



Challenge #12
Recreational Reservoir Design
Due Tuesday, May 19

Challenge Details:

Thank you for all of your hard work designing a new Electric Boat Marina! The developers loved your design and now want you to complete a design of a reservoir to house your newly developed marina. There is a new community being built in Southern California and the Metropolitan Water District (MWD) needs your help developing a recreational reservoir to supply these homes with water and serve as a community space.

In this challenge you will create a diagram of your reservoir and develop a pollution prevention plan.

Complete the plan and attached worksheet and send it to *Julie Miller Kalbacher at jamiller@mwdh2o.com. Make sure to include your name and school name on your responses. This activity is worth 100 points. You will earn points based on completing each question with detail, creativity and accuracy.*

Design Criteria and Constraints - Your design must include the following components.

- Your reservoir will need to supply water to **50,000 new homes** as part of a city expansion.
- The average household size for this community is **3 people per home** and the average person uses **85 gallons of water per day**¹.
- Your reservoir will also need to serve as a community and recreational space and will include your new electric boat marina (designed in a previous challenge). You can include various other recreation spaces.
- Use [Lake Skinner](#) as an example but select a new location for your reservoir complex in your watershed.
- Name your reservoir.
- Create a logo for your reservoir (*optional*).

Deliverables - Your challenge submission must include the following components.

- Reservoir plan in [Google My Maps](#) (including relevant drawings and dimensions for the reservoir, dam, and recreation area).
- Answers to all questions below (*see italic text for example calculations*).
- Environmental Analysis and Campaign Material.
- *Optional*: Reservoir Logo to include with the above deliverables.

¹ <https://lao.ca.gov/Publications/Report/3611>

Part 1: Planning and Design

1. To begin planning and designing your reservoir, you will need to know how much water the residents in the new city expansion will need.
 - a. How much water (in gallons) will you need to supply 50,000 new homes for a year in **gallons**? *You will need to use the above criteria and constraints for this question. Think about how many people will live in the new city expansion and how much water they use in a day! But remember we want you to tell us how much water you will need to supply in **a year**.*
 - b. Convert the water volume amount from gallons to acre feet (a common unit for large amounts of water).
*Hint: An acre foot is the volume of **water** necessary to cover **one acre** of surface area to a depth of **one foot**. It is equal to exactly 43,560 cubic **feet**, or to 325,851 U.S. **gallons**.*
2. Now that you know your yearly demand, you can start identifying a good location for your reservoir within [MWD's Southern California service area](#). Typically, these are created along valleys with flowing water streams, if available, but oftentimes need to be supplied from large sources such as rivers or snowpack.
 - a. Take a look at an [example reservoir plan for Lake Skinner](#). Notice the location, surface area, dam location and dimensions.
 - b. You will create your reservoir within your own watershed. Use the [CA Water Management Planning Tool](#) to find your watershed. (Tip: In the layers section, expand the Watershed Boundary Dataset; watershed boundaries are labeled "10-digit HU"). If you are unable to find an ideal space for a reservoir in your watershed, create your reservoir in another Southern California watershed.
 - c. Use [Google Maps](#) along with [this](#) map to explore areas in MWD's Southern California's service area that could be a good location for your reservoir. Enable satellite view and then hold down Alt/Option on your keyboard when you pan the map to see the landscape in 3D.
 - d. Once you find a good location, you're ready to create your own map with your reservoir plan. Go to [My Maps](#) and create a new map (here is a brief [intro tutorial to Google My Maps](#)).
3. Use the drawing tools to create new markers, lines, or polygons on your map as shown in the example 2.a. You can customize each of these features and you can add a title, a description, and even a photo.
 - a. What is the surface area of your reservoir?
 - b. What is the length of the dam required?
4. Aside from surface area, you will need the average depth of your reservoir to calculate the volume of water it can hold. This is often very difficult to calculate so for this exercise we'll assume your average reservoir depth is 40'. (For extra credit, you can use a simple way to determine the average depth of your reservoir by exploring the example map on 2.a, Layer 2).
 - a. What is the volume of water in cubic feet your reservoir can hold (multiply surface area by average depth)?
 - b. How many acre-feet of water can your reservoir hold (one acre foot is 43,560 cubic feet)?

