

ArcGIS Online Student Guide

ArcGIS Online allows for public access of web-based maps that display geospatial information and data. In this Student Guide, you will learn the basics of navigating an ArcGIS webmap and some common Geographic Information System (GIS) vocabulary.

This guide is intended to be used as a supplement to this lesson, not as a step-by-step guide for the Exploring Runoff activity and worksheet.

Vocabulary

- **Attribute** - Non-spatial data or information that is associated with a particular feature.
- **Attribute table** - A tabular file that contains attributes related to a specific GIS layer.
- **Basemap** - The foundational map layer, which provides reference information for the other map layers.
- **Coordinate system** - A method used to locate a feature in space. It allows you to accurately reference the location of spatial data and evaluate the spatial relationships between different features.
- **Feature** - A geographic entity that can be represented on a map, such as a point, line, or polygon.
- **Geodatabase** - A database used to store and manage geospatial data.
- **Geoprocessing** - An operation that manipulates or analyzes geospatial data. GIS systems often call them tools. Examples include joining two datasets, reclassifying a data field, or clipping spatial data.
- **GIS** - A Geographic Information System. GIS combines recorded data with spatial information about location to produce visualizations, or maps, that can be used to communicate data results, analysis, and ideas.
- **Layer** - A collection of related geographic data that reference a spatial data source.
- **Layout** - A visual map produced from spatial data and other elements, usually including a title, scale, directional arrow, and legend.
- **Legend** - A map element that defines the symbols featured on a map.
- **Line** - A type of feature characterized by linear data, such as streams or streets.
- **Map extent** - The limits of the geographic area shown on a map.
- **Map scale** - The ratio of the distance shown on the map to the actual distance on Earth's surface, in the units corresponding to that of the coordinate system.
- **Map projection** - A method of displaying the Earth's sphere on a 2-Dimensional flat map.
- **Metadata** - Contextual information about a dataset, usually including the data's source, geographic extent, background information, and the definition of any abbreviations or acronyms.
- **Point** - A type of feature characterized by exact locations, such as cities.
- **Polygon** - A type of feature characterized by areas, such as counties or continents.

- **Raster** - An image that represents spatial data as grid cells. Raster data is often collected by satellites, drones, or other remote sensors.
- **Shapefile** - A format for storing spatial and attribute information, commonly used by GIS software.
- **Spatial Data** - Information about the location and attributes of geographic locations.
- **Symbology** - which is the manner in which a layer's data is displayed visually.
- **Topographic Map** - A map that represents the surface terrain of an area, showing elevation and land formations.
- **Vector Data** - A geographic data type which stores geographic features and its attributes as points, lines, or polygons.

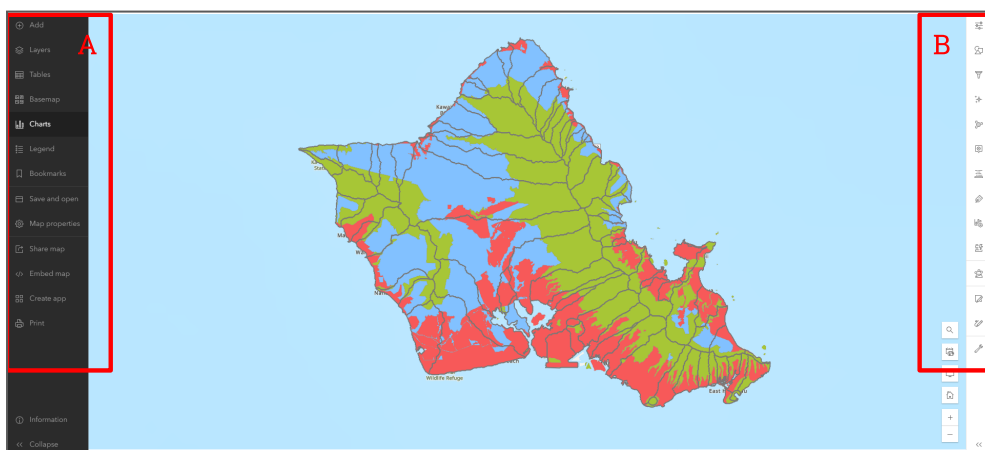
Explore the Map

1. Open your browser to access the O'ahu Watershed Map here: <https://gqr.sh/4xCu>



Don't be afraid to explore the map and click on different features! Any changes made during your session will not be saved or affect any displayed data.

