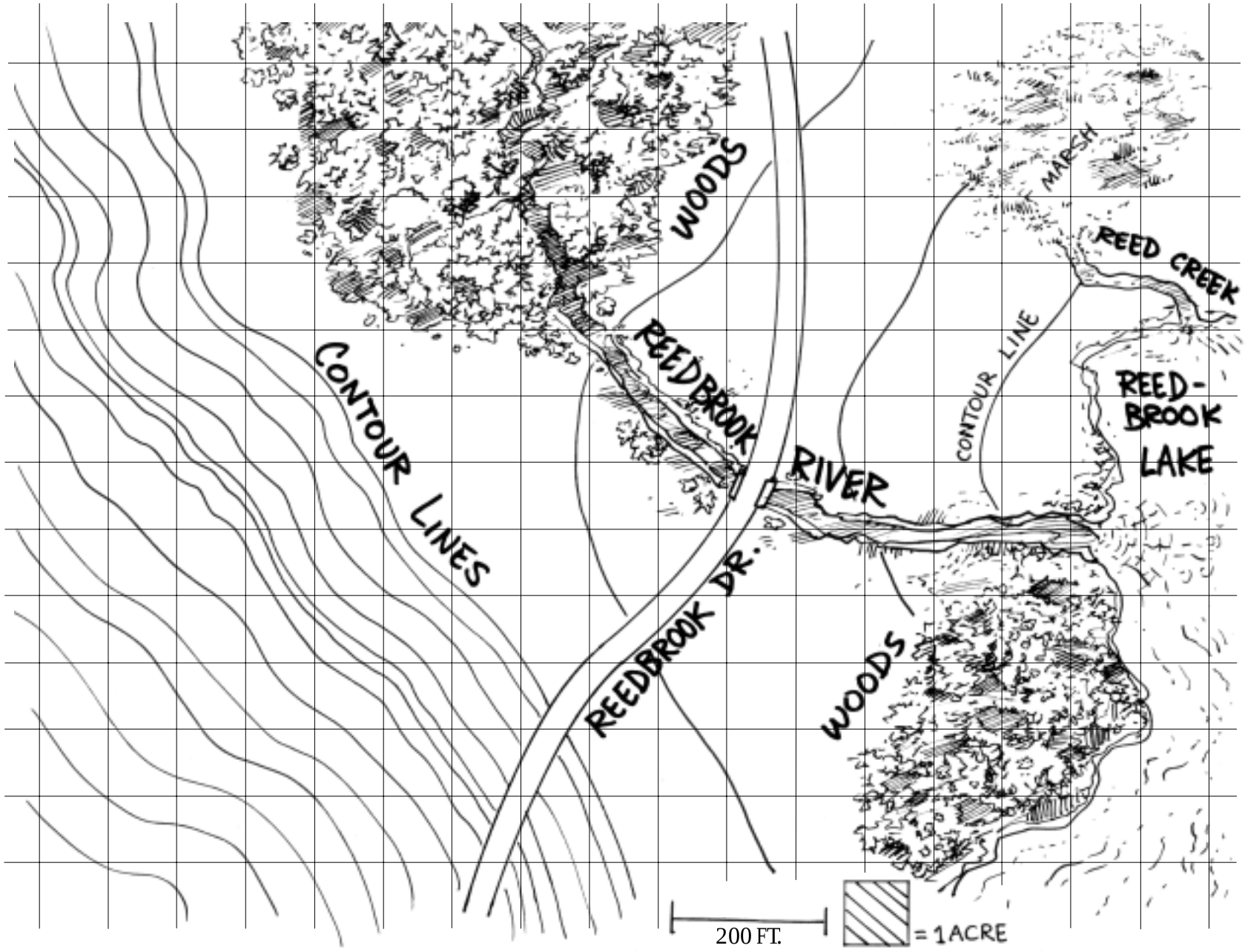

WOODS
MARSH
REED CREEK
CONTOUR LINES
REEDBROOK
CONTOUR LINE
REED-
BROOK
LAKE
RIVER
REEDBROOK DR.
WOODS
200 FT.
= 1 ACRE

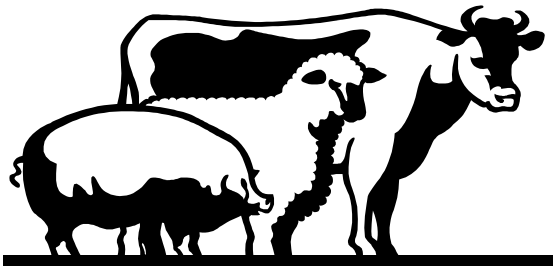
POLLUTION INDICATORS SHEET

Home with Septic System Location:

