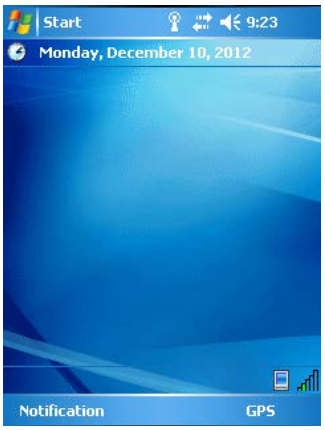
Using Arcpad 7.0.1 for GPS Data Collection in the Field

Table of Contents

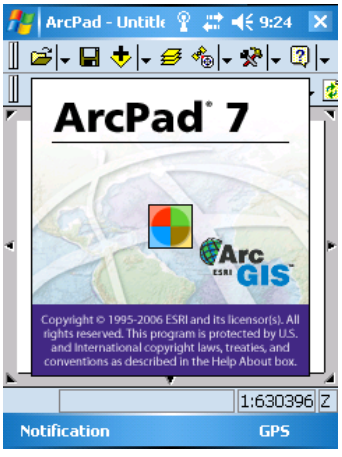
Section A: Open an ArcPad document

1. From main menu, press the Start menu.

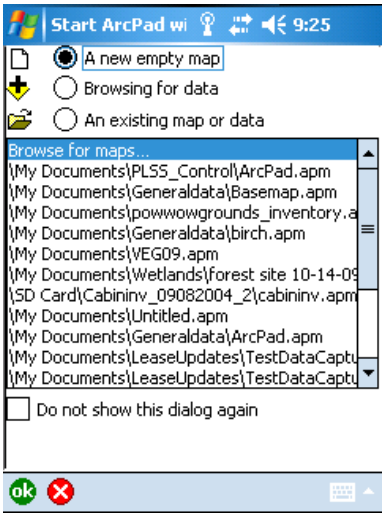


2. Open Arcpad 7.0.1 from the Start Menu

3. Wait for the ArcPad 7 program to load.

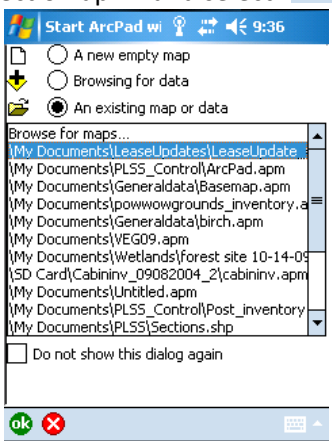


4. Start an ArcPad project. You 3 options----------→

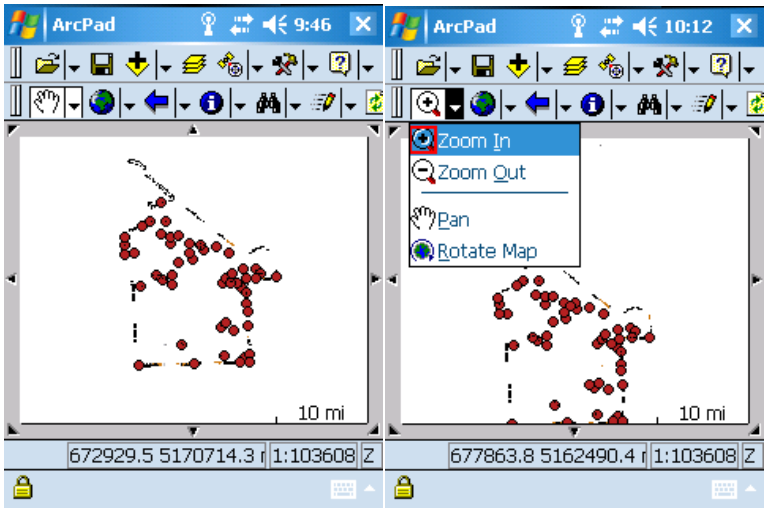


4.A) If you want to start a new project, select "A new empty map." Then browse for your data and add files as needed.

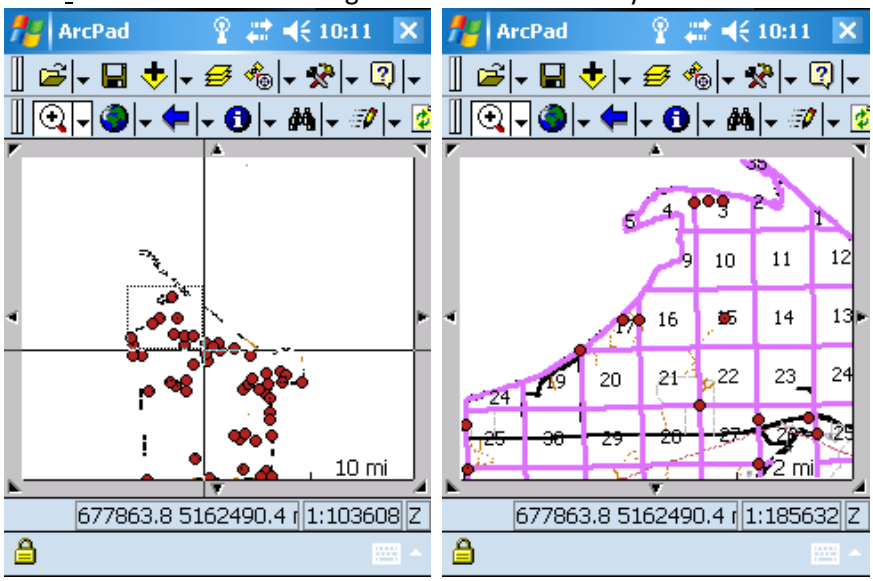
4.B) If you know you have a current project from which to continue your work, select "An existing map or data." Use this option to select the map project in the list below. In this example, open the document "LeaseUpdates_GPS_collection.apm" and select  at the bottom of the screen.



