

Southeast Coast Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 2.3.10

Post Survey GPS Data Processing—Version 2.0

Please cite this as:

Gonzalez, A., and L. C. Baron. 2023. Post survey GPS data processing—Version 2.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—2.3.10. Southeast Coast Network, Athens, Georgia.

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—Version 1.1* (Baron 2023). 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 #
July 28, 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
February 2023	Abigail Gonzalez	Updated SOP with the new version of PFO 5.9 and exporting data as geodatabase files, not shapefiles. Changed QA/QC to be done in ArcGIS Pro.	Data is better organized, and information is better kept as geodatabase files. ArcMap will only be used for DSAS, all other analysis and editing must be done in ArcGIS Pro.	2.0

Contents

	Page
Required Equipment/Data List.....	4
Desktop or Laptop Computer Running ArcGIS 10.x (with ArcCatalog) Procedure	4
Extracting GIS File from Trimble Geo 7x GPS	4
Set Unit Time Settings.....	5
Transfer GIS File to SSF File.....	7
Differential Correction of the GPS File.....	16
Export Corrected GPS File as a Geodatabase File	21
Setup Pathfinder Office	22
Set Export Properties.....	23
Rename Exported Files.....	33
Prepare GIS Files for Analysis	35
QA/QC, Editing and Formatting for DSAS	35
Attribute Fields.....	41
Create Metadata.....	41
Literature Cited	46

Required Equipment/Data List

- Desktop or laptop computer running Pathfinder Office (PFO) 5.60 or higher
- GPS unit (or data files) with shoreline monitoring GPS data collected according to SOP 1.3.22 *Conducting the GPS Shoreline Survey—Version 1.1* (Baron 2023)
- Desktop or laptop computer running ArcGIS Pro 3.x
- Desktop or laptop computer running ArcMap 10.x (with ArcCatalog).

Desktop or Laptop Computer Running ArcGIS 10.x (with ArcCatalog) Procedure

The purpose of this SOP is to ensure that the same data 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 1.1* (Baron 2023). 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 (geodatabase file or shapefile).

Extracting GIS File from Trimble Geo 7x GPS

This section contains instructions on how to transfer the GIS file created during the survey to a computer.

1. Extract the SD card from the Trimble Geo 7x GPS. Then insert to a computer.
2. Find the eight different files with the name of the survey that will be post-processed and prepared for analysis. For example, the data collected on 02/28/2023 at Timucuan Ecological and Historic Preserve (TIMU) was named “20230223TIMU” on the day of the survey. This naming convention is explained in SOP 1.3.22 (Baron 2023).
 - a. The eight files (Figure 1) should be placed into a folder on the computer. The output files (.SFF and .COR) made later will be placed in this folder as well.

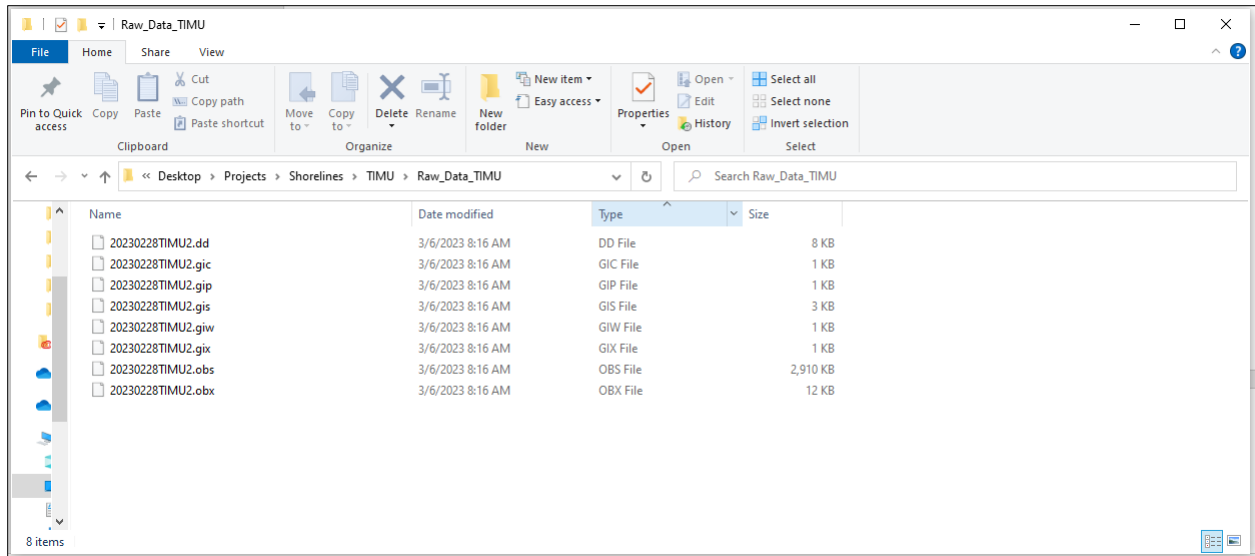


Figure 1. Screen capture of File Explorer showing the various file types that make up a GIS file.

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 2).

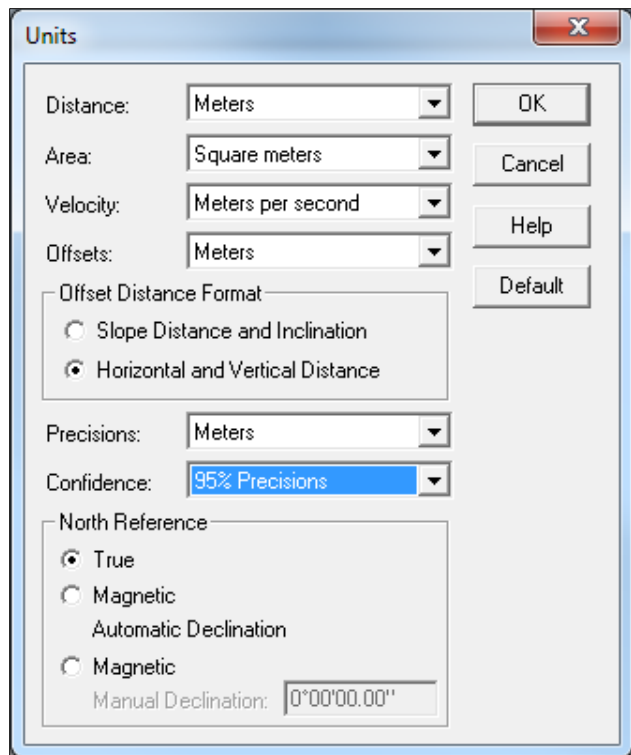


Figure 2. Screenshot of “Units” window in Pathfinder Office (PFO).

