

Southeast Coast Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 2.3.10

Post Survey GPS Data Processing—Version 1.1

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Summary

The following standard operating procedure (SOP) outlines the procedures for post-processing the shoreline survey GPS data collected using SOP 1.3.22 *Conducting the GPS Shoreline Survey* (Baron 2018). Following the steps and procedures outlined in this SOP will ensure that the same techniques are used, that will allow comparisons of datasets to be made within and between parks through time. The topics addressed in this SOP include: (1) set unit time settings, (2) transferring GPS data to computer, (3) differential correction of GPS data, (4) exporting corrected GPS files, and (5) preparing exported files for analysis. These procedures are adapted from the *Northeast Coastal and Barrier Network (NCBN) Geomorphological Monitoring Protocol Part I—Ocean Shoreline Position* (Psuty et al. 2010). This SOP assumes the user has at least an intermediate understanding of Geographic Information Systems (GIS) and a familiarity with GPS data and Pathfinder Office software.

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
28 July 2020	Lisa Cowart Baron	Updated SOP with information to create a table with quality control data that will be used in the annual report	This step is performed to check the data during data processing, and was not previously reported. Now it will be included in the report.	1.1

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Required Equipment/Data List

- Desktop or laptop computer running ArcGIS 10.x
- Desktop or laptop computer running Pathfinder Office (PFO) 5.60 or higher
- GPS unit with shoreline monitoring GPS data collected according to SOP 1.3.22 (Baron 2018)

Procedure

The purpose of this SOP is to ensure that the same data set collection methods are used to monitor SECN shoreline change along the coastal parks, allowing comparisons to be made within and between parks over time. The high-tide neap-tide swash line will be mapped according to SOP 1.3.22 *Conducting the GPS Shoreline Survey—Version 1.0* (Baron 2018). Once the data are collected, the following steps should be followed to post-process the data for higher accuracy and prepare the data for analysis. Pathfinder Office (PFO) will be used to transfer the GPS data from the GPS unit to the computer, differentially correct the GPS data, and export the GPS data as an ArcGIS compatible format (shapefile).

Set Unit Time Settings

This section contains instructions on how to set the unit and time setting in PFO. Once the settings are set, they should remain this way when PFO is opened in the future; however, always check to ensure that the settings are correct.

1. Open PFO.
2. Click **options > units**.
 - a. Check that the following units are set (Figure 1).

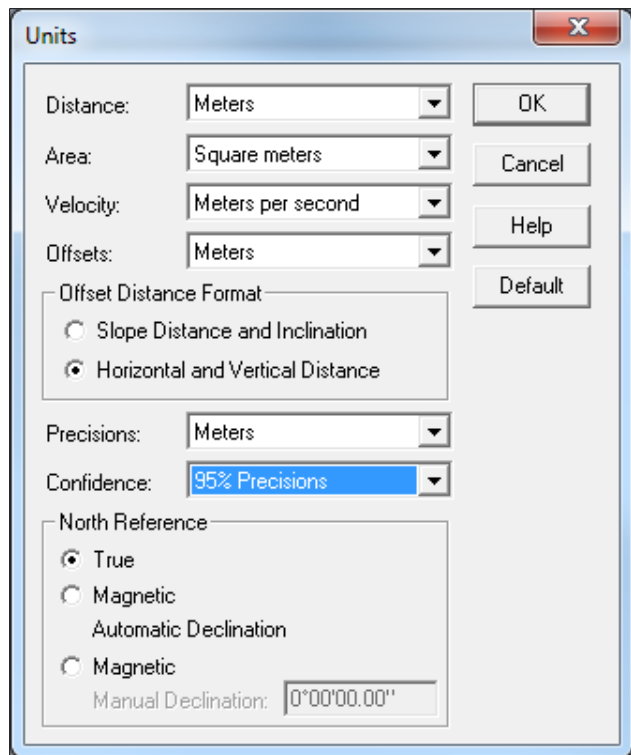


Figure 1. Screenshot of 'Units' window in Pathfinder Office (PFO).

- b. Click **OK**.
3. Click **options > time zone**. (Figure 2)

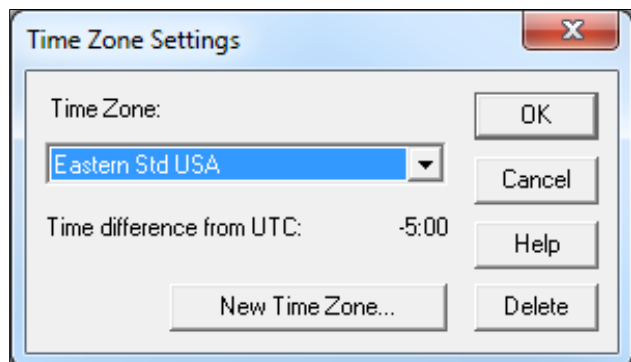


Figure 2. Screenshot of 'Time Zone Settings' window in PFO.

- a. Set to the current time zone.
 - i. Eastern Std USA is observed in the winter, starting the first Sunday in November through the second Sunday in March.
 - ii. Eastern Day USA is observed in the summer, starting the second Sunday in March through the first Sunday in November.

- b. Click **OK**.

Transfer GPS File to Computer

The following section describes how to transfer a GPS file from a GPS unit to a personal computer. The GPS file transfer should be performed after data collection to ensure data backup.

1. Connect the GPS unit to the computer and power it on.
2. The 'Windows Mobile Device Center' window (Figure 3) will appear and attempt to connect with the GPS unit.



Figure 3. Screenshot of 'Windows Mobile Device Center' window.

3. Once connected, click connect without setting up your device.
4. Open PFO.
5. The 'Select Project' window will appear (Figure 4).

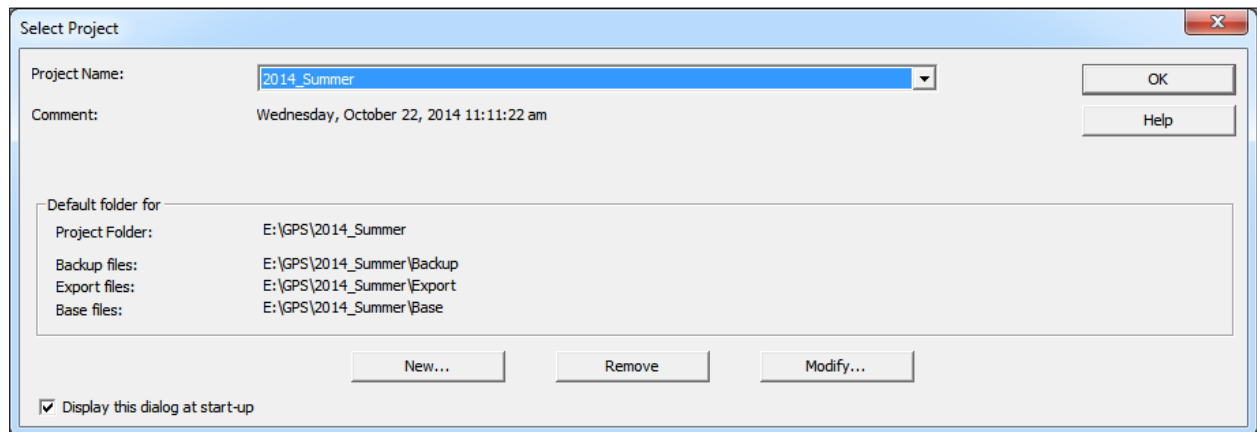


Figure 4. Screenshot of the 'Select Project' window displaying a default project that was previously created.

6. Select the park project where the data were collected. If there is not a project for the park where the data were collected, create a new park project. The same park project will be used to transfer data for that park in the future.

- a. To select a previously created park project:

- i. In the 'Select Project' window, click the drop down arrow next to the **Project Name** field (Figure 5).

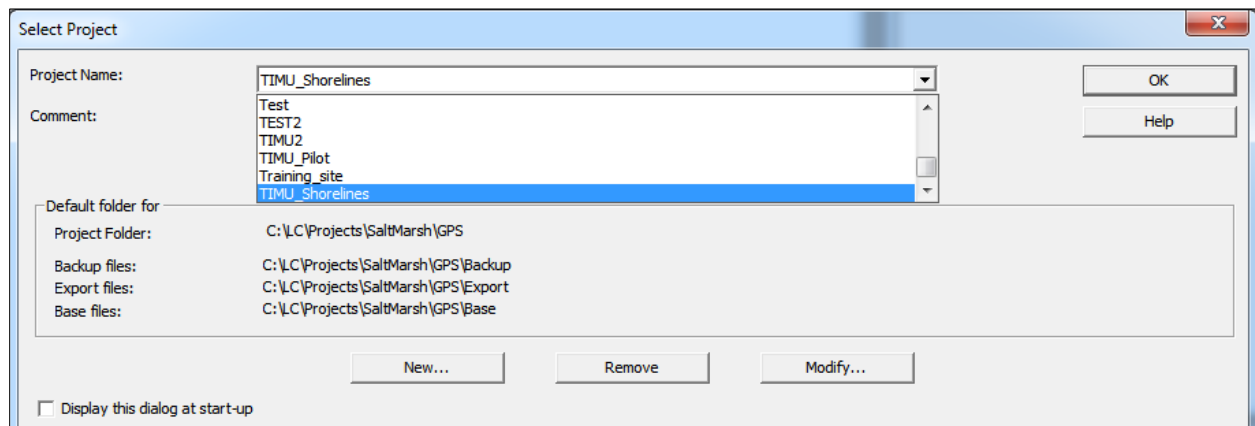


Figure 5. Screenshot of the Select Project window showing the drop down list of previously created projects with a PARK_Shorelines project selected.

- ii. Select a previous park project.

- iii. Click **OK**.

- iv. Go to step 7.

- b. To create a new park project:

- i. Click New. Select the location of the new project (where the data will be transferred).
- ii. Use the following format for the project name: "PARK_Shorelines" where PARK is the four letter park code. For example, for data collected at Canaveral National Seashore, type in CANA_Shorelines.
- iii. Note: the new folder name will be populated after the selected project location (Figure 6).

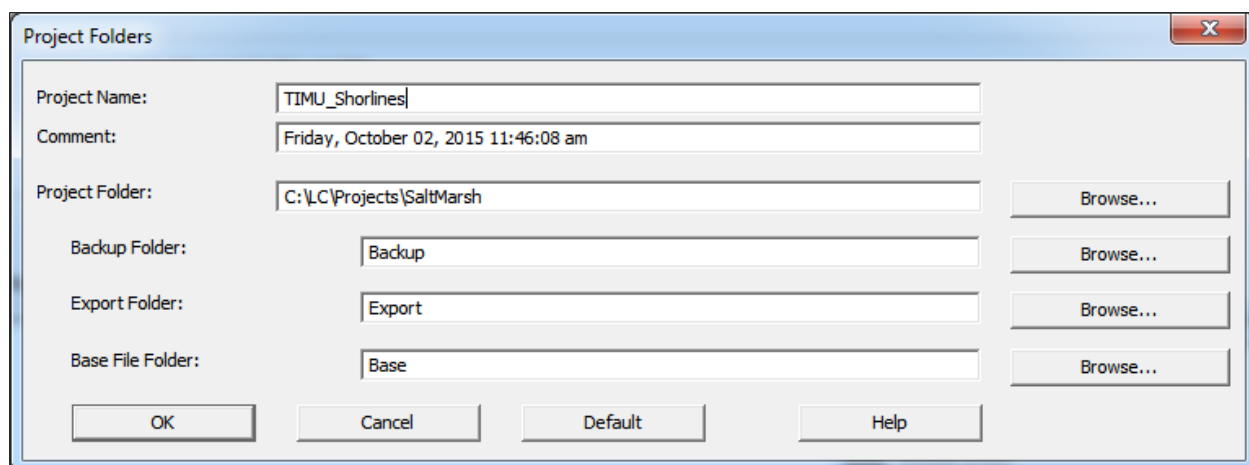


Figure 6. Screenshot of 'Project Folders' window displaying the Project Folder (location previously selected) and the Project Name created.

- iv. Click **OK**.
- v. The new park project that was just created should populate the 'Select Project' window (Figure 7).