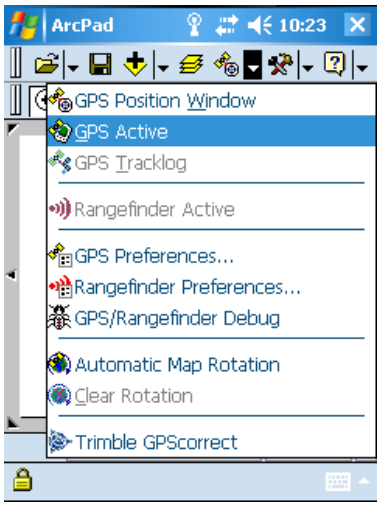
5. Under the menu, click on the world icon, which will bring your map to the scale of the Bad River Reservation. Otherwise, you can use the Zoom In or Zoom Out tool, using the drop-down arrow to the right of the Pan tool.



6. Use the Zoom In tool to draw a rectangle around the location you want to zoom in to.



Section B: Activating your GPS Receiver



1. Activate GPS
2. Wait until the symbol of inactive GPS collection  becomes active:  . Test this out by walking around with the GPS held almost HORIZONTALLY (or at a slight angle with the screen facing you). As you walk around, you should see the arrow move with your change in direction ( to  to  …etc.
3. With you GPS actively receiving satellite coordinates, you need to ensure your GPS is receiving enough information from **4 or more satellites** to accurately triangulate your location. Open the GPS Position Window, to make sure you are connected to satellites. Notice in **Figure A** there are no satellites within the circle *(which depicts the positions of satellites in orbit above your head)*. In Figure B, you can see numerous satellites in the "aerial globe" view . When you have good reception with satellites (wait 5-10 minutes), then you can begin collecting GPP data.

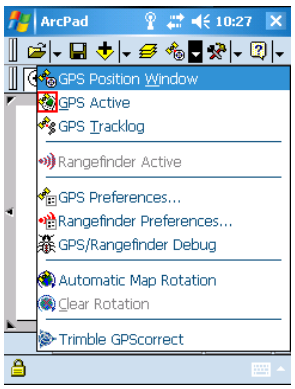


Figure A
Example of NO satellites:

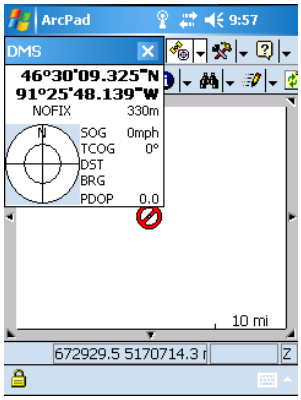
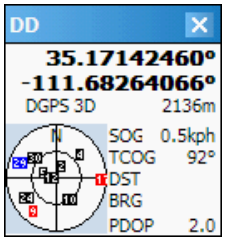


Figure B
Example of satellites connected:



Section C: Ensuring GPS Accuracy (Real-time Differential Correction)

Additional Info on GPS Accuracy & Differential Correction of GPS

(resource from http://www.spatial-ed.com/gps/gps-basics/135-differential-correction-methods.html, Accessed 12/10/2012)

All GPS data collected in the field has error. Without correcting for atmospheric interference in the satellite signal, GPS data may only have accuracy up to 15 meters.

Autonomous means uncorrected data. An autonomous, or uncorrected, position has no correction applied. It is subject mostly to atmospheric delay. These errors can be removed, however, when the positions are corrected with either the GPS Analyst extension for ArcGIS, GPS Pathfinder Office utilities or a **real-time source (*see below)***. The best accuracy you can expect to attain with any GPS receiver without a correction method applied is within 15 meters (2D RMS) for the horizontal measurement. Vertical accuracy is within 25 meters. This is typically true for any commercial GPS receiver from any vendor.

2. Real-time methods

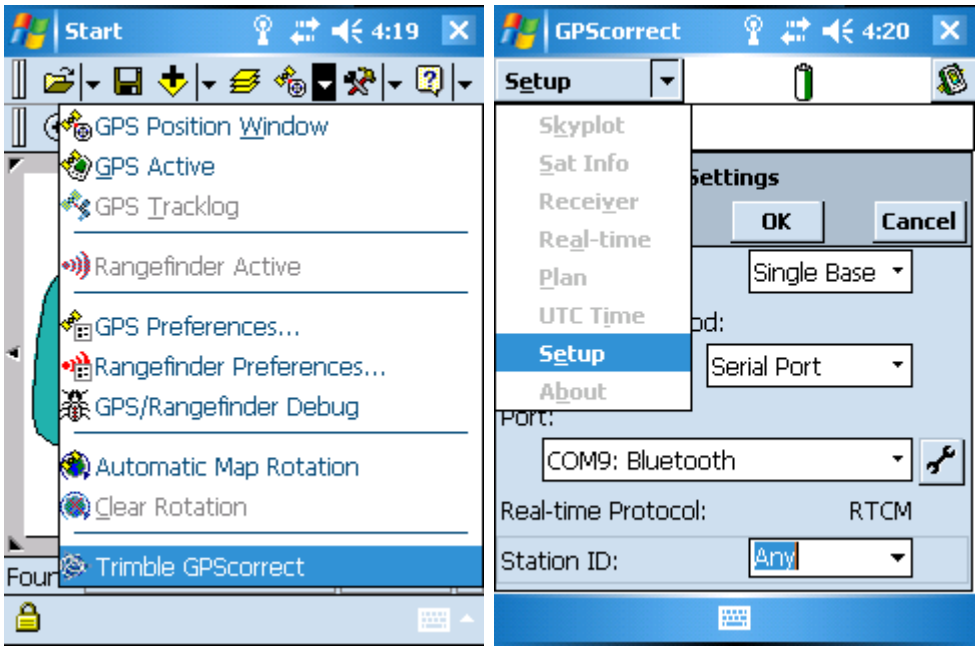
Real-time correction is recommended for navigation with any receiver while in the field. The base station is broadcasting signals for corrections of rover data while in the field and is ideal for navigation purposes where corrections are needed on the spot. The disadvantages of real-time correction include less accuracy due to latency in both the correction and rover signals, different ephemeris at the base and at the rover and datum transformation issues. **For the best accuracy available, always re-correct positions with a more accurate, post-processing method upon return to the office.**