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

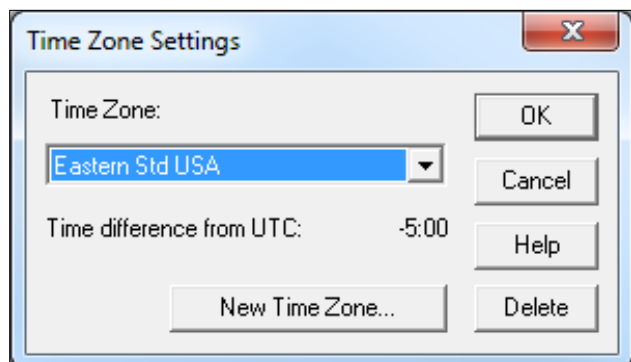


Figure 3. Screenshot of “Time Zone Settings” window in PFO.

- 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 GIS File to SSF File

The following section describes how to transfer a GPS file from a GIS file to a .SSF file. The GPS file transfer should be performed after data collection to ensure data backup. An .SSF file is a file format used by Trimble GIS mapping software. It contains GPS position data recorded at the time of the survey using the Trimble Geo 7x data collector device.

1. Open PFO.
2. The “Select Project” window will appear (Figure 4). If not, click **File > Projects...** to open the “Select Project” window.

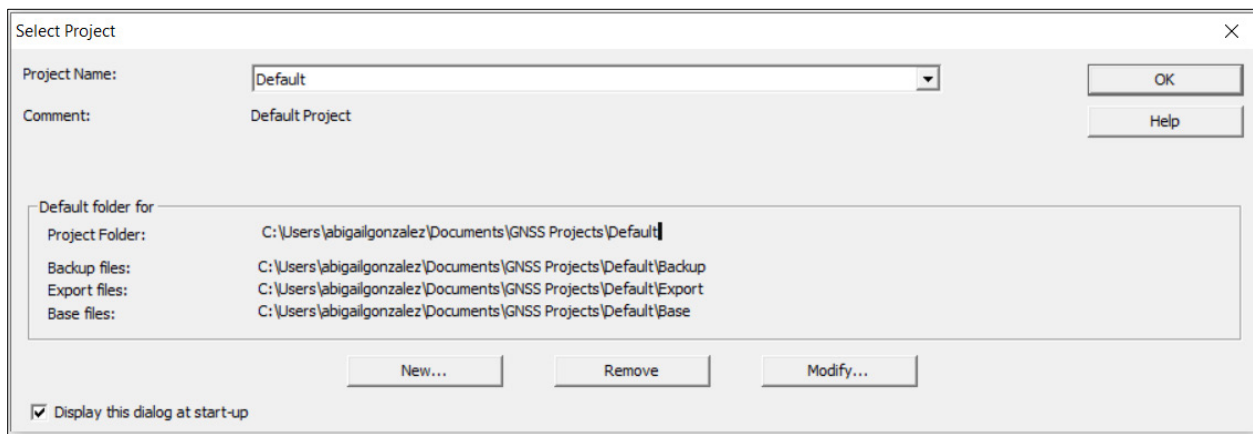


Figure 4. Screenshot of the “Select Project” window displaying a default project.

3. 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).

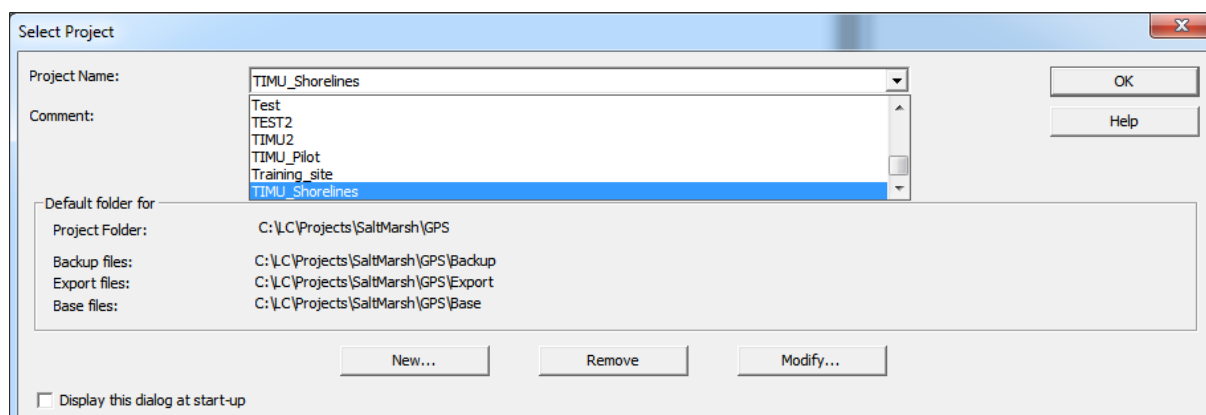


Figure 5. Screenshot of the Select Project window showing the drop-down list of previously created projects with a PARK_Shorelines project selected.

- ii. Select a previous park project.
 - iii. Click **OK**.
 - iv. Go to step 7.
- b. To create a new park project:
- i. Click **New...**
 - 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).

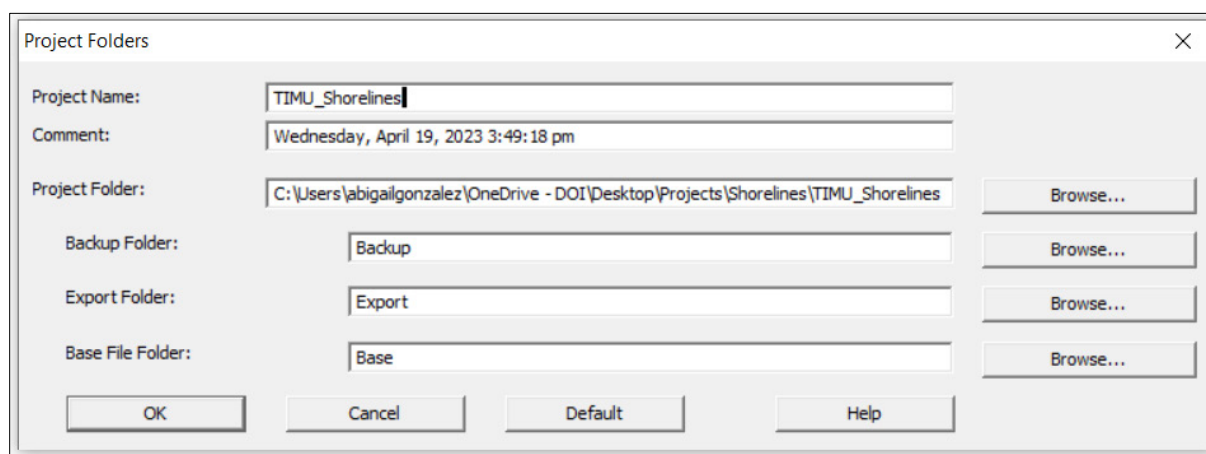


Figure 6. Screenshot of “Project Folders” window displaying the Project Folder (location previously selected) and the Project Name created.