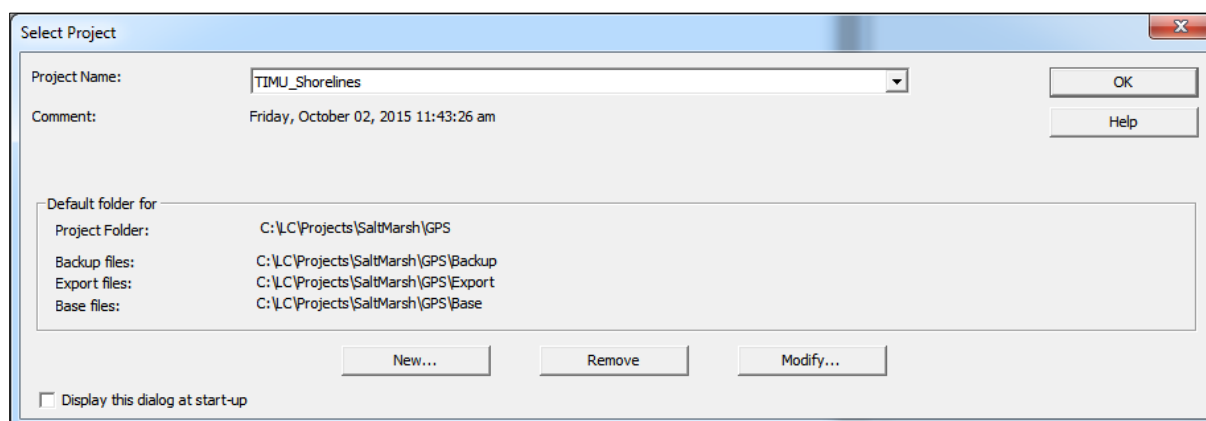


Figure 7. Screenshot of 'Project Folders' window displaying the previously selected Project Folder as the default location for the Project just created.

- vi. Click **OK** to make the main Pathfinder Office window accessible.
7. Transfer the data from the GPS to the PC by clicking Utilities > Data Transfer (Figure 8).

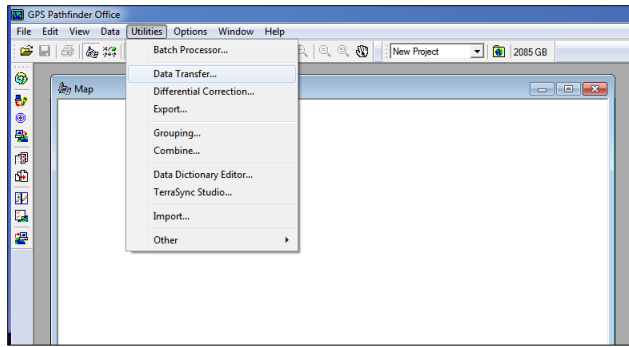


Figure 8. Screenshot of 'GPS Pathfinder Office' window.

8. The 'Data Transfer' window will appear and will begin connecting to the GPS unit (Figure 9).

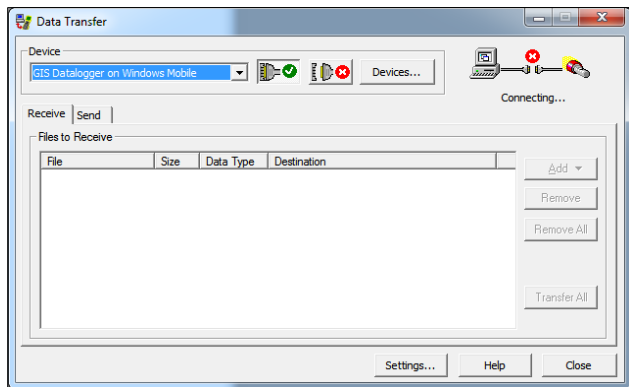


Figure 9. Screenshot of the 'Data Transfer' window showing the software is attempting to connect to the GPS unit.

9. Once the GPS unit connects, the window will appear as below (Figure 10). The unit should be recognized and connect automatically. The GPS unit does need to be ON in order to connect to the PC.
 - a. If the GPS unit does not connect, check the Windows Mobile window to see if the unit is still connected.
 - b. If the unit is not still connected in the Windows Mobile window, disconnect the cable between the PC and GPS unit and reconnect it.

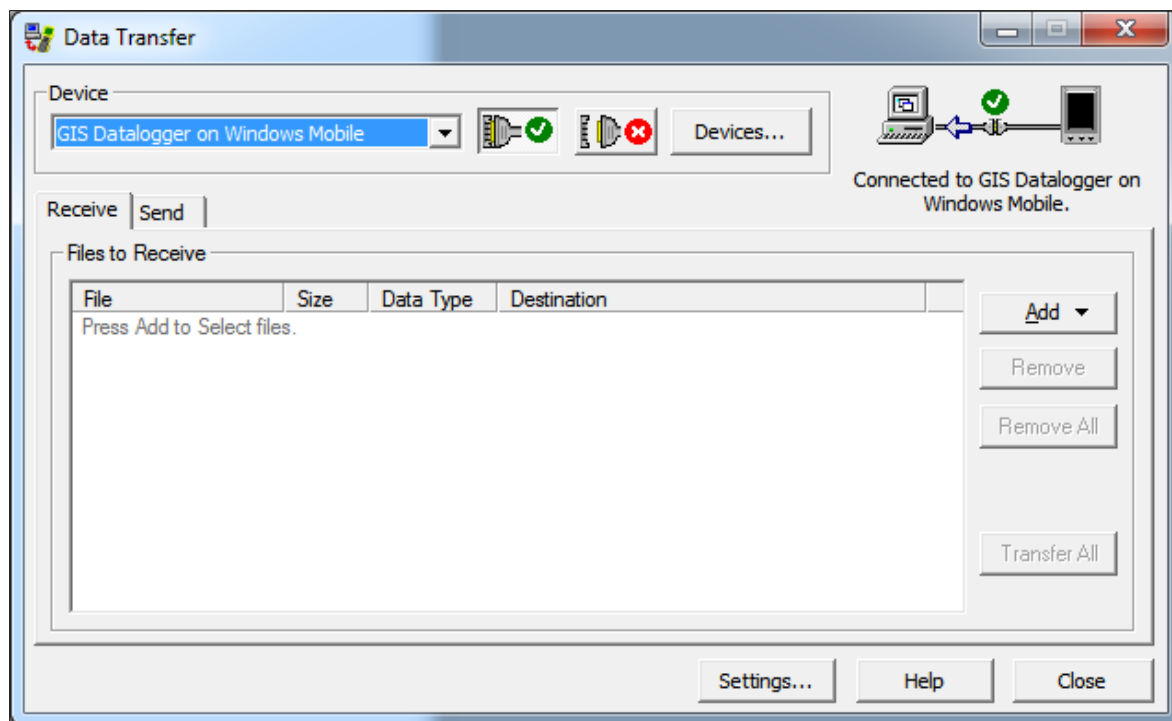


Figure 10. Screenshot of the 'Data Transfer' window showing the software has connected to the GPS unit.

10. Select the **Receive** tab and click **Add > Data File** (Figure 11).

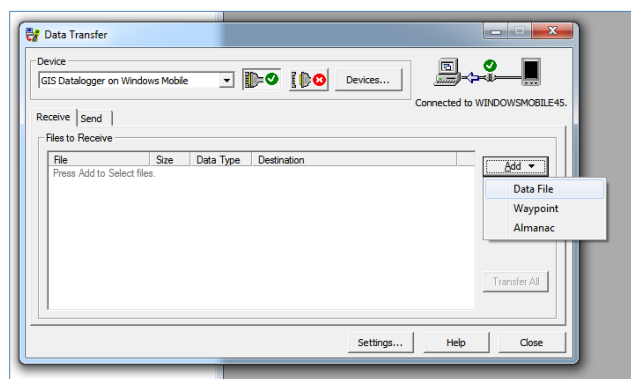


Figure 11. Screenshot of the 'Data Transfer' window showing the Receive tab active and Add options.

11. The 'Open' window will appear (Figure 12). Note: any files that have not been transferred will be highlighted automatically.

- a. Select the data files for the park project to transfer.
- b. Click **Open**.

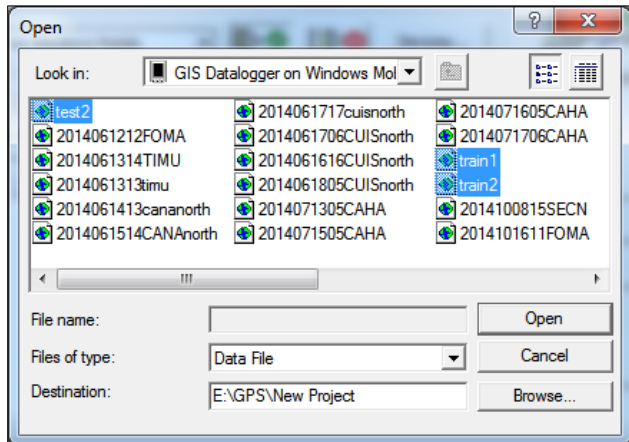


Figure 12. Screenshot of the 'Open' window.

12. The selected file(s) will be listed in the 'Data Transfer' window (Figure 13).

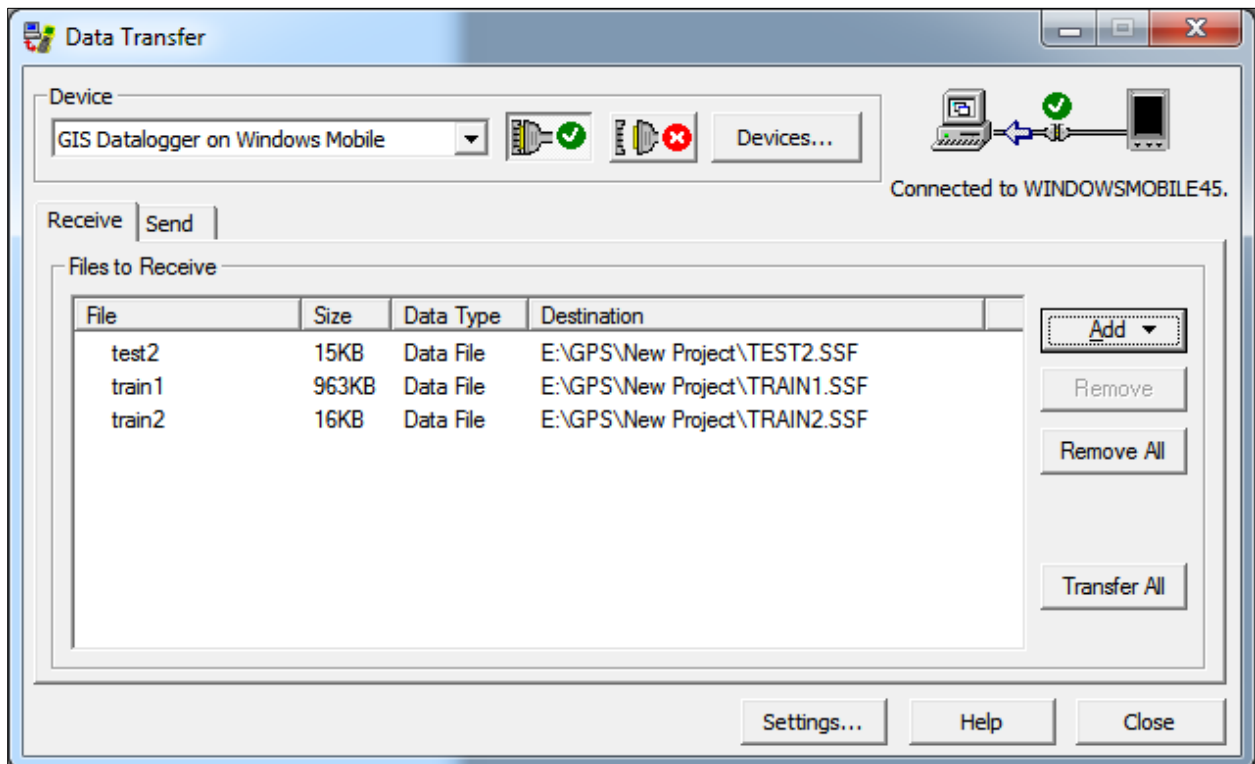


Figure 13. Screenshot of the 'Data Transfer' window.

13. Click Transfer All.

14. An information window will appear showing the progress of the transfer. Once the data have been transferred, a 'Transfer Completed' window will appear (Figure 14).

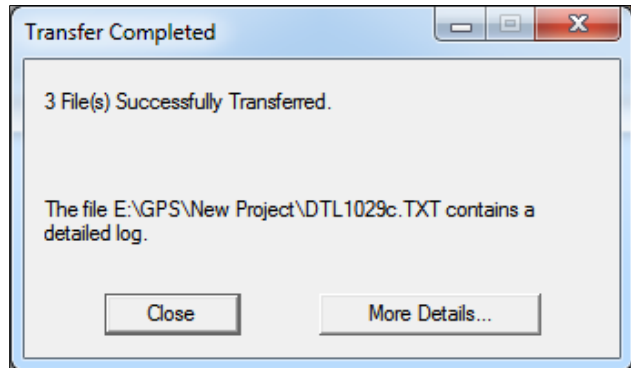


Figure 14. Screenshot of the 'Transfer Completed' window.

a. Click **close**.

