# Watershed Wonders

# *Introduction*

*Watershed Wonders* serves as the day s closing activity, requiring students to draw upon their newly acquired knowledge. After small groups participate in the stream and riparian stations, all reconvene at *Watershed Wonders* for a simulation of the land use planning process. Each student team assumes a special interest advisory role and then presents reasons why their land use recommendation should be accepted by a panel of  County Commissioners.

*"All streams are but a tributary to the ocean, which itself does not stream, and the shores are unchanged, but in longer periods than man can measure. Go where we will, we discover infinite changes in particulars only, not in generals."*

*Thoreau*

# Teacher Section

## *Objectives*

Students will be able to:

1) Investigate the watershed concept using local maps and data
2) Predict how specific land uses will impact water quality
3) Demonstrate an understanding of community processes, including competition for limited resources

WA SCIENCE Essential Academic Learning Requirements (EALRs): 1.2, 1.3, 2.1, 2.2, 3.1, 3.2

## *Concepts*

- Watershed
- How land uses affect water quality
- Competition for resources
- Differing perspectives
- Importance of issue awareness and steps to community involvement

## *Study Site Description*

Everyone meets together for this station, usually at the site where orientation takes place in the morning. Each team listens to the others until their turn to give a presentation to the Commissioners. The program coordinator may assign the scenarios for presentation by each participating school. Check with them ahead of time. (If field day time is limited, the presentation activity could take place at a later time or in the classroom.)

## *Vocabulary*

*(Definitions can be found in the Glossary)*

Best Management Practices
Issue
Mitigate
Runoff
Topographic Map
Topography
Watershed

## *Classroom Pre-work*

**MINIMUM PRE-WORK NECESSARY FOR FIELD STUDY:** 90 minutes for an understanding of watersheds and preparation for the presentation to be given to County Commissioners.

## *Post-work*

45 minutes to relate to your local watersheds and for assessment.

# *Watershed Is Where It's At*

*(15 minute activity)*

## *Objectives*

Students will be able to:
1) Describe the watershed concept
2) Give their watershed address
3) Cite ways people affect their watershed

## *Materials*

- ❑ Paper and Pencils
- ❑ Paper Bags
- ❑ Branch with twigs extending out from it

## *Background*

Ask students to explain the *watershed* concept. If they are unfamiliar with it, help generate discussion by using a bare tree branch to explain the definition found in the glossary. Pointing to different features, explain that the branch has twigs leading to a central stem and everything that happens to the twigs affects the stem. In every watershed, water flows to the lowest point, represented by the stem, which usually contains a receiving body of surface water. It begins with small rivulets and gathers in larger streams. On its way, water travels over the surface and across farm fields, forest land, suburban lawns, and city streets, or it seeps into the soil and travels as groundwater. All land on Earth is part of a watershed. A watershed may even be a drainage area surrounding a lake that has no surface outlet. Large watersheds are made up of many smaller watersheds, such as those that drain into the Columbia, Sacramento, and Mississippi Rivers or the Chesapeake Bay. Watersheds usually have the same name as the main body of water that drains them. In mountainous areas, watersheds are easy to delineate. However, even land that looks flat is part of a watershed. You could use the analogy that a watershed is like a raincoat; because... rain falls on it, water runs off it, water runs across it, its shape depends upon what s underneath, water pools on it, etc.

**Watershed Influences:** The personal actions of every watershed resident or visitor can affect it in numerous ways: Car oil and exhaust is washed off roads into streams, poorly maintained septic systems leak into groundwater, detergent from washing autos on pavement flows into nearby storm drains, and removal of riparian plants near homes and businesses allows pollutants to enter freely. All of these become part of the non-point source pollution that directly

## *Background* *continued*

impacts water quality. Conversely, people can benefit watersheds by turning off the faucet while brushing teeth to conserve water, planting green belt areas to filter urban runoff, and using non toxic methods to control home insect problems.

## *Procedure*

1. Watershed Address: Have students think about their home addresses. Most addresses describe where someone lives using numbers and the names of streets, towns, and states. Point out that the first part of the address is so specific that it is probably different for each student. The latter parts of the address (town and state) become more general, so they are probably the same for all students.

2. Ask students to write their home watershed addresses on a separate small piece of paper, keeping it anonymous. Does everyone in the class have the same watershed address? What is the watershed address for the closest town? The county? The state? The school? Watershed address examples are: Mission Creek or Icicle Creek, tributaries of the Wenatchee River, which is a tributary of the Columbia River, that flows into the Pacific Ocean.

3. Place the addresses in a bag. Have each student pick one out. Can they guess who belongs to each address?

## *Assessment*

Ask students to:

- ❑ Conduct a research project on their home watersheds to determine understanding of the concept. Include land use practices, riparian plants typical of the area, and any known information about water quality. Assess the watershed s health and justify the rationale. Draw a map of the watershed to accompany the written document, labeling businesses, homes, schools, parks and other features.

# *Watershed Cartography*

*(30 minute activity)*

## *Objectives*

Students will be able to:

1) List the components of a topographic (topo) map
2) Describe how contour lines function
3) Delineate a watershed area on a map
4) Read a topo map to complete a worksheet

## *Materials*

- ❑ Copies of enclosed topo map (Icicle Creek Watershed or one from your area)
- ❑ *Find Your Way* Mapping Exercise
- ❑ Pencils
- ❑ Transparency of Cashmere Mountain Township map or corresponding local map

## *Background*

There are many types of maps, including highway, street, administrative, travel guide, and forest maps. *Topographic maps* delineate natural features more precisely than conventional maps. Users include surveyors, backcountry travelers and pilots. When reading a topo map, try to visualize features in 3-dimensional terms. Horizontal and vertical differences are noted on topographic maps with contour lines. Spaces between contours are called contour intervals. Contour interval distances differ according to the scale of individual maps. Main characteristics to consider when reading contour lines are:

- Contour lines closely spaced indicate a steeper grade
- Contour lines widely spaced indicate a flat area or gentle slope
- Evenly spaced contours indicate a uniform slope
- When crossing a drainage, contour lines always look like a right side up V (the v points upstream)
- Contour lines joining indicate a high point, unless they are blue, where there is a lake

## *Procedure*

1. Make a transparency of the magnified topographic map of a township (Figure 1) and discuss its features. Ask students to come up and point out drainages, peaks, main roads, trails, flat/steep areas and ridges.

