Your School Site & Its Impact on Water

Local Water Resources and Pollution Prevention Learning Activity for High School Students

May 2002

Contra Costa Clean Water Program
255 Glacier Drive • Martinez, CA 94553-4897
Tel: (925) 313-2360 • Fax: (925) 313-2301

SPECIAL THANKS

The Contra Costa Clean Water Program thanks the following teachers
in Contra Costa County for assistance in developing this learning activity.

Joseph Breazeale
De Anza High School
West Contra Costa Unified School District

Patricia Carothers
Monte Vista High School
San Ramon Unified School District

Joni Lynn Grisham
Pittsburg High School
Pittsburg Unified School District

Alexandra Kunz
Monte Vista High School
San Ramon Unified School District

Our community is extremely fortunate to have such dedicated, enthusiastic and innovative
educators to shape our teens' intellects and to influence the quality of our environment.

The Program also wishes to thank the following administrators
for their leadership and guidance in developing curriculum that meets the needs
of both teachers and students.

Dan Hanel
Pittsburg Unified School District

Susan Magnone
Contra Costa County Office of Education

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Martinez, California 94553
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Contact the Contra Costa Clean Water Program
to receive additional copies of learning activity materials.

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STAGE 1: IDENTIFY DESIRED RESULTS

✓ California Content Standards for Biology/Life Sciences, Grades 9-12

Standard 6 (Ecology): Stability in an ecosystem is a balance between competing effects.

- Benchmark 6a: Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
- Benchmark 6b: Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

✓ California Content Standards for Earth Sciences, Grades 9-12

Standard 9 (California Geology): The geology of California underlies the state's wealth of natural resources as well as its natural hazards.

- Benchmark 9c: Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

✓ California Investigation and Experimentation Standards, Grades 9-12

Standard 1: Scientific progress is made by asking meaningful questions and conducting careful investigations.

- Benchmark 1l: Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

STAGE 2: DETERMINE ACCEPTABLE EVIDENCE

✓ Learning Journals and Group Discussion

- Students examine prior knowledge through questioning. They should record their preconceptions so that they can be reexamined at the end of the learning activity.
- Students revisit preconceptions after completion of the activity to identify and dispel any misconceptions.

Evaluation: Learning journals should not be graded for content, but the teacher may find it useful to provide an incentive for writing, such as a stamp or points for effort.

✓ "Live-at-Five" Interviews (Oral Quizzing)

- Students receive challenging questions to answer as a team or as individuals. Provide them an opportunity to collaborate, express their thoughts and refine their ideas.
- Students explain to an interviewer (another student or the teacher) their answer to a challenging question that has been posed.

Evaluation: While students are discussing their answers, the teacher can monitor their progress by listening in on their conversations and by noting their participation and involvement. As the interviewer moves from team to team, the responses can be evaluated for degree of conceptual understanding displayed.

✓ Vocabulary Quiz

- Match key words with definitions, or
- Write definitions and give illustrative examples for key words.

✓ Service-Learning Projects

- Students work in teams in response to a school or community need, such as a school-wide recycling and/or composting program.
- This learning opportunity could also be appropriate for the high school's Leadership class. Part of the project could involve writing a grant application to various agencies for project funding.

STAGE 3: PLANNING LEARNING EXPERIENCES AND INSTRUCTION

LESSON CONCEPT

The Earth is a complex system that changes over time, yet exists in a dynamic balance that is affected by human population and alterations of habitats. A change in one ecosystem may have far-reaching effects on the others since ecosystems are interdependent.

LESSON OVERVIEW

Students investigate the home and school sites as environments impacted by stormwater and urban runoff. Students observe and map the locations of litter, dirt, oil, grass clippings, etc. while estimating the direction of runoff that could carry these items into storm drains, nearby creeks or other waterways. Students identify stormwater pollution prevention behaviors that can be implemented at the school site and at home.

DESIRED OUTCOMES

Students will:

- *Gain* awareness of the home and school sites as unique watersheds impacted by stormwater.
- *Observe* and *record* potential stormwater pollutants at the home and school sites.
- *Explain* the environmental impact of contaminated stormwater or urban runoff.
- *Identify* stormwater pollution prevention behaviors to implement at the school site and at home.
- *Realize* and *appreciate* one's connection to the Earth and water systems.

STEPS FOR TEACHING

✓ *This is the lesson at a glance. Refer to page 12 for lesson plan detail.*

Two-day Option

Teacher Action	Student Action	Suggested Time
Day 1		
Investigate students' prior knowledge about the local watershed and stormwater issues.	Examining Prior Knowledge	10 min.
Provide background information on the local watershed and stormwater issues via video "Water is Life. Rescue it." and class discussion. (See following section "Background for Teachers.")	Processing Information; Relating	20 min.
Guide students to infer the possible environmental effects of stormwater contaminated by litter, oil, pesticides, and yard waste.	Processing Information; Inferring	10 min.
Direct students to observe the home site as an environment impacted by stormwater. Prepare students for school site observation activity.	Processing Information; Planning	15 min.
Day 2		
Ask students to share results from home site observation.	Processing Information	10 min.
Direct students to observe the school site as an environment impacted by stormwater.	Observing; Processing Information	20 min.
Ask students to share findings and conclusions.	Processing Information	15 min.
Instruct students to reflect upon the consequences of stormwater pollution and identify pollution prevention behaviors they can adopt at school and at home.	Reflection; Applying Knowledge	10 min.

Three-day Option

Teacher Action	Student Action	Suggested Time
Day 1		
Investigate students' prior knowledge about the local watershed and stormwater issues.	Examining Prior Knowledge	10 min.
Provide background information on the local watershed and stormwater issues via video "Water is Life. Rescue it." and class discussion. (See following section "Background for Teachers.")	Processing Information; Relating	20 min.
Guide students to infer the possible environmental effects of stormwater contaminated by litter, oil, pesticides, and yard waste.	Processing Information; Inferring	10 min.
Direct students to observe the home site as an environment impacted by stormwater. Prepare students for school site observation activity.	Processing Information; Planning	15 min.
Day 2		
Ask students to share results from home site observation.	Processing Information	10 min.
Direct students to observe the school site as an environment impacted by stormwater.	Observing; Processing Information	45 min.
Day 3		
Ask students to share findings and conclusions.	Processing Information	40 min.
Instruct students to reflect upon the consequences of stormwater pollution and identify pollution prevention behaviors they can adopt at school and at home.	Reflection; Applying Knowledge	15 min.

BACKGROUND FOR TEACHERS

Clean Water Act

Surface waters in Contra Costa County are an important resource for its residents. The creeks, rivers, the Delta, and the Bay provide the main source of drinking water in addition to forms of recreation such as boating, fishing, and swimming. The cornerstone for protecting this valuable resource and controlling water pollution was the Federal Water Pollution Control Act of 1972. In 1977, the Act was reauthorized and renamed the **Clean Water Act** (CWA). The goal of the CWA is the "restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters." Under this Act, it is illegal to discharge pollutants from a **point source** into any surface water without a National Pollution Discharge Elimination System (NPDES) permit. EPA has the authority to set standards for the quality of wastewater discharges. Amendments to the CWA in 1987 increased the ability of EPA and states to improve water quality by addressing toxic discharges, allowing citizen lawsuits, and funding municipal sewage treatment facilities.

Sources of Pollution

Surface water pollution originates from sources that are classified by regulatory agencies as either point sources or non-point sources. **Point source pollution** comes from a single identifiable source. It tends to be highly regulated and can usually be routed to a treatment facility. Examples include oil refineries, chemical plants, and sewage treatment plants. Pollution, such as urban runoff, cannot be linked to a single, identifiable source and is classified as **non-point source pollution**. Water that runs off city streets, parking lots and driveways during rainstorms and from excess landscaping watering may contain litter, metals, oil, grease, and other automotive fluids. Runoff from homes, parks, and agricultural fields generally contains yard waste, animal waste, fertilizers, and pesticides. Water flowing through construction sites can lead to problems with sediment such as turbidity in the waterways, a high pH from concrete cuttings, and contamination by paint and other chemicals used on site.

Recent stormwater regulations are beginning to reduce non-point source pollution from industries and cities. Farming practices that emphasize soil conservation and appropriate use of pesticides are effective in reducing pollutants in runoff. We can help prevent non-point source pollution by properly disposing of used motor oil, using fewer pesticides or less toxic alternatives, and carefully assessing lawn and garden practices. By reducing the potential contaminants that residents leave on streets, driveways and lawns, we can make a substantial contribution to improving the quality of creeks, rivers, the Delta, and the Bay.