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

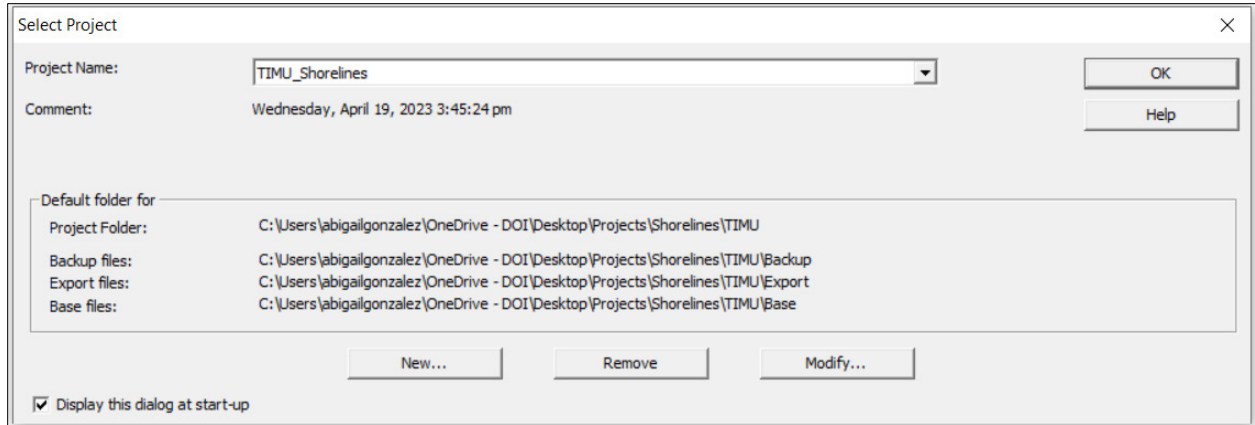


Figure 7. Screenshot of “Project Folders” window displaying the previously selected Project Folder as the default location for the Project just created.

- vi. Click **OK** to make the main Pathfinder Office window accessible.
4. To transfer the data from a GIS file to SSF file, click **Utilities > Data Transfer** (Figure 8). The “Data Transfer” window will then appear (Figure 9).

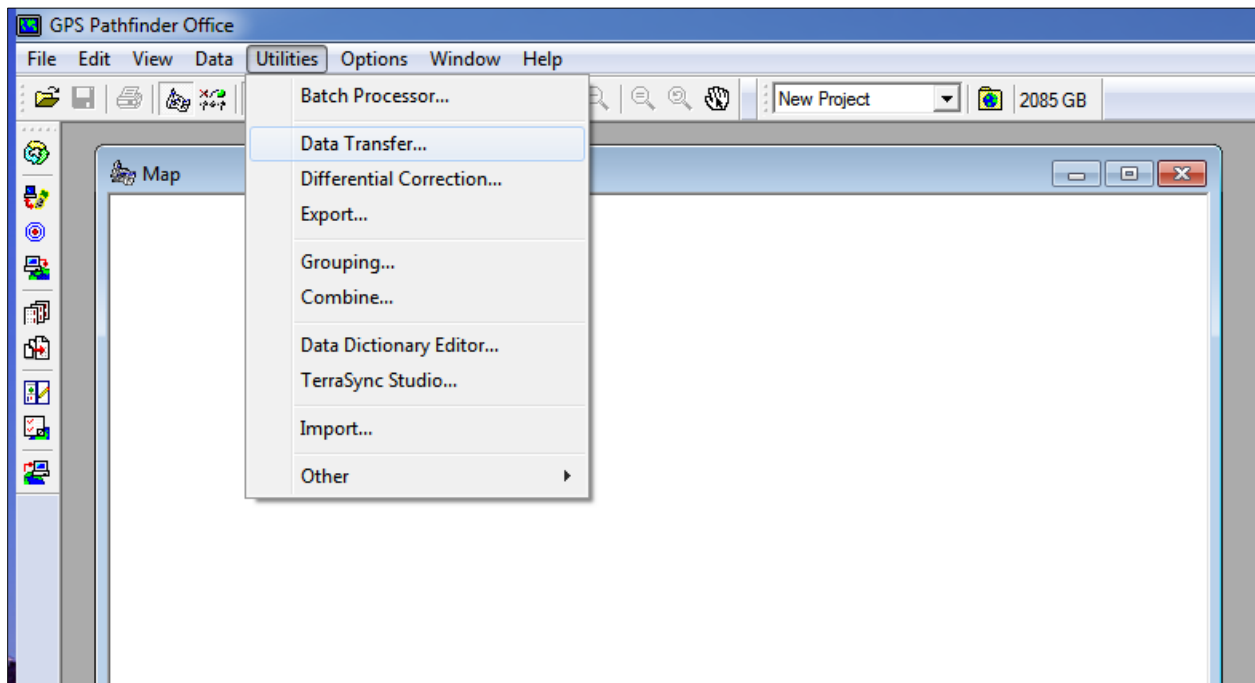


Figure 8. Screenshot of “GPS Pathfinder Office” window.

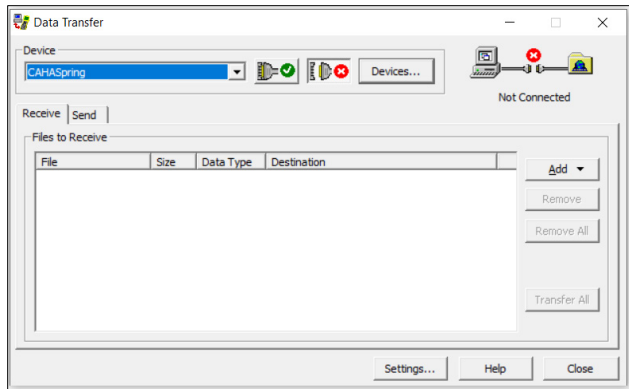


Figure 9. Screenshot of the “Data Transfer” window.

5. Click **Devices...** to connect to the folder containing the GIS files extracted from the Trimble Geo 7x. The “Devices” window will open (Figure 10).