15. Check that the data files have been properly transferred.

a. Open Windows Explorer by clicking **Start > Computer**.

b. Navigate to the project file location.

c. Data with an .SSF file ending should appear (Figure 13).

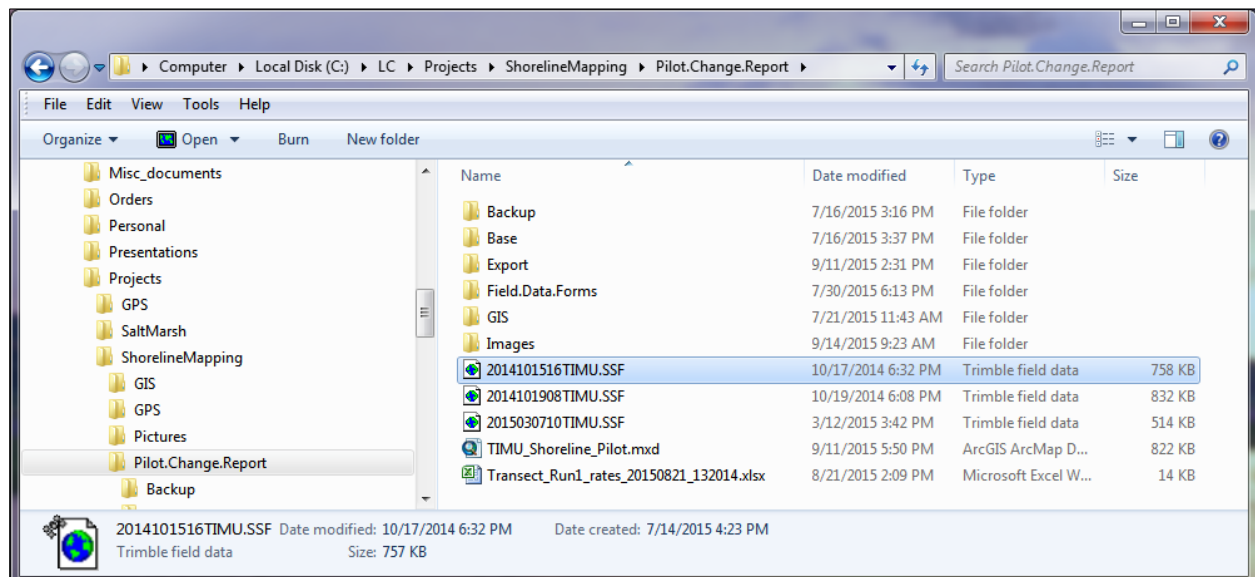


Figure 15. Screenshot of the 'Windows Explorer' window.

16. Close the 'Data Transfer' window.

17. Complete the Data Download section of the Field Data Form the shoreline survey information was recorded on.

Differential Correction of the GPS File

The following section describes how to differentially correct the GPS files that were transferred from the GPS in the previous section. Differential correction utilizes the Continuously Operating Reference Station (CORS) sites and reduces positional errors in the collected GPS data. Correct each GPS file (.ssf) separately. A processing spreadsheet row is filled in for each GPS file corrected, that includes the GPS filename, corrected files generated (.cor and .txt), CORS station used, and the post processor.

1. Open PFO.
2. Open the park project created previously.
3. Open an .SSF file by clicking the folder button in the toolbar or File > Open.
4. The file will be displayed in the Map window. If the map window is not open, click View > Map (Figure 16).

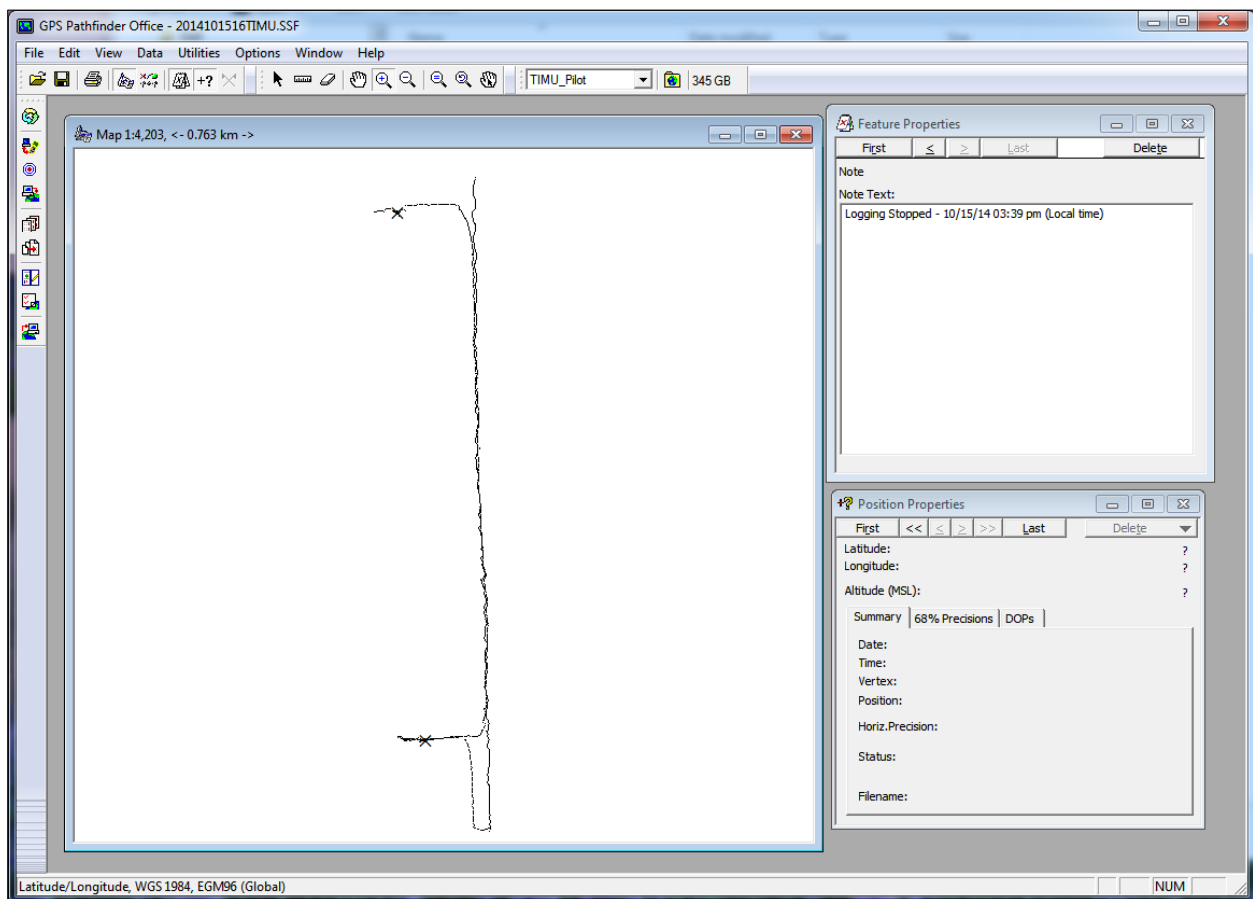


Figure 16. Screenshot of 'Map' window in Pathfinder Office.

5. Go to Utilities > Differential correction.
6. The 'Differential Correction Wizard' window will appear with the open file listed (Figure 17).

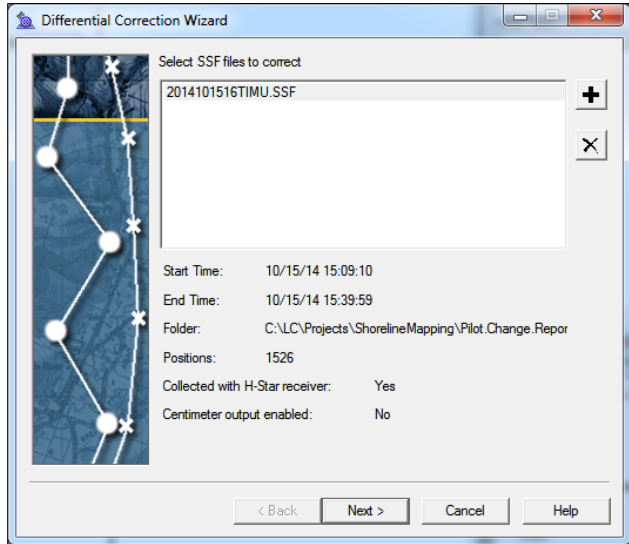


Figure 17. Screenshot of 'Differential Correction Wizard' window showing the dataset that is currently open in PFO.

- a. Click **Next**.
- b. Stepping through the wizard, select the following criteria as in Figure 18:
 - i. Processing Type—Automatic Carrier and Code Processing
 - ii. H-Star Processing—Use single base provider.
 - iii. Click **Next**.

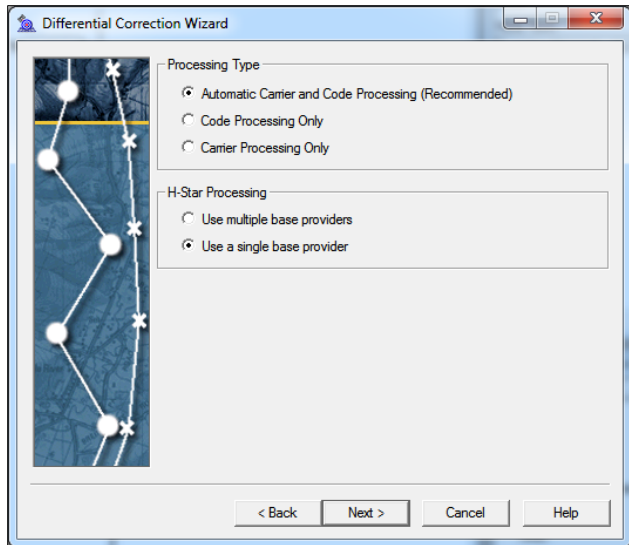


Figure 18. Screenshot of 'Differential Correction Wizard' window displaying the Processing Type and H-Star Processing options.

c. The Connect Settings will be displayed (Figure 19).

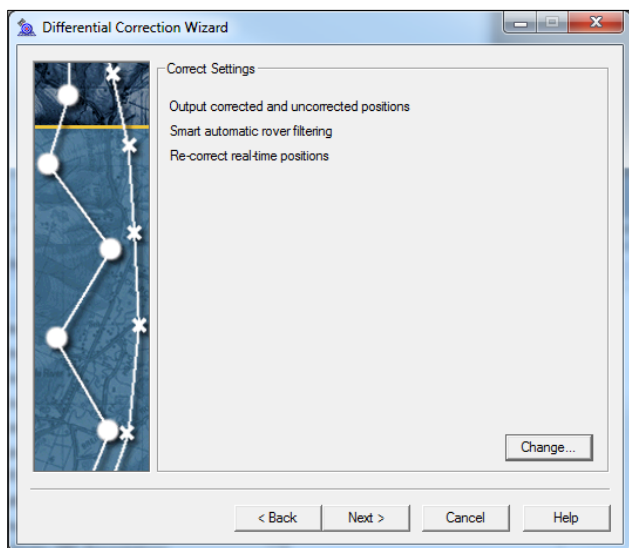


Figure 19. Screenshot of 'Differential Connection Wizard' window showing the Connect Settings options.

- i. If the settings match Figure 19, click **Next**. Otherwise, click the **Change** button and switch the settings to match the above figure, then click **Next**.
- d. The 'Base Data' and 'Reference Position' information will be displayed.
 - i. Select **Base Provider Search** and click **Select** (Figure 20).

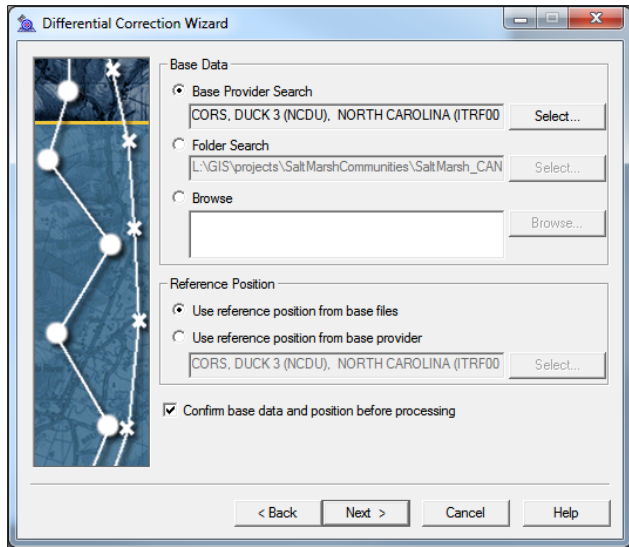


Figure 20. Screenshot of 'Differential Connection Wizard' window showing the Base Data and Reference Position options.