Environmental Impact

Stormwater pollution is the untreated contaminated water that drains from the streets and surfaces of Contra Costa County into the creeks, rivers, the Delta, and the Bay. The largest source of stormwater pollution is the general public, and the most common pollutants are litter, used motor oil, pesticides, yard waste, paint, and fertilizers. The environmental impact of these items on our waterways is significant. Used motor oil, pesticides, and paint simply poison the fish, birds, and all other aquatic life. Yard waste and most litter degrade over time and deplete

the oxygen supply for aquatic life. These animals may mistake plastic fragments for food leading to strangulation or gastrointestinal blockage. Fertilizers contribute to algal blooms and excessive plant growth leading to a decrease in biodiversity. Polluted water in the creeks and detention basins can also percolate through the soil leading to contamination of the soil and groundwater.

Storm Drain System

Excess water from rainfall and outdoor watering needs a place to go where it won't be a safety hazard or damage property. Streets drain water runoff from our homes and businesses. Runoff flows along the gutters into storm drain inlets and through underground pipelines. Most stormwater runoff flows directly to detention basins, roadside ditches, creeks, rivers, the Delta, and the Bay. Since runoff is untreated and reaches these important waterways that people and wildlife depend on, it's important to keep runoff clean.

The storm drain system and the sewer system are two separate drainage systems. The sewer system, or sanitary wastewater system, takes all household wastewater from toilets, showers and sinks, and routes it from your plumbing system to a sewer treatment plant. The storm drain system, on the other hand, was intended to route rainwater quickly off the streets during a heavy storm, but unfortunately takes all urban runoff along with it. Chemicals, trash and debris from lawns, parking lots and streets, either intentionally or accidentally spilled, go straight into the creeks, rivers, the Delta, and the Bay.

Discussion Guide for "Source of Pollution" Overhead/Worksheet

Behavior	Problem	Solution
Spraying fertilizer/ herbicide/ fungicide on a golf course	Excess fertilizer can run off into the creek and lead to algal blooms and loss of biodiversity. Herbicide and fungicide can poison wildlife.	Use only when needed and follow directions on the bottle for the proper amount.
Hosing down pavement at service station	Auto fluids go to the creek and poison wildlife.	Use kitty litter on spills, sweep up, put in a bag and take it to a Household Hazardous Waste (HHW) Collection Site. Call 1-800-NO-DUMPING for a site near you.
Driving	Copper from brake dust washes into the creek and poisons wildlife.	Carpool, reduce driving, promote the design of less toxic brake pads.
Littering on and off campus	Litter gets swept in the creek and is unsightly. Wildlife may mistake it for food and suffer gastrointestinal blockage. Eventually some of the litter will break down and, in doing so, robs	Use appropriate trash bins and recycling containers.

	dissolved oxygen from the water that aquatic life depends on.	
Leaving behind pet droppings	Pet droppings get washed into the creek. These droppings introduce bacteria and viruses into the waterways that cause human health problems. Fecal matter also contains a high concentration of nutrients, which can lead to excessive plant growth, potentially choking oxygen out the streams and killing aquatic life.	Bring baggies when walking the pet, and pick up any droppings.
Leaking automotive fluids from parked car	Automotive fluids contain heavy metals that can poison wildlife.	Keep vehicles tuned and leak-free.
Raking yard waste into storm drain	Yard waste clogs storm drains or travels through them to the creek where it degrades over time, robs oxygen from the water and kills aquatic life.	Use the green waste containers or start a compost pile.
Washing car in the driveway	Soaps and detergents contain large concentrations of phosphorus, which aids algal and plant growth in aquatic systems. This can choke oxygen out of streams by 1) reducing flow and light penetration (i.e., photosynthesis) and 2) more plant decomposition, which uses oxygen.	Wash the car on the lawn where the water and soap can soak in rather than run into the storm drain. Another option is to use a professional carwash facility where they capture, filter and reuse the water.
Changing oil in the driveway	Drips and spills can get washed into the storm drain system from rain, hoses or sprinklers.	Use kitty litter to absorb spilt oil, sweep up, put in a bag and take it to a HHW Collection Site. Call 1-800-NO-DUMPING for a site near you. Don't hose it down.
Dumping used oil down the storm drain	Used motor oil contains heavy metals that can poison wildlife.	Take the used oil and filter to a used oil collection site. See *www.funnelhead.com* for locations throughout Contra Costa County.
Spraying pesticides in garden	Excess pesticides run into the storm drain during watering or a rainstorm. These chemicals can poison aquatic life in nearby creeks.	Use less toxic or non-toxic alternatives and use only the amount that is needed.
Discharge from industrial plant	Foreign elements get introduced into the air and waterways.	Direct wastewater to a treatment plant. Use "scrubbers" to clean gaseous emissions.

GETTING READY

- Obtain a simple map of the school site. Decide how you want to group the students and section the map accordingly. Either make enough photocopies for each student to have one or sketch the map onto butcher paper and cut it into sections.
- Determine whether or not you want the students to document the pollution with cameras. If so, check with the photography or technology departments about borrowing digital cameras. Another option would be to have students bring cameras from home or use disposable film cameras.
- Decide if you want the students to pick up the litter after they have documented its location. If you have more than one class involved in this learning activity, you may want to save the litter pick-up for the last class of the day so that each class has items to observe and record.

WHAT YOU WILL NEED

- "Water is Life. Rescue it." Video
- Overhead transparency: Sources of Pollution
- Overhead transparency: Storm Drain System

Enough photocopies for each student to have a:

- Learning sheet: Sources of Pollution
- Learning sheet: Storm Drain System
- Activity Worksheet: Home Site Observation
- Activity Worksheet: School Site Observation
- Map of the school site or butcher paper map section

Optional:

- Cameras, one per team
- Garbage bags, one or two per team

TEACHER NOTES

- ✓ The distinction between point source and non-point source pollution can be confusing and doesn't need to be emphasized. The polluting behaviors themselves warrant more attention than classifying the sources.
- ✓ Students may enjoy producing their own version of the video. One team could be involved in videotaping and interviewing the other teams as they conduct the school site observation.

KEY WORDS

BAY

A body of water formed by a recess in the shoreline of a sea or lake; a drowned valley.

CONTAMINANT

A substance that decreases the purity of another substance, which may directly or indirectly harm organisms.

DELTA

Freshwater from the rivers mingles with salt water from ocean tides, creating a rich and diverse aquatic ecosystem.

ECOSYSTEM

A self-sustaining and self-regulated community composed of interdependent organisms, along with their energy sources, physical and chemical surroundings.

GROUNDWATER

The underground water below the surface of the water table, stored in rocks, sediment or soil.

NON-POINT SOURCE POLLUTION

Pollution that does not come from a single, identifiable source. Includes materials that wash from roofs, streets, yards, driveways, sidewalks and other land areas. Collectively, this is the largest source of stormwater pollution.

PERCOLATION

The gradual movement of a liquid through a porous medium such as the ground.

POINT SOURCE POLLUTION

Pollution from a single identifiable source such as a factory or a sewage-treatment plant. Most of this pollution is highly regulated at the state and local levels.

RUNOFF

Excess water from storms, irrigation, residential use, etc. that flows over the land surface.

STORM DRAIN SYSTEM

The interconnected streets, gutters, inlets, underground pipelines, outfalls, detention basins, roadside ditches, and surface water bodies that drain stormwater and urban runoff away from homes and businesses.

STORMWATER

Water from rainfall or other precipitation.

SURFACE WATER

Water that is located on the surface of the Earth, such as creeks, rivers, lakes, the Delta, and the Bay.

WATERSHED

An area that drains to a particular watercourse or body of water.

ACTION NARRATIVE: LESSON PLAN DETAIL

DAY 1

Prethink (10 minutes)

Set the stage for the lesson. Have the students identify and record their preconceptions by writing their answers to some or all of the following questions. Have them keep their answers for comparison with their knowledge at the end of the learning activity.

1. What is runoff?
2. When rain falls on a roof, where does it go?
3. When water from sprinklers flows off the lawn, where does it go?
4. When we wash our cars in the driveway, where does the water go?
5. Which outdoor surfaces will absorb water and which will not?
6. Where does the water in street gutters go?
7. Why do we have storm drains?
8. Where does the water from the storm drains or roadside ditches go?
9. Is stormwater or urban runoff treated by a water treatment facility?
10. How can urban runoff affect local water bodies?