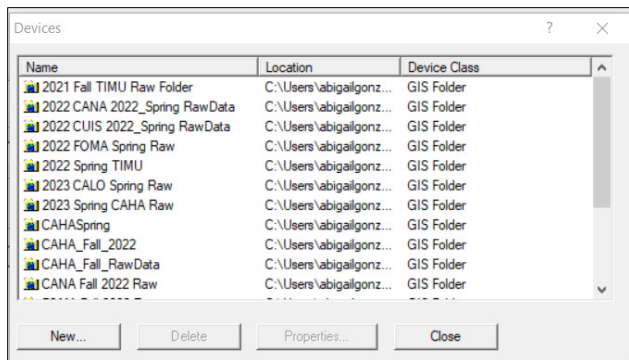


Figure 10. Screen capture of the “Devices” window.

6. Click **New...** The “Create New Device” window will open (Figure 11).

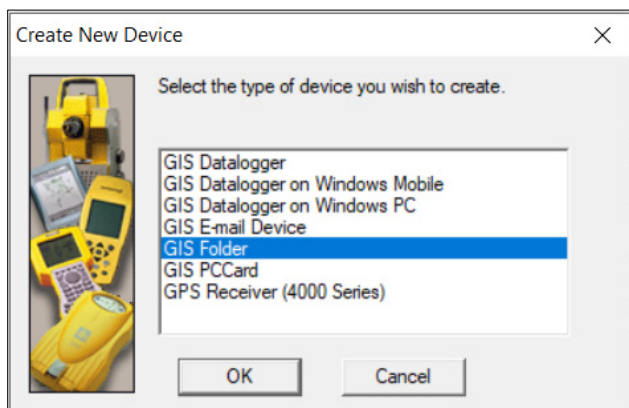


Figure 11. Screen capture of the “Create New Device” window.

7. Select **GIS Folder**, then click **OK**. The “Add New Device – Folder” will open (Figure 12).

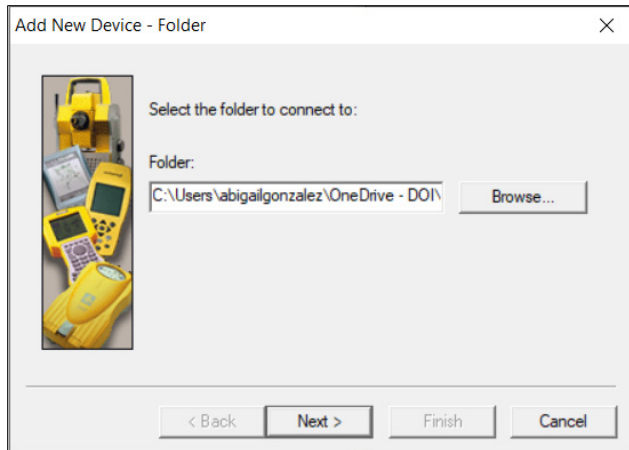


Figure 12. Screen capture of the “Add New Device – Folder” window.

8. Under “Folder:” click **Browse...** and the “Browse for Folder” window will appear (Figure 13). Browse to the folder with the 8 different GIS files extracted from the Trimble Geo 7x device. Select the folder, then click **OK**. Then click **Next >**.

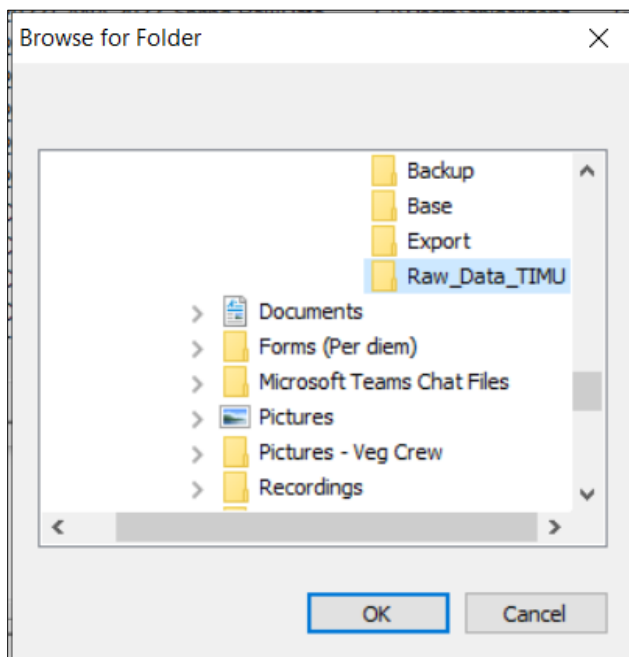


Figure 13. Screen capture of the “Browse for Folder” window.

9. The next “Add New Device” window (Figure 14) should appear. For “Type:” select **TerraSync** from the drop-down list. Then for “Version:” select **v3.xx**, **v4.xx**, **v5.xx** from the drop down list. Click **Next >**.

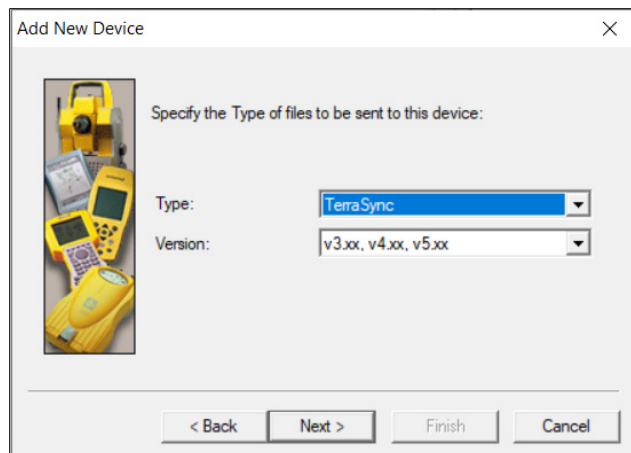


Figure 14. Screen capture of the “Add New Device” window. Showing what to select for “Type” and “Version.”

10. The next “Add New Device” window (Figure 15) should appear. Under “Name:” specify a name for the device (in this case the folder) you have defined previously. Click Finish. You will then see the Data Transfer window (Figure 16).

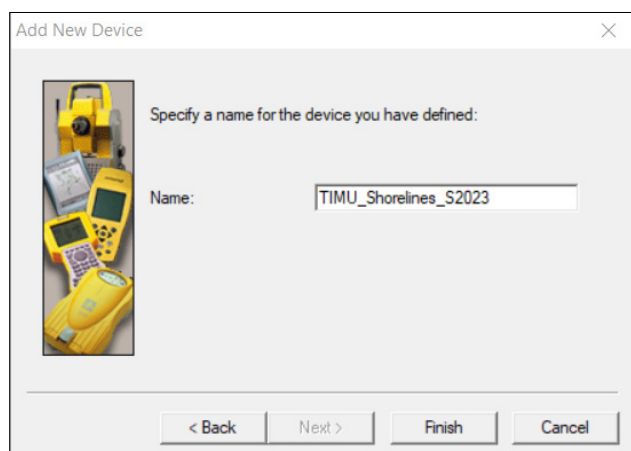


Figure 15. Screen capture of the “Add New Device” window.