2. Upon opening the map, you should be able to see the Map Viewer, featuring the island of O'ahu. The Map Viewer also contains two vertical toolbars: the Contents toolbar (A) and the Settings toolbar (B). The Contents toolbar (to the left) can be used to manage and view the contents of the map, while the Settings toolbar (to the right) can be used to edit and analyze data within the map layers.



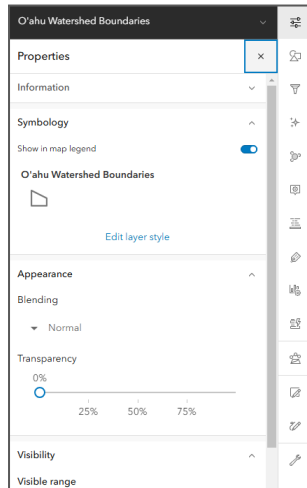
3. Navigate around the map by left clicking and holding your mouse or trackpad and dragging the map in any direction. This is also called "panning."
4. Zoom into central O'ahu using one of these three actions:

- a. Click on the plus and minus buttons located on the bottom right to zoom in and out.
 - b. Scroll your mouse wheel forward (toward the computer screen) to zoom in and away (away from the screen) to zoom out. For a trackpad, use the pinch-to-zoom function or the applicable zoom gesture for your device.
 - c. Hold down the Shift button, click the left button on your mouse or trackpad, and draw a box around the target area to zoom in on the area.
5. On the Contents toolbar, click the Layers button . You will see the layers of data shown within the map. Familiarize yourself with managing map layers with the following procedure:

- a. Hide a layer by clicking on the Eye icon  that appears when you hover over the layer's name. Clicking the icon toggles the layer's visibility temporarily, which is helpful when you need to analyze a specific layer on a map with many different components.



- b. Click on the three dots  to the right of the layer's name and open Show properties to view information about the layer. The Properties pane shows the data source for the layer and the layer's symbology.



- c. Close the Properties pane and once again, click on the three dots to the right of the layer's name. Open Show table to view the layer's attribute table. The attribute table shows data about the layer's features in a tabular format. For example, the attribute table for "O'ahu Watershed Boundaries" contains data about the watershed name assigned to each polygon and area information.

Open tabs: 1

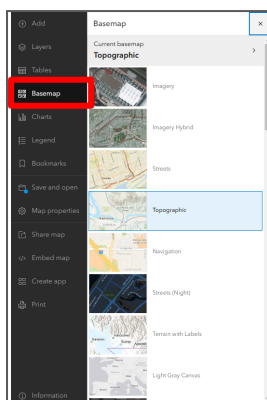
O'ahu Watershed Boundaries x

87 records, 0 selected

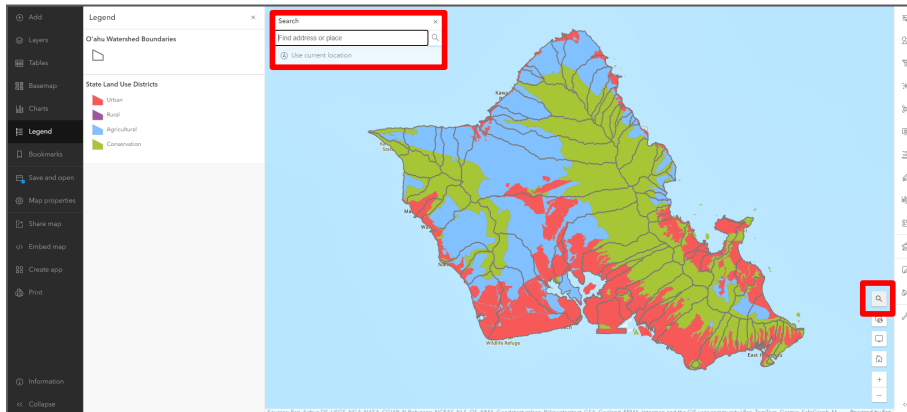
	WUNAME	WUC	HUC	SWMA	area_sqmi	Area_m2
	Aiea	3058	3,058	0	2	5,277,879.26
	Ala Wai	3049	3,049	0	19	48,757,481.2
	Anahulu	3084	3,084	0	16	42,268,113.4
	Diamond Head	3048	3,048	0	0	999,112.93
	Hahaione	3043	3,043	0	2	5,588,810.41
	Haleiwa	3026	3,026	0	1	1,649,348.74
	Hakipuu	3021	3,021	0	2	5,371,202.02
	Halawa	3057	3,057	0	14	36,435,979.1
	Halehaa	3015	3,015	0	0	