- ii. Click **Update List**. The base provider list will start downloading and the list will be updated (Figure 21).
- iii. Select a CORS base provider that is closest. A CORS that has both GPS and global navigation satellite system (GLONASS) is the best. An '*' in the 'G' column in Figure 20 denotes the CORS has GLONASS satellites. However, the information in the 'Select Base Provider' window is not up to date. Check the CORS information for the closest station on the NOAA CORS map web page.

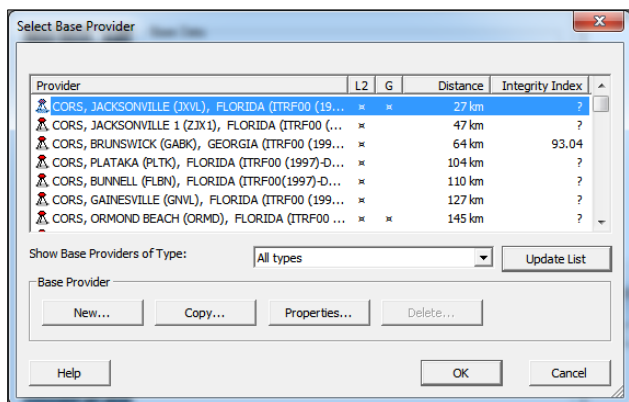


Figure 21. Screenshot of 'Select Base Provider' window.

- iv. Click **OK**.
- e. The 'Differential Correction Wizard' window will be updated with the selected base station information (Figure 22).

- f. Toggle ON 'Use reference position from base files.'
- g. Check the box near the bottom of the window to 'Confirm base'
- h. Click **Next**.

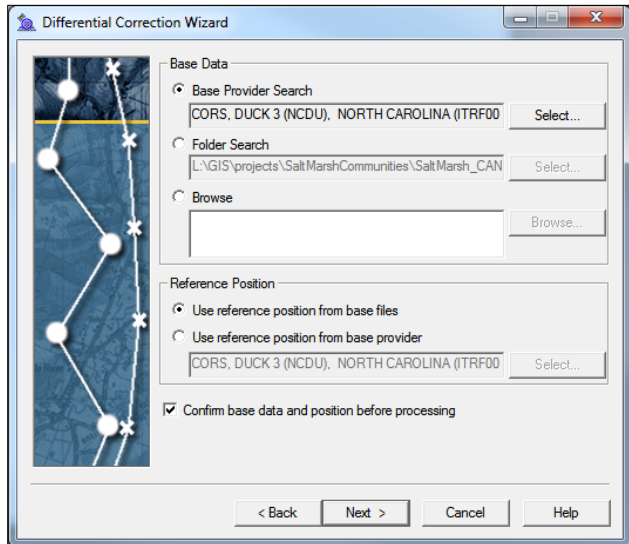


Figure 22. Screenshot of 'Differential Connection Wizard' window showing the Base Data and Reference Position options with the base station selected listed as the Base Provider Search.

- i. The 'Output folder' and 'Output Filename' information will be displayed (Figure 23).
 - i. Select the following criteria: 'Output Folder'—Use the project folder
 - ii. 'Output Filename'—create a unique filename based on the input filename.
- j. Click **Start**.

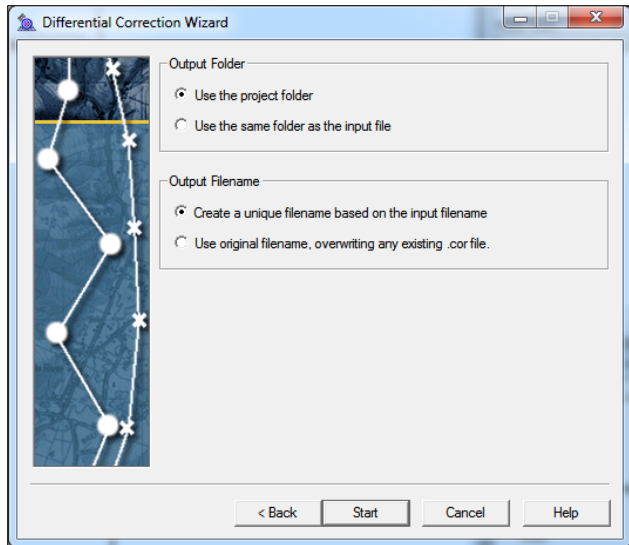


Figure 23. Screenshot of 'Differential Connection Wizard' window displaying the Output folder and Output Filename options.

k. The wizard will search for the base files (Figure 24).

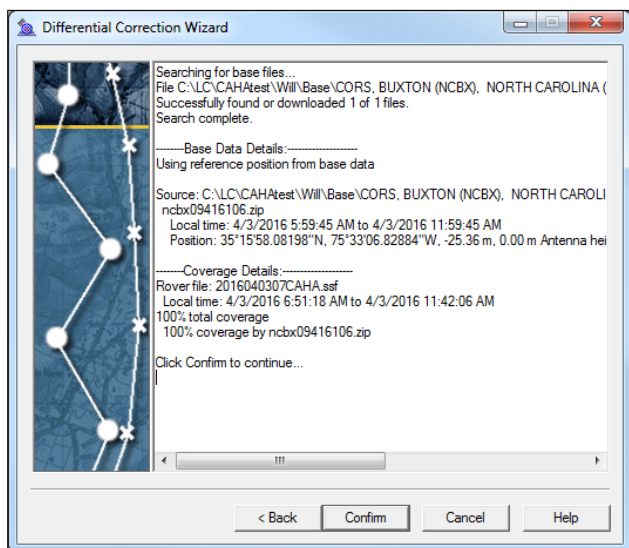


Figure 24. Screenshot of the 'Differential Connection Wizard' window of the 'Differential Connection Wizard' window.

- l. Open an internet browser.
 - i. Navigate to the [NOAA National Geodetic Survey website](http://www.noaa.gov/geodetic/survey).
 - ii. Click the CORS link on the left side of the page.
 - iii. Type in the four letter CORS station selected, which is listed in the 'Differential Connection Wizard' window.

- iv. Click **Enter Siteid**.
- v. Click **Coordinates** on the left side of the webpage.
- vi. Click **Position and Velocity**.
- vii. Compare the position displayed in the Differential Correction Wizard window with the coordinates shown in the NAD_83 (2011) POSITION (EPOCH 2010.0). These should match up to the fourth decimal place.
- m. If there is 100% coverage, click **Confirm**. If there is not 100% coverage, click **Back** and select the next closest CORS site until you get 100% coverage.
- n. The wizard will display the error associated with the corrected data (Figure 25).
- o. Click **Close**.

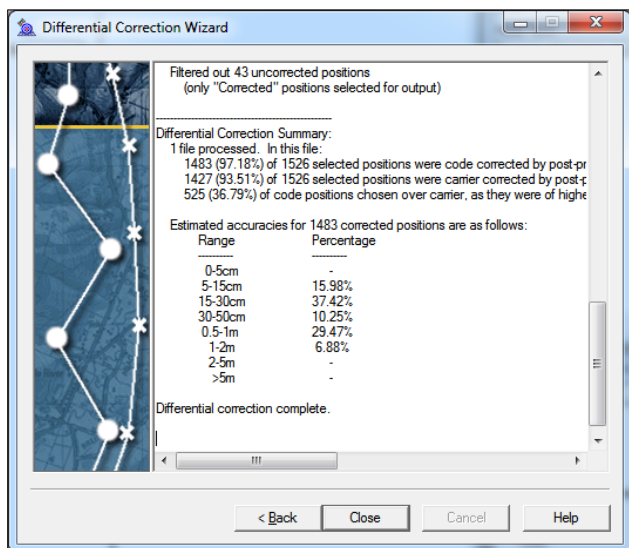


Figure 25. Screen capture of the 'Differential Correction Wizard' window displaying the differential correction information, including the accuracy of the corrected data.

- p. Open Windows Explorer and navigate to the project folder location.
 - i. There should be two new files listed, a .cor and a .txt (Figure 26).

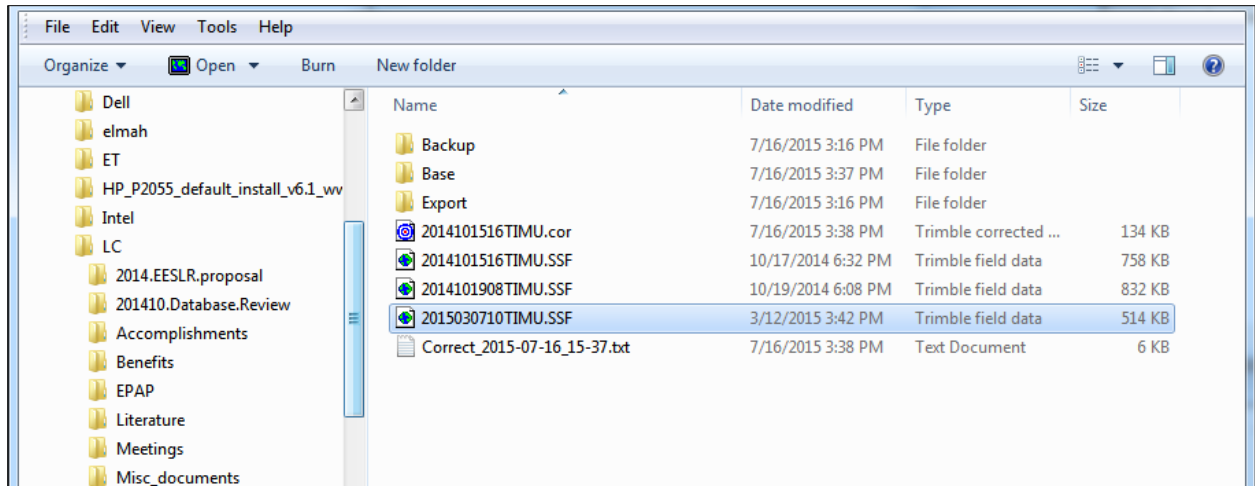


Figure 26. Screen capture of the Windows Explorer window.

- ii. Rename the new .txt file with the same naming convention as the .ssf and .cor filename from which it was created, but retain the 'Correct_YYYY_MM_DD_TIME' at the end of the filename (Figure 27).

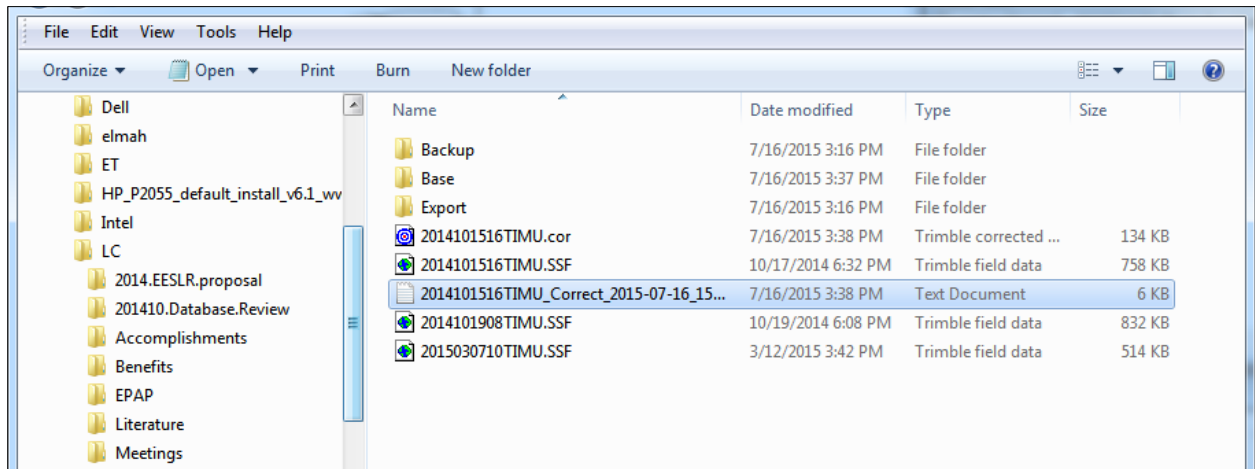


Figure 27. Screen capture of the 'Windows Explorer' window displaying the renamed .txt file containing the differential correction information.

