Sustainable Water Webquest

Grades 9-12th

Resources developed by San Mateo County Office of Education's (SMCOE)
Environmental Literacy and Sustainability Initiative (ELSI) • Last updated May 2020



Purpose and Overview of WebQuests: WebQuests are a self-directed learning tool that helps learners construct their own learning by determining which sources are most useful. In a WebQuest learners can:

- Choose the Order - Explore resources in any order you want!
- Choose the Duration - Some resources you might glance through quickly, while others you might spend more time reading carefully.
- Choose to Go Beyond - Consider the resources in the WebQuest just a starting point for your inquiry. Let the links take you to other sources that deepen your learning.

SECTION I: Water as a finite resource

The resources in the section below will focus on the following problem statement:

- **Problem 1:** Water is a finite resource that is on the brink of being overused by humans.

Reflection Prompts: *As you navigate through the resources below respond to the following*

A. What was the most surprising or interesting thing you learned in these resources?
B. What or who are some of the most important variables that are contributing to the water system problems?
C. What evidence (data, facts, insights, observations) were you able to find in these resources of how ecosystems and biodiversity are impacted by these water problems?
D. What evidence (data, facts, insights, observations) were you able to find in these resources of how people are impacted by these water problems?
E. Where do you see opportunities for change in the water system?
F. If you could teach someone else the most important things to know about the issues related to these water system problems, what would you tell them? *Explain in no more than 2-3 sentences.*

WATER AS A FINITE RESOURCE

Overview: Water is a finite resource that all life on Earth depends on. Humans overuse it which puts strain on local water habitats and wildlife. • UNESDOC World Water Assessment: Read Chapter 1 *Water in a Changing World* for an overview of how water impacts development.	

The Water Cycle ● NASA: Gives a background on the water cycle. ● Video on how the water cycle works.	
Ecological Water Footprint ● Water Footprint: Similar to carbon footprint every human can calculate their own water footprint. This includes the water we drink and the water we use through secondary sources.	
Hydrosphere and Water Systems ● NOAA: Science at NOAA is the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; integration of research and analysis; observations and monitoring; and environmental modeling. Explore their topics to get an overview of water issues.	

SECTION II: Water Contamination

The resources in the section below will focus on the following problem statement:

- **Problem 2:** Humans have invented ways to manage local water sources and distribution; however, local water supplies are often polluted by humans.

Reflection Prompts: *As you navigate through the resources below respond to the following*

A. What was the most surprising or interesting thing you learned in these resources?
B. What or who are some of the most important variables that are contributing to the water system problems?
C. What evidence (data, facts, insights, observations) were you able to find in these resources of how ecosystems and biodiversity are impacted by these water problems?
D. What evidence (data, facts, insights, observations) were you able to find in these resources of how people are impacted by these water problems?
E. Where do you see opportunities for change in the water system?
F. If you could teach someone else the most important things to know about the issues related to these water system problems, what would you tell them? *Explain in no more than 2-3 sentences.*

WATER CONTAMINATION

Clean Water and Sanitation ● Humans have engineered systems to manage water supply; however, local water supplies are often polluted by human activities. ● UN Sustainability Goals promotes clean water as an essential part of human rights.	

Human Health • **Our World in Data:** Our World in Data is a non-profit website that brings together the data and research on the powerful, long-run trends reshaping our world. This entry provides information about the consumption, relative sources, and trade of energy. This entry covers the risks of unsafe drinking water and how it disproportionately affects low-income countries. • The Story of Bottled Water: A documentary on bottled water and water quality globally. In addition bottled water contributes to pollution through the creation of more plastic.	Our World in Data Clean Water Access THE STORY OF STUFF PROJECT
Water Quality Impacts from Energy Use • U.S. Energy Information Administration: Hydropower as renewable energy production in the U.S. • Hydraulic Fracturing (a.k.a. Fracking): Using water in a multiple step system to extract fossil fuels from the ground below ground water resources.	eia U.S. Energy Information Administration WATER FOOTPRINT® CALCULATOR
Water Quality Measurements • **EPA:** The EPA explains the data and measurement tools for different kinds of water assessments. • **National Geographic:** Water pollution is a growing global crisis as contaminants threaten human health and wildlife.	NATIONAL GEOGRAPHIC
Water Contamination and Environmental Health • Water contamination has huge impacts on local ecosystems • Harmful Algae Blooms create “dead zones” in which wildlife can not flourish due to algae absorbs all the available oxygen in the water. • **Nonpoint and point sources** are both sources of pollution of water ecosystems. The largest nonpoint sources are agriculture and urban runoff. Point sources are typically industrial factories or manufacturing.	
Water Contaminants and Human Health **PFAS:** Per- and poly-fluoroalkyl substances (PFAS), also known as perfluorinated chemicals, are a class of manufactured chemicals that have been used since the 1950s to make commercial and industrial products that resist heat, stains, grease and water, including ‘Scotchguard’, non-stick cookware products and fire-fighting foams. There are many types of PFAS, with the best known examples being perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate acid (PFHxS). These chemicals have been identified worldwide as emerging contaminants. Some PFAS have been shown to be toxic to some animals, and because they don’t break down in the environment, have potential to bioaccumulate in plants and animals.	

