Read All About It

Students become familiar with current environmental topics by reporting on newspaper, internet and/or television news stories.

Level(s): 6-8

Subject(s): Life Science, Earth Science, Civics, English

Virginia SOLs: Which science SOLs are covered depends on the individual story.
English SOLs: 6.1 a; 6.2 d,e,f; 6.3 d; 6.4 h; 6.5 a,c,d,e,g; 7.1; 7.4; 7.5 g; 7.6; 7.7; 8.2; 8.6 b,f,g, h, i

Objectives:
Students will be able to:

1. Locate news stories about the environment that are currently being reported in newspapers, on the internet or on television.

2. Summarize at least three environmental topics that are currently in the news.

Materials:
Student handout: *Searching the News*

Estimated Time:
55 – 90 minutes

Preparation:

1. Hand out *Searching the News* and give students two weeks to find as many of the items on the handout as they can. You might divide the class into groups to work together and make it a competition to see which group can fill the most spaces on the handout.

2. During the same time period, ask students to choose one articles on an environmental topic from a newspapers (cut out or copy the article), the internet (print the article) or a TV story (take notes on the story). They should document the source of each story:
   - **Newspaper**: name of newspaper, date, author or news service
   - **Internet**: name of web site, web site address, web site author, date if available
   - **Television**: name of program, channel, date and time of program\

Activity Procedure:

1. Post each group's *Searching the News* "bingo card" on a bulletin board, with the categories that they located crossed out. Check whether submissions are appropriate, and announce a "winner" if you have made a competition out of the exercise.

2. Have student groups choose a **leader** and a **reporter**. The leader will make sure everyone contributes to the discussion. The reporter will write a brief 2 or 3-sentence summary of the

main points of each news story (with the help of the group) and give an oral presentation to the class.

3. Have students take notes during each group's presentation.

Assessment Opportunities:

1. Have students summarize, in writing, three environmental news that were reported on by the class.

2. If you have access to enough copies of a particular day's newspaper for the entire class, hand them out and give students 10-15 minutes to locate a story on an environmental topic and summarize it in writing

Extensions:

1. Have the students work in pairs to read a newspaper article on an environmental topic and:
   - Identify the issue
   - Identify proposals for solutions if any have been offered
   - List pros and cons if any are mentioned
   - Identify the opinion of the writer, if possible, pointing to specific language as evidence

2. Assign groups to choose a topic to follow over the course of several weeks or months, summarizing articles in a journal. The teacher should screen topics to insure that they will be of continuing interest rather than a one-time story. Topics that are under discussion by legislators, the business and development community and environmental groups have the most potential to identify pros and cons associated with the issue and to develop over time. Have the groups report at the end of their time period, summarizing the issue and describing how the story developed over the time they followed it. If you like, you can ask them to express their opinions on the topic.

From **Action for a Cleaner Tommorrow**, pp.240-141

SEARCHING THE NEWS

The media plays a important role in raising awareness of environmental issues. You can find articles that relate to the environment in nearly any publication and newspaper.

Over the next two weeks, search through newspapers and magazines to find each of the environmental news clips listed here. Save your clips, or copies of clips, in a notebook. Number each one according to the corresponding number on the item below. Add the name of the publication, the date and the page number.

1 **A Headline about Good Environmental News**	2 **The Phrase "According to the EPA"**	3 **An Environmental Comic Strip**	4 **A News Story about the Environment**
5 **A Story on Science or Technology Related to the Environment**	6 **A Story on Health Effects of Pollution**	7 **A News item on Recycling**	8 **Environmental Hints in an Advice Column**
9 **Article that Refers to the Virginia Department of Environmental Quality**	10 **An Advertisement that Refers to the Environment**	11 **A Photo that References the Environment**	12 **A Story about Environmental Legislation**
13 **A Letter to the Editor that References an Environmental Issue**	14 **An Editorial about an Environmental Issue**	15 **A Headline that Refers to Air or Water Pollution**	16 **A Review of an Environmental Book or Television Show**

Environmental Dilemmas

Students discuss environmental dilemmas, consider possible solutions and reach a decision regarding what action to take. Some situations involve personal decisions and others are policy decisions affecting a community.

Level(s): 6-8

Subject(s): Earth Science**,** Life Science, Environmental Science, Ecology, Civics and Economics

Virginia SOLs: 6.5 f,g; 6.7 a,c,d,f; 6.9 a,c,d; LS4 a,b; LS12 a,b,d,e; CE3 d; CE9 a

Objectives:
Students will be able to:
1 Give three reasons why it is not always easy to solve water resource (and other environmental) problems.