Supply Background Information (30 minutes)

- Show video "Water is Life. Rescue it." (8 minutes)

  Key messages in video:

  1. Contra Costa watershed background info (storm drain system, creeks, rivers, Delta, Bay)
  2. Polluting behaviors and prevention practices (litter, oil, yard waste, pesticides)

- Group Discussion (22 minutes)

  1. Summarize key messages in video.
  2. Supply background information on Clean Water Act.
  3. Sources of pollution: Show overhead transparency "Sources of Pollution" and/or distribute accompanying learning sheet to identify specific polluting behaviors.
  4. Once the polluting behaviors have been circled, discuss the environmental impact of each pollutant and ways to prevent such pollution. (One fun way to do this is to have a student come to the overhead and circle one of the polluting behaviors with a transparency marker and then select another student to circle the next.) *See pages 8 and 9 for background information specific to this learning sheet.*
  5. Storm drain system: Show overhead transparency "Storm Drain System" and/or distribute accompanying learning sheet to identify the components of the storm drain system and differentiate it from the sewer system.
  6. Trace path of stormwater and urban runoff using overhead "Storm Drain System" to show the flow of water pollution; emphasize that stormwater empties into water bodies untreated; also mention the possibility of percolation leading to soil and groundwater contamination.

Problem for Student Investigation (15 minutes)

- Explain school site observation activity for Day 2.
- Assign teams to sections of the school site map, or stay grouped as a whole class as class dynamics dictate.
- Introduce "Home Study, Part I" as a practice exercise. Distribute worksheet.

Home Study, Part I

Introduce homework assignment. Due at the beginning of the next class.

- Observe the home site as an environment impacted by stormwater. Follow the same procedure as the school site observation activity. Be prepared to share results at the beginning of the next class.

DAY 2

Day 2 Activities can be split into two days, if desired, to allow for a more thorough observation and discussion.

Student Action (30 minutes)

Observation activity – viewing the school site as a watershed

- Students share findings from home site observation.
- Review activity directions for school site observation, and break into teams.
- *Optional:* Distribute cameras and trash bags for visual documentation and litter pick-up.
- Distribute handouts: activity sheet, school site map

1. Determine your assigned section of the school map.
2. Look for rain gutters and downspouts on school buildings. Mark downspout locations with "X"s on the map.
3. Use arrows on your map to estimate the direction runoff would flow in your survey area. Water will flow from high areas to low areas.
4. Look for a rainbow sheen on flowing water or puddles. This is evidence of oil pollution. Mark locations on map, and label "oil."
5. Look for litter, dirt, oil, grass clippings, etc. that could be washed into storm drains or nearby creeks. List observations, and mark locations on map.
6. Observe gutters and storm drain inlets or roadside ditches if available. Note if there is any flowing or standing water. Identify the source of the water: rain, sprinklers, hoses, other, or unknown.

Action Processing (15 minutes)

Discussion of activity, apply information and conclusions gained, identify and dispel misconceptions, revisit preconceptions.

- Teams present findings.

7. What did you see that could be washed directly into a creek or into the gutter and storm drain system?
8. Where do these things go after they enter the storm drains? How does this compare to your observations at home?
9. How can these particular items harm the environment?
10. What could be done to reduce stormwater pollution at school?

- Revisit questions from "Prethink" and apply to school site. Identify/dispel misconceptions. Compare answers from before and after the learning activity.

Home Study, Part II

Introduce homework assignment.

- Reflect upon and identify the consequences of stormwater pollution and potential pollution prevention behaviors that can be adopted at school and at home, focusing specifically on litter, oil, pesticides, and yard waste. Express your reflections in one of the following ways: writing a poem, recording a rap, producing a video, constructing a visual collage or writing a letter to the editor.

CHECKING FOR UNDERSTANDING

Student Reflections

- Letter to the Editor:
    - See Home Study, Part II
- Vocabulary Quiz:
    - Match key words with definitions, or write definitions and give illustrative examples for key words.
- Learning Journal writing prompts:
    - The most interesting discovery I made was…
    - I never realized that…
    - Contaminated surface water is a problem because…
- "Live-at-Five" Interviews (Oral Quizzing):
    - Why do we have storm drains or roadside ditches?
    - Where does the water from the storm drain system go?
    - Is stormwater or urban runoff treated by a water treatment facility?
    - How can urban runoff affect local water bodies?

Teacher Reflections

- Do students know how human activity and products can affect an ecosystem?
- Can students trace the flow of litter, oil, pesticides, yard waste, etc. through an ecosystem?
- Were students able to identify stormwater pollution prevention behaviors that can be adopted at school and at home?

EXTENSIONS

Student service learning projects

See the Appendix for a list of organizations that are sponsoring projects. Below are some suggestions.

1. Students work in teams in response to a school or community need, such as a school-wide recycling/composting program or a storm drain stenciling project.
2. Organize a local creek restoration project or participate in the Coastal Cleanup.
3. Part of the project could involve writing a grant application to various agencies for project funding. This learning opportunity could also be appropriate for the high school's leadership class.

Further research

4. Research what your community is already doing to improve water quality. Report findings to the class.
5. Conduct a survey of your school's lawn and garden practices, specifically yard waste disposal practices and fertilizer/pesticide application practices. Report findings to class.
6. Research your school's disposal practices of litter and hazardous waste from the automotive and chemistry classes.
7. Conduct additional research on the environmental impacts of litter, oil, pesticides, and yard waste on local water bodies. Report findings to the class.
8. Research the Clean Water Act of 1972 and the 1987 amendments to this act, along with the environmental conditions that prompted the passage of this legislation, and then write a one-page summary.

Literacy development

9. Read and write a summary of one or both of the following articles. Full text of the articles can be found in the Appendix.
    a. **Getting schools to recycle – a first step: A new state law will offer incentives for campuses to push waste management.**
    By Jim Sanders
    Sacramento Bee, October 23, 2001
    b. **Halifax Begins Search for Ways to Clean Up Monponsett Ponds**
    By Christine Wallgren
    Boston Globe, October 25, 2001

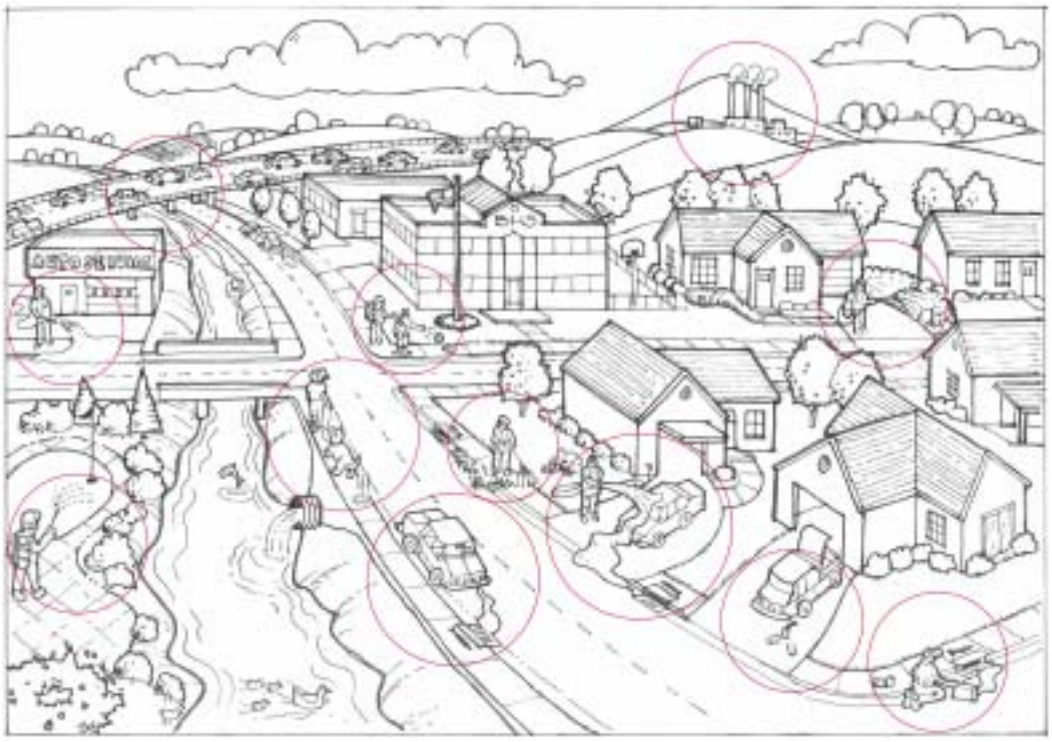
Laboratory exercise

10. Engage in toxicity testing of nearby creeks. Complete curriculum materials called "Toxicity Testing Protocol for Science Students *Ceriodaphnia Dubia*" are available through the Contra Costa Clean Water Program. Contact Chris Sommers at (925) 313-2364 or csommers@pw.co.contra-costa.ca.us for the teacher's manual, classroom handbook and lab/data sheets.

