A Guide for Studying the Restoration and Stewardship of

Colgan Creek

A Resource for Schools in the Colgan Creek Watershed

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For Trout Unlimited and the City of Santa Rosa

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Contents

Acknowledgements

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The lessons draw upon materials and reports from local sources, including the Russian River Watershed Association, Sonoma County, the City of Santa Rosa and the Sonoma County Land Trust.

The Internet provided the majority of the resources shared in this manual. Thanks to the many organizations, government agencies, universities and educators who develop high quality materials and make them available to everyone.

Introduction

The restoration of Colgan Creek that began in the summer of 2014 and will continue for several years provides an opportunity for students to learn about the creek and its watershed.

In urban environments, people are often unaware of the watershed they live within. How many have thought about where the water that sheds off their rooftops, driveways and lawns will go? Streams are confined and sometimes hidden from view, so people do not stop to observe them, or to think about how the streams are doing. Are they healthy? Are they clean? Can they support wildlife? Are they enjoyable to be near?

This curriculum guide offers some educational activities designed to increase awareness of Colgan Creek. It seeks to answer a few questions. Where is the creek in relation to students' homes and schools, their travel routes and places they often visit? Why are people working to restore the creek, and what does the restoration involve? What is a healthy creek? What can students, and their families, do to improve the health of Colgan Creek?

The lessons include a variety of materials found on the internet, and some designed especially for Colgan Creek.

"We need to work with local elementary and high schools to monitor, restore, and educate children about creeks."

"Schools should use the creek in every subject: science, math, English, writing, art, history, spiritual meaning, etc."

PUBLIC COMMENTS FOR CITYWIDE CREEK MASTER PLAN

Colgan Creek and You

Students will determine where Colgan Creek is in relation to their homes, school, travel routes, stores, and other familiar locations. They will become more aware of the creek as a natural element in their environment.

Materials

Computers with internet connection, projection system, Colgan Creek Tour Power Point, street maps of Santa Rosa (if no internet connection is available)

Preparation

For Using Online Maps

Set up your computer projection system.

Secure your internet connection and bring up the Russian River Watershed Google Map. In the Layers section, click off everything except: Russian River, Major Tributaries, Creeks, Sub-watersheds and Russian River Watershed.

Move around in the map and become familiar with the course of Colgan Creek, from Taylor Mountain to the Laguna. (When you hover exactly over the creek, a label will appear – Colgan Creek Flood Control Channel.)

Experiment with various ways to show the creek and surrounding neighborhoods, using both Map and Satellite views. In Map view, zoom in to show named streets. Switch to Satellite to show buildings students might recognize. Zoom out to show the topography of Taylor Mountain. Move the map around to explore the different reaches of the creek. Try using street view in neighborhoods your students know and along parts of the creek.

When you show the map to your students for the first time, you could start zoomed all the way out to get a global context, and gradually zoom in. Alternatively, you could start at your own school, and then zoom out until all of Colgan Creek is visible. Decide which approach you will take, and practice it.

For Paper Maps

Obtain several copies of a Santa Rosa street map from the Chamber of Commerce, a gas station, or other source.

On each map, use a blue pencil to outline the course of Colgan Creek, from Taylor Mountain to the Laguna. Draw circles around places near the creek that students are familiar with – schools, shopping centers, parks, trails, etc.

Procedure

Determine how aware students are about Colgan Creek by asking a few questions. Do they know locations where the stream is visible? Do they know how close they live to the creek? When they travel to and from school, have they ever noticed Colgan Creek along the way?

List some places they may know, such as the County Fairgrounds, Taylor Mountain Park, the Santa Rosa Marketplace, the trail along the creek near Monument Drive, Elsie Allen High School, streets that the stream passes under.

For computer mapping –

Project the Russian River Watershed interactive map onto a large screen in the classroom and show students the course of Colgan Creek, outlined in blue. At first, keep the scale large enough to show most, or all, of the creek. Follow the stream course with your cursor and call attention to the places students might know.

Then start to zoom into different areas. In satellite view, show students Taylor Mountain, the Marketplace, your school. Note the proximity of each place to the creek.

Get familiar with the shape of the creek and the landmarks that will help students get orientated in other maps views. Here are a few:

Where Highway 12 crosses over Highway 101. Colgan Creek is just south of this intersection, which is easily identifiable on most maps.

The large oval shape that is the racetrack at the County Fairgrounds.

The two round water tanks on Taylor Mountain that are close to Kawana Springs

The Santa Rosa Marketplace – parking lot and stores

Elsie Allen High School – the athletic field is a large oval shape.

Show students how to use the street view.

Now let students work individually at their own computer stations. Provide the link to the map and help them access it, if needed. Allow them to explore the map and different reaches of the creek.

Ask students to zoom into the map to find their own neighborhood, then locate their street. Give assistance if they cannot find their neighborhood. Or, using Google Map, enter the street address in the search bar. Note what major streets are nearby, and use this to find the student's home on the Russian River map. (You cannot search for an address in the Russian River map, but it is a better map for studying the creeks because they are colored in blue and very noticeable.)

Once they find their home, change the scale and move the map around until some portion of Colgan Creek is also visible. Students should determine how far they live from the creek. Can they walk there from their home? Using the street view, navigate the route to the creek, noting familiar landmarks along the way.

Procedure for using paper maps

Use the Colgan Creek Tour Power Point and project photos of various places along Colgan Creek and the landmarks that are nearby onto a large screen in the classroom. Use the photos to go on a virtual tour of the creek, discussing familiar places.

Hang maps on a wall, or display them on tables. Divide the class into small groups, one group for each map. Students should use the index on the map to find their street. How far is it from the creek? Have them trace in pencil the route they would travel from their home to the creek. Ask them to visualize some of the landmarks they would pass along the way.

Follow up

Ask students to write a paragraph that describes Colgan Creek in relation to their own home and activities throughout their neighborhood. For instance, they could say they ride their bikes or hike on a trail or street near the creek. Perhaps they shop at Costco, where the creek briefly goes under the parking lot, travel on a street that is alongside the creek, or cross over the creek on this or that street. Maybe they go to Taylor Mountain, which is where the creek begins.

To illustrate the paragraph, students can make a picture showing themselves biking, walking, riding, and shopping near the creek. For a challenge, have students write directions from their home (or your school) to the creek. Use street names, coordinates (east, west) and right turn, go straight, and approximate distances.