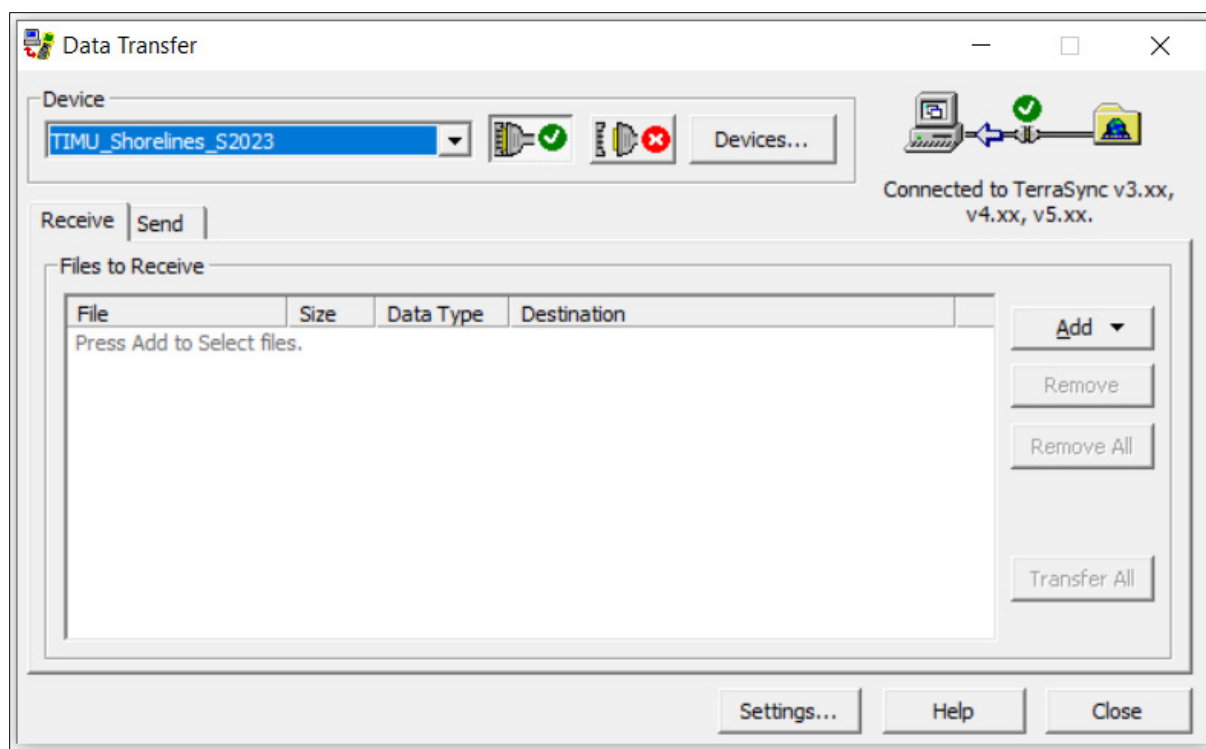


Figure 16. Screenshot of the “Data Transfer” window showing the software has connected to the folder with the GIS file.

11. Click Add > Data File (Figure 17).

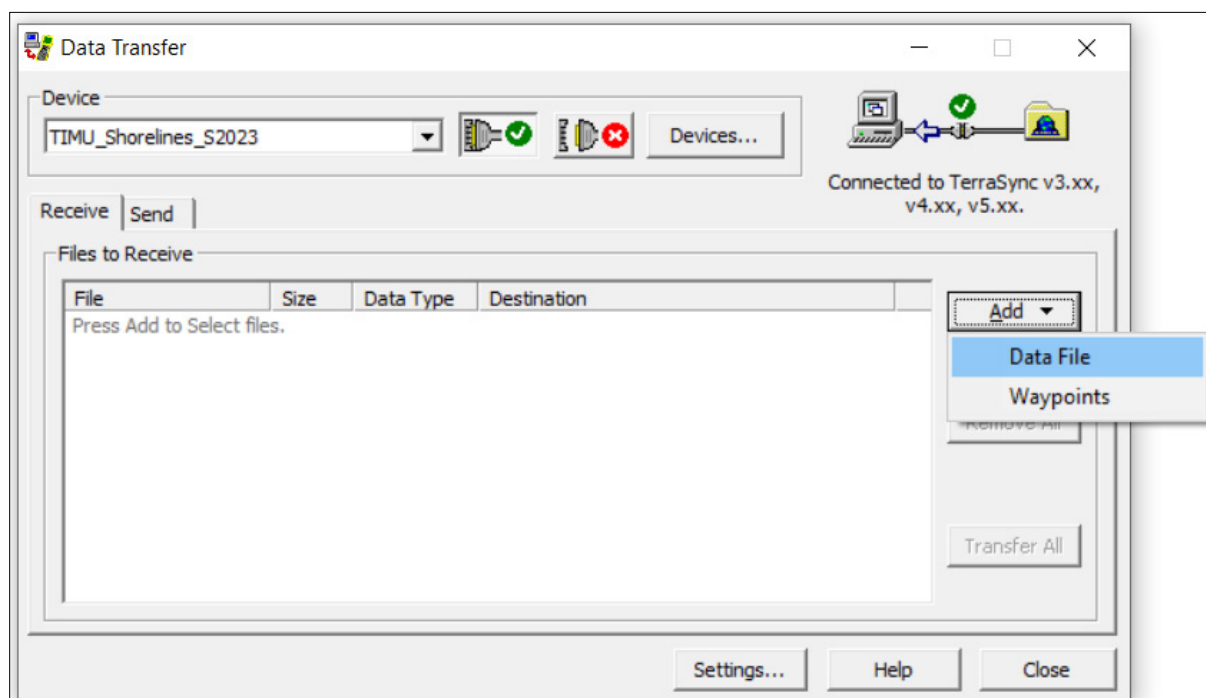


Figure 17. Screenshot of the “Data Transfer” window showing the “Add” options.

