A River Runs Through it

Eduardo Aleman, Veronica Gardea, Kim Jones, Thomas Starr King Middle School, Los Angeles Unified School District, Los Angeles, CA

GRADE 6

INTERDISCIPLINARY

WATER:
Water Systems

A Project-Based Learning Unit

How can students design a product that addresses the issues impacting the Los Angeles River, its watershed and surrounding community?

Students understand and explain human impacts on the Los Angeles River and its watershed for the last 150 years. Students advocate for issues pertaining to their own community and the local environment. Ultimately, this place-based unit will help students develop habits of mind and character including thinking critically and creatively, communicating effectively and being a responsible world citizen.

Children's Environmental Literacy Foundation · PO Box 412 · Chappaqua, NY · 10514 · 914.449.6868
www.celfeducation.org
For more information, contact us at info@celfeducation.org.

A River Runs Through It

Kim Jones, Veronica Gardea, Eduardo Alemán, King MS, LAUSD

Cover Page

Unit Title: A River Runs Through It
Grade Level: 6th
Subject Areas: Science/Math/Language Arts/Social Studies
Unit Duration: 6-8 weeks

Lead Design Team Members: Kim Jones, Veronica Gardea, Eduardo Alemán
School District: Los Angeles Unified School District
School: Thomas Starr King Middle School - Environmental STEAM Magnet
Subjects: Math, Science, Technology, Language Arts, Social Studies, Engineering, Arts

Topic: Human Impact on the Los Angeles River: Problems and Solutions

Keywords or Tags: LA River, watershed, sustainability, water, water cycle, systems, climate, weather, climate factors, climate change, aqueduct, aquifer, brackish, convection, ecosystem, estuary, fresh water, groundwater, hydrological cycle, infiltration, runoff, salinity surface water, wetland, Tongva, Gabrielinos, equilibrium.

Unit/Project Summary:

The main goal is for students to understand and explain the impact humans have had on the Los Angeles River and its watershed in the last 150 years, and to give students an opportunity to advocate for issues pertaining to their own community and the environment. Ultimately, through place-based learning, this unit will help students develop habits of mind and character including thinking critically and creatively, communicating effectively and being a responsible world citizen.

Open-Ended driving Question:

How can students design a product that addresses the issues impacting the Los Angeles River, its watershed and surrounding community?

Desired Student Outcomes

Learning Standards:

★ Science
- MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. (Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.)
- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

★ Math
- CCSS.MATH. CONTENT.6.SP.B.4: Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- CCSS.MATH.CONTENT. 6.SP.A.3.Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

★ ELA
- CCSS.ELA-LITERACY.W.6.7: 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.W.6.6: Use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.
- CCSS.ELA-LITERACY.W.6.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-LITERACY.W.6.1.B: Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text.

History/Social Studies
- CCSS.HSS-6.1.1: Describe the hunter-gatherer societies, including the development of tools and the use of fire.
- CCSS.HSS-6.1.2: Identify the locations of human communities that populated the major regions of the world and describe how humans adapted to a variety of environments.
- CCSS.HSS-6.1.3: Discuss the climatic changes and human modifications of the physical environment that gave rise to the domestication of plants and animals and new sources of clothing and shelter.

EfS Standards (USPESD)

- EfS Standard 1 – Students understand and are able to apply the basic concepts and principles of sustainability (i.e.: meeting present needs without compromising the ability of future generations to meet their needs).
- EfS Standard 2 – Students recognize the concept of sustainability as a dynamic condition characterized by the interdependency among ecological, economic, and social systems and how these interconnected systems affect individual and societal well-being. They develop an understanding of the human connection to and interdependence with the natural world.
- EfS Standard 3 – Students develop a multidisciplinary approach to learning the knowledge, skills, and attitudes necessary to continuously improve the health and well-being of present and future generations, via both personal and collective decisions and actions. They are able to envision a world that is sustainable, along with the primary changes that would need to be made by individuals, local communities, and countries in order to achieve this.