7. Fill in the processing spreadsheet, including the following sections:
 - a. GPS Data Filename
 - b. Processing Date
 - c. Processed By
 - d. Post Processing

8. Repeat the steps 2–7 to differentially correct the rest of the files that need to be corrected.

Export Corrected GPS File as Shapefile

The following section describes how to use PFO to export a corrected GPS file as a shapefile, rename the shapefile to retain the naming scheme of the original GPS filename, and project the shapefile so that its location will be known when opened in ArcGIS. A processing spreadsheet row is filled in for each GPS file corrected, with the exported files created and their coordinate system and datum.

Setup Pathfinder Office

1. In Pathfinder Office, using the park project from the previous section, open the .cor file by clicking on the folder button or **File>Open**. The corrected GPS file will be displayed in the 'Map' window (Figure 28).

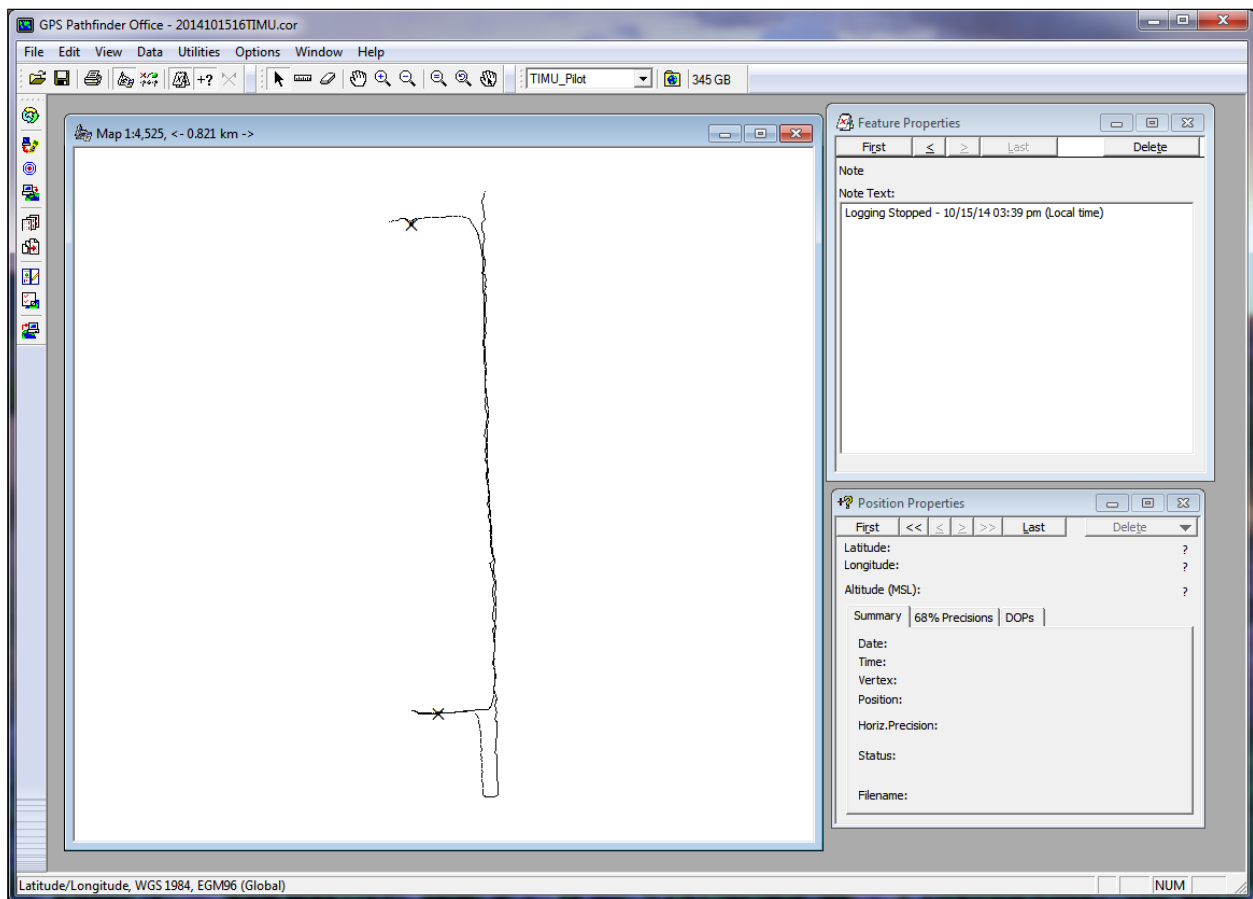


Figure 28. Screen capture of Pathfinder Office where the 'Map' window is displaying the corrected GPS file.

2. Click **Utilities > Export**.
3. The 'Export' window will appear (Figure 29).
 - a. Make sure that the file you selected is listed under **Selected Files**. If not, browse to the location of the file, select it, and click **Open**.
 - b. PFO will automatically put the exported file in the export folder of the project folder. The location will be displayed under **Output Folder** (Figure 29).
 - c. In the **Export Setup** section, choose an export setup that is an ESRI Shapefile format. It can be listed as 'New ESRI Shapefile' or 'Sample ESRI Shapefile' (Figure 29).

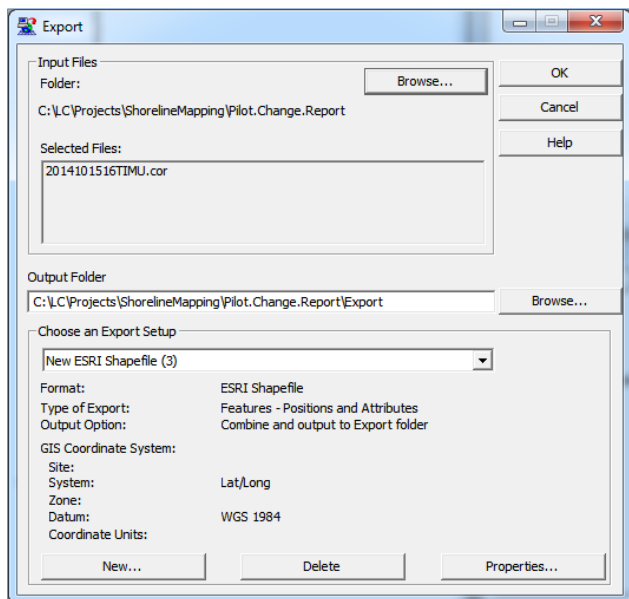


Figure 29. Screen capture of the 'Export' window displaying the Input Files, Output Folder, and Export Setup. The Export Setup shows the ESRI Shapefile format selected.

Set Export Properties

Below are the steps to set the parameters for exporting the corrected GPS files as an ESRI shapefile. After clicking **Properties** in the 'Export' window, select the following information in each tab.

1. On the data tab, select the following options:
 - a. Features-Positions and Attributes—Export All Features (Figure 30).

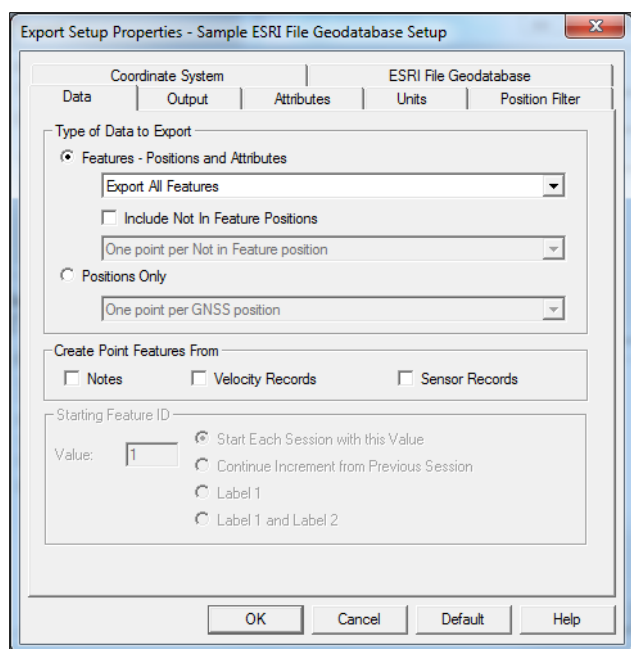


Figure 30. Screen capture of the 'Export Setup Properties' window, showing the DATA tab.

2. On the **Output** tab, select the following default settings (Figure 31):
 - a. Output Files—Combine all input files and output to the project export folder
 - b. System File Format—DOS Files.

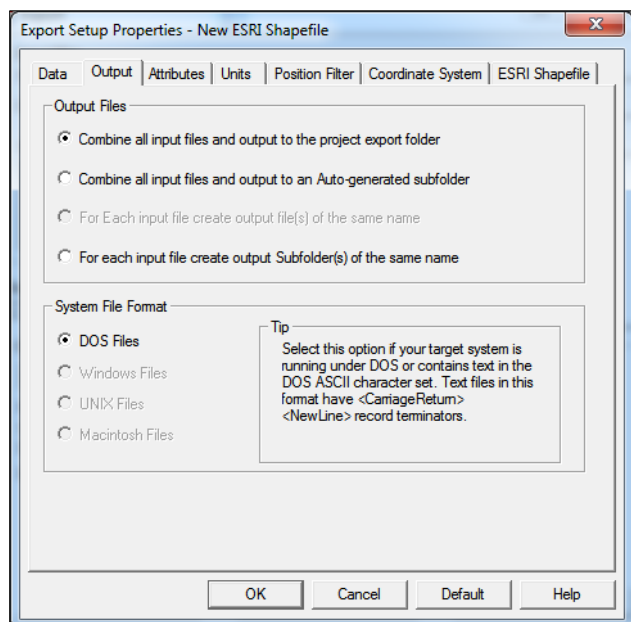


Figure 31. Screen capture of the 'Export Setup Properties' window, showing the OUTPUT tab.

3. On the **Attributes** tab, select the following (Figure 32):

- a. Export Menu Attributes As: Attribute Value
- b. All Feature Types—Toggle ON all attributes
- c. Line Features—Toggle ON all attributes
- d. Point Features: Toggle ON all attributes
- e. Area Features—Toggle ON all attributes.

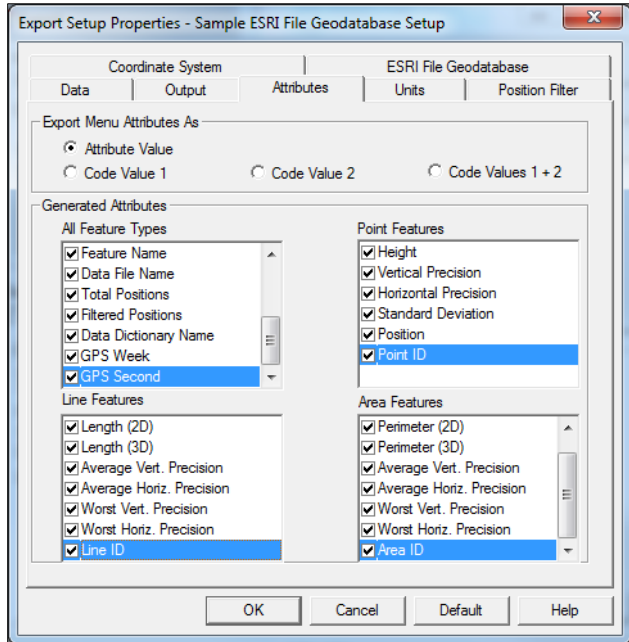


Figure 32. Screen capture of the 'Export Setup Properties' window, showing the ATTRIBUTES tab.

4. On the **Units** tab (Figure 33):
 - a. Check 'Use Current Display Units.'
 - i. Distance—Meters
 - ii. Area Units—Square Meters
 - iii. Velocity Units—Meters Per Second.
 - iv. Note: If the PFO settings were set in the beginning, these should already be meters.

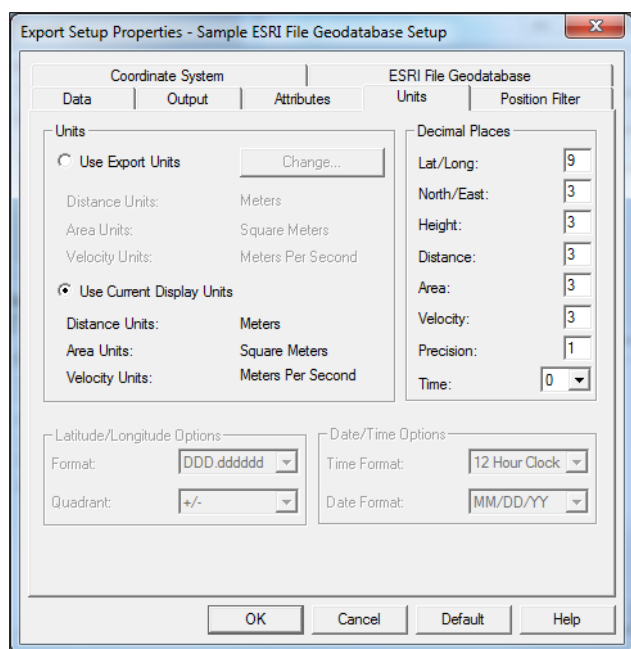


Figure 33. Screen capture of the 'Export Setup Properties' window, showing the UNITS tab.