Lesson Resources

Russian River Watershed interactive Google map. Russian River Watershed Association

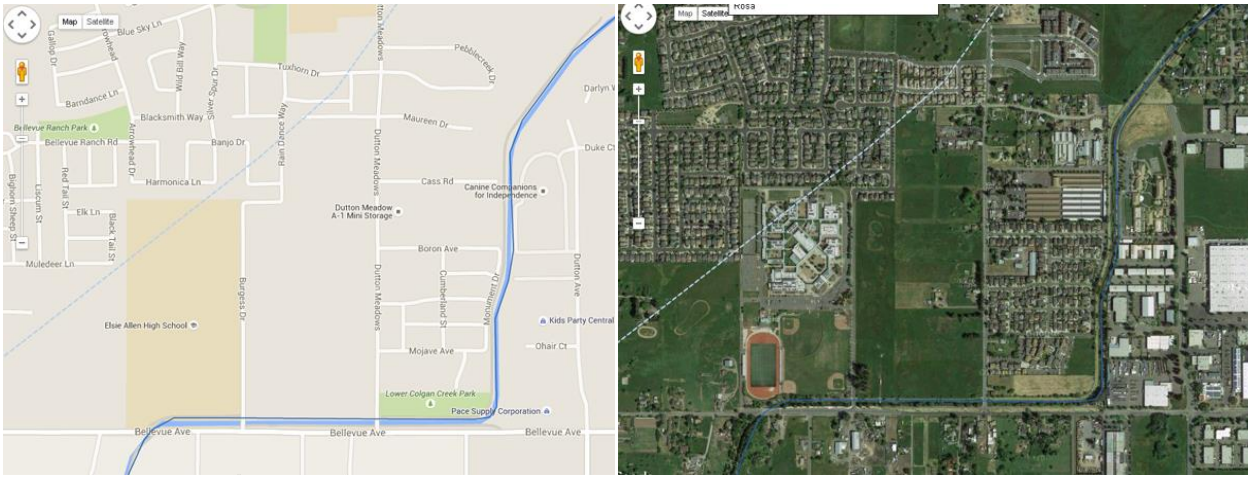


Photo tour of Colgan Creek - As Power Point As pdf

Maps

Websites

Map Skills for Elementary Students National Geographic

Google Maps for Education

Map Skills and Higher Order Thinking – From North Carolina.

Russian River Watershed Association Google Map with streams marked

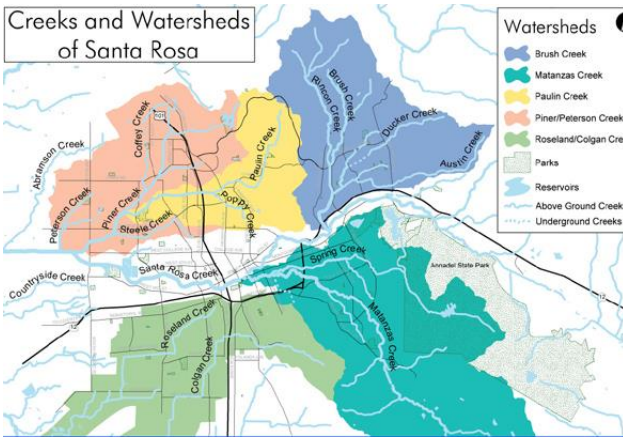
Laguna de Santa Rosa Watershed. A nice, clear map of the streams in the watershed, including Colgan Creek.

Google Map showing Colgan Creek watershed boundaries, schools, water quality monitoring sites, and more.

An Interactive Map, focused on Taylor Mountain. A good map for exploring the watersheds, topography and streams in Santa Rosa and Sonoma County. GPS data are already entered. Click on **Draw the Map**. [Data = name,latitude,longitude "Taylor Mountain (Sonoma County, California)",38.40066,-122.67476]

City of Santa Rosa Downloadable PDF Maps

A wide assortment of PDF Maps you can download directly to your PC to view or print. (Some files may be very large due to the high level of detail in the maps). Two examples are shown below.



Creeks and Watersheds of Santa Rosa, colored watershed map

Colgan Creek from Taylor Mt. to just below Elsie Allen High school. Found in Subcategory Master Plan

Sonoma County

Sonoma County Maps. - Download the kzm files to view maps in Google Earth.

The Russian River Watershed. Sonoma County Water Agency

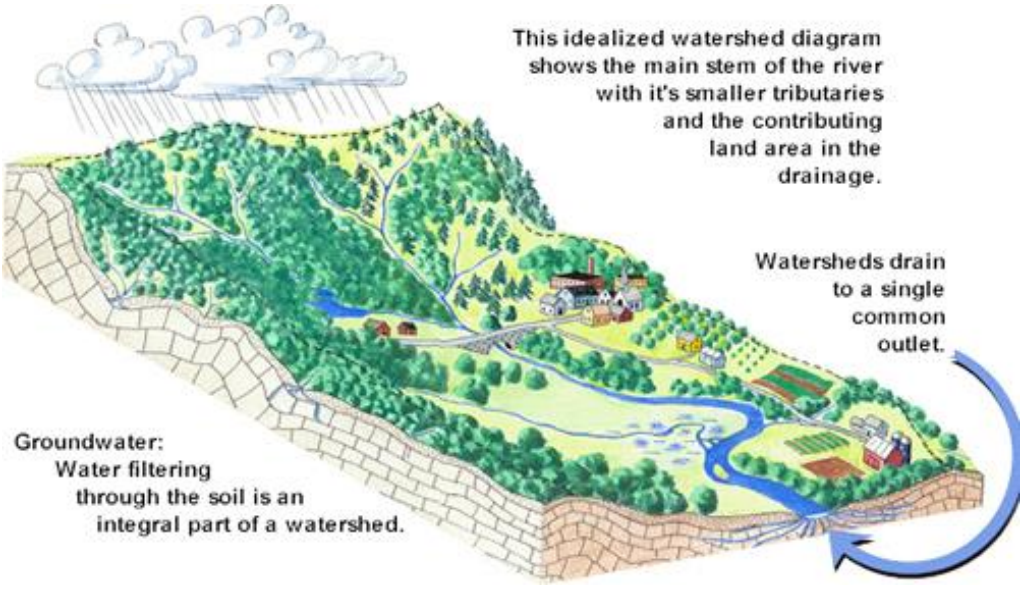
We All Live in a Watershed

A watershed is an area of land where all the water drains to a single water body such as a river, lake, or the ocean. Watersheds are often named after the river or creek that they drain in to. For instance, the Russian River watershed is named after the Russian River. Watersheds are divided from each other by elevated land features such as hills and mountain ridges. Watersheds vary in shape, size, climate, vegetation, and many other physical characteristics, making each one a unique hydrologic system that stores and conveys water.

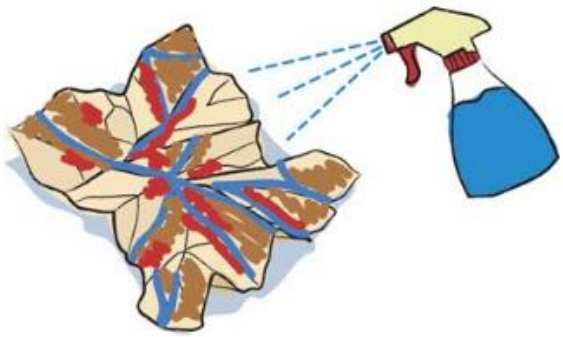
The health of a watershed depends on how we, as residents, use the land within it. Our daily practices affect water quality and the ecosystems that rely on it. Though many residents do not realize it, our cities and towns are essentially connected to creeks the same way rural land is, through a network of drainages. Artificial drainages such as street gutters, ditches, and storm drains are prevalent in urban landscapes and convey water, sediment, and pollutants just like natural drainages. Both urban and rural landscape drainages in our watershed have the same destination: creeks and the Russian River. Text from Urban Creek Care Guide.