12. The “Open” window will appear (Figure 18). 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**.

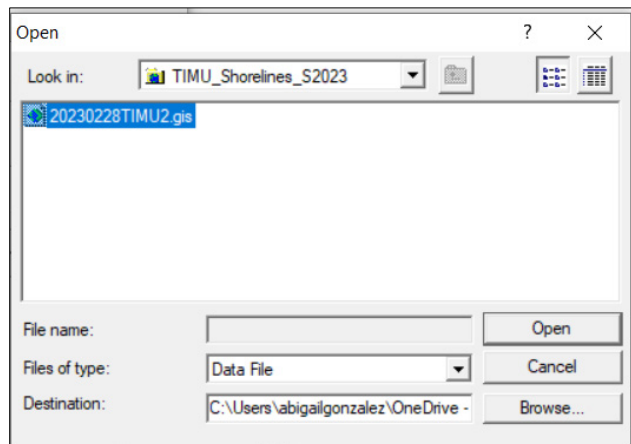


Figure 18. Screenshot of the “Open” window.

13. The selected file(s) will be listed in the “Data Transfer” window (Figure 19).

- a. Click **Transfer All**.

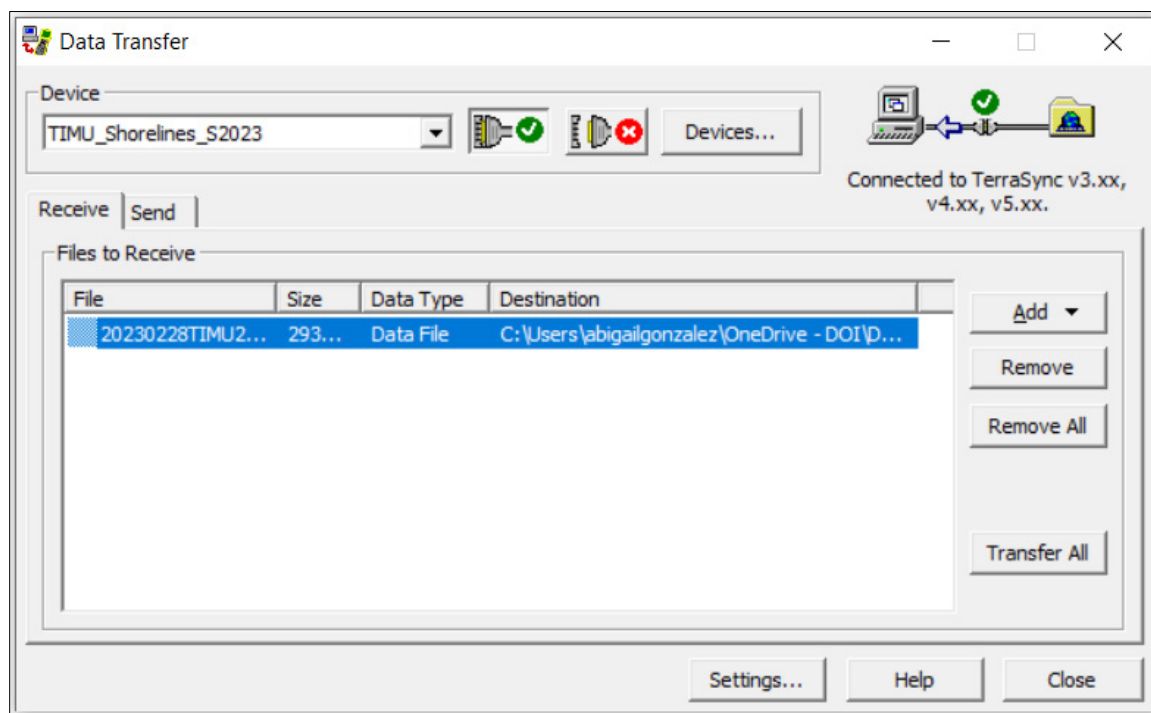


Figure 19. Screenshot of the “Data Transfer” window.

- b. Once the data have been transferred, a “Transfer Completed” window will appear (Figure 20).
- c. Click **Close**.

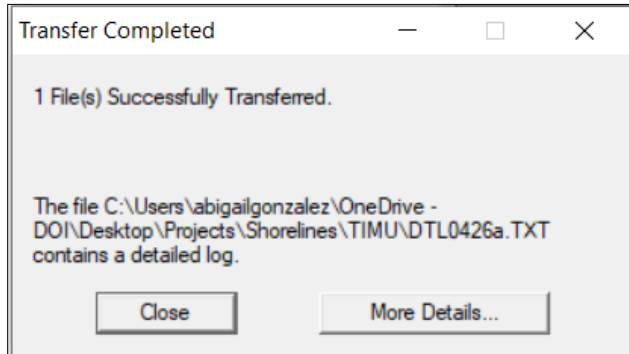


Figure 20. Screenshot of the “Transfer Completed” window.

14. Check that the data files have been properly transferred.
 - a. Navigate to the project file location on File Explorer.
 - b. A data file ending in .SSF should appear (Figure 21).

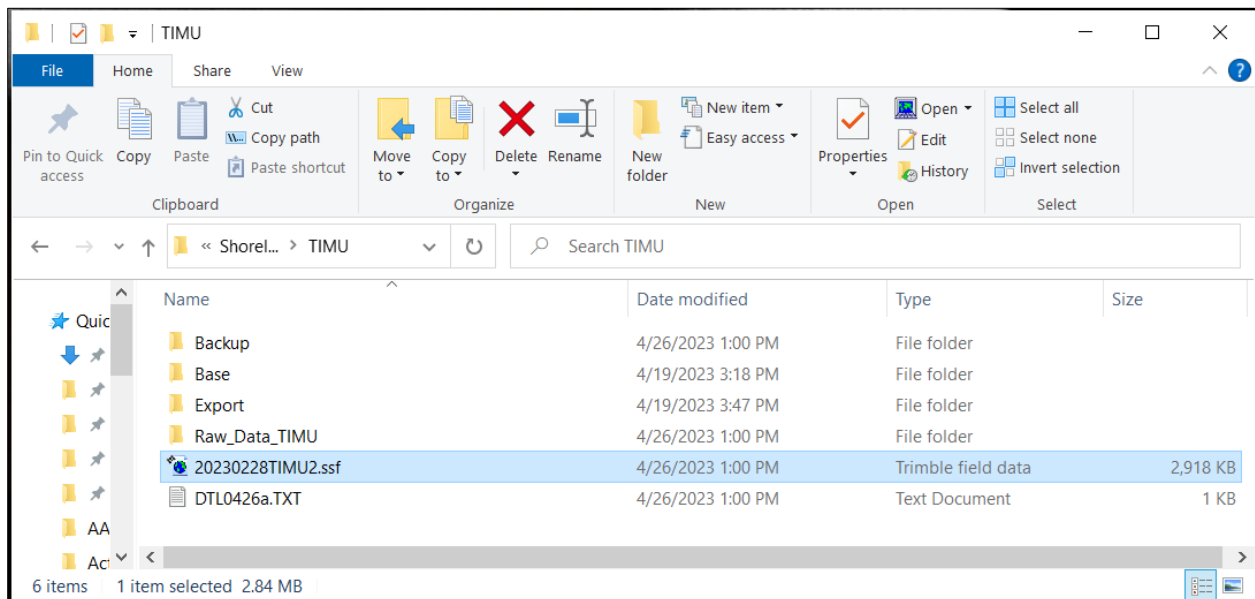


Figure 21. Screenshot of the “Windows Explorer” window.

