Latitude, Longitude and Associated Metadata

The Property Profile Form (PPF) requests the property name, address, city, state and zip. From these address fields, ACRES interfaces with Google Maps and extracts the latitude and longitude (lat/long) for the property location. ACRES sets the remaining property geographic information to default values. The data (known collectively as "metadata") are required by EPA Data Standards. Should an ACRES user need to be update the metadata, the Edit Fields link on the PPF provides the ability to change the information.

Before the metadata were populated by ACRES, the data were entered manually. There may still be the need to do so, for example some properties do not have a specific street address (e.g. a rural property located on a state highway) or an ACRES user may have an exact lat/long that is to be used. This Quick Reference Guide covers how to find latitude and longitude, define the metadata, fill out the associated fields in a Property Work Package, and convert latitude and longitude to decimal degree format. This explains how the metadata were determined prior to September 2011 (when the Google Maps interface was added to ACRES).

Definitions

Below are definitions of the six data elements for latitude and longitude data that are collected in a Property Work Package. The definitions below are based on text from the EPA Data Standard.

- **Latitude:** Is the measure of the angular distance on a meridian north or south of the equator. Latitudinal lines run horizontal around the earth in parallel concentric lines from the equator to each of the poles.
- **Longitude:** Is the measure of the angular distance on a meridian east or west of the prime meridian. Longitudinal lines extend from the north to South Pole around the earth, like slices of an orange.
- **Horizontal Collection Method:** Describes the method used to determine the latitude and longitude coordinates for a point on the earth. This specifies what type of method or device was used to identify the latitude and longitude, e.g., an address, an intersection, a Global Positioning System (GPS) device, a census block centroid, etc. The key is that the horizontal collection method determines *how* the coordinates were collected, not *where*.
- **Source Map Scale:** The number that represents the proportional distance on the ground for one unit of measure on the map or photo. For example, 1 inch corresponds to 50 feet on a map. (*Note: This is not filled out when using GPS*).
- **Reference Point:** The text that identifies the place for which the geographic coordinates were established. This specifies the location at the place where the coordinates were taken, e.g., entrance to a facility, center of a facility, etc. The key is that the reference point determines *where* the coordinates were collected, not *how*.
- **Horizontal Reference Datum:** The Horizontal Reference Datum is the coordinate reference system to which the latitude/longitude data in 11a and 11b relate. Per EPA's Latitude/Longitude Data Standard, there are three possible values associated with horizontal reference datum.

Refer to EPA's Data Standards for further explanations of the six required latitude and longitude data elements which can be found at the following URL: http://iaspub.epa.gov/sor_internet/registry/datastds/findadatastandard/epaapproved/latitudelongitude/LatLongStandard_08112006.pdf.

How to Find Latitude and Longitude

The most common method to determine latitude and longitude of a property is using GPS to electronically record the coordinates. It is also possible to use geographic information systems (e.g., ArcView), electronic (Terra Server or Google Earth), or paper maps from trusted sources (e.g., USGS) to identify latitude and longitude coordinates.

Using Online Sources to Determine Latitude and Longitude

If you do not have access to a GPS device, you may go online to www.terraserver.com and enter the property address, nearest intersection, or zip code to determine the latitude and longitude. After entering the address, intersection or zip code, press the Search button- the latitude and longitude information will be displayed the Search box.

Using Google Earth, you can enter the property address, nearest intersection or zip code to determine the latitude and longitude. The coordinates will be displayed at the bottom of the map and may be in degrees, minutes, seconds format. If this is the case, you can change this by going to the Tools menu on the toolbar and going down to Options. A new window will appear and on the first tab you can change the latitude and longitudinal display to Decimal Degrees. After doing this, the number format at the bottom of the screen will have changed.

> ***Note:*** *The EPA does not endorse TerraServer or Google Earth and only provides their names as a possibility for use.*

Using either Terra Server or Google Earth, you will be able to determine the properties latitude and longitude, but the metadata fields must be completed as well. The Horizontal Collection Method may be filled in as ***Interpolation – Satellite.*** Source Map Scale does not need to be filled out when using one of these digital methods. The Property Reference Point will often be Address Matching House Number or, if you looked up the property by identifying the nearest intersection, use Address Matching Nearest Intersection. Horizontal Reference Datum may be filled in as North American Datum of 1983.

