Geographical Information Systems for Small Utility Systems

Washington State Department of Health

Your Instructors Today…

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RCAP Rural Community Assistance Partnership

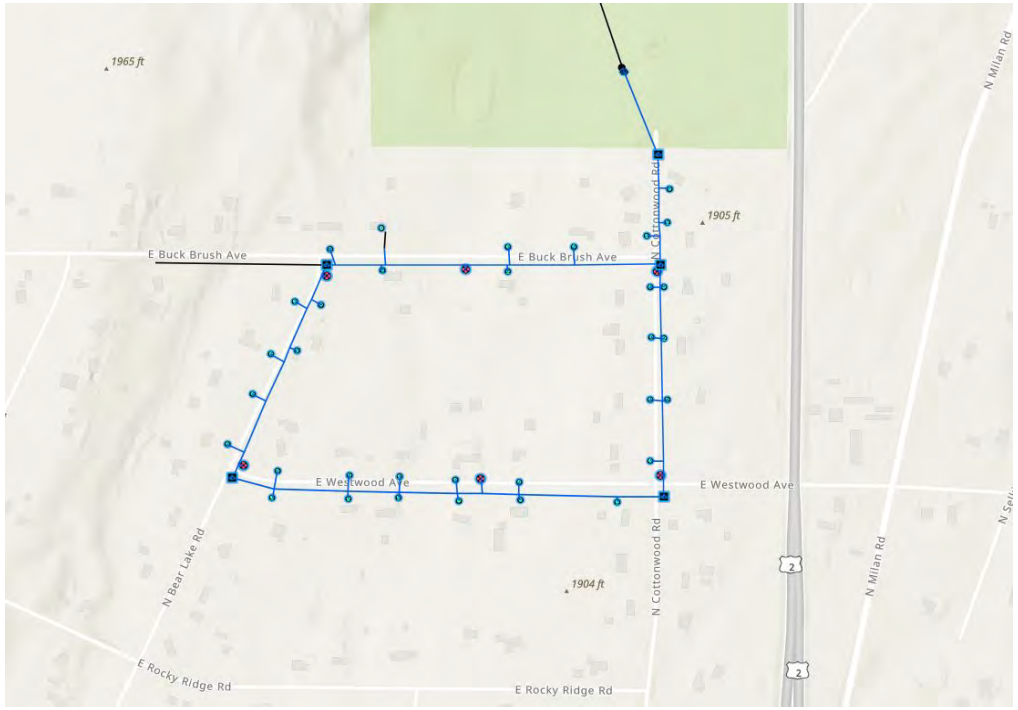
RCAC Programs

- Affordable housing
- Community facilities
- Water and wastewater infrastructure financing (Loan Fund)
- Classroom and online training
- On-site technical assistance
- Median Household Income (MHI) surveys

What is GIS

Geographic Information Systems(GIS)

Computerized mapping that is more than just a map.



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What is GIS

- A GIS map is broken down into layers and there are two layers types.
  - Vector Layers: Points, Lines, and Polygons
    - Attached to tables in a database and can be quarried.
  - Raster Layers: Images
    - Individual cells of with their sizes based on their resolution.
    - These cells contain cell values, as a value for Red, Green, Blue.

Why Use GIS for Small Utilities

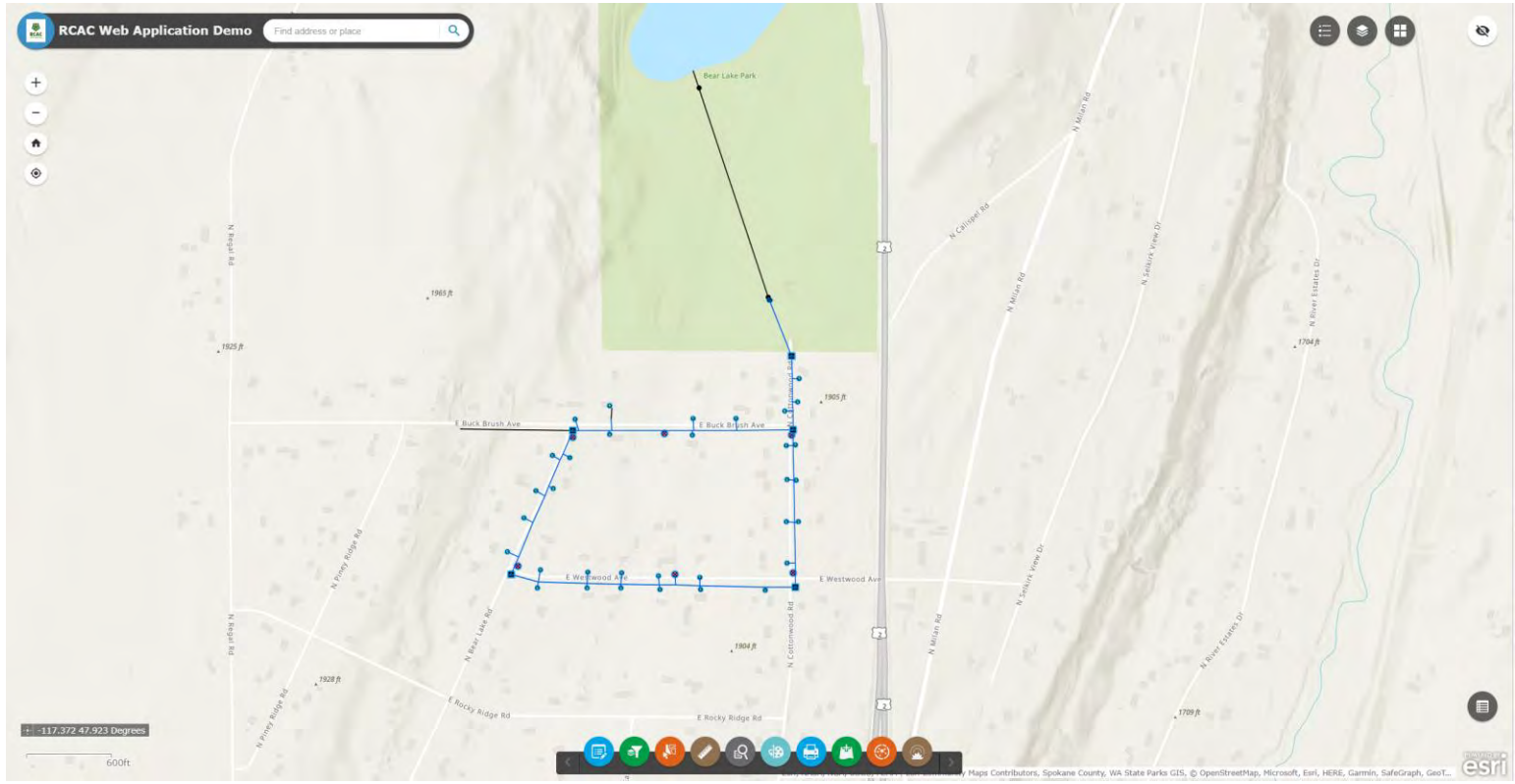
- Asset Management.
- To have a record of the locations of all your infrastructure.
- Analytical tools.
- Customer notifications.

GIS and Asset Management

- GIS can be used as an asset management tool.
- You can use GIS to tract the location of your assets.
- It be used to tract condition and install dates of your assets.
  - Fields on the data table can list install date, condition, date inspect, and any other information that is relevant to your system.
  - The data in the table can be exported as a .csv file to be used in programs like Microsoft Excel.

GIS Systems

ArcGIS Online



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ArcGIS Online

- A system by ERSI (Environmental Systems Research Institute).
- ERSI is the industry leader in GIS products.
- There are two main type of ArcGIS online accounts a organization can have.
  - Pay for what you need
  - Enterprise (A package of many GIS products that the prices are based on organization type and size.)

ArcGIS Online

- ArcGIS Online user types.
  - Creator
    - Every organization needs at least one of these
    - required to create and add new content.
  - Mobile Worker
    - Edit data in the field and the web using applications.
  - Editor
    - Edit data in application
    - does not use field applications.

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ArcGIS Online

- ArcGIS Online user types.
  - Viewer
    - Can view data but cannot make any edits.
  - GIS Professional
    - Abilities to a creator and access to the ArcPro software.

ArcGIS Online Field Maps

- ArcGIS Online Field Maps
  - Application that is used on a mobile device to take data out in the field.
  - Can be used with a GPS/GNSS unit to get high accuracy points.
  - Fill out the tables within this application.
  - Take pictures to attached them to the data.
  - Can be used online or offline (offline areas must be made and downloaded before going offline).

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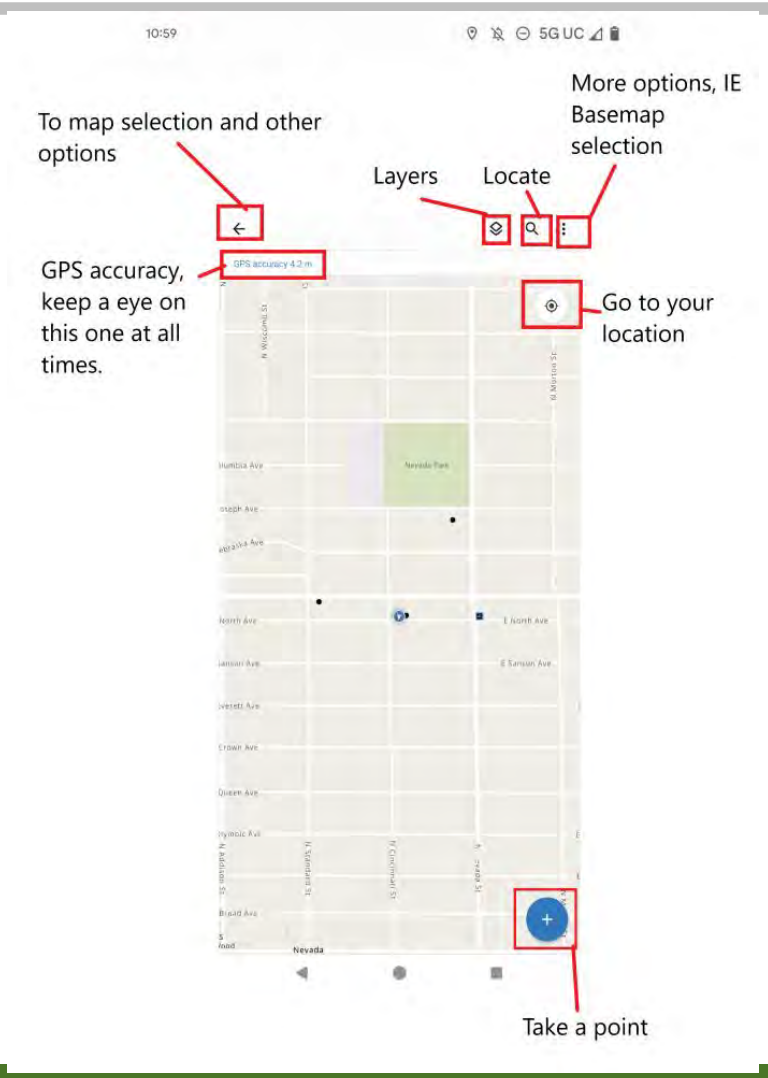
ArcGIS Online Field Maps

- Field Maps main view
- Make sure to always have a GPS accuracy listed, if it says no GPS your points are not following your location and will keep going to your last known location.



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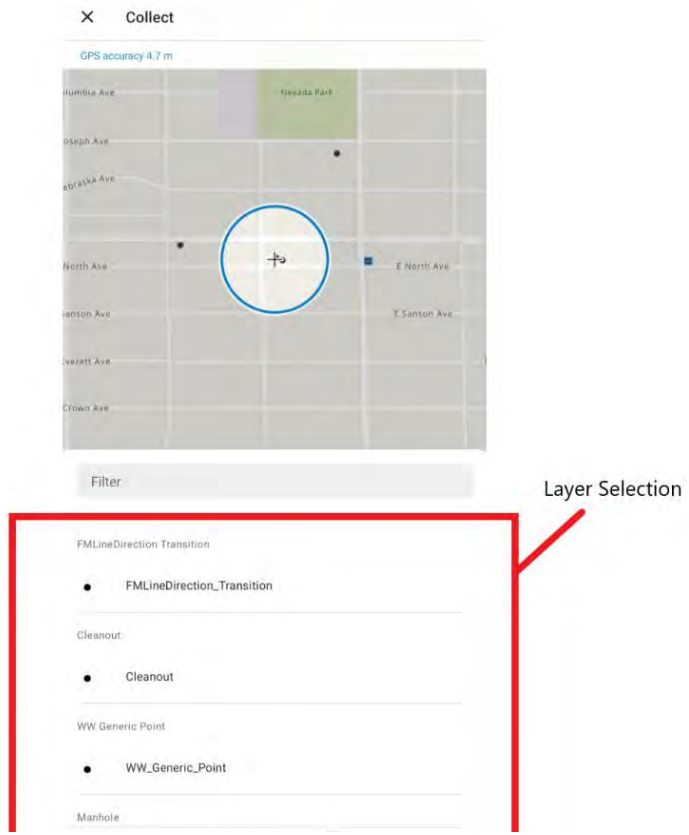
ArcGIS Online Field Maps

- Field Maps collect view
  - This is where you select what layer you want to use for the new object.
  - Taping the layer will take you to the New Feature view.



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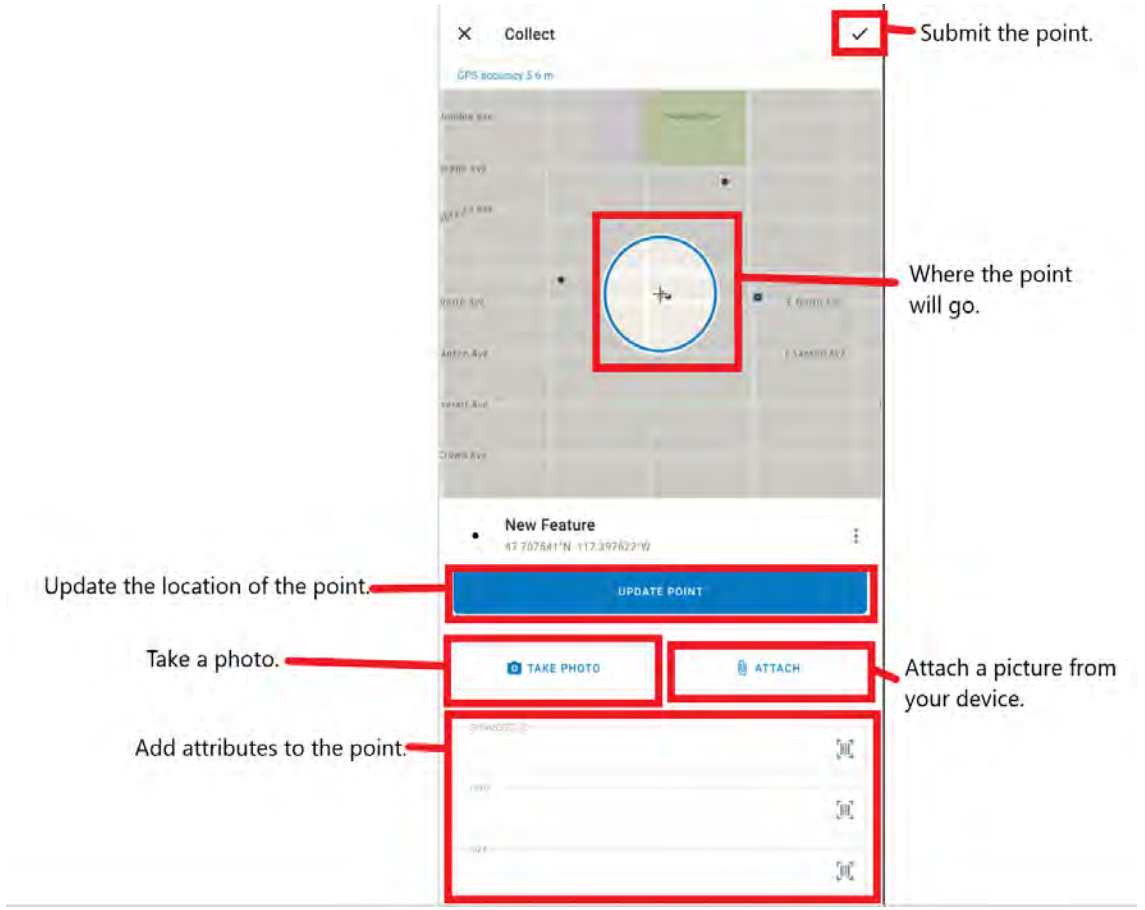
ArcGIS Online Field Maps

- Field Maps new feature view
- Where you add the point to the map. All attributes are added currently. Once you are done filling out the attribute fields and confirm the location of the point, tap the checkmark in the upper lefthand corner to submit the point.



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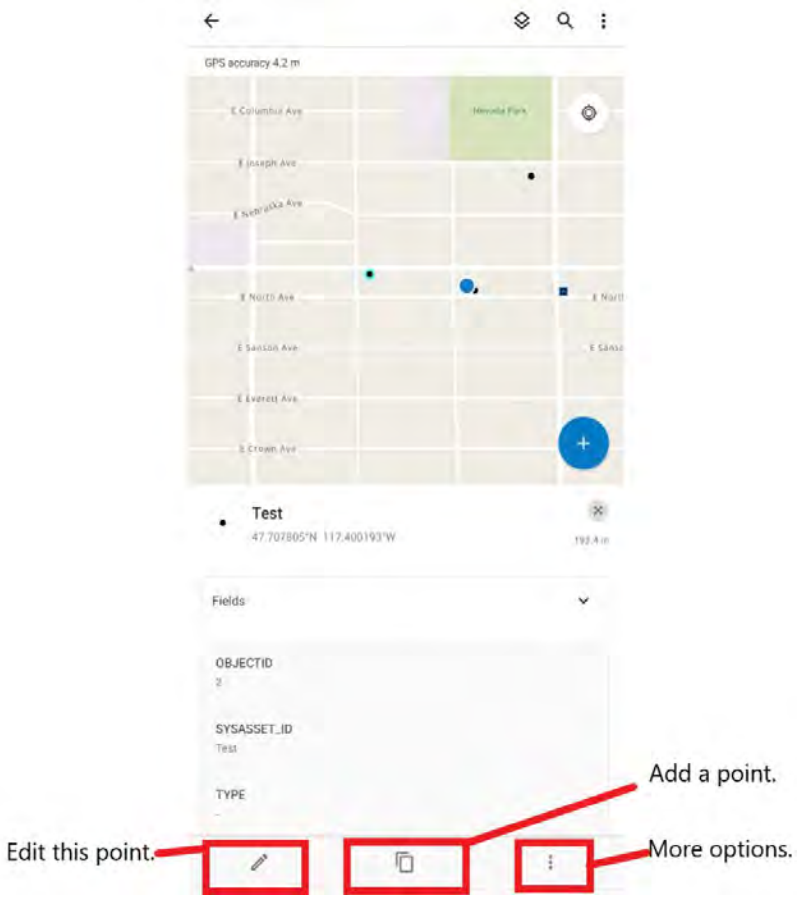
ArcGIS Online Field Maps

- Field Maps object information
  - Shows the information on an object that has been added. You can edit the point from here.
  - The other options can give you directions from your current spot to get to the point and the ability to delete the point.



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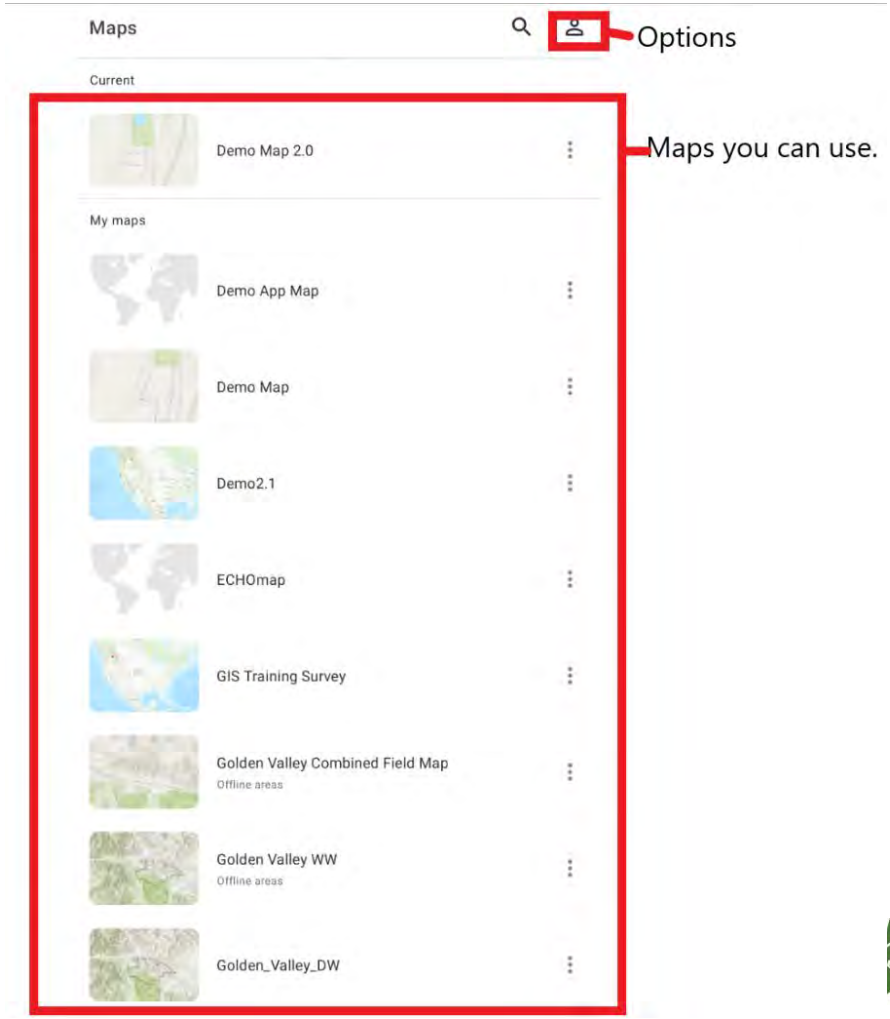
ArcGIS Online Field Maps

- Field Maps map selection
  - Where you can select a map to work on. This will show all maps you have access to with your ArcGIS Online account.
  - The Options option is where you can sign out and where you can change collection settings.