Real-time data is also referred to as DGPS (Differential GPS) or RTCM (Radio Technical Commission for Maritime Services). This actually refers to the data protocol often used to deliver the corrections. Real-time base station signals can come from many possible sources: a) integrated SBAS receiver, b) internal or external beacon receiver, c) satellite differential receiver like Omnistar, d) your own base station broadcasting corrections via a DGPS radio or over the Internet or e) VRS corrections over the Internet.

SBAS (Satellite-based Augmentation System) [Bad River Band will use this method]
SBAS provides correction data for visible satellites. Corrections are computed from ground station observations and then uploaded to geostationary satellites. This data is then broadcast on the L1 frequency, and is tracked using a channel on the GPS receiver, exactly like a GPS satellite. WAAS, EGNOS, and MSAS are examples of **satellite-based augmentation systems (SBAS).**
WAAS (Wide Area Augmentation System) was established by the Federal Aviation Administration (FAA) for flight and approach navigation for civil aviation. WAAS improves the accuracy and availability of the basic GPS signals over its coverage area, which includes the continental United States and outlying parts of Canada and Mexico.

To check your Real Time Differential Correction:

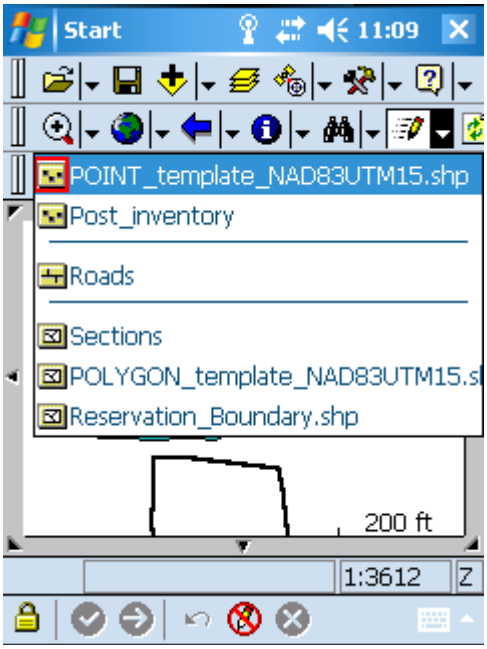
1. Open the Trimble GPSCorrect menu, go to “Setup”



Section D: Collecting GPS Points or Polygons

POINTS

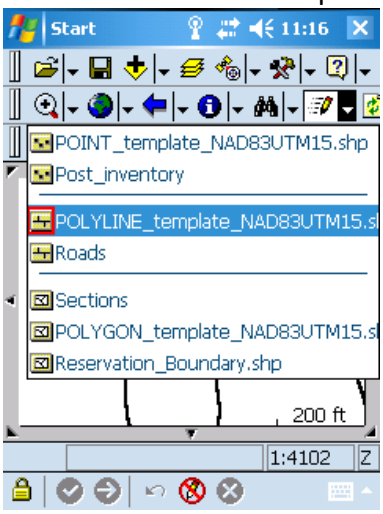
1. Make a point layer editable. Click on the arrow next to the pencil icon 



2. From the Point drop-down menu. Tap  to use points, and then click  , (**Capture Point Using GPS** button) to save the GPS point, and wait for the specified number of GPS to be captured and averaged.
3. Add attribute information to your point
   3.A. to save in memory the attribute information you enter, tap on another field.
   3.B. To save all attribute information, tap  to save your attribute information.
4. To finish editing, click the  again to stop editing.

POLYLINES

1. Make a line layer editable. Click on the arrow next to the pencil icon 



2. From the Polyline drop-down menu. Tap  to capture Polylines, and wait for the specified number of GPS to be captured and averaged.

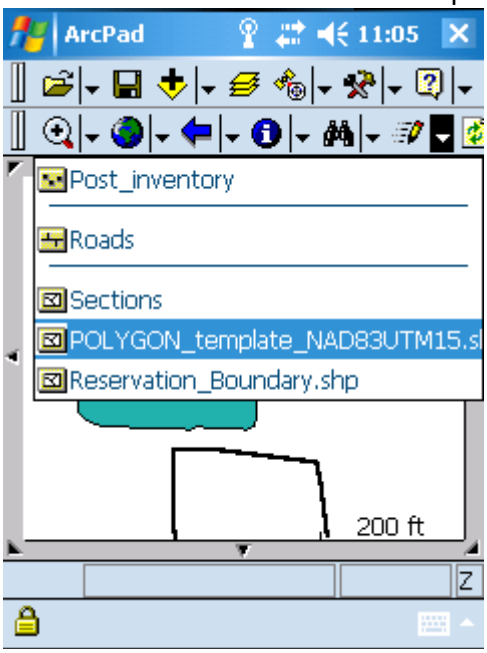
3. To collect GPS coordinates for:
   3.A. ***Individual Vertices***: create a polyline as a series of individually captured averaged vertices:Tap the **Add GPS Vertex** button  , and wait for the specified number of GPS positions to be captured and averaged. Repeat the process for each of the feature's vertices.

