GEOLocate 101

A Tutorial

Milwaukee Public Museum

DRAFT Feb 2020

A. Caywood
Eds. J. Colby & C. Tyrrell

Hello.

This tutorial will complement your training in using GEOLocate to georeference sites. Depending on your level of experience with EMu in general, or the GEOLocate tab in the Sites Module in particular, some of the content will be a review of familiar tasks. For those new to our database, EMu, this guide has several sections that provide a guide to navigating the program, understanding the mapping data, and why this data is important.

...If you're acquainted with GEOLocate and need a **Quick Start** checklist of georeferencing steps, required fields, and data standards, go to **Page 31**.

...If you're new to EMu and need some help navigating the tabs, please ask to review the ***EMu Basics*** tutorial.

...To learn how to navigate **GEOLocate Features**, including the panes and buttons, go to **Page 2**.

...If you'd like to begin **Georeferencing a Site in GEOLocate,** go to **Page 8** to review examples.

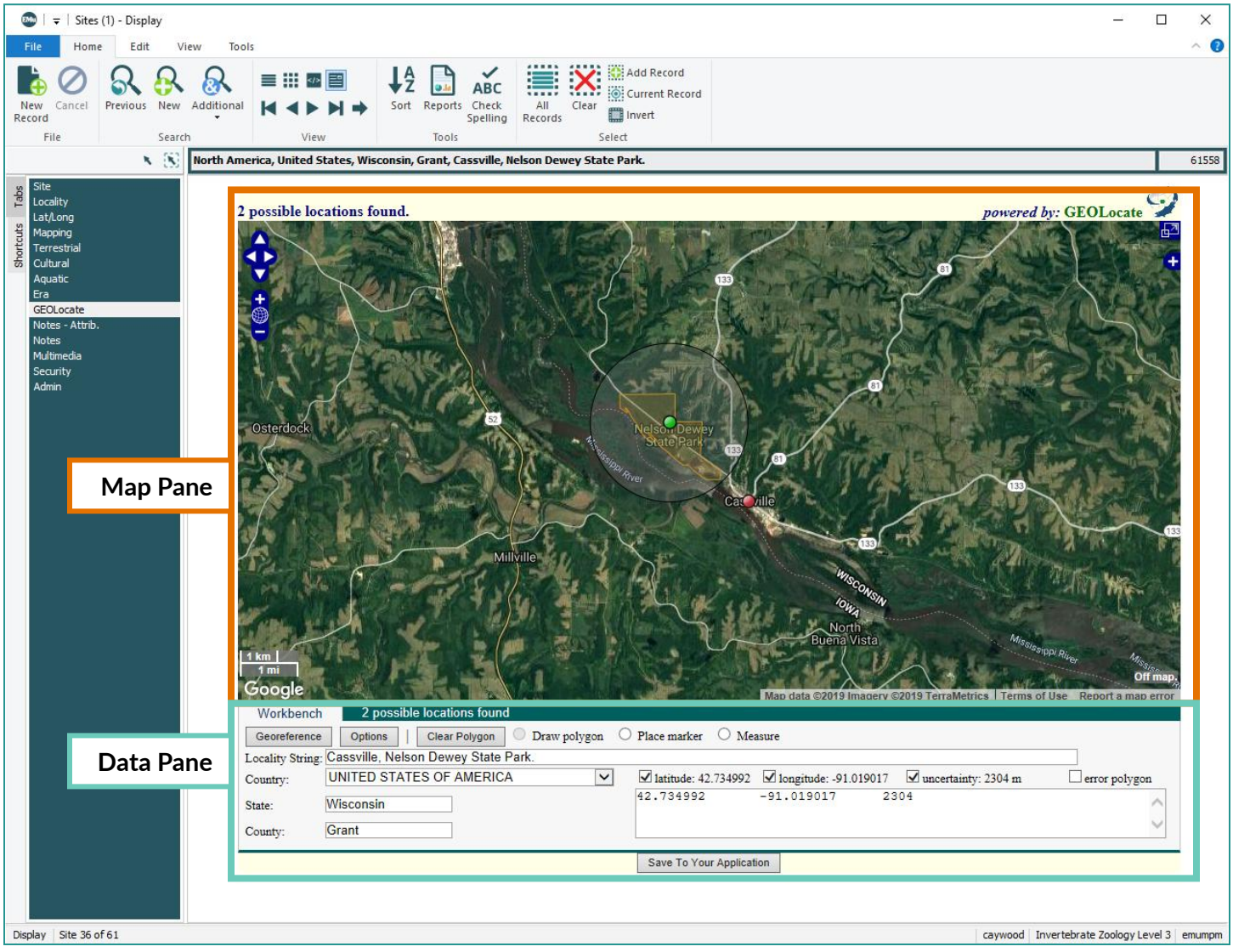
Contents

GEOLocate Features

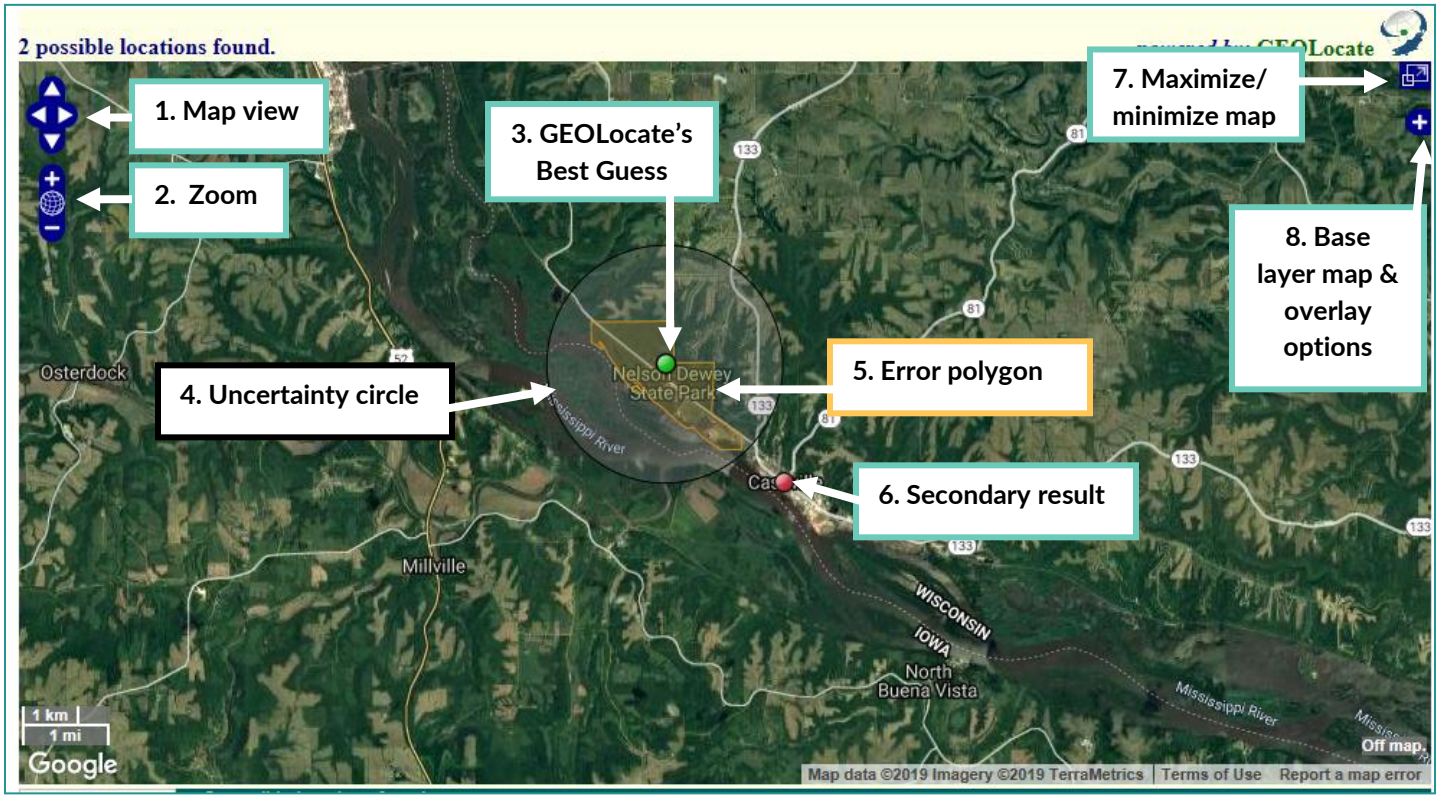
GEOLocate has a number of features you may find useful in the course of georeferencing sites. You are encouraged to use this section to explore the tabs and buttons in the module.

To review an iDigBio video tutorial, go to: https://vimeo.com/showcase/2163673/video/65222791

When you click on the GEOLocate tab after selecting a site to edit, you will see a two pane window:



Map Pane Features:



1. **Map View:** Up arrow= move view north, down arrow=move view south, etc. You may also click on the map and drag the map to adjust your view.

2. **Zoom:** Click + or – to zoom in or out. Click the globe to see the entire map of earth.

3. **Most likely result:** If GEOLocate is able to generate results from the locality data, it will place the results on the map. The green dot is the highest ranking result; this is what the program thinks is the most likely location.

4. **Uncertainty circle** *(Outlined in black.)*: The area of this circle should contain all possible alternate places the specimen could have been collected. How big/small the area is will depend on the specificity of the locality data.

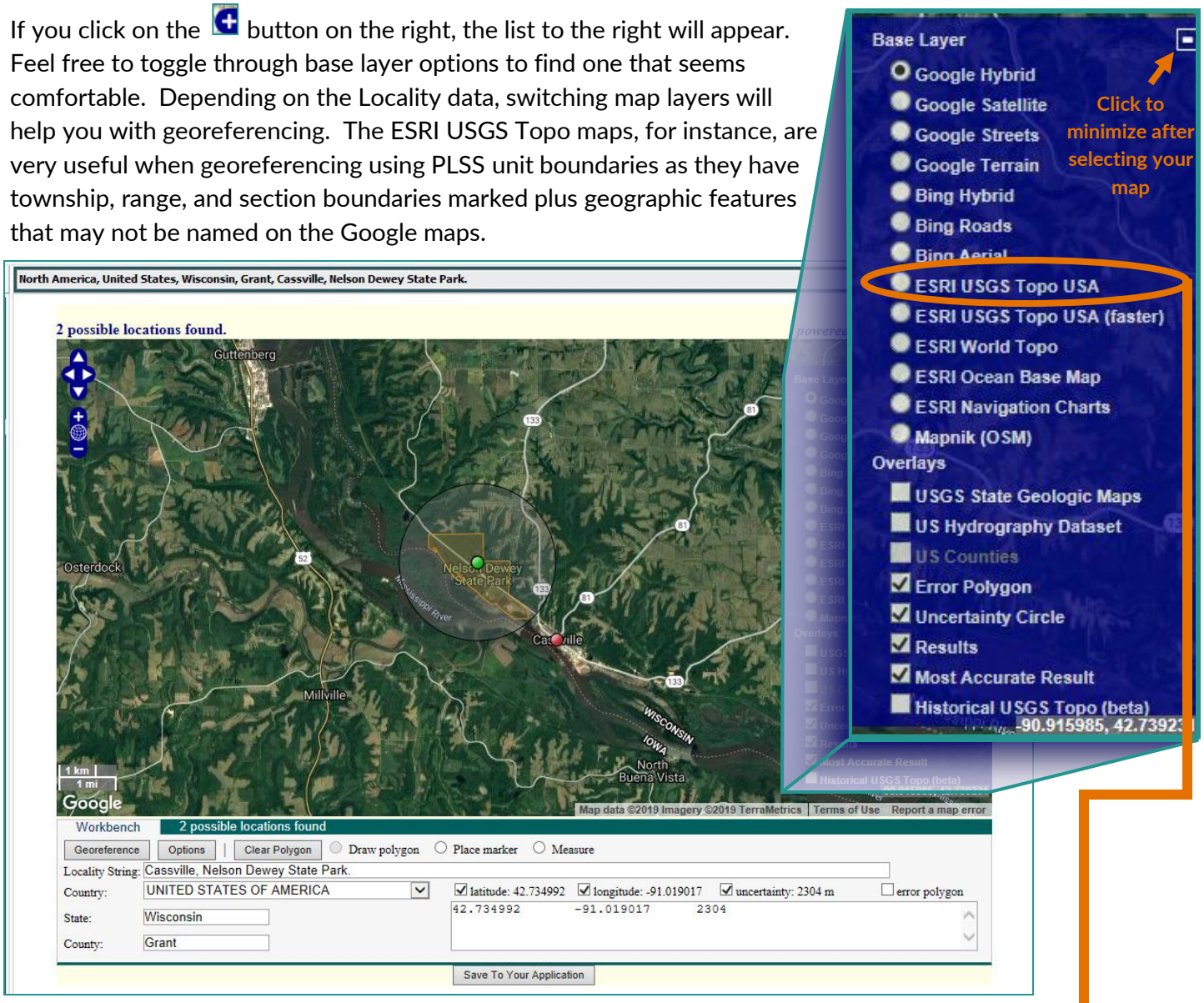
5. **Error polygon** *(Outlined in light orange.)*: GEOLocate will set an uncertainty polygon for the smallest named place in the locality data if it has defined borders. This can include states, cities, natural areas and parks, etc. The Uncertainty Circle should include the entire polygon.

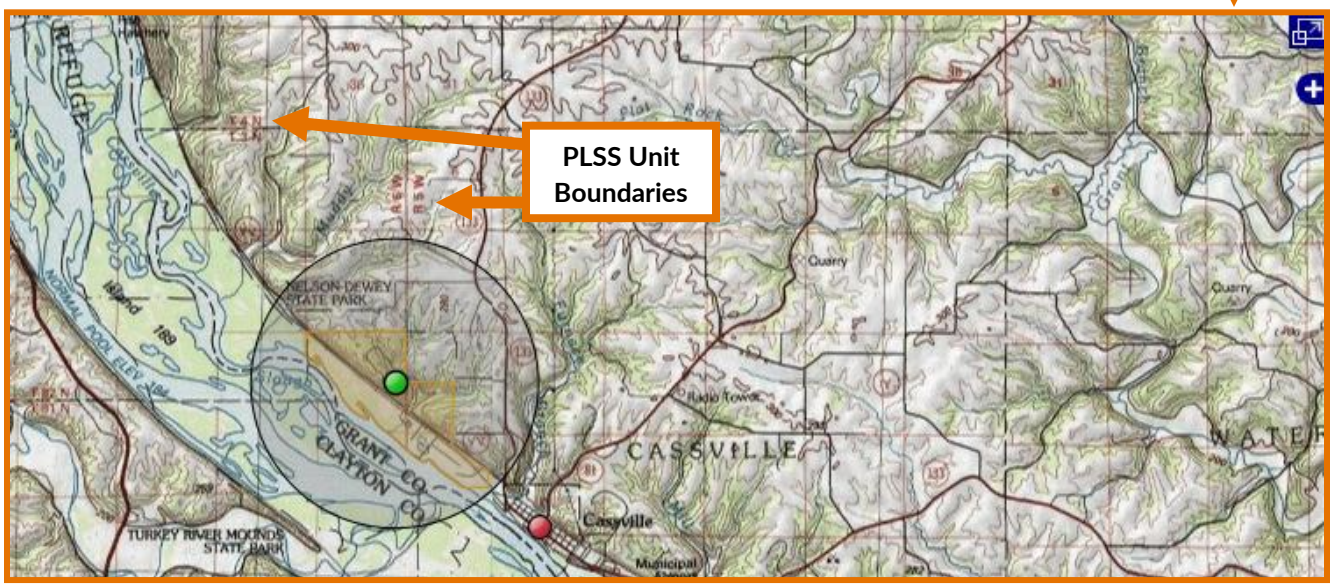
6. **Secondary Result(s):** Other possible results (locations) based on the locality data.

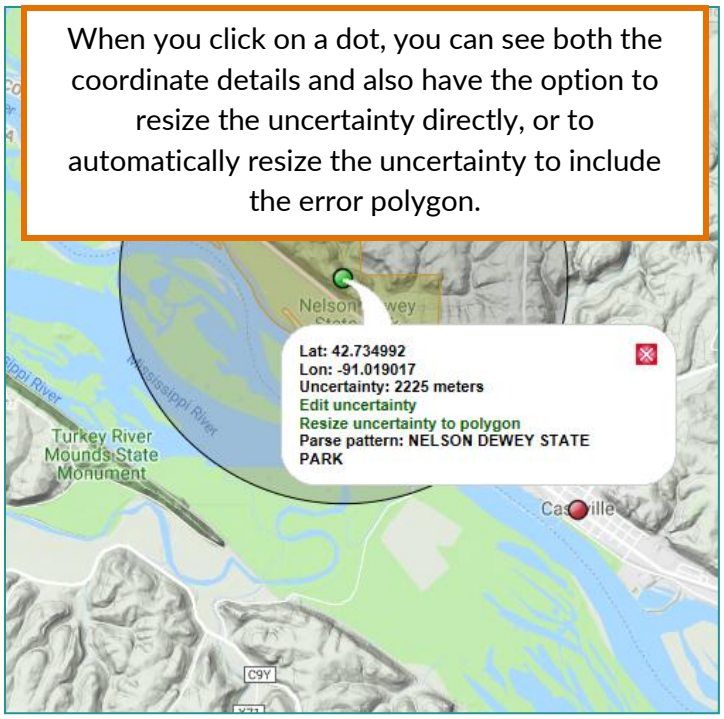
7. **Maximize/ minimize map:** This button will maximize your map to fill the full pane. The data pane will float on top of the map. In full frame, this button will minimize the map to fill the default pane.

8. **Base layer map & overlay options**: This is a convenient feature that allows you to toggle through different types of base maps (Google Hybrid is a default.) The default overlay settings include the uncertainty circle, error polygon, results, and most accurate result.

If you click on the button on the right, the list to the right will appear. Feel free to toggle through base layer options to find one that seems comfortable. Depending on the Locality data, switching map layers will help you with georeferencing. The ESRI USGS Topo maps, for instance, are very useful when georeferencing using PLSS unit boundaries as they have township, range, and section boundaries marked plus geographic features that may not be named on the Google maps.





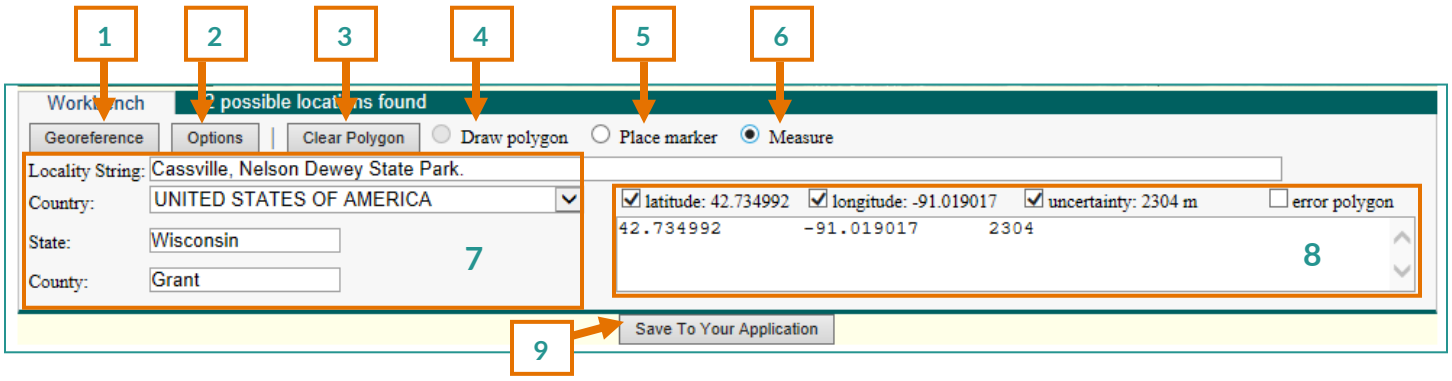


Note: Error polygons may not be desired for the group of sites you are georeferencing. However, if you are creating an error polygon, the uncertainty area should include the entire polygon. If you do not see the option to "Edit uncertainty," go to the **Georeferencing options** box discussed below and make sure the "Do Uncertainty" box is checked.

Data Pane Features

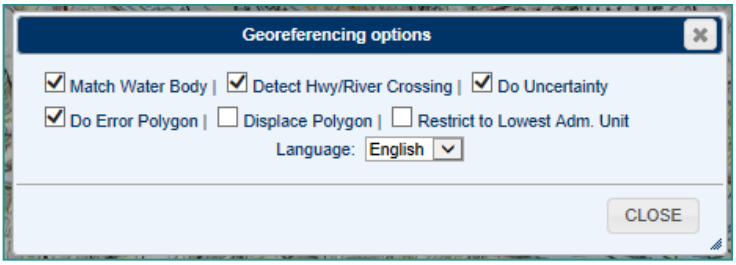
Workbench Tab

The Workbench tab contains the locality data as well as tools to adjust the location results in the map.



1. **Georeference:** If you edit the locality data, press this button to generate new results.

2. **Options/Georeferencing Options:** Click to access options for how the program calculates results. The collection manager will indicate if you should change from the defaults.



3. **Clear Polygon:** Click to remove the error polygon.

4. **Draw Polygon:** Click to create a polygon. Each click of the mouse will create a new vertex (corner) of your polygon, allowing you to trace irregular shapes such as water bodies or natural areas.

5. **Place Marker:** Click to place the marker on a location other than one of the results marked on the map.

6. **Measure:** While GEOLocate is capable of interpreting locality strings that include information like "3 miles north of Cassville," you also have the ability to check the results by using the measuring tool. When you click the button, you can draw a line to measure distances on the map:

Place the white box at your starting point, click, and then draw the line to measure the distance (km/mi displayed in green). Click once to create a polygon; click twice to pin the measurement in place. To remove the measurement from the map, double click the Measure radio button.

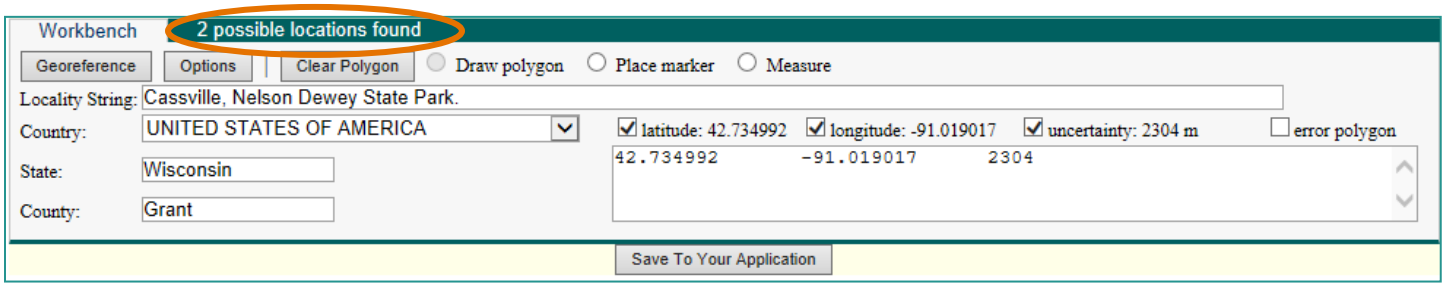
7. **Locality Data:** This data includes the Locality String, Country, State, and County. Other relevant information, such as township, range, and section information is on the Mapping tab.