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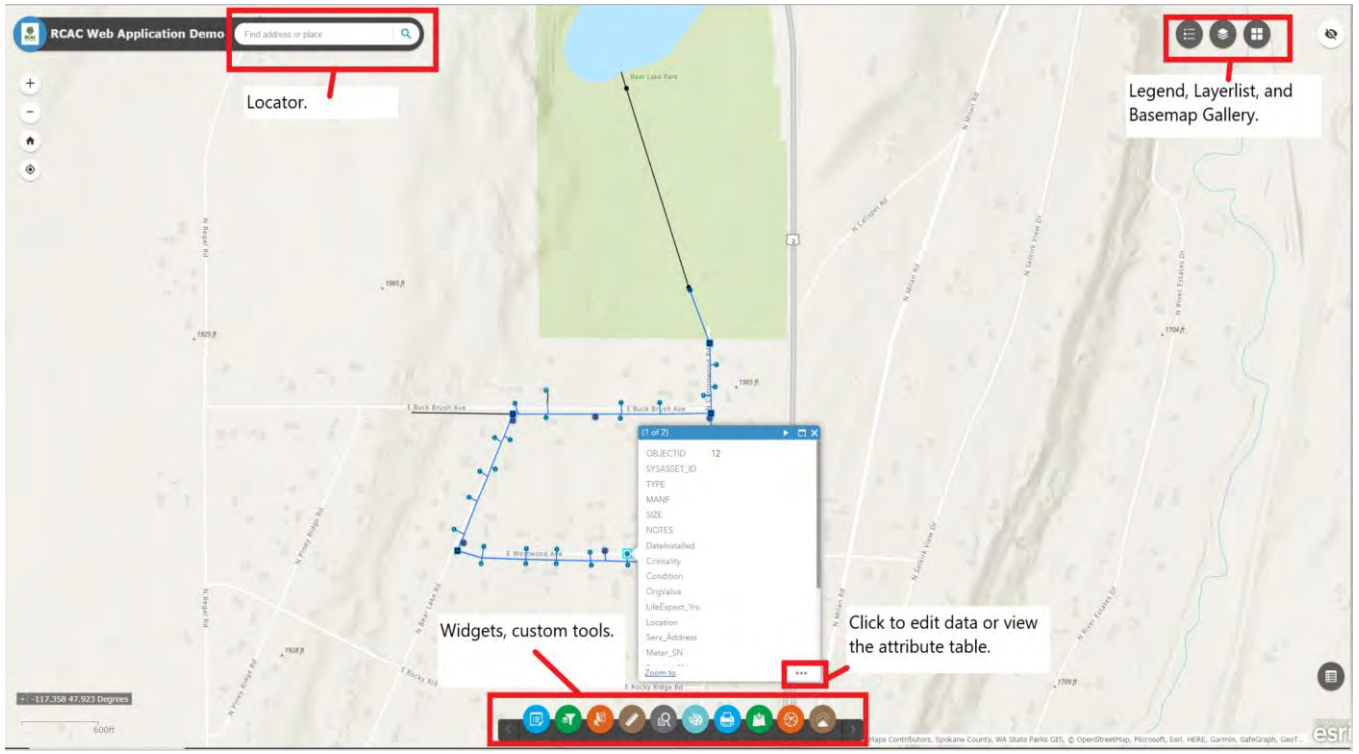
ArcGIS Online Web Applications

- ArcGIS Online web applications are a way to access many tools with any device connected to the internet.
- Applications need to be created by someone with a creator role and be customized with different layouts and tools.
- Great tool to edit data while in the office and to view data.

ArcGIS Online Web Applications

- Example of a web application.
- To view details on an item, click on it and the popup will display.
- You can edit the details from there.



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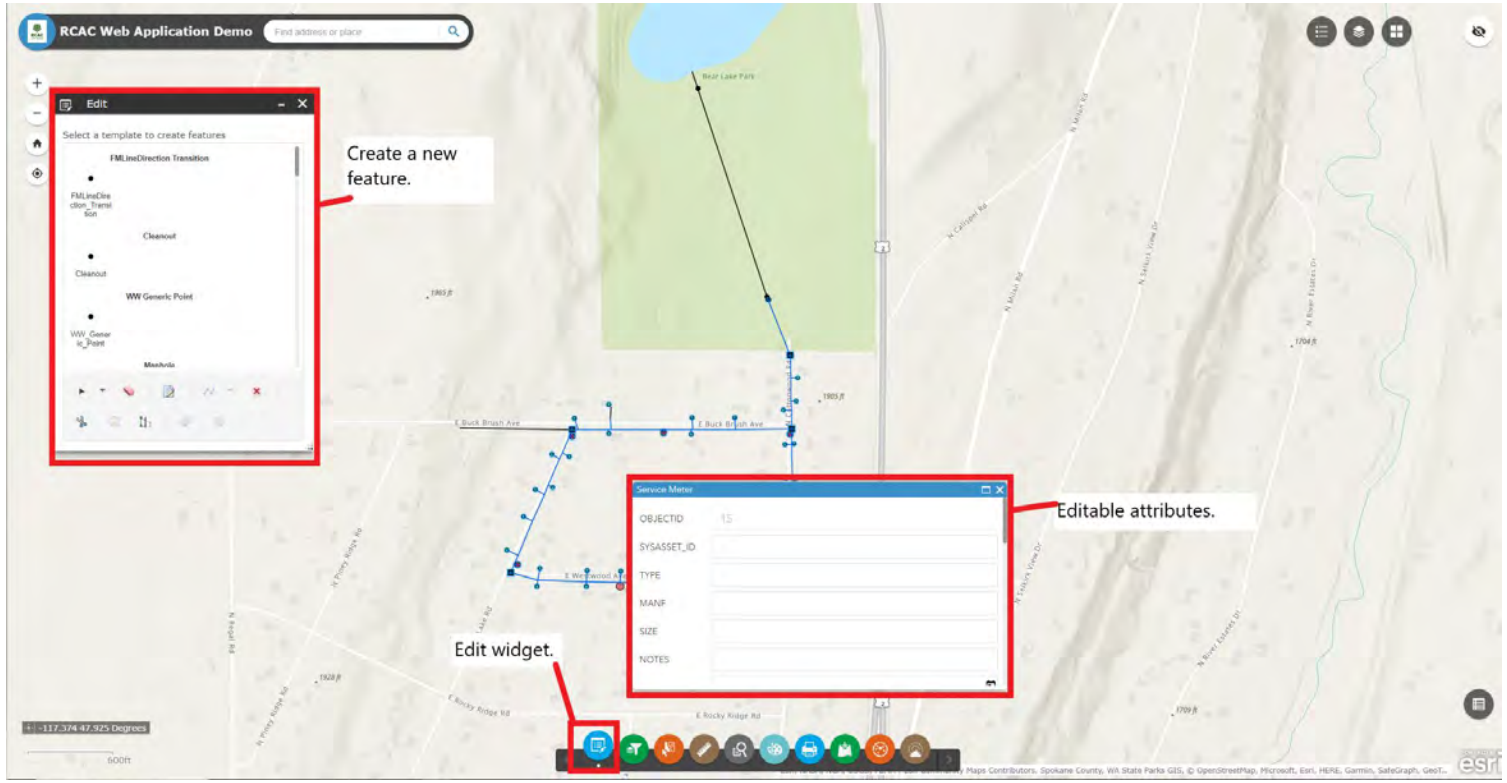
ArcGIS Online Web Applications

- This is editing tool.
- If a feature is selected, you can edit its attributes and move the feature.
- Add a new feature.



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ArcGIS Online Web Applications

- This is the selection tool.
- Select features and export their attribute tables into .csv tables.
- Great for asset management.

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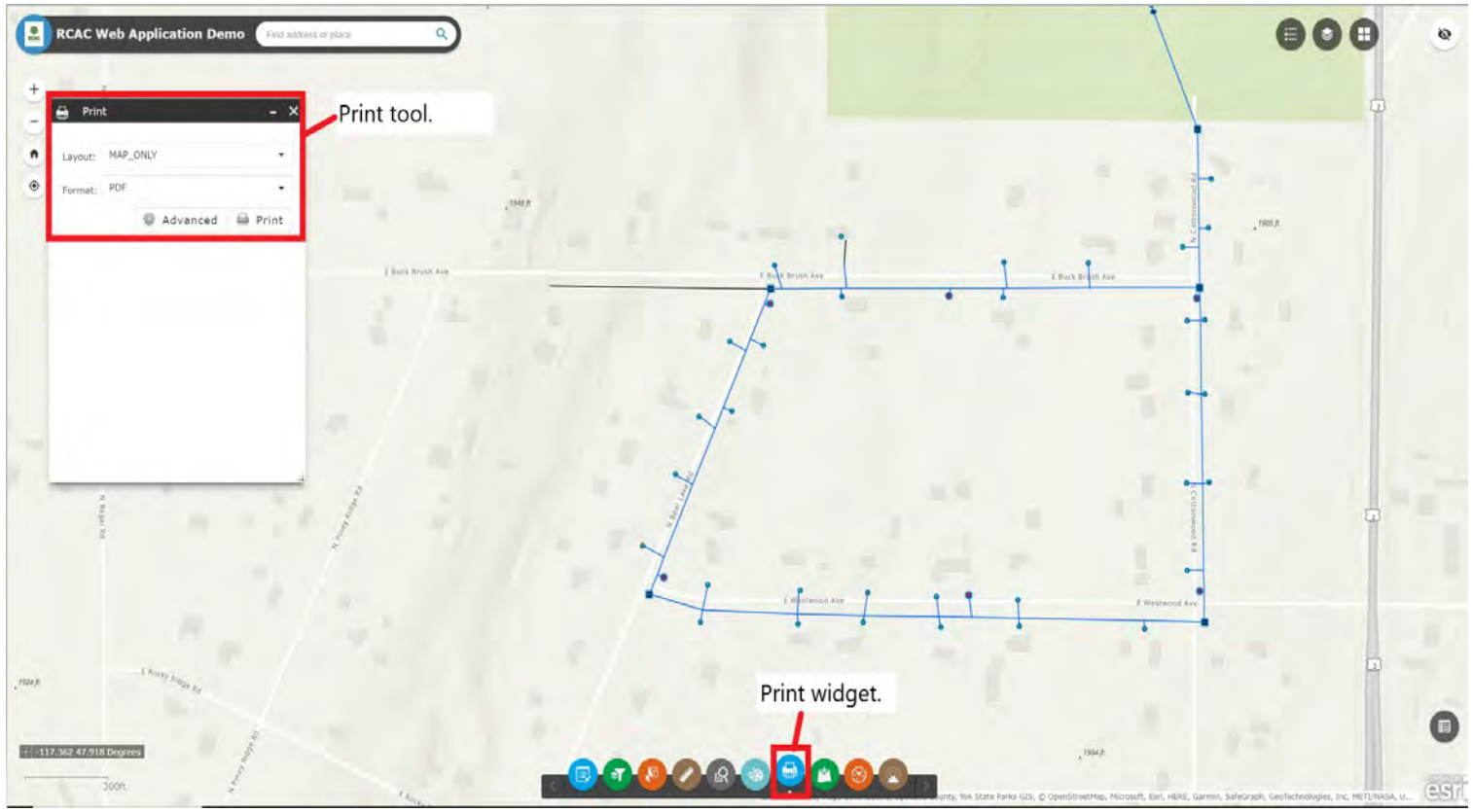
ArcGIS Online Web Applications

- This is the print tool.
- Will produce a printable map in many formats.
- Basic layout unless you're using an Enterprise setup.



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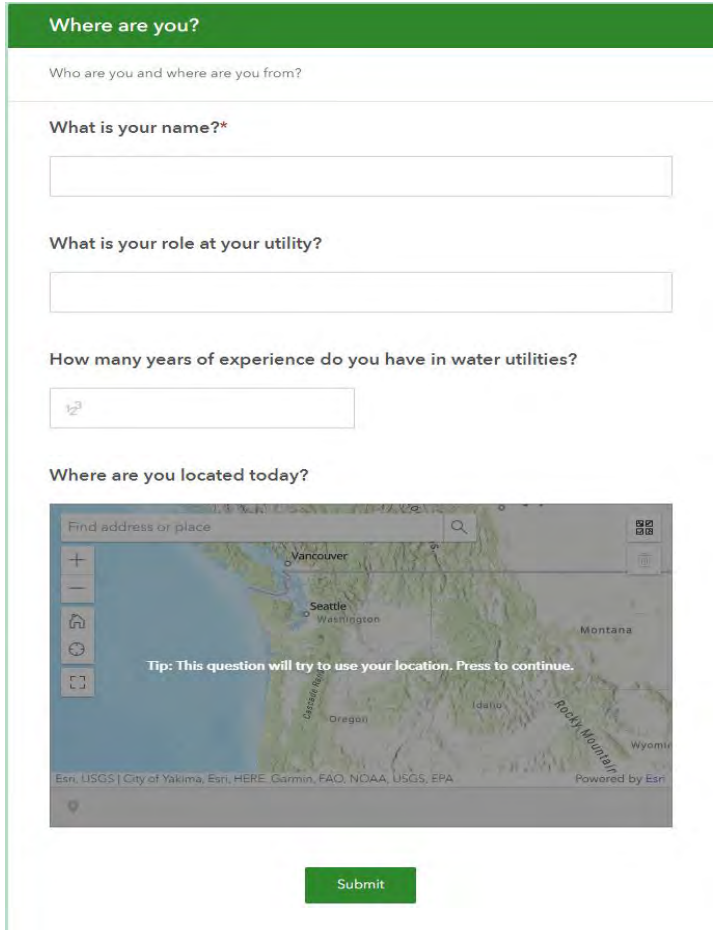
Survey 123

- Survey 123 is a great tool for public data collection and can be used instead of field maps for easier data entry.
- This tool is great for lead service line inventories.



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Survey 123

- Surveys can be set up with many different questions styles.
- Pictures can be submitted with surveys.
- A location can be added as a point, line, or polygon feature.
- You can set who is able to submit survey answers.
- Data from the survey can be added to a web map or in ArcGIS software.

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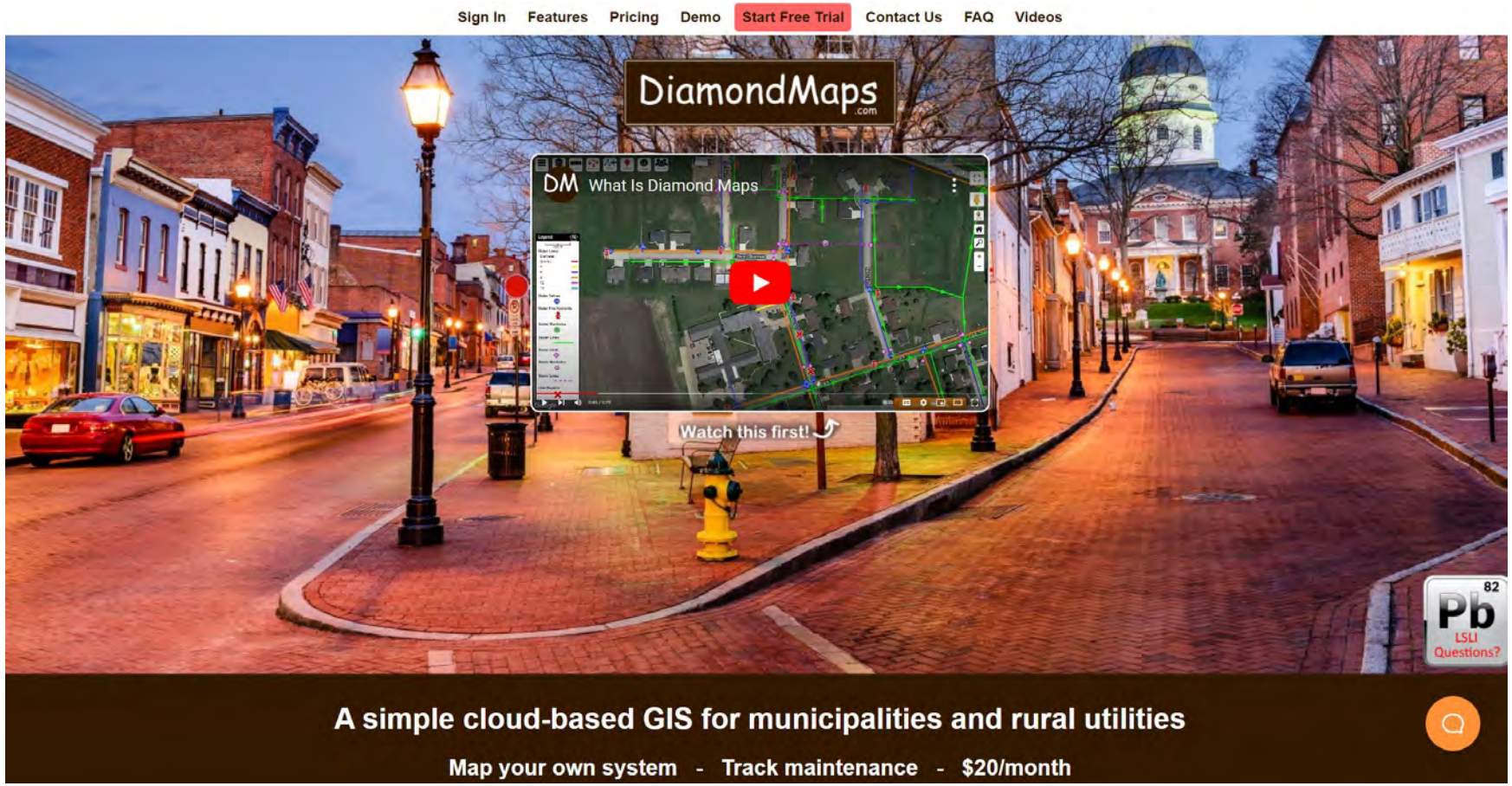
ArcGIS Online

- A reminder all previous tools need to be set up with someone with a creator role.
- RCAC can host organizations, so that a creator role is not needed for that organization.

Diamond Maps



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Diamond Maps

- Diamond Maps https://diamondmaps.com
- Another product that can be used to map your utility,
- Product has a focus for municipalities and rural utilities.
- $20 a month per user or enterprise accounts with a sliding scale, can be free for some organizations based on population.
- No creator user needed to create maps and layers.

Diamond Maps

- Online and offline mapping.
- No programming needed.
- Free 30-day trial.
- Google imagery and street view built in.
- RCAC can help with map creation.

Diamond Maps

- This is the main view while using Diamond Maps.
- Navigation on the right.
- Tools on the top left.
- Legend on the bottom left.

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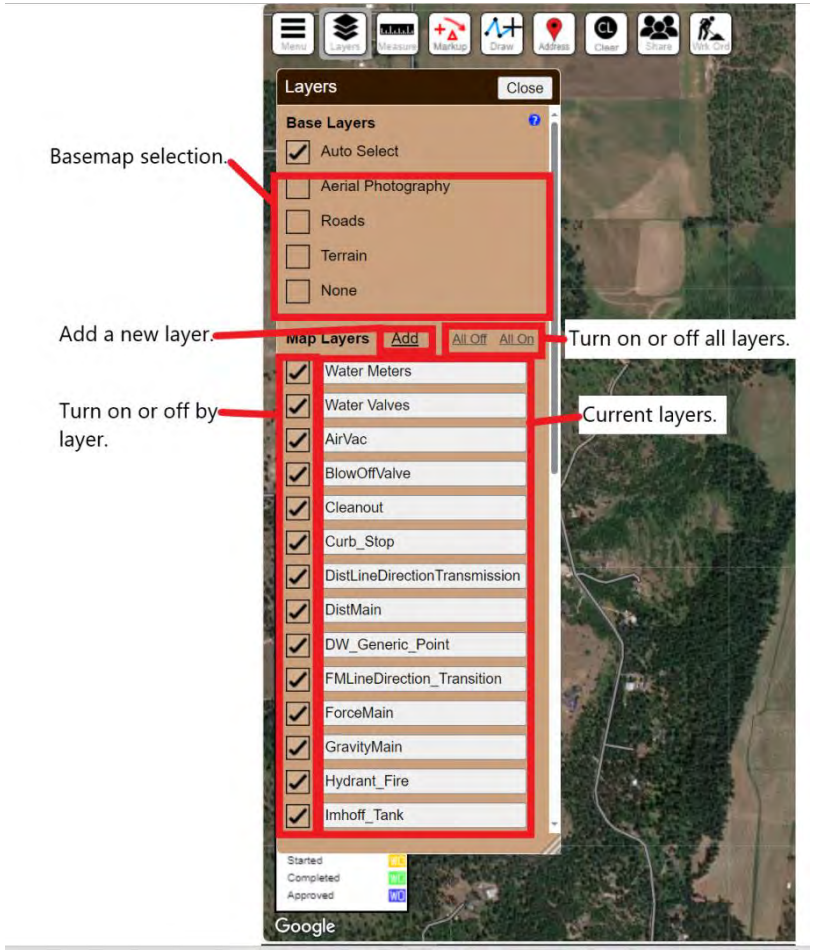
Diamond Maps Layers

- This is the layer tool.
- You can change the desired basemap.
- Turn on and off layers.
- Add new layers.
- Edit layers.



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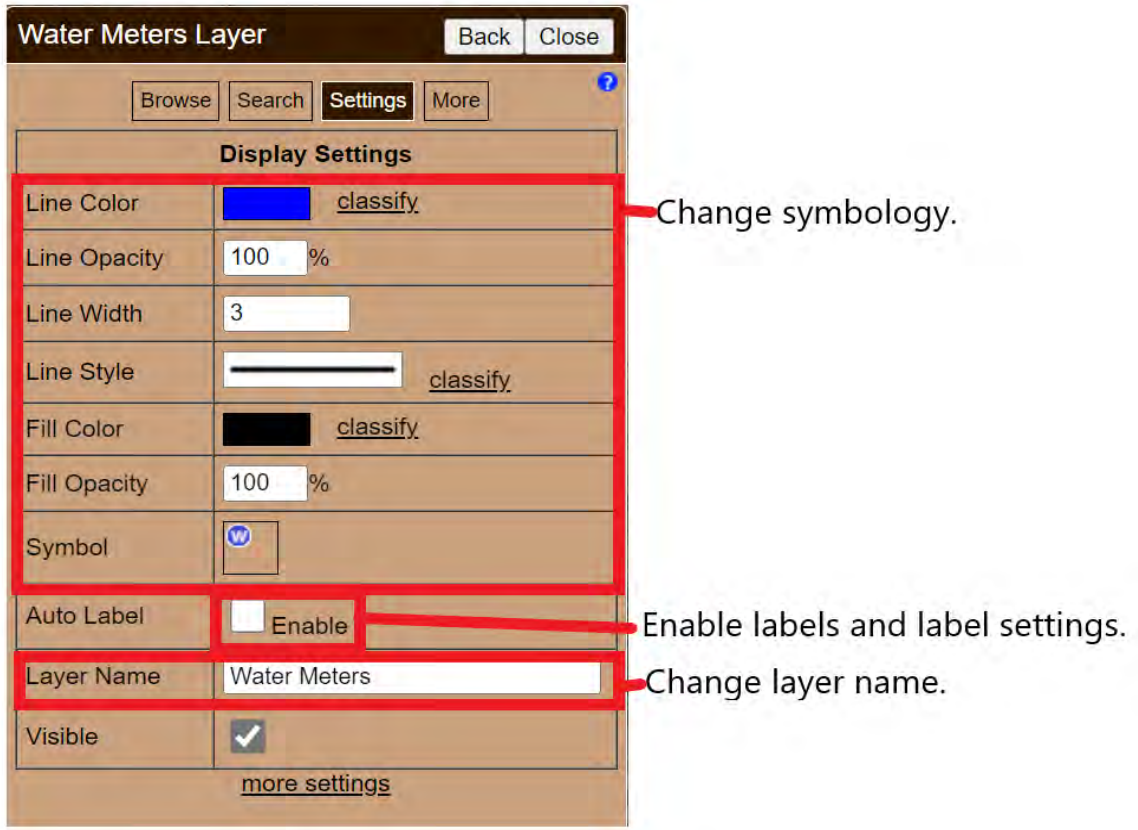
Diamond Maps Layers

- This is the layer settings.
- Layers in Diamond Maps can be points, lines, and polygons, so you have options to change symbology for all.
- Labeling can be added, and this will bring up label settings.
- The layer name can be changed.
- After any changes are done the save changes option will be at the bottom.



