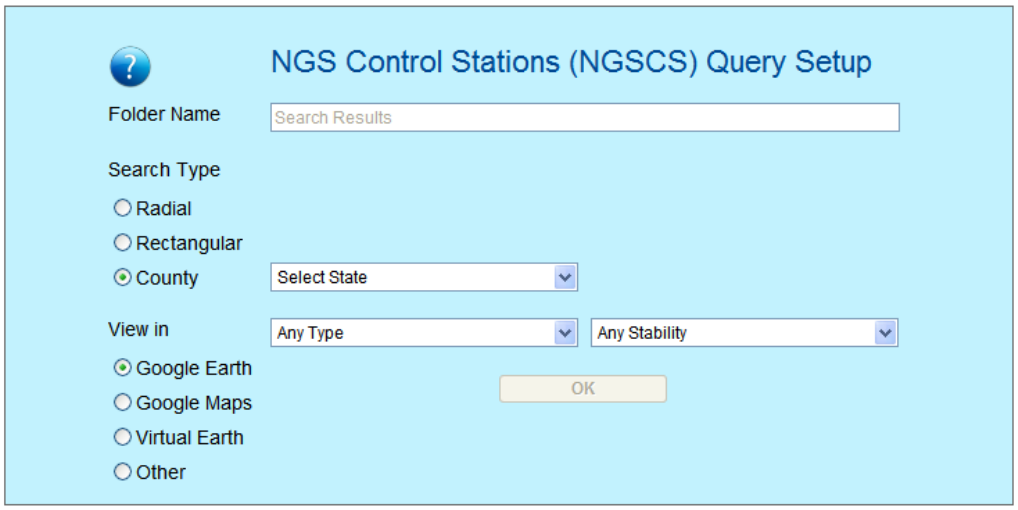
Accuracy and Precision of your GPS

Most geological mappers need to know the accuracy of their work. The more detailed the work required, the higher the accuracy to support the mapping. With GPS-based mapping, you can ascertain both the accuracy and precision of point locations. You can easily check GPS-based locations against digital base maps for intersections of roads and proximity to roads in order to ***visualize*** the likely uncertainties. However, while the GPS fix may place you near a geographical point observed on a digital base map, the accuracy of the map itself is unknown. A more rigorous methods employs Permanent Identifiers (PIDs) which are brass disc stations placed in the ground by the U.S. Geological Survey or Coast and Geodetic Survey. Many of these PIDs are routinely monitored by the CGS and the results are published in the public domain including the official 3-D coordinates of the PIDs. You can locate PIDs in your area of interest by searching the NGS site. A graphical method does this search using Google Earth or Google Maps to display the PIDs found. http://www.metzgerwillard.us/Setup.aspx



With County checked, select the state of interest and check OK.

PIDs are labeled in pink B's. Click on a PID of interest and the NGS data sheet for that point will be displayed on the lower screen. The Northing, Easting and Elevation in UTM metric coordinates can be read. Be aware that the published coordinates are referenced to a specific ellipsoid, for example, NAD83.

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.65
1        National Geodetic Survey,   Retrieval Date = APRIL  2, 2009
 HT1891 ***********************************************************************
 HT1891  DESIGNATION -  STADIUM A
 HT1891  PID         -  HT1891
 HT1891  STATE/COUNTY-  CA/ALAMEDA
 HT1891  USGS QUAD   -  OAKLAND EAST (1997)
 HT1891
 HT1891                        *CURRENT SURVEY CONTROL
 HT1891  ______________________________________________________________________
 HT1891* NAD 83(1992)-  37 52 16.16975(N)     122 14 58.33062(W)      ADJUSTED
 HT1891* NAVD 88     -       144.87   (+/-2cm)      475.3    (feet)  VERTCON
 HT1891  ______________________________________________________________________
 HT1891  EPOCH DATE  -        1991.35
 HT1891  LAPLACE CORR-           3.66  (seconds)                     DEFLEC99
 HT1891  GEOID HEIGHT-         -32.21  (meters)                      GEOID03
 HT1891  HORZ ORDER  -  FIRST
 HT1891  VERT ORDER  -  FIRST     CLASS I (See Below)
 HT1891
 HT1891.The horizontal coordinates were established by classical geodetic methods
 HT1891.and adjusted by the National Geodetic Survey in March 1994.
 HT1891.The horizontal coordinates are valid at the epoch date displayed above.
 HT1891.The epoch date for horizontal control is a decimal equivalence
 HT1891.of Year/Month/Day.
```

	Northing	Easting
HT1891;UTM 10 -	4,191,785.289	566,004.288

Set up your GPS over the PID of interest. A tripod makes this process stable. Be aware that the GPS horizon, time of day, HDOP, differential corrections, and all field conditions will affect the measurements you make. Set GeoMapper to Average (Static Mean Correctable). Use the Asbuilt graphic. Every 10 second collect a new data point to define a cloud of data. Eventually, an ellipse emerges. The center of the ellipse gives the average of the data. The radii give the uncertainty, the +/- of the location in terms of **precision**. The **accuracy** is another matter and is found by comparing the location of the **average** position of the data cloud with the **published** coordinates of the NCGS PID on which the GPS measurements have been made. In GeoMapper look at the upper row of items. Go to **ID** then drag down to **Distance to item**. Click of the mean GPS point and then click on the PID coordinate. This gives the accuracy which is a **systematic error** in contrast to the **random errors** of the data cloud. The two errors **compound** to represent the accuracy of your GPS location.

This map was made at PID HT1891 using 80-10 second averaging times for the Globalsat BC-337 GPS with a SiRFstarIII chipset (WAAS)

Systematic Error (relative to HT1892)= 2.332 meters

Random Error (relative to mean):
Easting 1 σ= 0.73 m
Northing 1 σ =1.63 m
Sum random error:
1 σ=SQRT(ADE^2+ADN^2)= 1.79m
2 σ = 3.90m
3 σ= 5.36
Total Error = Systematic +/- Random Error
1 σ **Total Error = 2.33+/- 1.79m**

1 σ **0.54 < Total Error < 4.12 m**
2 σ 0 <Total Error < 6.2
3σ 0< Total Error < 7.69 95%