Respondents were asked, "As far as you know, do you live in a watershed?" Thirty-five percent (35%) of the total sample know that they live in a watershed, 47% said they do not, and 18% are unsure.

Russian River Watershed Association Storm Water & Watershed Awareness Survey. 2012



Make a watershed model



Crumple a Watershed

This activity gives students an approachable perspective on watersheds by making simple watershed models. It also has extension activities, a Recipe for a Healthy Watershed and a glossary.

Make it up yourself

There are many ways to build a watershed model, so be creative. This photo shows aluminum foil over something to give shape – egg cartons, clay, sand. Use satellite views in Google Maps to get a general sense of terrain and shape of the Colgan Creek watershed.

Gunston Middle School Watershed Project

My Watershed Address

You know your street address. Do you know your watershed address? To figure out your watershed address, think about where you live. Use a map of Santa Rosa to find your home.

1) Write your street address on the first line

When it rains on the roof of your house or apartment, where does the water go? Is there a creek, stream, lake or river near your house that the water flows to?

2) The name of the closest body of water is the next part of your watershed address. Write the name of that waterway on the second line.

Part of Colgan Creek is in a storm drain. If you live in the neighborhood near the county fairgrounds, you cannot see the creek, but you are in the watershed.

3) Where does the water go from there? Trace the river or creek to the next body of water on the map. That's the next part of your address. Write the name of the water-way on the next line.

4) Keep following the path the water would take on the map until you get to a bay, ocean or lake. This is the last part of your watershed address. Write the name of the waterway on the last line. Now you know your watershed address!

Find your home on a map and determine which watershed you live in. You may live in a watershed other than Colgan Creek.

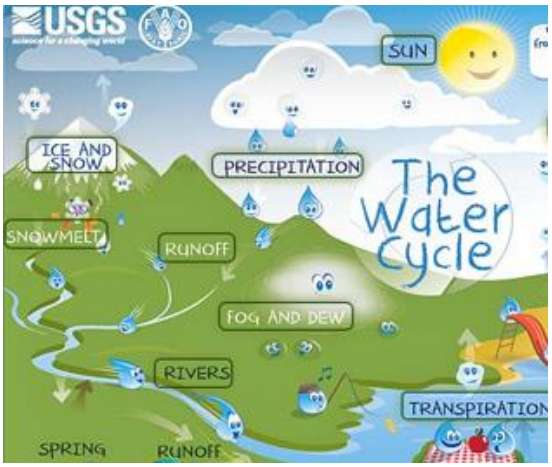
The Russian River Watershed Association map has watershed boundaries outlined. RR Watershed Map.pdf

On-line Resources for Learning about Watersheds and the Water Cycle

USDA Watershed Learning Animation
(You Tube video, 3:11 minutes)

Watersheds 101 by Surfrider.
(You Tube video, 1:50 min.)

The Water Cycle for Schools. Poster and interactive activity about the water cycle. US Geologic Survey



Colgan Creek and Its Watershed

Concepts

The headwaters of Colgan Creek arise from Taylor Mountain and from the neighborhoods around the county fairgrounds. The branch from Taylor Mountain flows above ground, but the branch that runs along Colgan Avenue is confined in a concrete pipe that is generally not visible. However, everything that flows into the storm drains in the streets flows into that conduit and affects water quality farther downstream.

Lower Colgan Creek, below the convergence of the two branches at the Colgan Box Culvert, is completely channelized. It flows through urban and residential areas, past schools and along busy roads. Along the way, the stream often receives pollution from the surrounding watershed.

Colgan Creek, like all the neighboring creeks, flows into the Laguna de Santa Rosa, which flows into the Russian River. Therefore, activities in the Colgan Creek watershed affect the health of the Laguna and the Russian River.

Objectives

Students identify the boundaries of the Colgan Creek watershed and describe the primary land uses in each section of the creek.

Explain types of activities occurring in the watershed that may be harmful to the creek.

Preparation

Preview the Colgan Creek Tour slide show and be prepared to discuss familiar places with students.

Make copies of the Components of a Watershed Worksheet. Write the words on the blackboard. Make copies of the Glossary (optional)

Procedure

First, students should watch the two videos from the previous lesson (We All Live in a Watershed), so they are familiar with what a watershed is.

View the Colgan Creek Tour slide show. Use the Power point or pdf.

As you are going through the tour, talk with students about the creek. Do they recognize any of the places in the photos?

Ask students to start observing the creek, and the surrounding land. How is the land being used? Could there be harmful effects from the land uses? Beneficial effects?

Give students the Components of a Watershed Worksheet and ask them to fill in the blanks, using the words provided. Allow everyone to check their answers, and make corrections, if necessary.

Now ask students to indicate on the worksheet the names of places, streets or neighborhoods that are in each generalized part of the Colgan Creek watershed. For instance, next to the River Source label, they could write Taylor Mountain and/or neighborhood around the fairgrounds.

Label places they know according to upstream, downstream. The fairgrounds are upstream from the Santa Rosa Marketplace. Bellevue Elementary School is downstream from Elsie Allen High School, etc.

The Main River would be everything below the Colgan Box Culvert. There are no direct tributaries, but there is a confluence of the two branches – Kawana Springs and underground Colgan Creek. There are no meanders, except for those recently created by the restoration work. This section of the creek (near Elsie Allen HS) now also has a floodplain.

The River Mouth would be at the place where it flows into the Laguna de Santa Rosa. The Laguna is a wetland.

Key for Components of a Watershed Worksheet

1. River Source
2. Upstream
3. Downstream
4. Main River
5. Tributaries
6. Floodplain
7. Watershed Boundary
8. Meanders
9. Wetlands
10. River Mouth

Lesson Resources

Colgan Creek Tour – Power Point or as pdf.

Components of a Watershed Worksheet

Taylor Mountain Regional Park – photos of the headlands and a map

Glossary

Channel --the bed of a stream or river, the path of ground through which a river flows

Erosion--the process in which a material is worn away by a stream of liquid (water) or air, often due to the presence of abrasive particles in the stream.

Estuary--a place where fresh and salt water mix, such as a bay, salt marsh, or where a river enters an ocean.

Features --the recognizable attributes of an area including landforms, vegetation, structures, and bodies of water.

Flood plain--a strip of relatively flat and normally dry land alongside a stream, river, or lake that is covered by water during a flood.

Headwater(s) --the source and upper reaches of a stream

Impermeable layer--a layer of solid material, such as rock or clay, which does not allow water to pass through

Meander --a curve in a river.

Non-point source --pollution that enters the water from a variety of sources including homes, farms, streets, and construction sites

Point source --pollution that enters the water from a single location as a concentrated source

River mouth --the point where a smaller body of water enters a larger body of water

River source --the point of origin of a stream or river

Tributaries --a stream feeding a larger stream or lake

Watershed --region or area draining ultimately to a particular watercourse or body of water

Wetlands --are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

What is a Healthy Stream? What is Stream Restoration? What is Happening with Colgan Creek?