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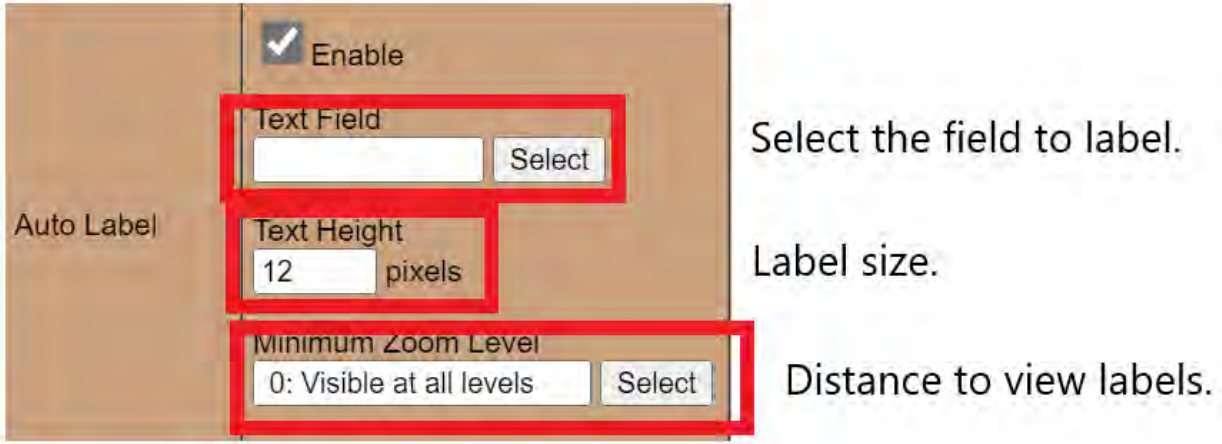
Diamond Maps Layers

- Here is where you can change your label settings.
- Select a field you want to base your labels on.
- Select the size of the label.
- Select at what zoom level you want to view the labels.



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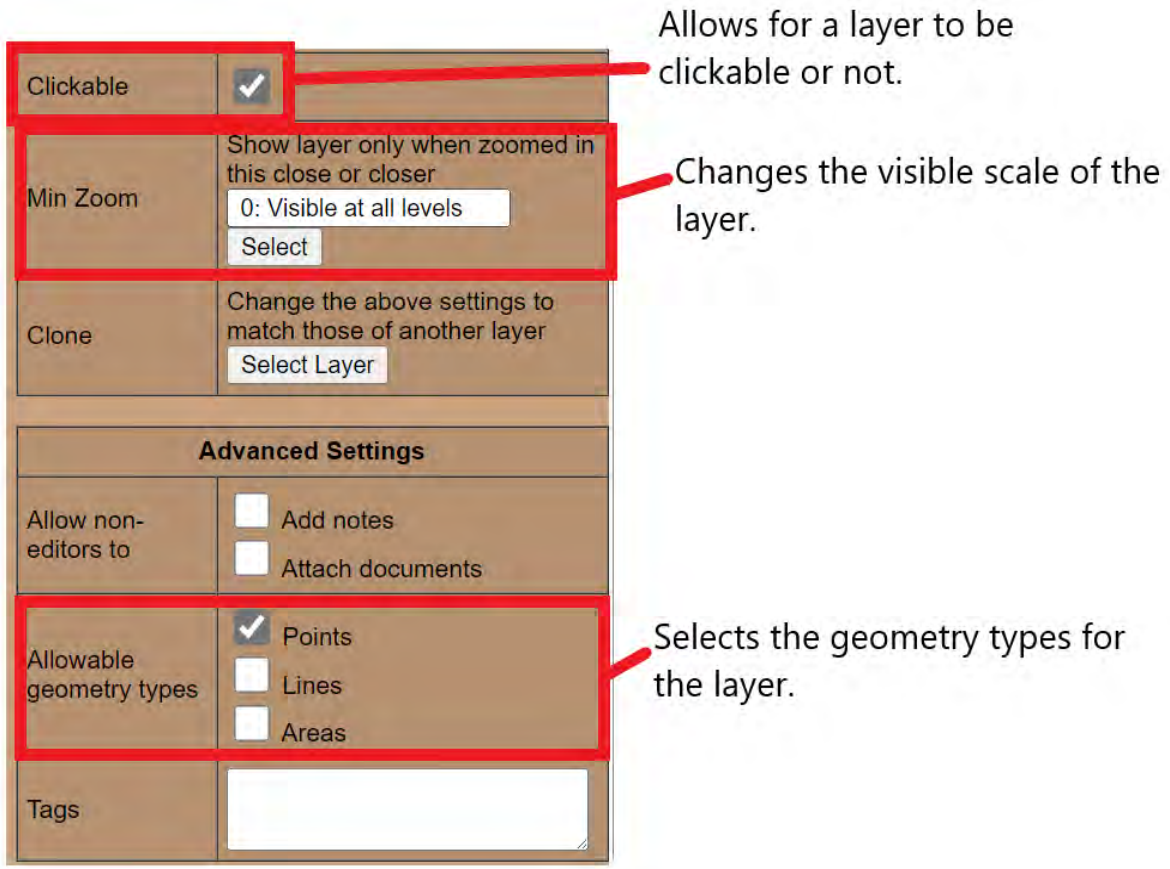
Diamond Maps Layers

- These additional settings let you make a layer clickable or not.
- Change the max visible scale.
- Set the allowable geometry types.



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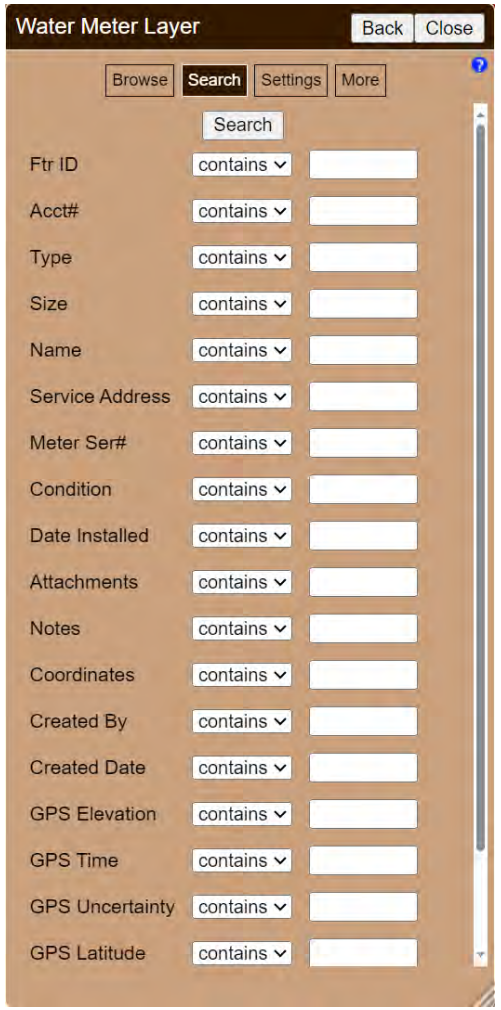
Diamond Maps Layers

- Search will allow you to search all fields or by each field.
- The contains can be change to =,<,>,=>,=<, to help define your search.



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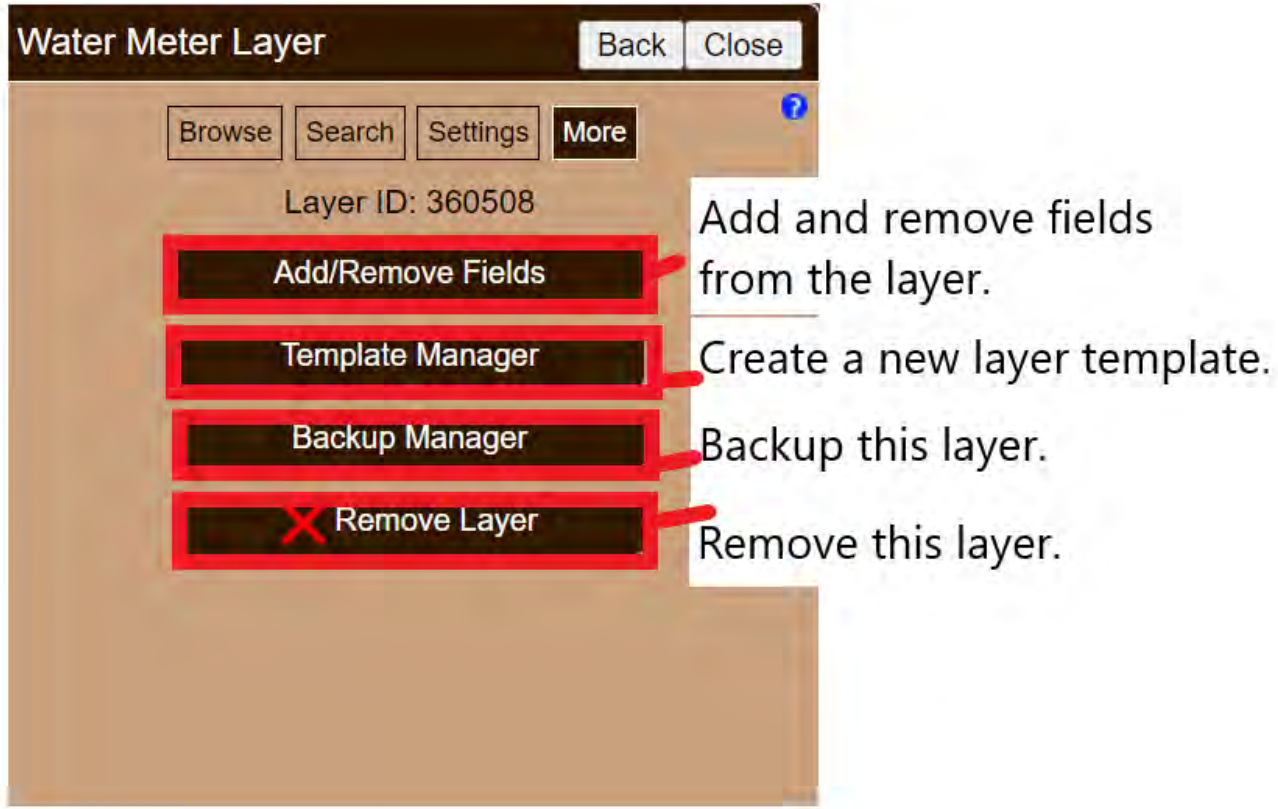
Diamond Maps Layers

- Add and remove fields from this layer.
- Create a new template that can be used in layer creation.
- Backup this layer, there is a 24-hour backup feature.
- Remove the layer.



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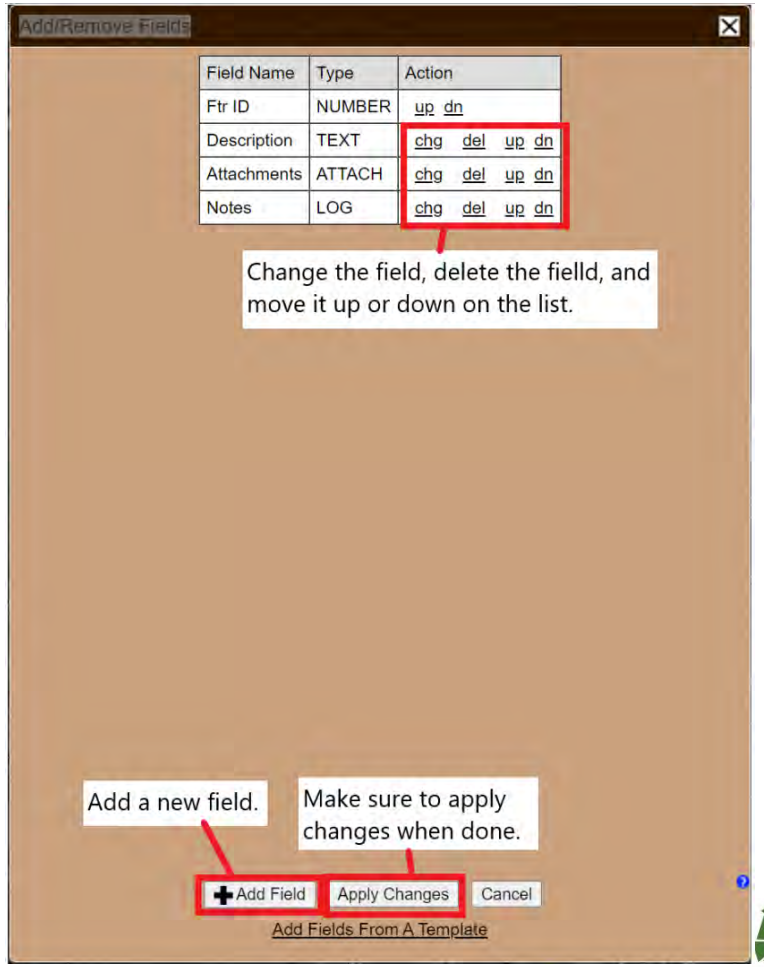
Diamond Maps Layers

- Here is where you can modify, add, and delete fields.
- Make sure to apply changes after doing any edits to the fields.



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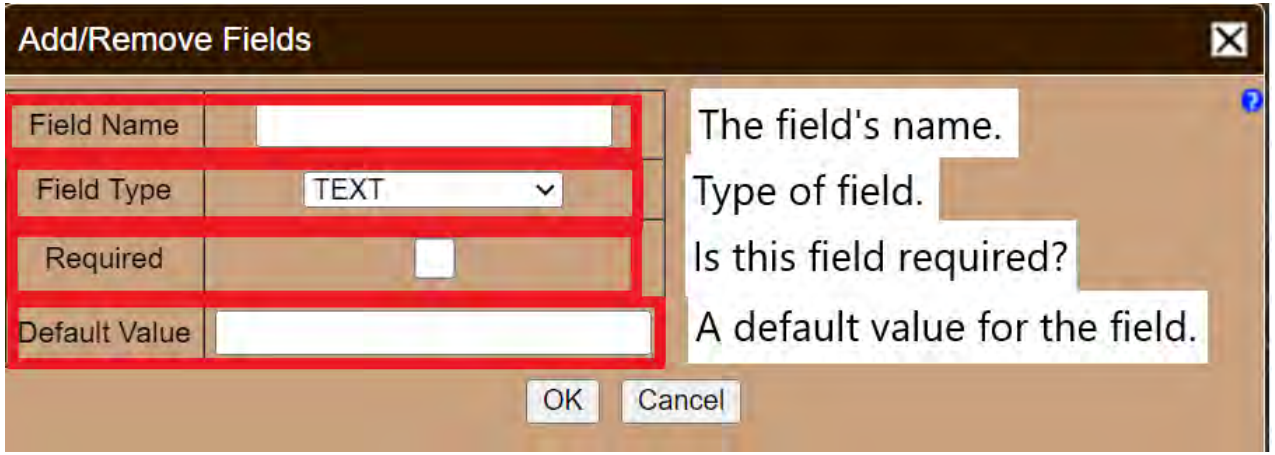
Diamond Maps Layers

- Here is where you put in the information for the new field.
- Field type can b many different options from text, to numbers, and even a check box.
- You can choose if this field is required or not.
- A default value can be set for this field.



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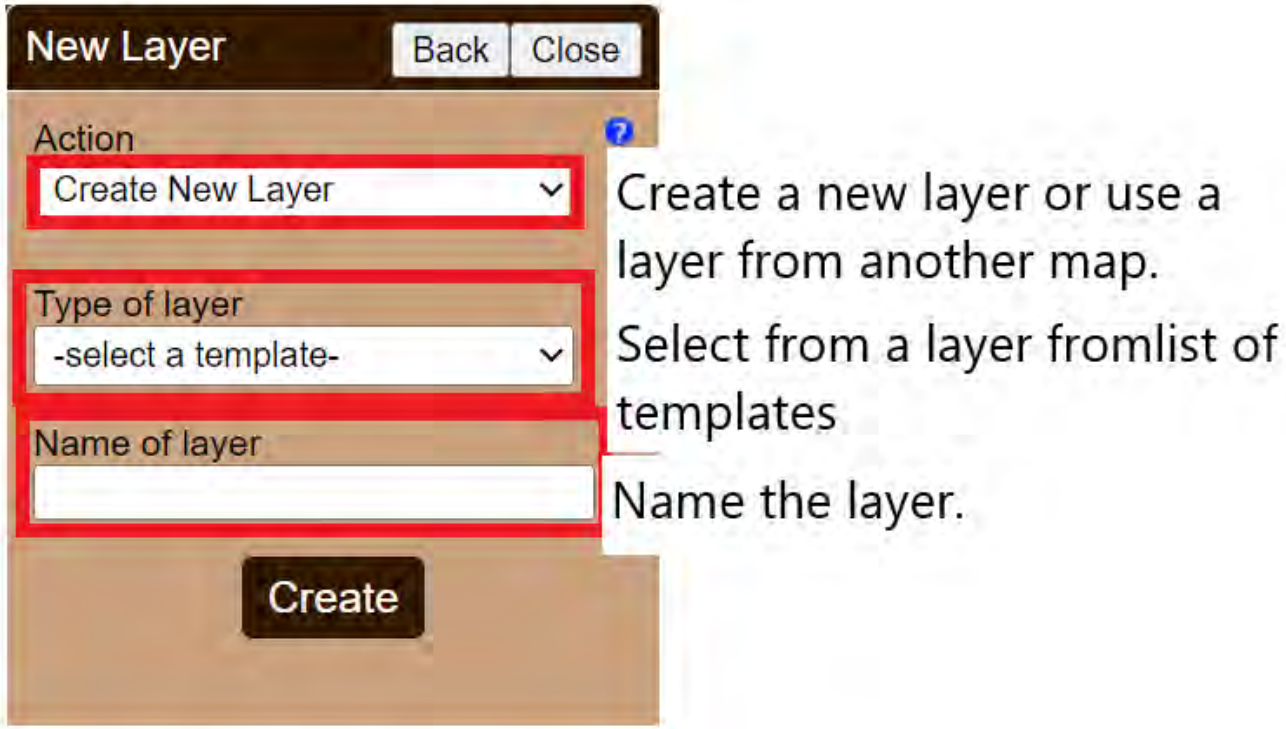
Diamond Maps Layers

- This is the new layer menu.
- Create a new layer or use one from another map.
- Diamond Maps has many templates made for utilities to select from or you can make your own.



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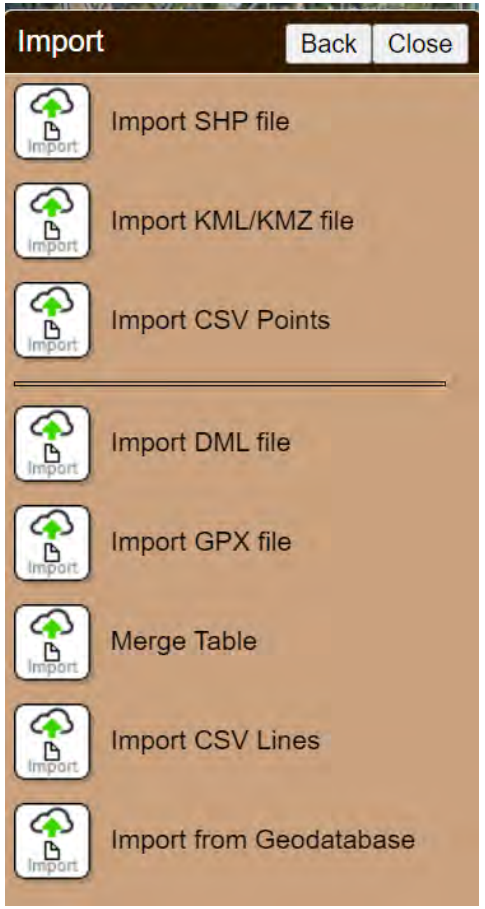
Diamond Maps Layers

- Under the menu button there is an import option.
- You can bring in data from other sources into your map. If you are coming from a ESRI product can import a zip file of shape files or a geodatabase right into Diamond Maps.



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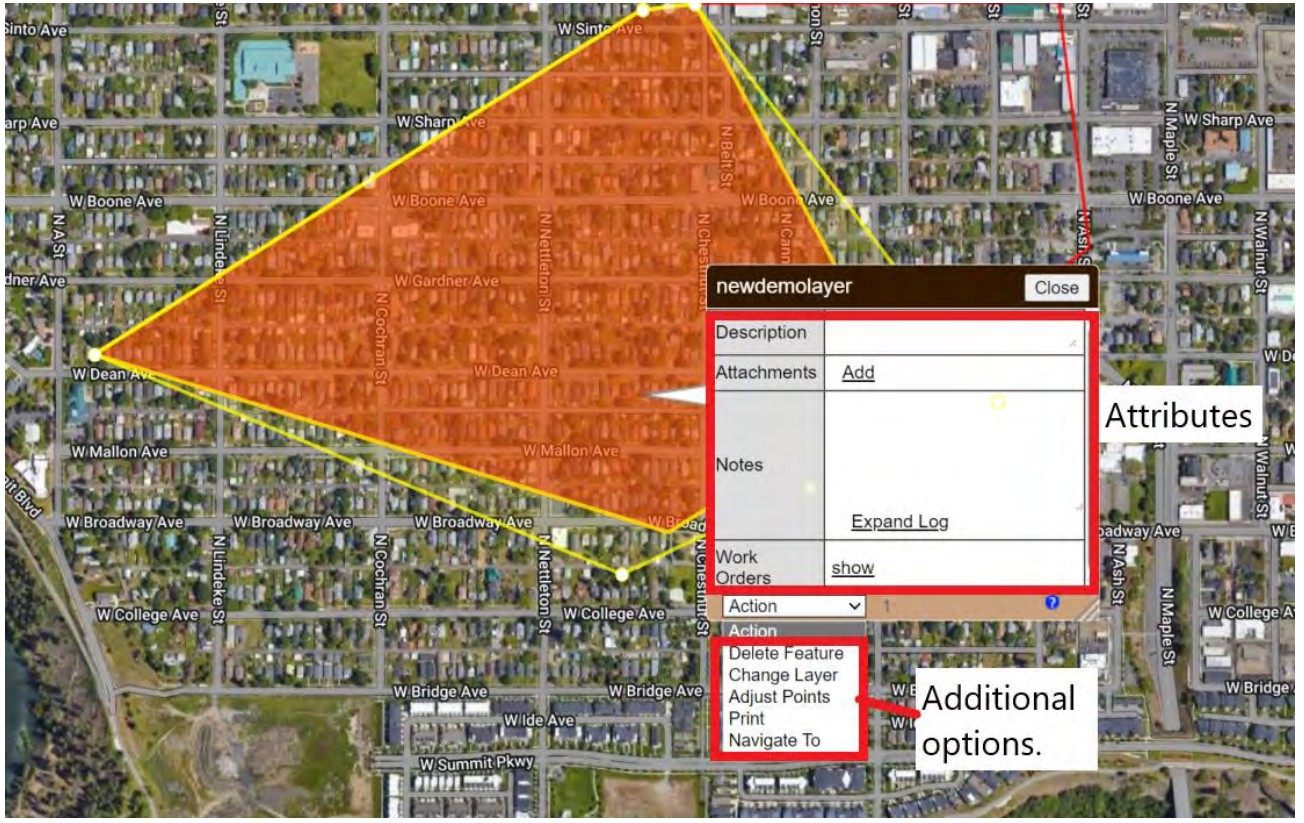
Diamond Maps Editing

- Clicking on a feature will bring up the attributes of that feature.
- Edit the attributes by typing or changing anything in the table.
- Add attachments.
- The add attachments will also bring up the option to take a photo with your device. Editing any information will bring up a Apply option on the top left.
- Clicking on Action will bring up additional options.