2. Discuss the pros and cons of proposals to solve water resource problems and work with others to reach a decision.

Materials:
- *Dilemma Cards* (these can be glued to cardboard and laminated for extra durability)

Estimated Time: 50 – 70 minutes

Preparation:
Prepare copies of the *Dilemma Cards* for the class.

Activity Procedure:
1. Provide students with the following scenario:

   Your friends have invited you to go out on their boat for an afternoon of water-skiing and fishing. You are really happy to be included. However, when you get to the dock, you find that your friends forgot to bring the lifejackets when they loaded the equipment early that morning. You are not a good swimmer, and you know it is illegal to go out in a boat without a lifejacket. What are you going to do?

   Tell students that this is a dilemma. Ask them to discuss the situation in groups and list reasons why it is a dilemma. Then call on each group to hear their reasons. Then tell them that managing water resources can encounter numerous dilemmas because everyone needs water and the water supply is limited.

2. Divide students into groups of 3 or 4. Each group should choose a *leader*, who will make sure everyone in the group has a chance to give present their ideas, a *reader* who will read

the dilemma cards out loud to the group. The other student(s) are *reporters* who will report the group's ideas and conclusions to the class.

3. Give each group one or more *Dilemma Cards*. The *reader* first reads one of the situations out loud for the group. Group members should take turns identifying reasons why it is a dilemma.

4. The reader then reads the list of options to the group. The group discusses the situation, lists some pros and cons for each option, and reaches a consensus about which option they think is the best, or identifies an alternative course of action, giving reasons for their choice.

5. Have each group report their dilemmas to the class, explaining reasons for reaching the solution they chose.

Assessment Opportunities:

1. Ask students to explain why water issues often result in disagreement.

2. Present students with an environmental dilemma of your own and have them list pros and cons for the solutions you suggest. Or have students make their own list of alternative solutions.

Extensions:

1. Have students research the dilemmas presented in the activity and determine if this additional information leads to a change in the course of action they would take.

2. Invite a community planner or water resource manager to speak to the class about a local water-related dilemma and discuss the processes involved in addressing the dilemma. **Note**: Planning for future water use of the City of Charlottesville is an excellent topic covering a wide range of issues. Consider inviting someone from the Rivanna Sewer and Water Authority or Albemarle County's Community Development Environmental Section.

From **Project Wet Curriculum and Activity Guide**, pp.377-381.

Dilemma #1

You've changed the oil in your car. You know the hazards of oil seeping into the ground water, yet you are in a hurry to attend an important meeting. How will you discard the used oil?

1. Put it in the back of the garage.
2. Place it in a garbage can for disposal in the city/county landfill.
3. Pour it on the ground somewhere out of sight when no one is looking.
4. Burn it.
5. Take it to an approved oil recycling facility in your area.
6. Other?

Dilemma #2

You are the mayor of a city which has an area near a river known to flood. A developer wants to build houses on the floodplain. These houses will have a great view of the river, will be conveniently located near the business district, and will entice prosperous people to move to your struggling community. You must make the final decision on the developer's request. Which option will you choose?

1. Inform the developer no building will be allowed.
2. Let the developer build in the flood area.
3. Insist the developer elevate the houses on piles of gravel in hopes of avoiding flood damage.
4. Instruct the developer to find an alternative building location out of the flood plain.
5. Other?

Dilemma #3

You own a cabin on a lakeshore and there are 400 other cabins facing the lake. Several residents around the lake have been complaining because they think the lake's water quality is poor. (There has been an increase in algae growth an unpleasant odors). A public service announcement informed the community that these problems likely are caused by septic tanks leaking sewage into the ground water that feeds into the lake. The announcement advised that septic systems should be checked every 3 years and pumped out if needed. It has been almost 10 years since yours has been checked. And you know other cabin owners have not checked their recently. If you check your septic tank and your septic system is found to be defective, it might be costly to repair. What are you going to do?

1. Sell the cabin.
2. Do nothing; your tank probably isn't leaking.
3. Have your septic tank checked and pumped. If it's leaking, pay to have it repaired.
4. Have your septic tank checked. If it is leaking, sell the cabin.
5. Have the septic tank checked. Fix it if it is leaking and forma a homeowner's association to encourage everyone else to check their tanks, too.
6. Work with other homeowners and your local government to apply for a government grant to pay for inspecting and repairing septic systems around the lake.
7. Other?