- Every home within 500 feet of water body = 10 pollution factors

Feedlot Location:

- Every feedlot within 1,000 feet of the river or lake = 100 pollution factors
- Every feedlot located within gullies (shown as a "v" on the map contour lines) = 50 pollution factors



Crops Location:

- For every acre of crops located in the marsh or the gullies, multiply by 5 pollution factors

Development Location:

- For every acre of land with a nonporous surface (commercial buildings, parking lots, roads, driveways) multiply by 10 pollution factors

- For every home developed in the wooded area on a lot of 1 acre or less multiply by 5 pollution factors

- For every acre of wetlands drained in the marsh, multiply by 10 pollution factors

STUDENT DATA SHEET

Calculate the total number of pollution factors entering the lake and river using the Pollution Factor Information Sheet.

GROUP LETTER _____

COMMUNITY NAME _____

GROUP MEMBERS _____

_____

TYPE OF LAND USE	NUMBER OF ACRES	POLLUTION FACTOR

TOTAL _____

GROUP A: GENERAL INSTRUCTIONS

Your land will be developed one step at a time. Complete **ALL** instructions and land use drawings from one envelope before opening the next envelope. Each student will take a turn opening and reading the contents of the envelopes to the group. This student will make the necessary decisions, but can receive advice from others in the group if they choose. Use all six envelopes.

The map represents some undeveloped land. You will be developing the land and drawing the land uses on this map. Once all of your land uses are drawn on the map, enlarge it on the butcher or freezer paper and attach it to the poster board. Label the map with your group letter and name your community.

The Site

The map shows about 344 acres of undeveloped land with 1 square equaling one acre. Each square is 100 feet by 100 feet. Contour lines show 20 feet elevation changes. Reedbrook Drive connects with the main road which leads to Reedville 7 miles away. There are two forested areas and a wetland marsh near Reedbrook Lake. There are two water sources: Reed Creek which drains from the marsh to the lake and Reedbrook River which originates in the woods. The water quality is good and people enjoy fishing and swimming in the lake.

Developing the Land

The development plan for your group is contained in the separate envelopes. All the instructions you will need are included. Each envelope is numbered in the order you are to open and use it. Divide the envelopes equally among your group, taking partners if necessary. Read the envelope contents one at a time. Draw the land uses on the map. Use your best judgement in placing fields and buildings, because once it is placed on the map, you are not allowed to make any changes.

Roads

You must build roads to service all of the land uses.

Separate Developments

If you do not have enough land in one area, developments may be separated and located in various sections of the map.

Wetlands

Wetlands may be drained in this land area activity for housing and agriculture development. However, several drainage ditches must be constructed. Draw the ditches as a line with an arrow showing the flow from the wetlands to the river.

Wooded Areas

Developments can be placed in the woods. It will be necessary to cut some trees and dispose of the wood, branches and stumps.

GROUP B: GENERAL INSTRUCTIONS

Read and Follow These Instructions First:

1. Your land will be developed one step at a time. Complete **ALL** instructions and land use drawings from one envelope before opening the next envelope.
2. Begin with the envelope marked Number 1.
3. Open all envelopes in order.
4. Each student will take a turn opening and reading the contents of the envelopes to the group. This student will make the necessary decisions, but can receive advice from others in the group if they choose.
5. Use all six envelopes.

Draw the Land Uses

The map represents some undeveloped land. You will be developing the land and drawing the land uses on this map. Once all of your land uses are drawn on the map, enlarge it on the butcher or freezer paper and attach it to the poster board. Label the map with your group letter and the name you gave your community.

Study the Environmental Effects

A section containing a description of the potential environmental effects of certain land uses in included at the end of these instructions. You may study this information, but you do not have to use it in making the development decisions.

The Site

The map shows about 344 acres of undeveloped land with 1 square equaling one acre. Each square is 100 feet by 100 feet. Contour lines show 20 feet elevation changes. Reedbrook Drive connects with the main road which leads to Reedville 7 miles away. There are two forested areas and a wetland marsh near Reedbrook Lake. There are two water sources: Reed Creek which drains from the marsh to the lake and Reedbrook River which originates in the woods. The water quality is good and people enjoy fishing and swimming in the lake.