How to Fill Out the Property Profile Form

Please enter the appropriate data into each field in the Property Work Package. The fields are described below, with further guidance as to format and options.

When you enter a property into ACRES for the first time, ACRES will automatically calculate the latitude and longitude based on the address you enter. If you edit or change the address, you can update the latitude longitude calculation by clicking "Update Latitude/Longitude below based on address" in the Property Background Information section of the Property Work Package.

Field 11a - Latitude - Please enter the decimal format of the measure of the angular distance on a meridian north or south of the equator. Latitudinal lines run horizontal around the earth in parallel concentric lines from the equator to each of the poles. Methods for converting Degrees, Minutes, Seconds format of latitude are provided at the end of this document.

> ***Note:*** *Latitude must be between 1 and 90 – and do not forget to indicate negative latitude, if necessary.*

Field 11b - Longitude - Please enter the decimal format of the measure of the angular distance on a meridian east or west of the prime meridian. Longitudinal lines extend from the North to South Pole around the earth, like slices of an orange. Methods for converting Hour, Minute, Second format of longitude are provided at the end of this document.

> ***Note:*** *Longitude must be between 0 and 180 - do not forget to indicate a negative longitude, if necessary.*

Field 11c - Horizontal Collection Method - Please enter the text that describes the method used to determine the latitude and longitude coordinates for a point on the earth. This specifies what type of method or device was used to identify the latitude and longitude, e.g., an address, an intersection, a GPS device, a census block centroid, etc. The key is that the horizontal collection method determines *how* the coordinates were collected, not *where*. Below are the standard EPA options for this field. Please indicate the most accurate option from this list.

Horizontal Collection Method possible responses *(responses marked with an asterisk are the most common):*

****Address Matching - House Number***	The absolute location point is defined by an automated conversion program based on a user-defined address. The primary characteristic used to define the point is the address's house number.
Address Matching - Block Face	The absolute location point is defined by an automated conversion program based on a user-defined address. The primary characteristic used to define the point is the city's block face.
Address Matching - Street Centerline	The absolute location point is defined by an automated conversion program based on a user-defined address. The primary characteristic used to define the point is the address's street.
****Address Matching - Nearest Intersection***	The absolute location point is defined by an automated conversion program based on a user-defined address. The primary characteristic used to define the point is the nearest intersection to the identified address.
Address Matching - Primary Name	The absolute location point is defined by an automated conversion program based on a user-defined address. The primary characteristic used to define the point is the address's primary name.

Address Matching - Digitized	The absolute location point is defined by applying digitally geocoded addresses to a digital map (MapQuest uses this technique). The process involves locating two kinds of files that are needed to perform geocoding. One file that contains the addresses which are to be address-matched and the other which is the digital street map which gives the geographic coordinates of the centerline of all streets, along with the range of street addresses that are found on each street segment. The street files for counties are available and downloaded from the ESRI website (www.esri.com).
Address Matching - Other	The absolute location point is defined by an automated conversion program based on a user-defined address. The primary characteristic used to define the point is other than one presented in this list.
Census Block - 1990 - Centroid	Absolute location point is defined by relating the point of interest to a known Census area where a latitude/longitude has been defined for its centroid - based on the Census Block-1990 data set.
Census Block/Group - 1990 - Centroid	The absolute location point is defined by relating the point of interest to a known Census area where a latitude/longitude has been defined for its centroid. This is based on the Census Block/Group-1990 data set.
Census Block/Tract - 1990 - Centroid	The absolute location point is defined by relating the point of interest to a known Census area where a latitude/longitude has been defined for its centroid. This is based on the Census Block Tract-1990 data set.
Census - Other	The absolute location point is defined by relating the point of interest to a known Census area where a latitude/longitude has been defined for its centroid. This is based on a Census data set other than one presented in this list.
GPS Carrier Phase Static Position	The signal emitted from a GPS receiver is the location where the receiver's antenna is presumed to be stationary on the Earth. The GPS receiver will emit GPS measurements based on the L1 or L2 carrier signal. These signals, a.k.a. GPS carrier frequencies, L1 (15735 MHz) and L2 (1227.6 MHz), are in the L-band.
GPS Phase Kinematic Relative Position	Kinematic positioning refers to applications in which the position of a non-stationary object (automobile, ship, bicycle) is determined. GPS phase kinematic relative positioning are relative measurements "on the fly" that may be made with using GPS receivers with kinematic packages. Accuracies of these kinematic packages can be compared to the relative positioning GPS. Real time kinematic GPS requires a radio link between the field receiver and the base station.
GPS (Pseudo Range) Differential	A technique to improve GPS accuracy that uses pseudo-range errors measured at a known location to improve the measurements made by other GPS receivers within the same general geographic area. Position accuracies to about +/- 2 meters can be obtained by comparison of a field GPS receiver with a fixed receiver at a known position. Basically, this involves using two resource grade GPS receivers to determine the

