



Environmental Defenders Program
EnvironmentalDefendersLA.com

Environmental Lesson Plan



5E Learning Sequence: Grades 4-6

*Developed by K-12 Science Education Specialists in L.A. County and Aligned With:
California Common Core Standards,
Next Generation Science Standards (NGSS), and
California Environmental Principles and Concepts (CA EP&C)*

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LESSON PLAN

Objective

Students will gain a shared understanding of what pollution is, identify sources and types of stormwater pollution and will be able to explain how pollutants in the streets end up in our rivers, streams, lakes, oceans and on our beaches. In addition, students will use steps in the engineering and design process to imagine and plan a new and better way of preventing waste and other pollutants from entering storm drains, and eventually our rivers, streams, lakes, beaches and the ocean.

Standards

Next Generation Science Standards (NGSS)

Elementary:

- [5-ESS3-1](#) Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.
- [3-5-ETS1-1](#) Define a simple design problem reflecting a need or a want that includes specific criteria for success and constraints on materials, time or cost.

Middle School:

- [MS-ESS3-3](#) Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- [MS-ETS1-1](#) Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- [MS-ETS1-2](#) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

California Environmental Principles and Concepts (CA EP&C)

- **Principle I** People Depend on Natural Systems
- **Principle II** People Influence Natural Systems

Common Core State Standards - Language Arts

Reading: Informational Text

Elementary

Key Ideas and Details:

- [CCSS.ELA-LITERACY.RI.5.1](#) Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Integration of Knowledge and Ideas:

- [CCSS.ELA-LITERACY.RI.5.7](#) Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- [CCSS.ELA-LITERACY.RI.5.9](#) Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

Middle School

- [CCSS.ELA-LITERACY.RST.6-8.1](#) Cite specific textual evidence to support analysis of science and technical texts.
- [CCSS.ELA-LITERACY.RST.6-8.7](#) Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- [CCSS.ELA-LITERACY.RST.6-8.9](#) Compare and contrast the information gained in experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Writing

Elementary

Text Types and Purposes:

- [CCSS.ELA-LITERACY.W.5.7](#) Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- [CCSS.ELA-LITERACY.W.5.8](#) Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

Research to Build and Present Knowledge:

- [CCSS.ELA-LITERACY.W.5.9](#) Draw evidence from literary or informational text to support analysis, reflection, research.

Middle School

Text Types and Purposes:

- [CCSS.ELA-LITERACY.W.6.1](#) Write arguments to support claims with clear reasons and relevant evidence.
- [CCSS.ELA-LITERACY.W.6.2](#) Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Research to Build and Present Knowledge:

- [CCSS.ELA-LITERACY.WHST.6-8.7](#) Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

- [CCSS.ELA-LITERACY.WHST.6-8.8](#) Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- [CCSS.ELA-LITERACY.WHST.6-8.9](#) Draw evidence from informational texts to support analysis, reflection, and research.

Speaking and Listening Elementary

Comprehension and Collaboration:

- [CCSS.ELA-LITERACY.SL.5.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-lead) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- [CCSS.ELA-LITERACY.SL.5.2](#) Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Presentation of Knowledge and Ideas:

- [CCSS.ELA-LITERACY.SL.5.4](#) Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- [CCSS.ELA-LITERACY.SL.5.5](#) Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

Middle School

Comprehension and Collaboration:

- [CCSS.ELA-LITERACY.SL.6.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 6 topics, text, and issues, building on others' ideas and expressing their own clearly.
- [CCSS.ELA-LITERACY.SL.6.2](#) Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Presentation of Knowledge and Ideas:

- [CCSS.ELA-LITERACY.SL.6.4](#) Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