Concepts

People have altered streams and rives from their natural conditions. The changes were often for flood control and water delivery. They usually did not enhance habitat for wildlife, and sometimes diminished beneficial uses for humans. Stream restoration is the act of bringing streams back to a more natural state, and restoring the balancing hand of natural processes.

Preparation

Preview the videos first and review the concepts. Consider where you might stop the video to discuss key concepts.

Think of local examples of streams and stream habitats that students might recognize. Have they seen Santa Rosa Creek? Been to the Russian River? What do they remember about the streams they have seen. Did they look healthy?

Procedure

This is a series of lessons that use three short videos describing natural stream restoration. The first video explains the characterists of a natural, healthy stream. The second shows problems that can occur when people try to control a stream in ways that are contrary to natural processes. The last video shows how streams can be brought back into balance through restoration.

The purpose for watching the videos is to understand why and how people are restoring Colgan Creek.

Give students the context. Did they noticed the big equipment on Colgan Creek in the summer of 2014? What do they think was happening there? How does the creek look different now?

After seeing the videos, ask if they have observed any conditions in Colgan Creek that are similar those they see in the videos. What problems do they think exist in Colgan Creek that could be fixed?

Explain that people have changed the creek's shape and added elements that should improve water quality, create more habitat for wildlife and give the creek more room to spread out when there are high flows.

A Natural Stream

A stream left alone is usually a healthy stream. Natural hydrologic forces tend to create stable streams.

Preparation

Preview the video. Review the concepts. Consider where you might stop the video to discuss key concepts.

Make copies of the Concepts page - 1 for each student.

Procedure

Ask students about streams or rivers they have seen. What is their experience with rivers? Do they swim, fish, go boating? Encourage them to recall and describe the stream or river they know.

What do students think makes a healthy stream? How can you tell if a stream is healthy?

View the video Streams in Nature. You may want to stop the video in key places to discuss what is being presented and relate it to what your students know.

Share the Concepts page. Discuss the main points. Take one or more concepts to explore and relate to a local stream. Ask students to write a paragraph explaining the characteristics of a healthy stream and how people affect streams. Encourage them to make drawings to illustrate their text.

Lesson Resources

Natural Stream Restoration: Streams in Nature University of Oklahoma. Division of Agricultural Sciences and Natural Resources YouTube 9:56 min	

Streams in Nature ~Concepts in the Video

Streams improve our quality of life because they give us opportunities for fishing, enjoyment of nature, rafting, and other recreation.

A healthy stream is in balance, or equilibrium.

When a stream is in balance, sediment input equals sediment moving out of system.

Sedimentation is the number one water quality issue in the USA.

A big concern is loss of stream banks and loss of use of property. People can loose valuable land to stream bank erosion.

How does a stream fall out of balance? Several ways:

> Agriculture - grazing cattle remove all the vegetation from stream banks, which become less stable, and quickly erode.
>
> Urbanization – development expands into rural areas, encroaches on streams, and increases impermeable surfaces.

Sedimentation fills in streams and reservoirs. It degrades habitat for insects and fish.

When a stream gets out of balance, natural stream restoration techniques can bring it back into balance.

Restoration is about adjusting the flow and speed of the water.

Analogy of driving on a road – a straight stream flows fast, curves in streams slow down the flow, which reduces the energy and force of the water.

A coarse, rough stream bottom also slows the flow, just like a rough road slows down a vehicle.

An artificial streambed (cement lined) has nothing to slow down the water.

Streams flow downhill. The slope of a stream channel is important. Slope is the change in height over a given distance. Curves increase the distance the water must flow from point A to point B. The same change in height over a longer distance (point A to B) results in a gentler slope. This reduces the velocity and force of the water.

Streams have riffles and pools. Riffles are areas with faster moving water and typically have gravel on the stream bottom. Sediment usually gets flushed out.

In the deeper pools, the flow is slower. Slower water has less energy and cannot move the sediment, which tends to settle out. So pools have finer particles (sediment) on the stream bottom.

The process of sediment movement in streams is called sediment transport.

Streams are dynamic systems. Healthy streams move a few inches in every decade. [The meandering that happens in an undisturbed stream is usually a slow process.]

Unstable streams can move several feet in a year and can take large chucks of land in one high-water episode.

Healthy streams have a mix of plant species along their banks [the riparian zone].

Healthy streams have structures, created by rocks, logs and plants. These increase stream habitat diversity and provide homes for aquatic plants, insects, fish, and other life.

Healthy streams have a diversity of habitat types and vegetation.

Why Do Streams Need Restoration? (When Good Streams Go Bad)

People sometimes alter streams and watersheds in ways that do not benefit the health of the stream ecosystem. For instance, making a stream straight and lining it with cement removes the natural stream processes. Urbanization and grazing can eliminate or reduce the riparian plants, which increases stream bank erosion.

Procedure

Review the concepts from the first video.

View the You Tube video, Good Streams Gone Bad. You may want to stop the video in key places to discuss concepts being presented.

Share the Concepts page. Discuss main points with class.

Show photos of Colgan Creek and ask students to identify problems they see.

List potential problems that are apparent in the photos, along with the locations of the problem areas.

Lesson Resources

Good Streams Gone Bad

University of Oklahoma Division of Agricultural Sciences and Natural Resources

You Tube - 7:43 min.

Good Streams Gone Bad ~ Concepts in the Video

Streams usually do not go bad by themselves. People try to control streams, and that causes problems.

Encasing a stream in concrete is a common example of how people try to control streams. Also, rip-rap, gabions, and culverts often create problems because they confine the stream.

Water moves too fast through concrete and, when it gets to a section downstream with a natural stream channel, the fast moving water causes increased erosion in that section.

Impervious surfaces in the watershed are also a problem. They decrease infiltration of water into the land and increase the amount of water flowing directly overland and into the stream. [This kind of runoff is often highly polluted, and does not get filtered by seeping into the land.]

Lessening the amount of area that water flows through makes it go faster. A confined stream channel has less area. Floodplains increase the amount of area water can flow through during high flows.

Floodplains are critical components of stream systems. When flows are high, water can spread out into the floodplain, slowing down the flow, dissipating energy, and reducing erosion.

Streams can become detached from their natural floodplains.

Down-cutting and widening of streams can occur. A stream with a heavy load of sediment can down cut (get deeper). The stream channel may also widen, as the banks erode or slide into the stream.

Sediment travels downstream and causes problems there. [The effects of erosion in one location are often felt all the way downstream]

Sediment is a pollutant. Sediment often brings with it excess nutrients, such as phosphorus, which can be bad for stream ecosystems. The soil/sediment eroding into a stream might also contain heavy metals.

Stream Restoration

Stream restoration is the process of bringing streams back into a natural balance. Often, the objective is to reconnect the stream with its floodplain, reduce the amount of erosion, stabilize stream banks, provide habitat for plants and animals, and increase opportunities for people to enjoy nature.

Procedure

Review the concepts from the previous two videos. Ask students which of the problems discussed in the previous video may be present in Colgan Creek. Is the creek channelized? (Yes). Does it have a wide floodplain? (Mostly no). Does the watershed contain lots of impervious surfaces (Yes, but less so in the lower portion of the watershed). Is there enough mixed vegetation along the streambank to provide shade and stabilize the banks? (Mostly, no). Are there any instream structures, such as boulders and logs? (No, except in the recently restored section.)