Learning Sheet: Sources of Pollution

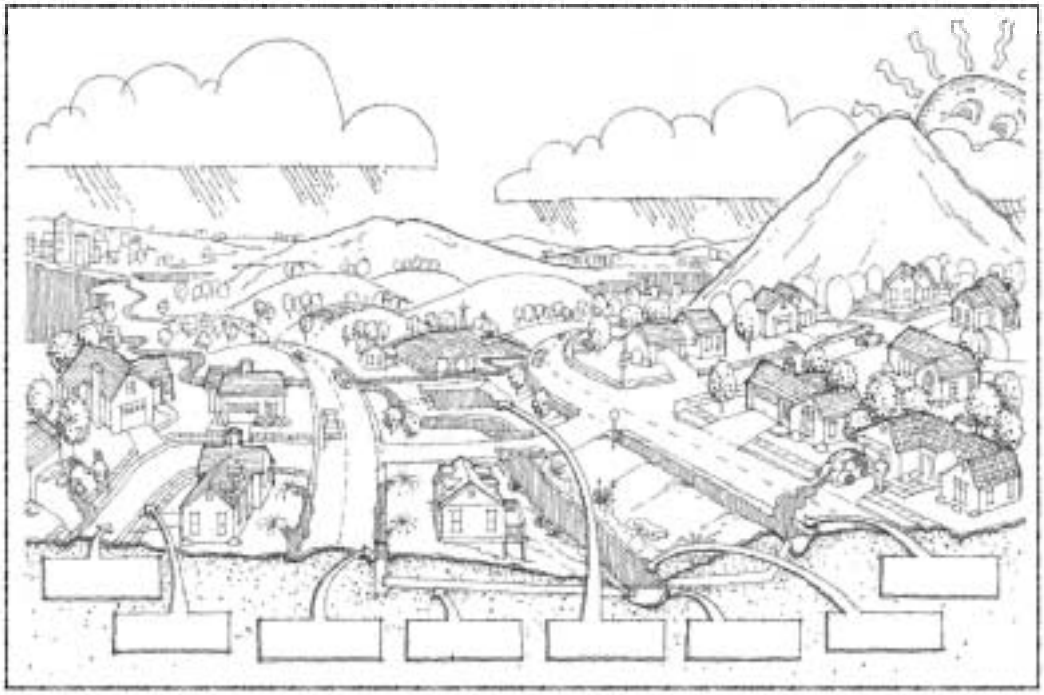
Student Page

Teacher Page

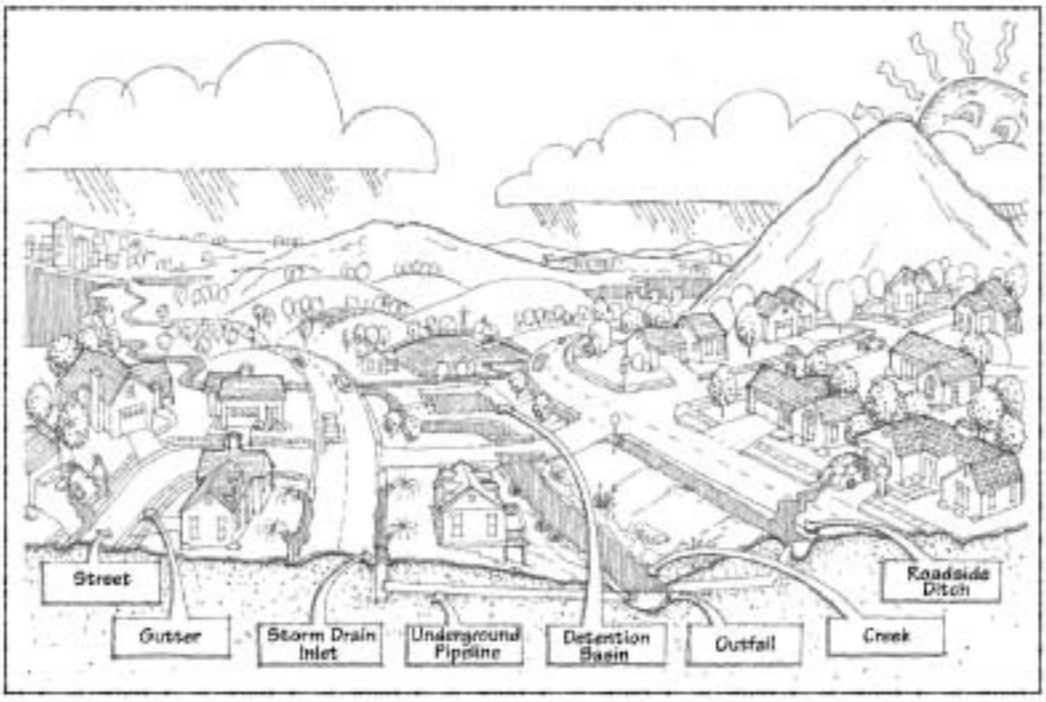


Learning Sheet: Storm Drain System

Student Page



Teacher Page



Name:

Period: *Date:*

Activity Worksheet: Home Site Observation

Objectives:

- Investigate the home site as an environment impacted by stormwater and urban runoff.
- Observe and map the locations of litter, dirt, oil, grass clippings, etc. while estimating the direction of runoff that could carry these items into storm drains or nearby creeks.
- Identify stormwater pollution prevention behaviors that can be implemented at home.

Procedure:

1. Sketch a simple map in the space provided below of the area immediately surrounding your home.

(over)

2. Look for rain gutters and downspouts on your home. Mark downspout locations with "X"s on the map.
3. Use arrows on your map to estimate the direction runoff would flow in your survey area. Water will flow from high areas to low areas.
4. Look for a rainbow sheen on flowing water or puddles. This is evidence of oil pollution. Mark locations on map, and label "oil."
5. Look for litter, dirt, oil, grass clippings, etc. that could be washed into storm drains or nearby creeks. List observations and mark locations on map.
6. Observe gutters and storm drain inlets or roadside ditches if available. Note if there is any flowing or standing water. Identify the source of the water: rain, sprinklers, hoses, other, or unknown.

Analysis:

7. What did you see that could be washed directly into a creek or into the gutter and storm drain system?

8. Where do these things go after they enter the storm drains?

9. Are there any items found that could pollute the environment? Why/How?

10. What could be done to reduce stormwater pollution at home?

Name:

Period: *Date:*

Activity Worksheet: School Site Observation

Objectives:

- Investigate the school site as an environment impacted by stormwater and urban runoff.
- Observe and map the locations of litter, dirt, oil, grass clippings, etc. while estimating the direction of runoff that could carry these items into storm drains or nearby creeks.
- Identify stormwater pollution prevention behaviors that can be implemented at school.

Materials Needed:

- Map of the school
- Pencil
- *Optional:* Camera, garbage bag

Procedure:

1. Determine your assigned section of the school map.
2. Look for rain gutters and downspouts on school buildings. Mark downspout locations with "X"s on the map.
3. Use arrows on your map to estimate the direction runoff would flow in your survey area. Water will flow from high areas to low areas.
4. Look for a rainbow sheen on flowing water or puddles. This is evidence of oil pollution. Mark locations on map, and label "oil."
5. Look for litter, dirt, oil, grass clippings, etc. that could be washed into storm drains or nearby creeks. List observations and mark locations on map.
6. Observe gutters and storm drain inlets or roadside ditches if available. Note if there is any flowing or standing water. Identify the source of the water: rain, sprinklers, hoses, other, or unknown.