15. Close the “Data Transfer” window.

Differential Correction of the GPS File

The following section describes how to differentially correct the data collected. Differential correction utilizes the Continuously Operating Reference Station (CORS) sites and reduces positional errors in the collected data. Correct each GPS file (.SSF) separately.

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 22).

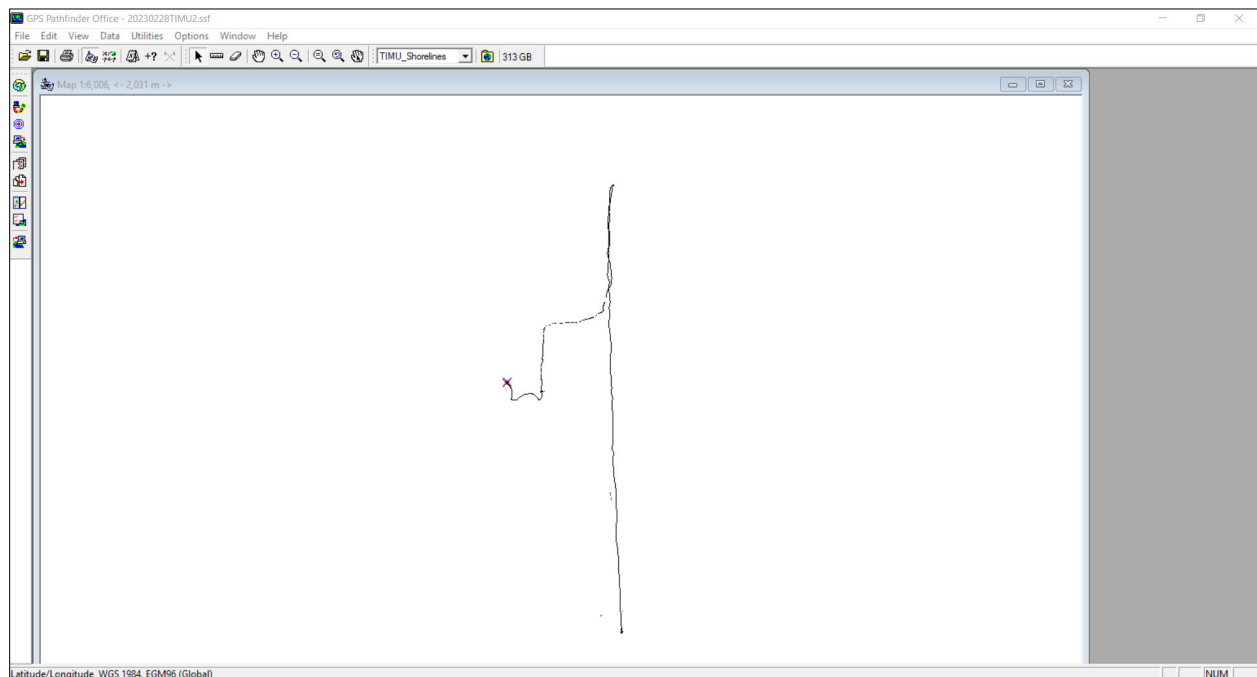


Figure 22. Screenshot of “Map” window in Pathfinder Office.

5. Go to Utilities > Differential Correction.
6. The “Differential Correction Wizard” window will appear with the open file listed (Figure 23).

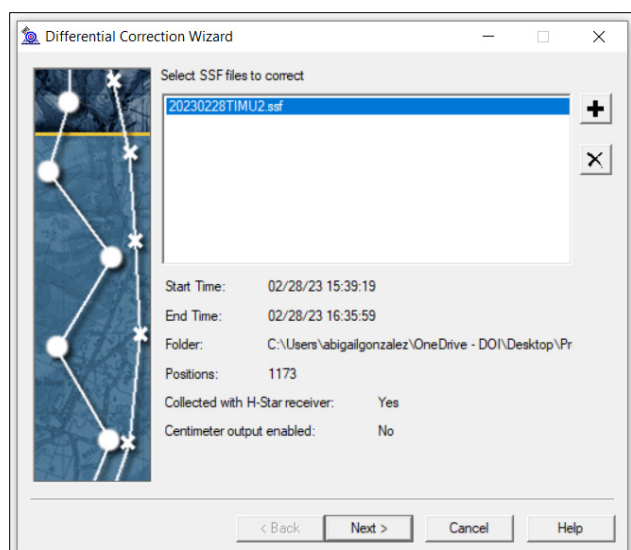


Figure 23. Screenshot of “Differential Correction Wizard” window showing the dataset that is currently open in PFO.

- a. Click Next.
- b. Stepping through the wizard, select the following criteria as in Figure 24:
 - i. For “Processing Type” select **Automatic Carrier and Code Processing**.
 - ii. “H-Star Processing” select **Use single base provider**.
 - iii. Click **Next**.

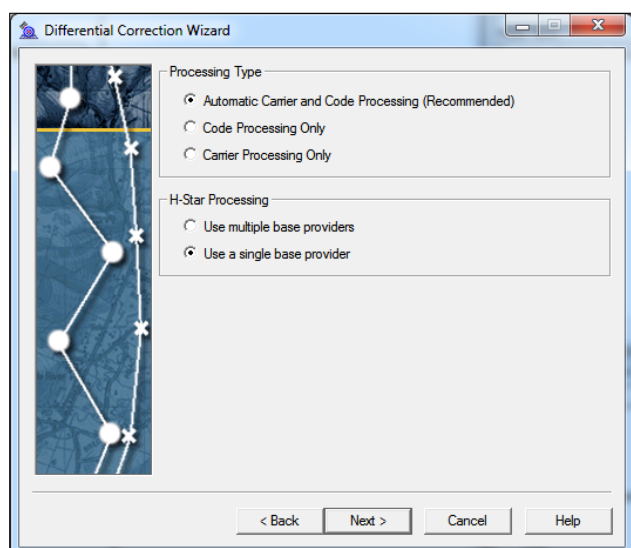


Figure 24. Screenshot of “Differential Correction Wizard” window displaying the “Processing Type” and “H-Star Processing” options.