2. Pair up the students. Distribute copies of *Cashmere Mountain Township* map, the *Icicle* (or local) *Watershed* map, and *Find Your Way* Student Worksheets.

## *Assessment*

- ❑ Using different topo maps, ask students to compare and contrast land uses as follows: Looking at the topography, are roads, buildings, farms and other features well placed? Consider proximity to water, slope steepness, possible natural disasters, etc. in the investigation.

- ❑ Write a critical analysis of a selected area. If it was found that some land uses were inappropriate for the current locations, indicate possible relocation sites on the map.

# *Find Your Way Mapping Exercise Answer Key*

## *Icicle Creek Watershed Map*

Use the Cashmere Mountain Township and Icicle Creek Watershed maps to find the following:

1. What is the Leavenworth National Fish Hatchery s elevation? *1200 ft.*
   Describe features of the area around it.

   *It is not U.S. Forest Service land (it is owned by the U.S. Fish & Wildlife Service and private landowners); the area is flat to mildly sloping; there s a road nearby; Icicle Creek splits at the hatchery; building outside the flood plain is possible on the site.*

2. Find the road that switches back more than six times. Why was it constructed that way?

   *There are many possible reasons: a) switching back is a way to gain elevation fast while keeping the road gradient suitable for logging truck mobility; b) the landowner may have wanted or needed to keep the road on his/her own property, so as to avoid trespassing on neighboring land; or c) access was limited by topographic features like rocks, cliffs, etc.*
   How would steep switchback roads such as these impact the hillside and Icicle Creek aquatic life? *There could be an erosion problem leading to siltation that affects fish, macroinvertebrates and other organisms. Stormwater may also be directed to structures below, with a potential for serious damage.*

3. List all the areas that would be suitable for building. Consider riparian areas, avalanche and debris flows, flooding, etc

# *Find Your Way Mapping Exercise Answer Key*

## *Cashmere Mountain Township Map*

1. What is the highest point and elevation?

   *Cashmere Mountain, 8501 ft.*

2. Find a flat area. What is the elevation? (check answer against map)

3. What is the elevation of Trout Lake? *4800 ft.*

   Little Caroline Lake? *5800 ft.*

   What is the elevation difference? *1000 ft.*

4. Find Eightmile Creek. Describe its course. Think of the type of land it flows through, the elevations, any tributaries, etc.

   *Eightmile Creek flows through Eightmile Lake and Little Eightmile Lake. Pioneer Creek and Mountaineer Creek are its tributaries; it flows into Icicle Creek; it begins at 5400 ft. and flows down to 3400 ft.; the terrain immediately adjacent to the creek is mildly sloped with some flat areas; there is a road at its lowest point.*

5. On the map, draw Pioneer Creek s watershed boundaries.

# *Perspectives Into Focus*

*(30 minute activity)*

## *Objectives*

Students will be able to:

1) Articulate pros, cons and compromises of a specific land use perspective
2) List differing land uses and issues surrounding each one
3) Discuss human activities in the Icicle Creek Watershed
4) Describe how land use decisions affect natural resources

## *Materials*

- ❑ Butcher paper or pages from an easel
- ❑ Crayons or markers
- ❑ Pencils
- ❑ Copies of the watershed planning scenarios (Student Section)

## *Background*

Elected or appointed public commissioners and councils often base land use decisions on the written and verbal testimonials of special interest groups. Sometimes there is extreme competition for natural resources and polarity among special interests is evident. Commissioners are charged with representing the whole community while deciding the best use of land. Compromise is the most common method of diffusing conflict and accommodating differing perspectives. This may sometimes take months to achieve and requires countless hours of research to arrive at the best solution. In this activity, students consider potentially controversial proposals and try to arrive at a reasonable compromise between diverse viewpoints that is still economically feasible.

## *Procedure*

1. Ask students to list common land uses near rivers, *issues* associated with those uses, and compromises that could work to satisfy the differing opinions. Tell them they will form advisory groups addressing proposed projects in:

   Agriculture: irrigated croplands and grazing
   Timber Management
   Urban Development
   Recreation

2. Ask students to think about the assigned land use and to represent a perspective they would not normally consider. Contact the *Kids in the Creek* coordinator to learn how the perspectives are divided between school groups. Review each *Watershed Planning Scenario* with students.

*Procedure continued*

3. For each scenario, have students identify pros, cons, special interest group perspectives, and a land use plan that reflects a compromise. Role-playing the proponents, dissenters and special interests may help to stimulate discussion. Students become the Citizens Advisory Committee who have been asked to look at the proposals and recommend land use plans to Planning Commissioners. After careful consideration, they will give feedback to the Advisory Committee about what they have heard. As in real life, the commissioners may or may not arrive at a decision at that time. Take all materials needed for the presentations to the *Kids in the Creek* site.

## *Assessment*

Provide students with typical land uses in your community and ask them to:

- ❑ List potential current and long term effects to area natural resources from these land use activities
- ❑ Match uses with mitigation measures that are realistic

## *Classroom Post-work*

1. Research current community issues over the long term and maintain a journal with the help of newspaper articles, magazines, radio/television news, etc. Critically examine perspectives, mitigations and final actions. Interview agency personnel and private landowners.

2. Select an issue
   - ❑ brainstorm relevant roles, assign special interest groups, prepare class presentations
   - ❑ research a local issue and give recommendations to a local governing body such as a planning commission, city council, Fisheries Resource Office (U.S. Fish and Wildlife Service), a conservation district board of supervisors, etc.
   - ❑ invite representatives from differing perspectives for a panel discussion

3. Examine what you can do locally - i.e. adopting your watershed, assisting with a community project, etc.

4. Organize students to create a special independent project involving *Kids in the Creek* information for display at a county fair or educational festival.