	location of a point by taking several GPS reading in an area. *Note: Pseudo-range refers to errors in a distance measurement based on the correlation of a satellite transmitted code and the local receiver's reference code that has not been corrected for errors in synchronization between the transmitter's clock and the receiver's clock.
***GPS (Pseudo Range) Precise Position**	The most accurate dynamic positioning possible with GPS, based on the dual frequency P-code. This code (called the Precise Positioning System or GPS) primarily available for the Department of Defense and national security purposes. It is not for general public use.
***GPS (Pseudo Range) Standard Position (SA off)**	The US government discontinued the use of Selective Availability (SA) and the GPS system became much more accurate. Currently, there are no government specifications to determine what the average error will be now. However, after performing a series of tests with SA "off" we have seen the average error reduced to within 10 to 20 meters of a stationary fixed position. With the addition of the Differential GPS receiver we have seen this reduced further to an average error of less than 5 meters (about 16 feet.)
***GPS (Pseudo Range) Standard Position (SA on)**	A Standard Positioning Service (GPS) for general public use. Selective Availability or SA is the intentional degradation of GPS signals which directly affect the accuracy of all GPS receivers which use these satellite signals.
***GPS (Pseudo Range) Standard - Service Correction**	Global Positioning System (GPS) applications that require consistent accuracy of less than six inches in mobile equipment need a commercial connection service. Normal civilian GPS positions are accurate to about 30 feet, and free differential correction services are accurate to approximately three feet. To get consistent GPS positions within a few inches, users must subscribe to a commercial GPS differential correction service. Farmers and others who use accurate GPS correction signals use the term RT. when referring to the most accurate GPS correction signals. Real-time Kinematic (RT.) differential correction refers to Global Positioning System (GPS) locations that are accurate to within a few inches. Commercial companies that supply GPS differential correction services often use the terms of centimeter and decimeter accuracies. These precise GPS differential correction services are used for agricultural equipment auto-steering systems and can be used for most other GPS applications in agriculture. The highly accurate GPS differential correction services use base stations with known locations to measure GPS position errors and geosynchronous satellites to deliver the corrections to receivers in mobile agriculture equipment.
***Interpolation - Map**	(1) Hard copy the absolute location point is defined by measuring relative distances on a hard copy map through manual efforts. This requires basic map knowledge about scales, conversions, projections, etc. (2) Digitized the absolute location point is defined by measuring relative distances on a map using a digitizer (tool used to translate paper based maps/photos digitally for computer mapping purposes). This requires basic map knowledge about scales, conversions, projections, etc.

