## Investigating Hydroelectric Power Dams with My World GIS Teacher Guide

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

Model the following procedural instructions with your students. It is recommended that you display your computer image at the front of the classroom.



#### 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.

This downloads the Hydro\_Map\_MW.m3vz file on to your desktop (see icon below).





a. Double click on the Hydro\_Map\_MW.m3vz icon to open the file in My World GIS.

The window below should open on your computer. Check to make sure you are in the **visualize** mode (see arrow below).



Step 3: Query and analyze US hydroelectric dams. (Questions 1 - 5)

- a. Click on the first layer USA Hydroelectric Dams in the Layer List.
- b. Click on the **table** icon on the **Layer List tool bar** (see arrow below). A data table for the **USA Hydroelectric Dams** layer will open.



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

			Table of Layer OSA Hydroelecti	ic Dains					
Mindo	ws								
1,184	(ecolds (or 1,184) Make Selection Hid						L Exchang	e Movid & Columns	Export.
	DAM NAME	WATERSHED	RIVER	STATE	YEAR COMPLETED	HEIGHT ft	RESERVOIR acre feet	LONGITUDE	LATITUDE
	MISSION	Hiwassee	HMASSEE R	NC	1924	50	1	-83.9333	35.0667
	OLD RIVER	Lower Red	OLD RIVER, MISSISSIPPI RIVER	LA	1990	128	1	-91.6167	31.0833
	LOWER EKLUTNA	Upper Kenai Peninsula	EKLUTNA RIVER	AK	1923	60	15	-149.325	60.35
	BEAVER CREEK DIVERSION	Upper Stanislaus	BEAVER CREEK	CA	1989	54	20	-120 2786	38 2344
	ALICE FALLS	Ausable	AUSABLE RIVER	NY	1895	50	24	-73 4647	44 5189
	UPPER SALMON FALLS A-PLANT & FOREBAY	Upper Snake-Rock	SNAKE RIVER	ID	1937	85	26	-114 9239	42 7725
	HIGH FALLS	English-Salmon	CHATEAUGAY RIVER	NY	1906	63	34	-74.086	44 91 35
	NY RMER	Upper French Broad	IVY R FRENCH BROAD R	NC	1918	63	40	-82.6	35 7667
	DYLWILDE	Big Thompson	BIG THOMPSON RIVER	CO	1979	57	43	-105 3117	40.43
n	BRADEORD	Malte	WAITS RIVER	VT	1905	50	54	.721283	43 9917
ĭ	MURPHYS FORERAX SOLITH	I Inner Stanislaus	ANGELS CREEK	CA	1953	67	67	-120 433	381498
2	han	Interior Reports Rise	100000 Officery	DD	1050	05	74	66 6766	18 222
2	CHATEALICAY CHARM	English Solmon	CHATEAUGAY RA(ER	NIV.	1054	63	72	74 11 24	44.0217
	UPPER ON MONTONIA	English-Salinon	CHATEROOKT RIVER	191	1004	70	15	444.0075	44.0317
4	OFFER SALINON FALLS B-FLANT FOREBAT	Opper Snake-Rock	SNAKE RIVER	10	1947	70	80	-114.9075	92.1711
-	CHICAGO PARK FOREBAT	opper bear	DEAR RIVER	UA	1800	00	87	-120.0033	38.1606
0	SUPERIOR FALLS	Diad-Montreal	MUNIREAL	NVI		138	100	-90.4149	46.5597
(	BUX CANYON	Pena Ureille	PEND OREILLE	DVA.	1955	105	100	-117.4267	48.7967
8	BUX CANYON FOREBAY DAM	Pend Oreille	PEND OREILLE	WA.	1955	32	100	-117.4267	48.7959
9	ROZA DIVERSION	Upper Yakima	YAKIMA RIVER	WA	1938	67	100	-120.465	46.7467
0	BEAR CREEK DIVERSION	Upper San Joaquin	BEAR CREEK	CA	1927	55	103	-118.9594	37.3306
	PELLEJAS	Interior Puerto Rico	PELLEJAS	PR	1950	50	108	-66.7066	18.2116
2	MINNEWAWA	Middle Connecticut	MINNEWAWA BROOK	NH	1923	63	120	-72.18	42.9167
3	RES NO. 5	Lower Willamette	BULL RUN RIVER - 0S	OR	1911	55	150	-122.6	45.5125