Dilemma #4

You and a friend are driving in the country and you see someone dumping a 55-gallon (209-liter) drum of dark liquid into a shallow stream. What should you do?

1. Stop and ask what is going on.
2. Call the police on your cell phone.
3. Drive by a little later to investigate by smelling and feeling the liquid.
4. Take down the license number of the nearby truck and report the situation to the fire department.
5. Other?

Dilemma #5

You are the governor of your state. Many streams are drying up because water is being diverted for municipal, industrial and agricultural uses. This has resulted in fish kills. Furthermore, people who like to canoe, raft and kayak have sent letters of complaint. Industry and agriculture are major sources of income for y our state, but you also like its reputation for outdoor recreation and scenic beauty. What action will you take?

1. Ask industry and agriculture to stop using water.
2. Locate and publicize other rivers around the state where people can fish and canoe.
3. Establish a committee to study the problem.
4. Propose construction a dam and reservoir to store water for release when needed.
5. Buy out the water users so they will have to move to new locations.
6. Establish a water conservation program with incentives.
7. Other?

Dilemma #6

Your friends have spread a plastic tarp on a hill and are spraying it with a hose. This creates a great water slide. However, sliding repeatedly kills the vegetation on the hillside, and large amounts of water are consumed during the game. Your community has experienced water shortages, but there have been no notices about conserving water for almost a year. You have been invited to take a dive down the hill. What should you do?

1. Report the game to the local authorities and have them cut off the water supply.
2. Change into your bathing suit and join the fun.
3. Try to encourage you friends to do something else. Like play basketball or go skateboarding.
4. Join the activity, but only for a short while, encouraging your friends to stop with you.
5. Refuse to join in, and go home and watch television.
6. Lecture you r friends on the reasons not to waste water.
7. Other?

Dilemma #7

You have moved across the country. You love to fish, and you are know for your skill at catching a particular species. This species is not found in lakes and streams around your new home, and you miss catching and eating them. A friend from your old neighborhood has offered to bring a tank of these fish to introduce into one of your local streams. You have heard that introduced organisms, such as starlings, zebra mussels and purple loosestrife, are competing with native species for resources. How should you respond to your friend's offer?

1. Tell your friend to bring the fish; you can't wait to get a population growing.
2. Tell your friend you are already learning how to catch new species of fish, so not to bother.
3. Check with a local fish and wildlife agent to learn if the introduced fish will compete with native fish.
4. Tell your friend to bring the fish; fry up a few and release the rest – they'll probably die anyway.
5. Other?

Dilemma #8

You are the head of a household. You are trying to save money; because your water bills have been large, you have decided to practice water conservation methods to reduce consumption by family members. Although you have installed low-flow faucets on your showerheads and sinks, your family insists on taking long hot showers (sometimes over 20 minutes). What are you going to do?

1. Hold a family meeting to discuss why conservation is important, and ask that shower times be reduced.
2. Order family members to cut down their shower time to five minutes, or else you will turn the water heater down, or off.
3. Figure the cost of water per gallon and how many gallons flow out of the showerhead each minute. Tell your family that you will time their showers and they will be charged (or their allowances reduced) for each minute over five they shower.
4. Tell family members that you will compare monthly water bills, and if a bill is lower than the previous one, the money saved will go toward a family trip or entertainment event.
5. Nothing. Your family has a right to bath as long as they want.
6. Other?

Dilemma #9

You are a city council member for a community located adjacent to a large, privately owned wetland. The wetland is home to rare wildlife and migratory birds; some wetland managers indicate that the wetland helps control surface runoff. The owner has decided to sell her land and move to a new location. The land is an area that is surrounded by lucrative businesses, where land prices are high and parking is an issue. What should you encourage the council to do?

1. Provide tax incentives to a local development consortium, to help them purchase the land around the wetland and seek permits to develop it for business.
2. Launch an initiative to have the city purchase the land. This will require new taxes and protect the wetland forever.
3. Apply for a permit to fill the wetland with soil from a local hill, developing the wetland into a parking garage and community park.
4. Leave the fate of the wetland to the desires of the community's special interest groups to decide.
5. Wait and see who buys the wetland, and then decide what to do.
6. Other?