Interpolation - Photo	(1) Hard copy the absolute location point is defined by measuring relative distances on hard copy aerial photographs through manual efforts. This requires trained photo interpreter (a person who is trained in using low-oblique aerial photos to view images in stereo. A photo interpreter also can determine scales and order of aerial photos and also calculates distances, building heights, land use, etc.) (2) Digitized The absolute location point is defined by measuring relative distances on aerial photographs using a digitizer (tool used to translate paper based maps/photos digitally for computer mapping purposes). This method also requires a trained photo interpreter.
Interpolation - Satellite	(1) Hard copy The absolute location point is defined by measuring relative distances on hard copy satellite images through manual efforts (determining scales and order of satellite imagery to calculate distances, building heights, land use, etc.). Requires a trained photo interpreter. (2) Digitized The absolute location point is defined by measuring relative distances on satellite images using a digitizer (tool used to translate paper based maps/photos digitally for computer mapping purposes). This requires a trained photo interpreter.
Interpolation - Other	The absolute location point is defined by measuring relative distances on an object that is other than one presented in this list.
Loran C	The absolute location point is defined by using receivers and broadcasting stations to calculate the distance from a known point through triangulation, This requires knowledge of LORAN receivers, publications, and correction methods. Background LORAN-C was originally developed to provide radio navigation service for U.S. coastal waters and was later expanded to include complete coverage of the continental U.S. as well as most of Alaska. Twenty-four U.S. LORAN-C stations work in partnership with Canadian and Russian stations to provide coverage in Canadian waters and in the Bering Sea. LORAN-C provides better than 0.25 nautical mile absolute accuracy for suitably equipped users within the published areas. LORAN-C provides coverage for maritime navigation in U.S. coastal areas. It provides navigation, location, and timing services for both civil and military air, land and marine users. The LORAN-C system serves the 48 continental states, their coastal areas, and parts of Alaska.
Public Land Survey Quarter Section	The absolute location point is defined by an automated conversion program that relates U.S. Public Land Survey System (PASS.) descriptions to a latitude/longitude. This conversion is based on quartering.
Public Land Survey Section	The Public Land Survey System (PLSS) is a method used in the United States to locate and identify land, particularly for titles and deeds of farm or rural land. The system is in use in all states except the first 13 states, and Vermont, Texas, and Hawaii. The system has been in general use since the Land Ordinance of 1785. Its basic units of area are the township and section. It is sometimes referred to as the rectangular survey system.

Classical Survey	The absolute location point is defined by using a traditional method of measuring horizontal distances, elevations, directions, and angles. This requires a trained, licensed surveyor.
Zip code - Centroid	The absolute location point is defined as the absolute location point that is associated with the center of a zip code area where the point being identified is located.
Unknown	Horizontal method used to define the latitude/longitude is unknown or unspecified.
Global Positioning Method - unspecified parameters	The absolute location point was determined using GPS, but the specific parameters of the GPS use are unknown or were not indicated.
Digital Map Source (TIGER)	The term TIGER® comes from the acronym Topologically Integrated Geographic Encoding and Referencing which is the name for the system and digital database developed at the U.S. Census Bureau to support its mapping needs for the Decennial Census and other Bureau programs. The design of the TIGER® database adapts the theories of topology, graph theory, and associated fields of mathematics to provide a disciplined, mathematical description for the geographic structure of the United States and its territories. The topological structure of the TIGER® data base defines the location and relationship of streets, rivers, railroads, and other features to each other and to the numerous geographic entities for which the Census Bureau tabulates data from its censuses and sample surveys. It is designed to assure no duplication of these features or areas.
SPOT satellite	The SPOT imaging satellite provides digital elevation models (DEMs) and vegetation imaging of any location on Earth. It allows realistic 3D perspectives. DEMs are used as part of the simulation market which includes civilian and military flight simulation, defense mission planning, video-games, and other visualization-based applications. SPOT has the capability to produce up to 80% of the required elevation models to support image-based 3D mapping business worldwide. SPOT is the only satellite system with the dedicated technology to create DEMs for commercial distribution. SPOT was launched in 2002 and is managed by Spot Image.
Multi-Spectral Scanner	An instrument on some satellites (Landsat) used for imaging the earth. An MSS image will have data recorded by the scanner from three or more bands of the electromagnetic spectrum. ArcInfo (a GIS mapping program) can read multispectral images in various formats.