+ Create feature

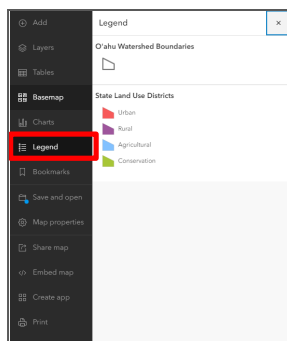
6. Close the attribute table and click the Basemap button  on the Contents toolbar. Try changing the map's basemap and consider the different information that is shown through the various available basemaps. Make sure to toggle the visibility of the appropriate layer to be able to view the basemap.



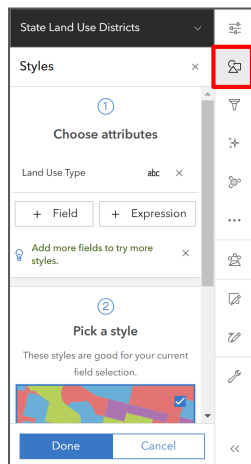
7. Navigate to a specific address by clicking the Magnifying Glass icon  on the bottom right. In the search bar that appears, enter your school's address to zoom into your location. You might need to toggle the visibility of a layer to see where the map zooms to.



8. Select the Legend button  on the Contents toolbar. If you are using a device with a smaller screen, you might need to click a button with three dots  under the Basemap button to find it. Use the map's legend to determine what each layer's symbols represent.



9. In the Settings toolbar, click the Styles button . You can use this pane to change a layer's symbology. With the Style pane open, click the "State Land Use Districts" layer on the dropdown menu at the top and notice that "Land Use Type" is selected under the Choose attributes section. In this section, you can choose which data is symbolized. Scroll down to Pick a style and note that "Types (unique symbols)" is selected for this layer - this allows you to symbolize your data by the unique categories of land use type. The "Location (single symbol)" option will result in the same symbology for all the polygons in the layer. If you select Style Options, you can click the symbols to change the colors attributed to each land use type.



Advanced

If you are interested in working further with ArcGIS, you will need an ArcGIS Online account. With an account, you will be able to import data, use geoprocessing tools, and create and share maps. Accounts require the purchase of a user license. While HDOT cannot provide financial assistance, ask your organization if they already have support for ArcGIS software. You may also be able to apply for free Esri software at

<https://www.esri.com/en-us/industries/k-12-education/schools-software>. Access ArcGIS Online here: <https://www.arcgis.com/index.html>.

Some geoprocessing tools that you should be familiar with are:

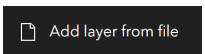
- **Clip** - A tool used to crop the extent of the target layer to match the extent of another layer.
- **Dissolve** - A tool used to merge or aggregate adjacent features.
- **Buffer** - A tool used to add a boundary of a specified distance around the input features.
- **Join** - A tool used to transfer the attributes of a layer or table to another target layer or table based on a specified data relationship.

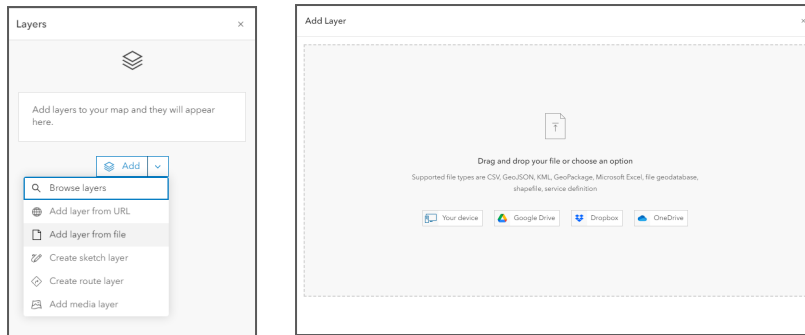
Using the procedure below, try creating a map of Waikele watershed and land use data to practice your skills with geoprocessing tools:

1. **Open a new map:** Once you have signed into your ArcGIS Online account, click on the Map button  on the navigation bar at the top of the page. This will create a new map for you to work within.
2. **Import the data:** Download the "O'ahu Watershed Boundaries" and "State Land Use Districts" zipfiles¹. Make sure to save them to an easy-to-find file pathway on your computer. You may also choose to download the metadata for the datasets, which is useful to understand background information about the dataset and what each attribute or field name means.