Dilemma #10

You are a taxpayer in a coastal state that owns large tracts of land which historically were wetlands. Through complex engineering, the land has been drained to provide flood protection and to open the area for development and agriculture. These accomplishments have saved lives and improved the standards of living for many residents, while increasing revenues from crop exports. However, populations of some organisms living in the wetlands, such as scarlet ibis, wood storks, and panthers, and along the coastal areas, such as coral reefs, lobsters, and shrimp, have been greatly reduced. Shrimpers and other fishing industries have suffered fropm low harvests, and the number of tourists has declined. There is a proposal to restore the historic water flow pattern in some areas. This will increase your taxes. What should you do?

1. Vote down the tax; you pay enough in taxes already.
2. Vote for the tax; a restored, healthy ecosystem is goof for everyone.
3. Vote down the tax because communities will be flooded.
4. Vote for the tax because your best friend makes his living on a shrimp boat.
5. Other?

Back to the Future

Students analyze streamflow data for a hypothetical town's nearby river to discover seasonal trends in flow variation, and to determine the frequency of water shortages and floods. Students then use the data to help decide where to locate new housing and/or industrial development in relation to the river's floodplain.

Level(s): 6-9

Subject(s): Earth Science, Civics and Economics

Virginia SOLs: 6.5 f,g; 6.7 c; 6.9 a,c,d; LS12 e; CE3 d; CE9 a; Math 6.9 c; 6.18 a; 6.19; 7.4 a; 7.16; 7.17 b; 7.18; 8.3; 8.11; 8.12

Objectives:
Students will be able to :
1. Analyze streamflow data by calculating monthly averages.
2. Analyze streamflow data by determining months in which flood or water shortages occurred.
3. Convert streamflow data expressed in cubic feet per second to millions of gallons per day.
4. Use streamflow data and other information to set appropriate development goals for a riverside town and choose the best site for building.

Materials:
- News reports of floods in the Mississippi or local river basins and of water shortages (optional)
- Copies of *Streamflow Discharge Data, Parts I and II*
- Copies of *Community Planning Map*
- Copies of *Community Views*
- Graph paper
- A paper cube 12 inches on a side (optional)

Estimated Time: 50-90 minutes

Background Material: *Streamflow Data and 100-Year Floods*

Preparation:
Make copies of articles on local water shortage or water management issues (see examples below under **Additional Reference Material**).

Activity Procedure:
Part I
1. Have students describe events they have experienced, or heard of, related to variations in water supply, either droughts or floods. You might want to share news articles of events (or assign articles to read in advance).

2. Show students the Streamflow Discharge Data (Part I) and explain that these are measurements of the quantity of water flowing past a certain point within a certain period of time. Explain that the measurements are in cubic feet per second (cfs). You might want to show them a cubic foot made of paper (if a river discharges 300 cfs, 300 of these "boxes of water" pass by a certain point within one second).

3. Have students work in groups of three or four to plot the monthly averages from *Streamflow Discharge Data (Part I)*. There are 39 years of data. Divide the number of years by the number of groups and assign each group a set of data to graph. Each group can plot their data on their own graph, and then all the data can be combined on a large graph for the class to see. Hydrologists refer to this type of graph as a hydrograph.

4. Discuss the following questions:
   - During which month(s) does the greatest amount of water flow in the river?
   - In which month(s) is the streamflow lowest?
   - During which months did the streamflow exceed 3,000 cfs? This is flood stage.
   - How many months are there between flood events?
   - In what years was the discharge less than 600 cfs in June or July? This could be a time of critical water shortage or drought.

Part II

1. Hand out the *Community Planning Map*. Normally water stays within the river channel. When the river floods, water fills the floodplain area. Explain that a community plans to expand into a new area along this river. Four sites – Locations 1, 2, 3 and 4 – have been proposed.

2. Provide students with the following information. The land in the floodplain is flat and fertile, and it provides attractive views of the river. Because the area has been known to flood, land values in the floodplain are lower than land above the floodplain. However, if the home or business owner wishes to take out flood insurance to protect against flood damage, the cost could be very high. The cost of transporting water from the river escalates as distance from the river increases. The volume of water normally passing through the river makes it conducive to commercial use: certain industries want to build factories in the area so they can have access to the water for manufacturing purposes, Towns that support industry are more likely to have larger populations because factories provide opportunities for jobs. (NOTE: This information pertains to this activity's scenario and may differ in actual situations).

3. Hand out copies of *Community Views*, and have students read and discuss the four views of proponents of Locations 1, 2, 3, 4 on where to expand the community.