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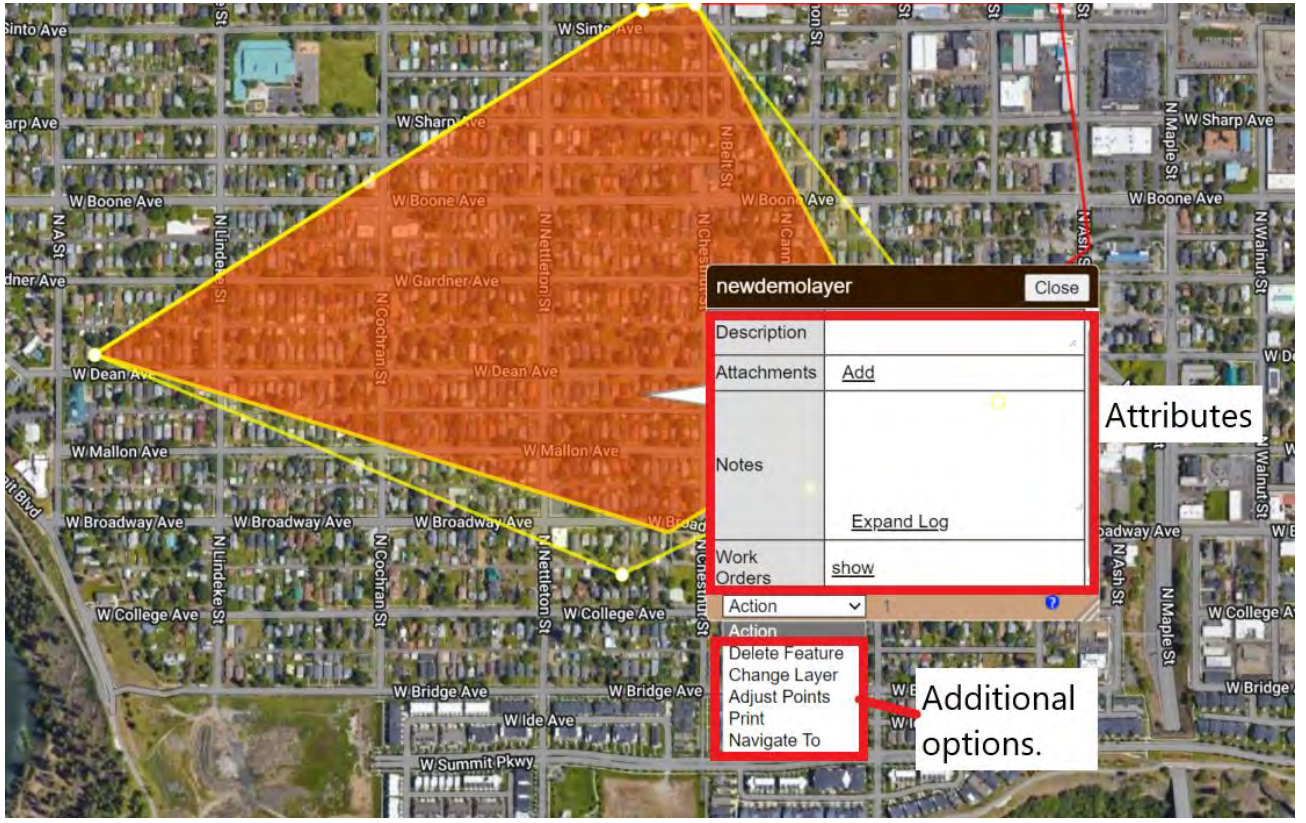
Diamond Maps Editing

- In the action menu you can delete the feature.
- Change the feature to a different layer type.
- Adjust the vertices.
- Put the attribute table into a printer friendly page.
- Navigate To will bring up Google Maps and set the feature as the location to navigate to.



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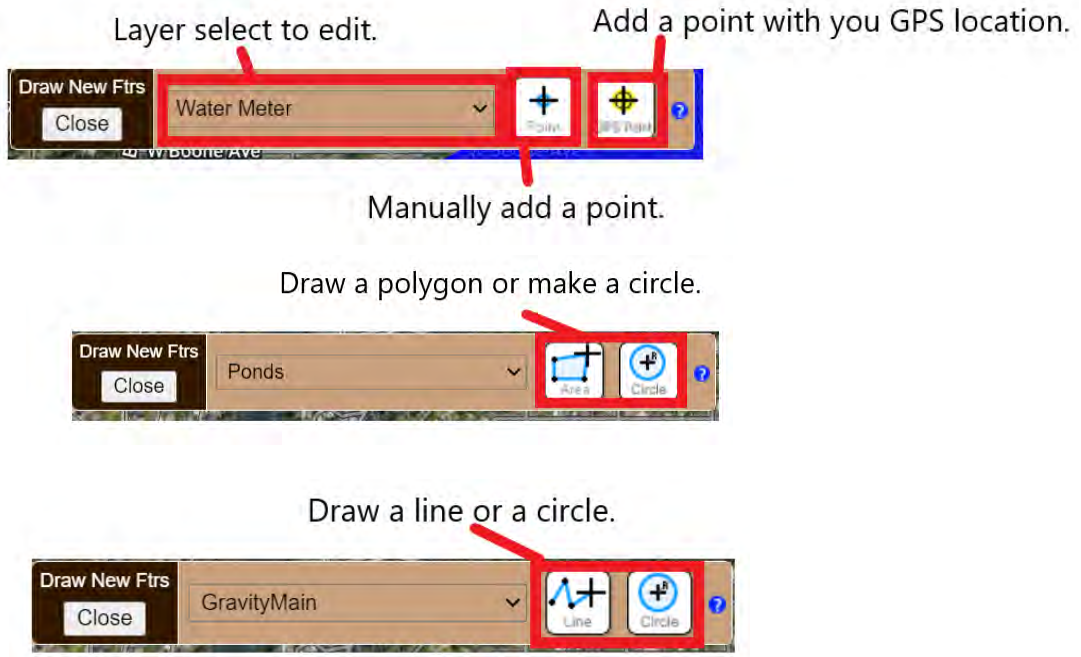
Diamond Maps Editing

- The draw function changes based on the style of layer selected.
- Manually add a point, a polygon, a line, or make a circle polygon or line.
- GPS point will have the application go into GPS mode.



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Diamond Maps Editing

- GPS mode stays on till you turn it off in the GPS Status menu.
- Diamond maps will use your device's location services to map points.
- If you move the map away from the GPS point while in GPS mode, the map will move back to your current location.

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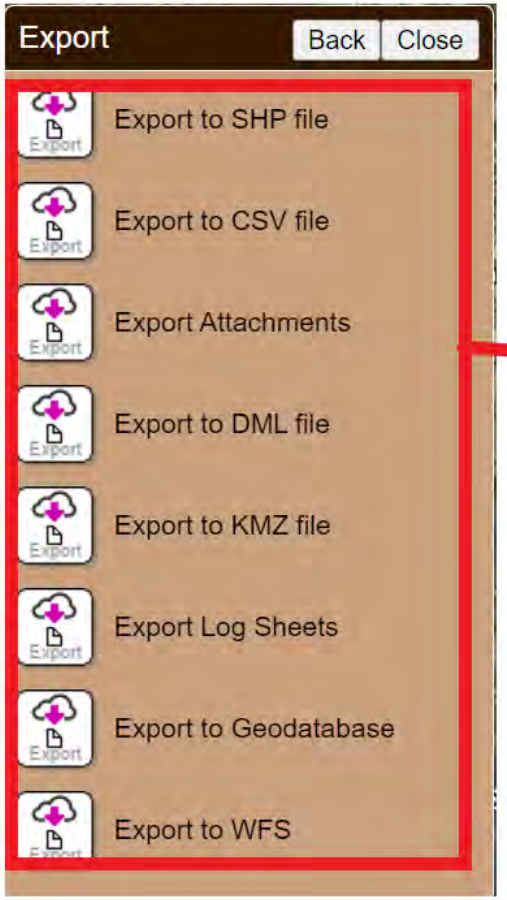
Diamond Maps Export

- You can export your data from Diamond Maps.
- Export to CSV is great for assets management, as you can get a table of all your assets.
- You can also export the data to be used in other GIS systems and Google Earth.



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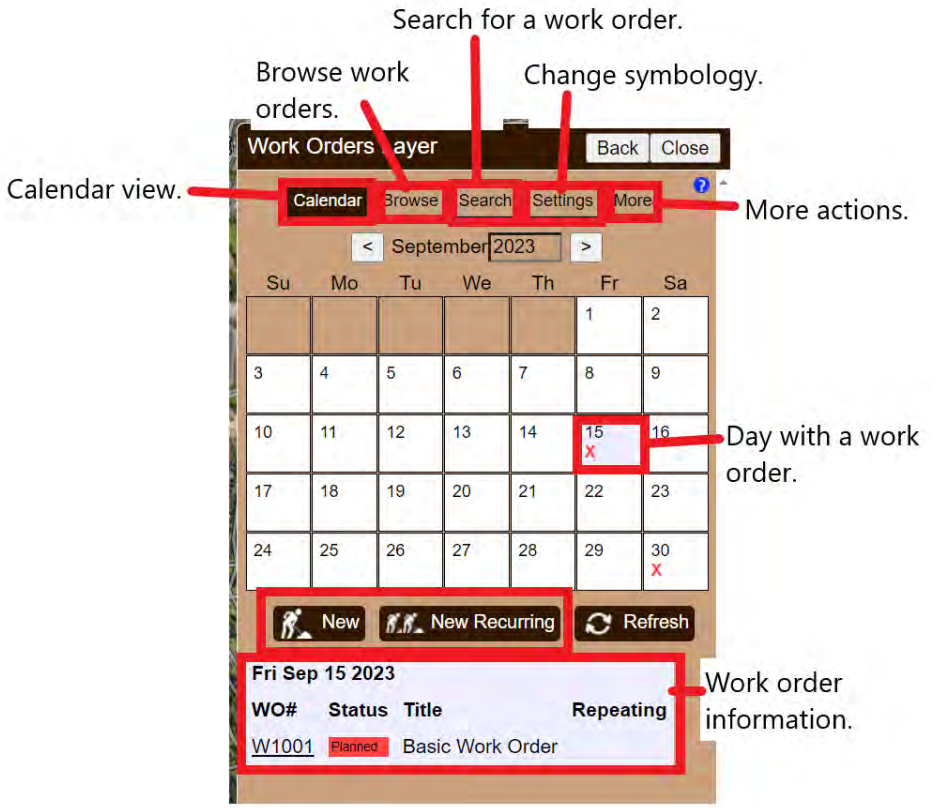
Diamond Maps Work Orders

- Diamond maps has a built-in work order system.
- Click on a date on the calendar and create a new work order.
- Delect a feature on your map to assign the work order to a feature or click an open area.
- Browse work orders in your system.
- The “More” tab will allow you to change the fields for the work order layer.



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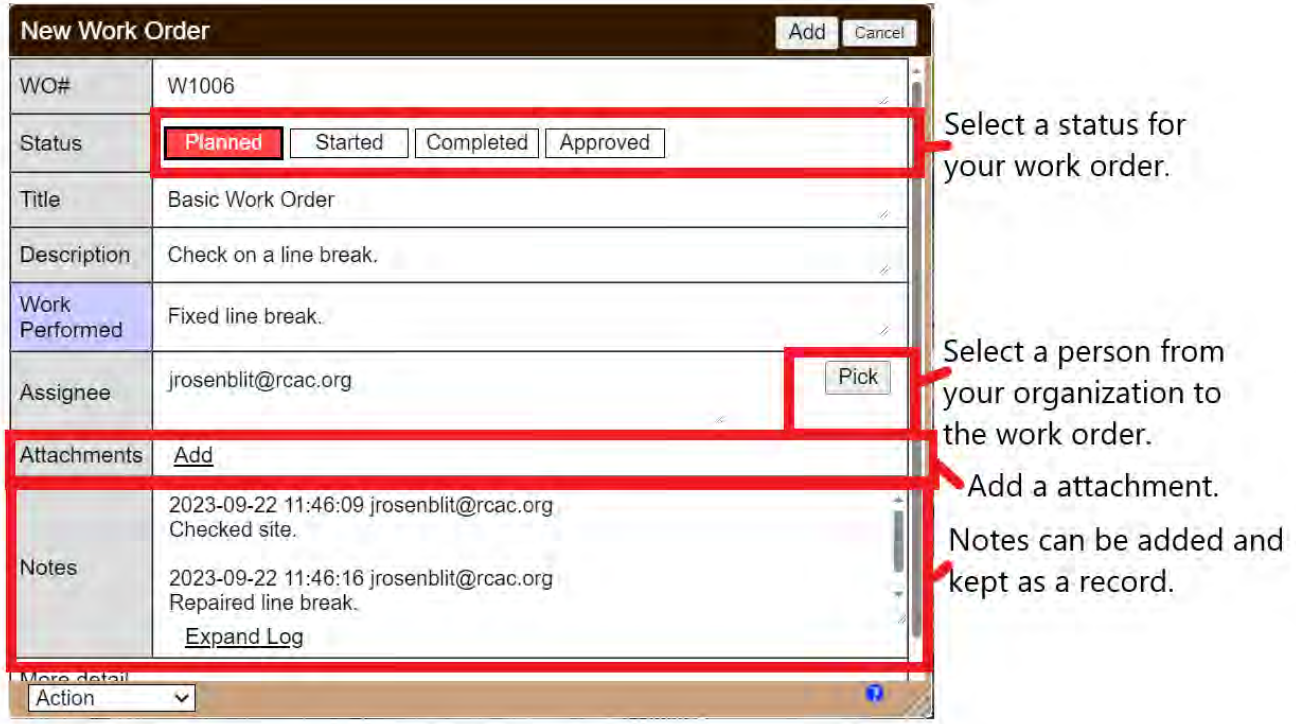
Diamond Maps Work Orders

- New Work Order menu allows you to add and modify a work order.
- If you click on a work order on the map it will bring up this window.
- Can add notes to the work order, and it will record who and at what time it was recorded.
- You can pick a person within your organization to assign the work order to.
- You can select a status of the work order.



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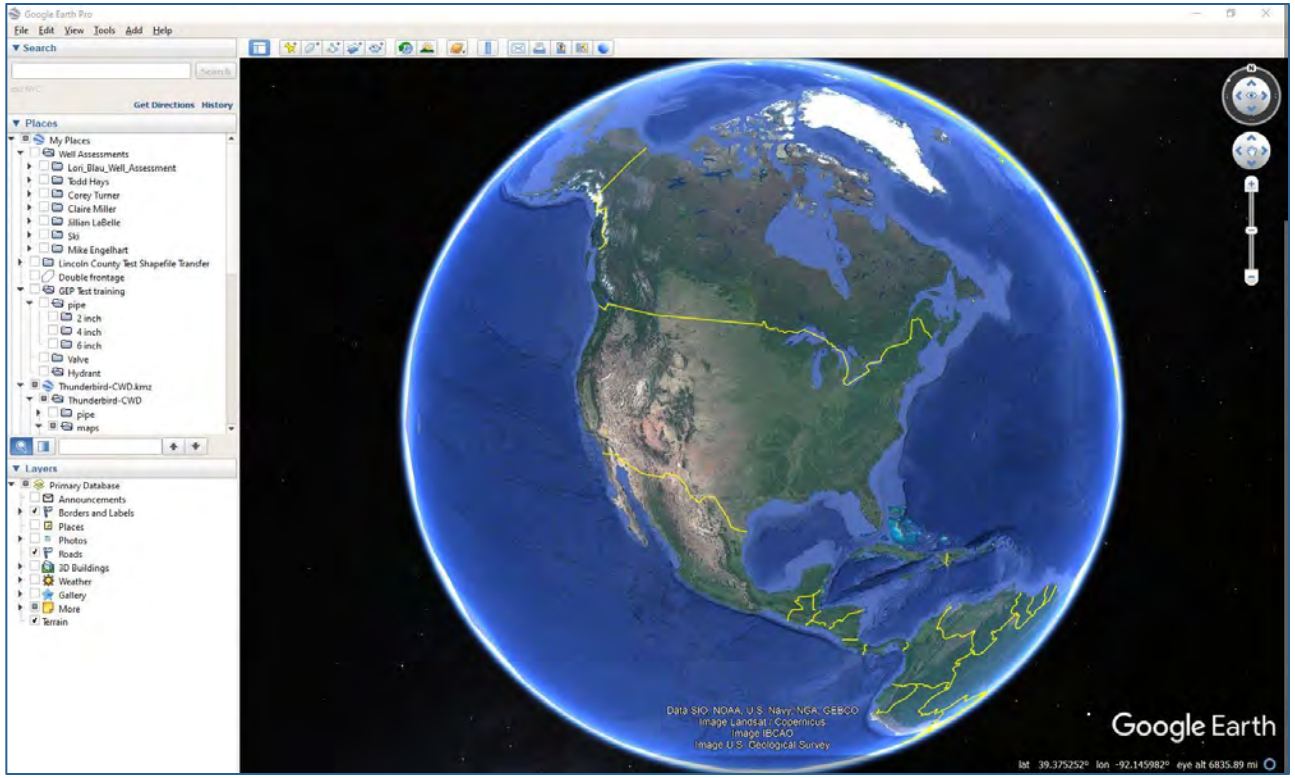
Google Earth Pro

- Offline mapping software.
- Must record coordinates in the field and then import them in.
- Limited options within the map.
- Free software download.
- Not a true GIS system.



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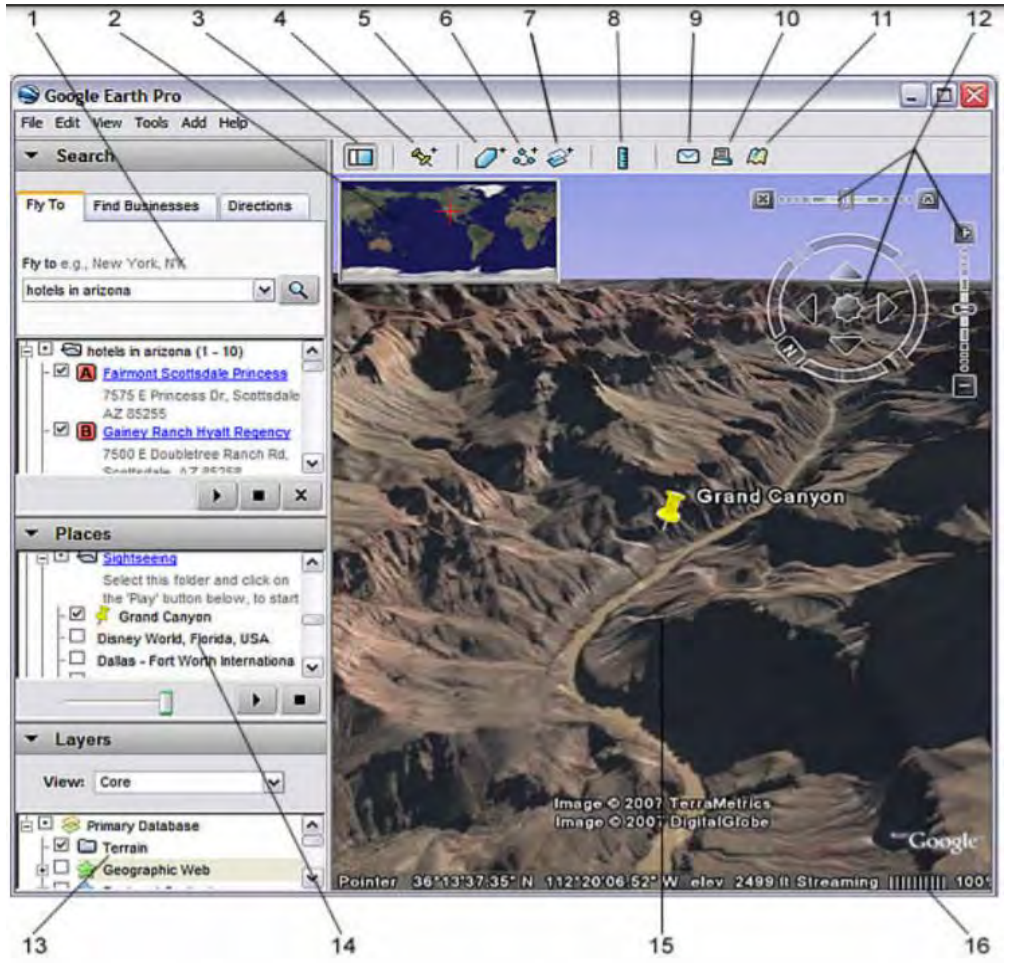
Google Earth Pro

- Data can be imported to Google Earth from a ESRI shapefile.
- A map made with a ESRI product can be made into a KML file that can be used in Google Earth.
- Does not have tables for data, but the description fields can be made to look like tables with HTML code.

Getting to Know GEP – Some Features of Main Window



1. **Search panel** - Use this to find places and directions and manage search results. Google Earth EC may display additonal tabs here.
2. **Overview map** - Use this for an additional perspective of the Earth.
3. **Hide/Show sidebar** - Click this to conceal or the display the side bar (Search, Places and Layers panels).
4. **Placemark** - Click this to add a placemark for a location.
5. **Polygon** - Click this to add a polygon.
6. **Path** - Click this to add a path (line or lines).
7. **Image Overlay** - Click this to add an image overlay on the Earth.
8. **Measure** - Click this to measure a distance or area size.
9. **Email** - Click this to email a view or image.
10. **Print** - Click this to print the current view of the Earth.
11. **Show in Google Maps** - Click this to show the current view in Google Maps in your web browser
12. **Navigation controls** - Use these to tilt, zoom and move around your viewpoint (see below).
13. **Layers panel** - Use this to display points of interest.
14. **Places panel** - Use this to locate, save, organize and revisit placemarks.