(over)

Analysis:

7. What did you see that could be washed directly into a creek or into the gutter and storm drain system?

8. Where do these things go after they enter the storm drains? How does this compare to your observations at home?

9. How can these particular items harm the environment?

10. What could be done to reduce stormwater pollution at school?

APPENDIX: ADDITIONAL RESOURCES

LABORATORY ACTIVITY

Complete curriculum materials called "Toxicity Testing Protocol for Science Students *Ceriodaphnia Dubia*" are available through the Contra Costa Clean Water Program. Contact Chris Sommers at (925) 313-2364 or csommers@pw.co.contra-costa.ca.us for the teacher's manual, classroom handbook and lab/data sheets.

SERVICE LEARNING OPPORTUNITIES

Antioch Dunes Wildlife Refuge
Some of the volunteer projects include: weeding, butterfly surveys, plant surveys, plantings, and seed collection.
Contact: Antioch Dunes Biologist, (510) 792-0222

Coastal Cleanup Day
An annual statewide cleanup event in mid-September organized by the California Coastal Commission's Adopt-A-Beach Program and supporting organizations throughout the state. By cleaning up, collecting data on what you find, and recycling, you'll demonstrate that environmental stewardship protects our coast and waterways and is everyone's responsibility.
Contact: (800) COAST-4U

Contra Costa County, Department of Public Works
Volunteers are needed for monitoring urban creeks using biological indicators.
Contact: Chris Sommers, (925) 313-2364

Dow Chemical Company
Community Outreach – Dow Wetlands
Contact: Sheryl Sturges or Krist Jensen, (925) 432-5576

Earth Team
A collaborative network connecting Bay Area teenagers, teachers, and youth leaders with numerous environmental, educational, and government organizations. Its purpose is to set youth into action in their communities using the website, www.earthteam.net, as a central location to organize, mobilize, and disseminate environmental information. The website offers a comprehensive listing of restoration projects and suggests a variety of action projects that are linked to state standards.
Contact: Sheilah Fish, (925) 376-5794

East Bay Regional Park District
Seasonal projects include: trail rehabilitation, tree planting, restoration efforts, planting of native plants, and park cleanups.
Contact: Kathleen Fusek (510) 544-2515 or Sharon Seffes (925) 756-0195

Keep California Beautiful
Volunteers are needed for various cleanup, beverage container recycling, and beautification efforts all over the state during the month of April.
Contact: http://www.keepcaliforniabeautiful.com/involved.htm

Pleasant Hill Bayshore Disposal
Contact: Jason Nortz, (925) 671-5806

Urban Creeks Council
Volunteers are needed for native vegetation planting.
Contact: Josh Bradt, (510) 540-6669

VIDEO

"Synthetic Sea: Plastics in the Open Ocean"
©2001 Algalita Marine Research Foundation
Captain Charles Moore explores the accumulation of plastic in the Pacific Ocean and the effects of its fragments on aquatic life. He demonstrates how plastic fragments outnumber and mimic krill and other food sources in the ocean. (9 minutes)
To order, contact: Captain Charles Moore
Algalita Marine Research Foundation
345 Bayshore Ave.
Long Beach, CA 90803
Tel: (562) 439-4545
Email: LandnSea@ix.netcom.com

WATERSHED MAPS

A map of your school's watershed can be ordered from the Contra Costa County Public Works Department. Call the Contra Costa Clean Water Program at (925) 313-2360 for your city's representative who will help place your order.

WEBSITES

City of Los Angeles Stormwater Program
http://www.lastormwater.org
This website describes the storm drain system and issues related to stormwater pollution. Although this site is specific to the City of Los Angeles, the information, pictures and graphics generate insight into most storm drain systems.

City of Monterey Stormwater Education Program
http://www.monterey.org/publicworks/storminfo.html
This website shares a large variety of stormwater pollution prevention behaviors that focus on car care, home maintenance and repair, landscaping and gardening, painting, and pest control.

Contra Costa Recycling & Waste Reduction Guide
http://www.co.contra-costa.ca.us/depart/cd/recycle/
A comprehensive listing of local recycling centers and programs along with tips to reduce waste can be downloaded at this website. Information can also be requested by calling the Recycling Hotline at 1-800-750-4096.

Earth Team
http://www.earthteam.net
This website offers resources for implementing a variety of action projects that are linked to state standards. The action projects are primarily designed by community experts with contact numbers and links for further information. A popular component of the website is the On-line Speakers' Bureau that brings environmental experts to the classroom through live chat sessions. Earth Team also provides county coordinators that can be involved as a resource and support to teachers and environmental club leaders.

EPA's Environmental Education Center
http://www.epa.gov/teachers/background_information.htm
This website is a well organized collection of fact sheets, brochures, and web pages that provide basic and clear information you can use to explain a variety of environmental issues.

Keep America Beautiful
http://www.kab.org/gaccomm2.cfm
This website offers tips for organizing community clean-up efforts.

San Francisco Bay Area Watersheds & Resources
http://www.museumca.org/creeks/
This website provides information on San Francisco Bay Area watersheds and resources. They have a listing of watersheds representing the modern waterscape. Many of the listed creeks have associated nonprofit organizations doing monitoring, restoration, and advocacy work for the creek.

The San Francisco Estuary Project
http://www.abag.ca.gov/bayarea/sfep/sfep.html
This website serves as a clearinghouse for information on the Bay-Delta ecosystem, including such topics as wetlands, wildlife, aquatic resources, and land use.

U.S. Geological Survey's (USGS) Water Science for Schools
http://ga.water.usgs.gov/edu/
This student-friendly website offers information on many aspects of water, along with pictures, data, maps, and an interactive center where they can give opinions and test their water knowledge.

Water Education Foundation
http://www.water-ed.org/
This website provides water related curricula and classroom materials through Project WET.

Getting schools to recycle – a first step

A new state law will offer incentives for campuses to push waste management.

By Jim Sanders – Oct. 23, 2001

Reprinted with permission from the *Sacramento Bee*.

California expects more people and less room for garbage in coming years, so it already requires cities, counties and state agencies to recycle – but not schools.

Students who separate their paper, plastics, bottles and cans at home often find no such opportunities on campus.

In many cafeterias, everything from half-eaten sandwiches to sticky soda cans is tossed into a single trash can.

Schools aren't required to teach much about environmental education, and those that do aren't pushed to back up the words with action.

But there's a movement afoot, albeit a tentative one, to promote resource conservation and curriculum at all grade levels.

A new state law, effective Jan. 1, uses a carrot rather than a stick approach to reform, encouraging increased recycling at schools by:

* Requiring that the state's framework for science, a guideline for curriculum, be revised to include recycling, energy conservation, water conservation, pollution prevention and other aspects of environmental education.

* Creating an Office of Integrated Environmental Education, within the state Integrated Waste Management Board, to develop a strategy for teaching environmental education.

* Offering $1.5 million in grants to help schools launch innovative resource conservation programs.

* Encouraging schools to expand their recycling efforts, and requiring the state to offer ambassador programs in which trained student volunteers instruct other youth on environmental issues.

"It's an important first step," said Mark Murray, executive director of Californians Against Waste. "You can put all the educational fliers in people's garbage cans that you want, but at some point you need to create a new conservation ethic."

If 75 percent of California schools do not voluntarily launch recycling and waste-reduction programs by Jan. 1, 2004, the new law suggests that mandatory measures be considered.

Gov. Gray Davis, in signing SB 373, said: "Through education, our current and future consumers will learn to respect and conserve natural resources by making informed environmental choices."

But nothing in SB 373, by Sen. Tom Torlakson, D-Antioch, requires a reluctant campus to recycle even one soda bottle. Or guarantees any money to purchase new bins. Or requires schools to report any recycling progress they make. Or mandates that students be tested on their environmental knowledge.

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Getting schools to recycle

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Amendments to SB 373 deleted a proposed requirement that schools submit annual reports on their waste-reduction programs and identify revenues received from selling recyclables.

An early version of SB 373 also would have required creation of a database to allow comparison of schools and districts on recycling efforts.

Despite the amendments, Torlakson said, "We think there's an opportunity to create momentum and that school districts will find the more they recycle and reduce waste, the more they'll save money, too."

But critics say teachers should be focused on academics, not garbage cans.

Assemblyman Dennis Hollingsworth, R-Temecula, said he felt the bill was rushed through the Legislature and he is concerned about its potential impact on the state waste board and on schools.

"We keep adding more and more to the education code when we ought to be getting back to basics," he said.

Terri Burns, a deputy superintendent for the state Department of Education, said a "one size fits all" approach to recycling might not work in a state where school districts vary in size from 710,000 students to fewer than 10.