1. *The datasets and metadata can be accessed from the following places:*
 - *The Hawai'i Storm Patrol Young Professionals Program webpage (<https://www.stormwaterhawaii.com/lesson-plans-activities/>)*
 - *The State of Hawai'i Office of Planning and Sustainable Development GIS Data (<https://planning.hawaii.gov/gis/download-gis-data-expanded/>)*
 - *Look for the two datasets named "**Watersheds**" under the Inland Water Resources section and "**State Land Use Districts**" under the Cadastral and Land Descriptions section.*

3. **Import the layers into ArcGIS Online:**

- a. In the Contents toolbar, select the Add button  and navigate to Add layer from file .



- b. When uploading a shapefile to ArcGIS, the file must be zipped. Make sure that your shapefiles are located in their respective zipfiles prior to importing.
4. **Symbolize the layers:** Follow the prior instructions (Part 1, Step 9) to click into the Styles tab and edit each layer's symbology.
- a. For the O'ahu Watersheds layer, change the fill color to transparent so that the land use layer is visible.
- b. For the State Land Use Districts layer, under Choose attributes select the "ludcode" field and choose a color for each of the land use types. Rename the values to their full names: Conservation for C, Urban for U, Agricultural for A, and Rural for R. Note that there are no Rural land uses present on the island of O'ahu, but areas do exist on other outer islands.
5. **Filter the watershed data:** Hide the State Land Use Districts layer for now. Navigate to the Filter button  on the Settings toolbar and make sure that the O'ahu Watershed Boundaries layer is selected in the drop down menu at the top of the pane. Select Add new to add a new filter, enter the condition "WUNAME is Waikele", and save your edits. The layer is now filtered so that only the Waikele watershed is displayed.

O'ahu Watershed Boundaries

Filter

Show features where [Clear all](#)