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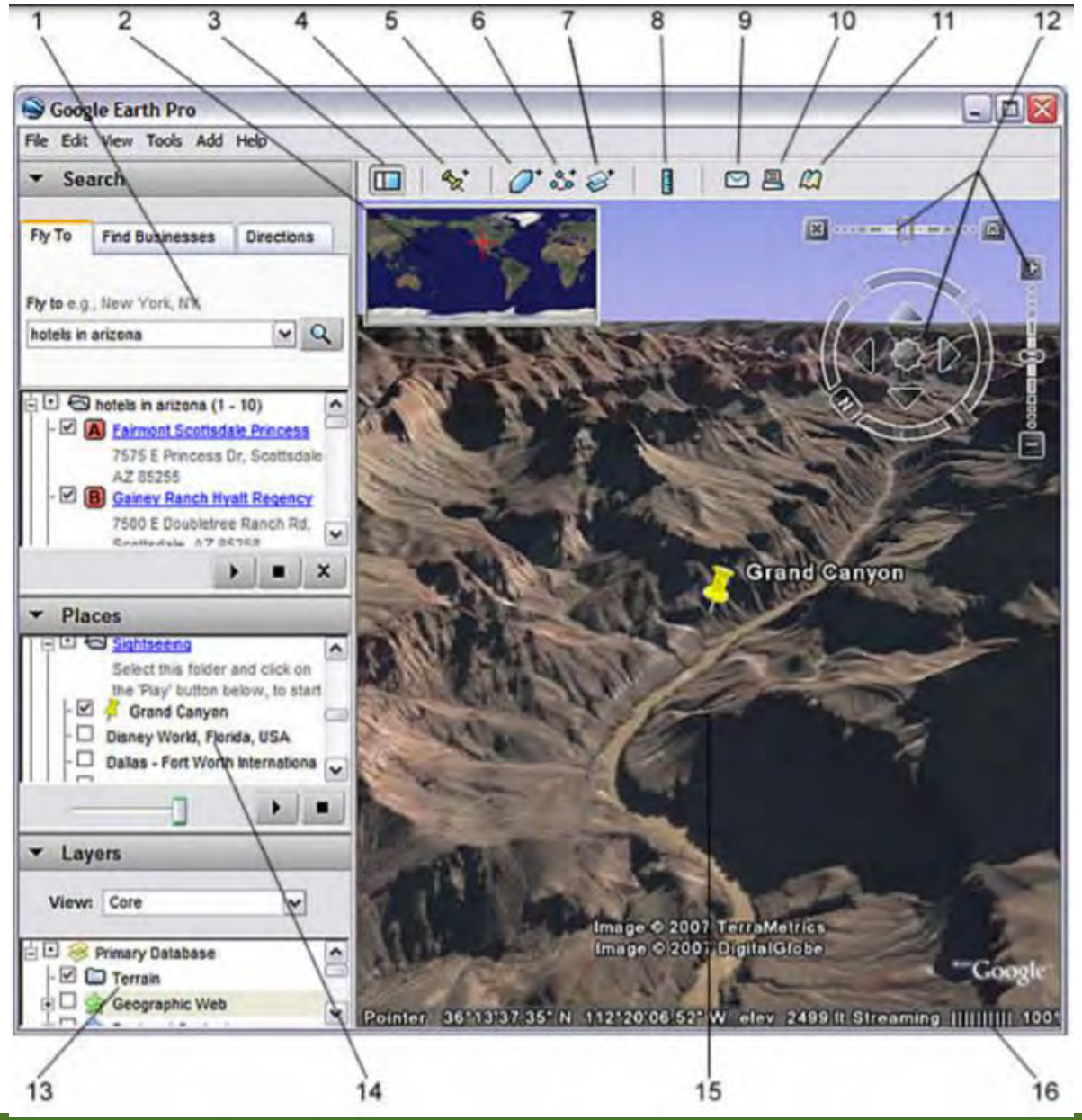

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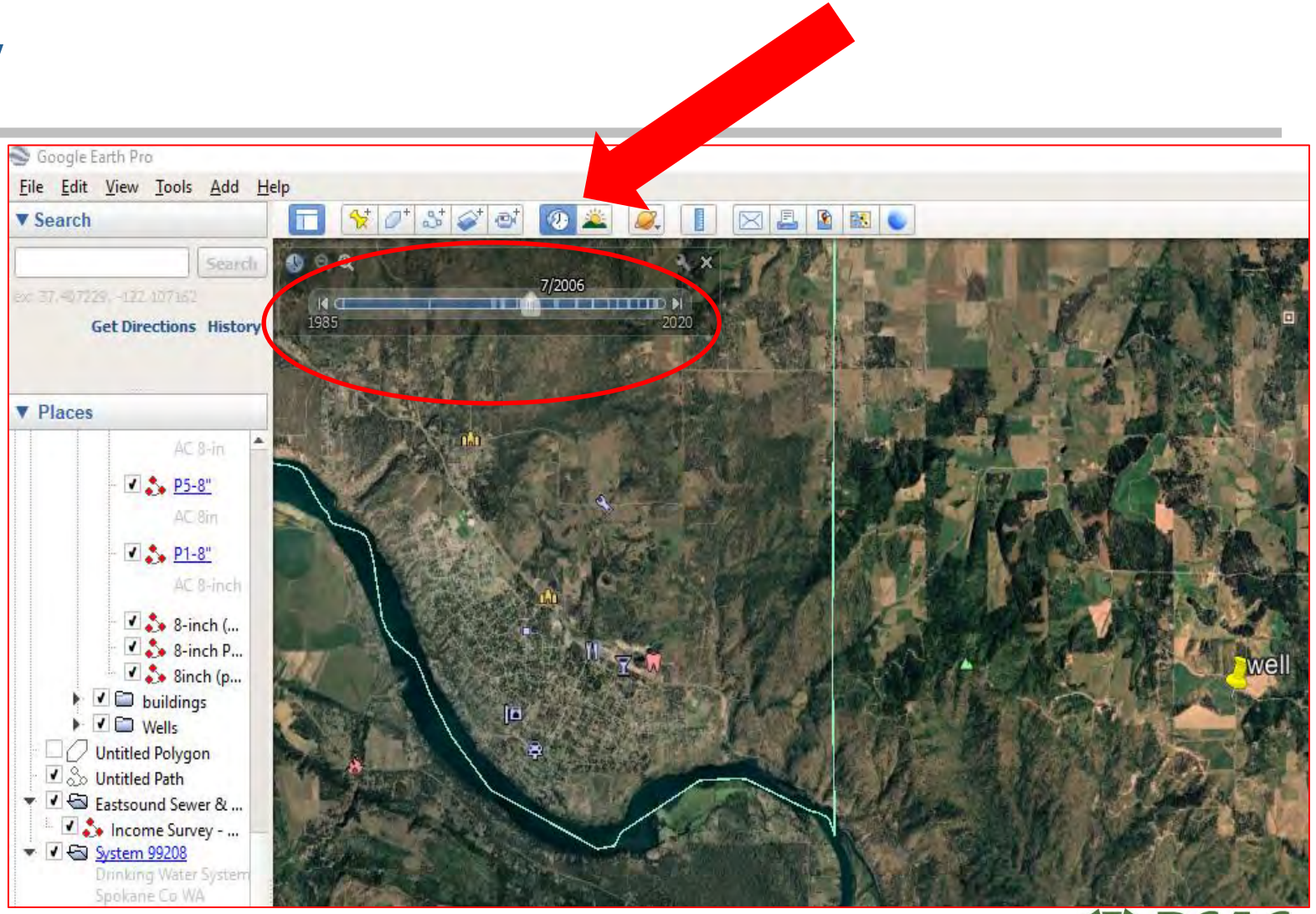
Historical Imagery

- Was it built in 1985?
- 1995?
- 2020?
- You might be able to tell from GEP historical imagery.



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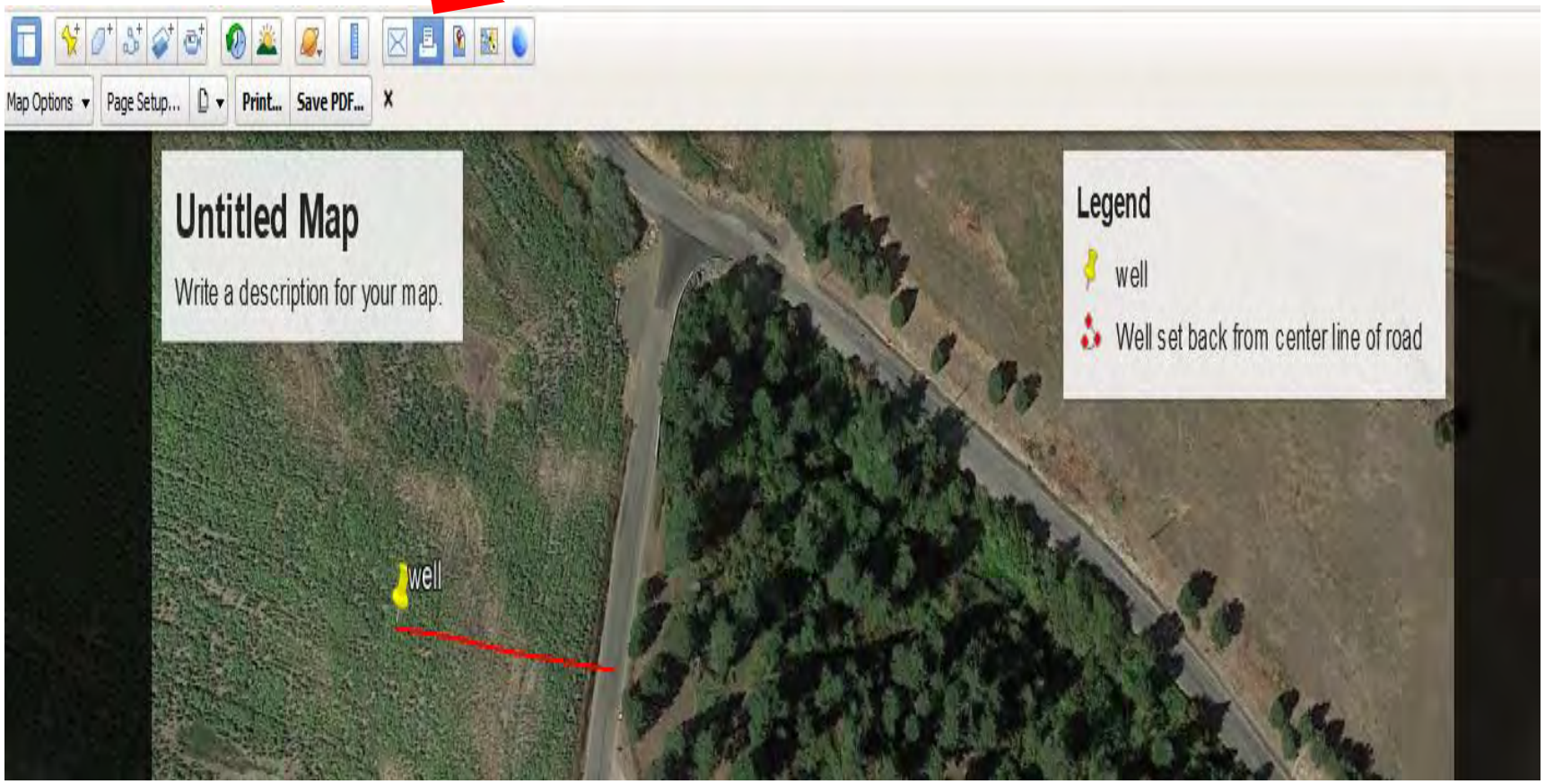
Print or Save Image

Both allow you to add:

- Map title
- Map description
- Legend



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Let's Start Mapping

1. Open Google Earth Pro
2. Enter a zip code, city, address or GPS coordinates in the search window, in the top left corner

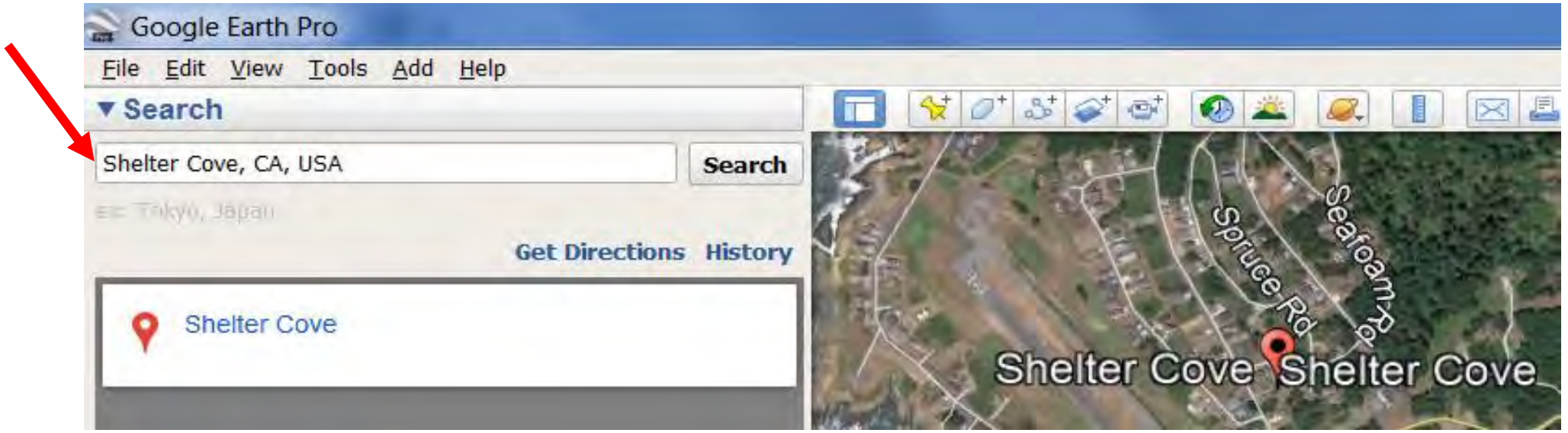

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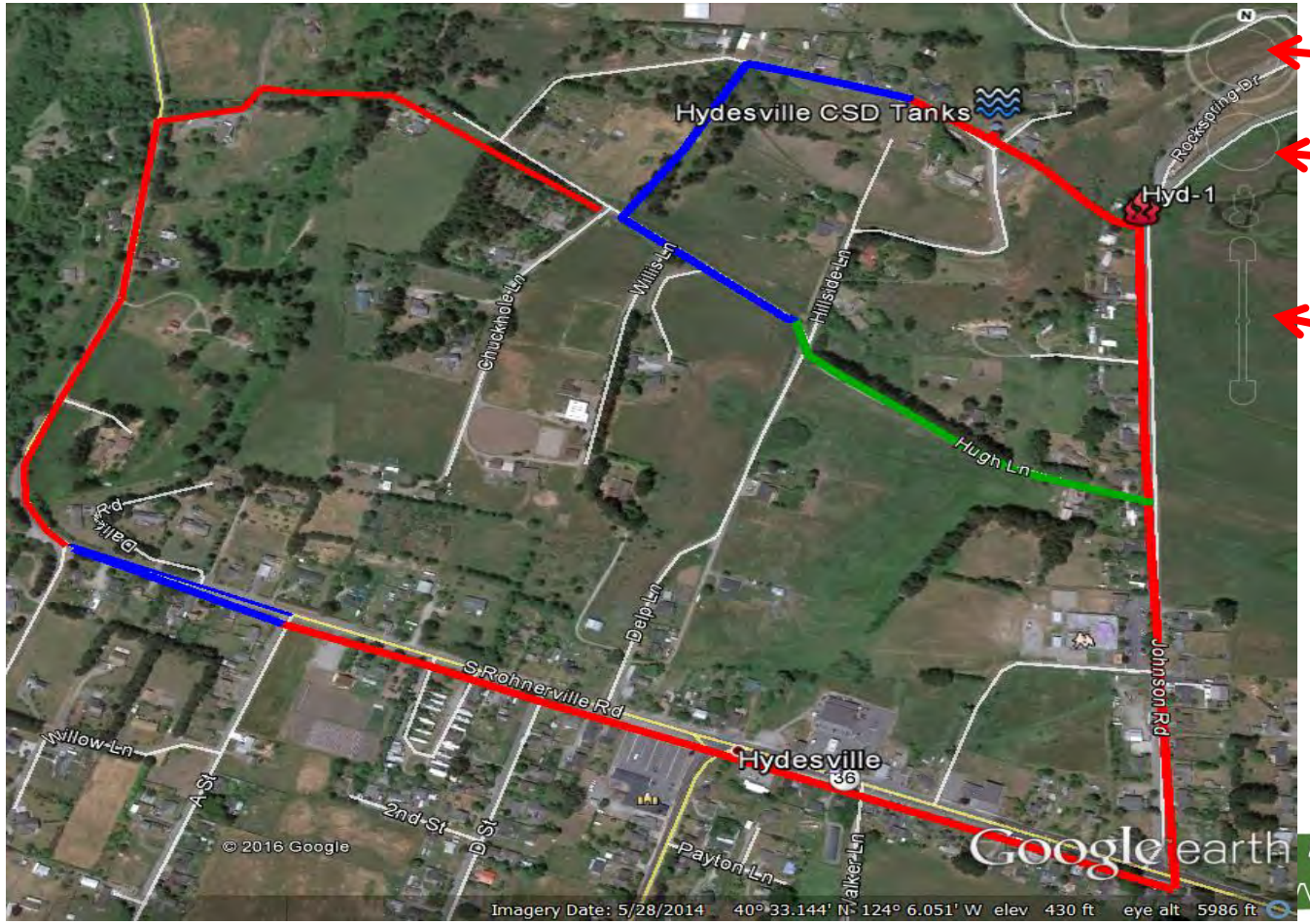
Image Controls

Use the zoom and pan tools to position the satellite image to the system area.



Tilt 3D
Rotate
Move
View

Zoom in/out

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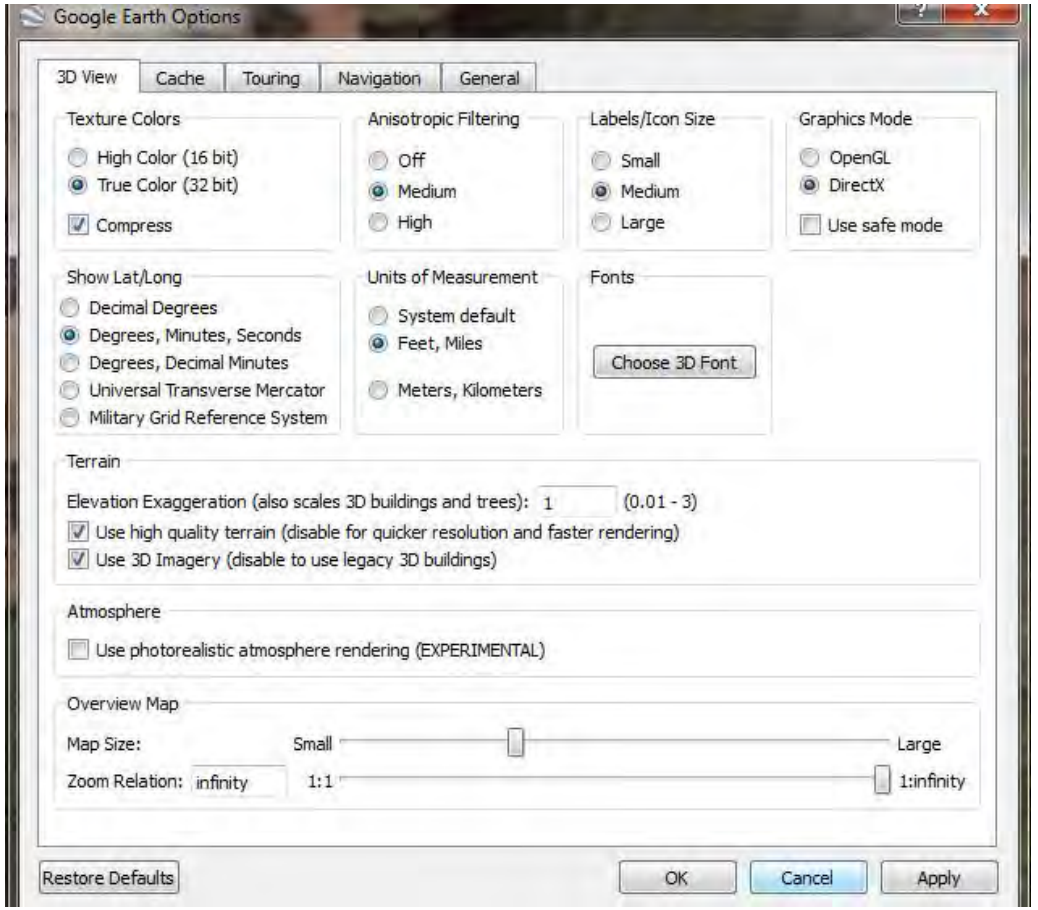
Tools – Options: Lat/Long Format Options

Lat: 47.692530°
Long: -117.077601°

Lat: 47°41'33.12"N
Long: 117° 4'39.39"W

Lat: 47° 41.552'N
Long: 117° 4.656'W



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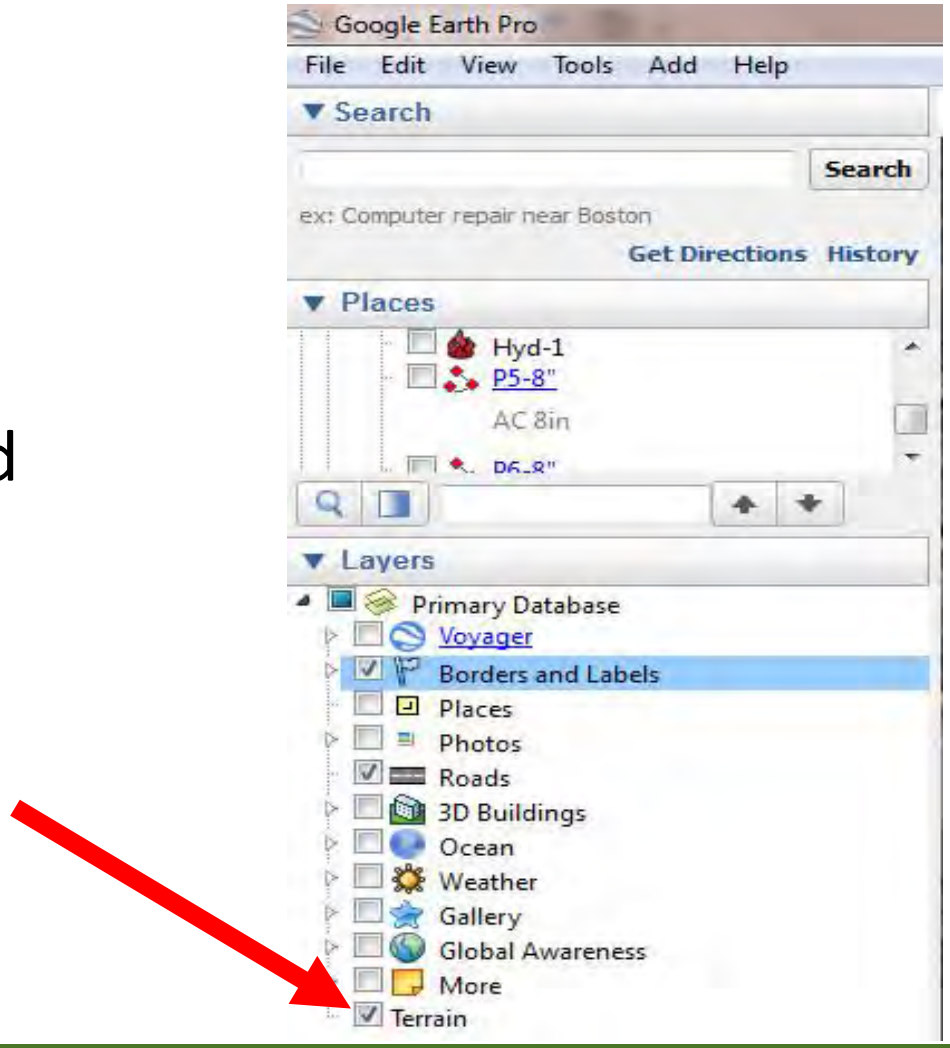
Layers

To show ground elevation at pointer



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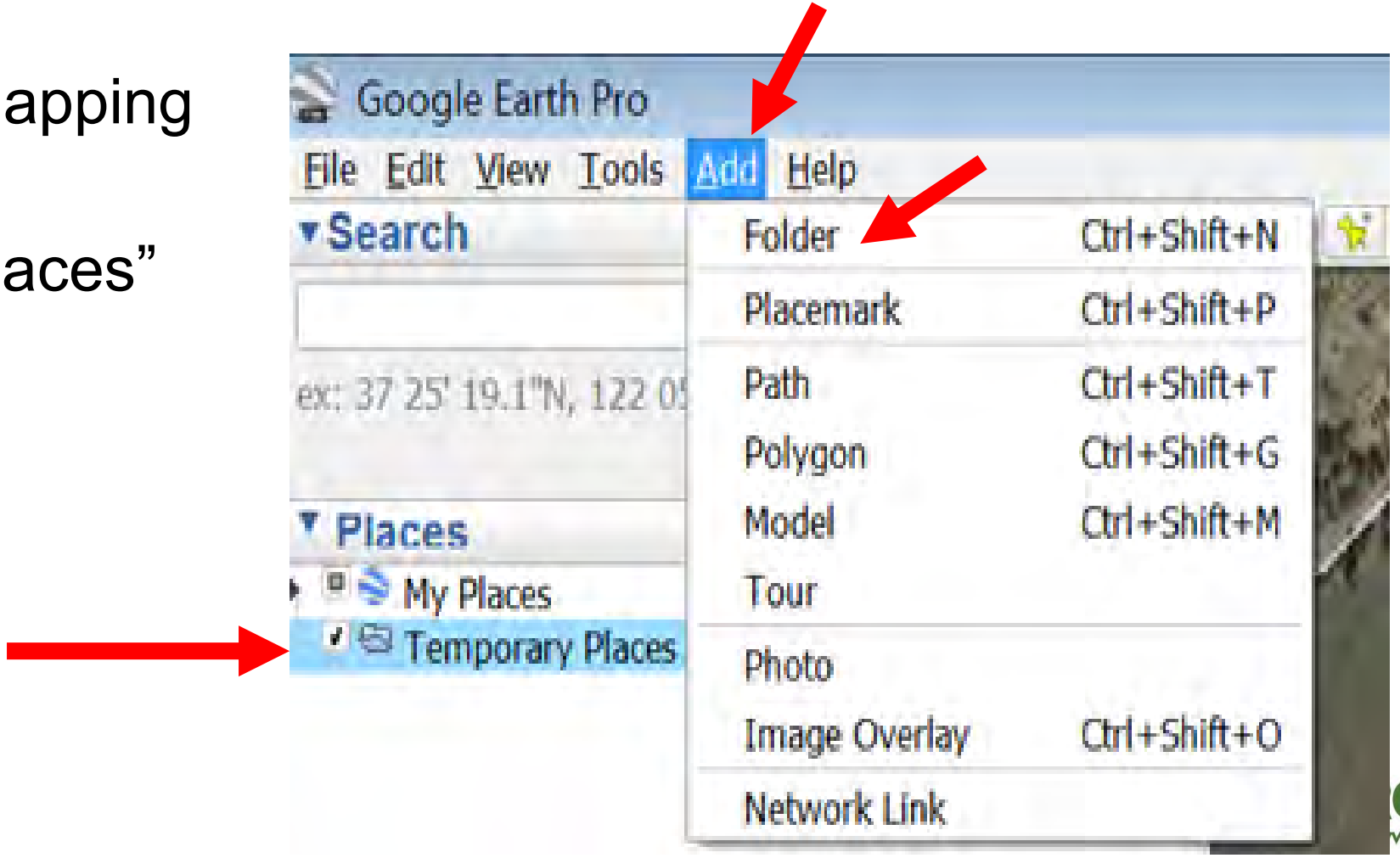
Add Folder