But the Department of Education supports an increased emphasis on campus recycling and environmental instruction, she said.

"We need to ensure that folks are doing what they can to divert (waste)," Burns said.

Natalie Stork, 16, who is helping to organize a white-paper pickup program at Sacramento's John F. Kennedy High School, said recycling is "one way we can work to make this a better place."

"There's more to life than academic subjects," Stork said. "You have to think of the future and what's important to the rest of your life."

John Wheat, 16, of Elk Grove High said training students to recycle could be difficult because many don't even bother throwing their trash away.

"There's so much waste produced at school that recycling would be helpful," Wheat said. "I think it should at least be tried."

Though not required, some schools already run extensive recycling programs, grow campus gardens or assign classroom projects that promote resource conservation.

At Park View Center School in Simi Valley, for example, students created a worm farm, which recycled cafeteria waste and served as a valuable learning tool. Students raised money by selling worms and the compost they produced.

Tricia Broddrick, an administrator with the state Integrated Waste Management Board, said the environment offers endless learning opportunities-from calculating campus waste to testing creek waters-that could be integrated into existing courses.

"We're not asking schools to do more, we're asking them to do the same thing differently," she said.

Statewide, California schools annually generate more than 330,000 tons of compostable organic matter, 155,000 tons of

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recyclable paper, 30,000 tons of recyclable metal and 10,000 tons of recyclable glass, according to a legislative report.

Collecting and disposing solid waste currently costs school districts $75 million to $125 million a year, the report said.

Tony White, an Elk Grove High School teacher who oversaw campus recycling at a junior high school several years ago, said such programs require time and money.

Recycling bins need to be acquired, distributed and emptied regularly. Soda bottles must be washed. Ants controlled. Publicity arranged. Teachers informed. Volunteers recruited. Students trained.

"I think a lot of teachers out there would support a recycling program," White said. "But if it's something that's mandated, I think someone should step up with resources."

Halifax Begins Search for Ways to Clean Up Monponsett Ponds

By Christine Wallgren – Oct. 25, 2001

HALIFAX - Boaters on the two Monponsett ponds complain that the water level is low. Lakeside residents claim it is so high their cellars flood. Both sides agree the water quality is poor.

The town began looking for a long-term solution this month by advertising for a consultant to study and identify plants and algae in the lakes and to suggest how to remove those that are harmful. Selectmen will also appoint a lake study committee to find solutions to pollution from failing septic systems, methyl tertiary butyl ether (MTBE) leaked from motorized boats and Jet Skis, and oily run-off from roads. Once a study has been completed, the town may qualify for grant money to address the problems.

Brockton has used the lakes since 1964 as a secondary water supply. The city draws against the natural westerly pond flow from October to May, diverting water east to Silver Lake, to the city. Halifax selectwoman Margaret Fitzgerald, a longtime crusader for a lakes cleanup, claims Brockton treats the lakes as though they were reservoirs, stockpiling water for when it is needed. The unnaturally high level causes the water to stagnate, flood cellars, and saturate old septic systems. Health officials have frequently been forced to close public beaches due to high bacterial counts. Adding to the problem is Brockton's dam on West Monponsett pond, which is so choked with weeds it blocks proper downstream flow.

Brockton is required by law to allow 900,000 gallons of water a day to flow downstream over the dam during diversion months, and officials have periodically asked Brockton to continue the practice year-round. Fitzgerald and others believe that has not been done. They would like a maximum water level put into the state law regulating Brockton's lake use. Currently, only a minimum water level is specified.

"All discussions up until now have been informal, and there's nothing in writing saying Brockton has to do it," said Charles Seelig, the town's executive administrator. "We've never sat down in formal negotiations with the city and said, `This is what we want.' That's something we might now want to do."

Seelig has drawn up a list of tasks to be included in the lake study. He completed the first step a few weeks ago, sending out proposals for weed control. Officials will review those proposals next month. Lake levels are expected to be part of the study, said Seelig, since they may affect weed growth.

Selectmen will rely on the health board to handle septic issues. Seelig has suggested a "red flag file" be created to identify lake side septic systems that require pumping more than three times annually.

Health Agent Cathleen Drinan has spent a lot of time addressing faulty systems along the lake. Last summer, she tracked a couple bad systems from outflow pipes where testing showed high bacterial counts. Drinan also used dye to trace the flow of sewage from suspected systems into the lake. She recently asked the fire department to use its heat-detecting infrared camera. Once the water temperatures fall, she will try to detect hot spots that show where sewage is seeping

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Monponsett Ponds

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into the pond. "I know personally from speaking to them, some of the homeowners love the lakes and are dedicated to keeping them clean," said Drinan. "Others should just consider taking advantage of the housing market right now and selling."

Several old single cesspools are still operating near the pond. Those systems simply drain into the groundwater. "There's no treatment at all for the sewage," said Drinan. "I'm thinking of asking the homeowners on the lakes to meet with me unofficially, to see if anyone has any suggestions for dealing with the septic problems."

She said low interest loan money is available to repair faulty systems through a grant administered by the board of health. No income guidelines must be met, and no money is needed up front from the homeowner. Last week, Drinan sent a letter to the state Department of Environmental Protection to request further suggestions for tracking and repairing faulty systems.

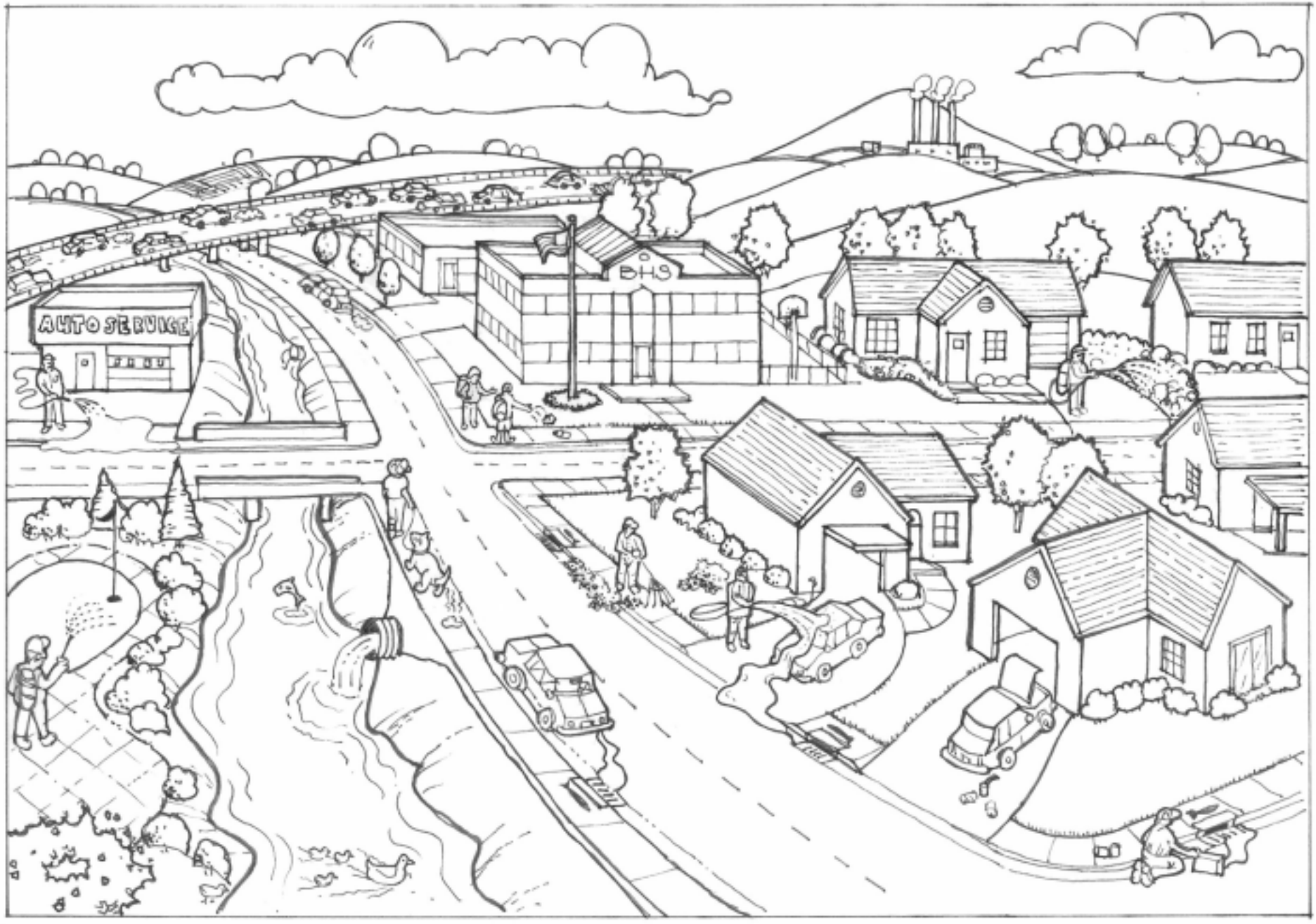
Those who live along the lakes say the effects of storm water runoff are frequently evident. Lakeside resident Joseph Tonello told selectmen last summer he saw a 50-foot plume of oil on West Monponsett Pond after a heavy rainstorm. Several drains along nearby streets flow out to the lake, and none have oil filters. As part of the lake study, Seelig has suggested all drains be examined. "There's a definite oil problem," agreed Drinan, who saw a slick on a recent trip to the lakes. "I think the street drains are in desperate need of filters."