1	HARRIET LAKE	Clackamas	OAK BROVE	OR	1923	68	152	-121.97	45.075
5	TRENTON - MAIN DAM	Mohawk	WEST CANADA CREEK	NY	1901	60	155	-75 1531	43 2853
	WEBSTERLAKE	Upper Chattaboothee	WHITE CR CHATTAHOOCHEE R	GA	1955	105	171	-83 7167	34 51 67
7	MIDDLESEX NO. 2	Minneski	WINDOSKI RIVER	VT	1928	51	180	.72 6824	44 7923
8	CASCADE	I Inner Androsconnin	ANDROSCOBOIN RIVER	NH	1903	57	200	-71 1877	44.449
o	TIGER CREEV REGULATOR	Linner Mekelumen	TIGED ODEEK	CA	1021	05	224	170.6	28.4167
°	IN INTERNAL	Opper in okeronne	MILL ODDERK	OA.	4007	50	204	420.0500	30.4107
	HONIERS	Opper Stamsaus	MILL UREEK	CA	1927	58	230	-120.3582	30.1905
	HALSET FOREBATINO. 2	opper bear	DRICKEEK	CA	1913	00	250	-121.1	38.0167
2	NORTH FORK DIVERSION DAM	Upper Houge	IN FK RUGUE R(UFFSTREAM)	UR	1928	50	250	-122.515	42.7583
3	SAXON	Bad-Montreal	MUNIREAL	pavi -		133	250	-90.3742	46.5392
4	WOLCOTT	Lamoille	LAMOILLE RIVER	VT	1920	52	258	-72.4431	44.5373
5	KEENE CREEK	Upper Klamath	KEENE CREEK	OR	1958	78	260	-122.47	42.13
6	KENT FALLS	Great Chazy-Saranac	SARANAC RIVER	NY	1991	56	265	-73.6053	44.7019
7	PRIETO	Culebrinas-Guanajibo	PRIETO	PR	1955	98	285	-66.8552	18.1833
8	OUR HOUSE	Upper Yuba	MIDDLE YUBA RIVER	CA	1969	97	290	-120.9958	39.4122
3	N. FORK REG. DAM	Upper Rouge	N. FORK ROGUE RIVER	OR	1965	50	309	-122.49	42.8167
ð	STANISLAUS FOREBAY EAST	Upper Calaveras Califo	NORTH FORK STANISLAUS RIVER-OS	CA	1908	55	320	-120.5	38.1667
1	W PHILLIPS CANAL MI 67.1	Middle Platte-Buffalo	TRI-COUNTY CANAL OFF PLATTE R	NE	1941	55	323	-99.8023	40.6983
2	DRUM AFTERBAY	Upper Bear	BEAR RIVER	CA	1968	104	330	-120.7667	39.25
3	KEENE CREEK DIVERSION	Upper Klamath	KEENE CREEK	OR	1959	78	339	-122.48	421289
4	DEERFIELD NO. 2	Deerfield	DEERFIELD RIVER	MA	1913	76	350	-72 7067	42 5733
5	BOLTON FALLS	Winneski	WINDOSKI RIVER	VT	1898	75	355	-72 8167	44.36
	MURUR	Mistaurca North Carolin	WATALIGA RIVER	TN	1017	77	388	-87173	36 343
	MORONOCO MILLS 50 ET DAM (EERC)	Medicid	WESTERI D RIVER	MA	1950	60	393	-77 8288	47 1658
2	MID ONELL CANAL ML16 9	Middle Blatte Buttale	TARGET CANYON COLLER	NIC N	1041	50	205	100 4942	40.0056
_	WID SNEEL CANAL MITTO	line as his iste	INNOET CHITTON CODEEL	DA	1041	50	100	70.004040	40.8530
2		Opper contata Decederal	DEEDER D DATE	N/T	1000	50	400	70.0017	10.04
	DODA ODDINOD	Deemeid	DEERFIELD RIVER	07	1922	50	412	-72.8333	42.000/
	DUDK OFRINGD	Norm Ompdua	NUMPUOR	UR	1852	120	412	-122.5117	\$3.3017
	NIAUAHA	upper Roanoke	RUANUKE	VA	1906	60	425	-/9.8/56	37.2544
5	FLATIRON	Big Inompson	CHIMINEY HULLOW CREEK	CU	1952	86	436	-105.2233	40.3683
1	CEDAR HILL DAM	Housatonic	HOUSATONIC RIVER	CT		109	445	-73.4972	41.6667
5	FROG LAKE DAM A	Clackamas	CLACKAMAS	OR	1955	50	460	-122.0406	45.09
5	FROG LAKE DAM B	Clackamas	CLACKAMAS	OR	1955	70	460	-122.0694	45.1217
7	ADJUNTAS	Interior Puerto Rico	RIO GRANDE DE ARECIBO	PR	1950	80	465	-66.7316	18.2016
		Outsheimen Outstalling	RIO RI ANICO	DD	1056	an	470	-66.816	18 21 93
8	YAHUECAS	Coleonnas-Oranation	INO DEALINGO	115	1000	00	41.0	00.010	
8 9	CENTRAL MIDWAY	Middle Platte-Buffalo	SUPPLY CANAL	NE	1841	60	500	-100.05	40.78