5. On the **Position Filter** tab, select the following default settings (Figure 34):

a. 'Filter by GNSS Position Info'

- i. Minimum Geometry: 2D (3 or more measurements)
- ii. Maximum PDOP: Any
- iii. Maximum HDOP: Any

b. 'Include Positions That Are'

- i. If the differential correction is <100% toggle ON Uncorrected. If differential correction was 100% toggle OFF Uncorrected
- ii. P(Y) Code
- iii. Real-Time SBAS
- iv. Real-Time Code
- v. Post-processed Code
- vi. Real-time Carrier Float
- vii. Post-processed Carrier Float
- viii. RTK Fixed

ix. Post-processed Carrier Fixed

c. Toggle **on** 'Include Non-GNSS Positions'

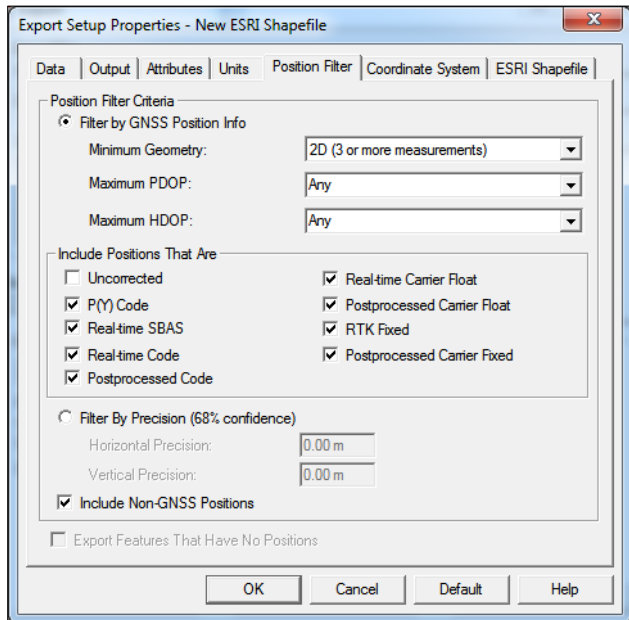


Figure 34. Screen capture of the 'Export Setup Properties' window, showing the POSITION FILTER tab.

6. On the **Coordinate System** tab (Figure 35), select the following:

a. Toggle **on** Use Export Coordinate System and click **Change**.

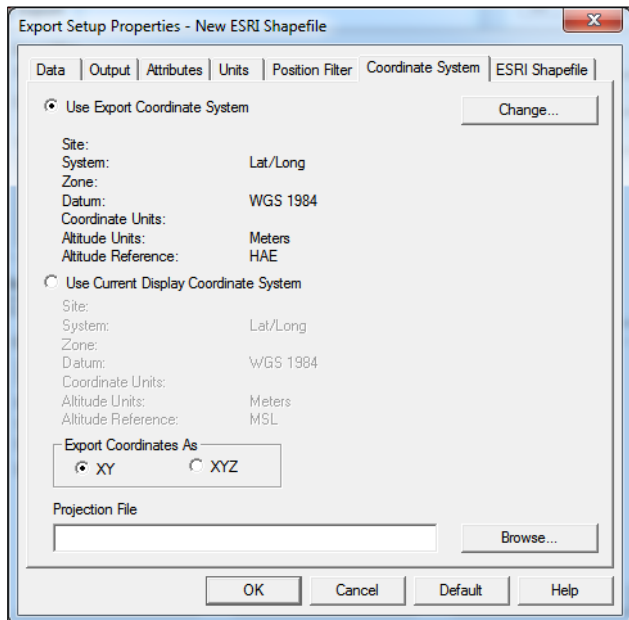


Figure 35. Screen capture of the 'Export Setup Properties' window, showing the COORDINATE SYSTEM tab.

- b. In the Export Window (Figure 36), select the following criteria:
 - i. System—UTM
 - ii. Zone —17N or 18N (CANA, FOMA, TIMU, and CUIS are 17N; CAHA and CALO are 18N)
 - iii. Datum—NAD 1983 (Conus)
 - iv. Altitude Measured From—Toggle ON Height Above Ellipsoid (HAE)

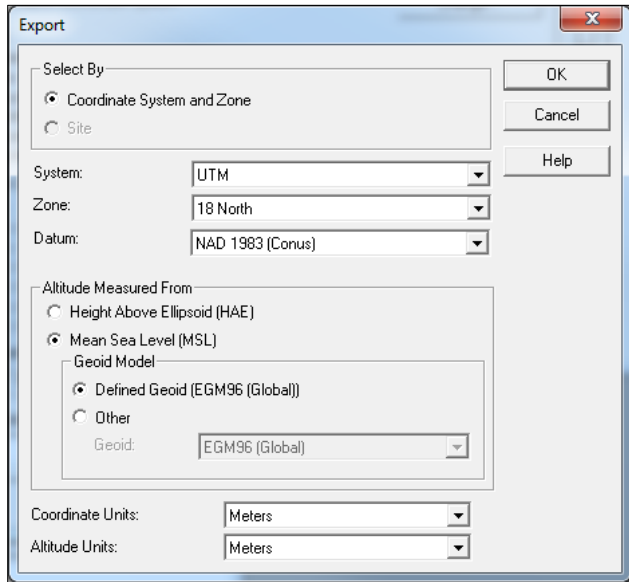


Figure 36. Screen capture of the 'Export' window. Displayed when you change the coordinate system.

- v. Click **OK**. The settings selected will be displayed under **use export coordinate system** (Figure 37).

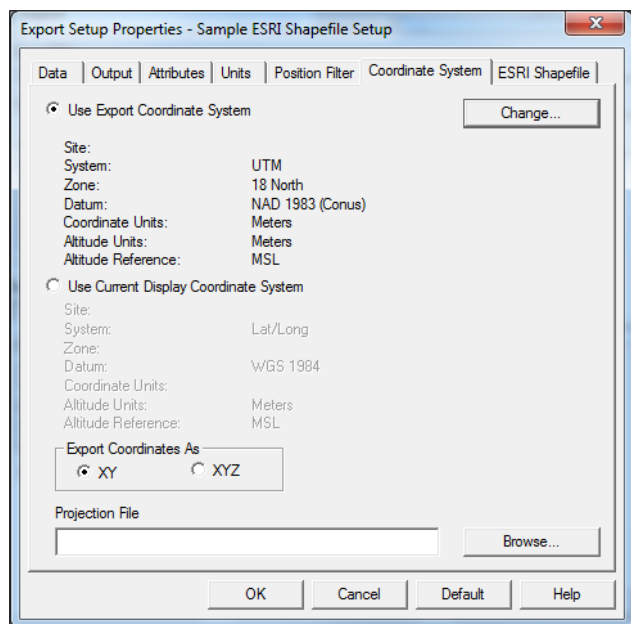


Figure 37. Screen capture of the 'Export Setup Properties' window, showing the COORDINATE SYSTEM tab.

7. On the ESRI shapefile tab (Figure 38), select the following:

- a. Toggle off Export Tracking Themes

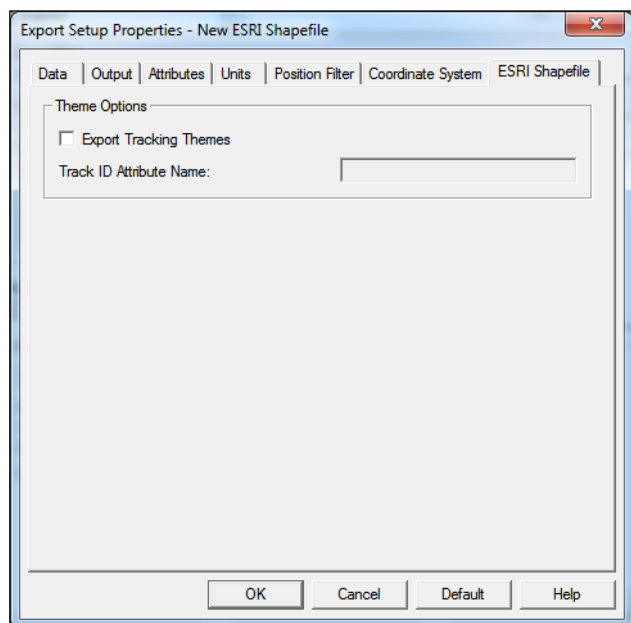


Figure 38. Screen capture of the 'Export Setup Properties' window, showing the ESRI SHAPEFILE tab.

8. Click **OK**

9. The 'Export' window (Figure 39) will be updated with the coordinate system information selected.

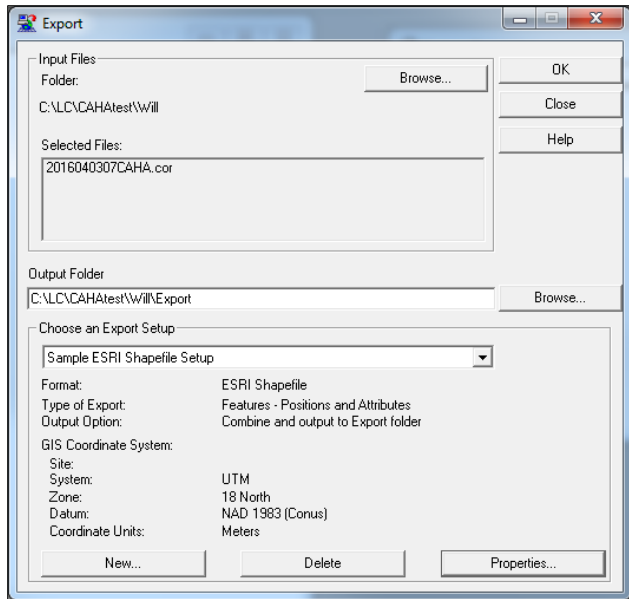


Figure 39. Screen capture of the 'Export' window displaying the Input Files, Output Folder, and Export Setup options. The coordinate system selected is listed under the GIS Coordinate System section.

Export ESRI Shapefiles

This section lists the steps to export the corrected GPS file as an ESRI shapefile with the attributes and settings set in the 'Set Export Properties' section.

1. On the Export window (Figure 39), click **OK**.
2. An information window will appear asking if you want to continue (Figure 40).
 - a. Click **Yes**

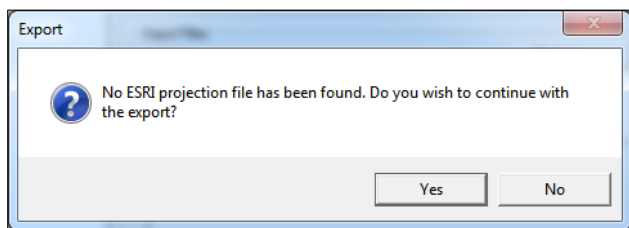


Figure 40. Screen capture of the 'Export' information message informing that the no projection file has been found.

3. A window will appear with information about the exported data (Figure 41).
 - a. Once the export is complete, click **Close**

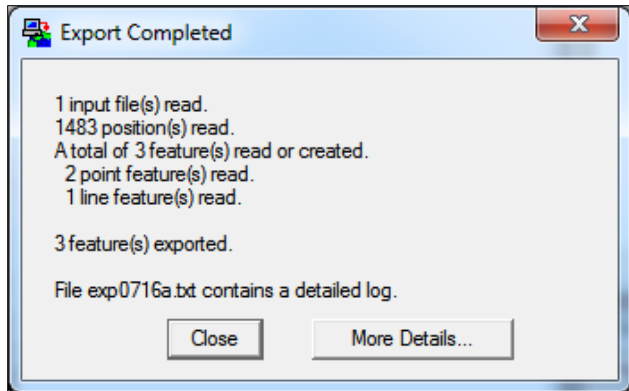


Figure 41. Screen capture of an information window informing that the export was completed and the number of features exported.