8. **Coordinate Field and Check Boxes:** The coordinate field is a tab delimited field showing the details of the highest ranked result/final result. Info for each checked box is shown in the field and will be passed to EMu; use check boxes to control the detail in the field.

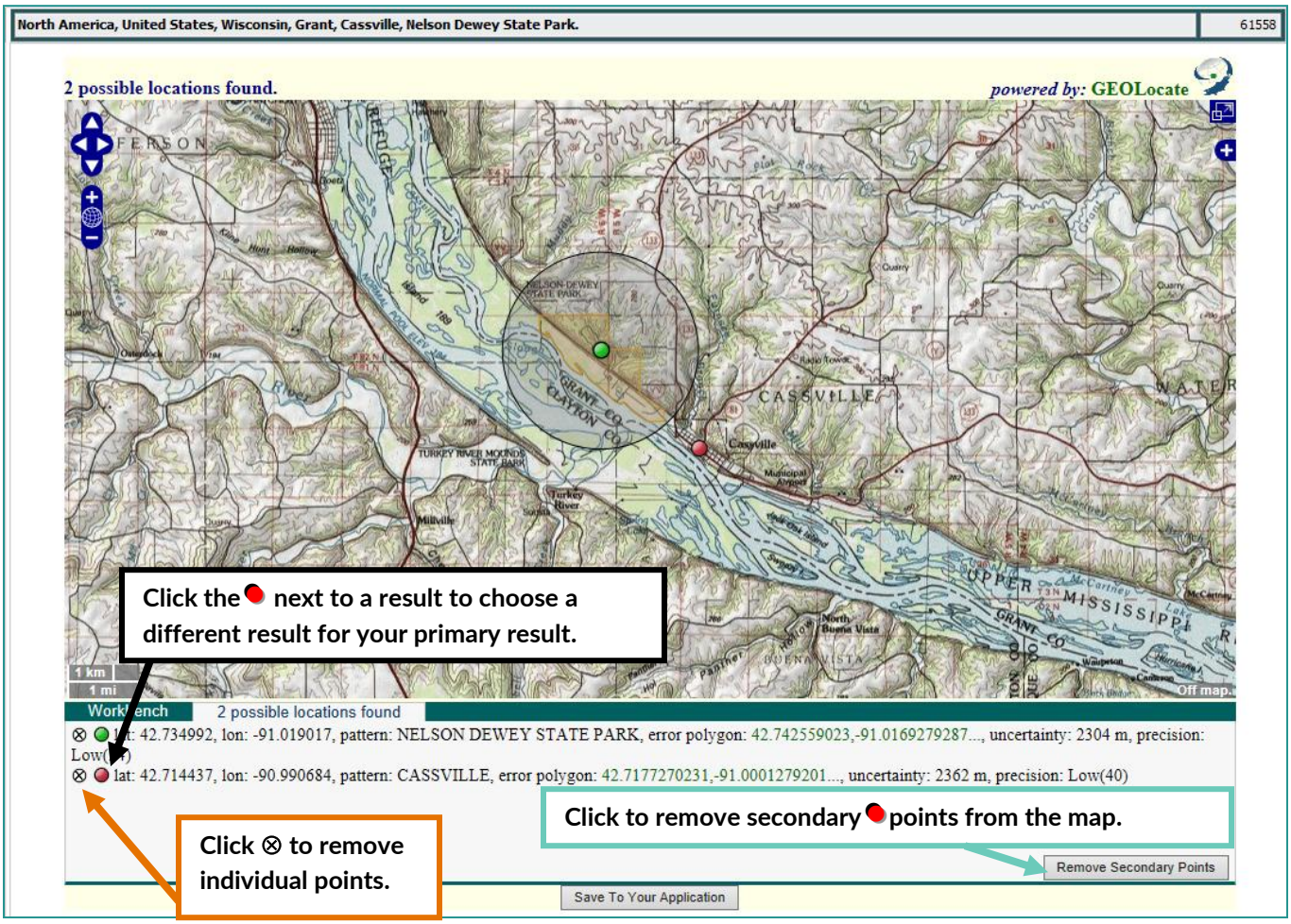
9. **Save To Your Application:** When you have finished georeferencing the site on the map, click this button to save the reference to the site record. ***Please note: the polygon vertices DO NOT save to the EMu site record.***

Results Tab

To access the results tab, click on the "possible locations" ribbon:



The locations will be listed in order from most to least accurate:

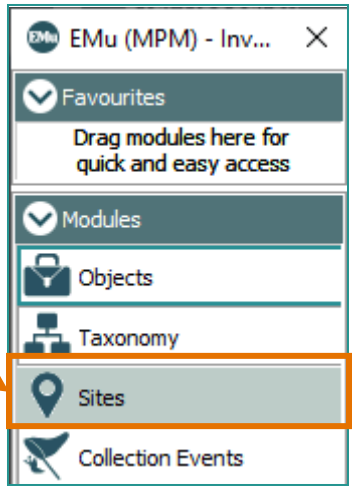


NOTE: Eliminating results from this list can help de-clutter your map, but only the primary (green) point's coordinates are saved to the application. Removing secondary points is entirely optional, and while worth reviewing if the primary is not correct, you do not need to clean up this list to georeference a site.

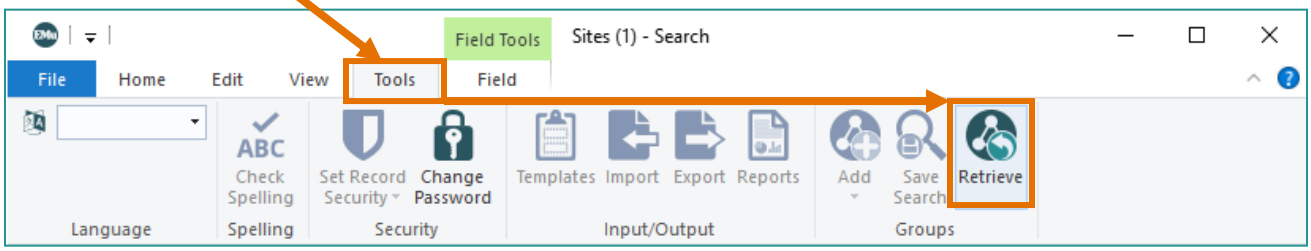
Georeferencing a Site in GEOLocate

Retrieving Your List

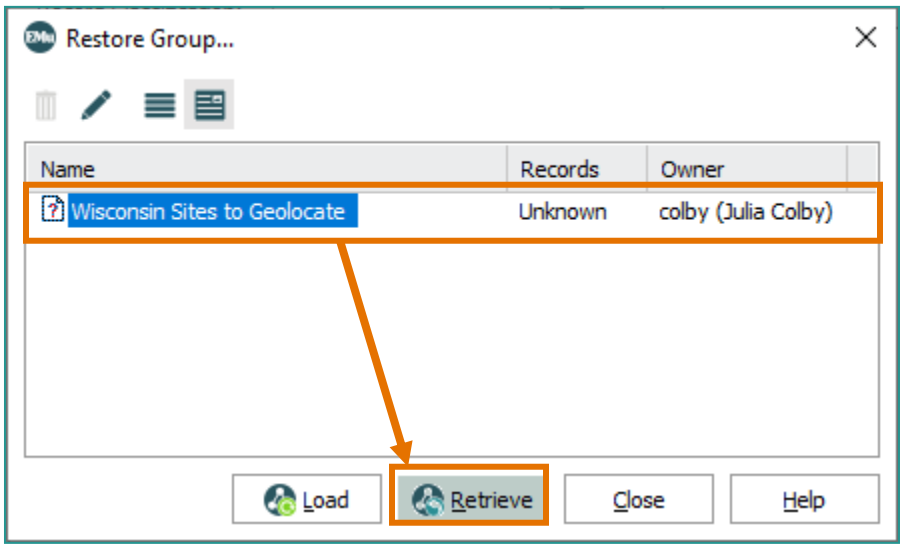
1. **Log into EMu (make sure you logged in under the correct group for the sites you will be working with) and open the sites module.**



2. **Retrieve the list that has been assigned to you**—*see the Collection Manager/ Curator if you do not know which list to work on*:

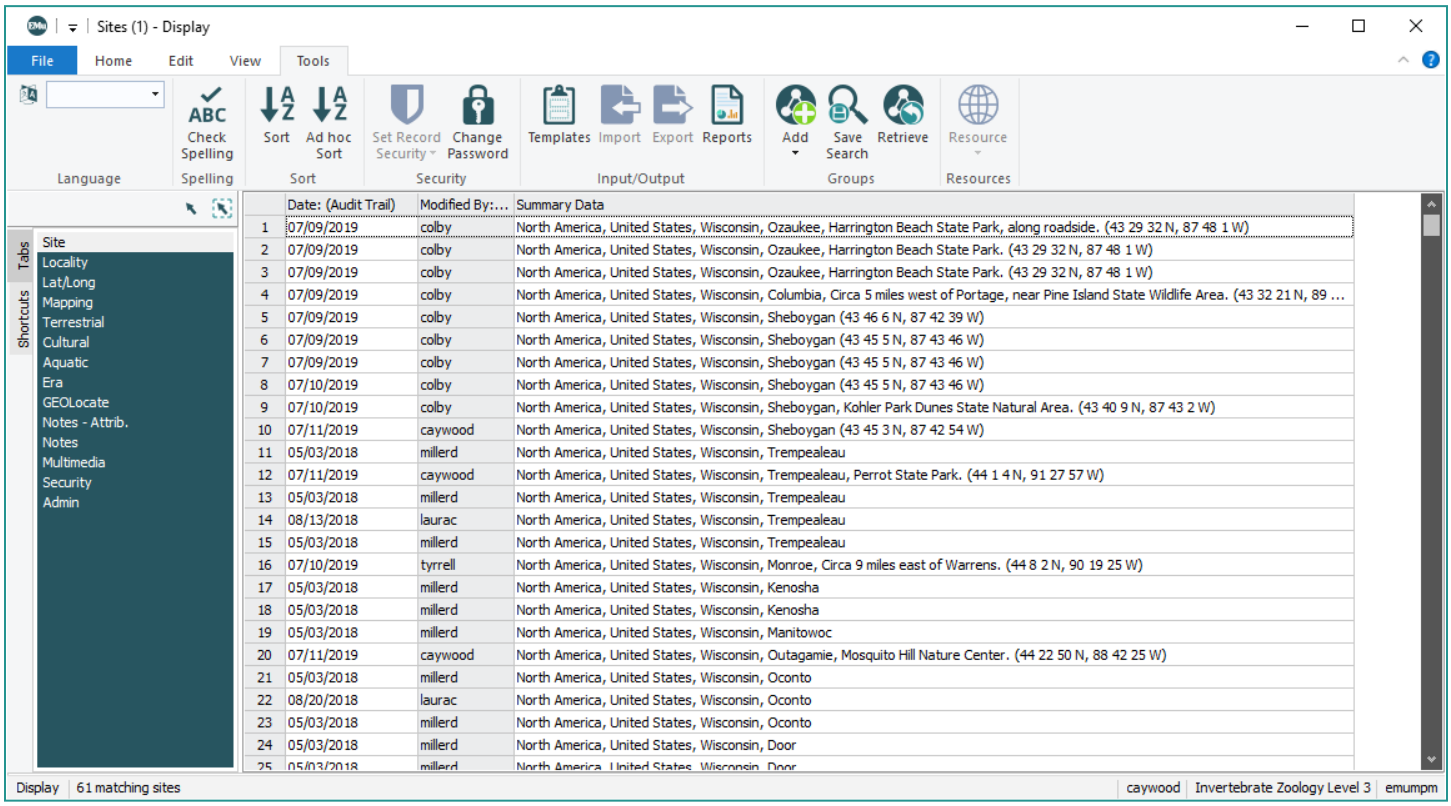


- Click on the Tools menu, and then select **Retrieve.**
- A new window will pop up with a list (yours will have a different title):

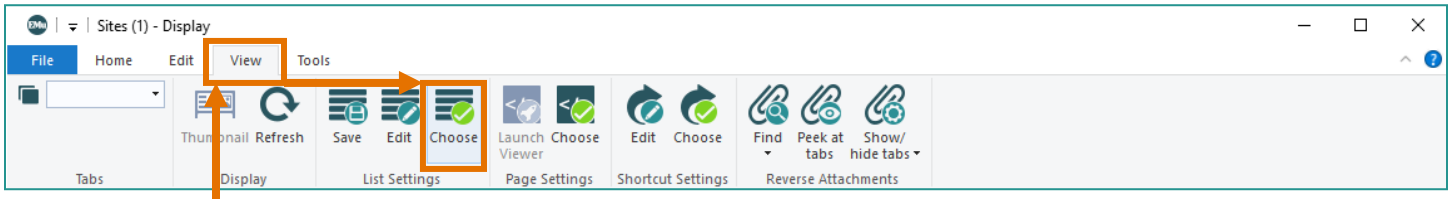


- Click on the list, and then click on **Retrieve.** (You can also double click on the list.) Click **No** when prompted for a summary.

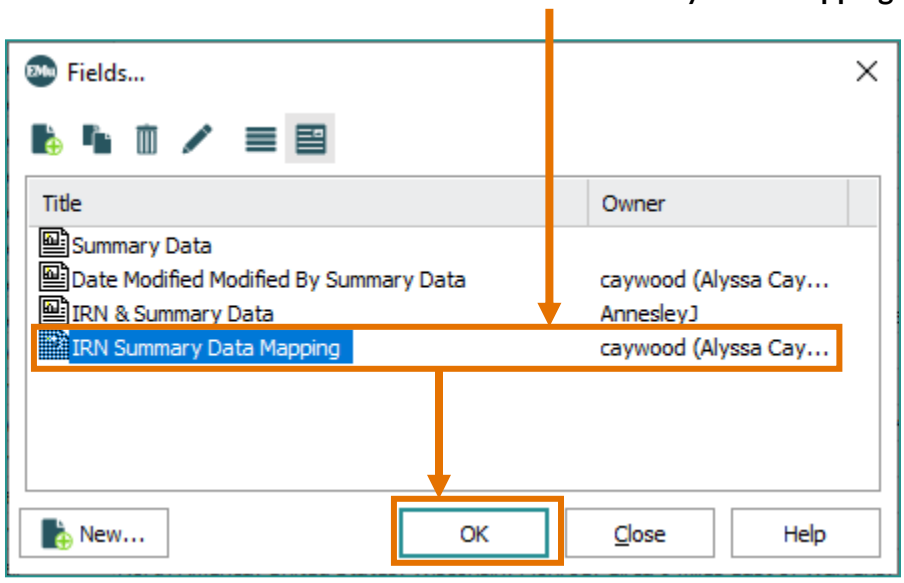
- Your results will be returned in a list:



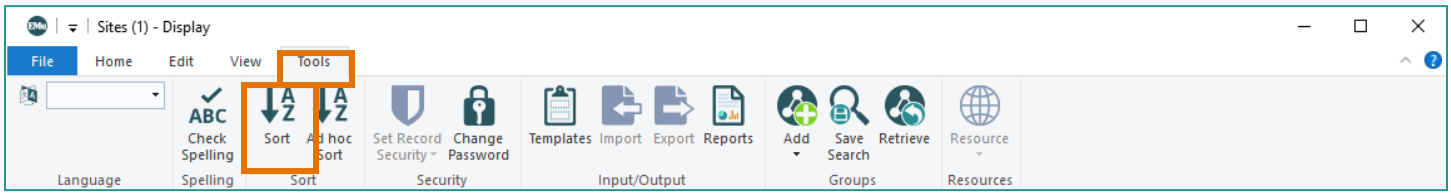
3. Organize the list by choosing a list view:



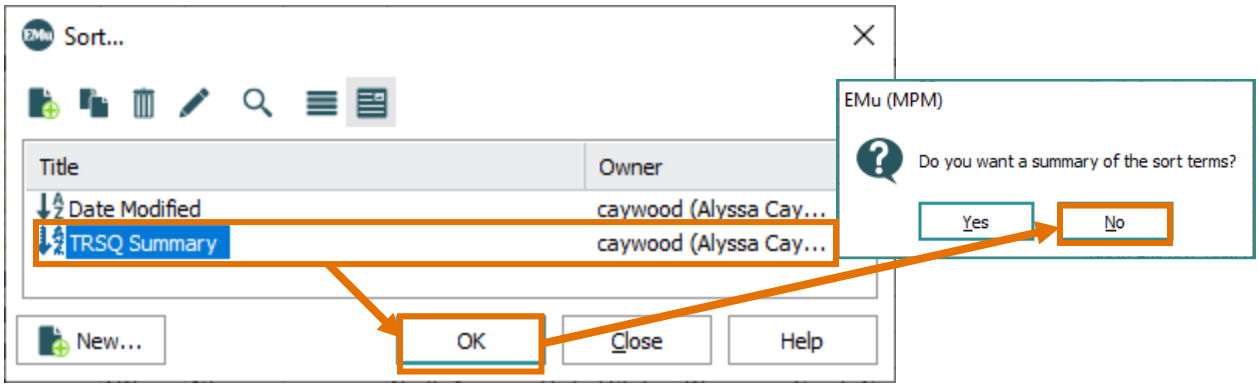
- Go to the View tab and select **Choose.** Select **IRN Summary Data Mapping:**



- Then sort your list by flipping to the Tools menu and selecting **Sort AZ:**

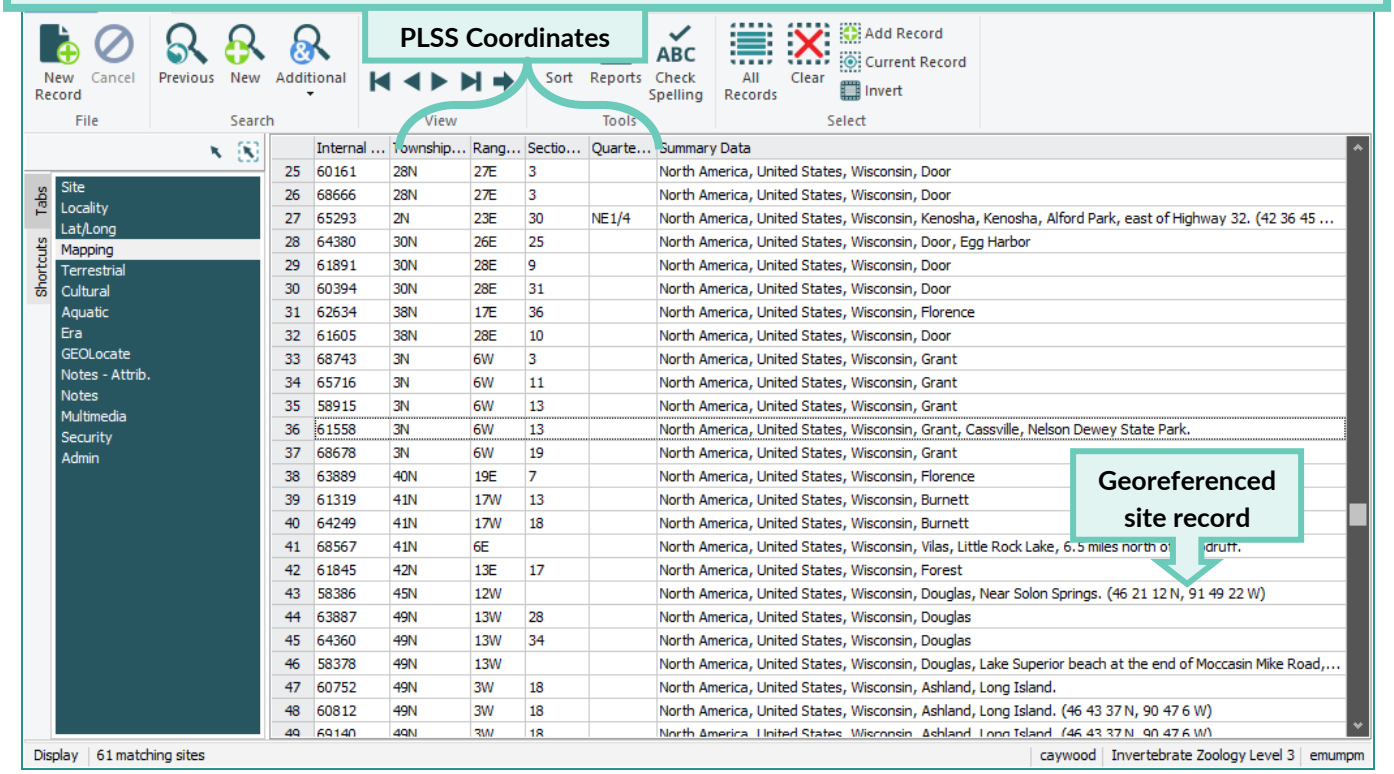


- For Zoology records, select the TRSQ Summary list. Click **OK** and **No** when you receive the prompt for a summary of the sort terms. Your list will be sorted by Township, Range, Section, and Summary Data.

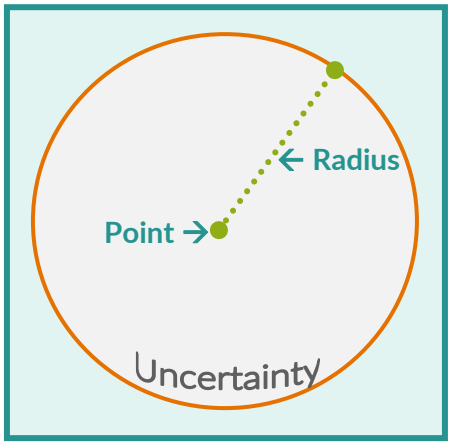


4. **To open an individual record, click on it.**

When reviewing the list, note which sites have longitude and latitude coordinates at the end of the summary data. These are records that have already been georeferenced, and after sorting, sort to the bottom of your list. Note any sites that have the PLSS/TRSQ (Township, Range, & Section) data, as you will need to refer to this information when georeferencing the site.



Example 1: Point-Radius Georeferencing



The Point-Radius method of georeferencing is the typical means of locating a site. Based on the description in the locality string, a point is placed at GEOLocate's best guess for the most probably site, and then a radius is drawn out from that point to create an uncertainty circle that will include the possible other areas where the specimen(s) could have been collected near the point. The size of the circle is determined by how precise we can be, based on the locality string and general standards for determining the extent of features—you will discover that location descriptions that might seem pretty clear and easy to locate might be comparatively imprecise when compared to more involved descriptions with more pieces to parse.

When creating the uncertainty circle, you will want to include the boundaries of whatever geographic feature it names (unless there is further information that would eliminate a portion of it (e.g. "the west shore of Pine Lake"). **Your job is to evaluate the options GEOLocate provides and accept or edit the best result, or create a new point-radius if necessary.**

5. **Georeference your site:**

There are two steps to georeferencing a site: finding/defining the site location, and determining the extent of the uncertainty.