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 **area** size of a football field. The figure on the left shows the area of one acre overlaid on an American football field.

One acre foot is about the **volume** size of a football field that is one foot deep. The figure on the right shows the volume of one acre foot. It is a volume that would hold 325,851 gallons of water.





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 belows 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.



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Instruct students to use the USA Hydroelectric Dams data table to answer **questions 1 - 5** on their investigation sheet.

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

Table of Layer "USA Hydroelectric Dams"

1,184 Records (of 1,184) Ind Make Selection From Howe					Export				
	DAM NAME	WATERSHED	RNER	STATE	YEAR COMPLETED	HEIGHT ft	RESERVOIR acre feet	LONGITUDE	LATITUDE
	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	-91.6167	31.0833
3	LOWER EKLUTNA	Upper Kenai Peninsula	EKLUTNA RIVER	AK	1923	60	15	-149.325	60.35
1	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
3	UPPER SALMON FALLS A-PLANT & FOREBAY	Upper Snake-Rock	SNAKE RIVER	ID	1937	85	28	-114.9239	42.7725
7	HIGH FALLS	English-Salmon	CHATEAUGAY RIVER	NY	1906	63	34	-74.086	44.9135
3	IVY RIVER	Upper French Broad	IVY R, FRENCH BROAD R	NC	1918	63	40	-82.6	35.7667
3	DYLWILDE	Big Thompson	BIG THOMPSON RIVER	CO	1979	57	43	-105.3117	40.43
10	BRADFORD	Walts	WAITS RIVER	VT	1905	50	54	-72.1283	43.9917
11	MURPHYS FOREBAY SOUTH	Upper Stanislaus	ANGELS CREEK	CA	1953	67	67	-120.433	38.1498
12	VIVI	Interior Puerto Rico	VN	PR	1950	85	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	Linner Snake-Rock	SNAKE RIVER	ID	1947	20	90	-114 9075	427717
15	CHICABO PARK FOREBAY	Linner Rear	REAR RIVER	CA	1966	60	97	120 8833	39.1806
16	STIPEDIOD FALLS	Part-Montreal	MONTREAL	ALC: NOT	1000	129	100	-90 41 49	46.5597
17	BOX CANYON	Pend Oreille	PEND ORFLUE	VMA	1955	105	100	117 4767	48 7967
18	BOX CANYON FOREBAY DAM	Pend Oreille	PEND OREILLE	VNA.	1955	32	100	117 4267	49 7969
10	DOT ON CANTON FOR DATE DAM	Line of Chines	VERD ONEILLE	1100	1000	32	100	100.484	40.1808
19	PEAD ODEEN DIVERSION	Upper Fakina	DEAD ODEEK	01	1930	07	100	120.403	40.1407
20	DEAR CREEK DIVERSION	Opper San Joaquin	DEAR UREEN	0D	1927	55	100	-110.9084	31.3300
21	PELLEJAS	Intenor Puerto Rico	PELLEJAS	PR	1950	50	108	-00.7000	18.2116
44	DEC NO. C	Mildale Connecticat	DULL DUDLOUGD 00	NH OD	1925	0.5	120	-72.10	42.3107
23	RES NO. 5	Lower williamede	BULL RON RIVER - 05	UR	1911	00	150	-122.0	45.5125