   3.B. ***Add Vertices Continuously:*** create a polyline as a series of individually captured averaged vertices: Tap the **Add GPS Vertices Continuously** button  , and travel along the feature's alignment. Tap the **Add GPS Vertices Continuously** button at any point to "pause", and then "resume", GPS data capture.

4. When all vertices have been captured: Tap the **Proceed To Attribute Capture** button 
5. Complete the attribute entry form or attribute table.
   6.A. To save in memory the attribute information you enter, tap on another field.
   6.B. To save all attribute information, tap  to save your attribute information.
6. To finish editing, click the  again to stop editing.

POLYGONS

1. Make a polygon layer editable. Click on the arrow next to the pencil icon 



2. From the Polyline drop-down menu. Tap  to capture Polygons, and wait for the specified number of GPS to be captured and averaged.

3. To collect GPS coordinates for:

   3.A. ***Individual Vertices***: create a polyline as a series of individually captured averaged vertices:Tap the **Add GPS Vertex** button  , and wait for the specified number of GPS positions to be captured and averaged. Repeat the process for each of the feature's vertices.

   3.B. ***Add Vertices Continuously:*** create a polyline as a series of individually captured averaged vertices: Tap the **Add GPS Vertices Continuously** button  , and travel along the feature's alignment. Tap the **Add GPS Vertices Continuously** button at any point to "pause", and then "resume", GPS data capture.

4. When all vertices have been captured: Tap the **Proceed To Attribute Capture** button 
5. Complete the attribute entry form or attribute table.

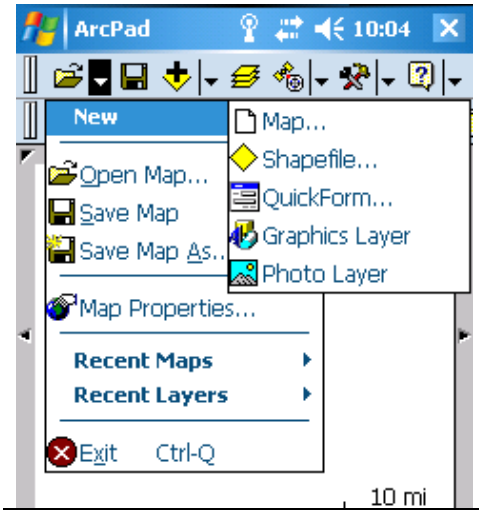
   6.A. To save in memory the attribute information you enter, tap on another field.

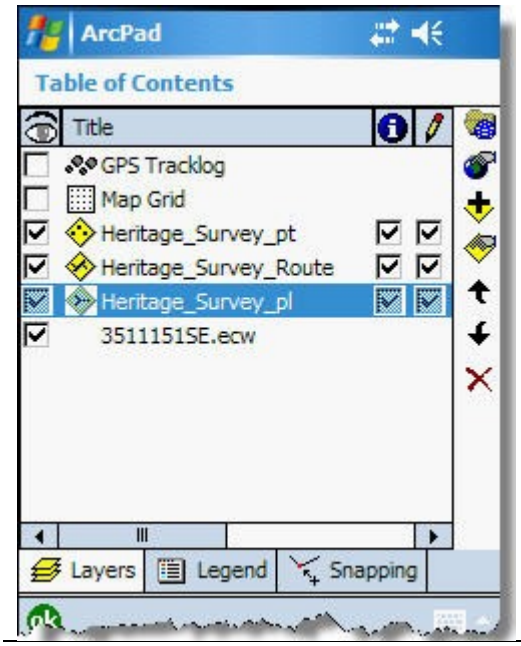
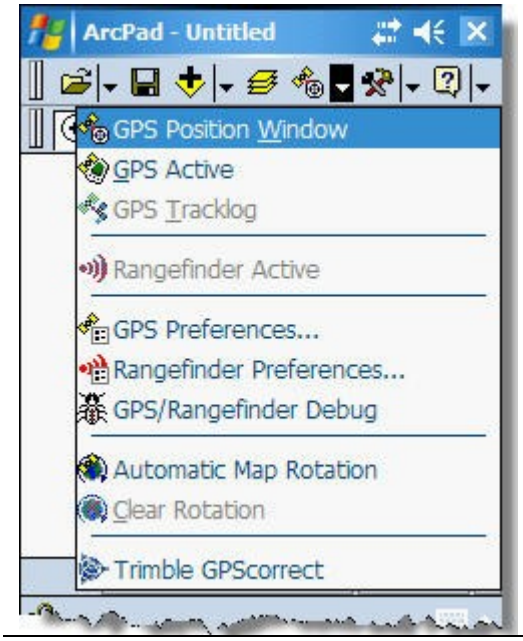
   6.B. To save all attribute information, tap  to save your attribute information.