5. Take your students on a *Rainy Day Hike* (next activity).

# *Rainy Day Hike*

*(30 minute activity for classroom preparation)*

## *Objectives*

Students will be able to:

1) Identify the watershed in which their school is located
2) Explain the role the schoolyard plays in the watershed

## *Materials*

- ❑ Maps of the local community, showing streams, lakes and topography
- ❑ Drawing paper
- ❑ 2 sets of copies of the Legend
- ❑ Waterproof outerwear (large trash bags can be used for ponchos by making a neck hole in the sealed end and small openings for the hands on the sides)
- ❑ Clipboards of sturdy cardboard with rubber band to secure paper (Tape 2 pieces of cardboard to form a book; students can close map inside cardboard to keep it dry.)
- ❑ Plastic wrap
- ❑ Pencils

## *Making Connections*

Students may be familiar with the idea of a watershed, but unaware that they live and attend school within one. Observing water flowing through and collecting on their school grounds provides students with direct experience in their watershed.

## *Background*

Puddles, streams, and lakes all have something in common. They collect water that has drained from watersheds. Watersheds are like funnels; they are drainage basins where surface water runs off and drains into a common collection site. Watersheds are separated from each other by land forms (ridge lines or mountain divides). Water falling on each side of the divide drains into different watersheds and collection sites.

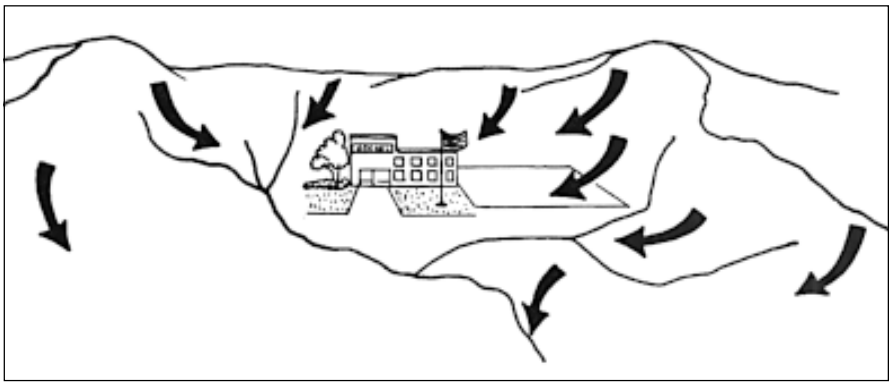
Surface runoff flows over a school s grounds on its way to the collection site (e.g., a river). Therefore, school yards are part of a watershed. (Puddles are the collection sites of mini-watersheds: land surrounding puddles are the mini-drainage basins that empty into the puddle.) When the puddles overflow or the soil becomes saturated, water is released.

As water flows from the school grounds, it combines with runoff from other land areas within the drainage basin. Materials from these other places are carried by the water.

## *Background* *continued*

While some substances decompose, settle out, or are filtered by soil, other matter continues to travel long distances downstream. Organic materials carried by the water nourish aquatic life. Some substances are toxic, however, and can endanger organisms consuming or living in the water.

Contaminants whose entry point into the watershed is difficult to locate are classified as non-point source pollutants. Along with residential areas, agricultural fields and paved parking lots, school grounds can contribute to non-point source pollutants. The schoolyard contributes point source pollution when the source of the pollutant can be traced back to a specific location on the school grounds (e.g., sewer, ditch, pipe).



## *Procedure*

1. Show students a map of the community and identify local rivers or lakes. Ask the class if they think a connection exists between their schoolyard and these bodies of water. Tell the class they will take a fair-weather and a rainy-day hike, to study what happens to the water that falls on and flows over their school property.

   Although plans for a rainy-day hike will generate student excitement, the wait for a wet day may prove discouraging. The lack of rain offers the opportunity to discuss with students the idea that people do not control the rain or other aspects of the weather. Remind students that even if people cannot control the weather, they can often predict it.

2. Have students listen to, watch, or read weather reports. When is rain predicted? Students can mark the calendar with the date and continue preparations for the hike.

## *The Activity* **Part I**

While planning for the rainy day have students create a map of the school grounds. Divide the grounds into sections and assign groups to map each area. Orient students to which direction is north so all maps face the same direction.

1. Remind groups to include the following: school buildings, parking lots, designated playgrounds, natural areas (trees, grass, flower gardens) with an emphasis on water features like streams, temporary and permanent ponds, and constructed water features like bird baths and fountains.

2. After students have completed their initial mapping, if there is a school building in their area, have them consider the following questions. Can they determine where the water that falls on the roof goes? Does it flow off the roof into gutters that lead to waterspouts or does it fall directly onto the ground? Have students place an X on the buildings to indicate the location of waterspouts.

3. Make two copies of student maps, one for the fair-weather hike where students make predictions of water flow and one for the rainy-day hike when students check their predictions.

4. For the fair-weather hike, give each group a copy of their mapped section and the *Legend*. Have each group predict the direction water will flow through their section. Where do students think water will be stored? Are there ponds or low spots?

5. Have students survey the ground of their section for possible sources of point and non-point contamination (oil stains on parking lots, trash, tainted soil near the school dumpster). What materials could be on the roof of the school building that could be washed off during a rain (bird and rodent droppings, insects, dirt, roofing material, leaves, twigs, etc)?

6. Assemble the map sections from the groups and post in the classroom. Have them summarize their predictions. How do the predictions of individual groups relate to each other? Where do students think water flows onto the school grounds? Where will it flow off the school grounds?

*Activity continued*

## Part II

1. On a rainy day, have students dress properly. Take them outside and begin a simple tour of the school grounds. Have students identify patterns in the water flow. Discuss what influences the direction water moves. Have students:
   - ❑ note slopes, depressions, cracks in the sidewalk, erosion trails, rocks, buildings, gardens, trees, etc.
   - ❑ compare how fast or slow water flows in different places.
   - ❑ identify ways water affects the surface of the school grounds (e.g., watering plants, eroding soil, piling up litter, washing away litter).
   - ❑ note water flowing from the roofs of buildings and waterspouts.