24	HARRIET LAKE	Clackamas	UAR GROVE	UR	1923	08	152	-121.97	45.075
15	TRENTON - MAIN DAM	Monawk	WEST CANADA CREEK	NY	1901	60	155	-75.1531	43.2853
26	WEBSTER LAKE	Upper Chattahoochee	WHITE CR, CHATTAHOUCHEE R	GA	1966	105	171	-83.7167	34.5167
27	MIDDLESEX NO. 2	Winooski	WINOOSKI RIVER	VT	1928	51	180	-72.6824	44.2923
28	CASCADE	Upper Androscoggin	ANDROSCOGGIN RIVER	NH	1903	57	200	-71.1872	44.449
29	TIGER CREEK REGULATOR	UpperMokelumne	TIGER CREEK	CA	1931	96	234	-120.5	38.4167
30	HUNTERS	Upper Stanislaus	MILL CREEK	CA	1927	59	238	-120.3592	38.1985
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	44.5373
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	Culebrings-Guanalibo	PRIETO	PR	1955	98	285	-56.8552	18.1833
38	OUR HOUSE	Upper Yuba	MIDDLE YURA RIVER	CA	1969	97	290	-120 9958	39.4122
39	N FORK REG DAM	Lipper Rouge	N. FORK ROOLE RIVER	0B	1965	50	309	-122.49	42.8167
40	STANISI ALIS FOREBAY FAST	Linner Calaveras Califo	NORTH FORK STANISI ALIS RIVER-OS	CA	1908	55	320	120.5	38 1667
41	W PHILLIPS CANAL ML67.1	Middle Platte-Buffalo	TRI-COUNTY CANAL OFF PLATTE R	NE	1941	55	323	-99.8023	40.6983
17	DRI M AFTERBAY	Linner Rear	REAR RIVER	CA	1968	104	330	120 7667	39.75
12	VEENE OREEV DIVERSION	Linner klamath	VEENE ODEEV	OR	1959	78	339	122.49	421299
14	DEEDELED NO. 2	Dearfield	DEEDELD DIVED	MA	1012	76	260	72 7067	42.6722
46	POLTON FALLS	Maccold	MINIOORIA DI/ED	N/T	1909	76	266	72.9167	44.36
10	MAL DUD	Motorene Medit Corolin	WINDOWN RIVER	Thi	1010	22	200	02.102	26.242
40	WODONCOO MILLO SE ET DAM (EEDO)	Washing a reprint carolin	INTROOM RIVER	N/A	1012	50	300	72.0200	40.345
41	WORONOCO MILLIS BUPT DAM (PERC)	Westield	TABOST CANNON COLUES	NUC.	1950	60	383	-72.0200	42.1000
10	MID ONELL CANAL MI 15.8	Minute riabe-Bullato	INNOCI CANTON COULEE	DA	1041	84	380	70.0343	40.6800
42	acapponing a	opper Juniata	DOMALA RIVER	PA NOT	1300	51	400	70.0317	40.94
00	SEARSBURG	Destield	DEERFIELD RIVER	V 1	1822	50	912	-72.8333	42.0667
21	SULA SPRINGS	North Umpqua	N UMPGUA R	UK	1902	120	412	122.0117	43.3017
2	NIAGAHA	Upper Roanoke	HUANUKE	VA	1906	60	425	-79.8756	31.2544
53	FLATIRON	Big Thompson	CHIMNEY HULLOW CREEK	CO	1952	86	436	-105.2233	40.3683
54	CEDAR HILL DAM	Housatonic	HOUSATONIC RIVER	CT		109	445	-73.4972	41.6667
55	FROG LAKE DAM A	Clackamas	CLACKAMAS	0R	1955	50	460	-122.0406	45.09
56	FROG LAKE DAM B	Clackamas	CLACKAMAS	0R	1966	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	Culebrinas-Guanajibo	RIO BLANCO	PR	1956	90	470	-66.816	18.2193
10	ODATEDAL MICHARAM	Middle Bloke Dollate	DUDDLY CANAL	A UT	Lanua.	100	600	100.06	40.70