Watch the YouTube video, Restoring Streams. You may want to stop the video in key places to discuss concepts being presented.

Share the Concepts page. Discuss main points with students.

Lesson Resources

Restoring Streams

University of Oklahoma Division of Agricultural Sciences and Natural Resources

You Tube 17:37 minutes

More Resources

Living Among the Fish . A Guide to Conservation of Fish Habitat in the Developed Landscape. UC Cooperative Extension. A good resource, with many photos, charts and information about restoring and protecting fish habitats.

Restoring Streams ~ Concepts in the Video

Natural restoration is helping the stream heal itself when it is "sick". It involves repairing biological processes and increasing biodiversity.

Restoration is a process. You need to define objectives and assess the stream to determine the local stressors.

The simplest way to restore is to remove the local stressors, such as cattle grazing and stormwater pipes, etc.

Sometimes it is necessary to reconstruct the stream channel. For instance, if the stream has been straightened and confined, you need to get it back to a more natural shape.

There are three parts to this kind of restoration: 1) reshaping the stream channel and flood plain, 2) adding curves in the streambed and 3) installing instream structures. [and replanting the streambanks with native plants]

Instream structures are usually made of large rocks and logs. There are several types of designs, such as making a V structure that directs water away from the banks.

Instream structures are designed to deflect energy away from banks to keep them from eroding and to provide different types of instream habitats. The stream usually scours the area just below a log or boulder, making a deep pool.

Right after manipulating the stream bank, straw, mats and other coverings are used to hold soil in place until the vegetation grows.

Planting the stream bank makes it more stable. A mix of grasses, shrubs and trees is best. Roots lock soil and gravel in place. Roots also slow water down.

Some plants are better suited to live next to streams. Willows thrive next to streams.

Trees help keep the water cool by shading it from sun. Cold water holds more oxygen, which is important for fish and bugs. Leaves falling into the stream provide the food for insects.

Native plants are best because they are well adapted to the place and they provide the types of habitats needed by native animals.

Exotic, invasive plants can quickly get established in disturbed areas. It is important to get natives in quickly and to remove invasive species right away.

Restoring Colgan Creek

Colgan Creek, below Kawana Springs, is confined in narrow channels. Some of the channels are made of concrete, and all stream sections are unnaturally straight. This is because, back when Santa Rosa was growing, city planners thought they could reduce the risk of flood damage by confining the channel and forcing the water to quickly flow away. It was common at the time.

> "Across the state, hundreds of miles of natural streambeds went into concrete straitjackets. The idea… was to create straight, precisely engineered structures that allowed water to move at "super critical flow"—a steady state where a maximum volume of water could be shunted downstream in a minimum amount of time.
>
> "It was the 'can do' era. Anything seemed possible. We built the interstate highway system. We were going to the moon. So the idea that we could replace these annoying flooding streambeds with elegant channels? That was very appealing." Mathias Kondolf. UC Berkeley

But then came the "ecology movement." People everywhere began to question why such things were happening. Wasn't there a way to remove the flood hazards without destroying the environment? Why should we have to destroy our streams, native vegetation, wildlife habitat, and recreation opportunities; and eliminate the air-cooling and -cleaning effects of the riparian vegetation? There must be a better way.

Protecting Urban Streams—a Case Study
Myra Erwin

Preparation

Preview the two slide shows. These are available as power points and as pdf files.

Read the newspaper articles about Colgan Creek restoration and urban streams and make note of the main points they address.

Students should have first seen the three videos about stream restoration, in the previous lessons.

Procedure

Show the Restoration Examples power point.

Ask students what they have noticed about Colgan Creek. Does it have any of the conditions they saw in the videos and the Restoration Examples slide show?

Show the Colgan Creek Restoration power point. Engage students in a discussion of how this work will help the creek. Encourage the use of vocabulary they have learned.

Ask students to read one or more of the articles describing the condition of Colgan Creek and the planned restoration work.

Students should pretend it is their job to get support for restoring the creek. Have them write a simple proposal that includes 1) statement of the problem 2) the proposed solution (what changes would they make to the stream) 3) expected benefits of the restoration.

Consider the time line. Discuss the amount of time required for vegetation to grow back. Some of the new plants, such as the willow, will grow quickly; others, like the oak and walnut trees, will take years to mature. Where do students think they will be, and what will they be doing by the time the trees grow big?

What's Next?

There is more restoration work planned for Colgan Creek. The stream section just upstream of the restored area is next. This restoration work will include creating a more natural channel with meanders and flood plains, and planting native riparian species that will enhance habitat. When this work is completed, a significant portion of Colgan Creek will become a natural, healthier stream.

Lesson Resources

Restoration Examples slide show - As Power Point As pdf **Colgan Creek Restoration slide show** - As Power Point, or as pdf

Articles

Santa Rosa eyes Colgan Creek restoration Press Democrat article July 31, 2010

Santa Rosa council awards contract for first stage of long-stalled project April 18, 2014

Big dig for small creek in Santa Rosa Press Democrat article July 27, 2014

Santa Rosa creek restoration project gets $1.6 million boost Press Democrat April 21, 2015

Problems Facing Urban Streams: Water Quantity: too little or too much water.

Trouble When Rain Comes: California's Concrete Flood Channels are Decaying. California Magazine

The Importance of Riparian

Terrestrial riparian habitat is the assortment of plant life that occurs adjacent to and is influenced by streams, creeks, and rivers. Riparian habitat occurs throughout Sonoma County, especially in rivers and streams that sustain year-round water flow. Native riparian vegetation is well adapted to the dynamic streamside environment and also can be found along freshwater marshes if water is flowing. Most riparian vegetation is deciduous and, unlike in most other California habitat types, summer is the active growing season in the riparian belt. Text from Biodiversity Action Plan

Procedure

Watch one or more of the brief videos about riparian functions. You could show them to the class as a whole, or divide the class into teams. Each team would view one video and prepare a list of riparian characteristics, benefits, and care / restoration.

The five videos originate from different regions of the United States. You could ask students to find the state where the video they viewed was made, and the river system that was discussed. What body of water does the river flow to eventually, the Atlantic or Pacific Ocean? Can they trace its route?

There are many common points made in the videos – the benefits of a healthy riparian are the same, regardless of where you live. Likewise, everyone lives in a watershed.

Lesson Resources – Video Summaries

California's Riparian Wild – Setting is the Consumnes River, Central Valley, California YouTube 7 min

> Scrub jays carry acorns and drop them. Some will sprout. Water flows from mountains into the valley. Dense woodland next to a stream is called the riparian. Riparian areas are important for supporting aquatic and land animals, such as the Western pond turtle. Rich soil depositted by the river supports plants. Riparian supports many birds and the plants that feed them. Deer, lizards, and other animals rely on the plants that are primary producers. There are 230 species along Consumnes River. The Valley Oak are the largest hardwood trees in CA. They are endemic to Central Valley. Lichens are a symbiosis of algae and fungi. Lichens ward off fungus on the trees. Insects live in and around the oaks - one is oak gall wasp. They create galls for larvae to live in and eat. Animal pathways in visible in

the riparian. Flies, mosquitoes and midges attract fish, and birds prey upon the fish. Only 5% of the CentralValley's original forest remains. Some people are working to protect and restore riparian habitats.