Teacher Background

A major source of pollution that ends up at our beaches or in our rivers, lakes, and oceans is a result of stormwater pollution. Stormwater is excess water that does not get absorbed into the ground during storms. As stormwater moves towards storm drains it picks up things like animal waste, litter, motor oil, yard clippings, plastic items, pesticides and other pollutants. These pollutants end up in our rivers, lakes, oceans and beaches and cause health related problems for children and harms aquatic life. Stormwater is not treated, therefore it goes straight to the ocean along with any pollutants it carries. A drainage system's primary function is to prevent flooding, unlike a sewage system which treats wastewater. Stormwater pollution also poses an increased risk to swimmers near storm drains that lead to the ocean or lakes. Those areas have a higher concentration of pollutants, which hurts ocean life, costs billions to clean up, and could lead to a loss of revenue from tourism as these recreational resources are closed to tourists. In this lesson students learn how we can all help reduce the extent of pollution in our rivers, lakes, oceans and on our beaches (source: <https://waterforla.lacounty.gov/water-quality/>).

The Clean Water Act (CWA) of 1972 controls pollutant discharge from what the Environmental Protection Agency (EPA) calls "point sources," like industrial, commercial, and municipal facilities, into any navigable waters of the United States. Point sources are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit, which requires compliance with technology- and water quality-based treatment standards. These polluters - such as mercury from Company A or untreated sewage from City B - are easy to identify and monitor. They fall easily under the enforcement powers of the EPA. However, waterway pollution from what EPA calls "nonpoint" sources (NPS) are far harder to control.

What are nonpoint sources of pollution?

Nonpoint pollution comes mainly from our own backyards. NPS pollution is caused by rainfall, snowmelt or irrigation moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. These pollutants include:

- Oil, grease, and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- Salt from irrigation practices and acid drainage from abandoned mines
- Bacteria and nutrients from livestock, pet waste, and faulty septic systems

According to the EPA, nonpoint source pollution is the leading remaining cause of water quality problems. Nonpoint pollution is known to have harmful effects on drinking water, wildlife and - as we are now learning - our sport and seafood fisheries. Clearly, as urbanization continues, the effects of nonpoint pollution will only worsen unless we all participate in efforts to reduce or prevent the problem.

What can be done?

Some activities aimed at preventing nonpoint pollution are federal responsibilities, such as ensuring that federal lands are properly managed to reduce soil erosion. Some are state responsibilities; for example, developing legislation to govern mining and logging, and to protect groundwater. Others are best handled locally, such as by zoning or erosion control ordinances. And each individual can play an important role by practicing conservation and by changing certain everyday habits.

What can private citizens do?

According to the EPA, the best ways private citizens can help reduce the effects of nonpoint water pollution are:

- Keep litter, pet waste, leaves, and debris out of street gutters and storm drain inlets (or catch basins) - these drain directly to lakes, streams, rivers, oceans and wetlands.
- Apply lawn and garden chemicals sparingly and according to directions on the label.
- Dispose of used oil, antifreeze, paints, and other household chemicals properly, not in storm drains. If your community does not already have a program for collecting household hazardous waste, ask your local government to establish one.
- Clean up spilled brake fluid, oil, grease, and antifreeze. Do not hose them into the street where they can eventually reach local streams and lakes.
- Control soil erosion on your property by planting ground cover and stabilizing erosion-prone areas.
- Encourage local government officials to develop construction erosion/sediment control ordinances in your community.
- Have your septic system inspected and pumped, at a minimum, every 3-5 years so that it operates properly.
- Purchase household detergents and cleaners that are low in phosphorous to reduce the amount of nutrients discharged into our lakes, streams and coastal waters.

(Source: <http://waterforla.lacounty.gov/water-quality/>)

Advanced Preparation

- Using Google Maps or any other map making resource, to prepare a local map of the areas around your school that shows the streets where storm drain inlets (or catch basins) may be found. This may require that you take a walk around your school area to choose the streets that will be included in the map. Make enough maps for your entire class. Look at the sample map in the resources section and in the Stormwater Pollution presentation.