To find or define the site location, you will need to decide which type of locality information you are working with. Locality information generally makes use of features in a landscape to define where a specimen was collected. A feature may be human made or natural, and have formal or informal boundaries that may or may be naturally or administratively defined. For example, a city is human made and its extent can be described on a map through administrative definitions (the city limits) and/or its proximity to natural geographic features (the shore of a lake or river). The three most common types of sites you will find described in locality strings are are:

- **Named Places—**Natural and man-made features in the landscape such as lakes, mountains, towns, roads, parks, etc with proper names, OR places defined by the locality description (e.g. the junction of two rivers, a township in the PLSS grid system, etc). See *Feature*, *Feature Name*, and *Named Place* in the **Glossary** for more details.

- **Paths—** a locality that is a linear feature, e.g. a road, trail, boundary, river, or contour line.

- **Offset*** **—** a displacement from a reference point, named place, or other feature. Offset is used here as the distance from a named place using the location of the named place as the starting point, and is usually used in conjunction with a heading (N, S, E, W, etc) to give a distance and direction from a named place.

** Term definition adapted from "Guide to Best Practices for Georeferencing." See Bibliography for full citation.*

Locality String	Type of Location	Explanation
Milwaukee, Union Cemetery.	Named Place	A defined location within the city limits of Milwaukee, WI.
Wauwatosa, Parkway where Honey Creek joins the Menomonee River, near North 72nd Street north of West Wisconsin Avenue.	Named Place	The junction of three linear features.
Bordering Rio Grande near El Paso.	Path/ Linear Feature	A section of river near a named place.
Minnesota, St. Louis, Duluth, Near College of St. Scholastica on Highway No. 4	Path/ Linear Feature	A section of road near a named place (College of St. Scholastica) within the city limits of another named place (Duluth, MN).
Kenosha County, Shore of Lake Michigan	Path/ Linear Feature	The section of shoreline within the confines of county borders.
Oak Creek, W of, above mtn creek, in mesquite prairie on hills.	Offset	A feature (mesquite prairie on hills), west of a named place (Oak Creek), above an unnamed feature (mtn creek).
Iola, 15 mi S of [15 miles south of Iola]	Offset	Area 15 miles south of a named place (Iola).
Hawaii Volcanoes National Park. Crater Rim Trail, along the edge of Kilauea Caldera between Field Center and Volcano House.	Offset	A section of a linear feature defined by three named places within the main feature (Hawaii Volcanoes National Park.)

Common Circumstances

Obviously, not all sites will have well-defined boundaries, but many of them will. The table below summarizes some of the common circumstances you will encounter. A full list of other scenarios—including interpreting offsets, intersections, verbatim latitude & longitude—can be found in the copy of **Georeferencing Quick Reference Guide** (http://www.herpnet.org/herpnet/documents/GeoreferencingQuickGuide.pdf). ***See the Digitization or Collection Manager if you need a copy.***

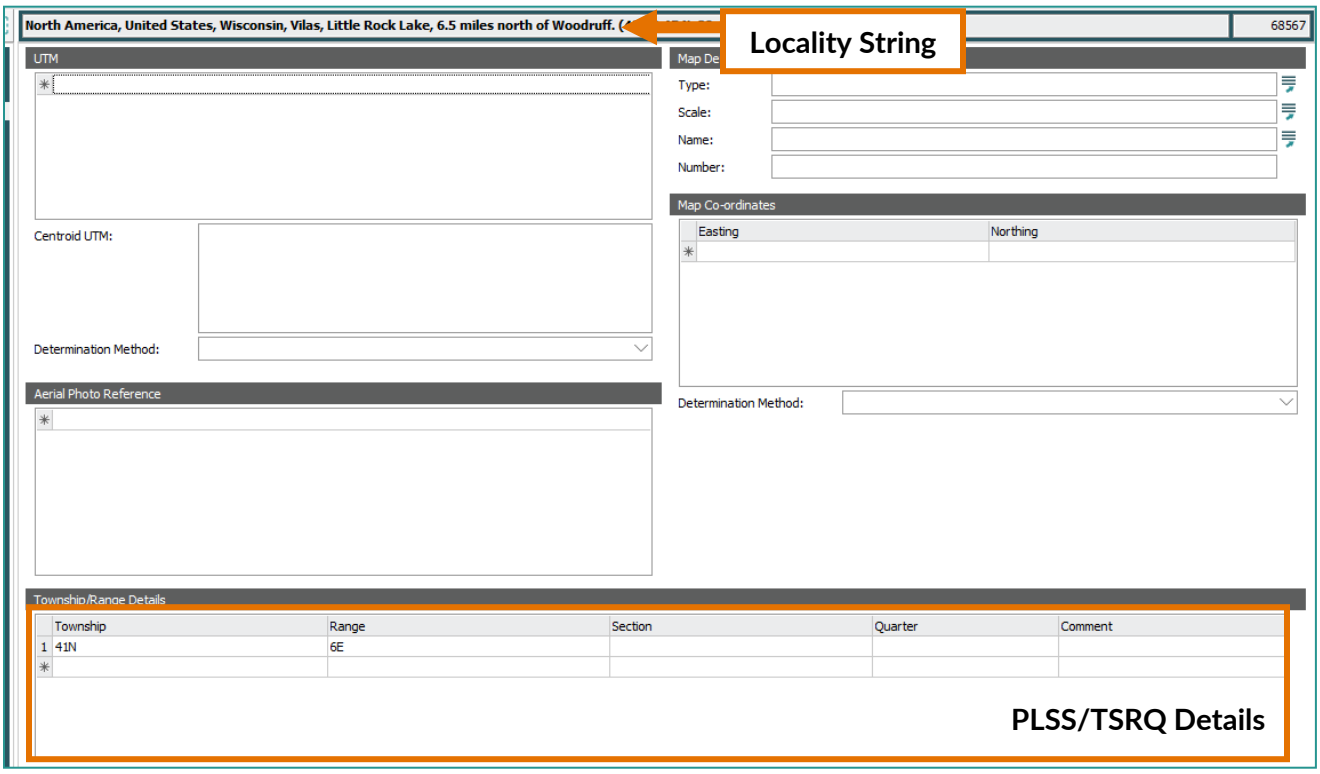
Situation	Finding the Point	Extent	Notes
Named Place w/Defined Area (e.g. "Milwaukee," "Lake Minnetonka," "Isle Royale," etc)	Look at the boundaries of the area; GEOLocate will usually create a polygon around the borders and place the point in the geographic center of the space, or the nearest point within the borders.	The radius should extend far enough that the entire circle contains all borders for the feature.	If GEOLocate does not generate a polygon on the borders of the feature, use the maps to determine as best you can the boundaries of the place.
Named Place w/ Undefined Area (e.g. "Walbecker Bog," "Cuidad Victoria and vicinity")	As near the center of named place as can be determined using a map.	Radius = ½ the distance between the point and the nearest named place (as the crow flies.)	
Street Address	You will probably have to use Google Earth. Put the point in the middle of the property, as near as you can figure.	Make the radius as big as you can ascertain the property to be.	These should always be checked; GEOLocate tends to put them in the middle of the lake. *
Distance from a city (ordinal direction) E.g. 5km south of Eagle	Measure 5 km from the center of the named place.	Radius = ½ of the distance between the point you placed and the nearest named place. If the nearest named place is Eagle, the radius would be half of 5km; 2.5 km or 2500m. If another named place was nearer than Eagle, you would use that named place.	Exception: if the string includes a second named place, like "Pike Lake 5km south of Eagle." *(see Named Place)*
Distance Along Road (e.g. Route 95, 5 km S of Townsville)	Put the point at the measured distance along the road.	Radius= ½ the distance between the point and the place named in the point.	
Path/Linear Feature (e.g. road, river, contour, trail)	Point should be placed halfway between the beginning and end of the path, or if only a section of the whole is named, the halfway point of that section.	Extent should include the whole or the section of the feature noted in the description.	

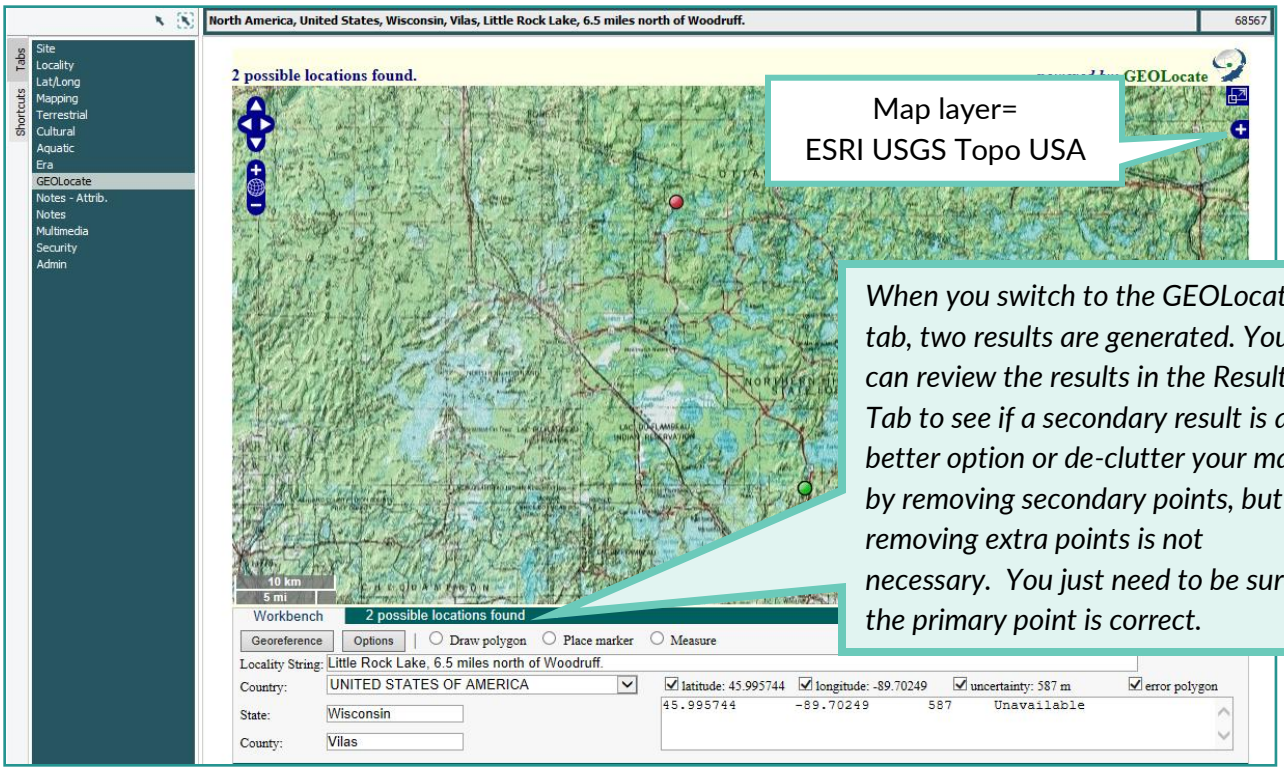
*If you find GEOLocate is erroneously placing terrestrial points in the center of water bodies, try unchecking **Match Water Body** in **Options** (see page 5 for more about the Data Pane's Georeferencing options) and click **Georeference** to generate a new set of results (this box will remain unchecked until you check it again).

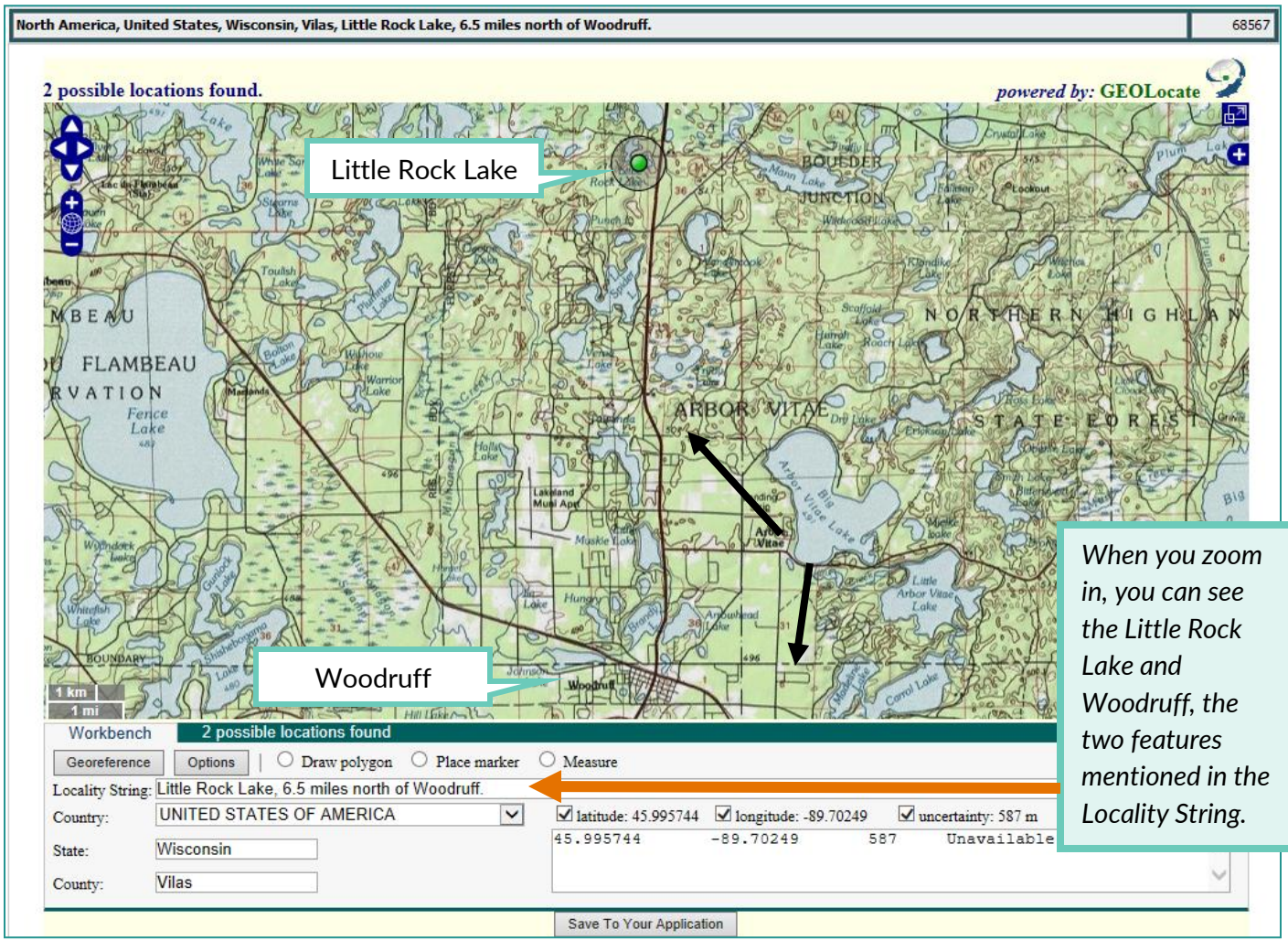
If after reviewing the table and the Georeferencing Quick Reference Guide you aren't sure how to set the uncertainty circle, see the Collection or Digitization Manager for help.

Named Places/Features

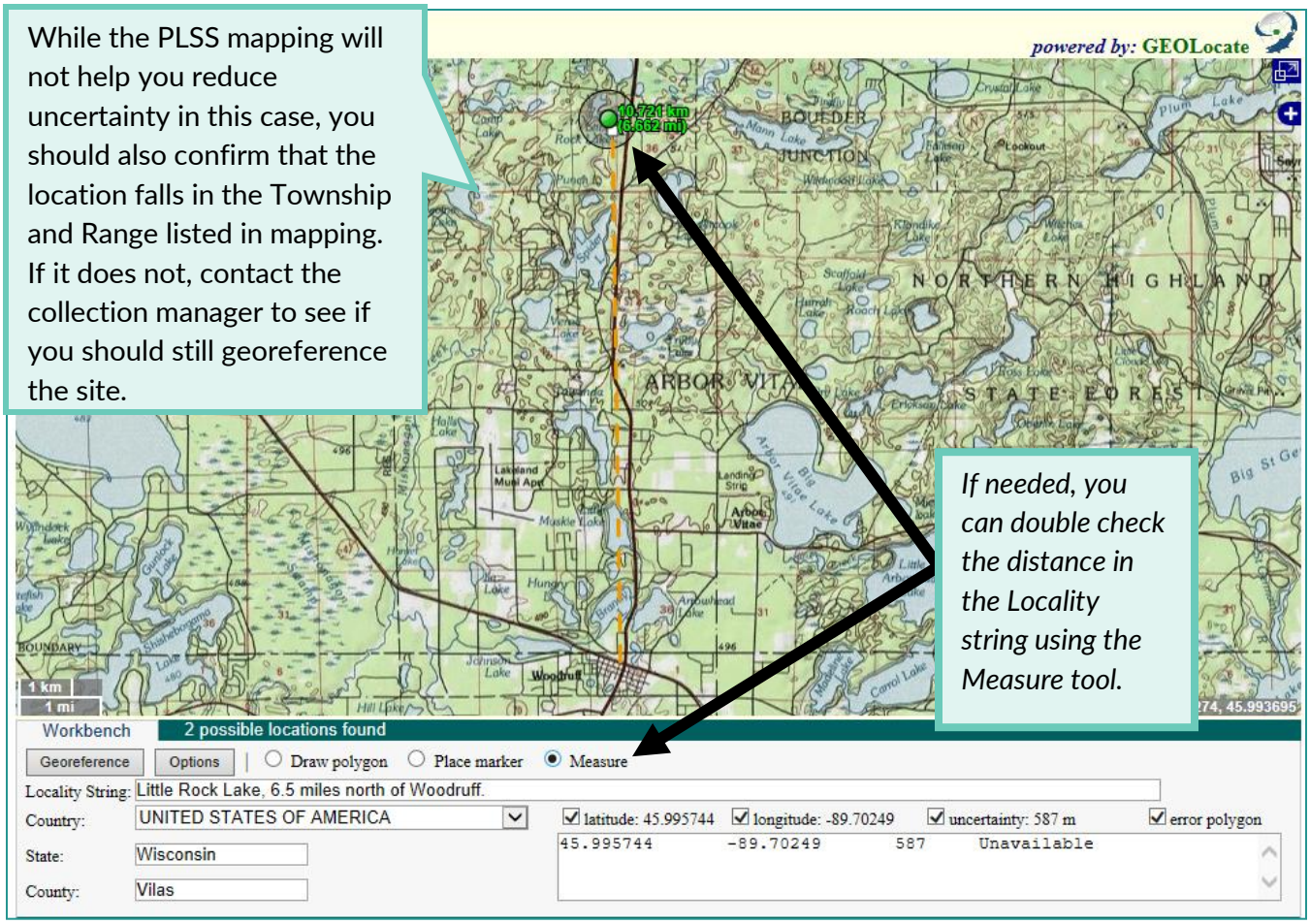
In this first example (shown below using the Mapping Tab), the PLSS Township/Range details only include the Township and Range—a roughly 36 mile square portion of Wisconsin. The locality string provides better detail for mapping the site.




North America, United States, Wisconsin, Vilas, Little Rock Lake, 6.5 miles north of Woodruff.
68567
Site
Locality
Lat/Long
Mapping
Terrestrial
Cultural
Aquatic
Era
GEOLocate
Notes - Attrib.
Notes
Multimedia
Security
Admin
2 possible locations found.
powered by: GEOLocate
Map layer=
ESRI USGS Topo USA
When you switch to the GEOLocate tab, two results are generated. You can review the results in the Results Tab to see if a secondary result is a better option or de-clutter your map by removing secondary points, but removing extra points is not necessary. You just need to be sure the primary point is correct.
10 km
5 mi
Workbench
2 possible locations found
Georeference
Options
Draw polygon
Place marker
Measure
Locality String: Little Rock Lake, 6.5 miles north of Woodruff.
Country: UNITED STATES OF AMERICA
State: Wisconsin
County: Vilas
latitude: 45.995744
longitude: -89.70249
uncertainty: 587 m
error polygon
45.995744 -89.70249 587 Unavailable


North America, United States, Wisconsin, Vilas, Little Rock Lake, 6.5 miles north of Woodruff.
68567
2 possible locations found.
powered by: GEOLocate
Little Rock Lake
Woodruff
When you zoom in, you can see the Little Rock Lake and Woodruff, the two features mentioned in the Locality String.
1 km
1 mi
Workbench
2 possible locations found
Georeference
Options
Draw polygon
Place marker
Measure
Locality String: Little Rock Lake, 6.5 miles north of Woodruff.
Country: UNITED STATES OF AMERICA
State: Wisconsin
County: Vilas
latitude: 45.995744
longitude: -89.70249
uncertainty: 587 m
45.995744 -89.70249 587 Unavailable
Save To Your Application

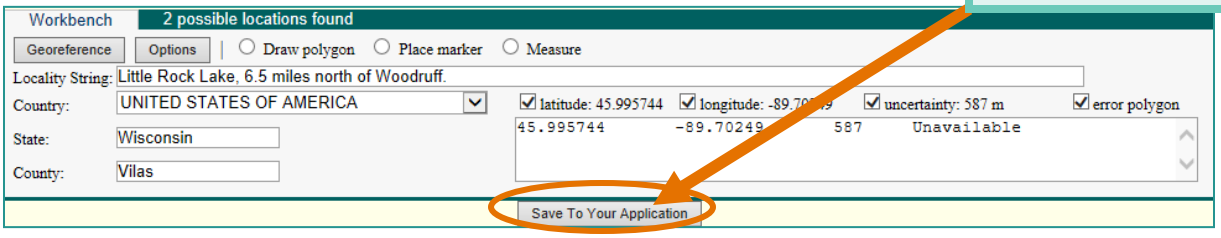
While the PLSS mapping will not help you reduce uncertainty in this case, you should also confirm that the location falls in the Township and Range listed in mapping. If it does not, contact the collection manager to see if you should still georeference the site.



If needed, you can double check the distance in the Locality string using the Measure tool.