Life on the Edge: Improving Riparian Function Oregon State University - 11:51 min.

The setting is in Oregon. The riparian area is the strip of plants along the water, the transition zone between water's edge and uplands. It supports abundant live and amMix of trees –large conifers, deciduous trees, ferns, shrubs and grasses. It is a busy part of the watershed – provides food for fish and other wildlife. Storehouse of organic material that feeds insects, birds, fish. Breeding habitat for birds. Canopy shades stream and controls temperature of stream. Plant roots stabilize the banks. Filters runoff. Supplies large wood to streams that makes ideal habitat. This large wood traps gravel and holds organic material.

Riparian can change by natural processes but also by human activities. Mudslides, development, roads, mining, grazing and logging can affect riparian areas. Example – sheep were removed and trees are coming back, along with the wildlife.

East of Cascades the geography changes. Rather than large trees that are found along the coast, the plants are shrubs. Grasses, sedge, etc. function as a sponge that absorbs water and slowly releases it back into system during the summer. This increases flows during summer. Livestock management is important to riparian restoration – keep livestock out during growing season. Fences keep out livestock and planting willows and other trees restores function. Willow cuttings can be planted any time and root easily. When restoring, create a mix of appropriate trees. Diversity of trees is important. Conifer take time to grow, but willows come in quickly. Sometime competing vegetation is removed to allow desired trees to grow. Restoration is a long term investment.

Riparian Buffers to Prevent Water Pollution . 3 minutes

The setting is the Lower Chippewa River , Wisconsin. Trees and shrubs next to the stream provide riparian buffers that help to maintain wildlife habitat, reduce pollution and minimize erosion. Buffers are important where surface water is likely to carry pollution into the river. City streets, highways, agriculture areas, and privately owned waterfront property carry pollution. Riparian zones filter pollution by interrupting the flow of surface water, slowing it down and giving it time to infiltrate. Fertilizers are trapped and used by the riparian vegetation, reducing the amount of nutrients going into the river. Riparian buffers provide structure by

holding the soil in place. To protect the riparian, allow trees to remain instead of plant lawns, and avoid use of herbicides.

Riparian Buffer Types, Functions, and Values . Arkansas University Extension. 3 minutes.

The setting is in Arkansas. Riparian buffers are strips of vegetation growing along side streams. They capture nutrients, runoff and sediment. Several types of riparian buffers exist. They all function to trap nutrients that are then taken up by plants instead of getting into the stream. Buffers also provide aquatic habitat and stream stability. They provide refuge, food and habitat for animals. Large trees shade the stream. Maintaining riparian areas increased timber value and creates some of the best recreational areas.

Streamside Forest Buffers Preserving Water Quality Stroud Water Research Center 5:46 minutes

The setting is a small farm in southeastern Pennsylvania. On this farm, 25 years ago, all farming activities went right up to stream, and all the pollution went into the stream, too. The farm began to implement best management practices, starting in the uplands. This included contour farming, terraces, and grass waterways, which all minimize soil erosion and the movement of pesticides and fertilizers to stream.

A buffer of trees was planted next to the stream and a swale was formed, which acts to trap stormwater. Ninety percent of rivers and streams that flow to the Chesapeake Bay start as steams that are small enough to jump over. Pennsylvania is the number one source of nitrogen, and the number two source of phosphorus and sediment in the Chesapeake Bay. Excess nitrogen is contributing to an oxygen dead zone in Bay.

With best management practices, 26% of the nitrogen and 43% of the sediment is now trapped by the swale and riparian buffer. A riparian buffer is not a panacea, there is still surface runoff, but it is reduced by terraces, swales, etc. The ideal width for a riparian buffer is 100 feet, but 50 feet is good and 25 feet is better than none. Start small and build on it. There is financial assistance available for farmers who want to use best management practices. Doing so improves the farm's viability and production and improves the bottom line. The farm becomes more profitable. These methods are the most simple and cost effective approach to eliminating pollution in Chesapeake Bay

More Resources

Riparian Zone - A nice three-page description of riparian zones from River Keepers.

Riparian Areas. A unit of study for high school, from the Oregon curriculum, The Stream Scene.

Riparian Systems. A Natural Resource Conservation Service publication, with good text and photos that could be used for student research projects.

California Riparian Habitat Restoration Handbook. From River Partners. Developed for the practitioner, this manual is technical, but clearly written.

Colgan Creek's New Riparian

The newly restored stretch of Colgan Creek now has a variety of native plants in the riparian area. Some, like the willow and sedges, will grow quickly. Others, like the Valley Oak and Black Walnut, will take many years to mature. Students can observe the changes in the riparian vegetation over the years, as they come and go to school and elsewhere.

Objectives

Students will be able to recognize at least five species of plants that are in the restored area of Colgan Creek. Optional – students will do further research each plant. Students will visualize where they will be, when they have grown older, and the various trees have grown large enough to shade the creek.

Procedure

First, students should know about the restoration of Colgan Creek and the importance of riparian areas. See previous lessons.

Ask students what they have observed recently about the plants along the restored part of Colgan Creek. Maybe they will notice that some vegetation was removed and the area looked bare. Have they observed what the new plants are, and how they are growing? Discuss the importance of using native plants when restoring a stream.

Show the slide show, Colgan Creek's New Riparian.

Lesson Resources

Slide show, Colgan Creek's New Riparian

Extension

Students can do on-line research about one or more of the species and create a short Power Point presentation. They may use the New Riparian show as a starting point and add information to the empty text boxes. Or they can create their own.

Research and report on how riparian plants have been used historically. Willow, oak, and sedges, have been used by native people for centuries.

Monitoring Riparian Areas With a Camera. This is an activity your students could do on Colgan Creek. Save all the photographs over the years, and create an on-going documentary slide show.

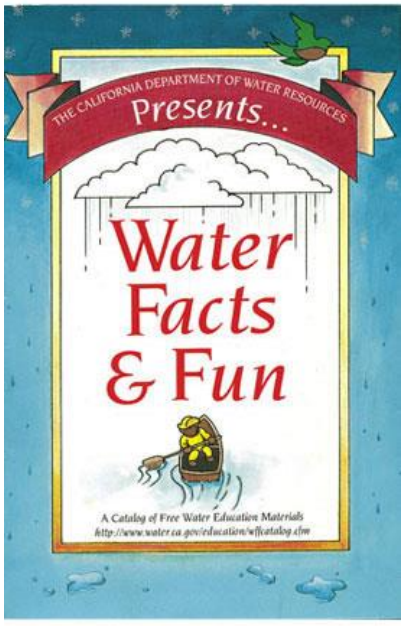
Storm Run-Off - How Does it Hurt Streams and What Can We Do About It?