Big Ideas of Sustainability	**Essential Questions of Sustainability**
Systems * Earth is a complex system of interacting rock, water, air, and life. * Water is found everywhere on Earth, from the heights of the atmosphere to the depths of the mantle. * Water is essential for life on Earth. Earth is a unique planet in our solar system because water has coexisted on Earth's surface in three phases (solid, liquid, and gas) for billions of years allowing the development and continuous evolution of life.	• How are human and natural systems connected? • What happens in a system when it is out of balance?
Cycles * Earth's water cycles among the reservoirs of the atmosphere, streams, lakes, ocean, glaciers, groundwater, and deep interior of the planet. The total amount of water on Earth's surface has remained fairly constant over geologic time, although its distribution among reservoirs has varied. The water cycle is essential to Earth and connects Earth systems. * Fresh water is less than 3% of the water at Earth's surface. Most of this fresh water is stored as glaciers in Antarctica and Greenland. Less than 1% of Earth's near-surface water is potable.	• What cycles are we a part of? • In what ways do we impact cycles?
Long-Term Effects * Humans affect the quality, availability, and distribution of Earth's water through the modification of streams, lakes, and groundwater. Engineered structures such as canals,	• In what ways does how we live today, impact how people live in the future? • How are we shaped by the land/How

dams, and levees significantly alter water and sediment distribution. Pollution from sewage runoff, agricultural practices, and industrial processes reduce water quality. Overuse of water for electric power generation and agriculture reduces water availability for drinking. *Source: http://www.earthscienceliteracy.org/*	do we shape the land? • Why do animals or humans move from place to place?
Equilibrium * Water resources are essential for agriculture, manufacturing, energy production, and life. Earth scientists and engineers find and manage our freshwater resources, which are limited in supply. In many places, humans withdraw both surface water and groundwater faster than they are replenished. Once fresh water is contaminated, its quality is difficult to restore.	• What makes a system balanced? • What throws off its balance? • What happens when you or your community is out of balance?

Learning Objectives

Students will understand that . . . (concepts)

- before colonization, the Tongva (or Gabrielinos), lived in balance with the Los Angeles river. They developed a way of life uniquely suited to this area. The lush environment provided them with food, water, clothing and tools. They acknowledged and respected their environment and the natural climate cycles of flooding and drought and built their settlements accordingly. Their dwellings were made out of willow and tule and located on higher ground well outside the floodplain. Their lifestyle is an example of sustainable living.
- the city of Los Angeles, since its beginning as a pueblo, until the cosmopolitan mega city it is now, has grown exponentially over time and such growth has been possible due to increased amounts of water being transported to a dry land.
- population growth has had an impact on the river, its watershed, and the ecosystems and communities surrounding it. The river has been transformed into a long canal to control flooding and while flooding control has been successful, much of the wild flora and fauna has disappeared. In addition, the deposition of rich soils in the valleys and the replenishment of beaches with sand via the natural transportation of the river systems cannot occur anymore due to the channelization of the river.
- there are new Los Angeles river revitalization efforts, some of which are controversial. River plans are moving forward at the federal level and in Sacramento. On the one hand, there are plans to redesign the river to capture more storm water directing it to aquifers rather than allowing it to flow via the river out to sea. This will allow our region to decrease its reliance on water imported from other parts of California and the Western U.S. by as much as 14% per year. The plans also include maintaining flood-control measures while opening up the river to new kinds of public access with 2,300 acres of new park space within a mile of the river. On the other hand, critics fear that behind these efforts, there is a hidden agenda. Urban developers are looking to build new

construction and start rampant real-estate speculation in communities along the river. This will only increase pollution and drive entire communities out of their place.
- the LA River, in particular the islands, provide a home for a sizeable population of transient families and individuals.
- Earth is a complex system of interacting subsystems: the geosphere, hydrosphere, atmosphere, and biosphere.
- water is found almost everywhere on Earth, from high in the atmosphere (as water vapor and ice crystals) too low in the atmosphere (precipitation, droplets in clouds) to mountain snowcaps and glaciers (solid) to running liquid water on the land, ocean, and underground. Energy from the sun and the force of gravity drive the continual cycling of water among these reservoirs. Sunlight causes evaporation and propels oceanic and atmospheric circulation, which transports water around the globe. Gravity causes precipitation to fall from clouds and water to flow downward on the land through watersheds.
- the relative availability of water is a major factor in distinguishing habitats for different living organisms, including humans.
- the climate of any particular place is influenced by a host of interacting factors. These include latitude, elevation, nearby water, ocean currents, topography, vegetation, and prevailing winds. The global climate system and any changes that occur within it also influence local climate.
- Los Angeles averages year-round moderate-to-warm weather. The climate is classified as a Mediterranean climate, which is a type of dry subtropical climate, characterized by seasonal changes in rainfall—with a dry summer and a winter rainy season—but relatively modest transitions in temperature.

