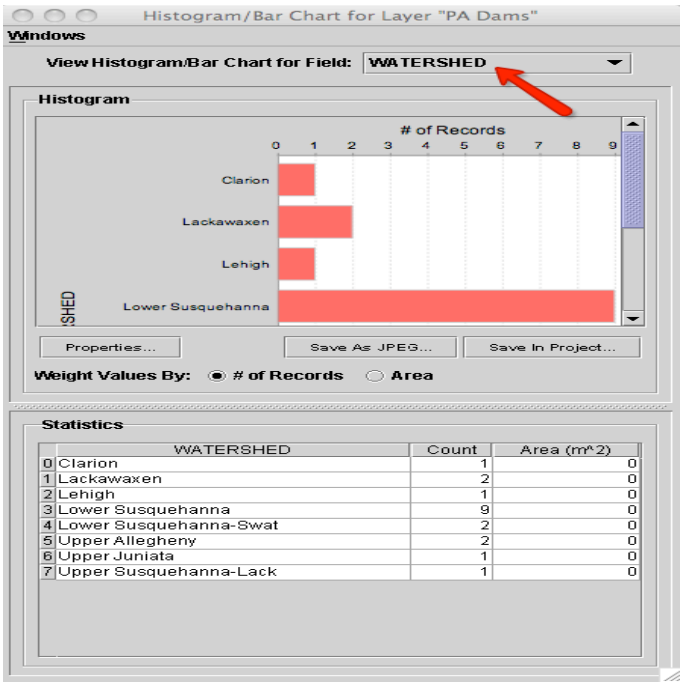
Use the PA Dams data table to answer the **questions 19 - 23** on your worksheet. Close your data table when you are finished.

b. Click on the **histogram/bar chart** icon on the **Layer List tool bar** (see arrow).



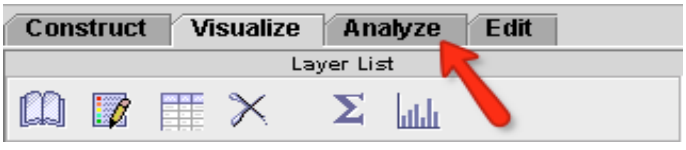
c. Click on the box to the right of **View Histogram/Bar Chart for Field** and select **WATERSHED** (see arrow).

The histogram/bar chart will display watersheds that host Pennsylvania hydroelectric power dams and the number of dams in each watershed.



Answer question **24** on your worksheet. Close your histogram when finished.

d. Click on the **Analyze** tab above the **Layer List**.



e. Click **By Value** (see arrow #1).

Click the box to the right of **Select Records from** and select **PA Dams** from the list (see arrow #2).

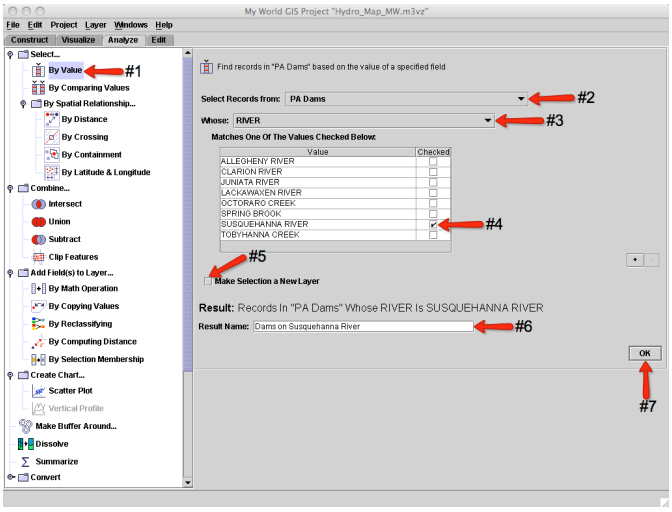
Click the box to the right of **Whose** and select **RIVER** from the list (see arrow #3).

Check the box to the right of **SUSQUEHANNA RIVER** (see arrow #4).

Uncheck the box to the left of **Make Selection a New Layer** (see arrow #5).

Type **Dams on Susquehanna River** in the **Result Name** text box (see arrow #6).

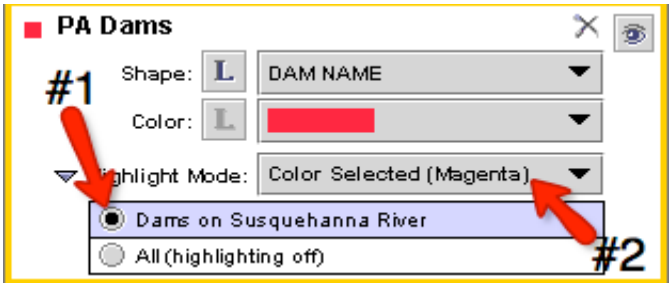
Click **OK** (see arrow #7).



My World GIS will add a sublayer called **Dams on Susquehanna River** to the **PA Dams** layer (see arrow #1).

Click the box to the **right** of **Highlight Mode** and click on **Color Selected (Magenta)** (see arrow #2).

This will change the color of PA dams on the Susquehanna River to Magenta.



Use the GIS map to answer **question 25** on your worksheet.

f. Click on the **table** icon on the **Layer List tool bar** (see arrow).

Use the data table to answer **question 26** on your worksheet.