Condition

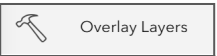
WUNAME

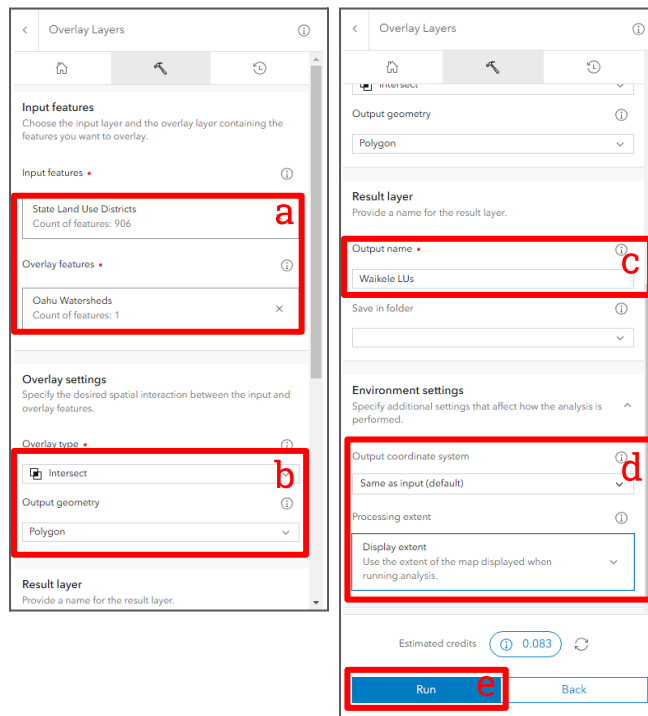
is

Waikele

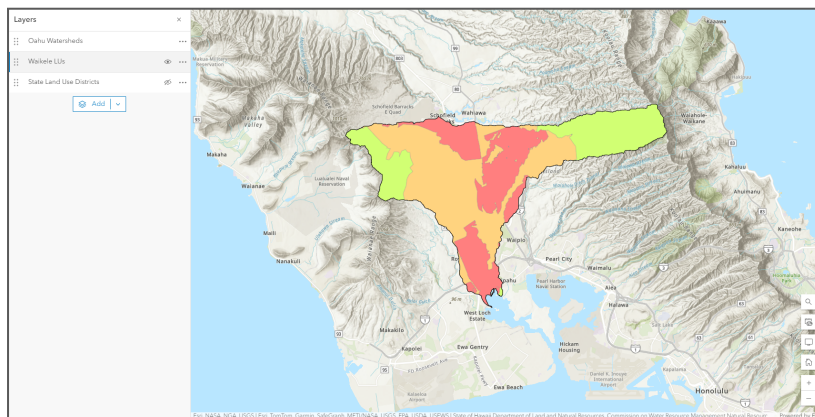
+ Add new

Save Cancel

6. **Clip the land use layer:** Toggle the visibility for the State Land Use District layer so that it is displayed. On the Settings toolbar, select the Analysis button  to view geoprocessing tools. Search for the Overlay Layers tool  in the search bar. You will use this tool to clip the Land Use layer to the Waikele watershed with the following settings:
 - a. For the Input features, use the State Land Use Districts layer, and for the Overlay features, use the O'ahu Watershed Boundaries layer.
 - b. Use the Intersect overlay type and select Polygon as the output geometry.
 - c. Create a name for the resulting layer.
 - d. Under the Environment setting tab, set the Processing extent to Display extent and make sure that your current extent is set to include all of Waikele watershed. If not, zoom in or out to adjust your map accordingly.
 - e. Select Run to clip the layer according to your settings. A new layer under the name you created should appear in the Layers tab.



- f. In the Analysis tab, select History  to view the progress of your geoprocessing.
- g. You will need to re-symbolize the clipped land use layer after the geoprocessing is complete. Toggle off the old land use layer's visibility so that only data for Waikole watershed is visible. Your resulting layer should look like the one below.



7. **Dissolve the land use classes:** In the Settings toolbar, select the Analysis button  to view geoprocessing tools. Search for the Dissolve Boundaries tool  in the search bar. You will use this tool to aggregate land use areas of the same type using the following settings.

- For the Input features, select the clipped Waikele Land Uses layer.
- Toggle Dissolve features with matching field values on and select "ludcode" as the field to match. This specifies how the polygons' boundaries will be dissolved.
- Toggle Create multipart features on. This specifies that all matching polygons will be aggregated into a single feature.
- Create a name for the resulting layer.
- Under the Environment settings tab, set the Processing extent to Display extent and make sure that your current extent is set to include all of Waikele watershed.
- Select Run to dissolve the selected boundaries. You will generate a new layer with three multi-part polygons for each of the land use types: urban, agricultural, and conservation. Take a look in the layer's attribute table and notice that there are only three records. You will need to re-symbolize the layer as before.

Open tabs: 1

Waikele LUs Dissolved

3 records, 0 selected

	ludcode	Count_	Area in Square Kilometers
	A	8	54.87
	C	5	33.73
	U	7	36.89

Dissolve Boundaries

Input features
Choose the input layer containing the features you want to dissolve.

Input features •

Waikele LUs
Count of features: 20

Dissolve settings
Specify which features should be dissolved and any summary statistics.

☒ Dissolve features with matching field values

Fields to match •

ludcode

☒ Create multipart features

☐ Calculate statistics for dissolved features

Result layer
Provide a name for the result layer.

Output name •

Waikele LUs Dissolved

Save in folder

Environment settings
Specify additional settings that affect how the analysis is performed.

Output coordinate system

Same as input (default)

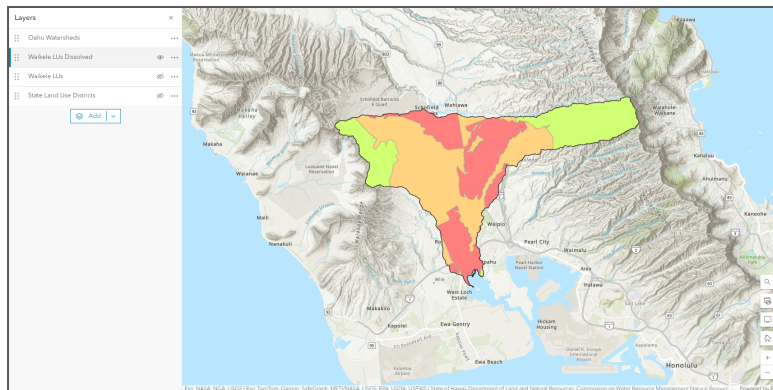
Processing extent

Display extent
Use the extent of the map displayed when running analysis.

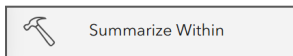
Estimated credits 0.087

Run Back

- g. Toggle off the old land use layer's visibility. Your resulting layer should look like the one below.