4. Ask students to list pros and cons for building on a floodplain. Discuss the benefits and drawbacks of establishing industries in a community. Here is a list of some pros and cons for building on a floodplain:

PRO	**CON**

Low property taxes	Chance of flooding
Flat building surface	Economic and emotional impacts
Scenic views	temporary and permanent:
Easy access to river	- loss of home and contents
Fertile soil	- business closure with loss of income
Ease of transporting water	- injury or death
	- fear
	- cost of flood insurance

5. Ask students to predict outcomes for building in each location, and for encouraging different types of development (farming, residential, business, industry). Have each group select one site for expansion and the type of development they would encourage, listing the reasons for their choice.

6. After groups have made their decisions, read the Outcomes (below).

Outcomes

If you chose #1 or #2, the end result is a large community, including three factories and several farms. The main difference is that #1 is in the floodplain and #2 is not. During the winter months, the community needs approximately 60 million gallons of water per day. In summer, because of agriculture and residential lawn and garden demands, water needs increase to nearly 500 million gallons per day.

If you chose #3 and #4, the end result is a medium-sized community, including one small factory, a number of small businesses, and several farms. Again, the main difference is that #4 is in the floodplain, while #3 is not. During the winter months, the community needs approximately 50 million gallons per day. In summer, because of agriculture and residential lawn and garden demands, water needs increase to nearly 350 million gallons per day.

7. Provide students with the *Streamflow Discharge Date (Part II)*. This table represents the six-year period following the community's expansion. Have students look for times when the river flooded (cfs > 3,000). Have them identify times when the community might have experienced water shortage (cfs for June or July < 600). To confirm whether there is enough water for community needs, have students use the conversion of 1 cubic foot per second = 0.646 million gallons per day. They can then calculate how many gallons of water the river supplies (i.e, 922 cfs x 0.646 = 595.61 million gallons per day).

8. Students choosing Location #3 should then find that they have avoided a flood and have enough water during most low-discharge months. Students may be interested in checking how other sites fared. Location #1 would have flooded and experienced water shortages. Location #2 would have experienced water shortages but would not have flooded, while Location #4 would have enough water but would have flooded.

9. Ask students if they think their choices of locations in the activity would have been different if the interval between floods was about 50 years. What about 100 years? Or 500

years? Provide students with information about the Midwest flood of 1993; ask students whether they think homes destroyed by a flood should be rebuilt on a floodplain.

10. Have students summarize how past records of streamflow can help communities plan for the future.

Assessment Opportunities:
Generate your own set of data for students to perform the following tasks:
1. Graph streamflow data.

2. Interpret streamflow data to identify fluctuations in discharge above floodstage and below the level that meets community needs.