Start any new mapping project with:

- “Temporary Places”
- “Add”
- “Folder”



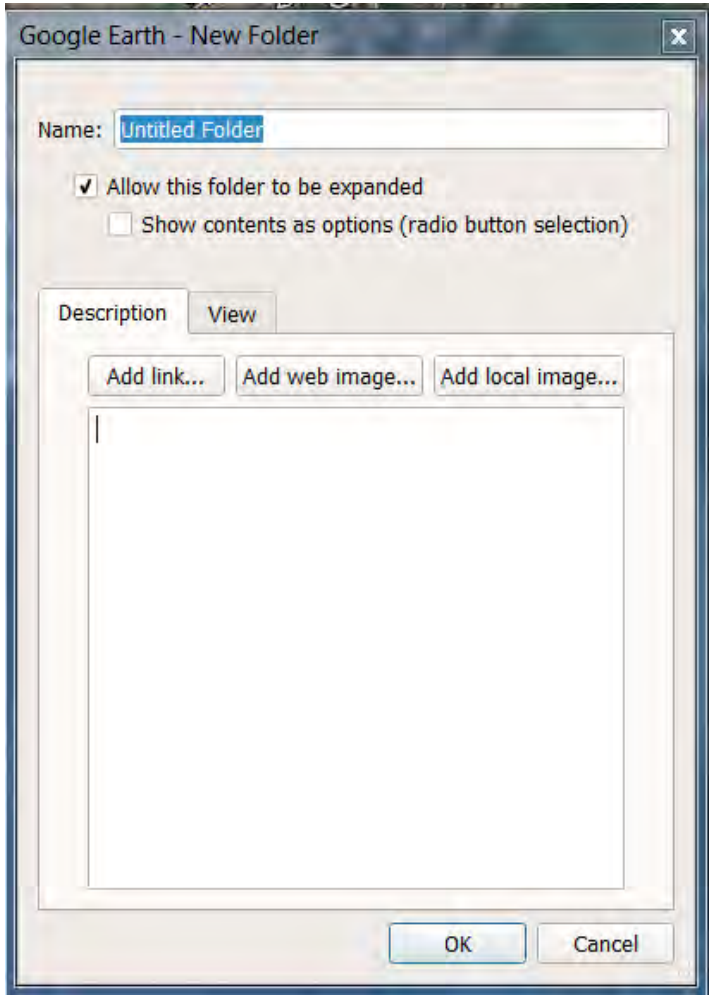
Create a Folder Name and Save

Name your folder

Add a description

Save your folder by clicking OK.

- OK = Save in the properties box.
- This folder can now hold all the new mapping Placemarks, Paths and Overlays you create.



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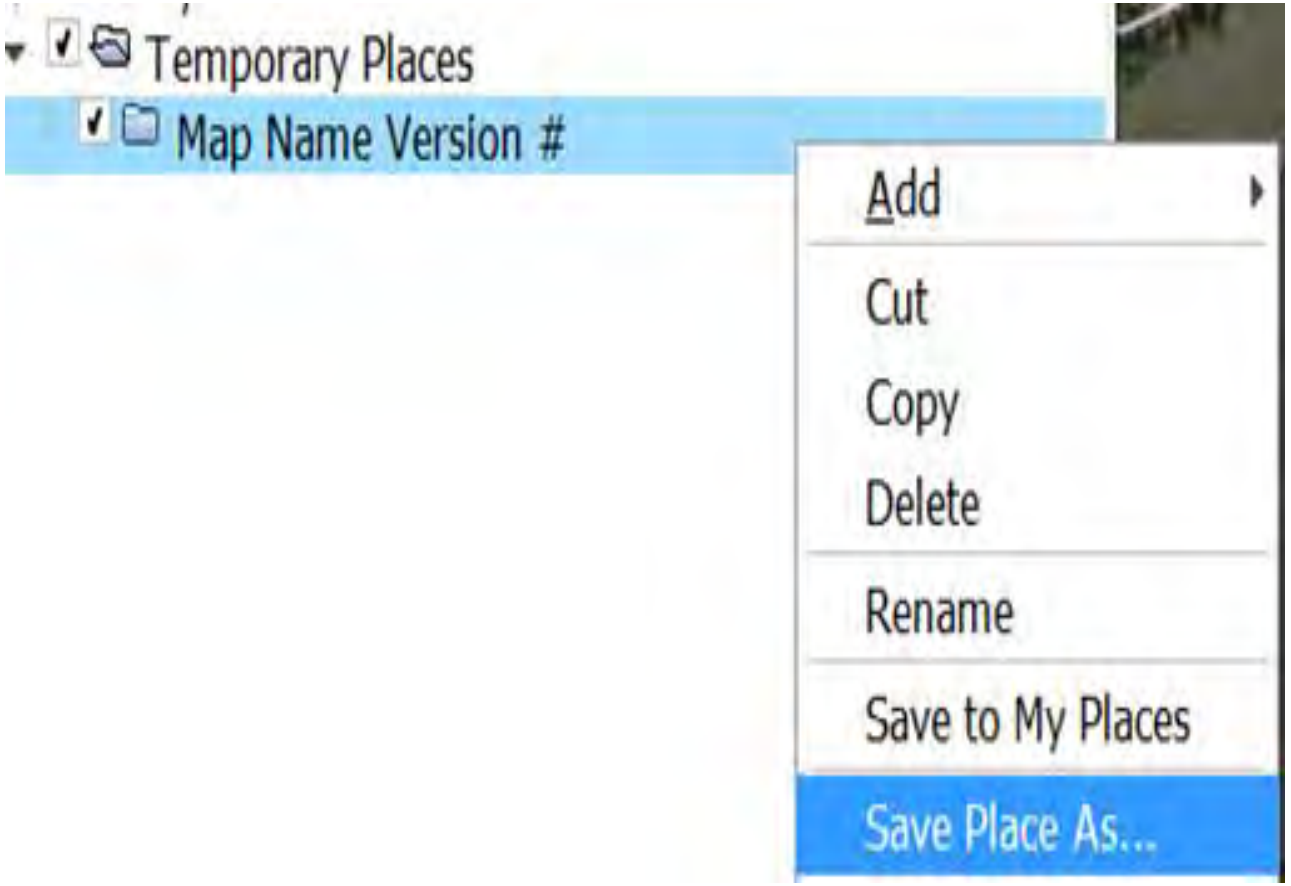
“Save Place As”

- Save the folder using “Save Place As”
- This allows you to select the location on your computer to save the map file.



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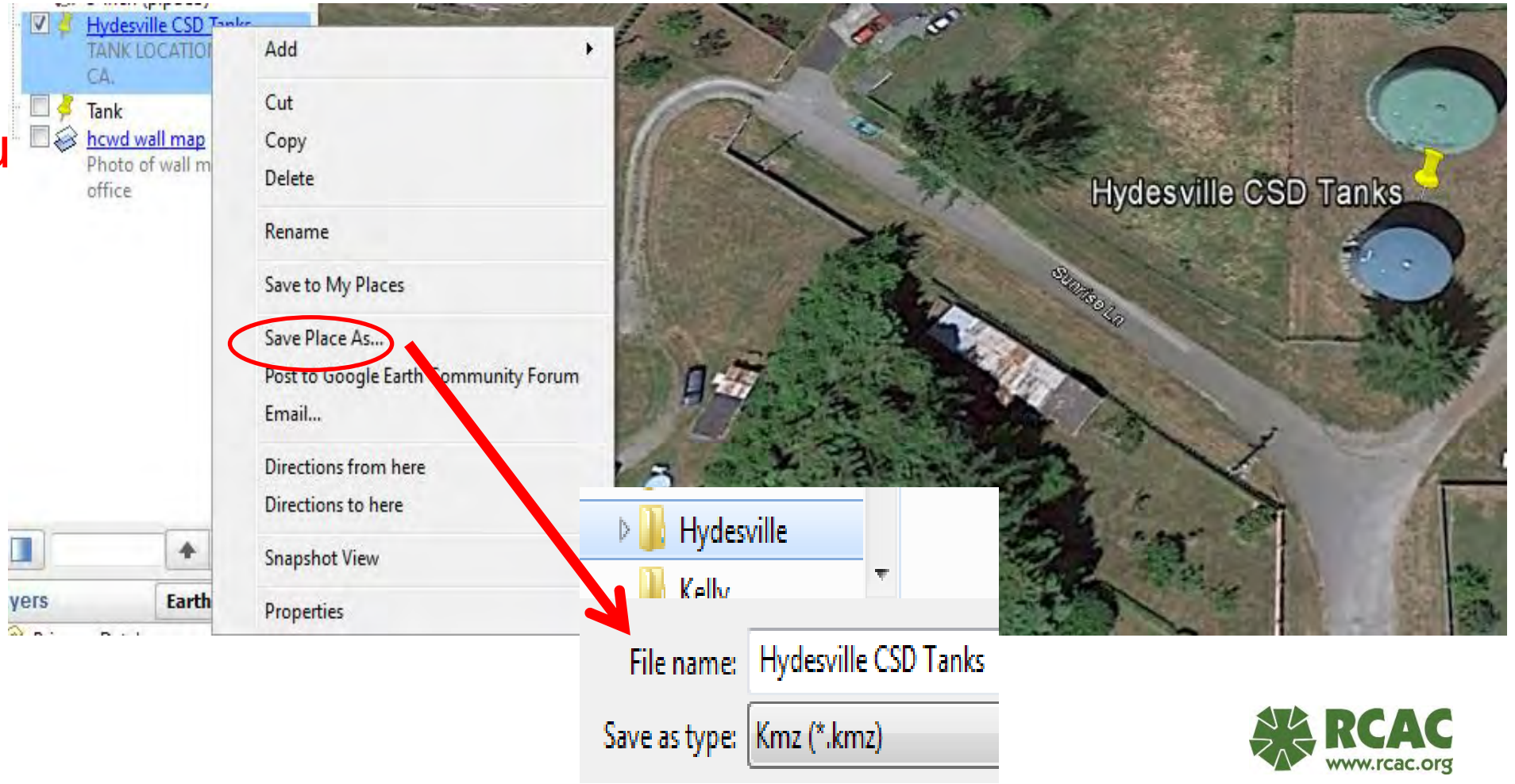
“Save Place As”

“Save Place As” allows you to select the location to save the folder.



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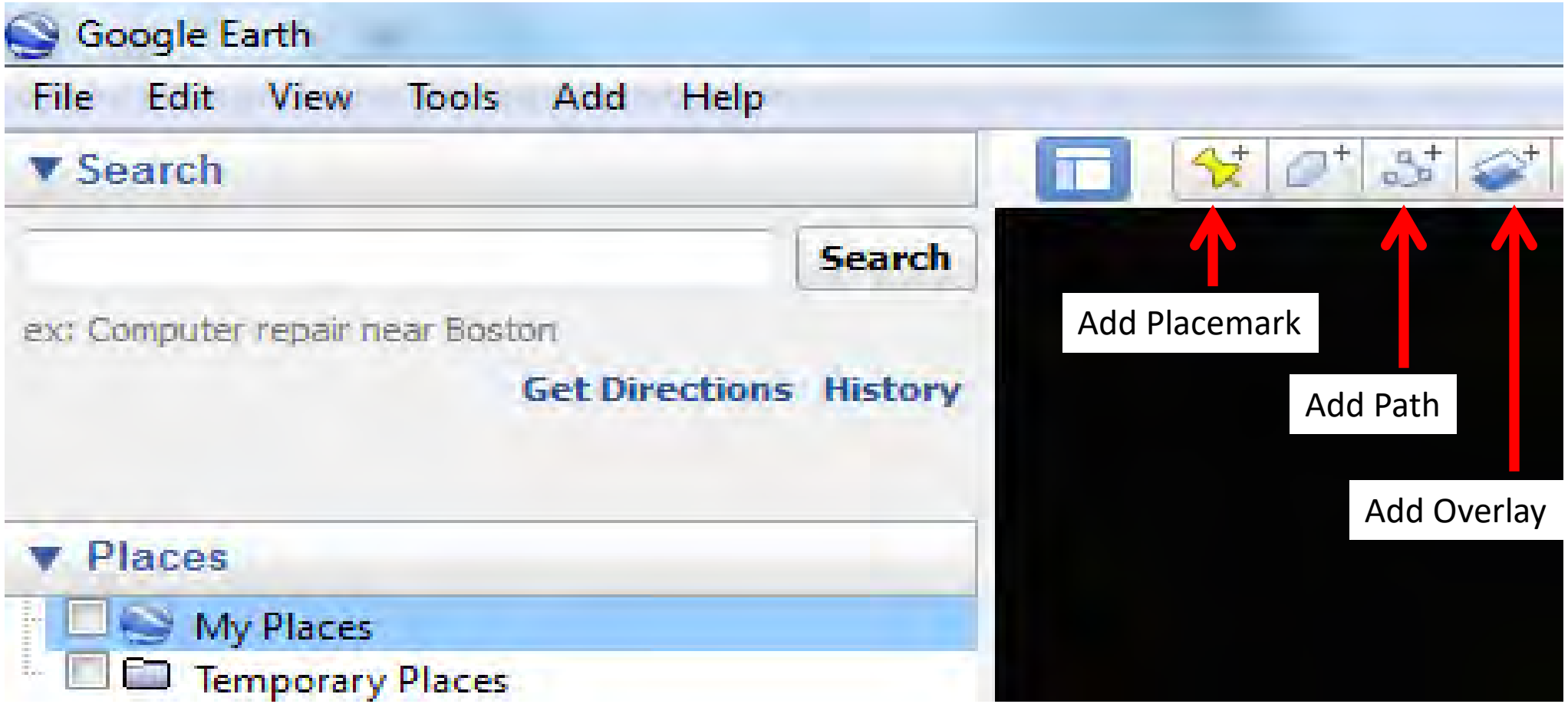
Basic Mapping Tools



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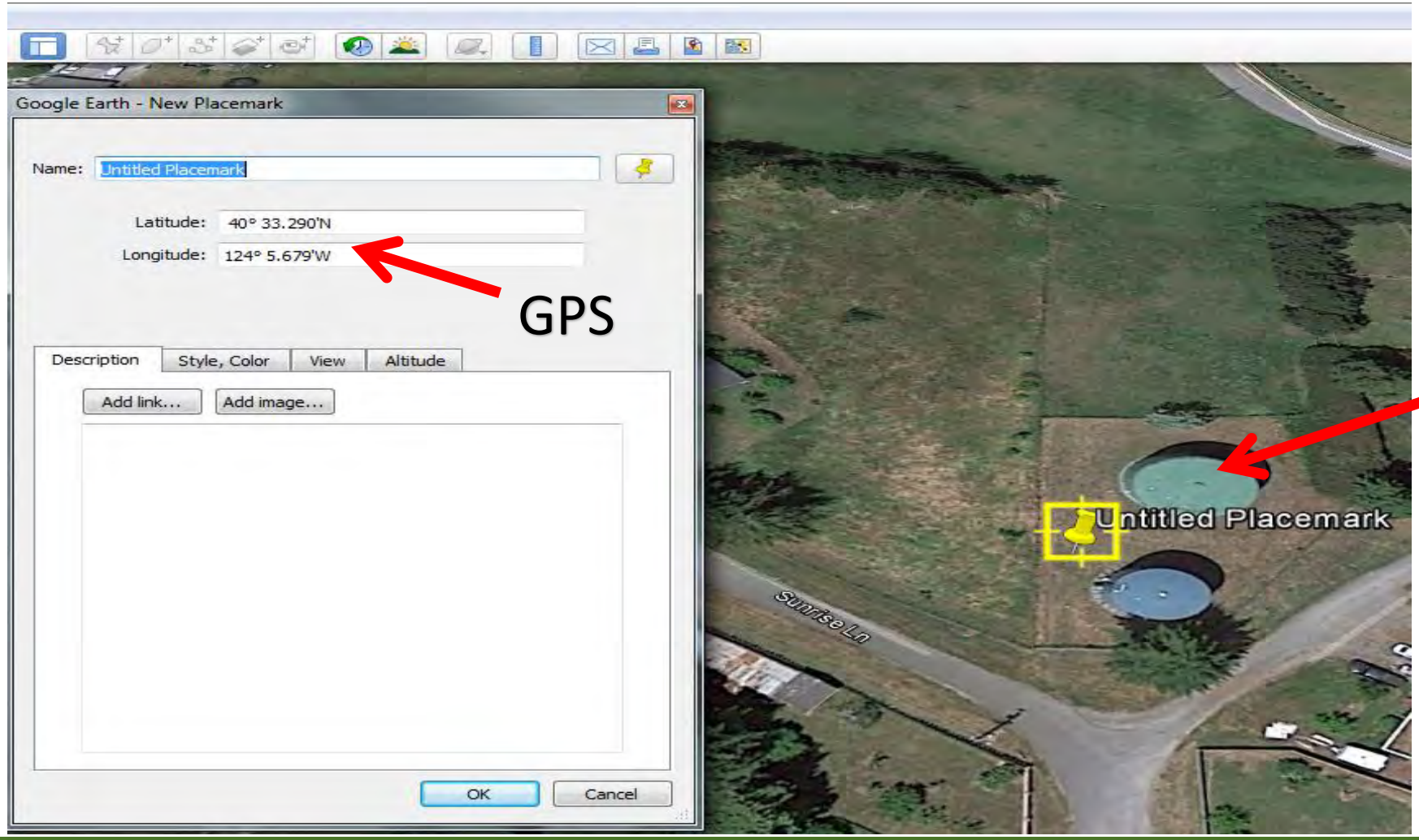
Adding Features: Reference vs. GPS



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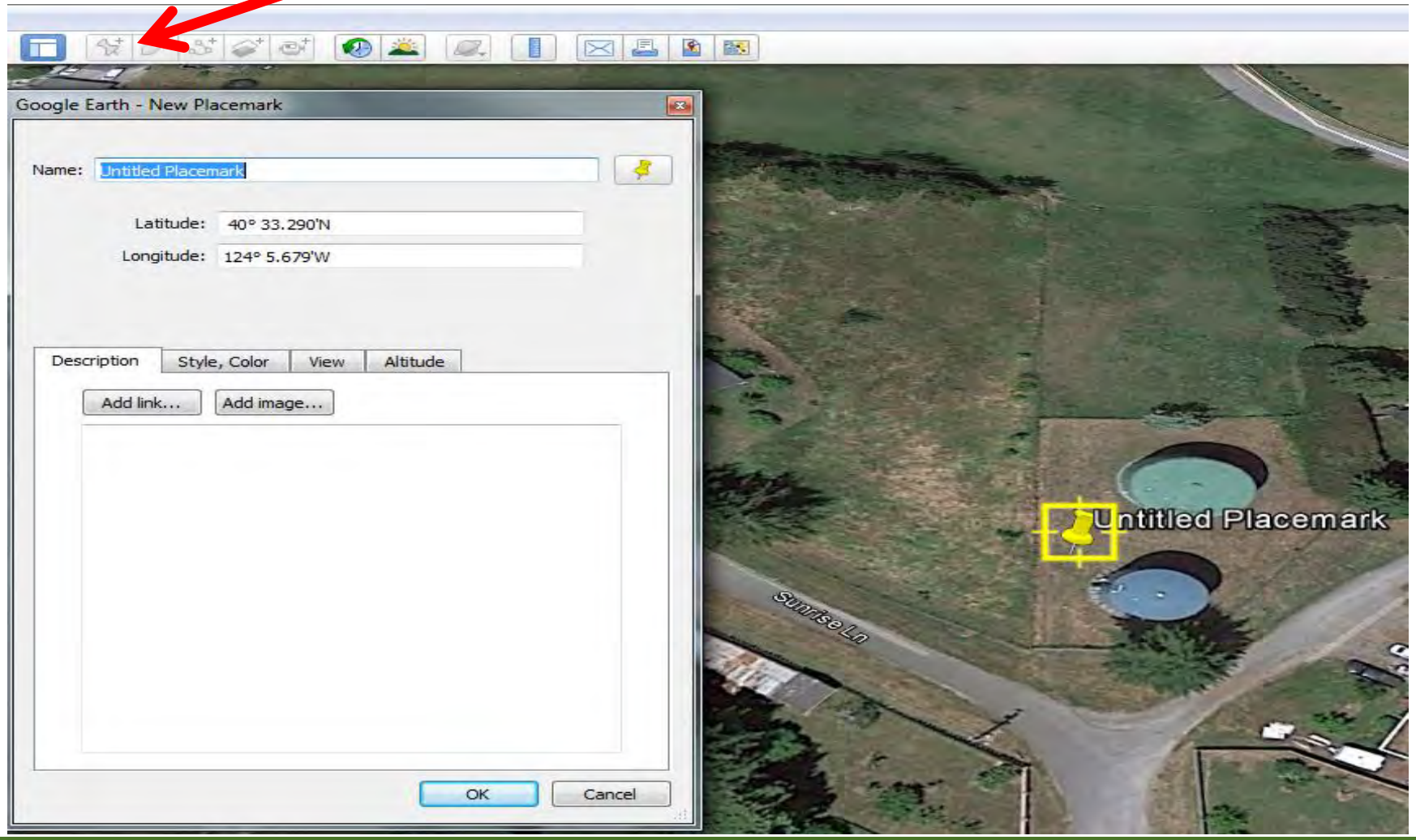
Add Placemark



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Edit Placemark

1. Reopen the properties box by right clicking on the new marker and selecting “properties”.
2. This will open edit mode and allow you to move the marker and edit the label text.
3. The marker will be surrounded by a flashing yellow box when in edit mode and the properties box will be on the screen.
4. Save your edits by clicking OK in the properties box before closing **OR**
5. OR Select “Cancel” to remove placemark.