The Old Colony Planning Council is doing a study of the lakes under a $44,000 grant from the Department of Environmental Protection. While the entire sub-watershed is being looked at, the Monponsett ponds are the primary focus. It includes an inventory of septic systems bordering the ponds, and the identification of cesspool systems as well as Title 5 compliant systems. The council has also been looking at storm drains as part of its study, and it will make some recommendations about the installation of filtration devices. The draft results of the study are due to be presented to the town next month.

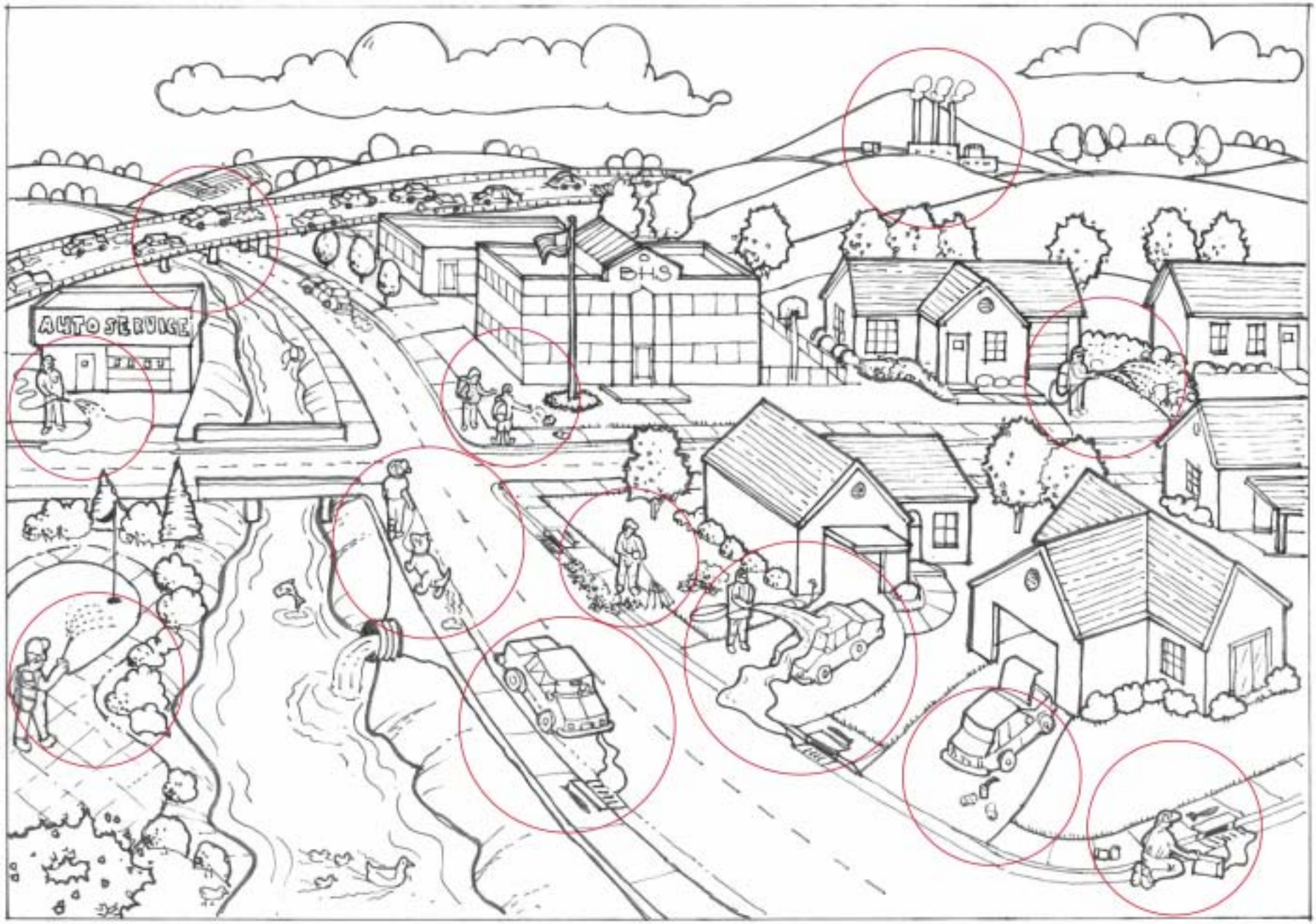
Surface water testing for MTBE began a year ago at the suggestion of Fitzgerald. Tests have shown increased concentrations in the summer, although the levels have remained within the range of acceptability. Highest concentrations have been found in West Monponsett Pond, where there is a state boat ramp. The selectmen this summer ordered periodic testing of pond sediment as well. While the two ponds recharge the town's drinking wells at the YMCA camp and Richmond Park, no MTBE has been detected during well testing.

"The lakes are one of the best assets the town has and taking care of them is tremendously important," Fitzgerald said. "They are not only a resource for our drinking supply, they are also a recreational resource and provide an identity for the community. We're perfectly willing to share the lakes with other people, but they have to care about them the way we do."