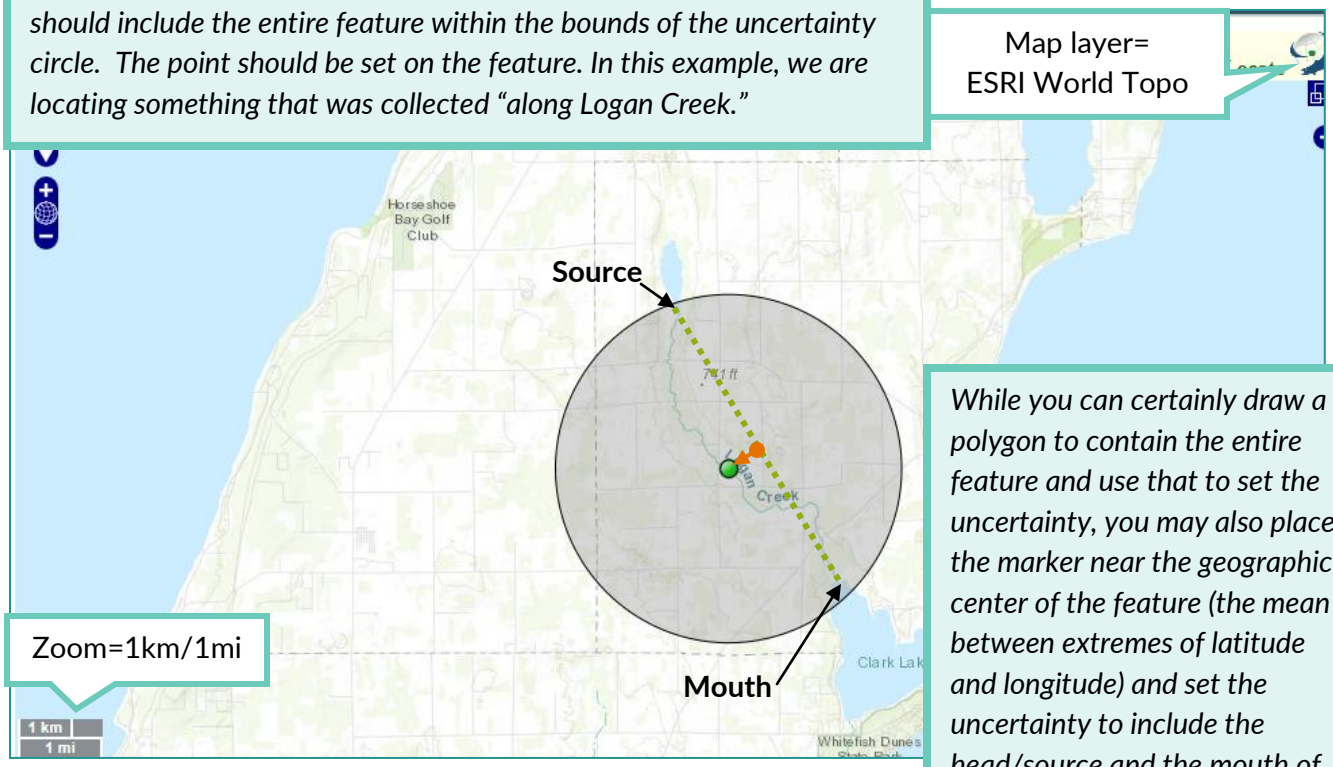
If you zoom in, you can see the borders of the lake are within the uncertainty area.

*Since this seems appropriate for the site, we will save the coordinates by clicking **Save To Your Application.***

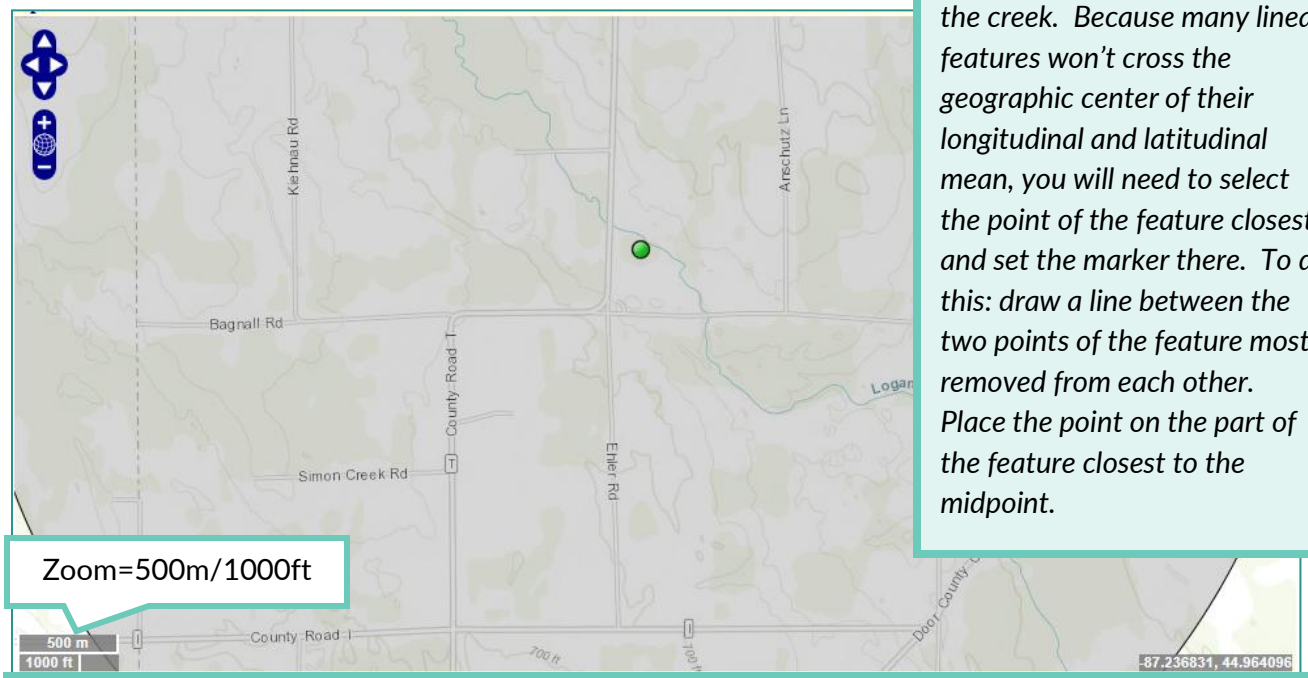


With path or linear features, such as a river, trail, road, or contour, you should include the entire feature within the bounds of the uncertainty circle. The point should be set on the feature. In this example, we are locating something that was collected "along Logan Creek."

Map layer=
ESRI World Topo

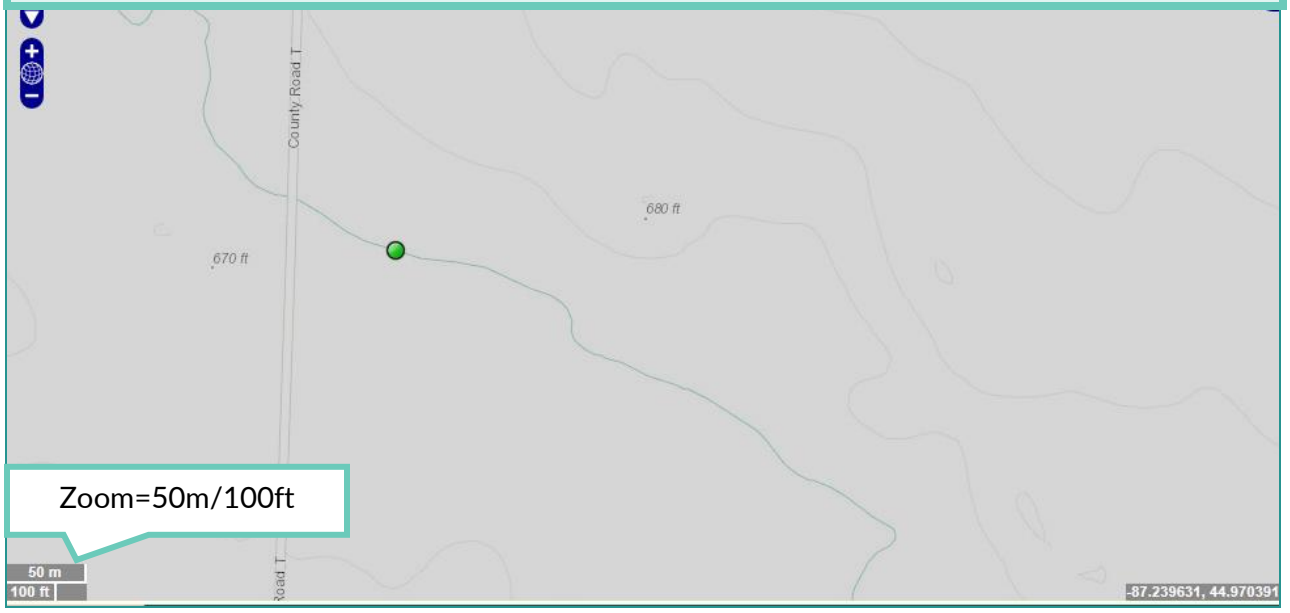


While you can certainly draw a polygon to contain the entire feature and use that to set the uncertainty, you may also place the marker near the geographic center of the feature (the mean between extremes of latitude and longitude) and set the uncertainty to include the head/source and the mouth of the creek. Because many linear features won't cross the geographic center of their longitudinal and latitudinal mean, you will need to select the point of the feature closest and set the marker there. To do this: draw a line between the two points of the feature most removed from each other. Place the point on the part of the feature closest to the midpoint.



Be sure to refine your results by zooming in; as you can see above, zooming from 1km/1 mi to 500m/1000ft shows that the marker is not on the feature, but just below.

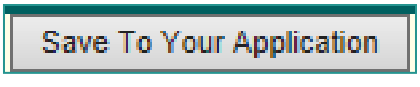
Adjust the placement of the point, zoom out, and adjust the uncertainty if necessary.



When your adjustments are done, you are ready to save the site.

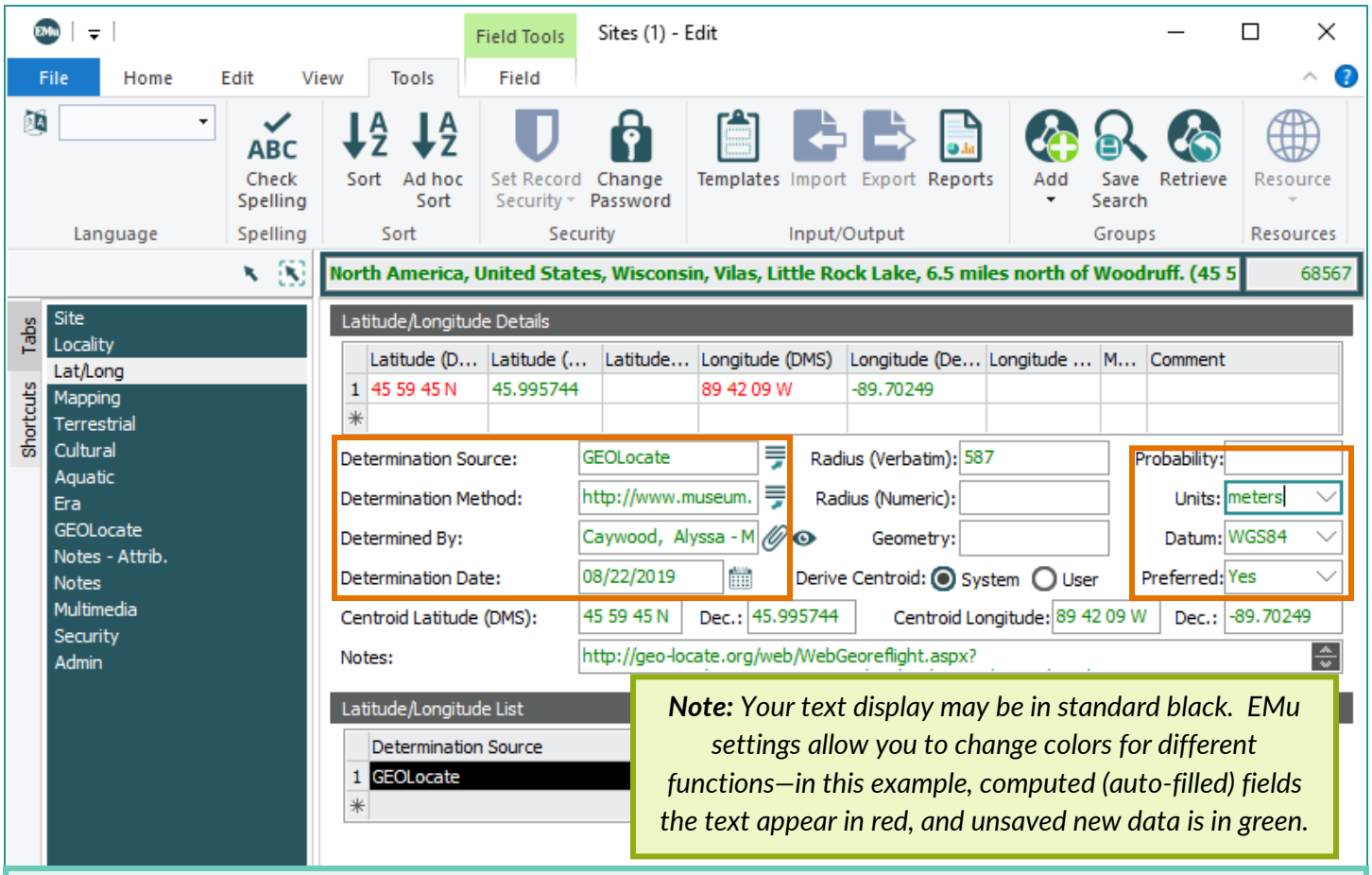
Note: While this example demonstrates what to do if the only locality data available is a named linear feature, generally these features will have other locality data (county, city, or offset details) that will help you narrow the uncertainty to a smaller area. In these cases, instead of using the beginning and end of the feature to determine extent, you would only need to include the feature within the borders of the city, county, etc. to set an appropriate area of uncertainty.

6. Once you are finished georeferencing the site, click Save to your application button at the bottom of the screen.



7. Jump to the Lat/Long tab, and make sure that your changes have been saved. Fill in the following details:

Emu Field	Value	Type of field
Determination Source	GEOLocate	Look up list
Determination Method	http://www.museum.tulane.edu/GEOLocate/instruction	Look up list
Determined By	Your Name	Type it in!
Date	Today's date	Either CTRL+ ; OR use the calendar
Datum	WGS84	Drop down list
Preferred	Yes	Drop down list
Units	Meters	Drop down list



Note: *Your text display may be in standard black. EMu settings allow you to change colors for different functions—in this example, computed (auto-filled) fields the text appear in red, and unsaved new data is in green.*

After the first time you fill in these values, you can press the F9 key in each field to ditto the values on subsequent records.

Please note: if you go back to the GEOLocate tab after saving, the map will not display the point you picked, but rather the algorithm generated points; this will not affect your saved work.

Offsets

A Brief Interlude on Attributed Notes and When NOT to Georeference

While this example did not require the use of any maps other than GEOLocate to georeference the site, it may be necessary to consult other resources *(see Appendix B. Georeferencing Resources for recommended sites).* If you used another resource as a reference, made an assumption or inference about the intended location described, or if you cannot georeference a site, you will need to go to the **Notes-Attrib** tab and add a note. If you cannot determine the precise location of a named feature because the place name has changed, no longer exists, etc, but you do have other mapping coordinates or data that can be georeferenced, go ahead and georeference the site based on the information you can locate. Please leave a note detailing on what coordinates you based your georeference, and any additional information that might help with further research (sources checked, etc). If the precise location conflicts with the other mapping data, please follow the instructions for inaccurate or conflicting localities below.

You should not georeference a site if it is:

- **Too General/Nonspecific:** Only a state, province, or a country is listed, or the locality details are a regional description rather than a specific site-e.g. "SE Arizona," "south rim of Grand Canyon."
- **Dubious:** When the verbatim or precise locality is "probably [location]", "[Location?]."
- **Inaccurate/conflicting:** The location given cannot be correct- e.g. the location you are given does not actually occur in the larger geographic region given.
- **Unable to Determine Location:** After researching the site, you cannot find the location. The location given may have been renamed, no longer exist, it does not show up on any map, etc, and there are no other coordinates or data to make a more general reference. Your collection manager will give you a range for how long to research a site before moving on, but if it's been longer than 20 minutes, add an attributed note and move on.

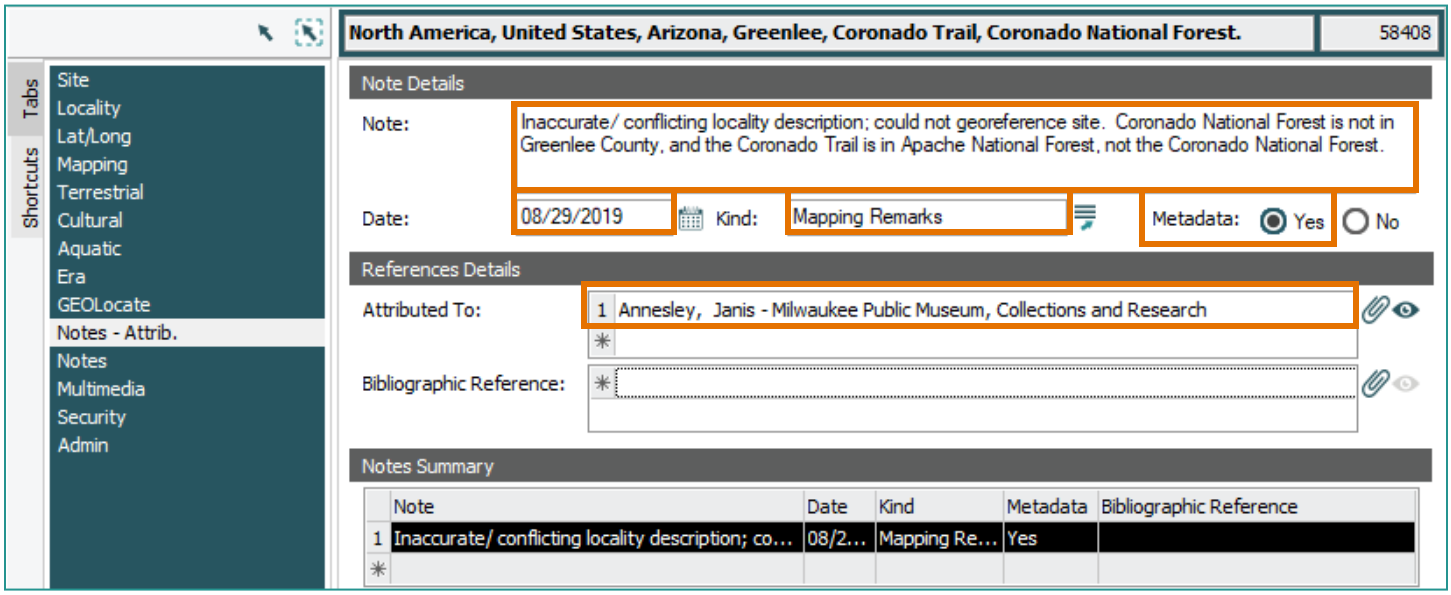
If you cannot georeference a site or had an issue georeferencing, please add a note on the **Attributed Notes** tab (**Notes-Attrib**) and fill in the following fields:

Emu Field	Value	Type of field
Note	Details should be in sentence format with appropriate punctuation. Clearly describe any inferences you made, additional resources you used, or why you were unable to georeference the site. *(See next table for standard Note comments.)*	Text field.
Kind	Mapping Remarks	Look up list
Attributed To	Your Name	Type it in!
Date	Today's date	Either CTRL+ ; OR use the calendar
Metadata	Yes	Radio Button

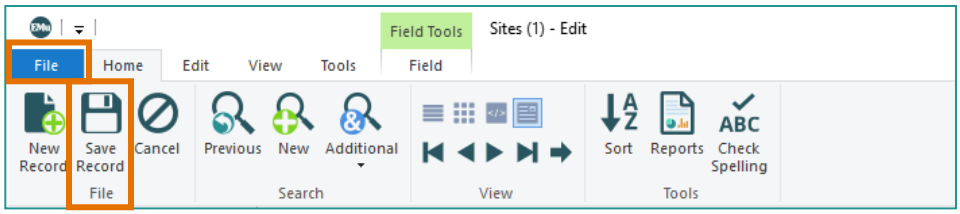
Please use the formatted sentences below to begin your notes on the sites:

Note Reason	Sentence Format
Inference Made	Inference made regarding site locality; [describe what you've assumed and why.]
Cannot Determine Precise Locality	Could not determine precise locality. Georeference based on "[coordinates or other data]." [Provide any details that may be helpful for future research.]
Additional Resources Used	Additional resources used to georeference site: [list resources.]
Dubious Site Locality	Dubious locality description; could not georeference site.
Inaccurate/ Conflicting Site Locality	Inaccurate/ conflicting locality description; could not georeference site. [Follow with explanation of conflict or inaccuracy.]
Nonspecific Locality	Locality description is not specific enough to georeference site. [You do not need to add a Note for states, provinces, or countries.]
Unable to Determine	Unable to determine location; may require further research. [Provide any details that may be helpful for future research.]

Please refer to the screen shot below:



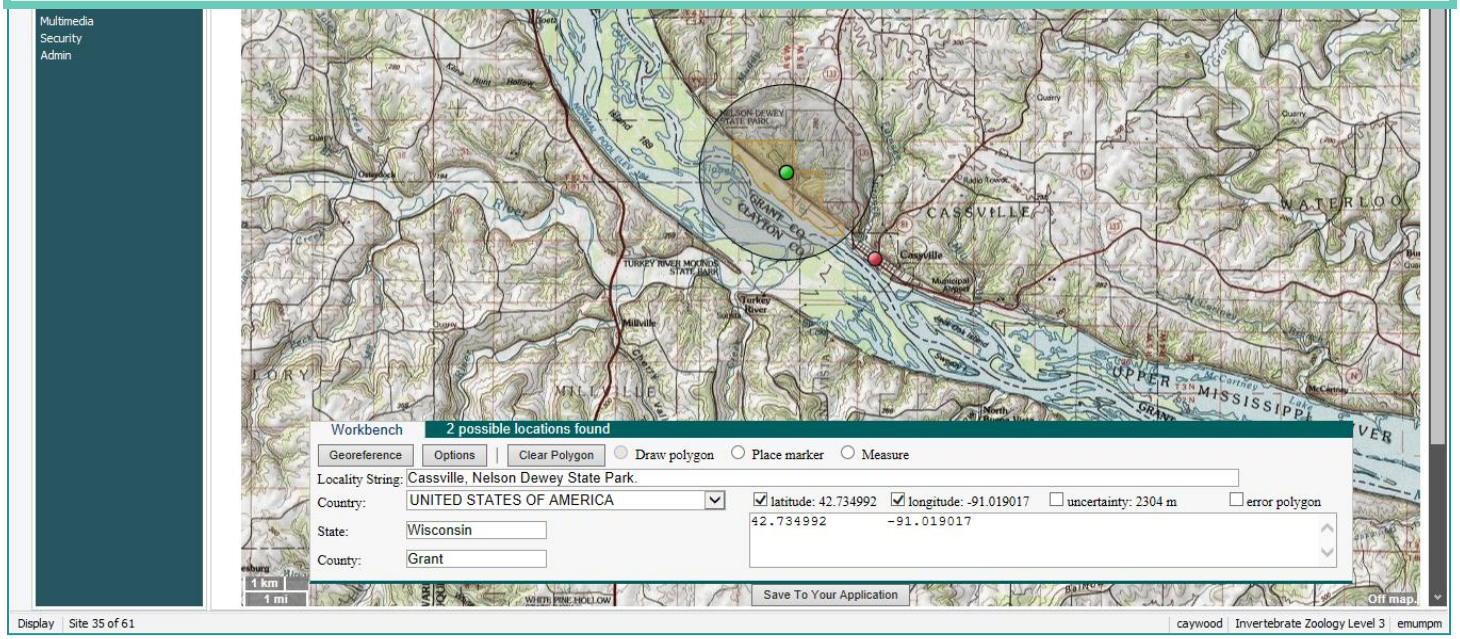
8. **If necessary, add an Attributed Note.**
9. **When you have completed adding any necessary notes, Save the record, and choose the next one from the list.**



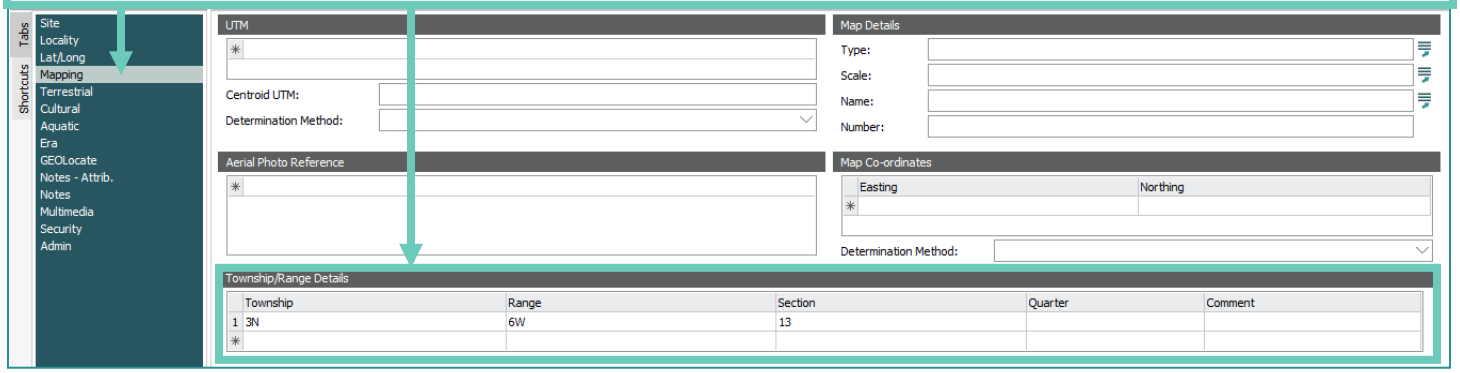
Example 2: Error Polygon Method

When GEOLocate georeferences a site, it will provide an error polygon for those areas that have defined boundaries (e.g. towns, state parks, etc). If the site GEOLocate suggested is not suitable or needs refinement, you may need to place your own marker on the map and adjust the uncertainty area. You may need to use other resources (Wikipedia, Google Maps, etc, or the notes on the site itself) to locate the point.