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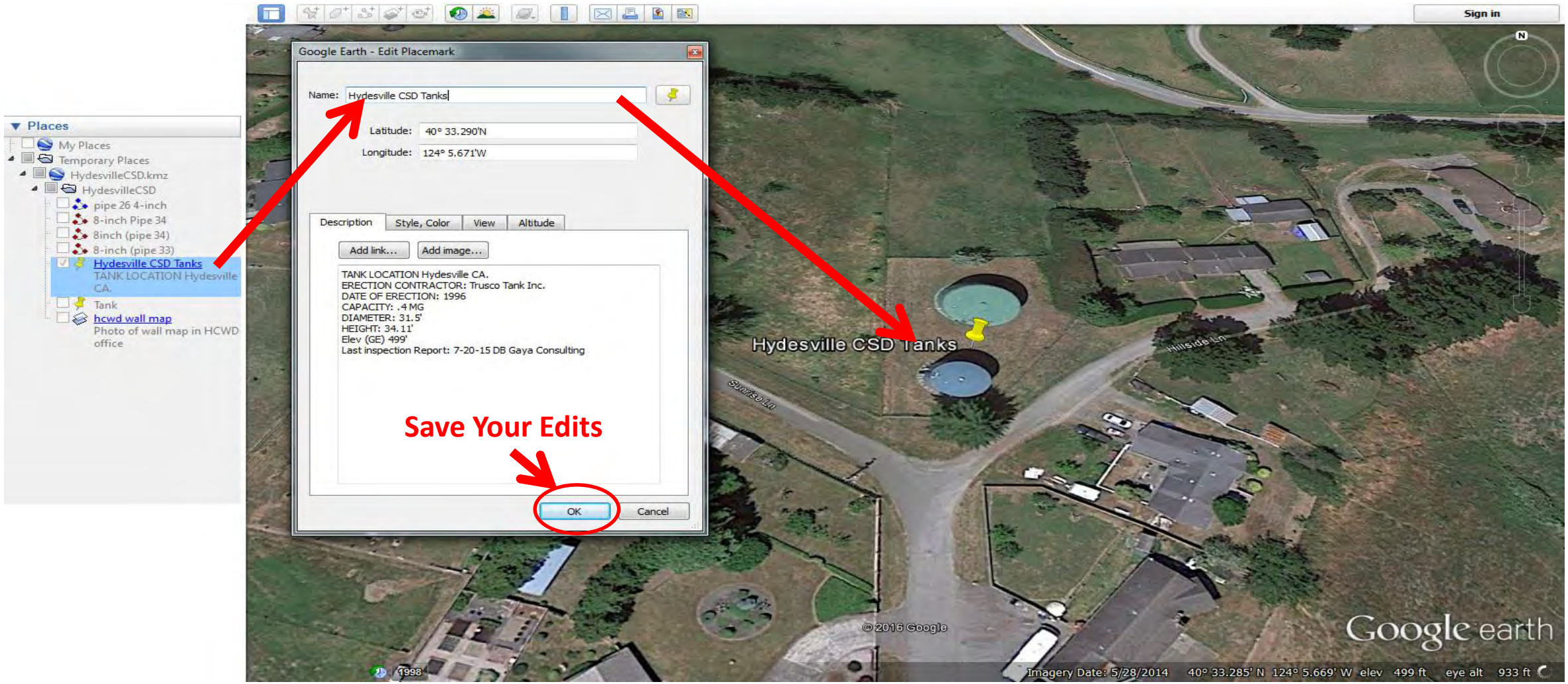
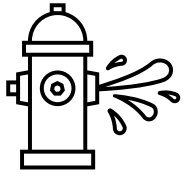
Edit Placemark



How to Change Placemark Icons

From the GEP standard icon to a fire hydrant:



1. Select picture or icon of fire hydrant
2. Save image in your pictures folder
3. Select “Edit Placemark”
4. Next to “Name” click on the Placemark icon
5. “Add Custom Icon” and open your saved picture. Save your work by clicking OK

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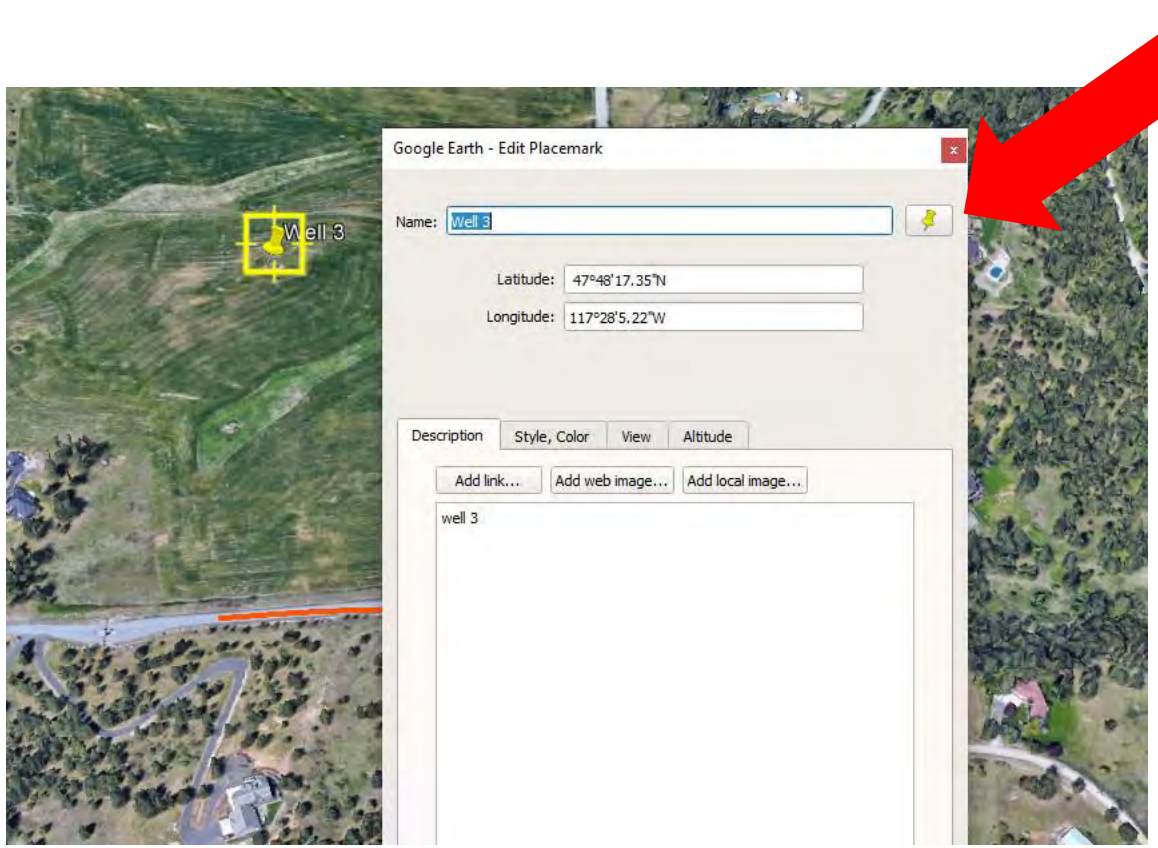
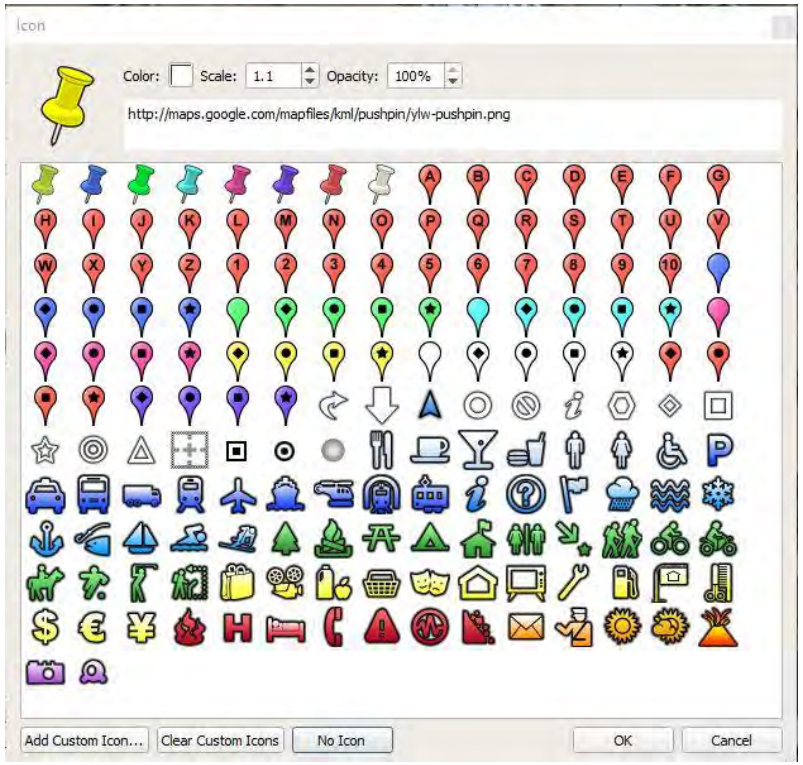
How to Change Placemark Icon





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Add Path = Add Pipe

1. Select Path tool
2. Name your Path
3. Add a description
4. Start drawing the pipe by left clicking once on the starting point of the pipe
5. Then click again at each change of direction
6. Do not hold down on the left mouse, as this will rapidly create multiple points “vertices” that must be undone
7. OK to save or right click to undo

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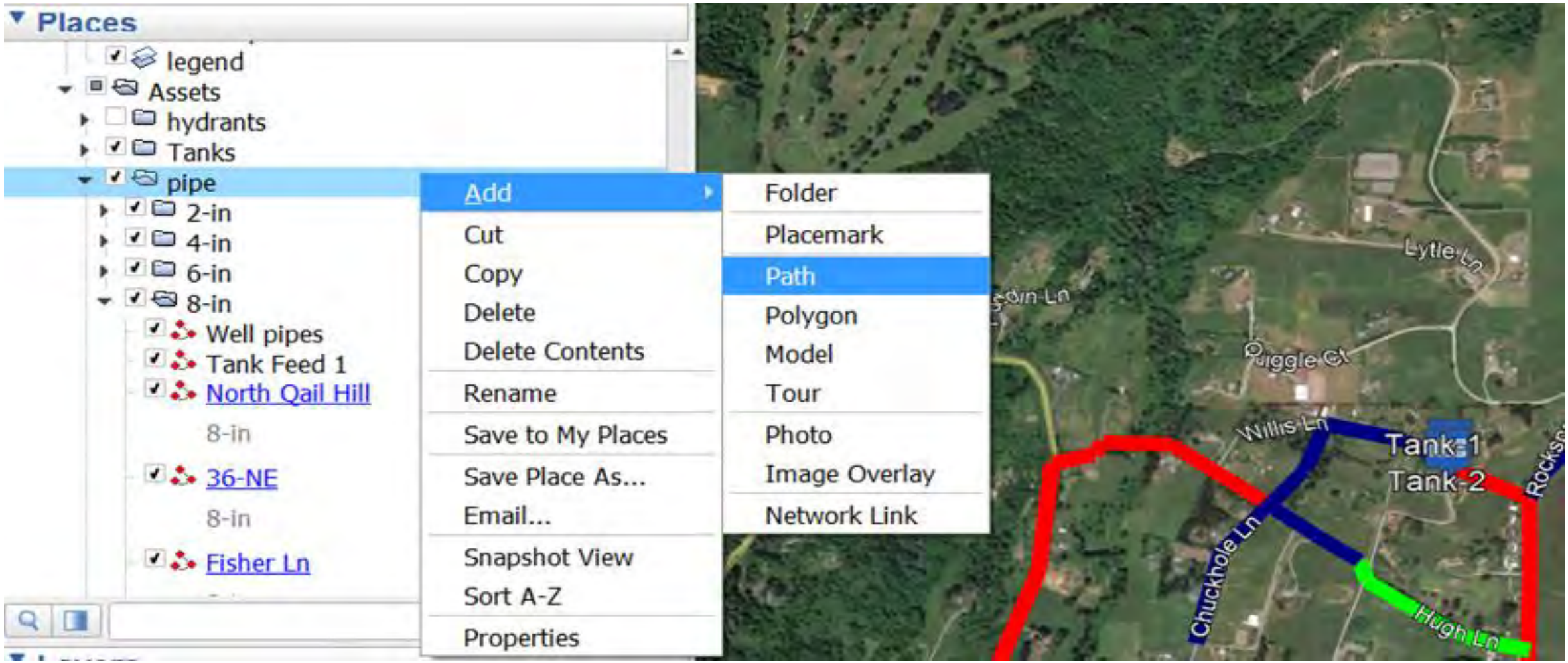
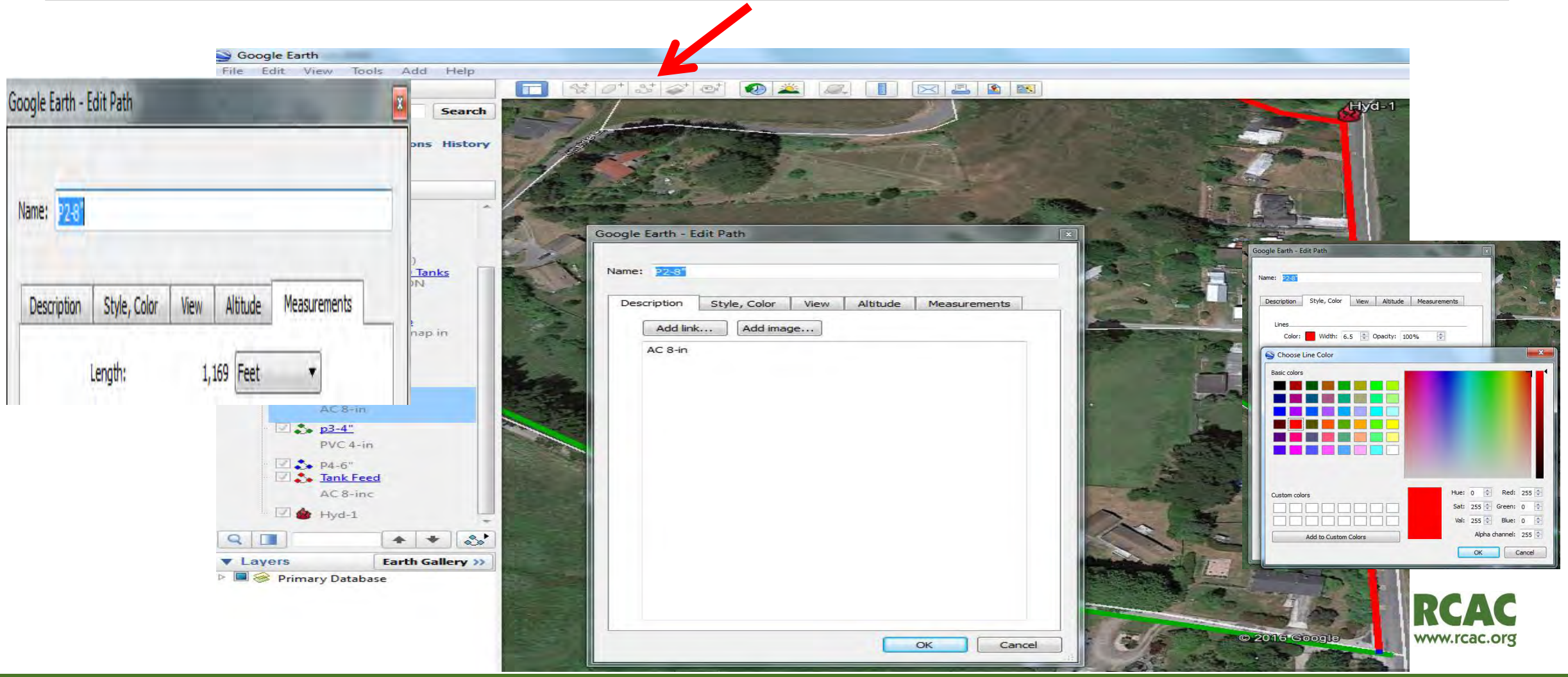
Add Path = Add Pipe



Edit Path = Edit Pipe

1. Change the pipe color using the “Style, Color Tab”
2. Record detailed information in the description box (diameter, type and age)
3. Click OK when finished to save your edits

Edit Path = Edit Pipe



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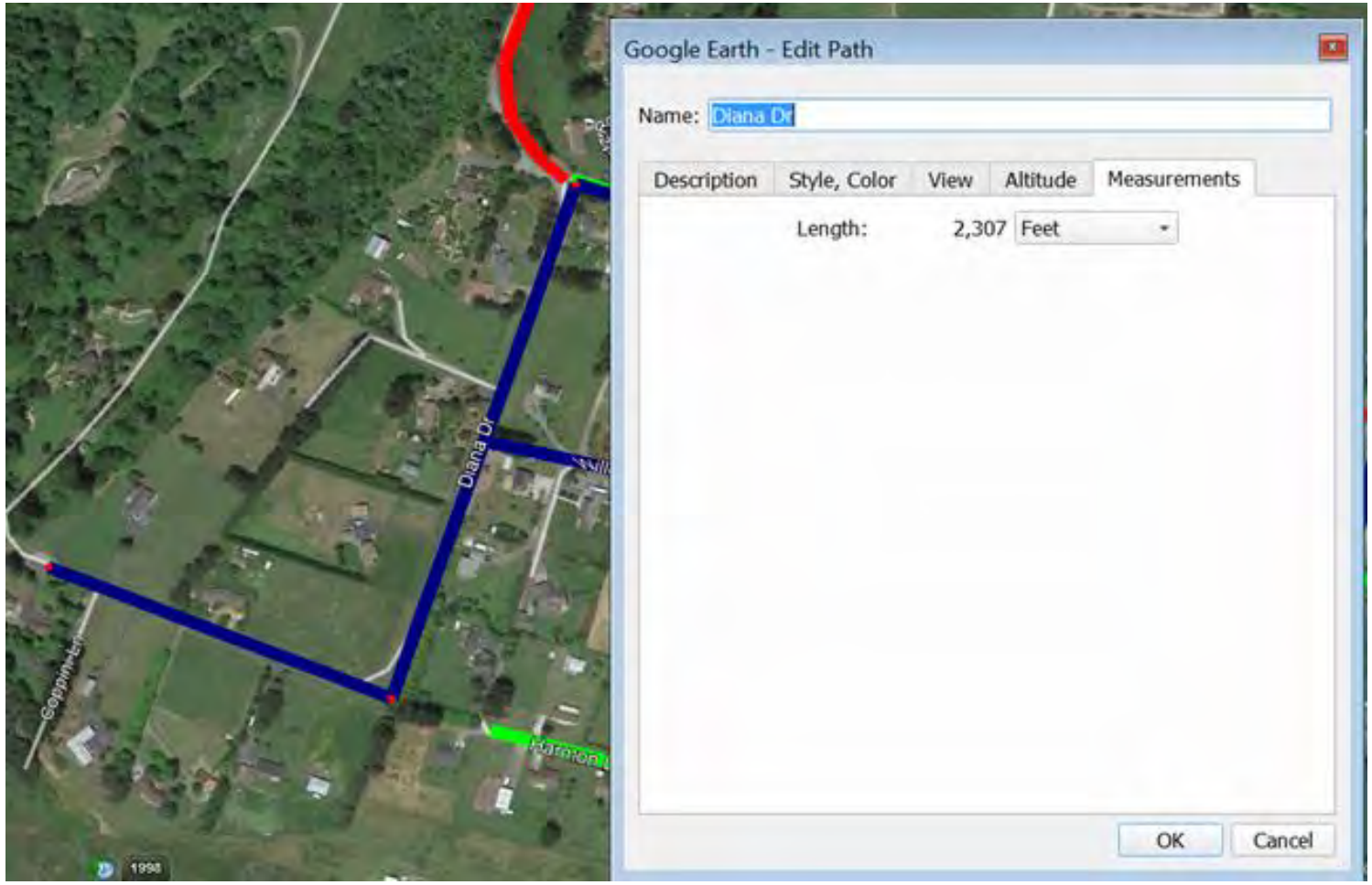
Measure Path = Measure Pipe

For previously created pipe:

Click on the “Measurements Tab” in the properties box to view the path/pipe length.



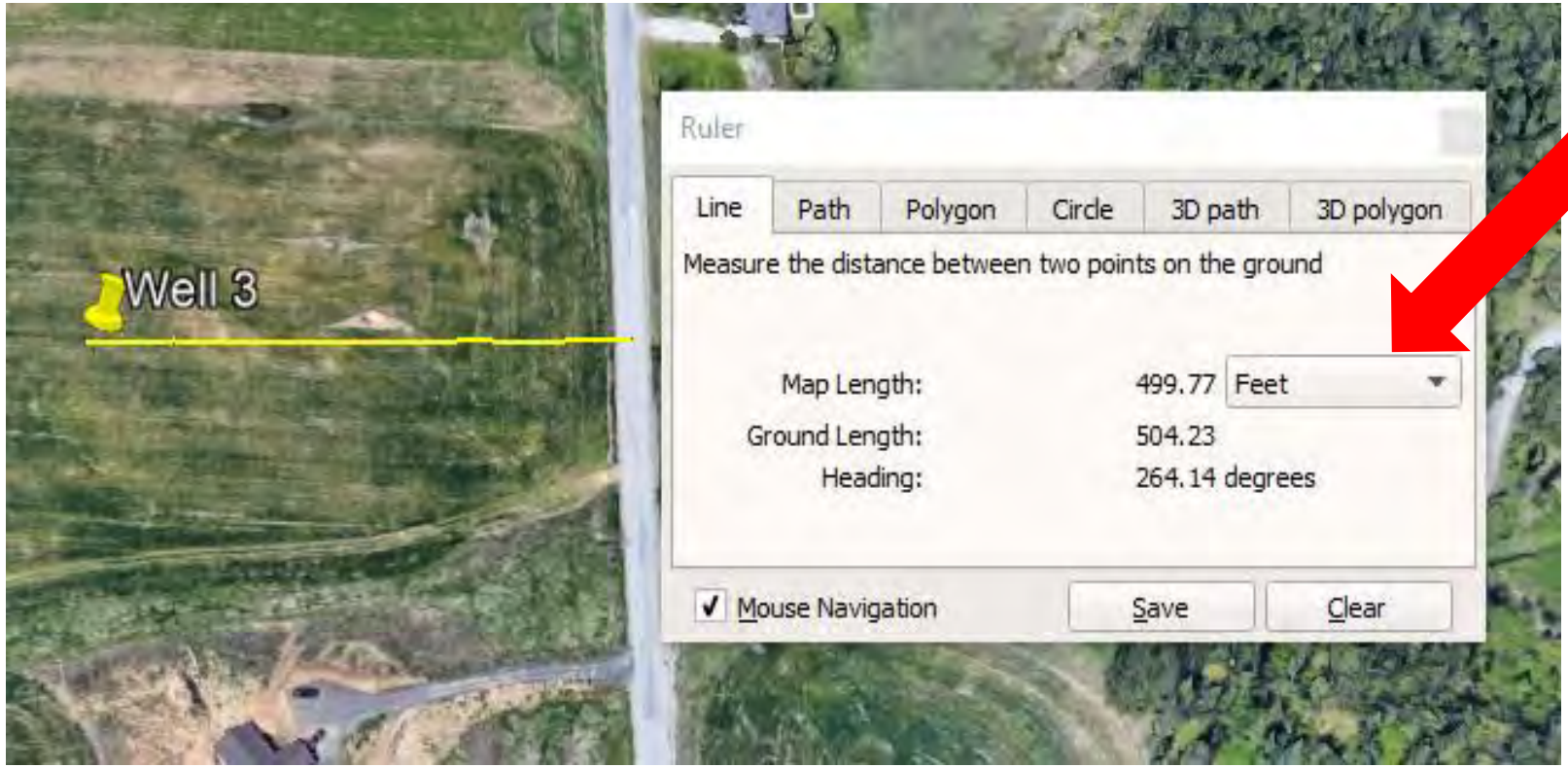
Ruler

Make a:

- Path
- Polygon
- Circle

With a set length or diameter

Save as a new path



Add Radius

Ruler:

- Chose “Circle”
- Click of center of circle and hold down left mouse button.
- Drag out to the distance needed.
- Save and name.