Roads

You must build roads to service all of the development.

Separate Developments

If you do not have enough land in one area, developments may be separated and located in various sections of the map.

Wetlands

Wetlands may be drained in this hypothetical land area for housing and agriculture development. Indicate drainage ditches by drawing a line from the wetlands to the river. *NOTE: In the real world, there are environmental regulations restricting wetlands draining.*

The Woods

Developments can be placed in the woods. If the lot sizes are 1 acre or less, it will be necessary to cut some trees and dispose of the wood, branches and stumps.

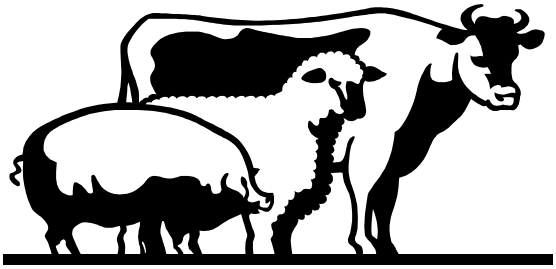
GROUP B:
POTENTIAL ENVIRONMENTAL EFFECTS OF CERTAIN LAND USES

This information tells how land use decisions affect the quality of nearby water resources. You do not have to follow this information.

1. Homes with septic systems should be located at least 500 feet from surface water to prevent septic effluent from polluting the water. Septic systems should be located downhill from wells and springs and at least 100 feet away.

2. Gullies that form in steep terrains increase soil erosion that can pollute many gallons of surface water with pesticides, fertilizers, and other wastes. Planting grass and other vegetation in the gullies can help filter the soil and other pollutants out of the surface runoff. To draw a grass waterway on the map, make diagonal green lines about 50 feet wide for the length of the gully.

3. Animal waste runoff from feedlots can pollute the surface water with nitrates and other contaminates. Feedlots should be at least 1,000 feet from surface water.



4. The way crops are planted on the land can affect soil erosion and water quality. On land that has a slope of 5 percent or greater the crops should be planted in strips parallel to the contour of the land. The strips should be 100 feet wide and can alternate with other crops. To show this method of planting crops on the map, draw fields in stripes of not more than 100 feet wide and parallel to the contour of the land.

GROUP C: GENERAL INSTRUCTIONS

Read and Follow These Instructions First:

1. Open one envelope at a time beginning with the envelope marked with a number 1.
2. Open all envelopes in order.
3. Read all six envelopes.

Read and Follow the Regulations

Select one person in the group to represent the local zoning board. This person will ensure that land uses that could pollute the water are properly sited. Before any member of the group draws the development on the map, the zoning board representative must be asked for a permit to place the development on the site chosen. A permit will be issued if the development does not violate any of the regulations.

Draw the Land Uses

Your land will be developed by looking at all of the required developments. Each player will take a turn opening and reading the envelopes. This student will make the necessary decisions using the advice of the other members of the group. Plan the best site for all developments before you begin to draw on the map.

The Site

The map shows about 344 acres of undeveloped land with 1 square equaling one acre. Each square is 100 feet by 100 feet. Contour lines show 20 feet elevation changes. Reedbrook Drive connects with the main road which leads to Reedville 7 miles away. There are two forested areas and a wetland marsh near Reedbrook Lake. There are two water sources: Reed Creek which drains from the marsh to the lake and Reedbrook River which originates in the woods. The water quality is good and people enjoy fishing and swimming in the lake.

Roads

You must build roads to service all of the development.

Separate Developments

If you do not have enough land in one area, developments may be separated and located in various sections of the map.

Wetlands

Wetlands may be drained in this hypothetical land area for housing and agriculture development. Indicate drainage ditches by drawing a line from the wetlands to the river. *NOTE: In reality, there are environmental regulations restricting wetlands draining.*

The Woods

Developments can be placed in the woods. It will be necessary to cut some trees and dispose of the wood, branches and stumps.

REGULATIONS FOR GROUP C

COUNTY BOARD MEMBER

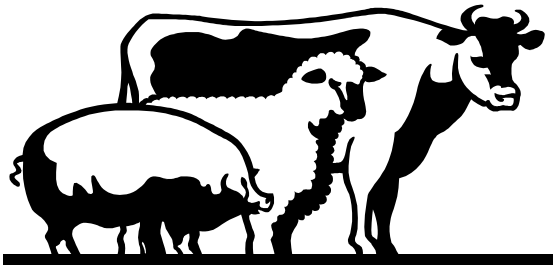
LAND USE CONTROLS AND MANAGEMENT ACTIVITY REGULATIONS

These regulations must be strictly followed.