Students will know that . . . (facts)

- sustainable living is a lifestyle that attempts to reduce an individual's or society's use of the Earth's natural resources and personal resources. The Tongva or Gabrielinos lifestyles are examples of sustainable living.
- the hydrosphere is the ice, water vapor, and liquid water in the atmosphere, ocean, lakes, streams, soils, and groundwater.
- plants and animals (including humans) depend on water (also land and air) to live and grow. They in turn can change their environment (e.g., the shape of land, the flow of water).
- about 97 percent of Earth's water is in the ocean; most fresh water is contained in glaciers or underground aquifers; only a tiny fraction of Earth's water is found in streams, lakes, rivers.
- fresh water represents only 3% of Earth's water. Most of this water is in icebergs. Only clean surface

Students will be able to . . . (skills)

- locate the Los Angeles river on a map and trace it from its beginning in the mountains to its end in the ocean.
- identify all the most important components in the water cycle in a diagram or model.
- summarize how the water demand in the city of Los Angeles increased over time as the population increased.
- list the different solutions to bringing water to Los Angeles over time, as well as the massive engineering efforts that resulted in the canalization of the Los Angeles River to control its floods.
- appraise the impact the

water can be used by humans. • rivers make up 0.49% of surface freshwater. Rivers account for a small amount of freshwater, this is where humans get most of their water. • a watershed is the area of land where all of the water that falls in it and drains off of it goes to a common outlet. • Los Angeles river begins at the Santa Susana and Simi Hills mountains and ends at Long Beach. • Earth's water is always in movement, and the natural water cycle, also known as the hydrologic cycle, describes the continuous movement of water on, above, and below the surface of the Earth. Water changes states between liquid, vapor, and ice, with these processes happening in the blink of an eye and over millions of years. • Los Angeles' climate is classified as a Mediterranean climate. • Los Angeles river is 52 miles long. • The topography of the Los Angeles river is highly unusual. It ranges from 10, 000 feet in the San Gabriel Mountains to sea level in a very short distance.	aforementioned solutions had on the environment and the flora and fauna around the Los Angeles river and its watershed. • estimate the sustainable local amount of water (per person and population) in a future green Los Angeles. • lower the water and power usage of our school. • describe the unique topography of our watershed. • distinguish between the storm drain versus the sewer systems. • describe common fauna and flora (emphasis on birds) native to the Los Angeles River • llst the different interacting factors influencing a region's climate, with Los Angeles as an example.

Place, Problem, and Project (P3) Community Connections		
Place	**Problem**	**Project**
• Thomas Starr King Middle School • Hyperion Water Treatment Plant and Education Center • Echo Park Lake • TreePeople • LA River • Malibu Lagoon State Beach • Sepulveda Basin	*What is the human impact on the LA River?* Concerns include: • debris/plastics polluting the LA River and animal habitat • industrialization and development of the riparian ecosystems surrounding the river.	Students will: 1) research data collected by FoLAR*on the amount of debris entering the LA River. 2) find solutions to prevent debris from entering the river to stop the problem at its point source. 3) identify challenges facing the Los Angeles River and create a service-learning project and presentation. The project and presentation will cover pollution, runoff, marine debris,

		development, and preserving the riparian habitat.
P3 Possibilities		
Parks	Community Resources	Community Garden
Natural Resources	Parents	School Garden
Neighborhood as Classroom	Museums	Facilities Staff
Nature Centers	Teachers	Community Specialist
Local Leaders	Parents	Elected Officials
Professional Experts	Municipal Services: Services (Los Angeles County Department of Public Works, Los Angeles Sanitation Department)	

Assessment Plan	
Learning Objectives	**Evidence and Criteria (Assessment)**
Students will conduct two "Following Arroyo Sacatella's Path" (Arroyo Sacatella is a tributary of the LA River that has dried up and that goes right through our campus) walking field trips around the community to become familiar with streets, sidewalks, storm drains and other man made features affecting the flow of rainwater. Students will also observe and document the topography, difference in microclimates and other natural occurrences interacting in the local environment that have an impact on the flow of rainwater. Community leaders and water specialists from Tree People will accompany our students on this three-square mile radius field research.	Observation Table Worksheet /Field Notes *(see attached)* Google Map: Pins highlighting: topography, important drain storms, and areas of significance.
Students will be able to make connections between the different spheres of the Earth system by observing Echo Park Lake and categorizing their observations.	Observation Table: Connection Among Systems *(see attached)*