Concepts

The water that runs off urban landscapes when it rains is often polluted and goes directly into streams. The amount of impervious surface in a watershed increases run-off and concentrates the pollution. There are things people can do to reduce polluted run-off.

> Colgan Creek in Santa Rosa, Foss Creek in Healdsburg, Fife Creek in Guerneville and Laguna Cotati Channel in Cotati all displayed elevated results for several pollutants measured, showing that stormwater pollution is widespread and affects the entire Russian River watershed.
>
> Russian River Keeper First Flush Report 2008

Resources



How Urbanization Affects the Water Cycle. 4 pages of good graphics and descriptions.

Storm Water Curriculum for Teachers My Fair Lakes.com

Urban Runoff Model Build a simple watershed model that demonstrates how the volume of stormwater runoff increases as urban watersheds are roofed and paved over.

Surface Water Runoff. US Geologic Survey.

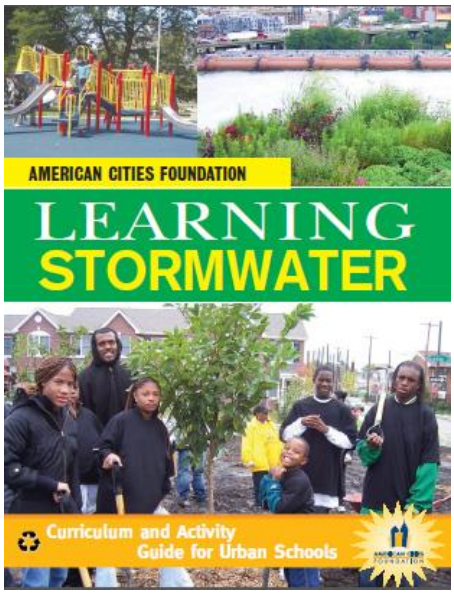
County of Los Angeles Environmental Defenders Program offers 5 lesson plans online.

The Department of Water Resources offers water education materials at no charge

Stormwater Matters – Several activities sheets about stormwater.

Non-point source pollution – you are the solution. A nice animated site from Hawaii

Learning Stormwater - A Curriculum and Activity Guide for Urban Schools



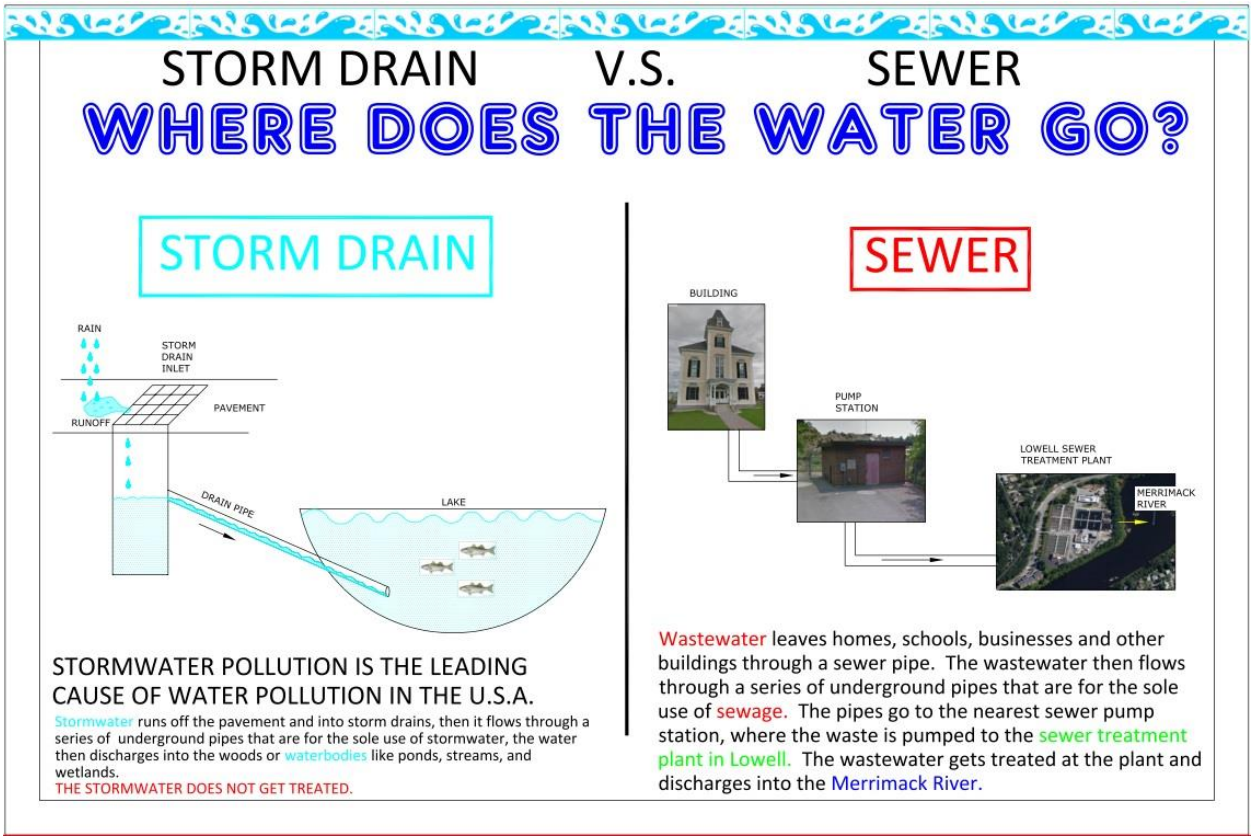
This is a good collection of lesson plans, developed for Philadelphia, addressing basic concepts that apply everywhere. Some of the materials are place-specific , but they can be easily adapted for Santa Rosa. From the American Cities Foundation.

Video

Slow the Flow, Make Your Landscape Act Like a Sponge. Video. Aproximatly 25 minutes. California Waterboards Stormwater Runoff Program

Poster

Where Does Water Go? From Chelmsford, MA



Water Quality

Water quality in Colgan Creek is not good. The restoration of Colgan Creek is expected to improve the water quality to some extent, especially the water temperature, dissolved oxygen, sedimentation and turbidity. However, some water quality problems may still persist, such as presence of nitrates and phosphates, because these arise mainly from pollution sources throughout the watershed, such as streets, parking lots and industrial waste and residential use of biocides and fertilizers.

If you choose to engage your students in monitoring water quality, you can borrow the equipment from the Colgan Creek Education project. There is equipment for testing: Temperature, Dissolved Oxygen, pH, Turbidity, Conductivity, Phosphates, and Nitrates. Contact us to borrow any of this equipment.

Once you have some data to share, please go to the Colgan Creek website and add your information. The site has an interactive map and a procedure for submitting your data. Over time, you and your students will be able to show the positive changes in water quality brought about by the restoration and by your stewardship.

Curriculum Materials

The Stream Scene –Unit on Water Quality

A very good unit of study, including nutrients, water temperature, dissolved oxygen, pH, sediments

How Healthy Are Our Waterways? Water Quality Monitoring.

This 22 page manual describes human sources of pollution, types of pollution and how they affect the stream, and explains water quality parameters.