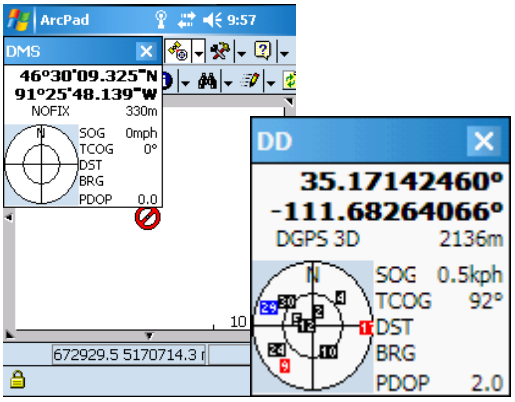
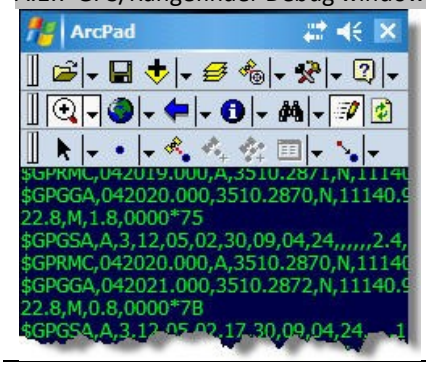
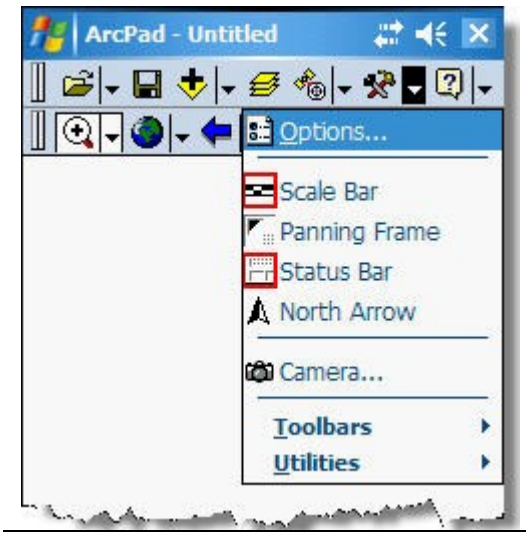
6. To finish editing, click the  again to stop editing.

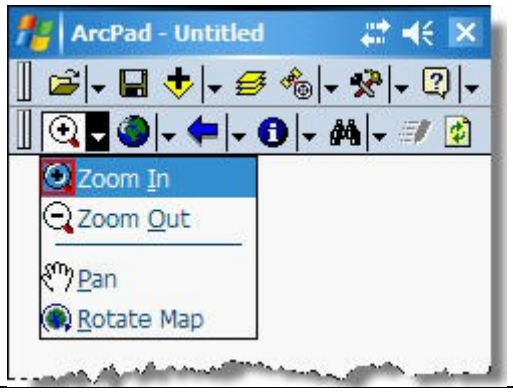
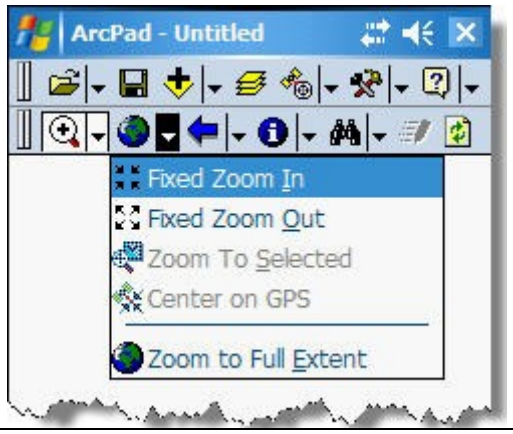
Appendix A: Toolbars, Menus, Buttons, and Forms

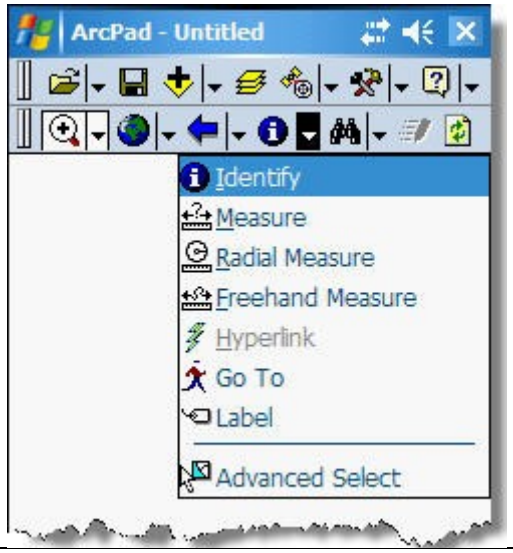
Appendix A - Toolbars, Menus, Buttons, and Forms

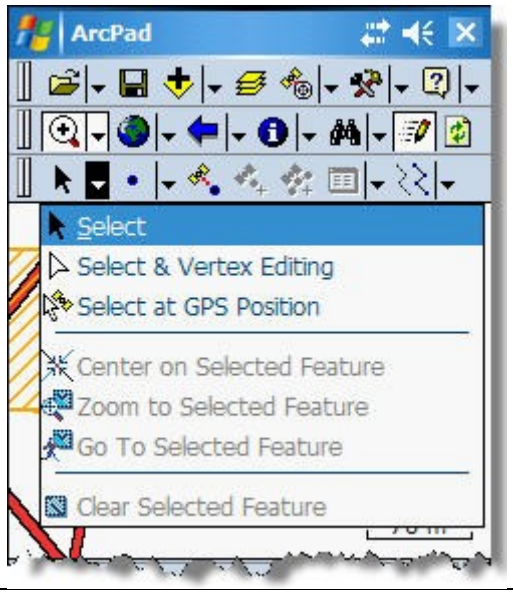
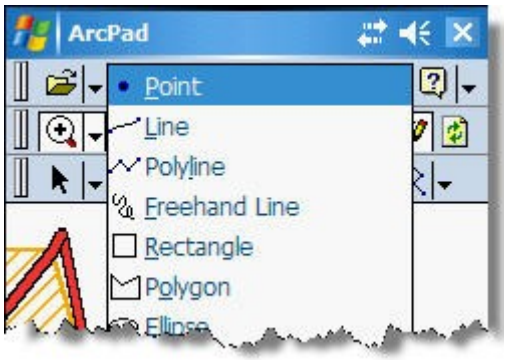
A.1 Main Toolbar Menus, Buttons, and Forms	Description of Frequently Used Functionality
A.1.1 Open Map drop-down menu 	Create a new QuickProject, map, shapefile, or QuickForm - Tap **New**, and select the item to be created. Where necessary, a wizard will guide users through the process. Open an existing map - Tap **Open Map…**, and browse to an ArcPad map file (**.apm**) on the mobile device. Save the current map – Tap **Save Map** or **Save Map As…**. If necessary, browse to a folder and provide a name for the saved map. View the current map's properties – Tap **Map Properties…** and select the map Property tab(s) of interest. Close ArcPad – Tap **Exit**.
A.1.2 Save Map button 	Save the current map – Tap the **Save Map** button. If necessary, browse to a folder and provide a name for the saved map.
A.1.3 Add Layer drop-down menu 	Add a vector or raster layer to the current map – Tap **Add Layer…** and browse to vector or raster layers on the mobile device. All layers within a map must share the same spatial reference, and their spatial reference must match that of the map. An example of a spatial reference is NAD 1983 UTM Zone 12 North.