Because the polygon vertices are not saved to the EMu Sites record, you should consider the Error Polygon Method a tool for refining uncertainty circles, not a permanent addition to the site record. In this example, we will use PLSS data from the Mapping tab in Sites to refine the error polygon provided and reset point and the uncertainty.

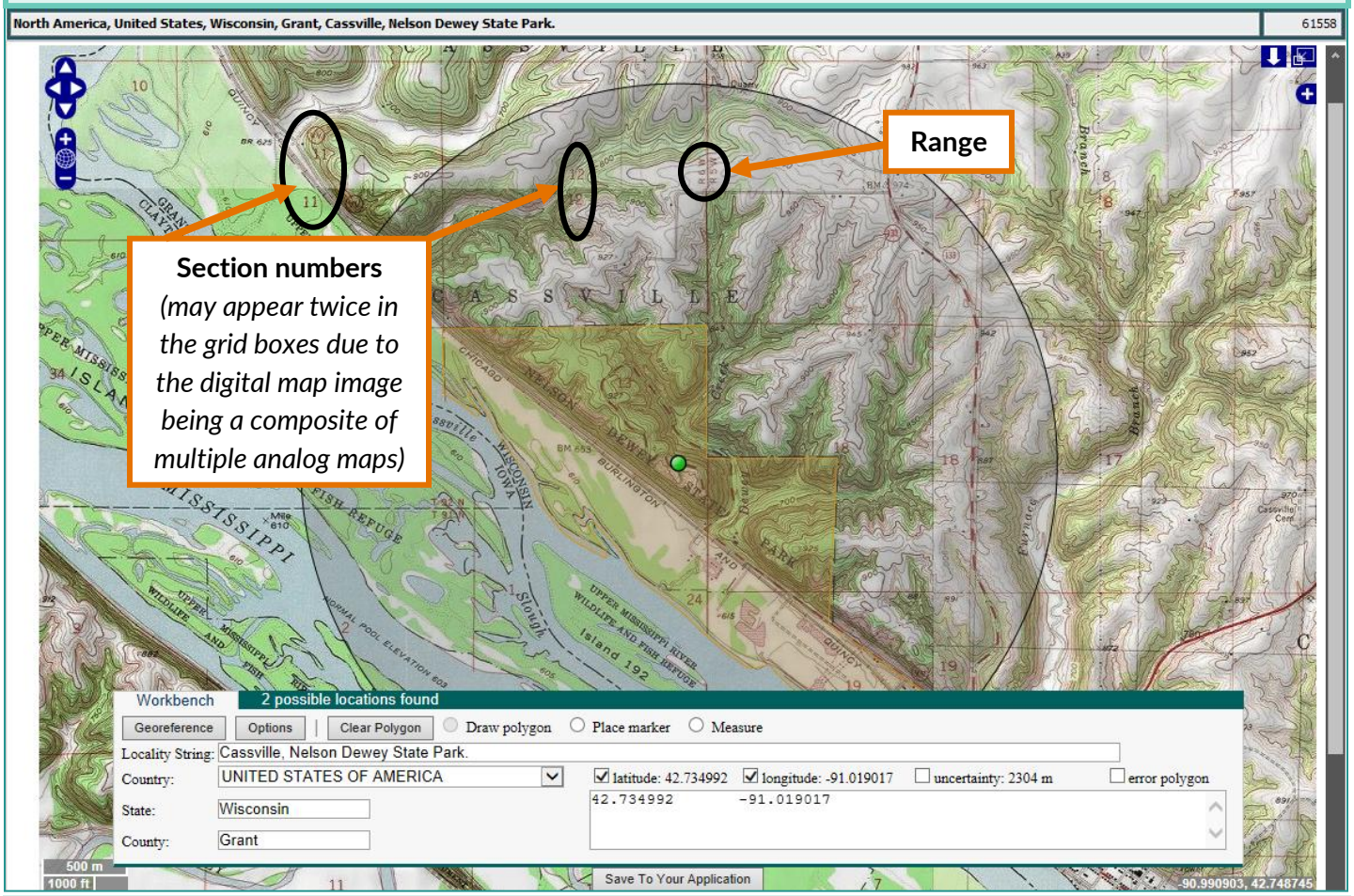


If asked to do so for your site group, you should toggle to the Mapping tab to get the Public Land Survey System unit coordinates (if recorded). Note them down for reference. (Ex: Township=3N; Range=6W; Section=13 or T3N/ R6W/ S13). This data can help refine your uncertainty area.



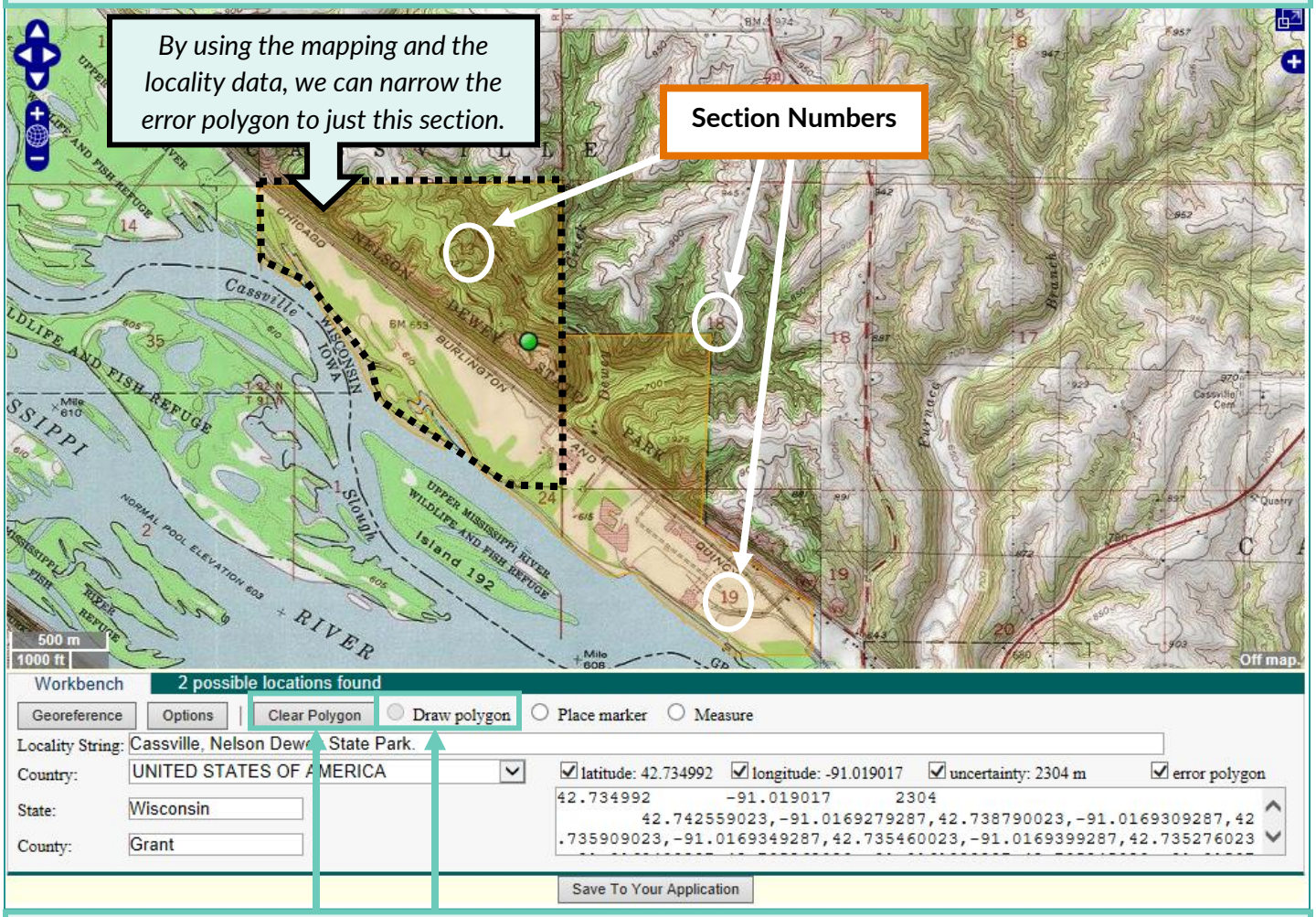
If you zoom in (you can use the map buttons or the scroll wheel on your mouse) you can see the PLSS unit boundaries on the map.

The USGS maps are composite images from scanned maps, so the map may look different as you zoom in/out, or certain sections may vary in color intensity. The Section boundaries are in red with their numbers in red at the center of the section, and the Townships and Ranges are written along their borders (but not always consistently; it may require some searching).

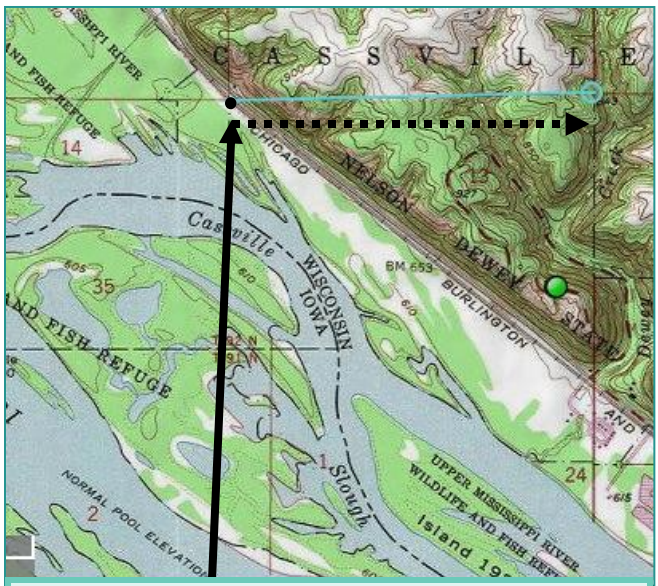


Because the error polygon and the uncertainty overlays both darken the map, you may find the map easier to read if you turn off the uncertainty while you examine the map to draw the error polygon. You can turn off the display of these items by clicking on the  *at the top right corner of the map.*

When we checked the mapping tab, the following information was recorded: T3N/ R6W/ S13. The error polygon below traced the borders of Nelson Dewey State Park, but includes the portions of the park that are in other sections. We will need to draw the polygon to include only section 13 (S13).

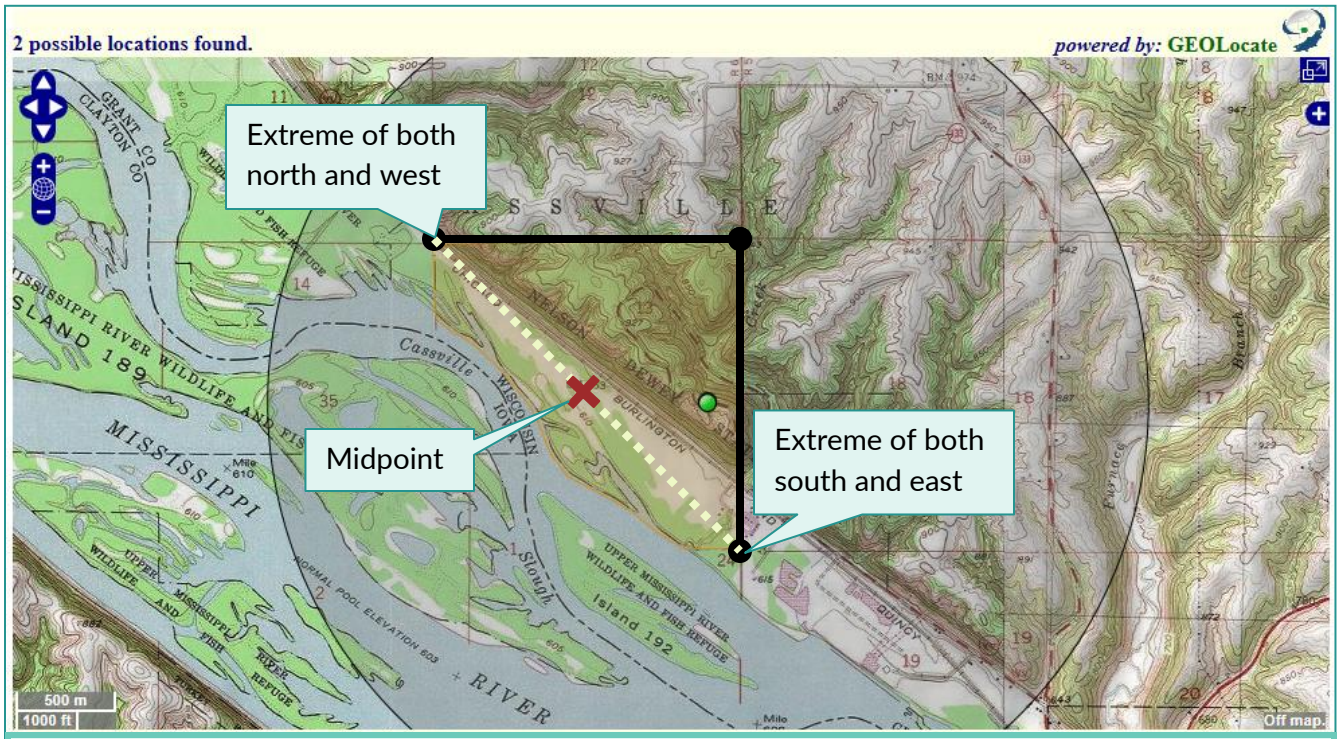


To draw a polygon, first click the "Clear Polygon" button and then click the "Draw Polygon" radio button.

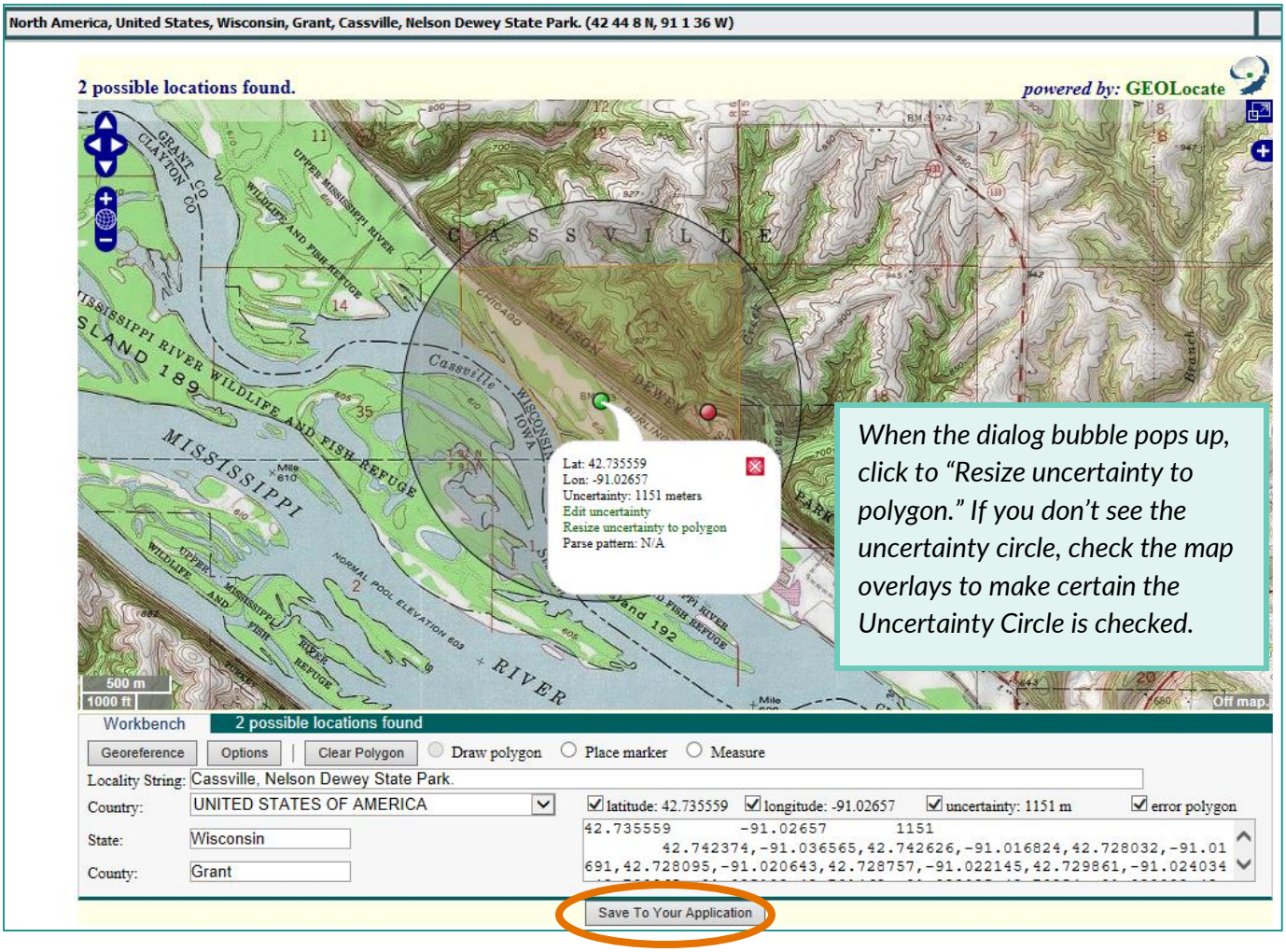


Place the cursor over your first corner, then click to begin tracing the polygon. Each click will produce a new vertex (corner.)

When you are back to the first corner, double click to close the polygon. You will see the polygon highlighted in orange. If you don't see the polygon, check the map overlays to make certain the Error Polygon is checked.



When done, use the cursor to move the green dot to an area in the geographic center of the polygon. To do this: find the halfway point between the most extreme (furthest away) points of the polygon The mean of those values combined will be the midpoint. If the center is outside the polygon, adjust so the green dot is within the boundaries you have drawn.

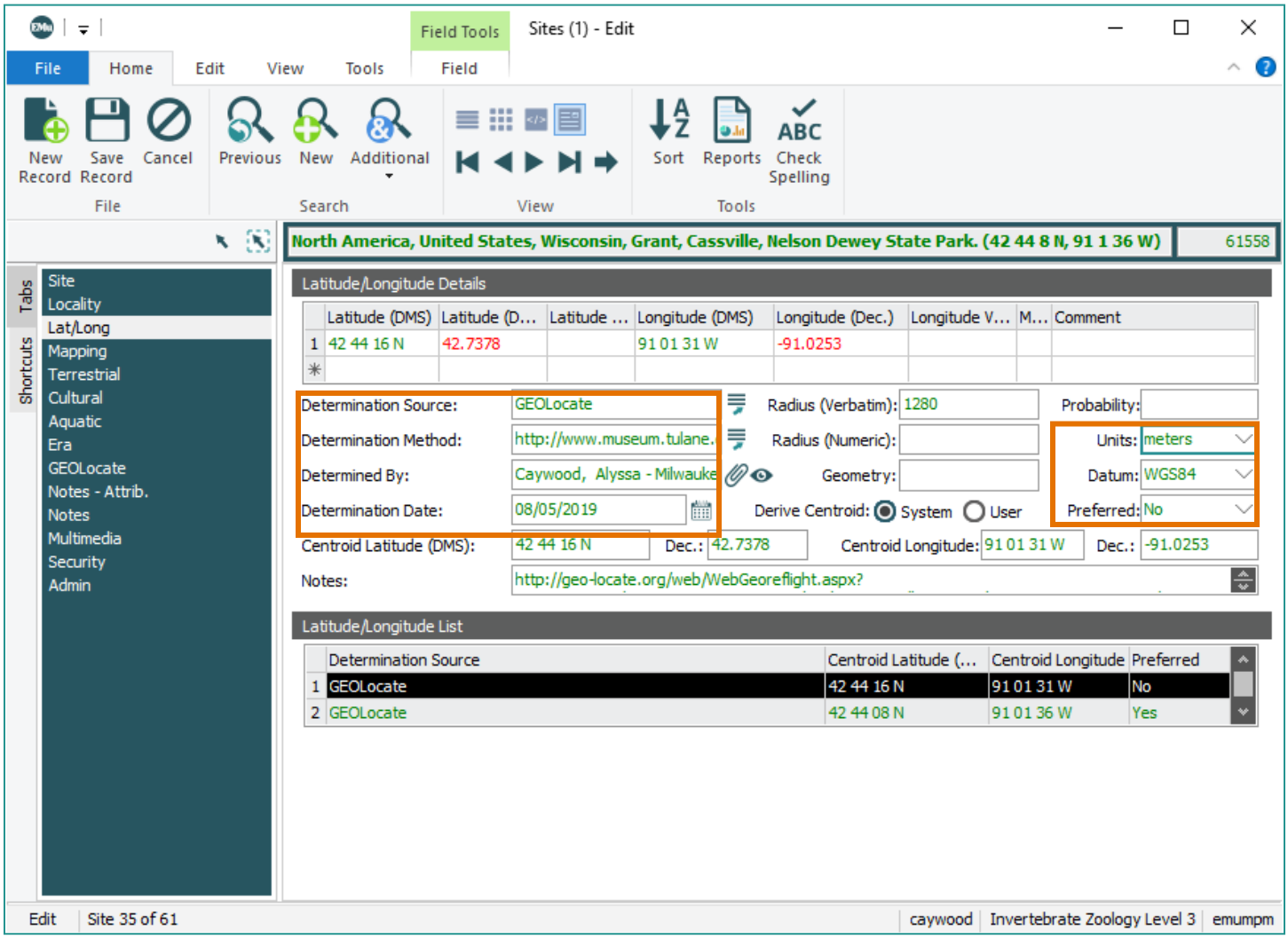


6. Once you are finished georeferencing a site, click "Save to your application" button at the bottom of the screen.

7. Jump to the "Lat/Long" tab, and make sure that your changes have been saved. Fill in the following details:

Emu Field	Value	Type of field
Determination Source	GEOLocate	Look up list
Determination Method	http://www.museum.tulane.edu/GEOLocate/instruction	Look up list
Determined By	Your Name	Type it in!
Date	Today's date	Either CTRL+ ; OR use the calendar
Datum	WGS84	Drop down list
Preferred	Yes	Drop down list
Units	Meters	Drop down list

Some details may auto-fill, so you may only be confirming they are correct:



After the first time you fill in these values, you can press the F9 key in each field to ditto the values on subsequent records.