Earth Force Green – 4 Poster Charts:

- Land Use
- Physical Conditions
- Water Quality
- Water Quality Parameters

The Water Sourcebook Grades 9-12

Use what you need and don't pollute is the message sent to children. From the U.S. Environmental Protection Agency. Includes many lesson plans. 855 pages.

- Introduction to Water
- Drinking Water and Wastewater Treatment
- Surface Water Resources
- Ground Water Resources
- Wetland and Coastal Waters

ANSWERS TO YOUR QUESTIONS ABOUT WATER MONITORING

Once you decide to start a water monitoring program in your school, you will find you have many questions. When should you monitor? How do you use the equipment? Luckily, all the answers you are looking for can be found through educational programs (including GLOBE) and through publications on the Internet. We've listed a few resources here but for a more complete list, see the Resources appendix, as well as the Water SOL and Other

Colgan Creek Information

Laguna de Santa Rosa TMDLs. Northcoast Regional Water Quality Control Board.

Laguna de Santa Rosa TMD Monitoring Plan California Regional Water Quality Control Board North Coast Region

First Flush Reports for 2007 and 2008. By Russian River Keeper

Season's first rains clean the streets, but where does it go? Press Democrat article

More Resources

Water Quality. Good descriptions of all aspects of water quality, from the US Geologic Survey.

A Study in Stream Ecology USGS. Learn how scientists for the USGS National Water Quality Assessment Program investigate the ecological health of rivers and streams across the United States. This video highlights USGS sampling methods for fish, macroinvertebrates (bugs), algae, and habitat. Join us, as we show biometric data can be used to assess the health of streams. YouTube Video 6:56

Watersheds Although this is about Florida, the concepts of watersheds, water quality and stewardship are same, regardless of where you live. YouTube 10:59

Stewardship – Caring for Colgan Creek

Concepts

Streams bring communities together, because everyone in the watershed contributes to the stream in some way. What do you contribute? What can students and their families do to help Colgan Creek? A lot. Every effort counts.

Procedure

Read the Creek Care Guides

Watch the Video Slow the Flow

List 5 things you and your family can do now to improve water quality.

List 3 things you will do in the future, when you are an adult.

Make a poster showing how you would like to see Colgan Creek look 10 years from now.

Lesson Resources

Colgan Creek Care Guide. Produced for the Colgan Restoration Project.

Urban Creek Care Guide. Russian River Watershed Association

My Healthy Stream. Trout Unlimited and Aldo Leopold Foundation

Slow the Flow, Make Your Landscape Act Like a Sponge. Video. Aprox. 25 minutes. California Waterboards Stormwater Runoff Program. See Summary on next page.

More Resources

Russian River-Friendly Landscape Guidelines Local examples

Living Among the Fish .. Very good descriptions of stream dynamics and how to keep streams healthy.

Low Impact Development Center – School Projects A simple, yet effective method to control stormwater is through the use of rain gardens.

Stormwater Matters – Several activities sheets about stormwater.

Only 41% of the total population understands that water that enters the gutters and storm drains goes directly into a river or other waterway; 20% believe the water goes to a sewage treatment plant; 13% think it just soaks into the ground; and 17% don't know where it goes.

Storm Water & Watershed Awareness Survey. 2012

Non-point source pollution – you are the solution. A nice animated site from Hawaii

Summary of Slow the Flow Video

Stormwater runoff is greatly increased when landscapes are paved and developed. Impervious areas do not allow water to soak into the ground. The capacity to carry pollutants is greater. Heavy metals, nutrients, and trash enter waterbodies in the runoff.

There are many small-scale things home owners can do to reduce runoff. These are sometimes called river-friendly landscaping (or ocean friendly). Early adopters will show others how it is done. A few methods are:

- Using pervious concrete instead of impervious concrete.
- Create bio-swales that slow down water and trap it.
- Replace sidewalks with paths made of stepping stones and soil.
- Mulch with leaves to suppress weeds and reduce use of pesticides and fertilizers.
- Install an efficient irrigation system.
- Use drought tolerant native plants.
- Create rain gardens – trap water and let it soak into soil.

There may be some resistance to these changes. Neighbors sometimes disapprove when lawns are replaced. People will get accustomed as they see the positive results.

Schools can change their landscape too. This can be a learning expericne in stormwater pollution prevention. At Dublin High school, they put in grassy swales where stormwater collects, and then infiltrates through a French drain back into the ground. A roof drainage system collects water and delivers it to the basin so it can soak into ground. Large-scale drainage systems are being used, as well as rainwater collection barrels. These methods are good teaching tools.

Low impact development is the new wave. Anticipate and design stormwater collection into new developments. The old method was to channelize streams, leaving no aesthetic, recreational or ecological value.

Stormwater runoff that reaches beaches contaminates the ocean water, making it unfit for people and animals. Urban watershed stewardship grants are available to citizens who want to implement stormwater runoff prevention projects.

Rip out concrete and replace with native plants. Lawns use large amounts of water and are labor intensive to maintain. Replacing lawn with native plants conserves water and the plants are easier to care for, since they are adapted to the location.

There has been a shift of focus from the end of the pipe, where polluted water flows into waterbodies, to the upland areas - the neighborhoods where the runoff originates. People feel more empowered when they can make positive changes in their own yards. Homeowners are the solution.

- Disconnect your downspouts
- Install a river friendly garden
- Capture rainwater and use it
- Build a rain garden or swale
- Install pervious pavement driveways and sidewalks

Design a Sign

Students can be good teachers. What would they like to tell people about how to take care of streams and the life that depends on them?

Objectives

Each student will design a sign about preventing pollution from entering storm drains.

Procedure

Discuss different methods that are used to teach and persuade people. The students have already been exposed to some of them – slide shows, videos, classroom discussions, reading various texts, etc. What about art in the public sphere? This can be a very effective tool for education.

Tell students they will design a sign to make people aware of storm drains in the Colgan Creek watershed. Show them the photos of storm drain art (Stormdrain Art pdf) and generate a discussion. What elements of the signs are most effective? How do they catch the eye, entertain, and get across a message to the public?

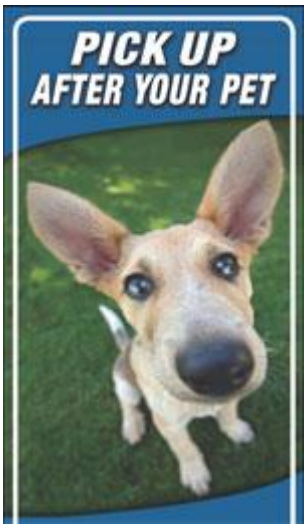
Provide art materials and/or computer programs and sufficient time for completion.

The US Environmental Protection Agency

Nonpoint Source Outreach Toolbox

Logos, slogans, and mascots help make memorable outreach campaigns. If you are stumped for ideas for your own campaign, check out our samples that are currently being used or have been used in the past


BE A SOLUTION!
To Nonpoint Source Pollution


PICK UP
AFTER YOUR PET


Jordan Creek
Keep It Clean!


Clean Streams
Happy Fish
Drains to Creek


SMASH
POLLUTION