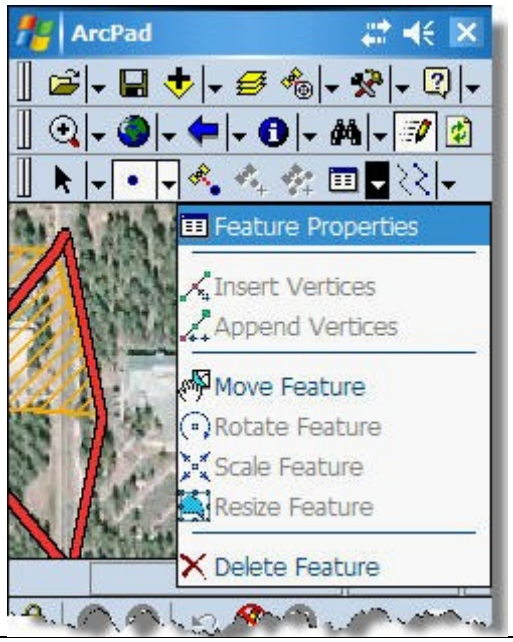
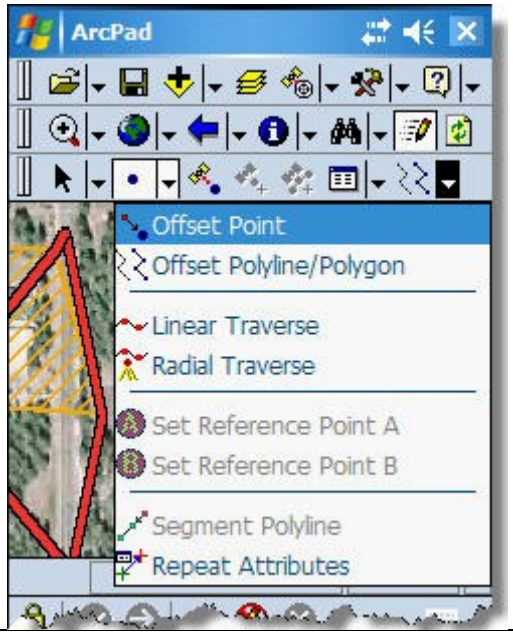
A.1 Main Toolbar Menus, Buttons, and Forms	Description of Frequently Used Functionality
A.1.4 Table of Contents form 	Tap  to open the **Table of Contents** form. Make a layer visible - Check the layer's box underneath the  icon. Enable ArcPad's Identify tool for a layer – Check the layer's box underneath the  icon. Start editing a layer – Check the layer's box underneath the icon. Modify a selected layer's properties – Select the layer and tap the  icon. Layer properties that may be modified include labeling, symbology, and reference/visibility scale. Modify a selected layer's draw order – Select the layer and move it up or down using the  or  icons. Remove a layer from the current map – Select the layer and tap the  icon.
A.1.5 GPS Position Window drop-down menu 	Open the GPS Position Window – Tap **GPS Position Window**. See the next panel for more information. Activate the GPS receiver – Tap **GPS Active**. Set GPS preferences – Tap **GPS Preferences**. View GPS data stream – Tap **GPS/Rangefinder Debug**. See the next panel for more information. Configure GPSCorrect – Tap **Trimble GPSCorrect**. GPS preference settings are saved in a file named **ArcPadPrefs.apx**stored in the **..\My Documents** folder. This file is updated whenever users tap  in the GPS Preferences dialog. Users can restore default values by deleting the **ArcPadPrefs.apx**file.

A.1 Main Toolbar Menus, Buttons, and Forms	Description of Frequently Used Functionality
A.1.6 GPS Position Window 	The **GPS Position Window** displays GPS position coordinates in user-selected format, GPS mode (differential 3-D, etc,), approximate elevation, satellite arrangement, navigation information (speed, direction, etc.), and position quality (PDOP, HDOP, etc.). In the skyplot, black icons indicate satellites that are being used to calculate the GPS position, Blue icons signify satellites that are seen, but unused. Red icons represent unseen satellites.
A.1.7 GPS/Rangefinder Debug window 	The **GPS/Rangefinder Debug** window displays GPS data as it streams from the receiver. Data displayed in a green font indicates valid GPS data. A red font indicates invalid GPS data. A blank window indicates that the receiver is not connected, or is not issuing GPS data.
A.1.8 Tools drop-down menu 	Set ArcPad options – Tap **Options…** and select the Option tab(s) of interest. Options settings are saved in a file named **ArcPadPrefs.apx**stored in the **..\My Documents** folder. This file is updated whenever users tap ok in the ArcPad Options dialog. Users can restore default values by deleting the **ArcPadPrefs.apx**file. Activate map elements – Tap a map element to activate or deactivate it. Active elements are signified by a red box, while inactive elements have no red box. Map elements include a scale bar, panning frame, status bar, and north arrow.