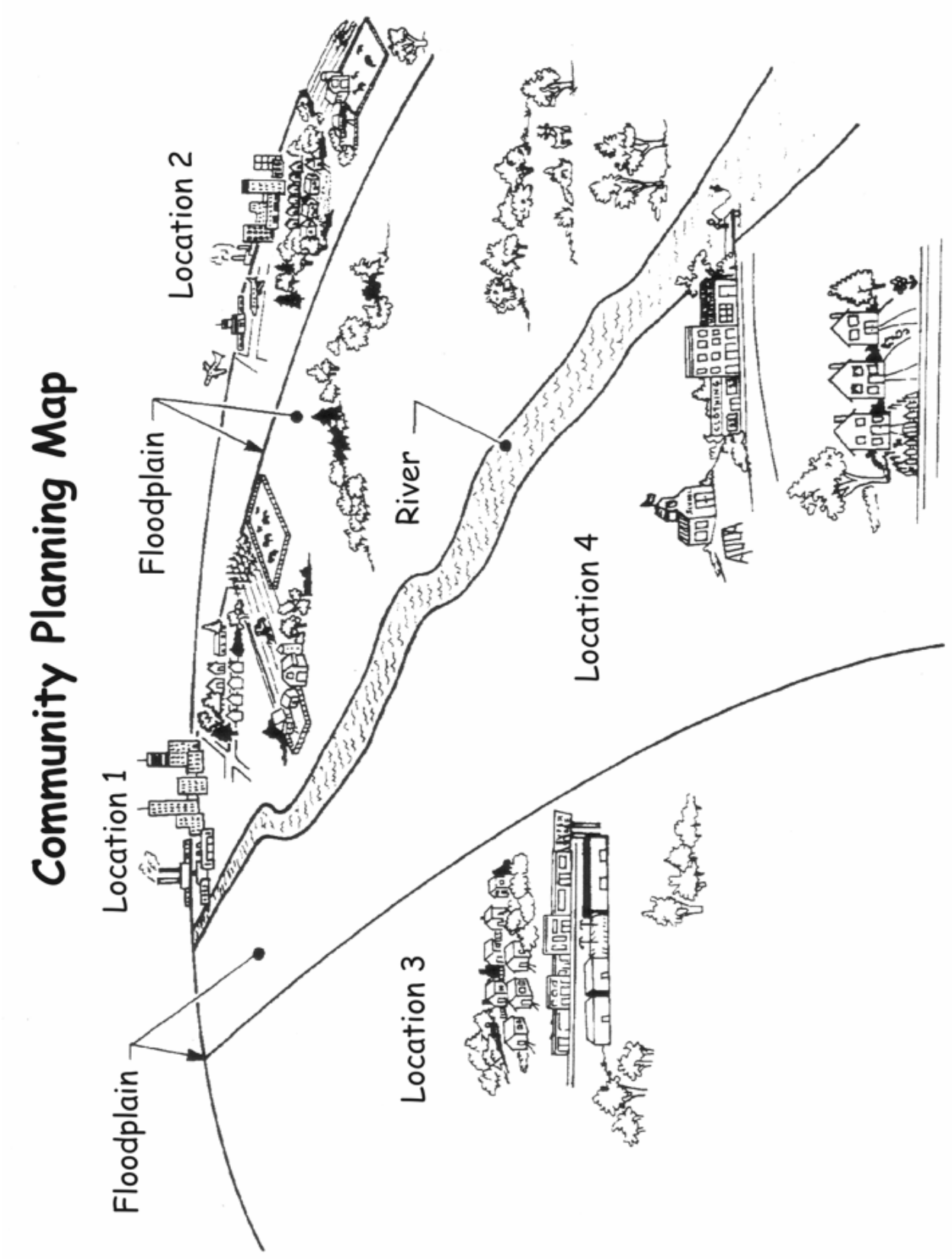
3. Analyze the risks and benefits of living in a floodplain.

Extensions:
1. Have students visit some of the web sites below that display realtime flow data for local rivers following a schedule (at a particular time once a day or once a week) and graph flow data over a period of time (1 month, 6 weeks, 3 months).

2. Have students visit the realtime flow data web sites and calculate the current flow in gallons per day. Visit a site after a major rain and compare.

3. Have students study the pros and cons for different solutions being considered to meet future water needs of the City of Charlottesville and reach a decision regarding which solution they think is the best (see the link below to the paper on report on the Rivanna Water and Sewer Authority's recommendations). Invite someone from the RWSA to speak to the class on the issue.

4. Have students research the issue of federal flood insurance and building on the barrier islands off the U.S. east coast in Virginia and North Carolina, or in low-lying areas in New Orleans that flooded in 2005.


Community Planning Map
Location 1
Location 2
Location 3
Location 4
Floodplain
Floodplain
River

Community Views

Location 1
I think we should build at Location #1. The property values are low and we won't have to pay high prices to get water into our homes. The soil is great for farming and the views of the river are wonderful! I also think we should allow industries to build their factories here. There is plenty of water for their production needs, and they will provide jobs for community members. There hasn't been a flood here in over 10 years, so it's nothing to worry about.

Location 2
Well, just because a flood hasn't happened in 10 years doesn't mean it won't. I say let's build above the floodplain. We'll have to pay more in property taxes and for water, but homes will be less expensive because we won't have to floodproof them or buy flood insurance. If we invite industries to locate at Location #2, people will have secure jobs and the city will prosper.

Location 3
Even though we'll have to pay more, I think we should build above the floodplain. Location #3 is a good distance from the floodplain, and the land is not too steep. I don't think we should allow industry to settle here; it will use too much water and create pollution problems. We should promote small businesses instead.

Location 4
I agree that we should plan for a small community and promote small businesses instead of industry. More people will place demands on our water supply, which could create serious problems for the town in times of drought. However, if we build on the floodplain, at Location #4, we'll have flat, fertile land, which is easier to farm and better for constructing houses. I don't think a flood is going to happen in our lifetime, so that shouldn't stop us from building.