Please note: if you go back to the GEOLocate tab after saving, the map will not display the point you picked, but rather the algorithm generated points; this will not affect your saved work.

8. **If necessary, add an Attributed Note.**
9. **Save the record, and choose the next one from the list.**

Appendix A: Why we bother and other queries

If you already have a location in the database, do you really need the map data, too?

Yes! While we strive to keep our data as standardized as possible, some verbatim descriptions for where a specimen was collected don't fit into a neat category. For example, "Where Pine Creek meets Spruce River, near Cty Rd N" is very specific, but unlike your street address, requires interpretation to find it on a map. Mapping this data gives each specimen a point of origin on a map, which helps give scientists and researchers a more accurate understanding of the distribution of the specimens in our collection. This data, combined with specimen data from other collections, help us understand where these organisms lived over time.

These coordinates are important because while place names and geopolitical borders may change over time, and different types of map projections may be subject to distortion, the coordinate systems used are relatively durable—and the data transferable—so fifty or a hundred years from now you won't need access to maps from the time the specimen was collected to know where it lived. Standardizing locations—as much as we can—to this type of system helps support the long term accessibility to these collections.

Can't a computer do this?

Sort of. If you've used the GEOLocate tool, you can see it can be surprisingly accurate when it suggests a location, but based on the description, it may pull up multiple possible locations. Humans are still better at interpreting the context of the location description and (hopefully) narrowing down the collection site to a particular point on a map (with a smaller degree of uncertainty). The software can get us most of the way there, but humans are still the best at refining and determining the accuracy of the program's guesses.

What if I only have a state?

You don't really need to bother georeferencing any specimen that doesn't have anything more specific than a state or province. Any location description much larger than a county (unless it's a state park or other type of natural area) usually won't need your attention—these we can do automatically. Actually, GEOLocate will not produce a result if you only have State, Province, or Country data. See page 17 for a complete list of circumstances where you shouldn't georeference a specimen.

Is an uncertainty circle ever not necessary?

No. Even if the site where the specimen was collected was located using the latest GPS equipment, there would still be uncertainty. Current technology can narrow the uncertainty to a few meters (or even centimeters), but not remove uncertainty altogether.

Is an error polygon ever not necessary?

Yes. There are several reasons why you might use a polygon to GEOLocate (*follow the link for Georeferencing: The Polygon Method on page 2 for more details*), but for some specimens, including Lepidoptera, it generally doesn't improve the data beyond what putting a marker on a map will do. There are a few exceptions, such as a space like an airfield, or a park, or a natural area—any space that has well defined boundaries. In these cases, the polygon can reduce the uncertainty associated with the site.

Appendix B: Georeferencing Resources

Please refer to these resources for more information about the GEOLocate program and georeferencing methods.

- **iDigBio GEOLocate Basics**
  4 minute tutorial on the web version of GEOLocate (functions in EMu are the same):
  https://vimeo.com/showcase/2163673/video/65222791

- **Guide to Best Practices for Georeferencing.**
  Includes glossary and a technical explanation of how to calculate uncertainty in most situations:
  http://herpnet.org/herpnet/documents/biogeomancerguide.pdf

- **Georeferencing: The Polygon Method**
  How and when to use an error polygon:
  https://www.idigbio.org/sites/default/files/working-groups/gwg/GeoreferencingBlogPolygons_FINAL-1.pdf

- **Georeferencing Quick Reference Guide**
  A short glossary of georeferencing terms and very accessible instructions on how to set your uncertainty radius in most situations: http://www.herpnet.org/herpnet/documents/GeoreferencingQuickGuide.pdf

- **Public Land Survey System (PLSS)**
  The PLSS gives us the town, range, section, & quarter (TRSQ). To understand how the PLSS units are designed: http://www.geography.hunter.cuny.edu/~jochen/GTECH361/lectures/lecture04/concepts/Map%20coordinate%20systems/Public%20Land%20Survey.htm

- **Tutorial on the Public Land Survey System Descriptions**
  The Wisconsin DNR's tutorial on the PLSS grid in Wisconsin:
  https://dnr.wi.gov/topic/forestmanagement/documents/plsstutorial.pdf

- **Wisconsin Township and Range Reference Map**
  A brief explanation of township & range concepts and an excellent map of WI townships.
  https://wgnhs.wisc.edu/pubs/000915/

For alternate maps or for alternate search options for named places:

- **USGS GNIS Feature Search**
  Search for named places and features.
  https://geonames.usgs.gov/apex/f?p=138:1:0:::::

- **Wisconsin Survey Control Finder (PLSS)**:
  Township/Range/County searchable.
  https://maps.sco.wisc.edu/surveycontrolfinder/#7/44.730/-90.143/PLSS/terrain

- **PLSS Map Viewer – ArcGIS:**
  Searchable by place name.

https://www.arcgis.com/apps/View/index.html?appid=019dd6f39fda4d3b811abfab0878b63b

- **The US**: https://viewer.nationalmap.gov/advanced-viewer/
- **Mapcarta**: https://mapcarta.com/

Appendix C: Public Land Survey System Basics

While you don't need to understand the deep history of the Public Land Survey System (**PLSS** or **USPLS**) to create accurate error polygons from mapping coordinates in GEOLocate, it will help you find the appropriate sections on the map more quickly if you have a basic idea of how the grids are laid out. For more in-depth discussions, please review the links provided on the previous page—or poke around online! There are many good sites describing the system in depth. Key things to know about PLSS:

Established by Congress in 1785, this is a grid system designed to partition United States public lands into units for settlement. It was done by teams of humans surveying large sections of land, which means:

- It's not a grid imposed on a map projection, but a reflection of lines measured on the ground.
- It can be used to locate areas, but not specific points.
- The descriptions, like **SW1/4, NE1/4, Section 13, T4N, R2E,** are legal descriptions of parcels of land.

The map below shows the **Principal Meridians** (longitudinal north-south lines) and **Baselines** (the parallels or latitudinal east-west lines) for the surveys. Each colored section represents a different region that was surveyed, each with a unique name for its principal meridian and its own **Origin**—the intersection of the section's principal meridian and baseline.

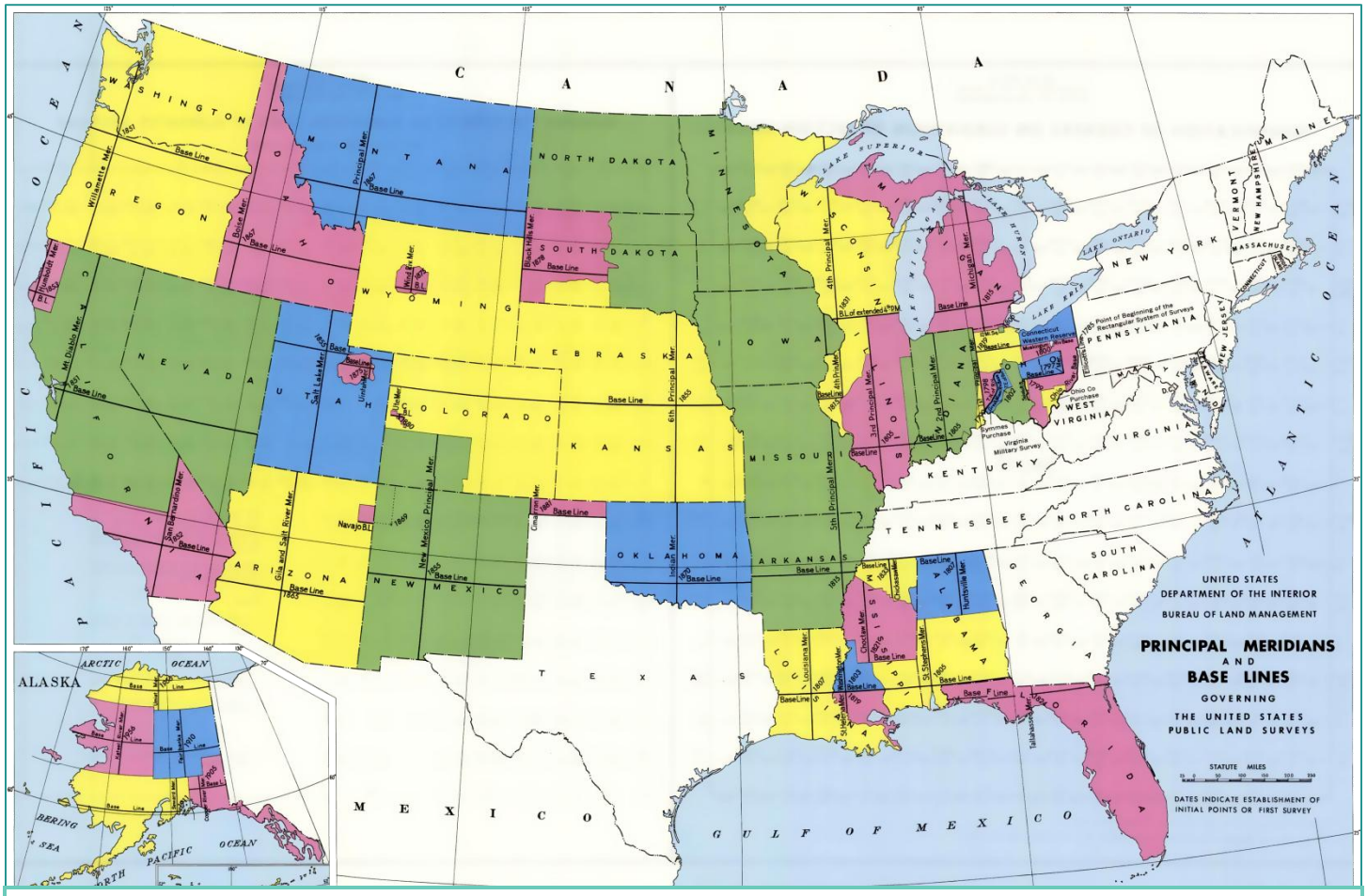
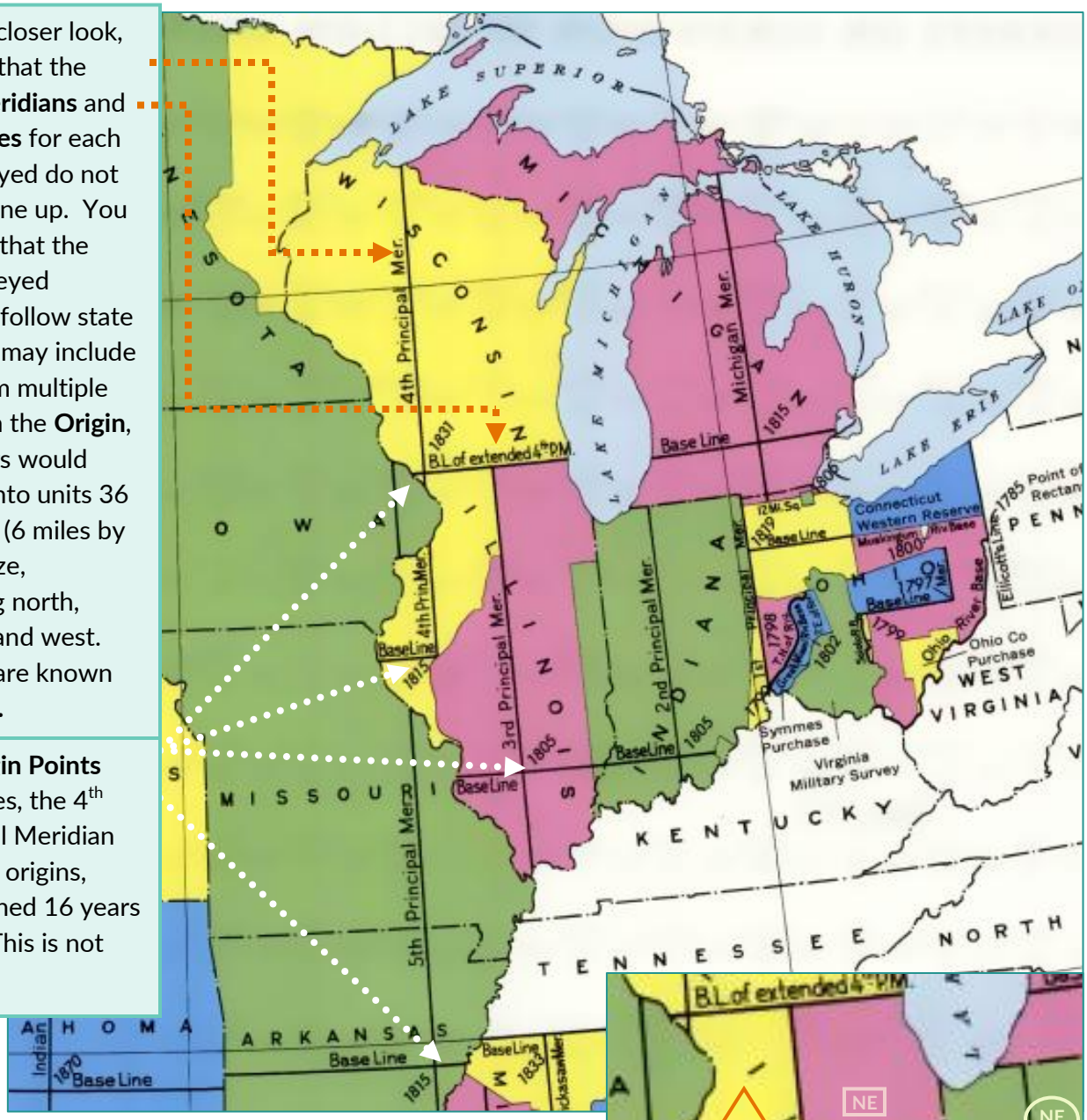


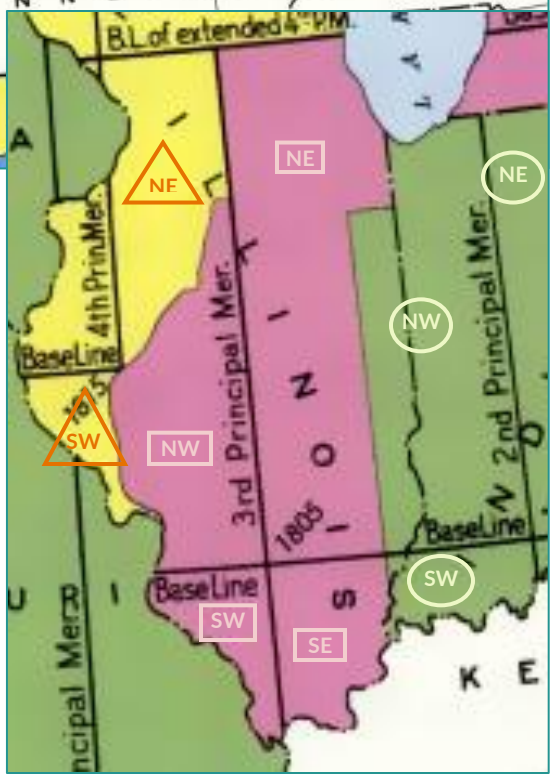
Fig 1. 1988 BLM map depicting the principle meridians and baselines used for surveying states (colored) in the Public Land Survey System. The areas in white are not covered by the PLS system.

If we take a closer look, you can see that the **Principal Meridians** and the **Base Lines** for each region surveyed do not necessarily line up. You can also see that the regions surveyed occasionally follow state borders, but may include sections from multiple states. From the **Origin**, the surveyors would divide land into units 36 square miles (6 miles by 6 miles) in size, incrementing north, south, east, and west. These units are known as ***townships.***

Origin Points

Note: Yes, the 4th Principal Meridian has two origins, established 16 years apart. This is not typical.





- Because the meridians and base lines were chosen for an entire area being surveyed, most states will not have even distributions of townships north or south of the baseline or east and west of the principal meridian. For instance, the base line for townships in Wisconsin follows its southern border, and the principal meridian runs north-south in the western half of the state.
- The units are numbered to the borders of the area surveyed; this can lead to labels for adjacent units seeming peculiar. Illinois is a good example, as the NW townships from the 2nd Principal Meridian survey (circles) are adjacent to the NE townships from the 3rd Principal Meridian survey (rectangles), and the NW and NE units from the 3rd are adjacent to the SW and NE units from the 4th Principal Meridian survey (triangles).

In a lot of ways, the regions surveyed are a patchwork quilt—the numbering pattern of gridlines is consistent within each patch, but may not align precisely (or sensibly) with the next patch. Let's take a closer look at how these grids are laid out, starting with how you identify a unit:

SW1/4, NE1/4, Section 13, T4N, R2E

This would be read as "southwest quarter of the northeast quarter of section 28, township 4 north, range 2 east" and works from the most detailed (smallest) part of the description out to the most general (largest). However, it's a bit easier to do what you're doing—interpreting the location of a particular unit—from the most general labels to the most specific, so we'll start by discussing the **Township** and **Range**.

As noted, from the origin in each of these regions, a grid is created of blocks measuring six miles on each side, known as ***townships***. They are identified by **Township** and **Range** labels. The Township label indicates how many rows north or south of the baseline the unit is and run parallel to the baseline. Range runs parallel to the principal meridian, so the Range label indicates which column the block is in east or west of the principal meridian.

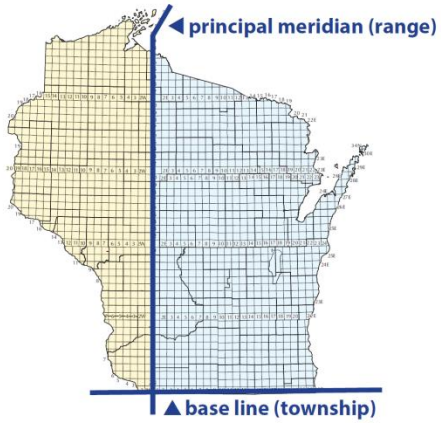


Fig. 2. Wisconsin Principal Meridian and Base line.

In the illustrations below, you can see a horizontal green line indicating units in the 32nd line north (32N) of the baseline, representing the Township. The vertical blue line indicates units in the column 18 to the east (18 E) of the principal meridian. The combination of T32N and R18E identifies a particular township or unit in the grid:

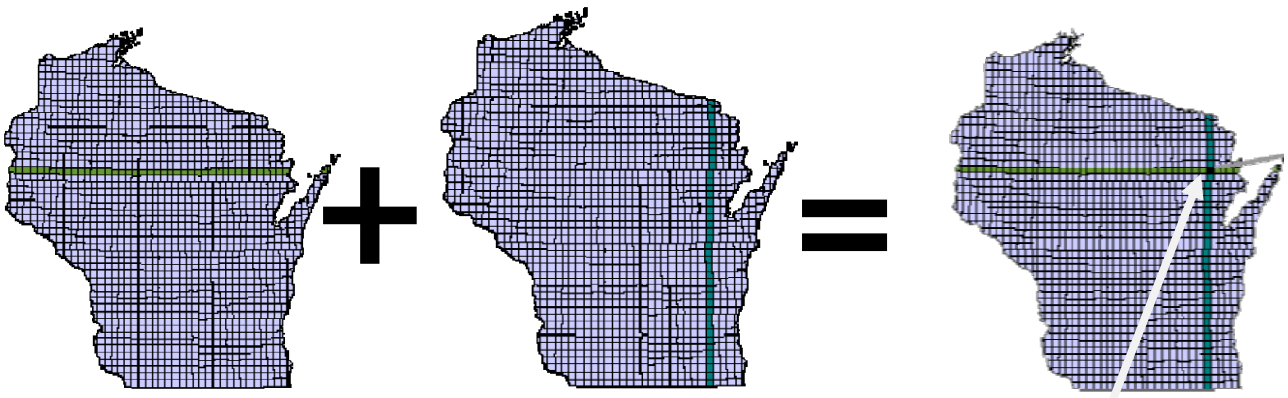
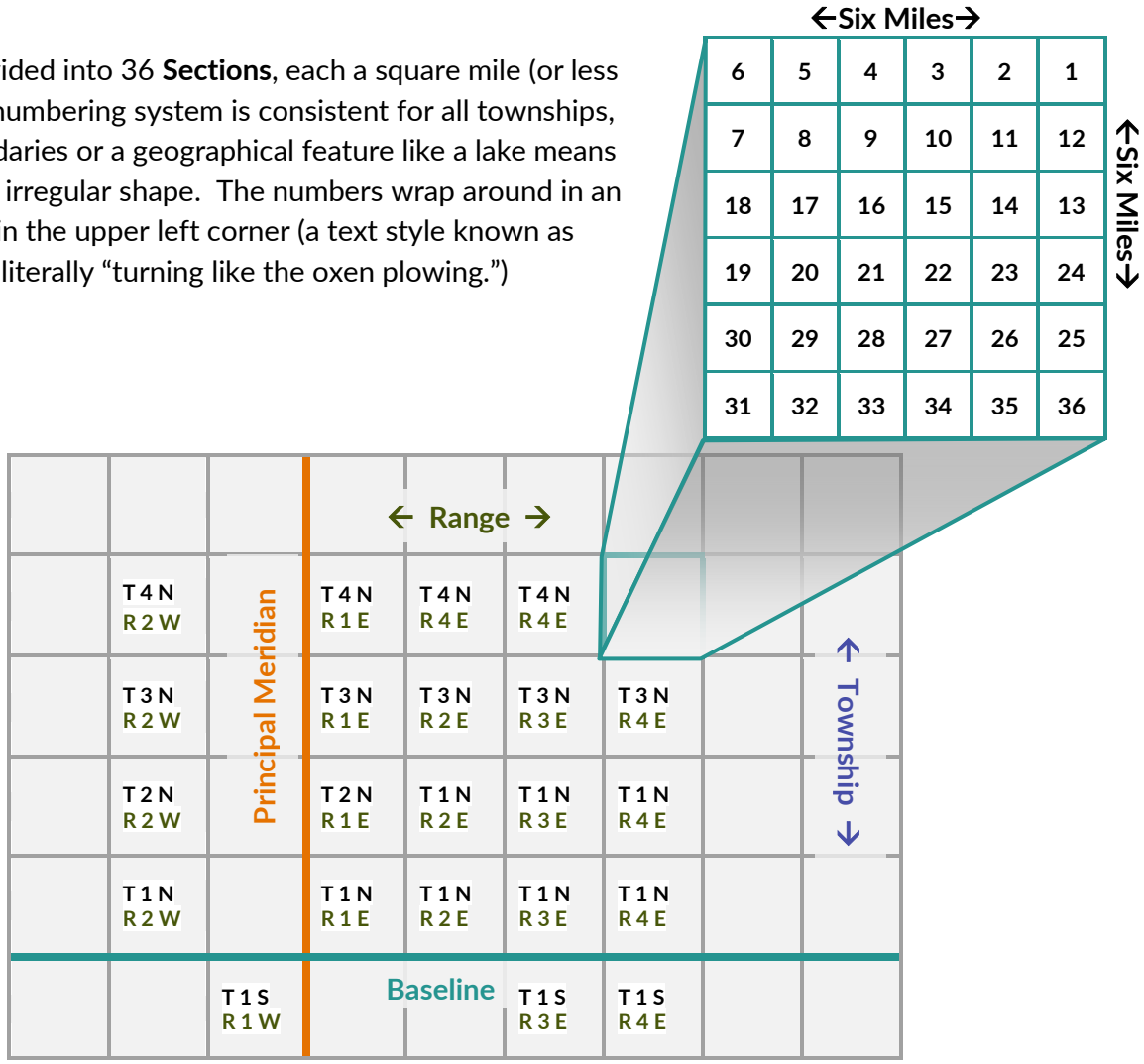


Fig.3.