*Demonstrate point/non-point source pollution by calling USFWS 509.548.7641 to borrow or 703.631-8810 to purchase an Enviroscape model*

2. Divide the class into their original groups and give each group a copy of their unmarked map section and the *Legend*. Have students indicate the following on their maps: direction and patterns of flowing water; natural and unnatural materials being carried onto and off their study area; and areas of standing water. Remind students to use pencils because ink runs. They can cover their note pads with plastic wrap or cardboard when they are not writing.

3. When students have completed their investigation, assemble the map sections and post. Arrows of adjacent map sections should line up. If they don t, discuss reasons for discrepancies.

## *Discussion*

Have students summarize the general patterns of surface water as it flows across the school property. They should identify areas where the flow of water is slowed by land forms and vegetation, where it collects in depressions, and where it flows off school property. Have them compare the completed map on the rainy-day hike to the map indicating their predictions. How accurate were their predictions?

Referring to a community map, discuss the school s location within a watershed. Trace the likely course of runoff from the school grounds into a local lake or river.

City engineers or planners have information on storm drainage systems, or can identify destinations of storm water runoff from streets and parking lots.

Have the class list uses of water in local lakes or rivers (e.g., drinking water, animal habitat, irrigation, swimming, fishing, etc.). Do any activities on your school grounds affect, positively or negatively, the water moving across it?

Some school property plans incorporate surface water treatment systems, such as detention ponds, to reduce materials carried by runoff. Ask the principal for a copy of the school site plan. Does the plan show the surface water management system for the school?

If students believe their school grounds contribute to erosion or to point or non-point source pollution, they may want to develop a plan to improve the area. They can plant trees or a garden, encourage parking lot patrons to keep their cars in tune, promote wise use of fertilizers and pesticides, etc.

## *Assessment*

Ask students to:

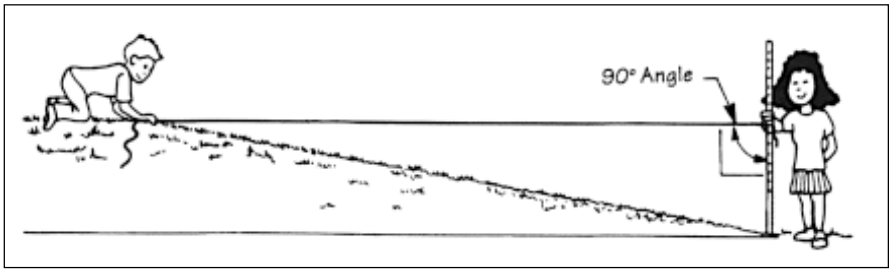
- ❑ Predict the movement of water and possible contaminants across their school grounds (Part I, steps 5 through 7).
- ❑ Identify the school s location within a watershed or in relation to a body of water (from *Discussion*)
- ❑ List ways the school grounds positively affect water passing through the watershed (from *Discussion*)
- ❑ Locate sources of point and non-point source pollution on the school grounds (from *Mapping* and *Discussion*)