Back to the Future: Streamflow Discharge Data (Part I)

Monthly Average Discharge in cfs for the past 39-year period up to the present year.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-38	147	144	150	306	802	1043	581	184	118	46	58	44
-37	43	47	61	861	1430	1158	437	159	145	207	112	85
-36	74	82	184	609	1411	937	462	150	82	113	108	75
-35	70	63	60	265	991	1648	502	168	108	144	142	157
-34	162	144	138	536	1194	863	235	54	85	86	97	81
-33	124	122	123	382	1055	1361	706	256	222	217	204	137
-32	152	172	172	910	1790	1453	820	374	203	207	169	154
-31	156	145	140	926	2708	3079	859	351	260	218	185	190
-30	199	164	200	585	755	1507	927	276	176	187	169	142
-29	149	149	157	549	1287	908	617	191	143	150	133	110
-28	108	105	99	137	694	1174	489	193	124	221	156	202
-27	178	138	180	941	2288	2132	747	291	215	227	190	163
-26	13	147	161	336	1600	1900	683	256	184	189	169	159
-25	144	146	145	386	2862	1950	692	326	240	191	183	163
-24	148	147	146	371	520	938	308	135	207	220	166	129
-23	125	115	169	545	659	751	213	101	101	107	105	92
-22	97	94	100	248	515	751	207	126	138	134	121	96
-21	99	119	117	703	952	2121	566	245	180	201	162	137
-20	120	159	146	214	1180	3608	670	257	215	206	209	158
-19	15	149	143	391	942	1437	707	259	173	169	158	197
-18	219	179	206	852	2057	2916	1759	666	438	312	247	184
-17	197	172	179	507	805	562	202	118	105	112	127	112
-16	113	113	141	269	1876	2778	1194	351	249	269	234	188
-15	12	166	216	347	516	974	355	276	229	212	185	151
-14	156	156	163	1312	2031	2010	741	314	250	243	189	168
-13	157	147	169	297	914	687	283	208	154	152	140	132
-12	146	142	154	642	726	1662	1049	363	310	259	215	186
-11	177	170	216	568	1198	3353	449	205	152	201	194	158
-10	150	162	216	492	2393	2877	1426	500	326	304	256	220
-9	212	198	273	494	2189	2272	1550	683	426	427	430	324
-8	289	275	288	641	1755	1985	1112	469	329	283	259	224
-7	216	189	213	712	1003	749	330	219	383	265	214	196
-6	189	194	475	1178	1815	2410	694	344	290	278	226	167
-5	155	152	213	375	725	520	284	172	128	125	131	121
-4	119	119	153	343	621	715	217	133	116	120	125	115
-3	120	114	149	644	994	954	351	174	156	165	156	131
-2	126	121	157	439	464	831	359	185	152	150	146	122
-1	167	150	177	288	1107	1661	832	277	240	241	254	204
Present	212	208	334	439	1263	2550	660	315	257	266	226	161

Back to the Future: Streamflow Discharge Data (Part II)

Monthly Average Discharge in cfs for six-year period following community's expansion.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	159	159	155	324	861	743	632	380	160	169	210	166
2nd	181	168	279	1089	2199	3161	953	378	246	244	223	171
3rd	168	158	162	209	1083	2227	1517	392	253	256	233	202
4th	181	181	179	492	1486	1114	615	349	312	238	183	152
5th	143	132	134	151	201	574	550	153	141	148	134	136
6th	132	131	198	623	1319	1783	955	347	346	230	196	160

From **Project WET Curriculum and Activity Guide**, pp.293-299.

Additional Reference Material:

South Fork Rivanna Reservoir and Watershed: Reflecting on 36 Years, Anticipating 50 Years (www.rivanna-stormwater.org/map09.htm)

View realtime flows of Virginia rivers at:

Rivanna River at Palmyra
http://waterdata.usgs.gov/va/nwis/uv?02034000

Mechum's River near Whitehall
http://waterdata.usgs.gov/va/nwis/uv?02031000

Hardware River near Scottsville
http://waterdata.usgs.gov/va/nwis/uv?02030000

Moorman River near Free Union
http://waterdata.usgs.gov/va/nwis/uv/?site_no=02032250&PARAmeter_cd=00065,00060,62620,00062

Articles on local water shortages and water management issues:

News - Drought Impact (23 September 2002)
http://www.vnla.org/Drought/NewsDroughtImpact092302.htm

Charlottesville Public Schools: Drought Forces Schools to Cut Water Usage
http://www.loper.org/~george/archives/2002/Sep/34.html

Rivanna Water & Sewer Authority Revised Staff Recommendation a Multi-Step, Integrated Water Supply Strategy Urban Water Service Area
http://www.rivanna.org/documents/water_supply_plan_approved.doc

Streamflow Data and 100-Year Floods

Floods and droughts frequently make the news. While many disasters are unexpected, sometimes people can prepare for the future by looking into the past. Understanding and interpreting streamflow data helps people predict and prepare for times of excess water or shortage.