- Familiarize yourself with the Los Angeles County Storm Drain System website that allows you to find drains, channels, catch basins, and debris basins in the County of Los Angeles. See Resources section for link.
- Look at “All the Way to the Ocean” video to prepare for possible questions students may have after watching the video. Video link: https://www.youtube.com/watch?time_continue=5&v=sZW2ByM623g

Time Needed

5 periods (55-60 minutes each)

Materials Needed

- Stormwater Pollution (4-6) PowerPoint
- Class set of your school map for School Community Field Trip
- Markers and chart paper
- Class set of Flow Map
- WiFi Access
- Optional: household materials for creating a prototype of a better stormwater basin screen

Vocabulary

Pollutant - Any substances that can hurt the environment.

Pollution - The presence of pollutants in the environment with adverse impact on humans, animals and plants.

Stormwater Pollution - Excess water that runs down streets and storm drains carrying pollutants from the environment.

Storm Drain - Pipes or channels that collect stormwater from streets and conveys it to the ocean to prevent flooding.

Storm Drain Inlet (or Catch Basin) - An inlet device where stormwater enters a storm drain system, often located on the side of street curbs or in parking lots.

Watersheds - An area of land that contains a common set of streams and rivers that all drain into a single body of water, such as a larger river, a lake or an ocean (<http://www.mbgnet.net/fresh/rivers/shed.htm>).

Directions

(S1) Lesson Title - Stormwater Pollution

Introduction (Engage)

What is Stormwater Pollution? (Time needed: 1 period)

1. (S2) Show students the picture of polluted beaches. Ask: *What is wrong with this picture?*
2. (S3) Ask: *How should a beach look?* Ask students which beach they would prefer to spend the day at with their family and/or friends. Ask students if they have seen places like in these pictures near their home or school, what did they think, how did they feel?
3. (S4) Ask: *Who made all this waste and how do you think it ended up at the beach?* Chart their responses. Most of their responses will probably blame humans leaving waste at the beach, which helps to explain the “Who.” Explain to students that not

all the waste on the beach was left there. Some of it arrived from far away. Ask students: *How would waste from miles away end up at the beach?*

4. (S5) What is Pollution? Go over the definitions of pollution and stormwater pollution with students. Ask them to identify the pollution in each of the pictures.

Procedure (Explore) - How do I identify storm drain inlets (or catch basins)? Where are the storm drain inlets (or catch basins) around our school and community? What path do they take to the ocean? (Time needed: 1 period)

School Community Field Trip: Finding Storm Drain Inlets (or Catch Basins) Around our School and Homes

1. (S6) Show students picture of the storm drain inlets (or catch basins) signs. Ask them if they have seen them before and what they think they mean. Guide them to explain that the water that goes down these storm drain inlets (or catch basins) will go directly to rivers/lakes/oceans, etc., and that they serve as signs to keep people from throwing waste in the street to keep it from polluting our waters.
2. (S7) Explain to students that they are going to go on a walk to identify storm drain inlets (or catch basins) found around the school and community streets. They will record the location of storm drain inlets (or catch basins) on their map. They will also record any items they identify as possible pollutants that may end up going down storm drain inlets (or catch basins).
3. (S8) Show them the School Community Field Trip Map. See sample in Resources/S8. Explain that their goal as they take a field trip of the streets around their school neighborhood is to find the storm drain inlets (or catch basins) that have those symbols. They must put a blue checkmark next to the approximate area where the storm drain inlet (or catch basin) is found.
4. (S9) After the walking field trip lead a discussion with the class about where the storm drains were and what were some of the pollutants they saw along the way. What will happen to all the waste they found?
5. Use the following website <http://dpw.lacounty.gov/fcd/stormdrain/index.cfm> to follow how the storms drains lead back to the ocean. This map is interactive and allows students to input the beginning address and follow the nearby storm drain inlets, catch basins, small and large channels, basins, watersheds, creeks, rivers, and eventually where these channels dump the storm water into oceans. As an

additional assignment, students can be asked to look for their home address and do the same thing.