A.2 Browse Toolbar Menus and Forms	Description of Frequently Used Functionality
A.2.1 Zoom In drop-down menu 	Zoom in to map features – Tap **Zoom In**. Then tap-and- drag a box around the features to zoom in to. Zoom out from map features – Tap **Zoom Out**. Then tap- and-drag a box to zoom the map's extents to. Move (pan) around the map – Tap **Pan**. Then tap-and- drag in the direction desired.
A.2.2 Zoom To Full Extent drop-down menu 	Zoom in by 25% - Tap **Fixed Zoom In**. Zoom out by 25% - Tap **Fixed Zoom Out**. Zoom to the selected feature(s) – Tap **Zoom To Selected**. Center the map on the current GPS position – Tap **Center On GPS**. Zoom to the map's full extent – Tap **Zoom To Full Extent**.
A.2.3 Go Back To Previous Extent drop-down menu 	Move backwards in the view extent history – Tap **Go Back To Previous Extent**. Move forwards in the view extent history – Tap **Go To Next Extent**.

A.2 Browse Toolbar Menus and Forms	Description of Frequently Used Functionality
A.2.4 Identify drop-down menu 	View read-only feature attributes – Tap **Identify**. Then tap a feature of interest. Measure distance, perimeter, azimuth, and area – Tap **Measure**. Then tap a series of points describing an alignment of interest. Finally, tap the **Proceed To Attribute Capture** icon  to view the alignment's metrics. Set a navigation target – Tap **Go To**. Then tap a point on the map that will serve as a navigation target. Next, open the GPS Position Window, tap the skyplot panel twice to cycle to the navigation display, and proceed with the navigation. Label individual features – Tap **Label**. Then tap a feature to label it with the attribute selected for display in the Layer Properties dialog.
A.2.5 Find drop-down menu 	Select features by attribute – Tap **Find Features…**. Complete the Find dialog, tap the **Results** tab to view matching records, select a record of interest, and select an action. Actions include: • Modify the feature's attributes. • Set the feature as a navigation target. • Zoom to the selected feature.
A.2.6 Edit form 	Tap  to open the **Edit** form. Start or stop editing a layer – Tap a layer to start or stop editing it. Layers open for editing are signified by a red box, while layers closed for editing do not have a red box. A map may contain many layers, but only one point, one line, and one polygon layer can be simultaneously open for edit. In the example at left, only the survey point and survey polygon layers are open for edit, as signified by the red box surrounding their icon.

A.3 Edit Toolbar Menus, Buttons, and Forms	Description of Frequently Used Functionality
A.3.1 Select drop-down meun 	Select a map feature – Tap **Select**. Then tap a feature on the map to select it. Selected features are highlighted with a cyan color, and a dotted box describes their extent (below).  Select a map feature for vertex editing – Tap **Select & Vertex Editing**. Then tap a feature to view and, if desired, edit its vertices. Vertices are indicated by a dark blue box, and can be inserted, deleted, or moved (below). 
A.3.2 Point drop-down menu 	Activate different feature types for data capture – Select one of these methods depending on the feature type to be captured. • Select  to activate the Point feature type for data capture. • Select  to activate the Polyline (line) feature type for data capture and start a new line feature. • Select  to activate the Polygon feature type for data capture and start a new polygon feature.
A.3.3 Capture Point Using GPS button 	Capture a point feature in the editable point layer using the current GPS position – Tap the **Capture Point Using GPS** button.
A.3.4 Add GPS Vertex button 	Capture a single vertex in the current polyline or polygon feature using the current GPS position – Tap the **Add GPS Vertex** button.
A.3.5 Add GPS Vertices Continuously button 	Continuously capture vertices in the current polyline or polygon feature using the current GPS position – Tap the **Add GPS Vertices Continuously** button.

A.3 Edit Toolbar Menus, Buttons, and Forms	Description of Frequently Used Functionality
A.3.6 Feature Properties drop-down menu 	View a selected feature's properties – Select a feature and tap **Feature Properties**. Properties include attributes and symbology. Insert new vertices to the selected polyline or polygon – Tap **Insert Vertices**. This is a way to modify a features shape by inserting new vertices into is alignment or perimeter. Vertices may be added on-screen with the stylus, or with a GPS position. Add new vertices to the end of the selected polyline - Tap **Append Vertices**. Vertices may be appended on-screen with the stylus, or with a GPS position. Delete a selected feature – Select a feature and tap **Delete Feature**.
A.3.7 Offset Polyline/Polygon drop-down menu 	Create a new polyLine starting at the end of the active or selected polyline – Tap **Segment Polyline**. Capture the attributes of an existing, selected feature and apply them to new features – Tap **Repeat Attributes**.

A.4 Command Bar Buttons	Description
A.4.1 Lock button 	Disable ArcPad's screen for stylus or GPS input – Tap the  button.
A.4.2 Save Geometry Changes button 	Save geometry changes to an existing feature – Tap the  button.
A.4.3 Proceed To Attribute Capture button 	End the geometry capture of a new feature and proceed to capturing the feature's attributes – Tap the button.
A.4.4 Undo button 	Undo the last edit made to a feature – Tap the  button to cancel the last edit.
A.4.5 Pen Toggle button 	Enable or disable use of the stylus for capturing new features – Tap the  button. Toggle the stylus (pen) off if you only want GPS input.
A.4.6 Cancel button 	Cancel edits to an existing feature's geometry, or cancel capture of a new feature – Tap the button to cancel all edits.