# Step 4: Use the analysis tools to create a new layer. (Questions 6 - 10)

How many hydroelectric power dams are between 300 and 500 feet tall? We are going to create a new GIS layer that will display all the hydroelectric power dams that are between 300 and 500 feet tall.

a. Click on the **Analyze** tab above the **Layer List** (see arrow below).



My World GIS will display the window below.



b. Click By Value (see arrow #1 below).

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 below).

Click the box to the right of **Whose** and select **HEIGHT ft** from the list (see arrow #3 below). **Check** the box to the left of **Is Less Than**, and type **500** in the text box (see arrow #4 below). **Check** the box to the left of **Is Greater Than or Equal to**, and type **300** in the text box (see arrow #5 below).

Type **300-500 ft high** in the **Result Name** text box (see arrow #6 below). Click **OK** (see arrow # 7 below).

000	My World GIS Project "Hydro_Map_MW.m3vz"
<u>File E</u> dit Project <u>L</u> ayer <u>Wi</u> ndows <u>H</u> elp	
Construct Visualize Analyze Edit	
♀ 📑 Select	▲
📋 By Value 🔶 #1	Find records in "USA Hydroelectric Dams" based on the value of a specified field
By Comparing Values	
🌳 📺 By Spatial Relationship	Select Records from: USA Hydroelectric Dams
- 🤔 By Distance	Whose: HEIGHT ft 🔹 🖌 🚽 📲
By Crossing	🗹 Is Less Than 500 44
- 💽 By Containment	Is Greater Than or Equal to 300 45
By Latitude & Longitude	
🌵 🗂 Combine	Make Selection a New Laver
– 🚺 Intersect	
– 🌐 Union	Result: Records In "USA Hydroelectric Dams" Whose HEIGHT ft Is Greater Than Or Equal To
- 🚺 Subtract	300 And HEIGHT IT IS Less Than 500
Clip Features	Result Name: 300-500 ft high #6
🌵 📑 Add Field(s) to Layer	
- [+] By Math Operation	
- 🌌 By Copying Values	T
– 🚼 By Reclassifying	
- 🛃 By Computing Distance	#7
By Selection Membership	
🌳 📑 Create Chart	
Scatter Plot	
Vertical Profile	
- 🂝 Make Buffer Around	
- <b>H+</b> Dissolve	
– <b>5</b> Summarize	

My World GIS will add a sublayer called **300-500 ft high** to the **USA Hydroelectric Dams** layer (see arrow below).

Look at map display. These dams are highlighted in yellow.

Layer List				
🕮 😰 🏢 🗙 Σ 🛄				
🔺 USA Hydroelectric Dams 🛛 🗙	۲			
Color: L				
➡ Highlight Mode: Color Selected (Yellow) ▼				
🗩 🖲 300-500 ft high				
All (highlighting off)				

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

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Instruct students to use the data table to answer **question 6** on their investigation sheet.

d. Close the 300-500 ft high window.

How many dams on the Columbia River generate electricity?

e. Click on the Analyze tab above the Layer List. Click By Value (see arrow #1 below).
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 below).
Click the box to the right of Whose and select RIVER from the list (see arrow #3 below). Type **Columbia** in the text box to the right of **Contains** (see arrow #4 below). Type **Dams on Columbia River** in the **Result Name** text box (see arrow #5 below). Click **OK** (see arrow #6 below).