Thematic Mapper	Landsats 4 and 5, launched in 1982 and 1984, respectively, were augmented with an advanced version of an Earth observation sensor known as the Thematic Mapper (TM). The TM provides a significant increase in data acquisition capability over the MSS in a number of ways. The TM sensor has seven spectral bands Six acquire Earth reflectance data, and one acquires Earth temperature data. The spatial resolution of bands in the visible and reflective infrared regions is 30 m, some 2 1/2 times better than the Multispectral Scanner (MSS). The TM sensor also has greater overall radiometric sensitivity than the MSS.
Public Land Survey Eighth Section	The absolute location point is defined by an automated conversion program that relates U.S. Public Land Survey System (PLSS) descriptions to a latitude/longitude. This conversion is based on an eighth of a section.
Public Land Survey Sixteenth Section	The absolute location point is defined by an automated conversion program that relates U.S. Public Land Survey System (PLSS) descriptions to a latitude/longitude. This conversion is based on a sixteenth of a section.
Public Land Survey Footing	The absolute location point is defined by an automated conversion program that relates U.S. Public Land Survey System (PLSS) descriptions to a latitude/longitude. This conversion is based on footing.
Zip code plus 4	The absolute location point is defined as the absolute location point that is associated with the center of a zip code sector (plus 4 indicates the section) where the point being identified is located.
Zip code plus 2	The absolute location point is defined as the absolute location point that is associated with the center of a zip code section (plus 2 indicates the section) where the point being identified is located.

Field 11d - Source Map Scale Number - Please enter the number that represents the proportional distance on the ground for one unit of measure on the map or photo. For example, 1 inch corresponds to 50 feet on a map.

Note: *This does not apply for methods using GPS.*

Field 11e - Reference Point - Please enter the text that identifies the place for which the geographic coordinates were established. This specifies the location at the place where the coordinates were taken, e.g., entrance to a facility, center of a facility, etc. The key is that the reference point determines *where* the coordinates were collected, not *how*. Below are the standard EPA options for this field. Please indicate the most accurate option from this list. The starred options below are the most likely reference points.

Reference Point possible responses *(marked with an asterisk are the most common):*

- *Entrance Point of a Facility or Station
- *Plant Entrance (General)
- Center of a Facility or Station
- Facility/Monitoring Site Boundary Point

- Point Where Substance Enters Facility/Monitoring Site (Can be Inside/Outside of a Facility Site)
- Point Where Substance is Processed, Treated, Settled, or Stored
- Point Where Substance is Released
- Point Where Substance is Monitored
- Points Not Represented by 101-107

Field 11f – Horizontal Reference Datum - Please choose which Reference Datum was used. The Horizontal Reference Datum is the coordinate reference system to which the latitude/longitude data in 13a and 13b relate. Per EPA's Latitude/Longitude Data Standard, there are three possible values associated with horizontal reference datum. If you used GPS to determine coordinates, by default you will use World Geodetic System of 1984 (WGS84).

Horizontal Reference Datum possible responses:

- **North American Datum of 1927 (NAD27):** This datum was based on the ground survey in Europe and North America in the 19th century. NAD27 was the standard for many years because the USGS published its topographic maps in this datum. If you are reporting a location using a USGS 7.5-minute map, NAD27 is your default datum.
- **North American Datum of 1983 (NAD83):** NAD83 updated NAD27 with current measurements using radio astronomy and satellite observations. When the USGS began publishing digital data, the NAD83 was used, which provided a more accurate representation of the earth's shape and a more accurate depiction of the location of objects on the earth.
- **World Geodetic System of 1984 (WGS84):** This datum was developed from the measurements calculated in the North American Datum of 1983. If you used a GPS to calculate your latitude/longitude coordinates, WGS84 is the default datum.

How to Convert Degrees, Minutes, Seconds into Decimal Degrees

If a GPS unit is not available, the following online conversion tool can be used.

1. Go to the following Web site: http://www.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html
2. Enter the Degrees, Minutes, Seconds into the appropriate fields.
3. Click on the "Submit Degrees, Minutes, Seconds" button.
4. Copy the results into the appropriate fields on the Property Profile Form or directly into the property Work Package in ACRES.

ACRES HELP DESK
acres_help@epa.gov or 703-284-8212
M-F, 9am-5pm EST