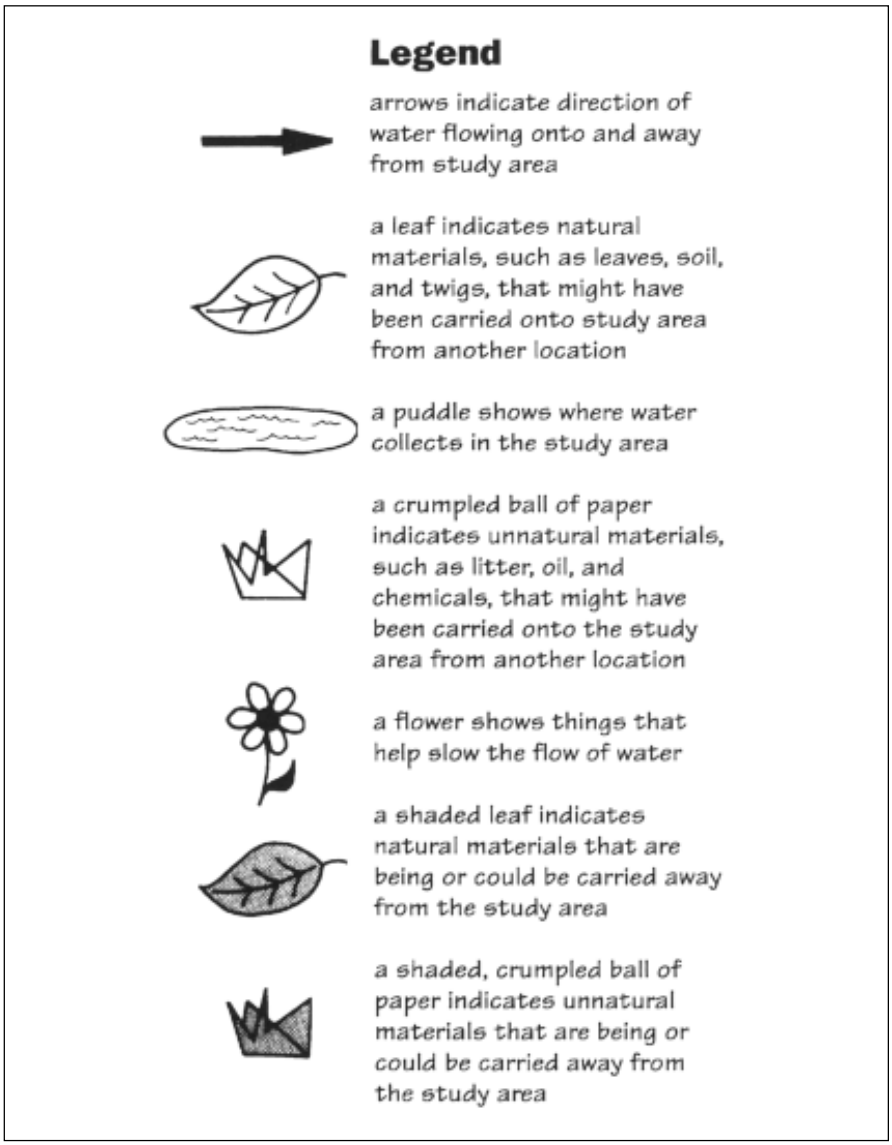
## *Extensions*

To increase the detail of their study area maps, students may include measurements of slope. Slopes can be classified as level, gentle, moderate, or steep. How does the steepness of slope affect rates of water flow, erosion, and sediment load? To measure slope, one student stands at the top of the study area (top of the slope) and another student, holding a meter stick, stands at the bottom. The run or distance between the two students is measured. The student at the top holds one end of a string at his ground level and the other end is extended to the student at the bottom of the slope. A level is needed to ensure the string is held straight. The point at which the string intersects the meter stick held by the second student is the rise. Slope gradient is calculated by dividing the rise by the run.

*Extensions*
*continued*

run ÷ rise = slope gradient (expressed as a percentage)



# Student Section

## *Find Your Way Mapping Exercise*

### *Cashmere Mountain Township Map*

Use the Cashmere Mountain Township and Icicle Creek Watershed maps to find the following:

1. What is the highest point and its elevation?

2. Find a flat area. What is the elevation?

3. What is the elevation of Trout Lake?_____
   Little Caroline Lake?_____
   What is the elevation difference?_____

4. Find Eightmile Creek. Describe its course. Think about the type of land it flows through, the elevations, any tributaries etc.

5. On the map, outline Pioneer Creek s watershed boundaries.

# *Icicle Creek Watershed Map*

1. What is the Leavenworth National Fish Hatchery s elevation?
   Describe features of the area around it.

2. Find the road that switches back more than six times. Why was it constructed that way?

   How would steep switchback roads such as these impact the hillside and Icicle Creek aquatic life?

3. List all the areas that would be suitable for building. Consider riparian areas, avalanche and debris flows, flooding, etc.

# *Perspectives Into Focus: Watershed Planning*

## *Student Instructions*

Familiarize yourself with the scenarios in this section to prepare for the presentation you ll be giving during *Watershed Wonders*.

1. Scenario setting is in the Icicle Creek Watershed
2. Refer to the map found at the end of the scenarios for more information
3. Each team will present on one of the following:
   Agriculture (Irrigated croplands and grazing)
   Timber Management
   Urban Development
   Recreation

Consider the proposed land use and its potential impacts on the area, both positive and negative. How will it affect the economy, natural resources, public services and quality of life? If there are negative effects, is there a way to *mitigate* or reduce them? Can the project be modified and still be affordable? Your charge is to convince the commissioners that your proposal is sound, has considered the various viewpoints, and truly represents the sentiments of a large segment of community members.

- Present for five minutes; be prepared for cross-examination by County Commissioners
- Be effective; content, delivery, and creativity are equally important
- Sprinkle classroom work with information learned during the *Kids in the Creek* field trip to show how your alternative will minimize impact on water quality, quantity, and habitat
- All group members must participate
- Use visual aids during presentation
- Keep your presentation positive and focused only on your land use
- Consult with your local Conservation District, U.S.D.A. Natural Resources Conservation Service, U.S. Forest Service, and U.S. Fish & Wildlife Service offices to learn more about various subjects and resources available for your use.

## *Introduction to Scenarios*

This little valley is ready to explode! It is near the popular destination location of Leavenworth, Washington and is surrounded by attractions such as Lake Wenatchee, Icicle Creek and the Wenatchee River, the Enchantment Mountains, Glacier Peak Wilderness and more. All this adds up to make this area, especially along Icicle Creek, the target of many land use proposals.

There are several options currently under consideration by the County Commissioners. The civic leaders are interested in economic and land use proposals that will bring in outside dollars to employ local residents.

You are a group of landowners acting as a citizens advisory committee to the County Commissioners. You represent local interests because you are farmers, ranchers, housewives, developers, timber managers, recreationists, business owners, retirees, and others from the community. It is true you would like to benefit from the land use decision, but you are being asked to give all the positive and negative aspects of current land use options, including those you favor and those you do not. Additionally, since there are several environmental issues, you must present a plan that reflects a compromise. The Commissioners would like you to provide comments and recommendations that they will consider for the next hearing.

Be aware — the public is interested in both development and responsible land use in this area. The Commissioners have expressed that they will follow your recommendations as long as you are able to justify them. Be as scientific as possible. Document the resources you use to make your decisions. Present facts, and include local concerns as well as potential short and long-term effects.

Base your presentations on background information provided for each of the following scenarios: Upper Management, Urban Development, Agriculture, and Recreation.

# *Timber Management*

You are to propose a management plan for 81 acres of private forest located in the NE 1/4 of Section 26 on the enclosed map, labeled Timber.

**Site Description Ownership:** Private; adjacent to public land

**Tree species composition and condition:**
Second growth Douglas-fir, and Ponderosa pine (currently overstocked) over most of the area. Ips beetle and mistletoe are interspersed throughout the densely wooded stand. Black cottonwood and alder are the main species adjacent to waterways.

**Understory Species:** Pinegrass, bitterbrush, lupine, vine maple

**Area:** 81 Acres

**Elevation:** 1600 - 2000 feet

**Average Annual Precipitation:** 16 - 40 inches

**Average Annual Air Temperature:** 45 degrees

**Temperature Range:** Average January, 24 degrees; Average July, 65 degrees

**Growing Degree Days:** 75 - 120 days

**Slope:** 20 - 45%

**Soils:** Thow gravelly fine sandy loam

**Soil Characteristics:**
Well drained, medium textured and moderately coarse textured; formed from pumice, volcanic ash and deposits of loess over granite, granodiorite, or gneiss bedrock.