- In theory, every grid cell represents about 36 square miles, but precision is variable, given the challenges of terrain and the limitations of the instruments of the time used by the surveyors. Grid units should not be used to calculate precise distances.
- Due to issues with laying grids on curved surfaces, the surveyors made corrections every 4th township & range line, so every 24 miles or so the townships are offset from each other. Occasionally, there chunks of land—particularly in the western U.S.—that got missed in error that may not be included in the survey, or if they are, are identified with half numbers (e.g. "T28.5N, R15"). WI does not have any half sections.

Each township is divided into 36 **Sections**, each a square mile (or less near borders). The numbering system is consistent for all townships, even if survey boundaries or a geographical feature like a lake means the township has an irregular shape. The numbers wrap around in an "s" pattern, starting in the upper left corner (a text style known as "boustrophedonic," literally "turning like the oxen plowing.")



Each section is further divided into 160 acre quarters, then each quarter is divided into 40 acre quarter-quarters, then the quarter-quarter is divided into 10 acre quarters, and so on (*you will occasionally see specimen collection sites identified more precisely than the quarter-quarter to the quarter-quarter-quarter level*).

Specimens sometimes straddle two or more quarters. In these cases, a collector may use "half" units (e.g., E1/2 NE ¼, as seen in Fig. 4.) On rare occasions you may also see the notation "C," indicating "center," written on labels as"C- NW ¼."

In EMu "Center" will appear in the **Quarter** field in the **Sites** module's **Mapping** tab in a variety of ways: "N Center," "Center," "C," etc. See the collection manager for assistance in interpreting the Mapping data if you find "Center" in another field.

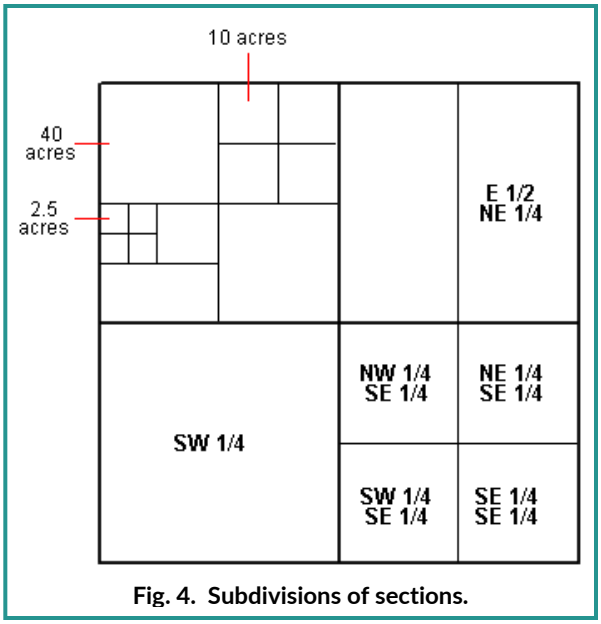
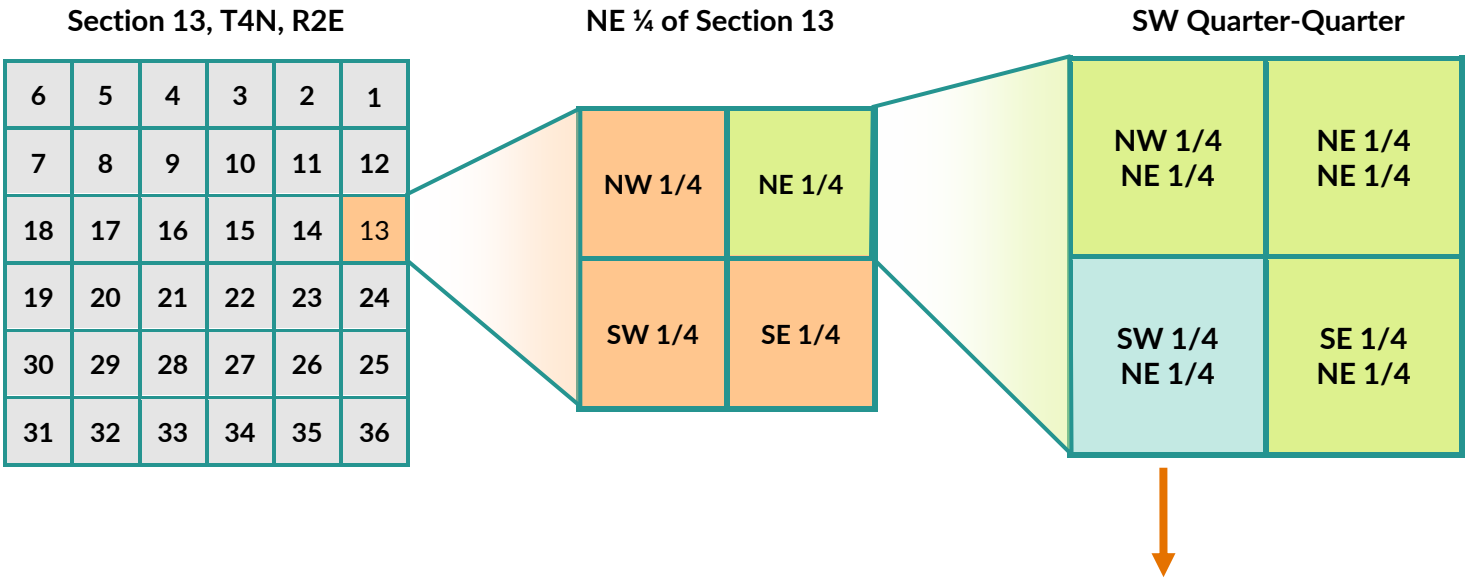


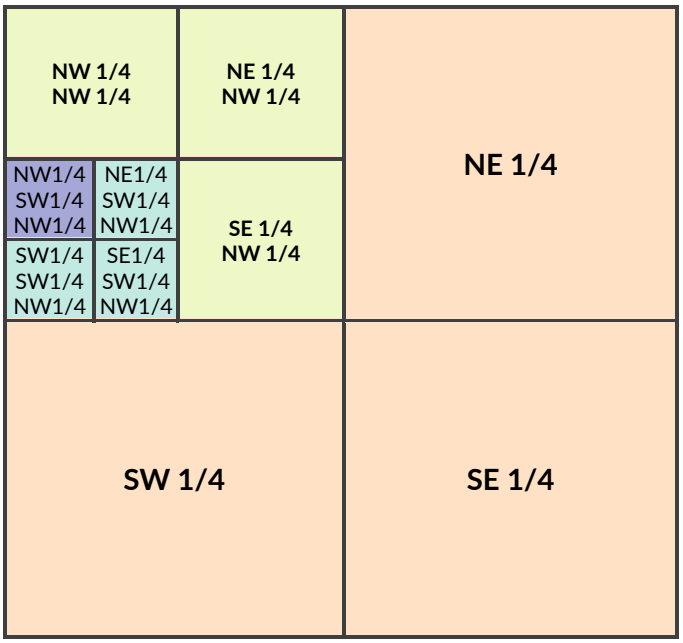
Fig. 4. Subdivisions of sections.

Let's discuss how to identify subsections of Sections by looking at our earlier example, **SW1/4, NE1/4, Section 13, T4N, R2E**. We start by identifying a specific unit of land within the township T4N, R2E:

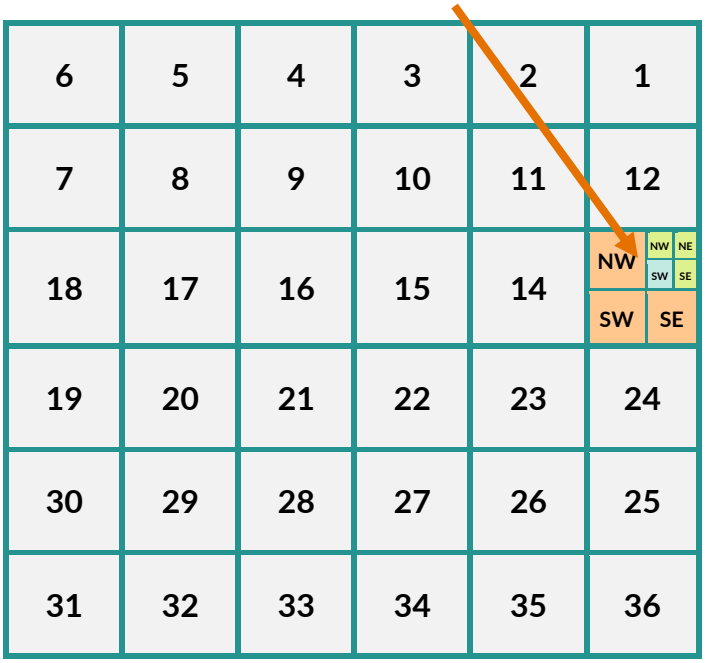


In EMu, quarter, quarter-quarter, etc data will appear in the same field (**Quarter**), which can intitially look confusing; "NW1/4SE1/4NW1/4" , "NW1/4SW1/4," or "SENE," which omits the "1/4" notation. Remember that these are written from smallest detail to the largest, so "NW1/4SE1/4NW1/4" is the "northwest quarter of the southeast quarter of the northwest quarter" of a section. Work from right to left to identify the correct quarter of the quarter-quarter section (below):

NW1/4SE1/4NW1/4



SW1/4, NE1/4, Section 13, T4N, R2E:



Some Quarters in EMu will have non-standard notation (e.g. only a "1," "2," "3" or "4," or "W1/2-27 N1/2-33"). Please see your collection manager for assistance with interpreting these mapping details.

When looking at maps, remember how sections are numbered to spot the borders between townships:

6	5	4	3	2	1	6	5	4	3	2	1
7	8	9	10	11	12	7	8	9	10	11	12
18	17	16	15	14	13	18	17	16	15	14	13
19	20	21	22	23	24	19	20	21	22	23	24
30	29	28	27	26	25	30	29	28	27	26	25
31	32	33	34	35	36	31	32	33	34	35	36
6	5	4	3	2	1	6	5	4	3	2	1
7	8	9	10	11	12	7	8	9	10	11	12
18	17	16	15	14	13	18	17	16	15	14	13
19	20	21	22	23	24	19	20	21	22	23	24
30	29	28	27	26	25	30	29	28	27	26	25
31	32	33	34	35	36	31	32	33	34	35	36

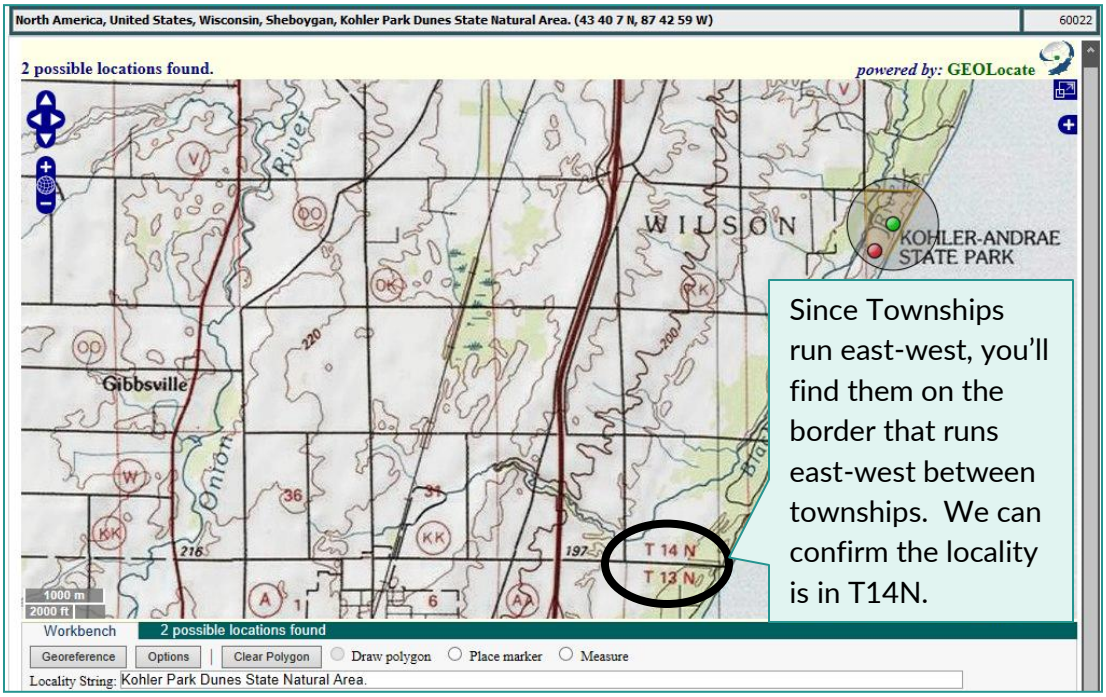
In GEOLocate, the ESRI USGS Topo USA maps have the PLSS townships and sections marked, although how much you see depends on your zoom. At 1000m, you will see the Township and Range boundaries marked, plus the corner sections for each township (1, 6, 31, 36). At 500m, you should see all the sections labeled.

If we apply this to GEOLocate in EMu, we start with the PLSS details, which appear on the Mapping tab:

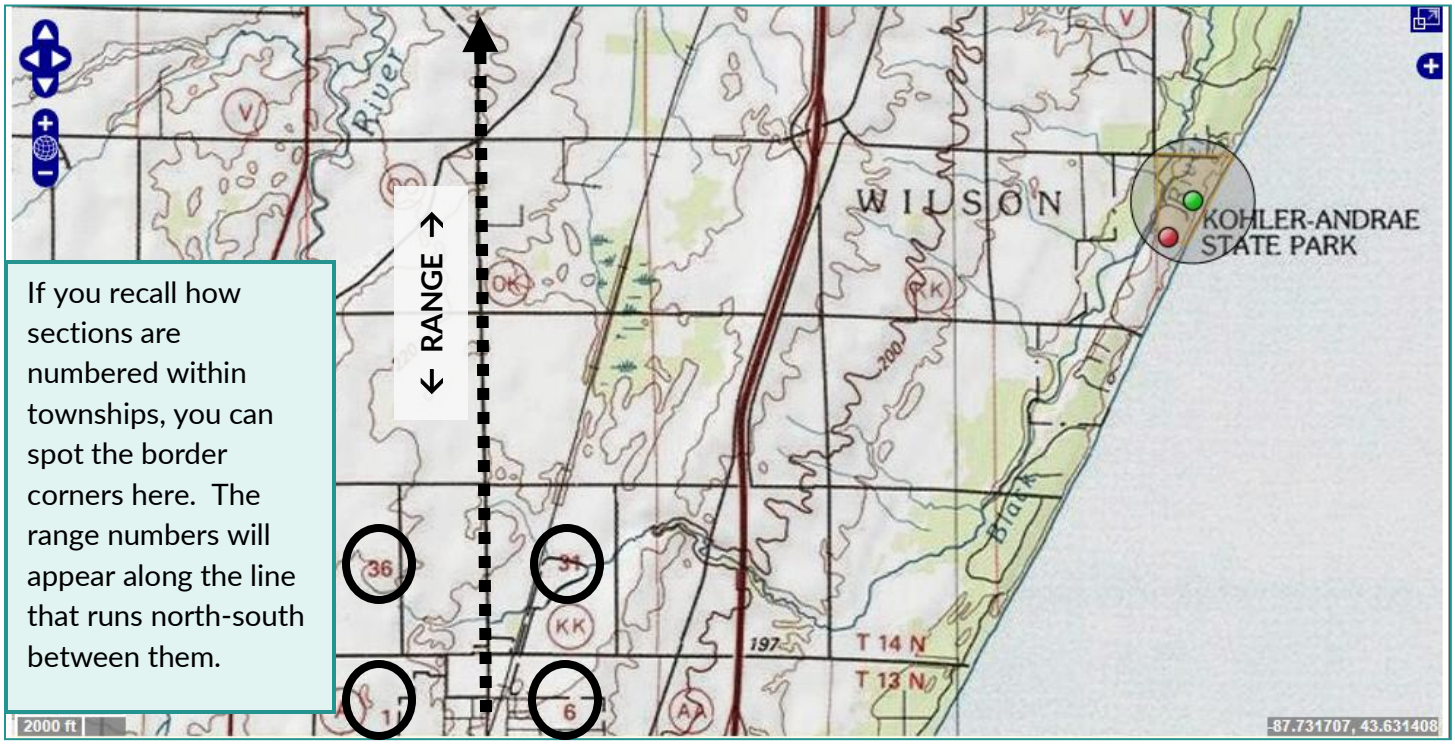
Township/Range Details

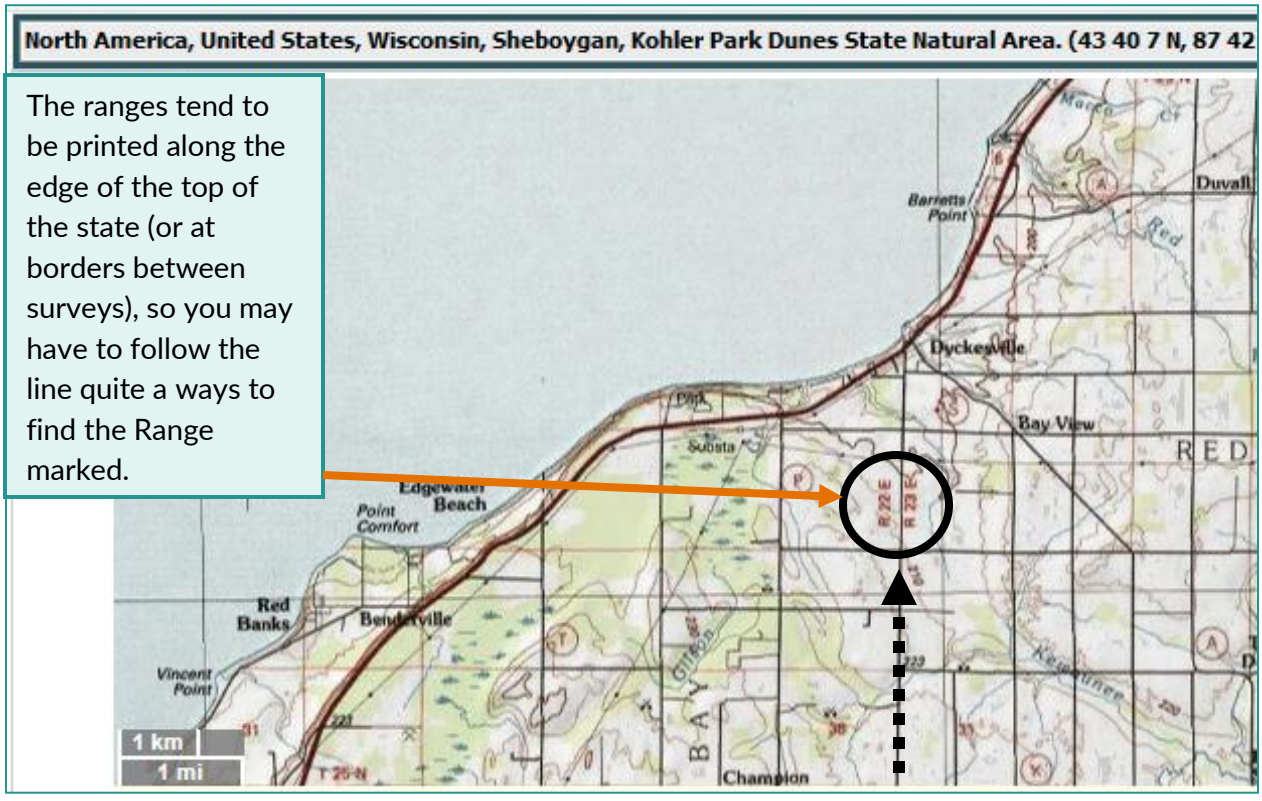
	Township	Range	Section	Quarter	Comment
1	14N	23E	23	NW1/4	
✳					

GEOLocate will generate results based on the Locality String; a quick Google search confirms that Kohler Park Dunes State Natural Area is a part of the Kohler-Andrae State Park. Next, you should confirm the park is in township *T14N*, *R23E*, by looking for the township and range on the map→



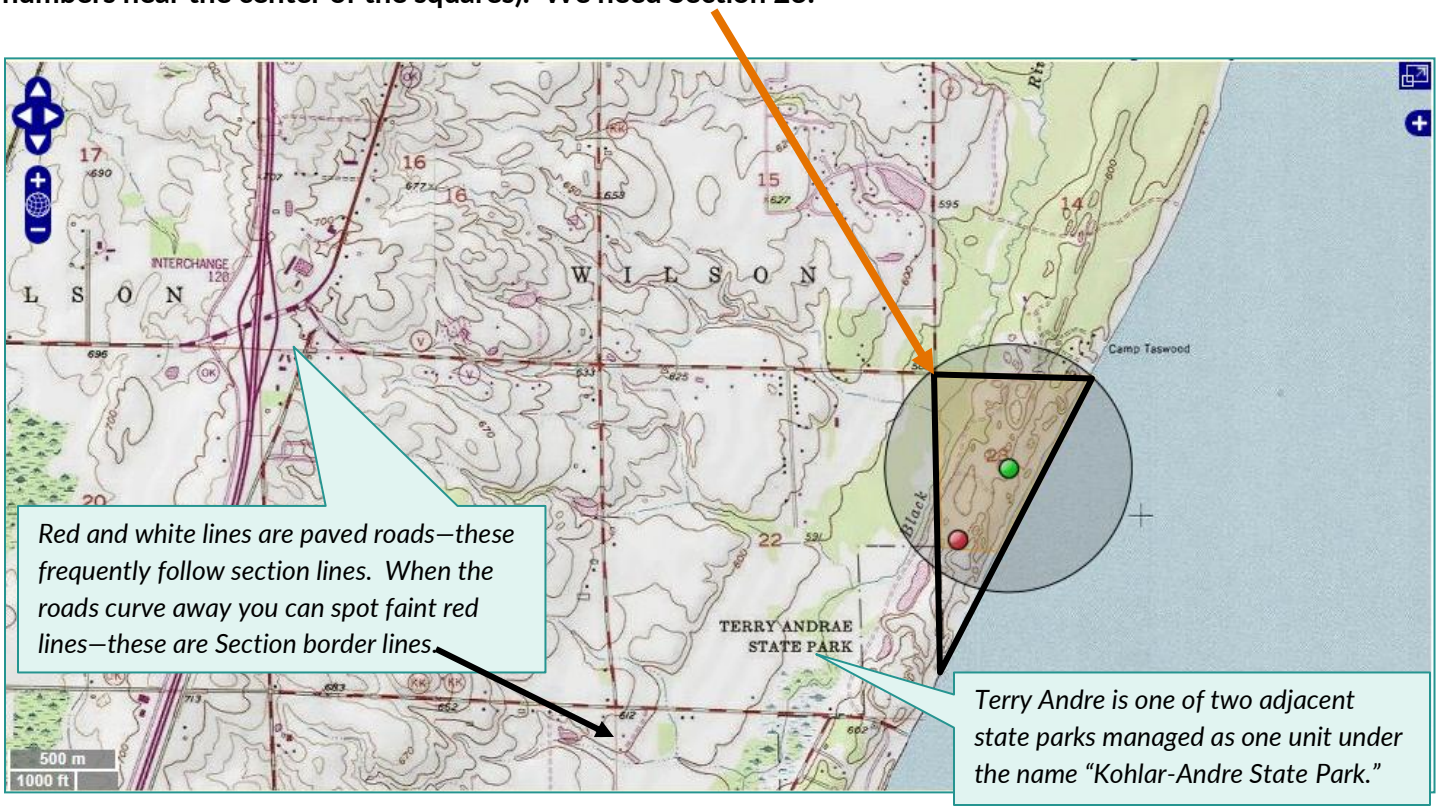
Next you'll want to confirm that the Kohler Park Dunes State Natural Area is in R23E:





If you're comfortable toggling between EMu and maps on the internet, the **Survey Control Finder for Wisconsin** or the **ArcGIS PLSS Map Viewer** are a quick way to cross check Township, Range, and Section details. You will, however, still need to find the necessary points on the GEOLocate map to create a polygon if your project or the site details require it.