6. (S10) Show students the video [All the Way to the Ocean](#). Have a class discussion that summarizes what Isaac and James learned about stormwater pollution.
7. Have the students complete a Sequencing Flow Map to describe how waste that goes down storm drain inlets (or catch basins) will eventually end up in the ocean and/or beaches. See Resources for Map. This step may be done individually or as a group. If done as a group, allow students to conduct a Gallery Walk to see other groups' Flow Maps and compare their map to the other groups'.

Procedure (Explain) - What information can I share with my community that helps them better understand how they can prevent Stormwater Pollution? (Time needed: 1 period)

Informational Brochure: How to Prevent Stormwater Pollution

1. If classroom has access to technology, give students the different websites that provide tips on how to prevent waste from polluting beaches. If no technology is available, print out the resources pages available.
2. (S11) In groups, have students design an Information Brochure or Booklet that will provide information to convince their community and public to do their part to prevent Stormwater Pollution.
3. (S12) Have students research the following and include this information in their brochure or booklet:
 1. What is Stormwater Pollution?
 2. What are some sources of Stormwater Pollution?
 3. What can they do to prevent Stormwater pollution?
4. Display the different brochures around the school so other students and community members can become aware of stormwater pollution and what they can do to prevent it.

Conclusion (Elaborate) - What human problem are we trying to solve? Does the solution use creativity and ingenuity to develop a new and better way of filtering waste and other pollutants out of stormwater basins? (Time needed: 2 periods)

Engineering and Design Project: Designing a Better Catch Basin Screen

1. (S13) Explain to students that engineers (people who use science and math to find solutions to human problems) go through a process to design or improve solutions. There are different design processes that engineers use; here is one example. Go over the different aspects of the engineering design process shown here: Ask, Imagine, Plan, Create, Improve. Explain to students that an engineer can begin at any part of the cycle because there is no starting or ending point and can jump forwards or backwards in the cycle as new information or discoveries are made.
2. (S14) Some of the screens used in the catch basins by the L.A. County Department of Public Works are made of very fine mesh material. Problem: When waste gets caught against the sides, it keeps water from flowing into the drains and on heavy rain days, water overflows completely carrying waste with it into the basins and flooding streets. Challenge students to design a solution to this problem.
3. (S15) When considering a design, engineers must consider constraints. Constraints are limitations to a design. Ask students: *What are some constraints when using a mesh screen to filter out pollution in this catch basin?* Lead a class discussion on constraints such as: the holes in the mesh have to be large enough to let water through but small enough to catch pollution, when the holes in the mesh get covered up water can not flow through then it overflows above the screen allowing pollutants to travel to the ocean and beaches, the metal used for the screen mesh needs to be strong to withstand the pressure of the water flow and rust resistant in order to last a long time, etc.
4. (S16) Imagine: Use creativity and ingenuity to develop some solutions to improve the catch basin screen. Encourage students to be creative.
5. (S17) Plan: Draw a detailed diagram of your prototype, known as a blueprint, and plan for the materials you would need to build it. Have students present their designs to the class. Have them answer the following questions: How does your solution prevent pollutants from going to the ocean? Where do they go instead? What type of materials did you use? Also elicit questions from their classmates. After each presentation ask students if they also can identify constraints to the design.
6. (S18) OPTIONAL Create: Following the design of your blueprint and using the materials around your home, create your prototype and test it. How does it work? What works best? What doesn't? What could work better?

7. (S19) OPTIONAL Improve: Based on your initial test, modify your design to make it better. Test it out again!

Resources

Los Angeles County Storm Drain System

The Los Angeles County Storm Drain System shows drains, channels, catch basins, and debris basins in the County of Los Angeles using a web-based map viewer. It currently includes facilities owned and maintained by the Los Angeles County Flood Control District (District), the City of Los Angeles, and United States Army Corps of Engineers (Corps). Information on the facilities, such as date built, size, and material can be obtained by selecting them. The plans are also available for the Corps and District facilities.