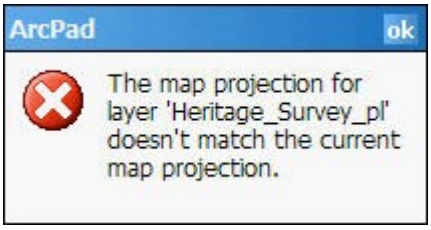
Appendix B: Common Errors

Avoid spatial reference mis-matches between the map and its layers

Warning! Changing the map's spatial reference does not change (re-project) the layer's spatial reference. **ArcPad does not project vector and raster layers on-the-fly, like ArcMap does,** so **all** layers **must** share the same spatial reference in order to be rendered correctly. Furthermore, the map's spatial reference must match that of all its layers.

In many cases, ArcPad warns users about mis-matches between a map's spatial reference and that of its layers (right). Nevertheless, it is possible for mis-matches to be created.

For instance, data layers might be referenced to NAD83 UTM Zone 12N while the map's data frame is referenced to NAD83 UTM Zone 13N. This would have the effect of writing Zone 13 coordinates into a Zone 12 shapefile, resulting in mischief, mishap, and mayhem.



4.1 Move a point feature using GPS

1. Select a point feature using the **Select and Vertex Editing** tool  . The point will be surrounded by a dark blue box.
2. Tap-and-hold on the point, and select Move To GPS from the context menu.
3. Wait for the specified number of GPS positions to be captured and averaged.
4. Tap Save Geometry Changes  to save the point's new location.
5. If needed, tap Feature Properties  to update the attribute entry form, and tap  .

4.2 Move a vertex of a polyline or polygon feature using GPS

1. Select a polyline or polygon feature using the Select and Vertex Editing tool  . Each of the feature's vertices will be surrounded by a dark blue box.
2. Tap-and-hold on the vertex of interest, and select Move To GPS from the context menu.
3. Wait for the specified number of GPS positions to be captured and averaged.
4. Tap Save Geometry Changes  to save the vertex's new location.
5. If needed, tap **Feature Properties**  to update the attribute entry form, tap  .

4.3 Capture a point feature midway through capturing a polyline or polygon feature using GPS

1. Begin capturing a polyline or polygon feature as described above.
2. If an opportunity arises to capture a point feature near the polyline's or polygon's alignment, tap the Add GPS Vertices Continuously button  to suspend data capture for that feature.
3. Move to the point feature's location, and capture it as described above.
4. Return to the point at which the polyline or polygon was suspended, and tap the Add GPS Vertices Continuously button  to resume data capture for that feature.
5. Complete polyline or polygon capture as described above.

4.4 Append vertices to the tail (end) of a polyline feature using GPS

1. Select a polyline using the Select tool  .
2. Select Append Vertices  from the Feature Properties drop-down menu.
3. Move to the tail (end) of the selected line and begin adding vertices with either the Add GPS Vertex button  or Add GPS Vertices Continuously button 
4. Continue along the feature's alignment until it is complete.
5. Tap Save Geometry Changes  to save the appended positions.
6. If needed, tap Feature Properties  to update the attribute entry form, and tap  .
7. Tap any other tool to deactivate the Append Vertices tool.

4.5 Insert vertices to the head (start) of a polyline using GPS

1. Select a polyline using the Select tool  .
2. Select Insert Vertices  from the Feature Properties drop-down menu.
3. Move to the head (start) of the selected line and begin adding vertices with either the Add GPS Vertex button  or the Add GPS Vertices Continuously button  .
4. Continue along the feature's alignment until complete.
5. Tap Save Geometry Changes  to save the inserted positions.
6. If needed, tap Feature Properties  to update the attribute entry form, and tap  .
7. Tap any other tool to deactivate the Insert Vertices tool.

4.6 Segment a polyline feature

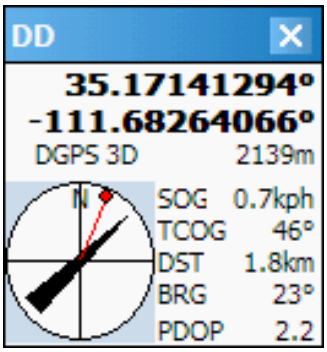
1. Select a polyline feature using the Select tool 
2. Select Segment Polyline  from the Offset Polyline/Polygon drop-down menu.
3. A new polyline feature will be automatically started, and its first vertex will coincide with the last vertex of the originally selected polyline.
4. Complete the polyline feature as previously described.

4.7 Repeat attributes

1. Select  a feature whose attributes are to be repeated when a new feature is created.
2. Select Repeat Attributes  from the Offset Polyline/Polygon drop-down menu.
3. Create new point, polyline, or polygon features, and note that any matching fields are populated with the originally selected feature's attributes.

4.8 Navigate to a feature

1. Select a feature using the tool. Tap  the Select drop-down menu, and select Go To Selected Feature. This will mark the feature as the current navigation target.
2. Open the GPS Position Window and tap the Skyplot panel twice to activate the Compass panel. The Compass panel indicates:
    a. Current GPS coordinates
    b. GPS mode
    c. Approximate elevation
    d. Speed
    e. Direction of travel (black pointer)
    f. Distance to the navigation target
    g. Bearing to the navigation target (red line)
    h. Indicator of position quality (PDOP)



3. Follow the red line to the navigation target. An alert is issued as the target is approached (right)