000	My World GIS Project "Hydro_Map_MW.m3vz"	
<u>File E</u> dit Project <u>L</u> ayer <u>W</u> indows <u>H</u> elp		
Construct Visualize Analyze Edit		
♀ 📑 Select	▲ 	
– 📋 By Value 🔶 #1	Find records in "USA Hydroelectric Dams" based on the value of a specified field	
– 📑 By Comparing Values	4 mm #2	
🌵 📑 By Spatial Relationship	Select Records from: USA Hydroelectric Dams	
By Distance	Whose: RIVER - #3	
- By Crossing	Contains  Columbia  4	
By Containment		• -
By Latitude & Longitude	Make Selection a New Layer	
💡 📑 Combine		
– 🕦 Intersect	Result: Records In "USA Hydroelectric Dams" Whose RIVER Contains "Columbia"	
— 🄲 Union	Result Name: Dams on Columbia River #5	
- 🚺 Subtract		OK
Clip Features		
🌳 📑 Add Field(s) to Layer		T
- [+] By Math Operation		
By Copying Values		#6
- Survey By Reclassifying		
- 🚰 By Computing Distance		
By Selection Membership		
🌳 📑 Create Chart		
- 💉 Scatter Plot		
Vertical Profile		
- 😵 Make Buffer Around		
Dissolve		
- 5 Summarize	▼	

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

Layer List					
🕮 🕼 💥 Χ 🛄					
🔺 USA Hydroelectric Dams 🛛 🗙	۲				
#1 Color: 🔳 💻 🔻					
Highlight Mode: Color Selected (Magenta)					
300-500 ft high					
🖲 Dams on Columbia River					
All (highlighting off) #2					

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f. Click the box to the **right** of **Highlight Mode** and click on **Color Selected (Magenta)** (see arrow #2 above). This will change the color of the dams on the Columbia River to Magenta.

Instruct students to use the GIS map and the Dams on Columbia River data table to answer **questions 7 - 10** on their investigation sheet.

## Step 5: Query and analyze the 10 most powerful US hydroelectric dams. (Questions 11 - 15)

- a. Click on the second layer top\_ten\_dams.shp in the Layer List.
- b. Click on the **histogram/bar chart** icon on the **Layer List tool bar** (see arrow below). A histogram/bar chart for the **top ten dams** layer will open.



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



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Instruct students to use the histogram/bar chart to answer **questions 11** and **12** on their investigation sheet.

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

Instruct students to use the histogram/bar chart to answer **question 13** on their investigation sheet.

- e. Close the Histogram/Bar Chart window.
- f. Click on the **table** icon in 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 is equal to 1,000,000 watts. Recall that when your television is on, it uses about **137** *Watts* of electricity each second it is on.



Instruct students to use the table data to answer **questions 14** and **15** on their investigation sheet.



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

a. Click on the Analyze tab above the Layer List. Click By Value.
Click the box to the right of Select Records from and select USA Hydroelectric Dams from the list. Click the box to the right of Whose and select STATE from the list. Type PA in the text box to the right of Contains.
Check the box to the left of Merce Selection e New Leven (see below)

Check the box to the left of Make Selection a New Layer (see below).

### Make Selection a New Layer

Type **PA Dams** in the **Result Name** text box. Click **OK**.

My World GIS will add a new layer called **PA Dams** to the Layer List (see arrow #1 below) and the names of the PA Dams in the panel on the right (see arrow #2 below).