<http://dpw.lacounty.gov/fcd/stormdrain/index.cfm>

Stormwater Pollution Basics

<https://waterforla.lacounty.gov/water-quality/>

Pollution Tip Card

<http://dpw.lacounty.gov/LACFCD/SWQ/files/PollutionTipCard.pdf>

California Stormwater Quality Association

<https://www.casqa.org/>

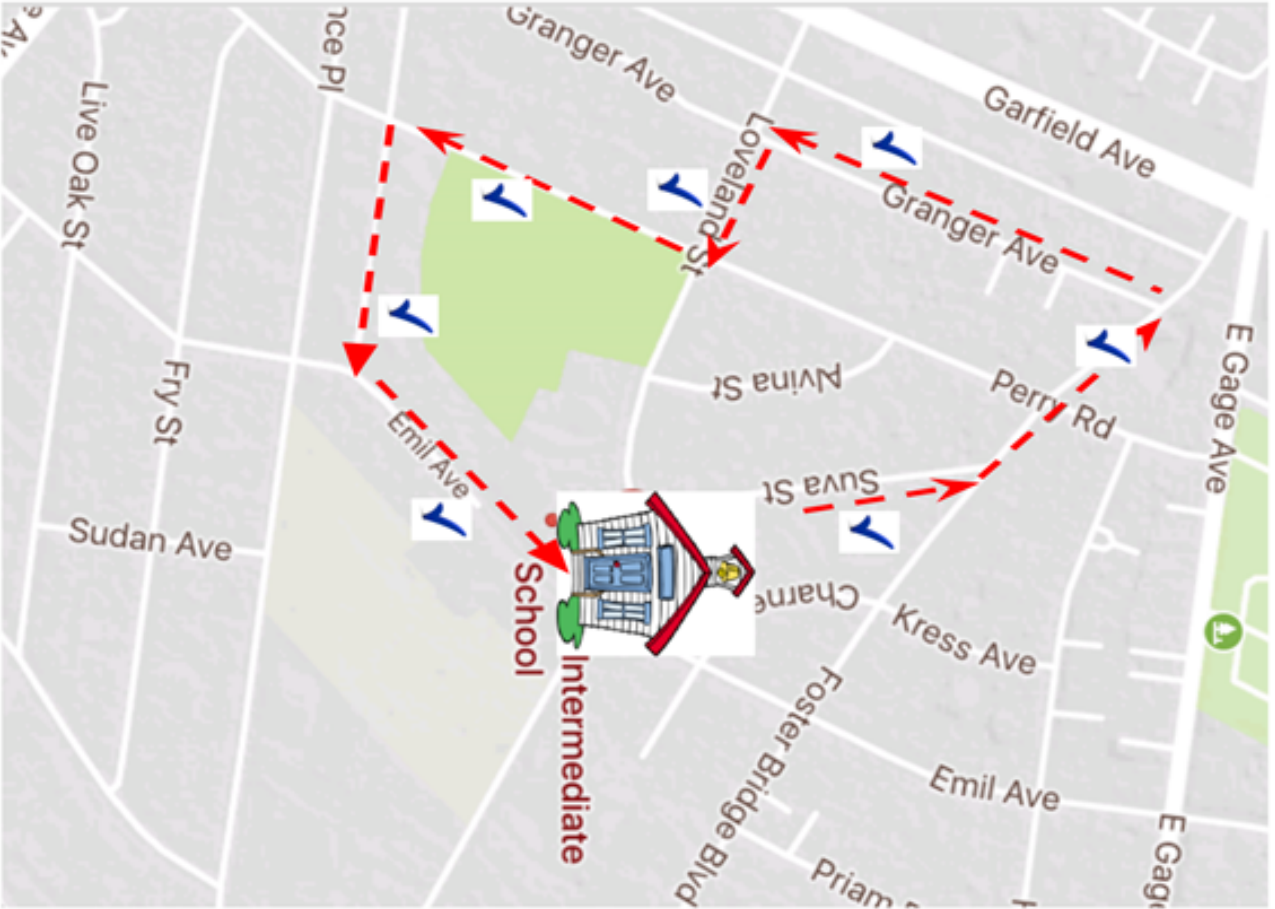
Beach Report Card - Interactive Map

<https://beachreportcard.org/36.1362748337651/-91.77311308787685/6>

NRDC Tips

<https://www.nrdc.org/stories/beach-pollution-101#solutions>

Infograph - page 18



KEY

route and direction of field trip

Storm Drain location

SAMPLE

Stormwater Fact Sheet

Stormwater Pollution in Los Angeles County

What is stormwater pollution?

During a storm when it rains, have you seen catch basins on the sides of the streets that collect stormwater? Water that runs off the street enters these catch basins and then goes into storm drains. These drains carry the stormwater to nearby rivers, streams, lakes and the ocean so the streets don't flood.

Only stormwater is supposed to go into the storm drains, but sometimes as stormwater moves along the street gutters, it carries pollution from the street, such as garbage, animal waste, and oil and grease from cars. Stormwater mixed with pollution is called stormwater pollution and should not enter into the storm drains. Examples of stormwater pollution include throwing garbage such as used cups and paper into the street, sweeping leaves or dirt into the street, and leaving pet waste on sidewalks or grass when it rains.

Isn't stormwater cleaned before going into the ocean, like sewage water?

No! In Los Angeles County, storm drains flow separately from sewer drains. In your house, used waters from sinks and toilets drain into underground sewer pipes and get cleaned at a treatment plant. Stormwater and the pollution it carries often flow from the streets and into the rivers, lakes, and the ocean without being cleaned.

How does stormwater pollution affect my community?

Stormwater pollution is bad for our health and bad for the health of the animals that live in rivers, lakes and the ocean. People and animals can get sick from touching polluted water. Sometimes beaches must close if too much pollution is found. Garbage and animal wastes found in your community can also make your neighborhoods look dirty and polluted. When there is too much garbage in catch basins, the streets may flood when it rains. Pollution in our storm drains, lakes, rivers and ocean must be cleaned, which can cost a lot of money.



What is the solution to stormwater pollution?

Below are a few things that kids can do to help protect our environment from stormwater pollution.

Don't throw garbage into the street. Garbage on the streets makes neighborhoods polluted. When it rains, garbage can clog catch basins and storm drains and make the streets flood. Any garbage dumped into the streets or catch basins can also be carried as stormwater pollution to nearby lakes, rivers and the ocean without being cleaned.

Pick up after your pet. Animal waste, when left on the ground, washes into storm drains and contaminates the beaches and ocean.