● **CA Water Boards:** Per- and Polyfluoroalkyl Substances (PFAS) Overview ● **PFAS Central** ● **EcoWatch:** Interactive Map Shows If Your Tap Water Is Contaminated with PFCs and PFAs ● **AP:** FDA finds Non-toxic in foods **Microplastics** Microplastics are small plastic pieces less than five millimeters long which can be harmful to our ocean and aquatic life. ● **NOAA:** Microplastics Overview ● **Guardian**: Deep Ocean May Be Riddle with Microplastics **Lead Contamination** Flint, Michigan is a modern day case study of water contamination and its effects on human health. ● NRDC: Flint Water Crisis: Everything you need to know	

SECTION II: Climate Change and Water

The resources in the section below will focus on the following problem statement:

- **Problem 3:** Climate change affects the conditions of all four of the Earth's spheres, including the distribution of water on the planet.

Reflection Prompts: *As you navigate through the resources below respond to the following*

A. What was the most surprising or interesting thing you learned in these resources?
B. What or who are some of the most important variables that are contributing to the water system problems?
C. What evidence (data, facts, insights, observations) were you able to find in these resources of how ecosystems and biodiversity are impacted by these water problems?
D. What evidence (data, facts, insights, observations) were you able to find in these resources of how people are impacted by these water problems?
E. Where do you see opportunities for change in the water system?
F. If you could teach someone else the most important things to know about the issues related to these water system problems, what would you tell them? *Explain in no more than 2-3 sentences.*

CLIMATE CHANGE AND WATER

Overview ● Climate and water have an interdependent relationship. Climate change fuels more extreme weather events and water issues lead to greater damage to human resources. ○ Union of Concerned Scientists: Water and Climate Change ○ Earth's System Video	Union of Concerned Scientists

Atmosphere • NOAA: Global climate is impacted through water.	
Hydrosphere • **Climate Central:** Heavy Rain and Flooding • NRDC: Hurricanes and how climate change will impact them • **C2ES:** Drought and Climate Change **California has been heavily impacted by climate change related droughts:** • LATimes: Climate change will make California's drought-flood cycle more volatile • NYTimes: California drought made worse by climate change	CLIMATE CENTRAL C2ES CENTER FOR CLIMATE AND ENERGY SOLUTIONS
Geosphere • **Global Change.Gov:** Climate Change and Sea Level Rise • UGSG: Ground water depletion and its impacts	GlobalChange.gov U.S. Global Change Research Program USGS science for a changing world

Biosphere
• Climate change threats key ecological areas of biodiversity including coral reefs, estuaries, and marine habitats:
  ○ **Effects on coral reefs**
  ○ **Estuaries**
  ○ **Marine**
• Ocean Acidification is the process of the worlds oceans absorbing CO2 from the atmosphere changing the pH of the water. This process decreased the amount of carbonate ions available in the water for wildlife to produce shells and essential building blocks for growth.
	WWF

SECTION III: Water Solutions

The resources in the section below focus on solutions to energy problems. Only explore when you are ready to do solutionary thinking and learning.

Reflection Prompts: *As you navigate through the resources below respond to the following*

A. What was the most surprising or interesting thing you learned in these resources?
B. How can we think globally and act locally when it comes to water issues?
C. Which solutions best address the key causes of water issues?
D. Identify some unintended consequences of the proposed solutions.
E. Which of these solutions do you already see present in your home, school, or community?