1. Homes with septic systems should be located at least 500 feet from surface water to prevent septic effluent from polluting the water. Septic systems should be located downhill from wells and springs and at least 100 feet away, 100 feet from a well, and 50 feet from a property line.

2. Gullies that form in steep terrains increase soil erosion that can pollute many gallons of surface water with pesticides, fertilizers, and other wastes. Planting grass and other vegetation in the gullies can help filter the soil and other pollutants out of the surface runoff. To draw a grass waterway on the map, make diagonal green lines about 50 feet wide for the length of the gully.

3. Animal waste runoff from feedlots can pollute the surface water with nitrates and other contaminates. Feedlots should be at least 1,000 feet from surface water.



4. The way crops are planted on the land can affect soil erosion and water quality. On land that has a slope of 5 percent or greater the crops should be planted in strips parallel to the contour of the land. The strips should be 100 feet wide and can alternate with other crops. To show this method of planting crops on the map, draw fields in stripes of not more than 100 feet wide and parallel to the contour of the land.

LAND USE CARDS

1. Charles Burns has saved money for years to invest in a small farm. Build Charles's farm according to the instructions listed below. Remember: one acre equals 1 square on your map.

- Shade in with gray, ¼ acre for a house (Note: This house will rely on a septic system.)
- Shade with red, ½ acre for a barn
- Shade with brown, 5 acres for a feedlot for the 40 head of cattle
- Shade with green, 5 acres for pasture
- Shade with yellow, 10 acres for corn
- Shade with purple, 10 acres for soybeans
- Using black, draw in the roads to the main highway. Be sure you can get to all of the fields

2. Tommy T. Tuttle has inherited about 46 acres of land and wants to settle down and live the good life. Build the Tuttle Farm.

- Shade in gray, ¼ acre for a house (Note: This house will rely on a septic system.)
- Shade in red, ½ acre for a barn
- Shade with brown, 5 acres for a feedlot for 55 head of cattle
- Shade with green, 10 acres for pasture and grass
- Shade with yellow, 15 acres for corn
- Shade with orange, 15 acres for alfalfa
- Using black, draw in the roads to the main highway. Be sure you can get to all of the fields

3. Millie Sue and Don Duckley have been farming for many years and decided to sell their farm to a developer and retire to Hawaii. Build the 30-acre subdivision.

- Shade gray, ¼ acre for each of the 20 houses
- Shade green, ¾ acre for the grass around the houses
- Shade blue, 7 acres for the pond, and green for the 3 acres for the park around the pond. Include walking trails and bike paths in tan
- Using black, draw in the roads to the main highway. Be sure all of the houses and the park are connected

LAND USE CARDS

4. Charles Burns recently married Ann McQuire and they have decided to expand the farm Charles bought.

- Using brown, expand the feedlot by 7 acres
- Using green, expand the pasture by 10 acres
- Using yellow, add 5 more acres of corn
- Using orange, add 5 acres of alfalfa
- Using black, shade in the connecting roads to the new fields

5. Tommy Tuttle finds farming a good way of life and wants to expand his farm.

- Expand his feedlot by 10 acres to take care of more cattle
- Add 10 more acres of corn

6. More and more people think the good life is in a natural setting and want to move to the Duckley's development. They will need an additional 20 acres.

- Build 10 more houses
- Build a 10-acre shopping center with a paved parking lot (shade black)
- Add a 3-acre strip of stores (shade tan)
- Add 4 acres of green trees and grass within the parking lot

READ FIRST CARDS

Group A: READ FIRST!

Open only one envelope at a time.
Complete all instructions before moving to the next envelope.
Begin with the envelope marked #1

Group B: READ FIRST!

Open only one envelope at a time.
Complete all instructions before moving to the next envelope.
Begin with the envelope marked #1

LAND USE PRACTICES

SEPTIC SYSTEMS

Many rural homeowners depend on onsite waste disposal system because municipal waste water treatment systems are not accessible. Nationally, there are more than 24.7 million households using some type of onsite waste disposal system. In Virginia, over two million citizens rely on septic systems. The U.S. EPA estimates that over one trillion gallons of waste is disposed of through septic systems yearly which is a major source of groundwater contamination. Improper siting and system failures cause wastewater to be carried to inadequately sealed wells or to lakes and streams polluting both ground and surface waters with bacteria, nutrients, toxic household chemicals and waste. To prevent this contamination, septic systems should managed correctly, being inspected and emptied every 3 to 5 years.