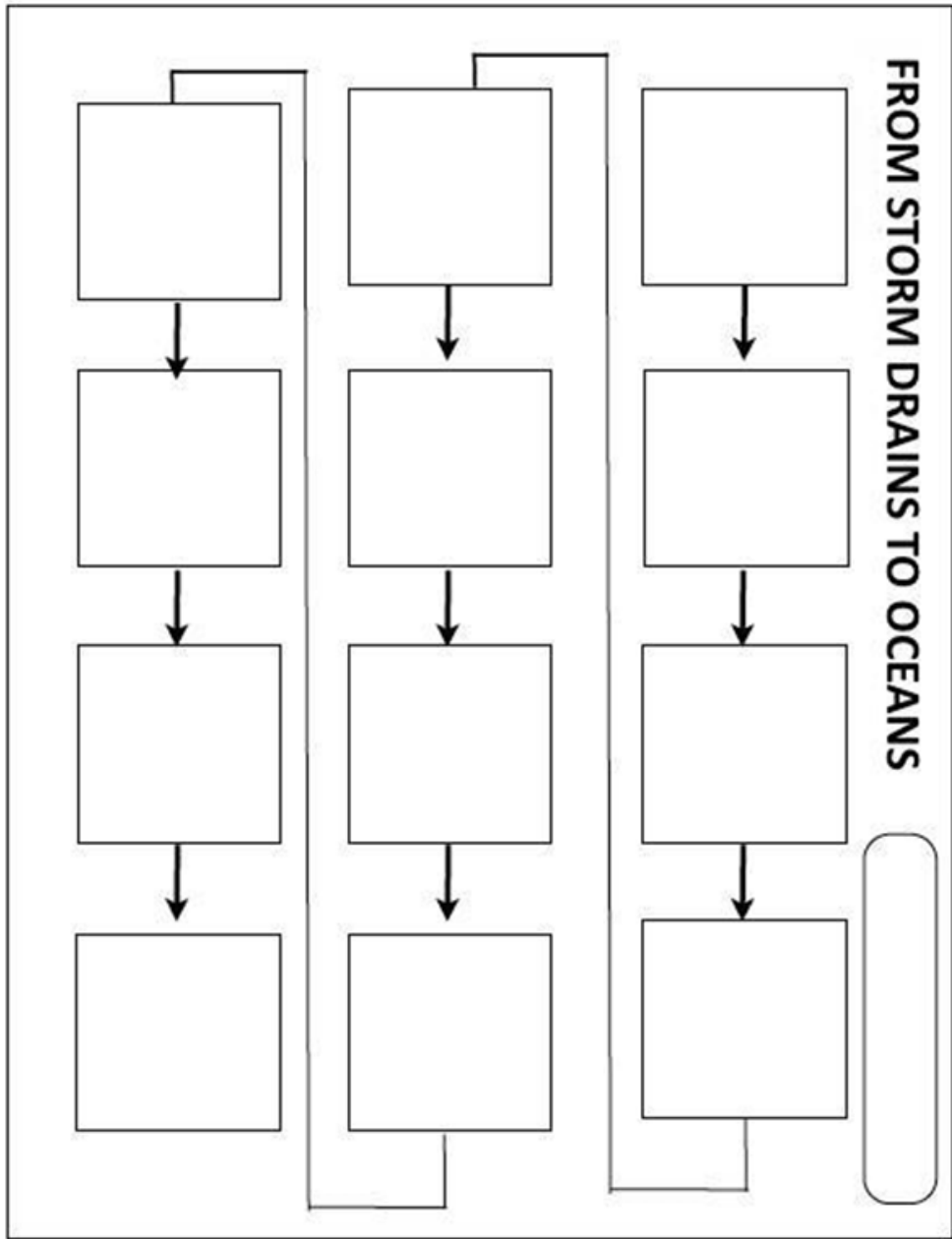
Put tree branches, leaves and other garden wastes in a bag or in a compost bin. Garden wastes, when placed on the sidewalk and in the streets, can wash into catch basins and clog the storm drains, causing the streets to flood.

Where can I get more information?

Call 1(888) CLEAN-LA to report clogged catch basins and get more information on preventing stormwater pollution and neighborhood clean-up events.

Source: Modified from the Los Angeles County Department of Public Works Stormwater Pollution Prevention "Frequently Asked Questions" <<https://dpw.lacounty.gov/epd/swims/help/faq.aspx>>

FROM STORM DRAINS TO OCEANS



HOW NATURAL SOLUTIONS HELP KEEP OUR BEACHES CLEAN



**STREAMS AND WETLANDS ARE ESSENTIAL FOR CLEAN BEACHES.
SUPPORT THE EPA'S CLEAN WATER PROTECTION RULE...
AND SWIM SAFER!**

Take action at nrdc.org/beaches