- c. Can your reservoir meet the demand for the city expansion of 50,000 homes? If not, what are some strategies you could use to meet the demand?
5. You need to supply your reservoir with water from the Colorado River Aqueduct (CRA). Use the line tool in your map to create a supply pipe for your reservoir.
- a. First, add the CRA map layer to your map. You can [download the layer here](#).
 - b. How long is your supply pipeline (in miles)?
 - c. It costs about \$2 million per mile² to build an average diameter water supply line. What is the total cost of your supply pipe?

Part 2: Watershed Health and Sustainability

For this part of the challenge, you have been asked to analyze the environmental impacts of your new reservoir design. Complete the table below to document the impacts and solutions for your design.

Impacts	Yes/No	How will this impact the environment?	What are some possible solutions?
Will there be permanent changes to the land?			
Will the development affect the existing habitats and species?			
Will there be any pollution sources that you will need to consider?			
Will the building of your reservoir affect vegetation?			
Will the increase of recreation and human traffic affect the			

² <http://www.sswd.org/home/showdocument?id=1002>



surrounding environment?			
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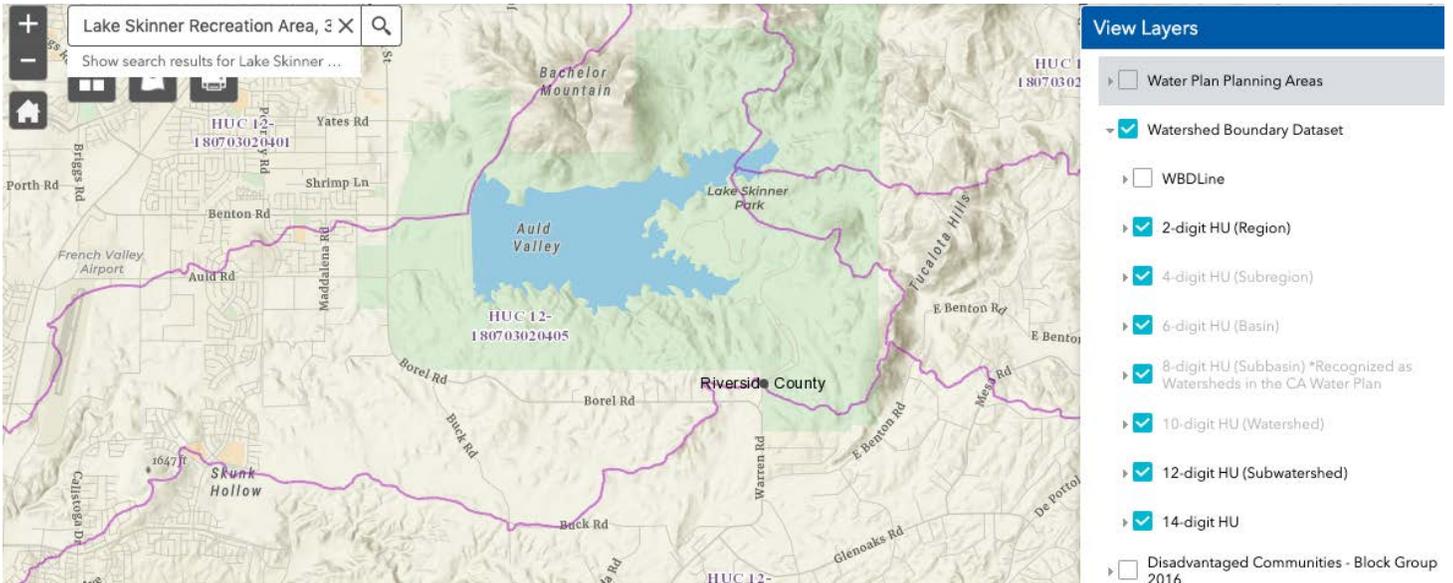
Part 3: Communicating the Importance of Watershed Health

Create a poster, flyer, powerpoint, brochure, or letter to encourage your reservoir users and residents to keep the watershed clean and pollutant free. Think of this as something you would post on the recreational area's bulletin board or send out to the new 50,000 homes. You'll want to make your material(s) educational, creative, and inspiring!

Appendix: Maps linked above



Map 1: Aerial view of the Lake Skinner map created in Google My Maps.



Map 2: Aerial view of the different watersheds near Lake Skinner using the CA Water Management Planning Tool



Map 3: Aerial view of other watersheds in Southern California