4. Open ArcCatalog and navigate to the location of the exported shapefile (Figure 42).

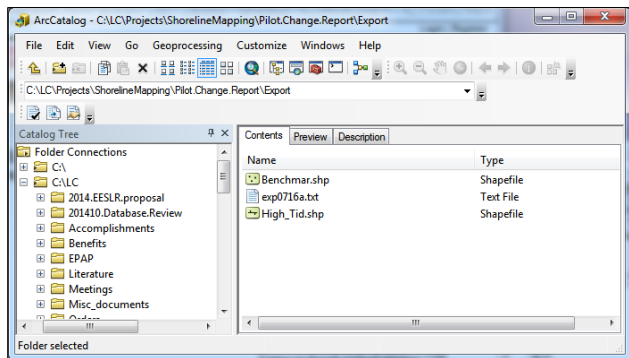


Figure 42. Screen capture of the 'ArcCatalog' window displaying the exported files.

- a. In addition to the shapefiles, there will be a .txt file exported also. Rename each of the exported files so that the GPS filename is followed by the exported name and complete the 'Benchmark' and 'High_Tide' clipped exported file names (Figure 43).
 - i. For example, 'Benchmar.shp' will be renamed 'YYYYMMDDHHPARK_Benchmark.shp' and 'High_Tid.shp' will be renamed 'YYYYMMDDHHPARK_High_Tide.shp'. Where 'YYYYMMDDHHPARK' is the GPS file from which the data are exported.

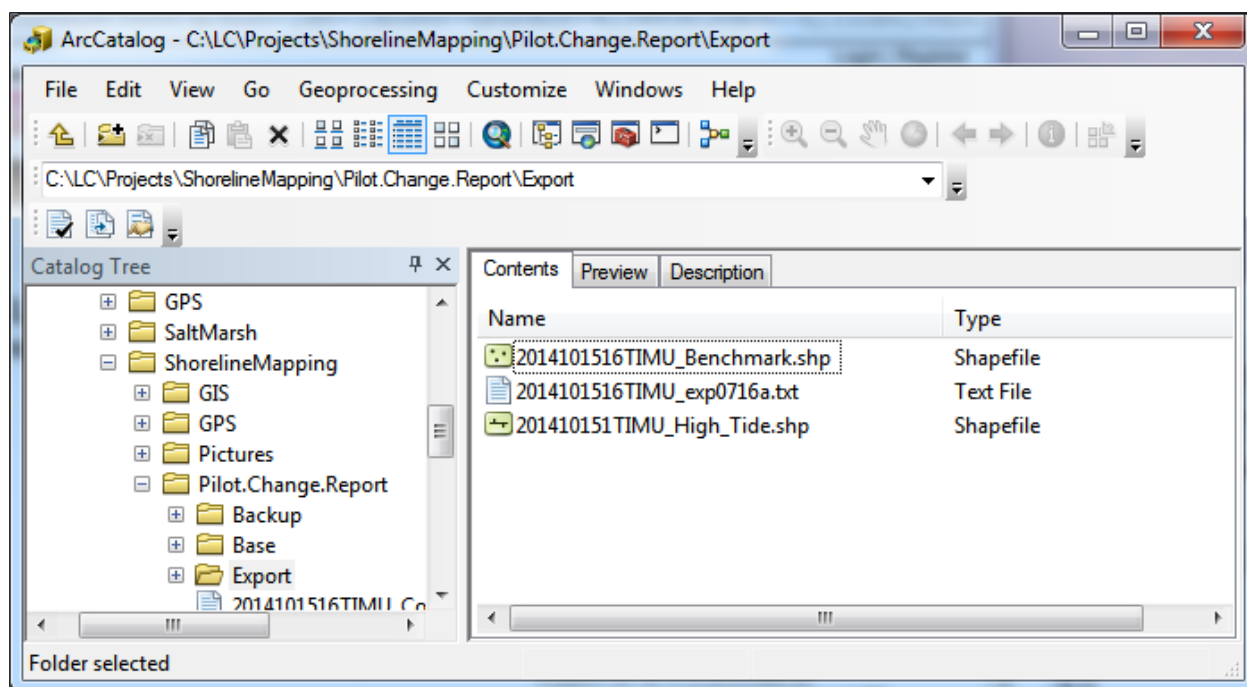


Figure 43. Screen capture of the 'ArcCatalog' window displaying the renamed files.

5. Define the projection of the exported shapefiles in each shapefile's properties window using the same coordinate system defined when the corrected GPS file was exported from Pathfinder Office.
 - a. CANA, FOMA, TIMU, and CUIS are NAD_1983_2011_UTM_Zone_17N
 - b. CAHA and CALO are NAD_1983_2011_UTM_Zone_18N
6. Fill in the processing spreadsheet 'Export' section.
7. Once the shapefiles have been renamed and their projections have been defined, repeat the steps in the 'Exported Corrected GPS File as Shapefile' section for any other differentially corrected GPS files (.cor).

Prepare GIS Files for Analysis

Once the GPS files have been differentially corrected, exported as shapefiles, and projected in UTM, the data need to be cleaned up and edited before they can be analyzed in DSAS. This section addresses QA/QC and editing of the data, formatting the shapefile(s) for analysis, and creating metadata.

QA/QC and Editing the Shoreline Shapefile(s)

The steps below describe how to edit the shoreline shapefiles and prepare them for DSAS.

1. Open ArcCatalog and navigate to the location where the shapefiles were exported (Figure 44).

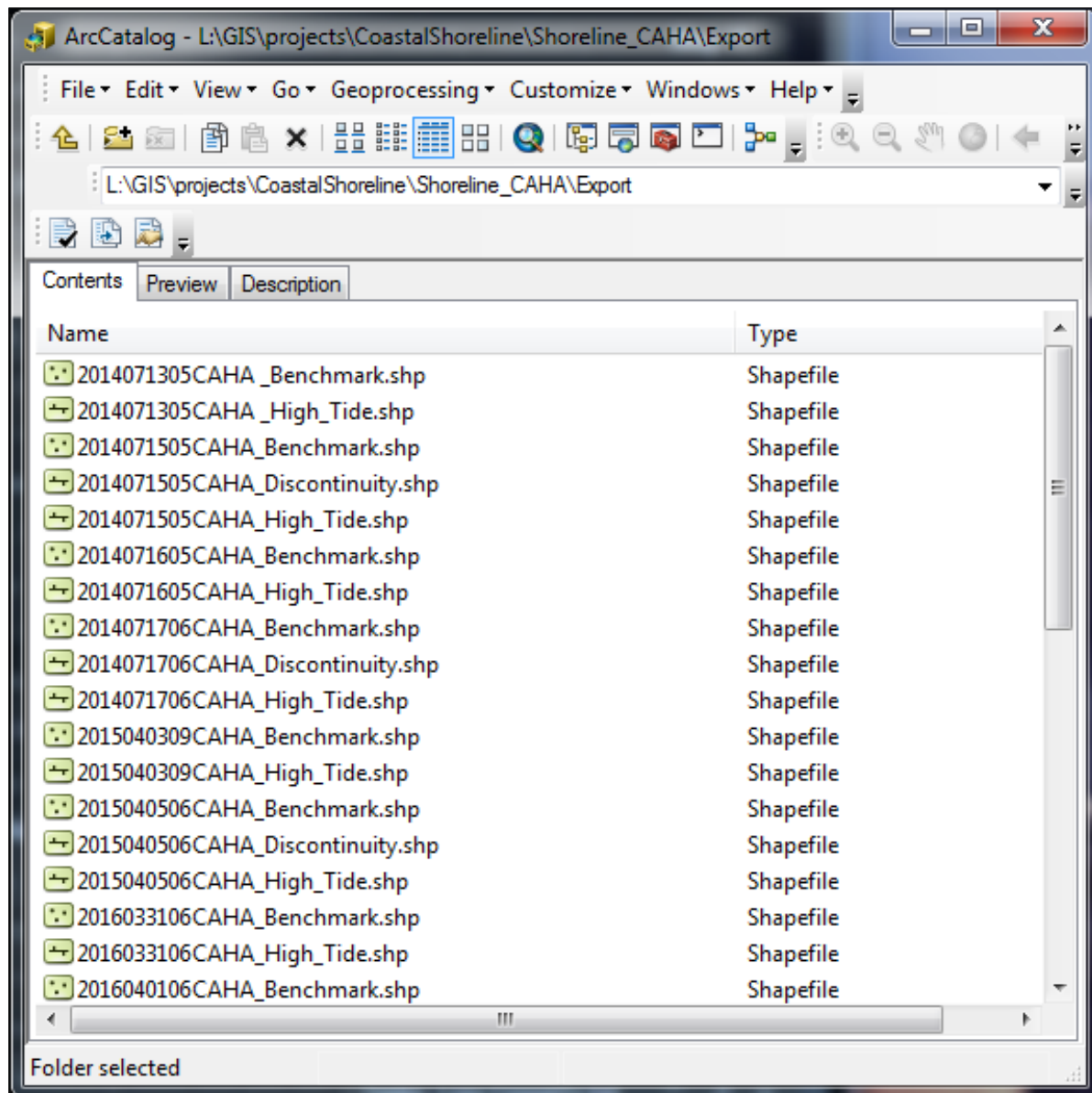


Figure 44. Screen capture of the 'ArcCatalog' window displaying the exported and renamed files in the park project folder.

- a. Create a copy of the high tide shapefile and rename it with '_Edit' at the end. For example, 2014101516TIMU_High_Tide_Edit.shp (Figure 45).

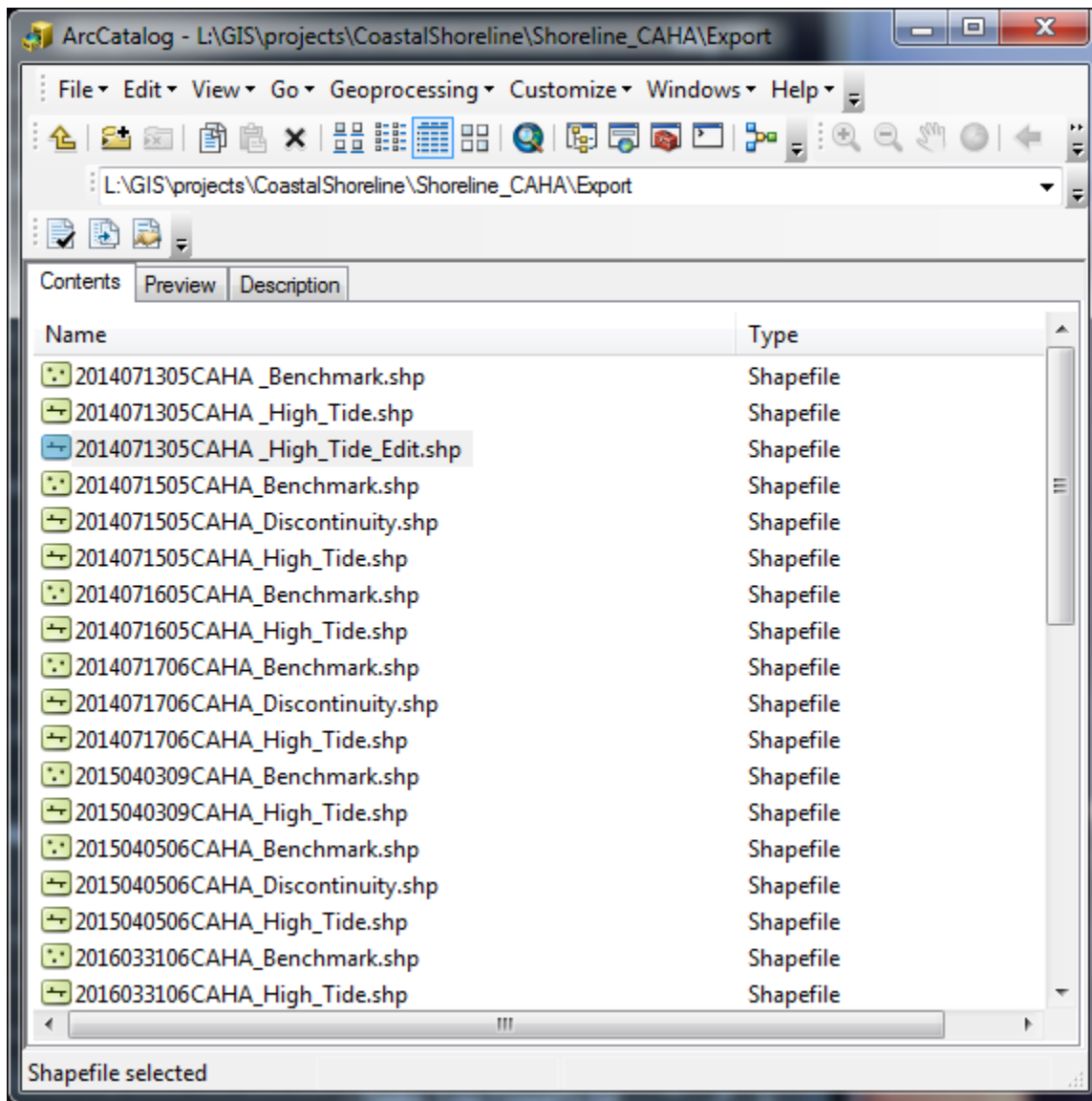


Figure 45. Screen capture of the 'ArcCatalog' window displaying a copied and renamed high tide shapefile.