YARDS AND GARDENS

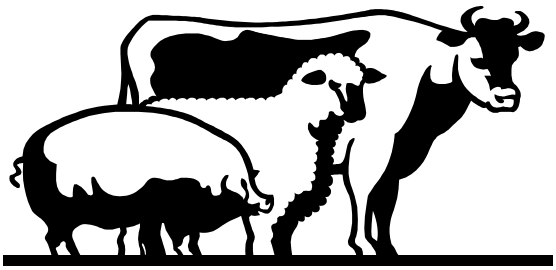
Landscaping can be a source of water pollution, in particular when planting non-native plants in yards and gardens. Many times, non-native vegetation needs fertilizer or additional water. This not only creates more runoff than usual but it also adds chemicals to the runoff. Conversely, planting native vegetation that adapts easily to local climate and insects reduces the need for fertilizer and extra water.

CROPS

Runoff from croplands carries pesticides and fertilizers with the soil into surface waters. In areas where there is significant rainfall, plowed fields can increase soil erosion. The mountainous regions of the western part of Virginia suffer the highest erosion losses. An estimated 43 million tons of top soil are lost each year. The most significant water pollutants are sediment and cropland erosion. Soil erosion practices such as strip cropping, no-till farming, and grassy waterways can reduce the loss of valuable soil. These practices also help protect water quality by preventing the movement of sediment and other pollutants from croplands to waters.

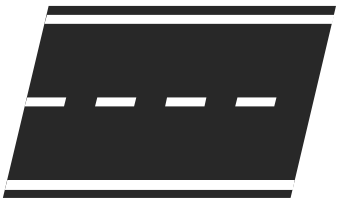
LIVESTOCK OPERATIONS

Animal feedlots are areas where animals are confined for feeding, breeding, raising or holding purposes. They can be located outside or in a building and do not require pasture lands. Today, more farms are building larger more specialized feedlots for poultry and livestock. These areas can cause significant pollution problems. Animal waste from feedlots, improperly constructed or leaking manure storage tanks and pits can contaminate both ground and surface water. Poorly run operations can release bacteria, viruses, excess nutrients and oxygen-demanding pollutants.



LAND USE PRACTICES

ROADWAYS



Deicing materials used to keep roads and highways safe can contaminate water. Salt used in winter to melt ice on roads in rural and urban areas poses a threat when washed into surface waters. Improperly stored stockpiles of these materials (salt mixed with sand and gravel) can render water unfit for humans or livestock. Runoff from paved surfaces such as highways, parking lots and community streets contain many other pollutants such as gasoline, motor oil, antifreeze and tire by-products. In warm seasons, pavement transfers heat to runoff water which in turn raises temperatures of receiving waters making them unlivable for aquatic life. Limiting paved surfaces helps to reduce this source of water contamination. Using partially paved surfaces interspersed with grass and natural vegetation which create pockets to absorb water is an alternative to large areas of pavement such as parking lots.

URBANIZATION

Nonporous urban terrain prevents water from gradually percolating into the ground. Instead, water collects in storm water systems creating large volumes of fast moving water that can erode vegetation and banks of streams. A typical city block creates 9 times more runoff than a wooded area of the same size. Pollutants such as nitrates, bacteria, litter, soil, toxic chemicals, and automobile products enter into urban storm water systems. In urban areas, runoff from impervious surfaces is a greater pollutant than municipal sewage. Limiting paved surfaces helps to reduce this source of water contamination. Using partially paved surfaces interspersed with grass and natural vegetation which create pockets to absorb water is an alternative to large areas of pavement such as parking lots and sidewalks.

FORESTRY PRACTICES

The water quality in forested areas is usually of very high. Effective forestry management practices help protect surface waters. Improperly managed forestry activities and harvesting can cause damage to sensitive ecosystems and water resources. Road construction, clear cutting, stacking and loading operations during harvests and controlled burning to prepare sites for planting or reduce the threat of forest fires can transfer the pollutants from the land to the water. Effective forestry operations can protect water quality from the harmful impacts of forestry activities.