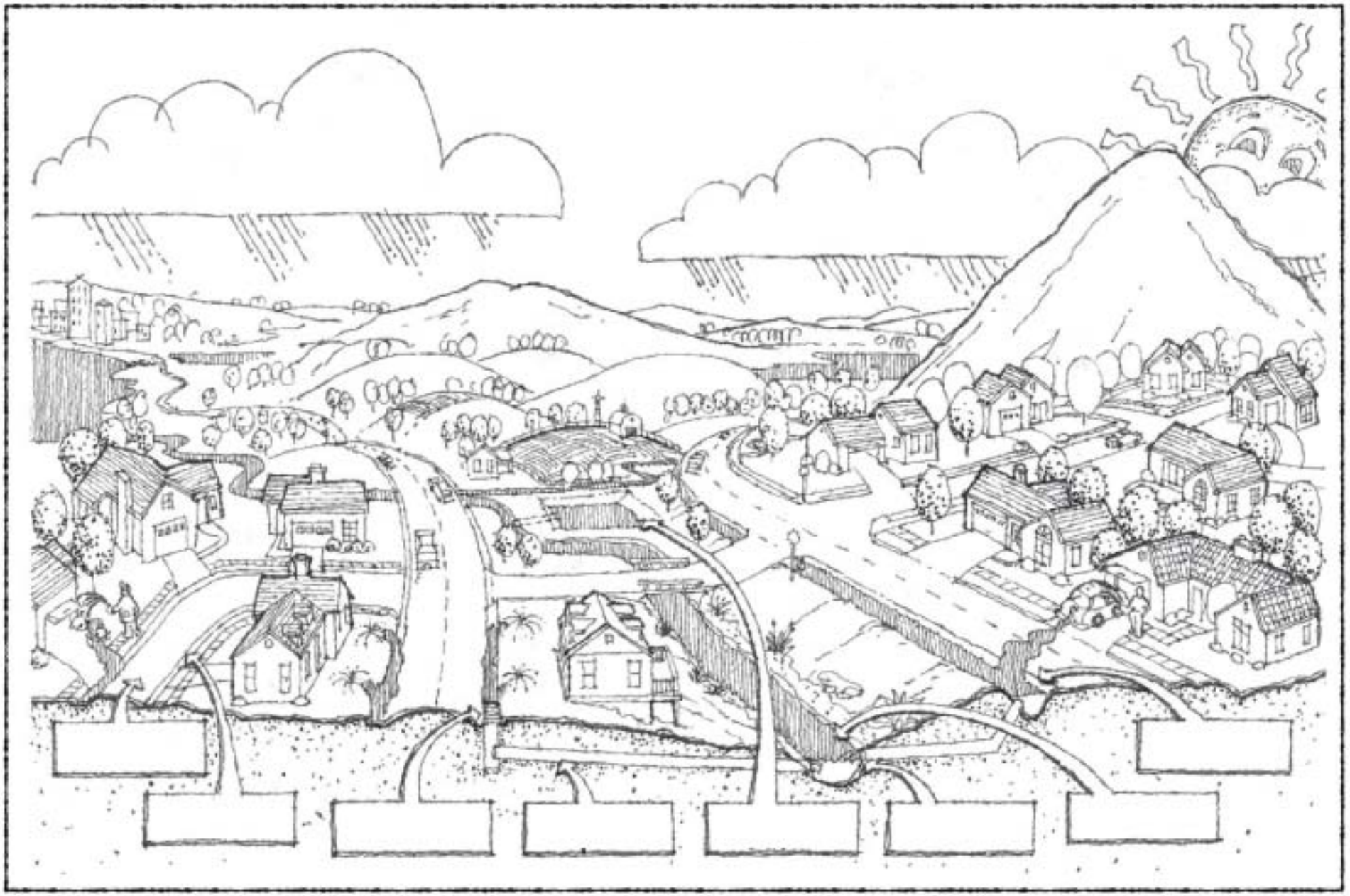
Sources of Pollution



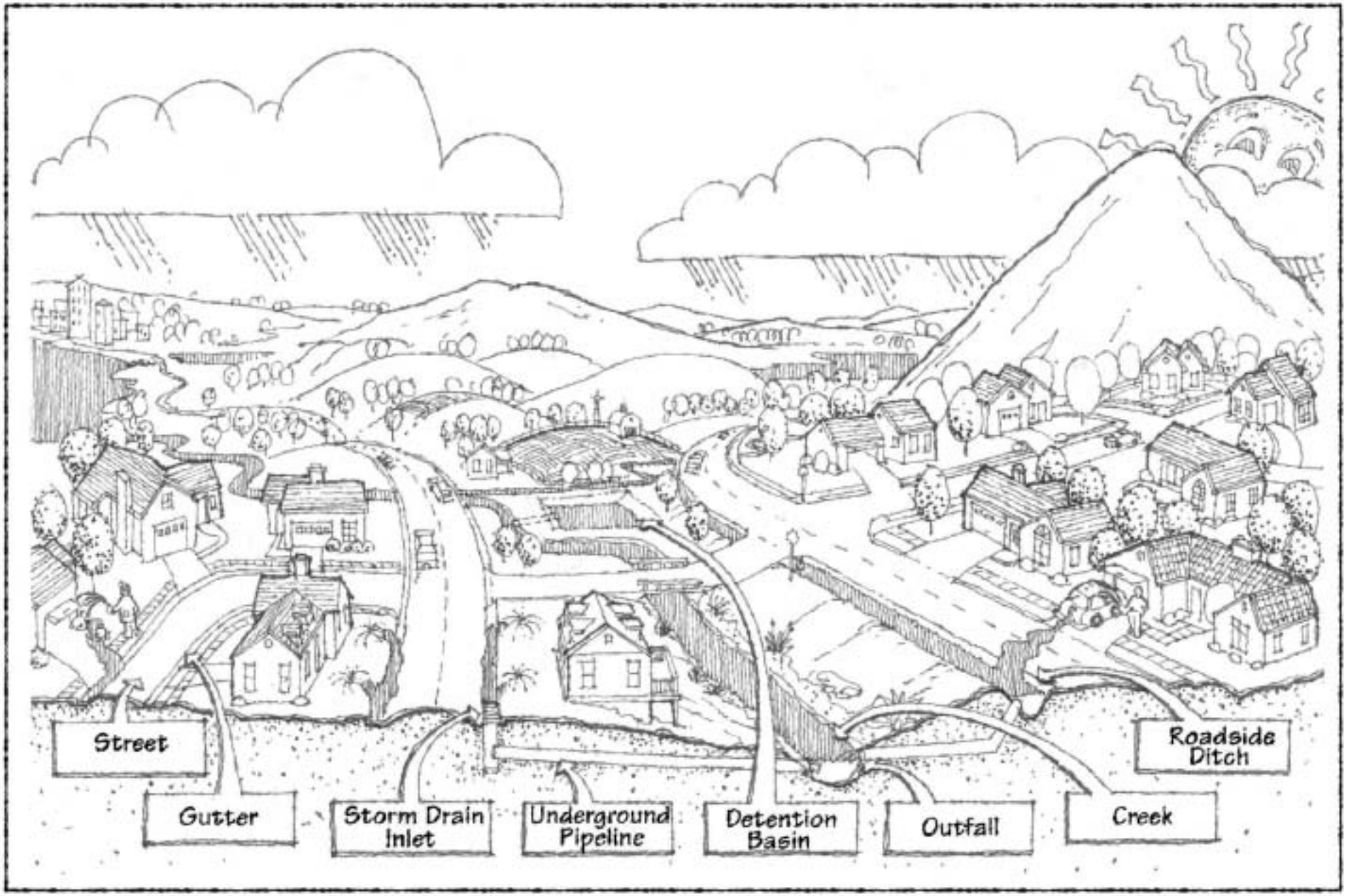
Sources of Pollution



Storm Drain System



Storm Drain System



Name:

Period: *Date:*

Activity Worksheet: Home Site Observation

Objectives:

- Investigate the home site as an environment impacted by stormwater and urban runoff.
- Observe and map the locations of litter, dirt, oil, grass clippings, etc. while estimating the direction of runoff that could carry these items into storm drains or nearby creeks.
- Identify stormwater pollution prevention behaviors that can be implemented at home.

Procedure:

1. Sketch a simple map in the space provided below of the area immediately surrounding your home.

(over)

2. Look for rain gutters and downspouts on your home. Mark downspout locations with "X"s on the map.
3. Use arrows on your map to estimate the direction runoff would flow in your survey area. Water will flow from high areas to low areas.
4. Look for a rainbow sheen on flowing water or puddles. This is evidence of oil pollution. Mark locations on map, and label "oil."
5. Look for litter, dirt, oil, grass clippings, etc. that could be washed into storm drains or nearby creeks. List observations and mark locations on map.
6. Observe gutters and storm drain inlets or roadside ditches if available. Note if there is any flowing or standing water. Identify the source of the water: rain, sprinklers, hoses, other, or unknown.

Analysis:

7. What did you see that could be washed directly into a creek or into the gutter and storm drain system?

8. Where do these things go after they enter the storm drains?

9. Are there any items found that could pollute the environment? Why/How?

10. What could be done to reduce stormwater pollution at home?

Name:

Period: *Date:*

Activity Worksheet: School Site Observation

Objectives:

- Investigate the school site as an environment impacted by stormwater and urban runoff.
- Observe and map the locations of litter, dirt, oil, grass clippings, etc. while estimating the direction of runoff that could carry these items into storm drains or nearby creeks.
- Identify stormwater pollution prevention behaviors that can be implemented at school.

Materials Needed:

- Map of the school
- Pencil
- *Optional:* Camera, garbage bag

Procedure:

1. Determine your assigned section of the school map.
2. Look for rain gutters and downspouts on school buildings. Mark downspout locations with "X"s on the map.
3. Use arrows on your map to estimate the direction runoff would flow in your survey area. Water will flow from high areas to low areas.
4. Look for a rainbow sheen on flowing water or puddles. This is evidence of oil pollution. Mark locations on map, and label "oil."
5. Look for litter, dirt, oil, grass clippings, etc. that could be washed into storm drains or nearby creeks. List observations and mark locations on map.
6. Observe gutters and storm drain inlets or roadside ditches if available. Note if there is any flowing or standing water. Identify the source of the water: rain, sprinklers, hoses, other, or unknown.

(over)

Analysis:

7. What did you see that could be washed directly into a creek or into the gutter and storm drain system?

8. Where do these things go after they enter the storm drains? How does this compare to your observations at home?

9. How can these particular items harm the environment?

10. What could be done to reduce stormwater pollution at school?