**Soil location:**
Mountainous uplands, mainly north to northwest facing slopes.

**Fire Profile:**
History of lightning-caused medium and high burn intensity fire throughout stand; high burn intensity along the creek.

**Wildlife Considerations:**
The unit is near the perimeter of a spotted owl circle. Harvesting operations may have to be restricted during certain hours during the nesting period early spring to mid summer. The stream is a tributary to one identified as potential prime salmon habitat. In this region, spring Chinook salmon and steelhead are listed as Endangered and bull trout listed as Threatened.

No other threatened or endangered species have been identified to date. Deer and elk are known to be present in the area, as well as a variety of small forest animals and birds.

**Aesthetics:**
This timbered area is visible from the main road and is near the village of Leavenworth, which derives the majority of its income from tourism. Old skid trails are visible from an early-1900s logging operation in the burned area.

**Other considerations:**
Access to the area is limited by rock outcrops and steep hillsides. There are very few roads. A concrete lined irrigation canal crosses the property. There is a narrow access road alongside the canal. The irrigation district has access rights for maintenance of the canal. The *Forest Practices Act* does not allow harvesting timber in the buffer zone adjoining a riparian area. It also requires an erosion control plan to be developed for the proposed harvest area.

# *Urban Development*

You are to propose an urban development plan for 35 acres of private property along Icicle Creek, labeled Urban on the enclosed map.

**Site Description Ownership:** Private land adjoining public land

**Area:** 35 acres

**Frost Free Season:** 150 - 165 days

**Average Annual Precipitation:** 12 - 25 inches

**Average Annual Air Temperature:** 50 degrees

**Average Temperature Range:** January, 16-33 degrees; July 51-89 degrees.

**Slope:** 3 - 8%

**Native Species Composition:** Ponderosa pine, snowberry, woods rose, oceanspray, pinegrass and sedge.

**Soils:** Brief gravelly sandy loam

**Soil characteristics:** Well-drained, moderately coarse textured soils that formed from alluvium derived from granodiorite, granite, gneiss, schist and sandstone.

**Soil location:** Low terraces near streams or on alluvial fans.

**Existing Housing in the Area:** Single family home sites are situated on an alluvial fan; some are within the 100-year flood plain. Septic systems and drainfields are not maintained regularly and incorporate older technology and materials. Homeowners tend to over water and over fertilize to achieve a golf course-looking lawn. There are few green belts around homes. Shake roofs are stipulated in the protective covenants. Private wells are drilled in the same hydrologic continuity as Icicle Creek. No off site drainage plan is in place to carry runoff safely away from adjoining properties.

**Wildlife considerations:** Instream flow has periodically been reduced to levels that have adversely affected spawning salmon populations. Some species have been listed as threatened or endangered. Black bears are known to frequent the area.

**Vegetation considerations:** Knapweed is prevalent in excavated areas. A significant wetland is located in a prime building spot within the proposed development area. The surrounding forest has a history of wildfire.

**Other Considerations:** A concrete lined irrigation canal that serves a majority of the lower valley orchards is perched on a rocky hillside above the proposed building sites.

# *Agriculture: Irrigated Croplands and Grazing*

You are to propose a farm plan for a *60-acre* family farm in the Icicle Creek area, labeled Agriculture on the enclosed map.

**Site Description Ownership:** Private

**Frost Free Season:** 130 - 165 days

**Area:** 60 Acres

**Elevation:** 1100-1200 ft.

**Average Annual Precipitation:** 15-25 inches

**Average Annual Air Temperature:** 46-50 degrees

**Slope:** 0-3%

**Native Species Composition:** Ponderosa pine, Douglas-fir, snowberry, rose and ninebark

**Soils:** Leavenworth loamy soil

**Soil Characteristics:** Moderately well drained, moderately coarse textured and coarse textured soils formed from recent alluvium derived from granite, gneiss, schist, and micaceous sandstone rock.

**Soil Location:** Bottom lands and low terraces adjacent to streams.

**Water:** The property possesses a first right to water from Icicle Creek; shallow wells are located a short distance downstream from property.

**Historical Production:** The land has long been used to raise 10 cow/calf pairs annually, and supports two horses and egg-laying hens. The family has always produced their own supplemental forage for their livestock and would like to continue this activity. They have also produced fresh eggs, fruits and vegetables for sale at the local farmers market.

**Landowner Perspective:** The landowner s desire is to keep the property in family ownership to be passed on to future generations. He would like the land to remain in agricultural production. The family has discussed the possibility of developing a vineyard and winery, with wine offered for sale to local residents and tourists. The family has always had a strong stewardship ethic. However, due to the concerns voiced by local residents and potential impacts to endangered species, they have decided to consult with their local Conservation District to develop a conservation plan to address the potential impacts of agriculture on the

environment. They have learned of a cost-share program that would assist them to make improvements on their property that protect water quality. It will pay for half the cost of improvements. They can contribute the value of equipment, labor and materials for their half of the costs.

**Considerations:** Agricultural market conditions and the local economy influence a farm s potential success. Options that allow the operation to diversify may help it to remain profitable. Refer to the following list of *Best Management Practices* for possible components to the farm plan.

## *Best Management Practices*

Following are descriptions of some of the Best Management Practices (BMP s) that can be implemented with landowners in the Wenatchee River basin. All meet the USDA Natural Resources Conservation Service Standards and Specifications and are proven methods of improving water quality:

- **Riparian restoration/Dormant stock planting:** Planting native vegetation to provide shade, buffer pollutants and stabilize streambanks. Vegetation intercepts surface flow and filters it before it reaches streams. It also prevents spray drift and lawn fertilizers from entering surface water and shades the water to reduce temperatures. Roots help prevent erosion by stabilizing the soil. In addition, vegetation helps protect streambanks from flood damage and stores water in the soil profile for later release during periods of low flow. It also contributes large woody debris to the stream and encourages a healthy aquatic food supply.

- **Animal Waste Management:** Management of animal waste in a manner that prevents or minimizes degradation of soil, air, and water resources.