Data collection is a critical component of most scientific investigations. Watershed managers analyze streamflow monitoring data to assess water availability, to allocate limited water supplies amount different water users,, and to manage flow problems (e.g, flood and drought).

Streamflow data are collected by many government agencies, including the U.S. Geological Survey and the National Weather Service (see internet links below for realtime flow data for three local rivers). Streamflow data are a measurement of the volume of water passing a given point over a period of time. To determine streamflow, watershed managers need to know the profile of the streambed, the height or stage of the river and the river's velocity. The data are mathematically converted to cubic feet per second (cfs). This information tells watershed managers how much water is flowing in the river at a given time.

Streamflow information is collected either by electronic gauges or manually. Electronic gauges, located near bridges or dams, typically record flows around the clock 365 days a year (see the internet links below). Manual sites are monitored daily, weekly, as needed, or after a rainfall. To take a manual reading, someone enters the stream or walks over the channel on a bridge or dock with a current meter and a gauging stick to record velocity and river depth.

Streamflow data are used to develop hydrographs, which show the amount of water flowing, or discharged over time. For example, the average monthly discharge may be plotted over a one-year period.

By monitoring a river's streamflow over many years, hydrologists learn about fluctuation patterns. For example, many rivers have low flows in the fall and winter, increased levels in the spring, and peak flows in the early summer. Hydrologists use data to create models that can help predict streamflow during and after rainfall, snowmelt and drought.

Watershed precipitation amounts or snowpack levels also help forecast possible streamflow levels. The amount of snowpack in a local mountain range directly affects the amount of water discharged in the spring or summer. Once research hydrologists know the patterns of streamflow, they inform water resource management agencies, city planners, extension agencies and farmers.

In addition to knowledge of slope, availability of water, soil type, and vegetation, information about flooding potential is essential for community planning. Watershed managers may recommend that people not live in a certain location because of its frequent flooding in the past. Such an area is called a floodplain (any area that can be flooded when the water level exceeds a stream's bank's). One option is to limit development in these areas, or leave them in their natural state. However, such sites are often desirable for human settlement because they are fertile, level, and scenic. Dams, dikes and levees can be built to protect an area from flooding, but these projects are costly and may still succumb to major floods. In addition, when such changes are made to a river in one location, it often results in higher flows and more frequent floods downstream.

The Midwest flood of 1993 will be remembered for many years. The flood caused the width of the Mississippi to increase 10 to 20 times its normal size and covered land with 15 feet

(4.5 m) of water. Fifty people were killed and over 40,000 were left homeless. Cost of damages were estimated in excess of 12 billion dollars.

What exactly does a 500-, 100-, or 10-year flood mean? Such labels are part of a classification system used to predict when a flood of a particular magnitude is *likely* to occur. Making these predictions involves studying past records of flood events and searching for a pattern. Generally, as the magnitude of a flood increases, it likelihood of occurrence decreases. This relationship exists because all the components of a large flood are unexpected, seldom occurring events (e.g., abnormally high rainfalls, high rates of snowmelt). Once every 100 years or so, two or more of these rare evens may occur simultaneously. The result can be an abnormally large flood. However, if residents of an area experience a 100-year flood, they should not rest assured that another flood of that magnitude will not occur in their lifetimes. Hydrologists can only say that, according to years for which data exists, a flood of that magnitude occurs, *on average*, every 100 years. The unpredictable nature of weather patterns could result in another 100-year flood the next year, 10 years later or 200 years later.

On the other extreme, droughts also dramatically affect our lives. Low amounts of rainfall and snowpack as well as normal fluctuations in weather patterns can result in shortages in surface water and ground water supplies. Limited amounts of available water may lead watershed managers to advise against development of certain industries or types of agriculture in a particular area unless alternate dependable sources of water are located.

An area experiences drought conditions when it has less than an average amount of rainfall; during these times crop production is often affected, as well as availability of water supplies. In 1998 a drought started in the United States that culminated in 2002 with a severe drought in 30 states. The drought locally affected crop production, resulted depleted reservoirs, wells and springs, and forced the cities of Charlottesville and Orange, for example, to place restrictions on water use by homeowners and many businesses.