8. **Calculate the land use area:** In the Analysis tab, search for the Summarize Within tool



in the search bar. You will use this tool to calculate the total areas for each land use type within Waikēle watershed.

- a. For the Input features, select the new dissolved Waikēle land use layer.
- b. In Summary areas, select Polygon layer as the area type and the filtered O'ahu watersheds layer as the Summary polygon layer.
- c. Under Calculate statistics, toggle Include summarized geometry of features on. This will calculate the total area of the land use polygons.
- d. Select Square Feet under Summarized area units and under Group by field, select the "ludcode" field.
- e. Create a name for the resulting layer.
- f. Under the Environment settings tab, set the Processing extent to Display extent and make sure that your current extent is set to include all of Waikēle watershed.
- g. Select Run to calculate the total areas for each land use type within the Waikēle watershed. This will generate a new layer with the area statistics in the attribute table. You will need to re-symbolize this layer similar to the watershed layer prior, with a transparent fill and black outline.

Summarize Within

Features to summarize
Choose the input layer containing the features you want to calculate statistics for.

Input features •

Waialeke LUs Dissolved
Count of features: 3

Summary areas
Choose whether to summarize within an existing polygon layer or within bins generated by the tool.

Area type

Polygon layer

Summary polygon layer •

Waialeke LUs Dissolved
Count of features: 3

Calculate statistics
Specify the fields and statistics you want to calculate. If none are specified, the output will only include the count of features within each bounding area.

Include summarized geometry of features

are specified, the output will only include the count of features within each bounding area.

Include summarized geometry of features

Summarized area units •

Square Feet

Field statistics

+ Field

Group by field

ludcode

Include minority and majority values

Include percentage of summarized feature

Result layer
Provide a name for the result layer.

Output name •

Waialeke LUs Area

Save in folder

hdothways

Result layer
Provide a name for the result layer.

Output name •

Waialeke LUs Area

Save in folder

hdothways

Environment settings
Specify additional settings that affect how the analysis is performed.

Output coordinate system

Same as input (default)

Processing extent

Display extent
Use the extent of the map displayed when running analysis.

Estimated credits 0.006

Run

Back

- Open the attribute table for this layer to view the total areas for land uses with the Waialeke watershed. Notice that the statistics for the land use districts are now fields within the Waialeke watershed row. You may have to scroll to the right to view the total area data.
- Toggle off the old land use layer's visibility. The attribute table of your resulting layer should look like the one below:

Open tabs: 1

Waialeke Watershed

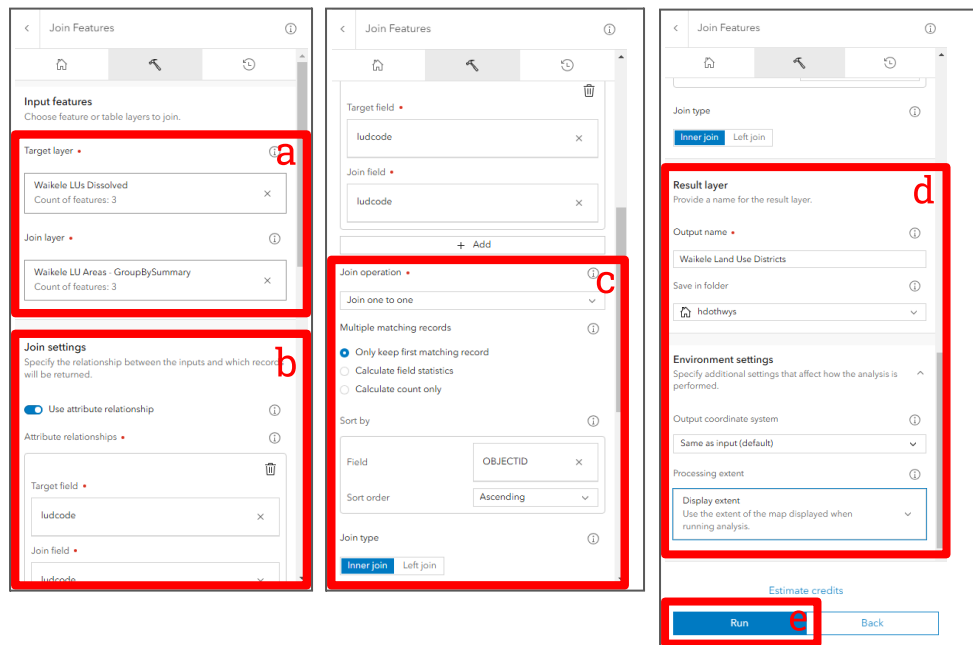
1 record, 0 selected

Shape Leng	Urban	Rural	Agriculture	Conservati	Shape Le 1
77,436.1450	397,108,416.0000	0	590,544,323.5000	363,066,437.3000	77,436.1450