- **Irrigation Water Management:** Management of irrigation water ensures that water is applied according to the needs of the crop and soil. This practice can promote optimum crop response, limit soil erosion, reduce water use and loss, reduce the movement of nutrients and pesticides by water, and conserve energy.

- **Integrated Pest Management:** Developing a pest management program that is both consistent with selected crop production goals and environmentally acceptable. Controls crop pests through a combination of cultural, biological and chemical control systems. Crop pests include weeds, insects, and diseases. This BMP can boost plant growth, control targeted pests, and reduce pesticide use and related impacts to surface and ground water quality.

- **Nutrient Management:** Managing the use of nutrients for optimum forage and crop yields. Ensures the nutritional needs of the crop are being met and minimizes off-site movement of nutrients. A nutrient management program should account for all sources of plant nutrients such as chemical fertilizers, organic wastes, legume crops, soil reserves, and crop resides. Nutrient management can reduce the loss of nutrients to surface and ground water, maintain soil fertility, supply nutrients for optimum crop production, and reduce production costs.

- **Fencing:** Enclosing or dividing an area of land with a suitable permanent structure that controls animal access to surface water.

- **Pasture management:** Establishing long-term stands of adapted species of perennial, biennial, or re-seeding forage plants. Planning for appropriate rotation of animals on different sections of pasture land to prevent overgrazing, excess nutrient deposition, and soil erosion.

- **Log Weirs:** Construction of low stage pools for irrigation diversions. Log weirs promote more natural sediment movement, create pools for fish habitat, are not barriers to fish migration, increase oxygen infiltration, and create less impact to streambanks than rock check dams. Rock checks involve placing rocks in the creeks annually to hold water for irrigation diversions. These diversions also collect sediment, both fine and coarse, until the next ordinary high water event occurs. High water events often obliterate these irrigation checks, causing bedload and sediments to be flushed downstream. The results are depositional features such as center bars that increase the lateral migration and cause unnatural movement of bedload. Streambanks are often negatively impacted by this deposition causing loss of live woody materials important to stability. For example, instantaneous flushing and the annual obliteration of loose check irrigation diversions are a problem for the entire Mission Creek system, just south of the subject area. The natural sandstone soils in the area also erode easily, often damaging or destroying pumps. Log weirs create a natural, consistent scour effect, resulting in less costly operation and maintenance of equipment. The log weirs would sustain ordinary high water flows, offering greater stability.

- **Conifer Streambank Treatment:** Protects eroding streambank toes while woody material becomes established for long-term stability. This practice can result in enough toe protection to allow important plant species to reestablish.

- **Reforestation:** These riparian plant species have a positive effect on water quality. They establish woody vegetation for erosion control, protect a watershed, and provide for uptake of soil- and water-borne chemicals and nutrients. With this, energy conservation is promoted, air pollution reduced and wildlife habitat enhanced.

These are only a few of the BMPs that will be established as part of Conservation Plans created with landowners to implement water quality improvement BMPs. While no single practice or location alone will restore water quality, multiple practices implemented on multiple sites, over time, achieve this goal.

# *Recreation*

Your advisory committee has been asked to propose a plan to the Commissioners for a private landowner whose 29-acre property is adjacent to Wenatchee National Forest land in the Icicle Watershed (labeled Recreation on the enclosed map). The landowner is currently operating a small outfitting business from the site, offering guided trail rides and pack trips. The owner would like to expand the business to provide year-round income from recreation related activities.

**Site Description:** The site has access to a variety of forest recreation opportunities, including lower elevation trails, streams, and meadows. The property is situated close to trailheads leading to wilderness areas with advanced hiking trails and high mountain lakes. Refer to the enclosed topographic map of the Icicle Creek Watershed for information about the physical characteristics of the region.

**Ownership:** Private land adjacent to large areas of public land as indicated by the enclosed map.

**Permits:** Required seasonally for portions of the Alpine Lakes Wilderness (public land); also required for outfitter/guide operations and forest resource collection.

**Area:** 29 Acres

**Elevation:** 1200 ft.

**Climate:** Mild summer temperatures and snowfall of almost 100 inches per year at the property elevation (and higher in the surrounding mountains) make this site a potential year-round recreation destination.

**Plant Species:** In uncultivated areas, Ponderosa pine, Douglas-fir, pinegrass, snowberry, rose and ninebark.

**Average Annual Precipitation:** 15-25

**Average Annual Air Temperature:** 46 —50 degrees

**Average Temperature Range:** January, 16-33 degrees; July 51-89 degrees.

**Frost-free Season:** 130-165 days

**Slope:** 0-3%; a portion of the property is 8-15%

**Soils:** Leavenworth loamy sand, Leavenworth fine sandy loam; Brief gravelly sandy loam on sloped areas of the property.

**Soil Characteristics:** Moderately well-drained, moderately coarse textured, and coarse textured (well-drained on slope). Runoff is slow over most soils; sloped areas are somewhat susceptible to water erosion.

**Geographic Characteristics:** The deep river valleys and angular peaks of this drainage provide spectacular scenery. There is also a potential for severe erosion on steeply sloped areas. Site includes areas within the floodplain.

**Wildlife Considerations:** Numerous species make their home in the watershed, including some with potentially negative interactions with humans, such as bears and cougars. Endangered species such as spotted owls, several fish species, and a number of plants are found in the area.

**Other Considerations:**
The Wenatchee and Okanogan National Forest is working to update the recreation component of the management plan for this watershed. They are gathering input from citizens. A variety of different recreation users are interested in increasing the opportunities for their activities in the watershed. Environmental groups are opposing these proposals because of their potential impact to the ecosystem and the cost of maintenance. Keep in mind the issues being raised regarding recreation impacts on public lands in the area, as well as other impacts on natural resources, the local economy, and infrastructure such as roads and utilities. Consider the expenses and space requirements for animal management, equipment and supply storage, and maintenance activities. Following is a partial list of activities that might be considered in the plan. Include any others you think are appropriate.