Source: http://www.agiweb.org/education/aapg/invest/invest12.html	Diagram: Systems Interactions at Echo Park Lake
Students will be able to locate the Los Angeles river on a Google map and trace it from its beginning in the mountains to its end in the ocean. They will be able to approximately draw the boundaries of the Los Angeles River watershed. Along the way, students will identify major landmarks. Students will complete a webquest on the Tongva/Gabrielino indians. They will choose an aspect of Tongva life to research. Using research, they will create an information card that has a picture illustrating the main idea of their research and a five sentence caption describing in their own words the interesting facts that they have discovered.	Map Activity • Map: LA River's headwaters and delta identified. • Identify: Major mountains, other bodies of water, major landmarks. Watershed Assessment: Students can create a virtual or hand-drawn map (grid paper) that demonstrates their understanding of the components and function of the watershed. This may be an individual or paired project. Vocabulary Test: Students will be able to identify and use vocabulary appropriately.
Students identify that humans are living things and clean fresh water is essential to their survival. Students summarize the major events in the history of Los Angeles as it relates to the Los Angeles river, water availability, distribution and consumption. These events include: • before colonization; Tongva/Gabrielinos • First Spanish settlers (pueblo, missions) • Gold Rush • Increased farming • Los Angeles River floods at the beginning of the XX Century • The canalization of the river • The creation of reservoirs, aqueducts and water treatment facilities: strategies to move and clean water • World War II • California State Water Project • Serving the water needs for current Metropolis *Source: EEI Unit "Earth's Water"*	Water for Life Assessment: Assesses student achievement of objective "identify that humans are living things and clean fresh water is essential to their survival." To demonstrate what they have learned, they provide written responses to questions. Timeline: Students will create a timeline with the major events in Los Angeles history as it relates to the Los Angeles river, water availability, distribution and consumption. Webquest: Teacher-created, differentiated research project. Digital Portfolio: Students reflect on their visit to the Hyperion Water Plant and explain how the knowledge acquired will help in their formation as responsible world citizens.

An LA Water Cycle from *The Los Angeles River Guide pp.84 - 89.*	Water Cycle: Juno Test *(for all students)* Choice for jigsaw activity: A. Water Cycle Performance B. Water Cycle Diorama C. Water Cycle Poster
Flora and Fauna of the Los Angeles River from *The Los Angeles River Guide*	Identify 7 birds, 7 other animals, and 7 plants that live around the LA river. Show how they are connected, and determine if any of the flora or fauna are keystone species and why.
Students will describe urban forms of pollution; provide reasons why people should monitor what they put on their lawns or in the streets; and identify ways to treat urban runoff. (Students guide a drop of water through a maze of "drainage pipes" to learn how activities in their homes and yards affect water quality.) *Project Wet* p. 231	• Storm drain monitoring program from *Project Wet p.235* • Maze Design: to simulate storm water drainage systems • Brochure Design: Identify sources of pollution. Explain why certain materials should not be dumped into the street or used carelessly. And describing steps individuals and communities can take to prevent surface water contamination.
Environmental Education Initiative (EEI): Dynamic Nature of Rivers	Weeklong investigation of rivers, deposition, and erosion.
Students will research the impact trash/recyclables have on landfills. Students will then find solutions to lessen the impact on landfills, rivers and oceans by recycling paper, plastic bottles and aluminum cans. As part of a School-wide recycling program using small bins to collect paper, plastic bottles and cans in the classroom.	Students will present their findings, teach others how to recycle properly and explain how the recycling funds will go towards the purchase of refillable water stations throughout the campus. The refillable water stations will reduce the use of plastic bottles in and around the school, community and LA River. We would like to work on providing water bottles to every King student to reduce single-use bottles consumption.

Learning Plan
Unit Timing and Duration: 12 weeks of instruction time, with 50-minute sessions four days per week, and one 45-minute session (Tuesday Professional Development Shortened Day). One week for presentations. **Local and Real World Context:** The 834 square miles of the Los Angeles River Watershed (see specific locations above) **Open-Ended Driving Question:** How does the Los Angeles River and its watershed shape living organisms?
Learning Events
Beginning: Engage Students will be engaged through a combination of field trips, open-ended questions, and activities that make them feel part of a larger hydrological, atmospheric, lithospheric and ecological systems that constantly interact with one another. In addition, audiovisuals, discussions and map readings will facilitate this sense of place within a greater system. Finally, students will have the opportunity to be agents of change through recycling, water conservation, and public advocacy of environmental issues and solutions
Middle: Inform Students will be exposed to a variety of scientific concepts related to the Earth Sciences, specifically Hydrology, Climatology, and Ecology, as well as History. Traditional and non-traditional educational strategies and techniques will be used to convey the information. Students will solidify their knowledge of these scientific topics and master mathematical, language arts and social studies skills in the process.
End: Apply Students will apply their knowledge in dialogue, discussion and presentations of issues surrounding the impact humans have on the Los Angeles River watershed and its surrounding environment. Students need to realize their part of a place, part of an environmental problem and are at the center of a solution to that problem.