General Goals, Definitions, and Mandates

General Goals

- **United Nations Sustainable Development Goals** (SDGs) are a collection of 17 global goals designed to be a "blueprint to achieve a better and more sustainable future for all." The SDGs, set in 2015 by the United Nations General Assembly and intended to be achieved by the year 2030, are part of UN Resolution 70/1, the 2030 Agenda. Two of their goals are about water:
  - Goal 6 is “Ensure access to water and sanitation for all”
  - Goal 14 is “Conserve and sustainably use the oceans, seas and marine resources”
- **Project Drawdown** lists coastal and ocean ecosystems as a sink for carbon. Restoring ecosystems and improving agricultural practices can have a big impact on reducing the effects of climate change.



UN Sustainability Goals

PROJECT DRAWDOWN

Definitions

- **Clean Water** is water that is free of pollutants. This term can refer to both drinking water and to water in the environment.

Mandates

- 33 U.S.C. §1251 et seq. (1972) U.S. Clean Water Act established major water pollution measures and wastewater standards. This landmark environmental act has set the precedent for many important protection measures since.
- California mandates for water are focused around providing access, conserving water, and reducing water pollution.
  - SB 1413 - Chapter 558 (2010), which requires school districts to provide access to free, fresh drinking water during meal times.
  - AB 1343 - Chpt 90 (2017), which allows school districts to enter into Go Low Flow Water Conservation Partnership with a public water system for purposes of reducing water use at schools.
  - CA EO B-37-16 (May 2016), which is the five-year roadmap used by the Brown Administration to “Make Water Conservation a California Way of Life.”

Sustainable Water Strategies

Water Efficiency

- WaterSense is a federal program to educate the public on water conservation. This program provides resources for schools, businesses, home residents, and for outdoor landscaping.
- Alliance for Water Efficiency is a nonprofit who provides resource tools on sustainable water use.
    - Water: What you Pay For
- Food and Agriculture Organization of the United Nations reports on how agriculture can make a difference to global water supply through sustainable use

Collection and Pollution Prevention

- Rainwater harvesting can provide water independence and reduce the need to treat stormwater. Cisterns are larger systems and water can be used for landscaping.
- Greywater filtering reduces the need for treated water by recycling gently used water from sinks and showers. Greywater is filtered through landscaping.
- Restoring the native habitats of estuaries and naturally filtering ecosystems. These ecosystems filter stormwater. By restoring them provides habitat restoration and pollution prevention.

Water Quality

- Thirst Project: Aims to provide clean water technology to developing nations.
- The Guardian overview on up and coming technologies to solve the world's biggest water challenges.

Marine Solutions

Sustainable Fisheries

- FishWatch offers education on where to find sustainable seafood
- SeafoodWatch from Monterey Bay Aquarium

The Ocean Clean Up

- **The Ocean Clean Up**
    - What is the Great Pacific Garbage Patch?
    - Solutions
    - Cleaning Up the Garbage Patches
- **National Geographic** (video) Kids Take Action Against Ocean Plastic students in Hawaii study the effect of plastic pollution on their beaches

Data Management • **Global Precipitation Measurement (GPM):** The Global Precipitation Measurement (GPM) mission is an international network of satellites that provide the next-generation global observations of rain and snow. Through improved measurements of precipitation globally, the GPM mission is helping to advance our understanding of Earth's water and energy cycles.	

Freshwater Solutions

FreshWater Ecosystem Health • Dam removal projects see huge impacts on the health of rivers and streams and the wildlife who rely on them. • Habitat protection, especially wetlands, can have huge impacts on water quality. • Certified Organic agriculture practices conserve water as well as reduce pollution from fertilizer runoff.	
Water Justice Movements • Justice movements to protect waters from pollution from fuel pipeline spills	

Local San Mateo County Solutionary Resources

San Mateo County Water Sources • Bay Area Water Supply and Conservation Agency (BAWSCA) - represents the interests of 24 cities and water districts, and two private utilities, in Alameda, Santa Clara and San Mateo counties that purchase water on a wholesale basis from the San Francisco Regional Water System (SF RWS). • SF Public Utilities Commission - Peninsula Watershed • County of San Mateo - Watersheds in the county
Water Pollution • Flows to Bay: San Mateo's county wide StormWater Pollution Prevention Program. Founded in 1990 SMCWPPP's mission is to reduce the pollution carried to local creeks, the San Francisco Bay, and the Pacific Ocean. • Pacific Beach Coalition: Pacific Beach Coalition (PBC) preserves coastal ecosystems through litter prevention and collection and native habitat restoration projects.
Sea Level Rise • San Mateo County Office of Sustainability- YESS Program: The Youth Exploring Sea Level Rise Science (YESS) project is an innovative program empowering youth to actively participate in local climate change solutions.