**Current and Potential Recreation Opportunities in the area:**

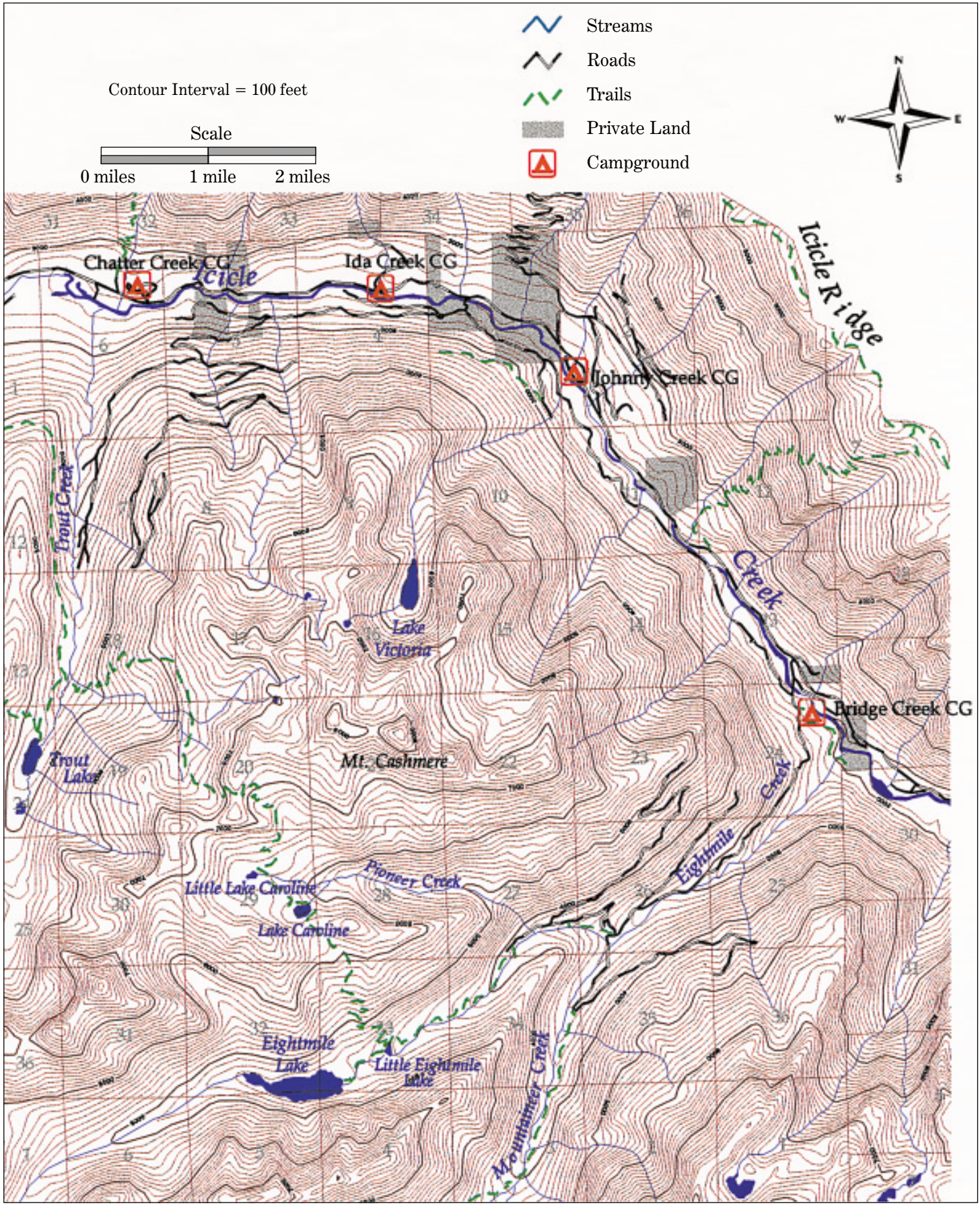
| | | |
|---|---|---|
| Backpacking | Camping | Climbing |
| Mountain biking | Rafting | Boating |
| Nordic skiing | Mining | Hiking |
| Fishing | Horse/Llama Packing | Hunting |

**Collecting forest resources:** mushrooms, Christmas trees, tree boughs, firewood

**Motorized recreation:** Off Road Vehicles, motorcycles

Other business opportunities such as equipment rentals, restaurant, gas station, convenience store, guided trips, sleigh rides, and scenic helicopter rides.

# Mt. Cashmere *and Vicinity*



*Insert the Icicle Creek Watershed Map (17 x 11 sheet) here*

*Insert the Aerial Map for Scenarios (17 x 11 sheet) here*

# Resource Specialist Section

This station requires a moderator and the involvement of all the station instructors. The moderator will direct a simulation in land use planning. The resource specialists have two roles. First, the specialists will act as resources to the student groups if there are questions prior to the presentations. Second, they will help to evaluate the groups during their presentations. Selected resource specialists may act as the governing body if local planning specialists are not available to assist. As the governing body, they can ask questions of the student group and then critique their presentations. Spend about one minute reviewing each group s presentation. Were the students realistic about the impacts of their land uses on water quality? What mitigations and compromises are they proposing to reduce those impacts? What was the group s greatest strength? What elements need improvement?

Comments on presentation delivery, content, and the creativity of solutions are appropriate. Presentation content should include positive and negative aspects of the proposed land use with a plan that reflects compromise.

## *Moderator's Role*

WATERSHED WONDERS is perhaps the most important station as it serves as a culminating activity. Students should arrive fully prepared for their presentations to the County Commissioners. The moderator s role includes time keeping. Time keeping at this station is especially important because students must return to their school bus at a specific time, whether or not the activity is completed! The total activity time is typically 50 minutes. This time period is divided into four presentations of five minutes each, and four five minute question-and-answer periods following each presentation. Five minutes will be allowed for the Commissioners to think about the session and respond to the student groups.

The moderator will coordinate the Commissioners question and answer period.