1. Open ArcMap.
2. Open the park shoreline change project map.
3. Add the benchmark, discontinuity edit, and high tide edit shapefiles. If not already included in the park project map, add recent imagery as a background (Figure 46).

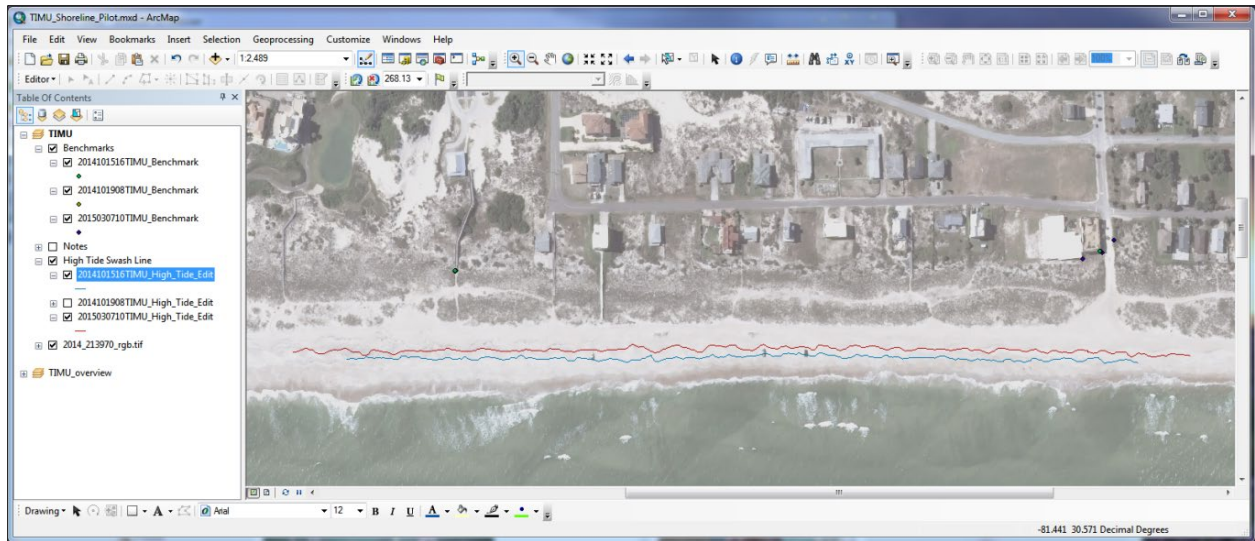


Figure 46. Screen capture of 'ArcGIS' displaying a park map and the copied and renamed shapefile that is going to be edited.

4. Review the data using the Field Data Form notes and the surveyors input. Visually assess the shoreline feature(s) and correct any errors.
 - a. Errors should be noted in the Field Data Form. Some examples may include:
 - i. Data logged when the surveyor meant to pause the data collection and tend to a visitor's question
 - ii. Data logged when the surveyor strayed from the high-tide neap-tide swash line (This information should be in the written notes on the Field Data Form)
 - iii. Any data logged that were not a high-tide neap-tide swash line, discontinuity, or benchmark.
 - b. Any corrections that are made in ArcMap should be recorded in the processing spreadsheet.
 - c. In the screen capture below (Figure 47), the surveyors forgot to pause the data collection while they went to answer a visitor's question, as shown on the red shoreline. The cause of the error was noted on the field data form during data collection.



Figure 47. Screen capture of the 'ArcGIS' map view displaying erroneous data that will be edited.

- d. For the above example, delete the portion of the line that extends landward of the red shoreline to clean up the data. Record the edit on the field data form. The edited result should look like the screen capture below (Figure 48).



Figure 48. Screen capture of 'ArcGIS' map view displaying the edited high tide shapefile.

- e. If the field data forms indicate the surveyor strayed from the high-tide neap-tide swash line and returned to the high-tide neap-tide swash line and started a new shoreline, clip the lines so that there is no overlap.
 - f. Address any other issues noted in the field data form that were resolved through editing and note changes in the processing spreadsheet.
6. Using the measure tool, measure the distance of the benchmarks to the location on the imagery. The most recent imagery available for the surveyed area should be used to check the benchmark locations, in addition to data collected during previous shoreline surveys. The imagery used in this step should have ≤ 1 meter resolution. If the distance measured from the imagery location of the temporary benchmark to the GPS location of the temporary benchmark is greater than five meters, the shoreline may need to be re-surveyed. Retain the distance information to make a table similar to Table 1 for the annual report.
 - a. **Note:** The error associated with imagery varies. The accuracy of 0.3 meter resolution Digital Orthophotos is 1.5 meters.

Table 1. Example table of quality control information for the benchmark locations used to check the shoreline data. The reference latitude and longitude, survey latitude and longitude, and distance between the two points is listed for the benchmark locations collected during the shoreline survey.

Benchmark	Reference Location Latitude	Reference Location Longitude	Survey Location Latitude	Survey Location Longitude	Distance (meters)
FOMA01	29.716705	-81.23299	29.716702	-81.232991	0.04
FOMA02	29.713442	-81.230369	29.713439	-81.230378	0.81

Format the Shoreline Shapefile(s) for DSAS

In order to be used in the DSAS routine (Himmelstoss 2009), once the shoreline shapefile has been edited it needs to be properly attributed. Additionally, if multiple features were created during the shoreline survey, they need to be dissolved into a single feature.

Dissolve the Shorelines

Once the shapefile has been edited, if there are multiple features, the features need to be combined into one feature. Use the Dissolve tool to perform this function. If there are not multiple shoreline features in the survey, delete the all fields, except the 'Park_Unit' and move to the Attribute Fields section of the SOP.

1. Open ArcCatalog.
2. Select the edited shoreline shapefile that will be dissolved.
3. Open the Dissolve tool in Arc Toolbox (Figure 49).

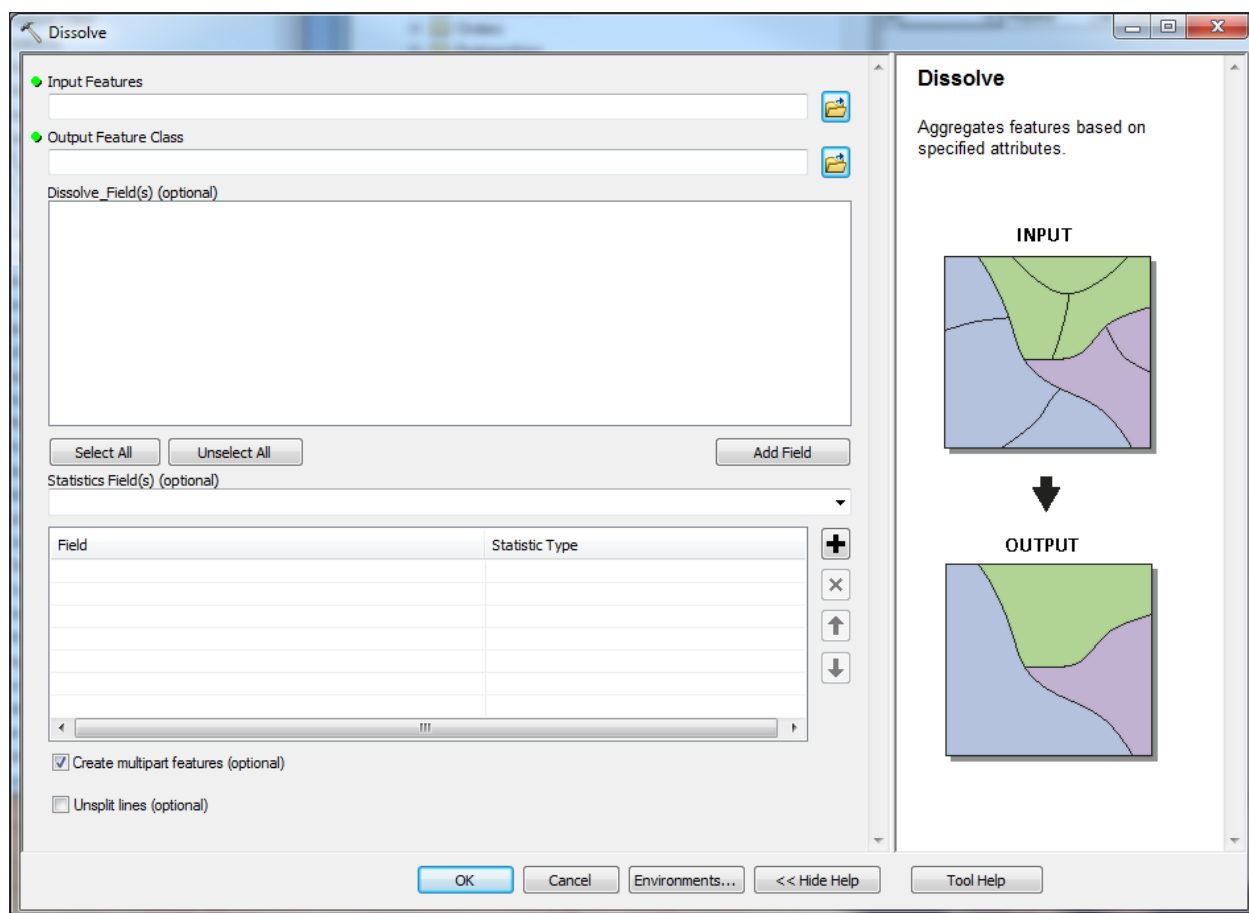


Figure 49. Screen capture of the 'Dissolve' tool window.

4. Make the following selections:
 - a. Input Features—the shoreline shapefile with features that will be dissolved
 - b. Output Feature Class—the name of the shapefile with '_Dissolve' at the end. For example, 2014101516TIMU01_High_Tide_Dissolve.shp;
 - c. Dissolve_Field(s)—Toggle ON Park_Unit
 - d. Toggle ON 'Create multipart features (optional)'
 - e. Click **OK**.

Attribute Fields

Specific fields are required by DSAS to calculate shoreline change, including date and uncertainty. In this workflow, the date and uncertainty fields will be created and populated. Refer to the DSAS manual (Himmelstoss 2009) for additional information and instruction regarding these fields.

The date field has to be in the MM/DD/YYYY format, as listed in Table 2. Create a new field named ‘Date_DSAS’ and populate it with the collection date of the GPS data in the required format. Refer to the DSAS manual for the field criteria required for the date field (Himmelstoss, 2009).

Table 2. List of fields and information for shoreline data to be used in DSAS. Refer to the DSAS manual for additional information about the field requirements (Himmelstoss 2009).

Field Name	Data Type and Additional Information
OBJECTID	Object ID, auto-generated
SHAPE	Geometry, auto-generated in geodatabase
SHAPE_Length	Double, auto-generated in geodatabase
DATE_	Text, user-created, length=10 MM/DD/YYYY
UNCERTAINTY	Any numeric field, user-created, length=4

The uncertainty field is a numeric field, as listed in Table 1. Create a new field named ‘Uncertain’ and populate the field with the value ‘5.’

Create Metadata for Shapefile(s)

Metadata should be created for each shapefile and layer within the geodatabase according to SOP 2.1.8 Dataset and Metadata Publication (SECN 2016), which complies with the Federal Geographic Data Committee standards.

Literature Cited

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- Himmelstoss, E.A. 2009. “DSAS 4.0 Installation Instructions and User Guide” in: Thieler, E.R., Himmelstoss, E.A., Zichichi, J.L., and Ergul, Ayhan. 2009 Digital Shoreline Analysis System (DSAS) version 4.0—An ArcGIS extension for calculating shoreline change: U.S. Geological Survey Open-File Report 2008-1278. *updated for version 4.3
- Psuty, N. P., M. Duffy, J. F. Pace, D. E. Skidds, and T. M. Silveira. 2010. Northeast Coastal and Barrier Network geomorphological monitoring protocol part I—ocean shoreline position. Natural Resource Report NPS/NCBN/NRR—2010/185. National Park Service. Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/664308> (last accessed July 2018).
- Southeast Coast Network (SECN). 2016. Dataset and Metadata Publication—Version 2.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—2.1.08. Southeast Coast Network, Athens, Georgia. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2238047> (last accessed July 2018).