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000	My World GIS Project "Hydro_Map_MW.m3vz"	
File Edit Project Layer Windows Help		
Construct Visualize Analyze Edit		
Layer List	Map	
	▶ i ▶ 💩 🖤 🔍 🗣 🏯 💠 👂 🖉 🖌 Map View.	-
PA Dams 🗡 🗃	#2	PA Dams DAM NAME
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1 US hudroologtrig Dame		MUDDY RUN INTAKE
		MUDDY RUN MAIN D
Color:		* NESBITT
∀ Highlight Mode: Color Selected (Magenta)     ▼		PINE GROVE
300-500 ft high		PINE GROVE LOWER
Dams on Columbia River		POCONO LAKE
All (highlighting off)		SAFE HARBOR
		TAFTON DIKE
top_ten_dams.shp × 3		WARRIOR RIDGE
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Selections		YORK HAVEN HEADI YORK HAVEN HEADI
14 Dam Divers		Metershade with Des
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7 Watersheds with Dams		🔲 Altamaha-St. Mary 🚝
	N ( 1997)	Androscoggin Analachicola
Fill Color: L BASIN		Arkansas-Keystor
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U.S. States		Cape Fear
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		Chowan-Roanoke
		Colorado Headwa
J		
	Cursor Location: 83.2785° W, 56.5291° N Projection: Miller Cylindrical V Scale	1: 35,746,877

Step 7: Query and analyze hydroelectric power dams in Pennsylvania. (Questions 16 - 23)

a. Click on the **table** icon on the **Layer List tool bar**. A data table for the **PA Dams** layer will open.



Instruct students to use the PA Dams data table to answer the **questions 16 - 20** on their investigation sheet.

- b. Click on the **histogram/bar chart** icon don the **Layer List tool bar**. A histogram/bar chart for the **PA Dams** layer will open.
- c. Click on the box to the right of View Histogram/Bar Chart for Field and select WATERSHED. The histogram/bar chart will display watersheds that host Pennsylvania hydroelectric power dams and the number of dams in each watershed.

d. Click on the Analyze tab above the Layer List. Click By Value (see arrow #1 below).
Click the box to the right of Select Records from and select PA Dams from the list (see arrow #2 below).
Click the box to the right of Whose and select RIVER from the list (see arrow #3 below).

Instruct students to answer question **21** on their investigation sheet.

Check the box to the right of SUSQUEHANNA RIVER (see arrow #4 below). Uncheck the box to the left of Make Selection a New Layer (see arrow #5 below). Type Dams on Susquehanna River in the Result Name text box (see arrow #6 below). Click OK (see arrow #7 below).

000	My World GIS Project "Hydro Map MW.m3yz"
File Edit Project Layer Windows Help	
Construct Visualize Analyze Edit	
♀ 📑 Select ▲	·
– 📋 By Value <del>////////////////////////////////////</del>	Find records in "PA Dams" based on the value of a specified field
<ul> <li>         —          <u> <u> </u></u></li></ul>	
🍳 🗂 By Spatial Relationship	Select Records from: PA Dams The HZ
- 🤔 By Distance	Whose: RIVER - #3
- 🖉 By Crossing	Matches One Of The Values Checked Below:
- 🔂 By Containment	Value Checked
By Latitude & Longitude	
🕈 🗖 Combine	JUNIATA RIVER
- () Intersect	OCTORARO CREEK
– 🛑 Union	SUSQUEHANNA RIVER
- () Subtract	
Clip Features	<b>→#5</b>
🌳 📑 Add Field(s) to Layer	
- []+[] By Math Operation	Make Selection a New Layer
- 🚱 By Copying Values	Result: Records In "PA Dams" Whose RIVER IS SUSQUEHANNA RIVER
- 📴 By Reclassifying	Result Name: Dams on Susquehanna River 46
- 🔥 By Computing Distance	
By Selection Membership	ОК
🕈 📑 Create Chart	1
- 💉 Scatter Plot	
Vertical Profile	#7
- 🎯 Make Buffer Around	
- <b>B</b> + Dissolve	
− ∑ Summarize	
🗣 📑 Convert 🗸	
<u>r</u>	

My World GIS will add a sublayer called **Dams on Susquehanna River** to the **PA Dams** layer.

Click the box to the **right** of **Highlight Mode** and click on **Color Selected (Magenta)**. This will change the color of PA dams on the Susquehanna River to Magenta.

Instruct students to use the GIS map to answer **question 22** on their investigation sheet.

e. Click on the **table** icon on the **Layer List tool bar**. A data table for **Dams on Susquehanna River** sublayer will open.



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Instruct students to use the data table to answer **question 23** on their investigation sheet.