With your zoom at 500m, you can see all the section borders (red and white lines) and number labels (red numbers near the center of the squares). We need Section 23:

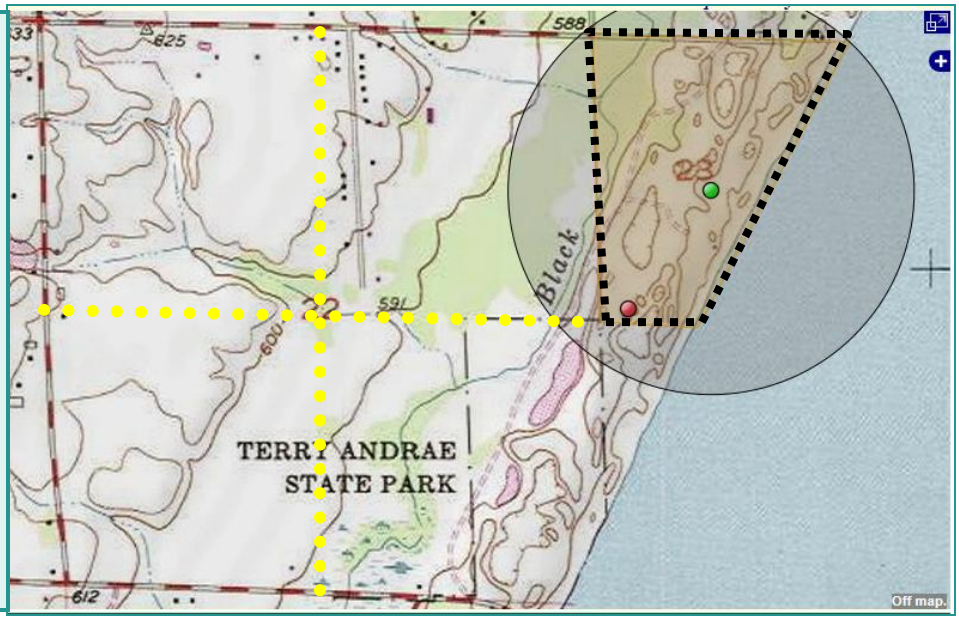


Red and white lines are paved roads—these frequently follow section lines. When the roads curve away you can spot faint red lines—these are Section border lines.

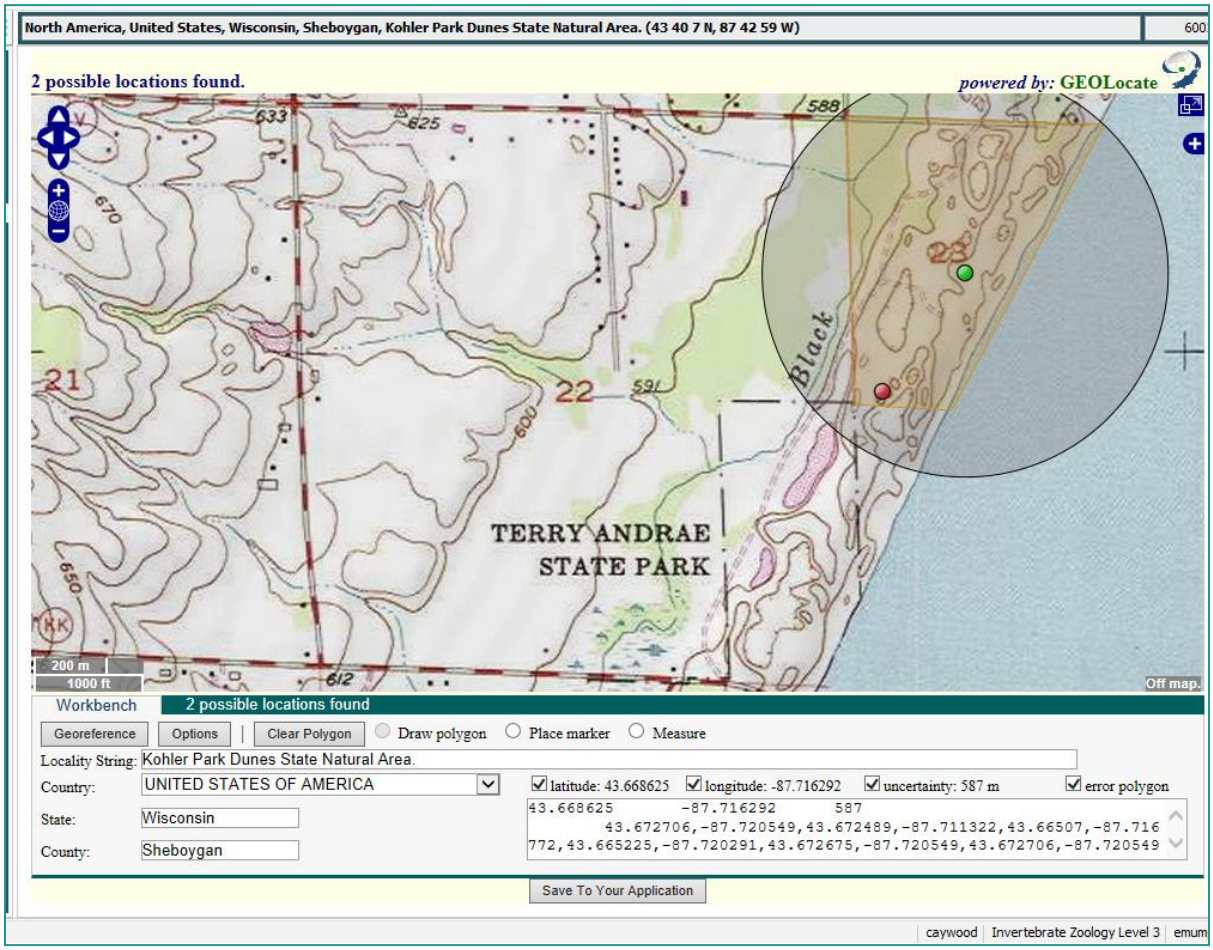
Terry Andre is one of two adjacent state parks managed as one unit under the name "Kohlar-Andre State Park."

Since the mapping details show us that we're looking for the NW1/4, Section 23, T14N, R23E, we need to draw a polygon that only includes the northwest corner of the section:

Due to either the map projection or survey errors, the lines on the map may not be precisely straight—follow the borders as well as you can. For townships along borders the sections may be irregularly shaped. It can be useful to look at an adjacent section to judge where to create the borders for your polygon so that it includes the quarter section you need.



Once you've drawn your polygon, since there is no other locality string data guiding where you set the marker, place it at the geographic center of the polygon. Then reset the uncertainty to the polygon and save your location to the application. Continue to the Lat/Long tab to complete the georeference details.



Note: If the Locality string provides enough detail to narrow the uncertainty even further, you do not need to polygon the section quarter—simply confirm that the marker you've placed would fall in the section or quarter noted, and then plot the uncertainty as appropriate for the feature. If you have questions about how to interpret a Locality description in the context of the PLSS details in the Mapping tab, please see the collection manager for help.

Image credits:

Fig.1: United States Geological Survey. https://nationalmap.gov/small_scale/a_plss.html. (Public Domain.)

Fig. 2: Lippelt, I. D. "Wisconsin township and range reference map." Wisconsin Geological and Natural History Survey. https://wgnhs.wisc.edu/pubs/000915/

Fig. 3: Wisconsin Department of Natural Resources. "Tutorial on the Public Land Survey System Descriptions." https://dnr.wi.gov/topic/forestmanagement/documents/plsstutorial.pdf

Fig 4: Albrecht, Jochen. "Public Land Survey System." http://www.geography.hunter.cuny.edu/~jochen/GTECH361/lectures/lecture04/concepts/Map%20coordinate%20systems/Public%20Land%20Survey.htm

Glossary

Accuracy* — a measure of how well data represent true values.

Datum* — a parameter or set of parameters that serve as a reference or basis for the calculation of other parameters [ISO 19111]. A datum defines the position of the origin, the scale, and the orientation of the axes of a coordinate system. A datum may be a geodetic datum, a vertical datum or an engineering datum. In this document, the term datum generally refers to a ***geodetic datum.***

Error Polygon—in geometry, a polygon is a shape described by a finite series of straight sides. When ***georeferencing***, this can be a shape generated by your software, usually defining the boundaries of a named place like a town, park, or natural area. In ***GEOLocate***, you may also draw a polygon to define an area—this is known as the error polygon.

Extent*— the geographic range, magnitude, or distance which a location may actually represent. With a town, the extent is the polygon that encompasses the area inside the town's boundaries. In this document, we usually refer to the linear extent – the distance from the geographic center of the location to the furthest point in the representation of the location.

Feature* — a natural or anthropogenic object or observation that can be represented spatially. The term "feature" may refer to categories of objects or ***feature types*** (e.g., mountains, roads, or cities) or to specific ***feature instances*** (e.g., Mount Everest, Interstate 25, or San Francisco), which are also sometimes referred to as "named places."

Feature Name* — a proper name applied to a ***feature;*** the name of a named place.

Footprint* — a spatial representation of a ***feature*** as an area. The extent and shape of a footprint may comprise the actual boundaries of a feature, the uncertainty around a point representation of a feature, or some combination of an estimate of the boundaries of a feature and the uncertainty associated with those boundaries.

Geodetic—(adjective) pertaining to **geodesy**, which is the science of measurement of the earth.

Geodetic datum* —a model of the earth used for geodetic calculations. A geodetic datum describes the size, shape, origin, and orientation of a coordinate system for mapping the surface of the earth (NAD27, SAD69, WGS84, etc.). Geodetic datums are often recorded on maps and in gazetteers, and can be specifically set for most GPS devices so the waypoints match the chosen datum.

Geographic center* — the geographic center of a shape is the mean of the extremes of latitude and longitude of that shape. If the result is not within the shape itself, choose instead the point in the shape nearest to the calculated geographic center.

GEOLocate—software developed to assist in georeferencing specimen collection sites. It works by breaking apart the ***locality string*** into common terms and parses out distances, compass directions, and key geographic identifiers (i.e. place names, highway/waterway crossings, distances, etc), using this information to determine a series of possible geographic coordinates. GEOLocate is accessible as an online program, can be downloaded as

a standalone program, or is an application within database programs like EMu, Specify, or Symbiota. *(This is why sometimes you will hear GEOLocate mentioned as a part of EMu and as its own thing—it's both.)* For more details, visit: https://www.geo-locate.org/about.html

Georeference* — to translate a locality description into a mappable representation of a feature (verb); or the product of such a translation (noun).

Locality String/Locality Description—verbal description of where a specimen was collected. Strings can vary from short and relatively non-specific, like "Rock Island State Park" or "Douglas County," to somewhat longer and more specific, such as "Lake Superior beach at the end of Moccasin Mike Road, near Wisconsin Point near Superior," or "Parkway where Honey Creek joins the Menomonee River, near North 72nd Street north of West Wisconsin Avenue." If the information has been ingested into EMu, the original verbatim label information will have been parsed into appropriate fields (state, county, municipality, township/range, etc). GEOLocate can parse the full string and provide results based on part or combinations of pieces of information in the string.

Named place* — used to refer not only to traditional features (q.v.), but also to places that may not have proper names, such as road junctions, stream confluences, highway mile pegs, and cells in grid systems (e.g., townships).

Offset* — a displacement from a reference point, named place, or other feature. Used here as the distance from a named place using the location of the named place as the starting point. Usually used in conjunction with heading to give a distance and direction from a named place.

Path— a locality that is a linear feature, e.g. a road, trail, boundary, river, or contour line.

Point-Radius—a georeferencing method where the most probable point of collection forms the center of a circle with a radius that describes the extent of the feature (named or otherwise) or other possible collection sites described by the locality information.

Uncertainty* —a "measure of the incompleteness of one's knowledge or information about an unknown quantity whose true value could be established if a perfect measuring device were available" (Cullen & Frey 1999). Uncertainty is a property of the observer's understanding of the data.

Uncertainty Circle—when using a GPS, uncertainty is a measure of how accurate the unit is for calculating the actual site location. In georeferencing, it indicates how sure you are of point on the map, which should always contain all of the areas that could be where the specimen was collected *(e.g., a specimen with a label that just says "Milwaukee" would include all of Milwaukee; a specimen with a location of 800 block of West Wells would have an uncertainty that includes the whole block).* Generally uncertainty is expressed as a circle; the center is place over the most likely point where the specimen was collected. Related terms include the *radius* or *area* of uncertainty; a two mile radius from the center point would create an uncertainty area of over 12 miles surrounding the central point.

WGS84 (World Geodetic System 1984) * — a coordinate reference system in common use globally to fit the shape of the entire Earth as accurately as possible using a single ellipsoid. Other ellipsoids (datums) are commonly used locally to provide a better fit to the Earth in a local region.

** Glossary terms from "Guide to Best Practices for Georeferencing." See Bibliography for full citation.*

Bibliography

Albrecht, Jochen. “Public Land Survey System.” CUNY: http://www.geography.hunter.cuny.edu/~jochen/GTECH361/lectures/lecture04/concepts/Map%20coordinate%20systems/Public%20Land%20Survey.htm

Chapman, A.D. and J. Wieczorek (eds). 2006. “Guide to Best Practices for Georeferencing.” Copenhagen: Global Biodiversity Information Facility. http://herpnet.org/herpnet/documents/biogeomancerguide.pdf

Lippelt, I. D. “Wisconsin township and range reference map.” Wisconsin Geological and Natural History Survey. https://wgnhs.wisc.edu/pubs/000915/

Wieczorek, John, et al. 2012. “Georeferencing Quick Reference Guide.” http://www.herpnet.org/herpnet/documents/GeoreferencingQuickGuide.pdf

Wisconsin Department of Natural Resources. “Tutorial on the Public Land Survey System Descriptions.” https://dnr.wi.gov/topic/forestmanagement/documents/plsstutorial.pdf

Yost, Michael. “Georeferencing Procedure Outline.” iDigBio: https://www.idigbio.org/content/steps-georeferencing-specimen-locality-data-community-examples

Yost, Michael. “Georeferencing: The Polygon Method.” iDigBio: https://www.idigbio.org/sites/default/files/working-groups/gwg/GeoreferencingBlogPolygons_FINAL-1.pdf

GEOLocate Quick Start Checklist and Tables

Welcome back to georeferencing! If you only need a reminder on the steps to georeference a site, below is a brief checklist. Refer to GEOLocate Features (pg. 5) for more details on the tools in the tab, and GEOLocate: A Guide to Georeferencing (pg. 11) for screen shots and more detailed instructions on how to georeference sites.

- ☐ When you've opened EMu, go to the **Sites** module.
- ☐ In Sites, open your list of sites (**Tools>Retrieve**) to georeference and sort the list (**View >Choose> IRN Summary Data Mapping** (or whatever sort you prefer)).
- ☐ Select the first site to georeference; if it has PLSS mapping data, note it down or go to the **Mapping** tab and record the TRSQ details.
- ☐ Go to the **GEOLocate** tab. Review the results.
- ☐ Refine the results; if there is PLSS unit data, redraw the polygon if necessary. You may remove the polygon if it is not necessary for your site.
- ☐ Make sure the uncertainty circle is sized appropriately.
- ☐ When you have the location and uncertainty circle placed, click **Save to Your Application**.
- ☐ Go to the **Lat/Long** tab. Fill in the following information:
    - **Determination Source:** GEOLocate
    - **Determination Method:** http://www.museum.tulane.edu/GEOLocate/instruction
    - **Determined By:** *Your Name*
    - **Date:** *Today's Date (short cut: "Ctrl ;")*
    - **Datum:** WGS84

  (For subsequent records, use F9 to duplicate the fields.)
- ☐ If necessary, add details about your decision on the **Notes-Attrib** tab.
- ☐ When complete, **Save** the record.
- ☐ Continue georeferencing until your session is complete.
- ☐ **Exit** EMu.
- ☐ **Log off or shut down** your computer.

Common Georeferencing Circumstances			
Situation	Finding the Point	Extent	Notes
Named Place w/Defined Area (e.g. "Milwaukee," "Lake Minnetonka," "Isle Royale," etc)	Look at the boundaries of the area; GEOLocate will usually create a polygon around the borders and place the point in the geographic center of the space, or the nearest point within the borders.	The radius should extend far enough that the entire circle contains all borders for the feature.	If GEOLocate does not generate a polygon on the borders of the feature, use the maps to determine as best you can the boundaries of the place.
Named Place w/ Undefined Area (e.g. "Walbecker Bog," "Cuidad Victoria and vicinity")	As near the center of named place as can be determined using a map.	Radius = ½ the distance between the point and the nearest named place (as the crow flies.)	
Street Address	You will probably have to use Google Earth. Put the point in the middle of the property, as near as you can figure.	Make the radius as big as you can ascertain the property to be.	These should always be checked; GEOLocate tends to put them in the middle of the lake. *
Distance from a city (ordinal direction) E.g. 5km south of Eagle	Measure 5 km from the center of the named place.	Radius = ½ of the distance between the point you placed and the nearest named place. If the nearest named place is Eagle, the radius would be half of 5km; 2.5 km or 2500m. If another named place was nearer than Eagle, you would use that named place.	Exception: if the string includes a second named place, like "Pike Lake 5km south of Eagle." *(see Named Place)*
Distance Along Road (e.g. Route 95, 5 km S of Townsville)	Put the point at the measured distance along the road.	Radius= ½ the distance between the point and the place named in the point.	
Path/Linear Feature (e.g. road, river, contour, trail)	Point should be placed halfway between the beginning and end of the path, or if only a section of the whole is named, the halfway point of that section.	Extent should include the whole or the section of the feature noted in the description.	

*If you find GEOLocate is erroneously placing terrestrial points in the center of water bodies, try unchecking **Match Water Body** in **Options** (see page 5 for more about the Data Pane's Georeferencing options) and click **Georeference** to generate a new set of results (this box will remain unchecked until you check it again).

If after reviewing the table and the Georeferencing Quick Reference Guide you aren't sure how to set the uncertainty circle, see the Collection or Digitization Manager for help.

Quick Access tables for required fields and data standards in the Sites Module:

Sites Lat/Long Tab Required Fields		
Emu Field	Value	Type of field
Determination Source	GEOLocate	Look up list
Determination Method	http://www.museum.tulane.edu/GEOLocate/instruction	Look up list
Determined By	Your Name	Type it in!
Date	Today's date	Either CTRL+ ; OR use the calendar
Datum	WGS84	Drop down list
Preferred	Yes	Drop down list
Units	Meters	Drop down list

Sites Attributed Notes (Notes-Attrib) Required Fields		
Emu Field	Value	Type of field
Note	Details should be in sentence format with appropriate punctuation. Clearly describe any inferences you made, additional resources you used, or why you were unable to georeference the site. *(See next table for standard Note comments.)*	Text field.
Kind	Mapping Remarks	Look up list
Attributed To	Your Name	Type it in!
Date	Today's date	Either CTRL+ ; OR use the calendar
Metadata	Yes	Radio Button

Sites Attributed Notes (Notes-Attrib) Data Standards	
Note Reason	Sentence Format
Inference Made	Inference made regarding site locality; [describe what you've assumed and why.]
Cannot Verify Precise Locality	Could not determine precise locality. Georeference based on "[coordinates]." [Provide any details that may be helpful for future research.]
Additional Resources Used	Additional resources used to georeference site: [list resources.]
Dubious Site Locality	Dubious locality description; could not georeference site.
Inaccurate/ Conflicting Site Locality	Inaccurate/ conflicting locality description; could not georeference site. [Follow with explanation of conflict or inaccuracy.]
Nonspecific Locality	Locality description is not specific enough to georeference site. [You do not need to add a Note for states, provinces, or countries.]
Unable to Determine	Unable to determine location; may require further research. [Provide any details that may be helpful for future research.]