Powered by Esri

9. **Join the area data to the Waikele Land Use layer:** Notice that a new table has now been generated in the Tables tab  under the Contents toolbar. Open the table. Note that there are three different rows correlating to the three land use types, but now each row has an area field with the calculated area in ft². Join this table to the dissolved Waikele Land Use layer so that the areas also are shown in the layer's attribute table. To do this, use the Join Features tool  in the Analysis tab.

- Use the dissolved Waikele Land Use layer as the Target layer.
- Use the table as the Join layer. Find the table by looking for the layer with "GroupBySummary" at the end of its name.
- Toggle on Use attribute relationship and select "ludcode" for both fields. For the join to work correctly, the field's values and field type need to match. The field name, however, does not necessarily need to match. The field values in this case are A, R, and C and the field type is String for both layers.
- Select Join one to one and follow the same process as before (Part 2, Step 7f) for the Result layer and Environment settings sections.
- Select Run to join the fields. A new layer under the name that you selected will appear upon tool completion.



- Open the attribute table to ensure the tool worked correctly. Your attribute table should appear similar to the one below:

3 records, 0 selected					 
	Waikele Kil...	Join ID	Summarized Area ...	Count of Polygons	
		1	590,576,900.17	1	
		1	363,094,458.17	1	
		1	397,044,019.68	1	

- g. Toggle off the old land use layer's visibility.
10. **Clean up your map:** Prepare your map for publication by making it easier for a viewer to read and understand.
- Remove any unnecessary or invisible layers. You should be left with two layers: one of the Waikele watershed boundary and one of the Waikele land use districts.
 - Rename the layers if necessary. The layer names should clearly state what the data featured represents. To do this, click the three dots to the right of each layer name in the Layers tab and select Rename .
 - Open the attribute tables for both layers and clean up the fields shown by clicking on the Gear icon  in the top right corner. Keep any important fields, such as the watershed name and the land use areas, and hide any unnecessary ones that do not provide important information.
 - If necessary, rename any fields whose name is unclear or shortened. To do this, select the Fields tab  in the Settings toolbar and change the Display name of your target field.

Manage field

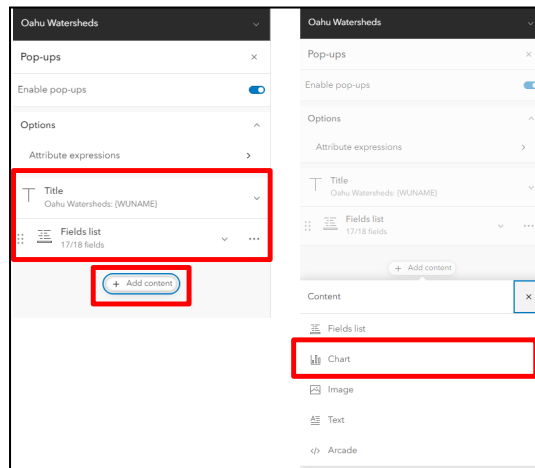
Display name

WUNAME

Delete field

Done

- Reconfigure both layer's pop-ups by selecting the Pop-ups tab  on the Settings toolbar. The pop-up is the frame that shows when a polygon is clicked. Under Fields list, remove the fields deemed unnecessary and keep only what is important for understanding the data. If you choose, you can create a chart that shows the land use areas by clicking Add content and selecting Chart.



- f. Check your map's legend by selecting Legend on the Contents toolbar. If any layer or value names do not accurately reflect the map's data, edit them in the Layers or Styles tabs.
11. **Save and share your map:** Once your map is ready to view, make sure to save it by clicking Save and open  in the Contents toolbar and selecting Save as . To share the map, select the Share map tab  on the Contents toolbar and set to the desired sharing level.

Resources

For more tutorials on using ArcGIS Online, explore Esri's library:

<https://learn.arcgis.com/en/paths/try-arcgis-online/>

If you come across a GIS term that you don't understand, try using Esri's GIS Dictionary to define it: <https://support.esri.com/en-us/gis-dictionary>