Addendum
Unit/Lesson Materials:
Lesson on Systems Interactions, including Observation Table (*See Attached)*
In this BrainPOP movie, Tim and Moby will tell you all about the earth's different climate systems, from the frozen poles to the steaming-hot tropics! You'll find out about the system scientists use to classify climates, and how factors like ocean currents and geographical features play major roles! There's information about the hot desert climate of the Sahara, the temperate climates found around the Mediterranean Sea, and the polar climates of Alaska and northern Russia! Whether your area experiences snowstorms, sandstorms, or monsoons, there's a lot here that you can learn from! https://www.brainpop.com/science/weather/climatetypes/
Tim and Moby explain what weather is and how different types of weather form. You'll find out what the engine for all weather is (it has something to do with water). https://www.brainpop.com/science/weather/weather/
You'll learn about surface currents, like the Gulf Stream, and gyres, the large, circular currents that exist in all the world's oceans. You'll also hear about the Coriolis Effect, the global conveyor belt, and the cool California Current. So don't drift off--pay close attention to this movie! https://www.brainpop.com/science/earthsystem/oceancurrents/
In this BrainPOP movie, Tim and Moby dive into the causes and consequences of drought. It might seem like we have an endless supply of water, but what happens when we start using more than the planet can provide? Variations in weather patterns can have a major impact on our water supply, and human activity only magnifies the effect of shortages. When droughts occur, ecosystems and agriculture feel the pain almost immediately. Even worse, in areas that lack modern pipes and plumbing, a drought can quickly escalate into a devastating natural disaster. Unfortunately, droughts are as unpredictable as the weather; but there are things you can do to help! Conserving water is a start. What's even more vital is curbing carbon emissions so we can prevent climate change and preserve our most precious natural resource. https://www.brainpop.com/science/earthsystem/droughts/
Tim and Moby explain how naturally occurring greenhouse gases in our atmosphere once helped transform Earth into a temperate and pleasant place. But as human civilization evolved our reliance on industry, manufacturing and large-scale agriculture has thrown this greenhouse effect out of whack. We're burning more fossil fuels and generating more heat-trapping gasses, like carbon dioxide and methane, than our planet can process. That's causing global warming on a scale we've never seen

before. But the trouble isn't just about temperatures. Climate change is leading to rising sea levels, water shortages, and more erratic, extreme weather conditions. We've already felt the effects of these shifts, but if we're not careful things will only get worse and more people will fall victim to the ripple effects of a hotter Earth. So watch this movie to learn more about what you can do to help … before things get too hot to handle.
https://www.brainpop.com/science/earthsystem/climatechange/

The Project WET Foundation is a nonprofit educational publisher of children's activity booklets, children's story books, educators' guides, maps and posters that teach a variety of critical water topics through hands-on, science-based activities. Project WET developed its first activities in 1984. In 1995, Project WET published its cornerstone publication, the *Project WET Curriculum and Activity Guide.*
http://www.projectwet.org/

Project Wet Activities:

- Color Me a Watershed (p. 239)
- Pollution Activity (p. 453)
- My Water Footprint (p. 441)
- A Grave Mistake (p.341)
- Macroinvertebrate Mayhem (p.43)

Art Connection:

- Water Mural of LA River Watershed (p.515)

Equipment

stream tables

Supplies and Materials

food coloring
ice
plastic cups
potting soil
sand
clay
grid paper

TreePeople inspires and supports the people of LA to come together to plant and care for trees, harvest the rain, and renew depleted landscapes. We unite with communities to grow a greener, shadier and more water-secure city at homes, neighborhoods, schools and in the local mountains. We work with volunteer leaders using our unique Citizen Forester model, and we influence government agencies for a healthy, thriving Los Angeles. https://www.treepeople.org/

Generation Earth is an environmental education program from the Los Angeles County Department of Public Works. Their goal is to educate and empower teens in Los Angeles County to be an active part of the solution to environmental concerns in their community. They offer do-it-yourself environmental projects that help youth make a positive difference at school, at home, and out in the world.
http://www.generationearth.com