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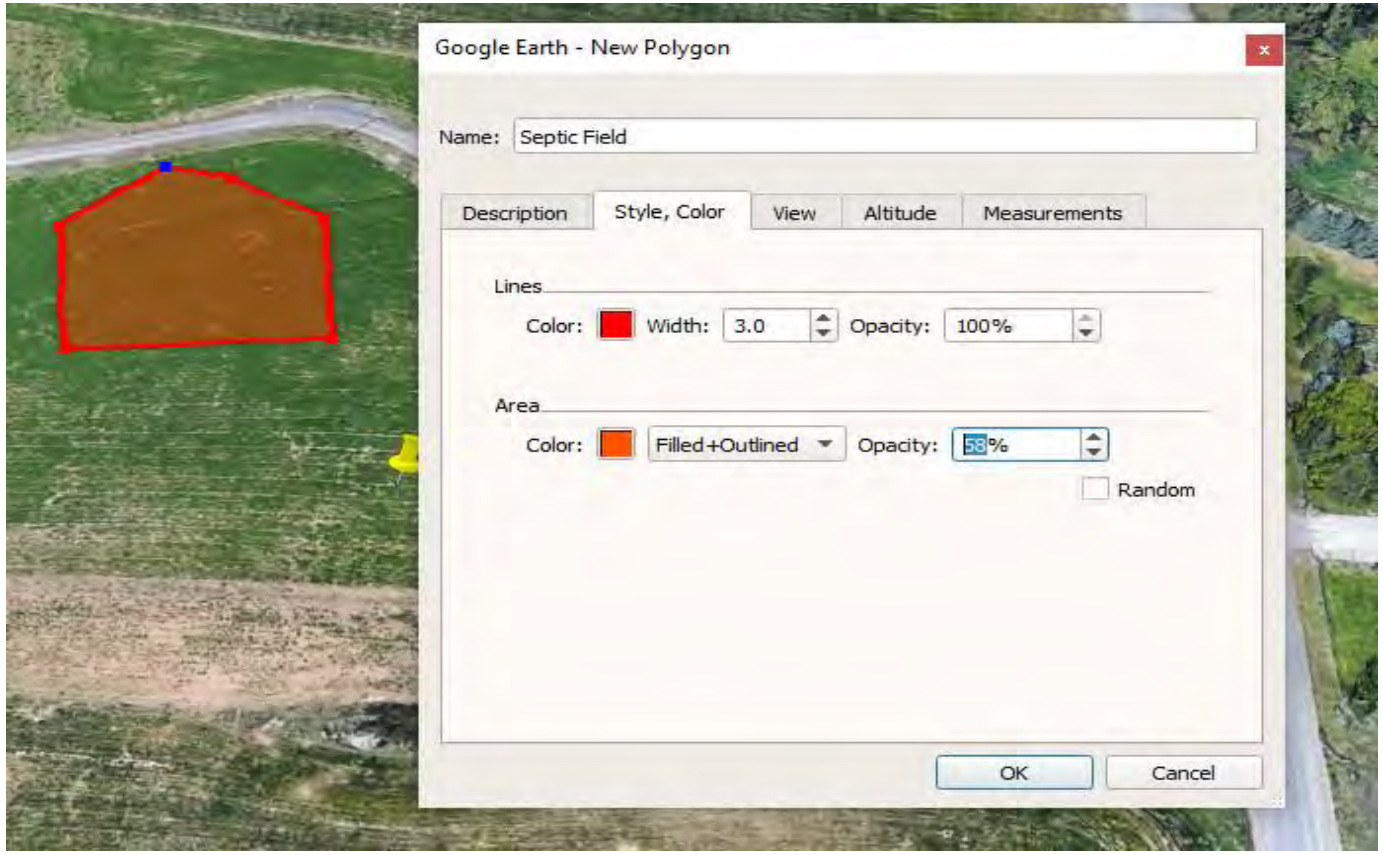
Add Polygon



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Add Image Overlay

1. Click “Add Image Overlay” and select a photo (jpg).
2. Use the green cross hairs and edges to position the photo over the satellite image, matching roads and other landscape features.
3. Move the map by holding on the center cross hair lines.
4. Stretch any corner to “rubber sheet” the photo to match the satellite image.
5. Rotate the photo by holding on the green diamond.
6. Adjust the transparency slider bar to see through the photo.
7. The map overlay’s primary purpose is to transfer known locations on the map to the GIS coordinate system by visual matching. Once the photo matches the underlying satellite image, the approximate latitude and longitude can be derived for anything shown on the photo overlay.

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Add Image Overlay

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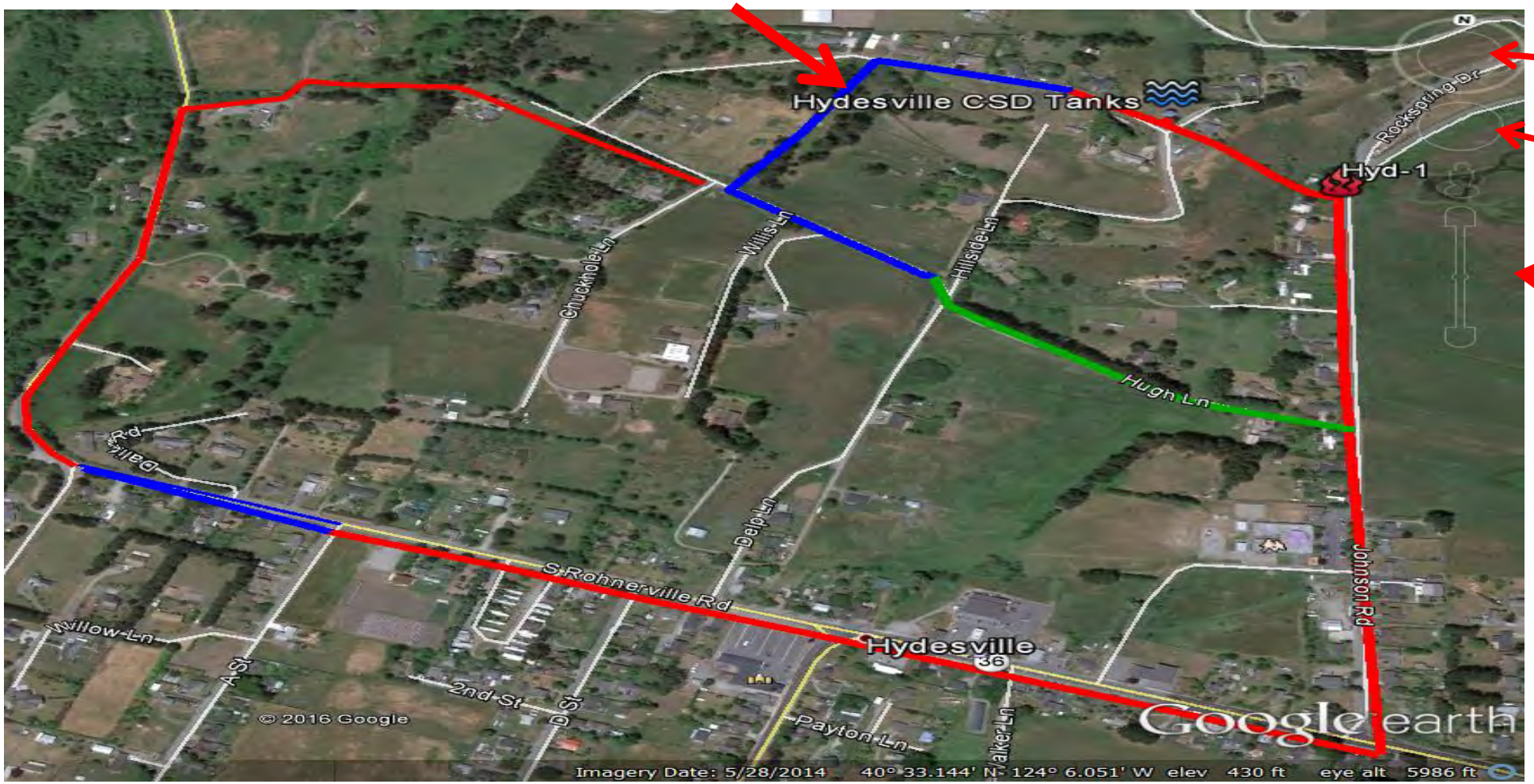
Draw Path/Pipe on Overlay



Tilt 3D
Rotate
Move
View

Zoom
in/out

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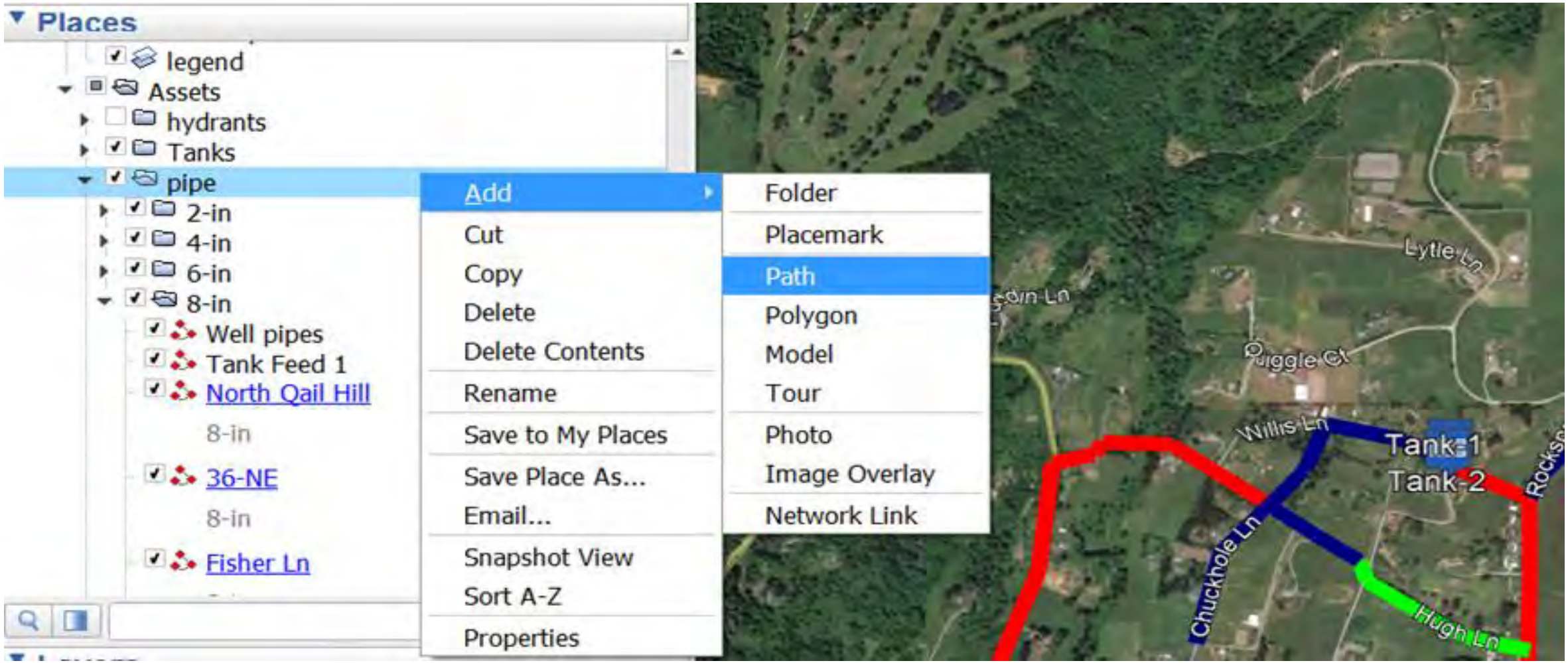
Add Path = Add Pipe

1. Start drawing the pipe by left clicking once on the starting point of the pipe
2. then click again at each change of direction
3. Do not hold down on the left mouse, as this will rapidly create multiple points “vertices” that must be undone
4. Right clicking = undo

Add Path = Add Pipe



Edit Path = Edit Pipe

1. Name the path/pipe
2. Change the marker color using the “Style, Color Tab”.
3. Change the marker symbol using the symbol button in the upper right-hand corner of the properties box.
4. Record detailed information in the description box (diameter, type and age).
5. Click OK when finished to save your edits.

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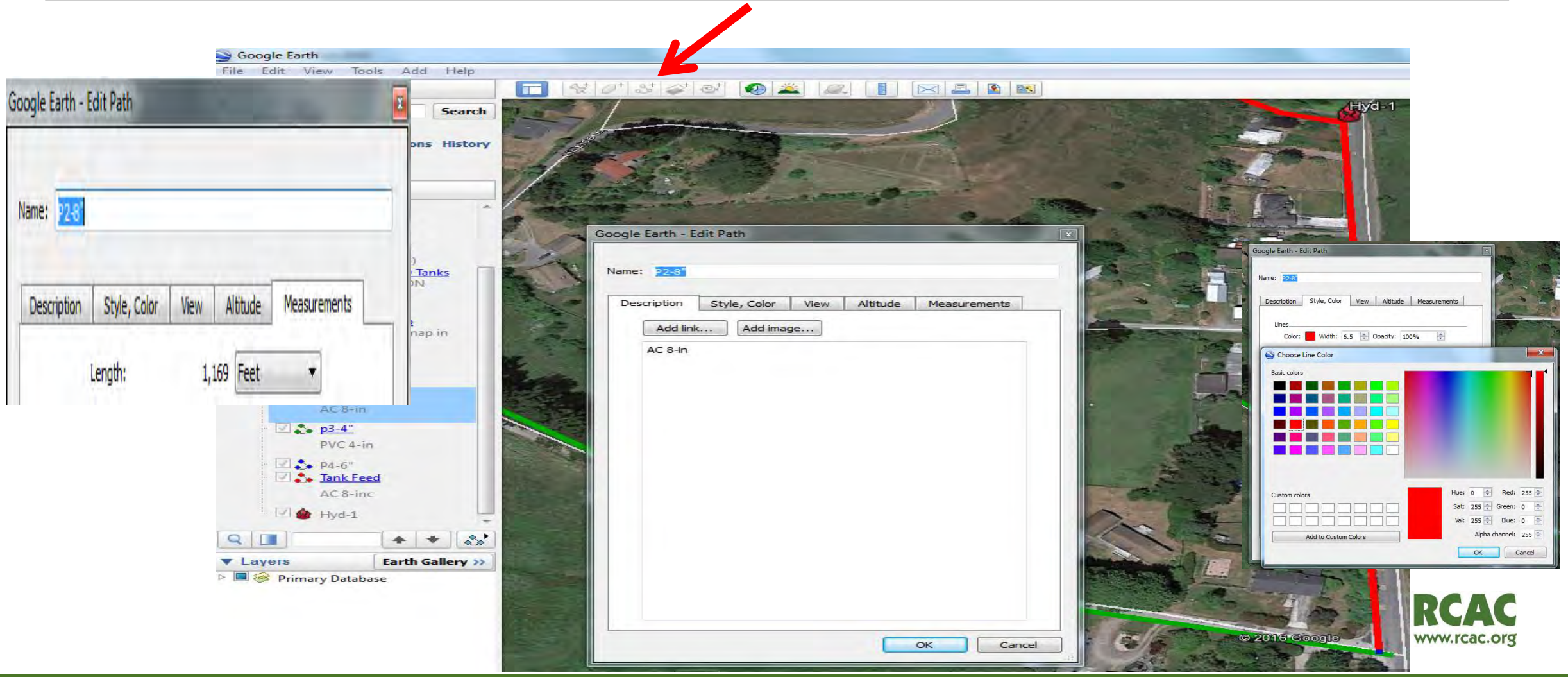
Edit Path = Edit Pipe



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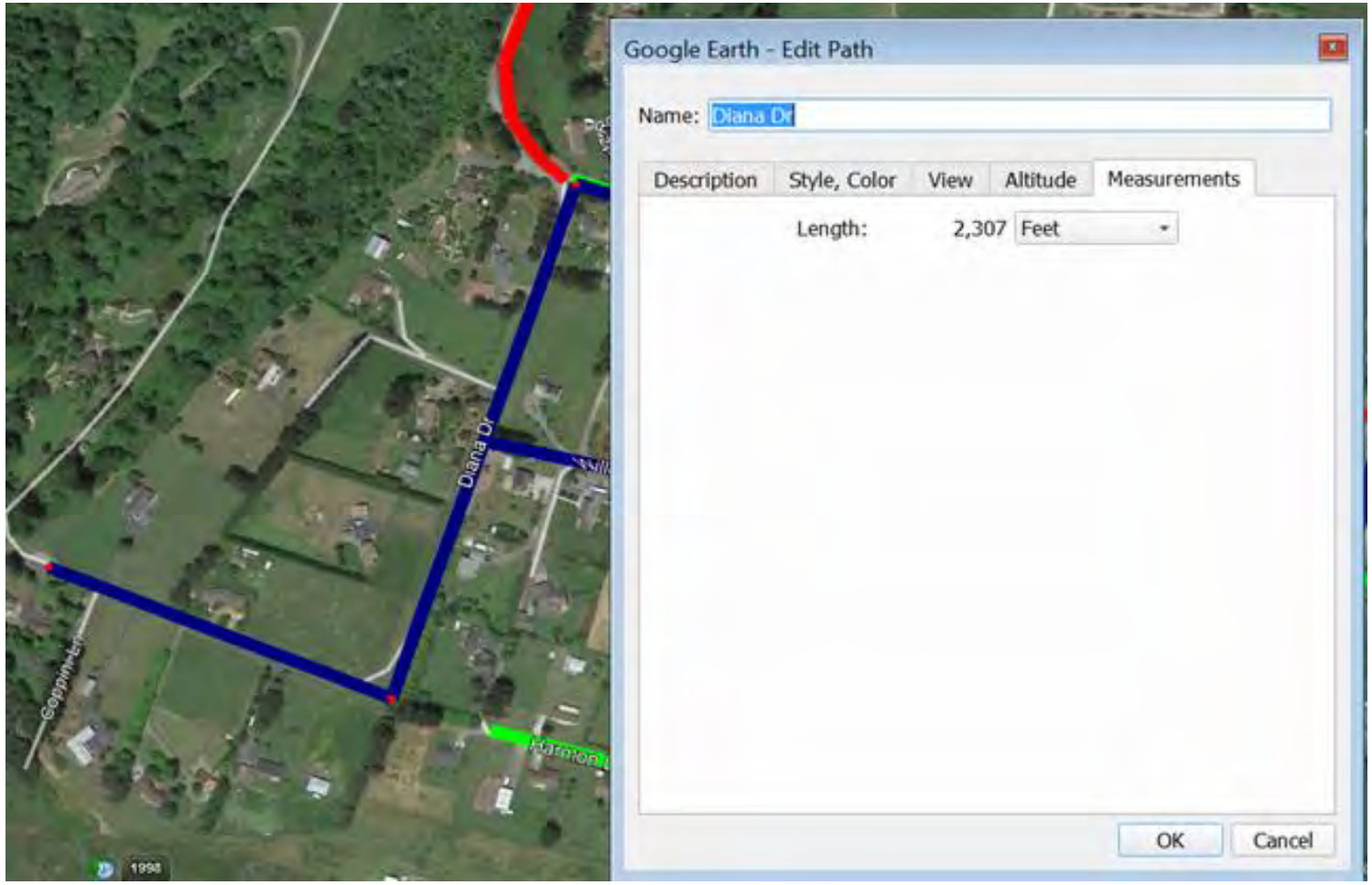
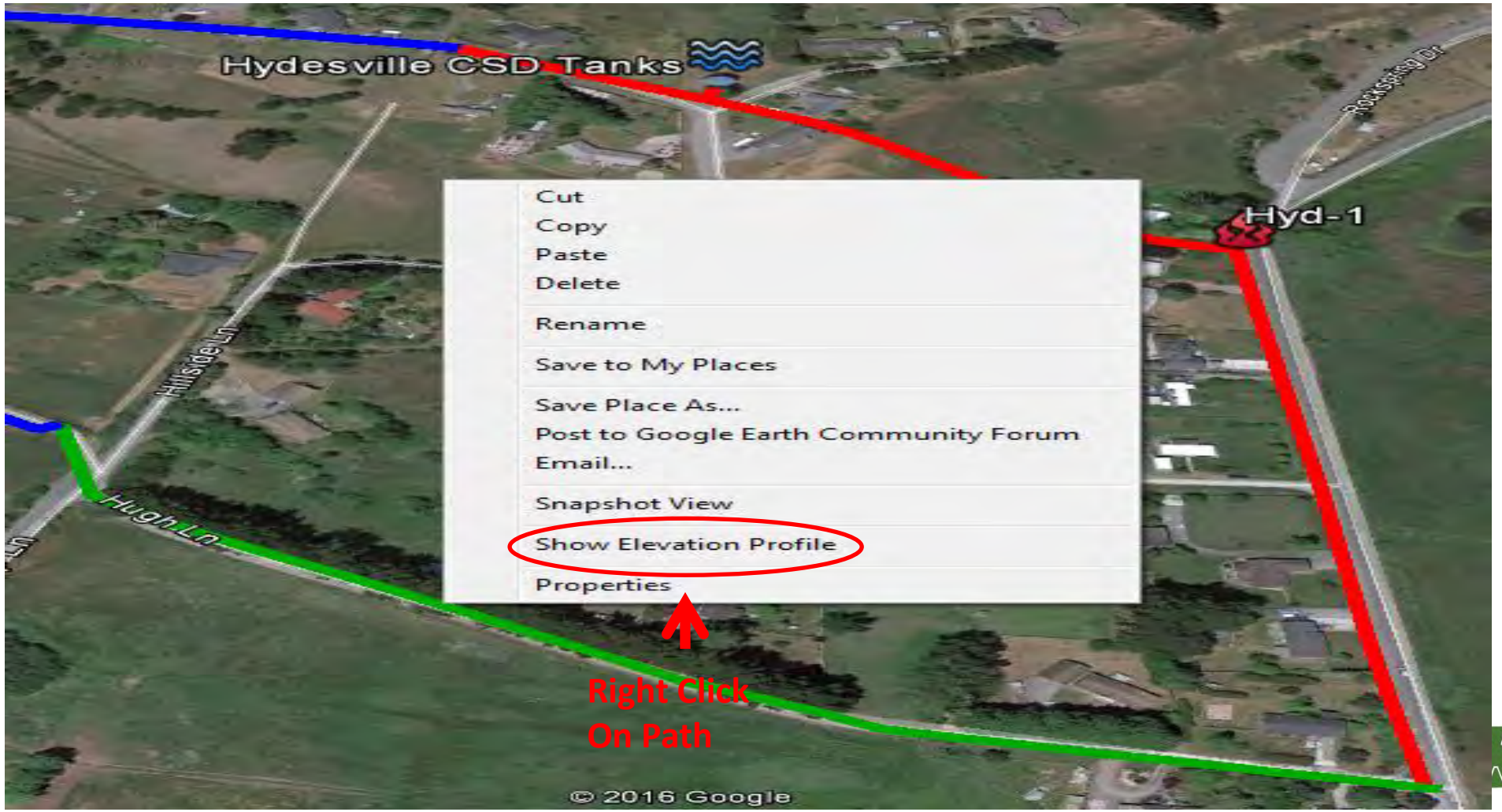
Edit Path = Edit Pipe

Click on the “Measurements Tab” in the properties box to view the path/pipe length.



Show Elevation Profile



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Show Elevation Profile

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SAVE AS YOU GO!

This program does not automatically save

This program does crash, especially if you are inputting a lot of data.

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Questions / Discussion

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For More Information

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