- c. The “Correct Settings” section will be displayed (Figure 25).

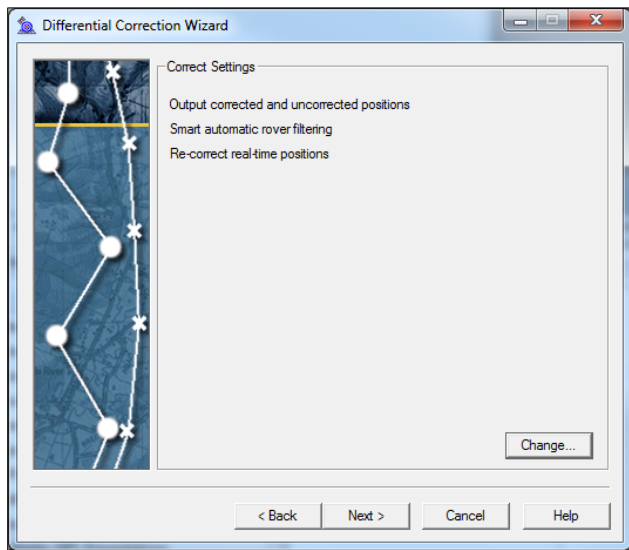


Figure 25. Screenshot of “Differential Connection Wizard” window showing the Connect Settings options.

- i. If the settings match Figure 25 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 26).

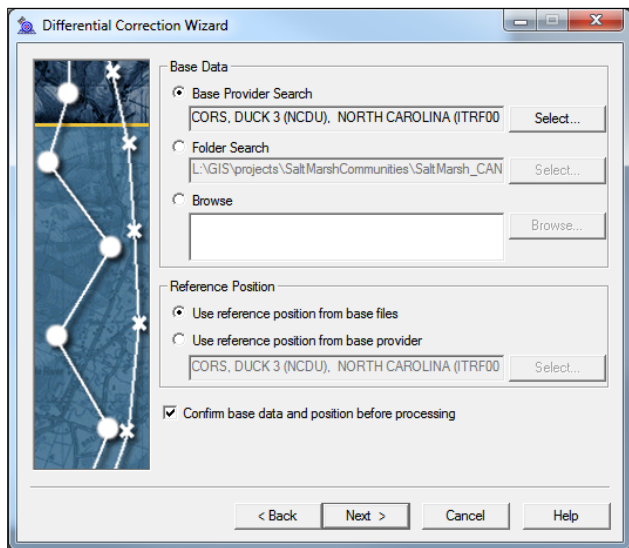


Figure 26. Screenshot of “Differential Connection Wizard” window showing the “Base Data” and “Reference Position” options.

- ii. Click **Update List**. The base provider list will start downloading and the list will be updated (Figure 27).

- 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 27 denotes the CORS has GLONASS satellites. You must select a Provider with a “*” in the “G” column, otherwise you will get an error when you correct the data.

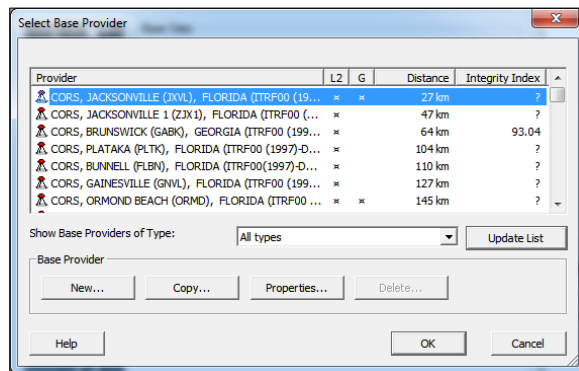


Figure 27. Screenshot of “Select Base Provider” window.

- iv. Click **OK**.
- e. The “Differential Correction Wizard” window will be updated with the selected base station information (Figure 28).
- f. Toggle ON “Use reference position from downloaded base files.”
- g. Check the box near the bottom of the window to “Confirm base data and position before processing.”
- h. Click **Next**.

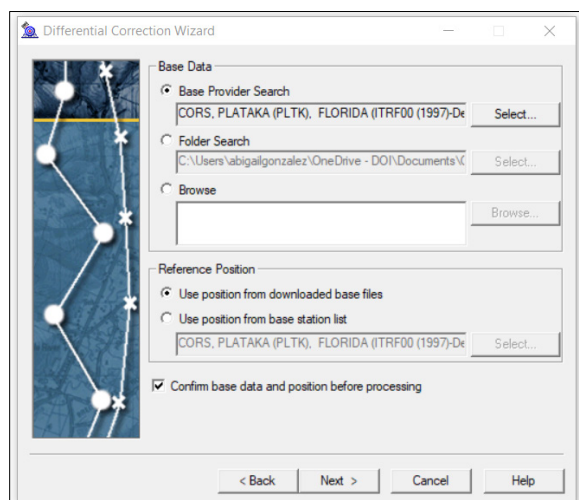


Figure 28. Screenshot of “Differential Connection Wizard” window showing the Base Data and Reference Position options with the base station selected listed as the Base Provider Search.

- i. The “Output folder” and “Output Filename” information will be displayed (Figure 29).
- i. For “Output Folder,” select **Use the project folder**.
- ii. For “Output Filename” select **Create a unique filename based on the input filename**.
- j. Click **Start**.

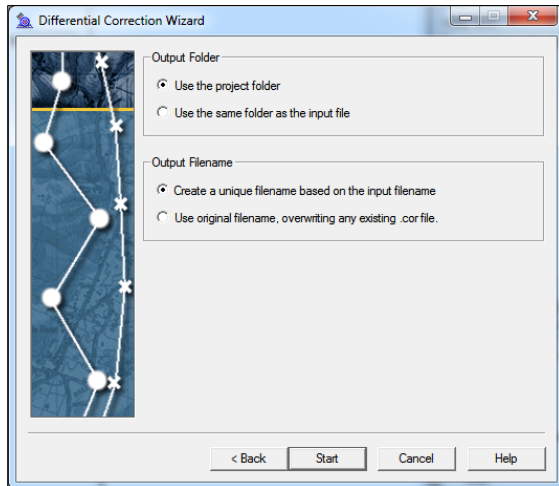


Figure 29. Screenshot of “Differential Connection Wizard” window displaying the Output folder and Output Filename options.

- k. The wizard will search for the base files (Figure 30).
- i. If there is 100% coverage, click **Confirm**. This is going to take several seconds to a few minutes, depending on how big the data set is.

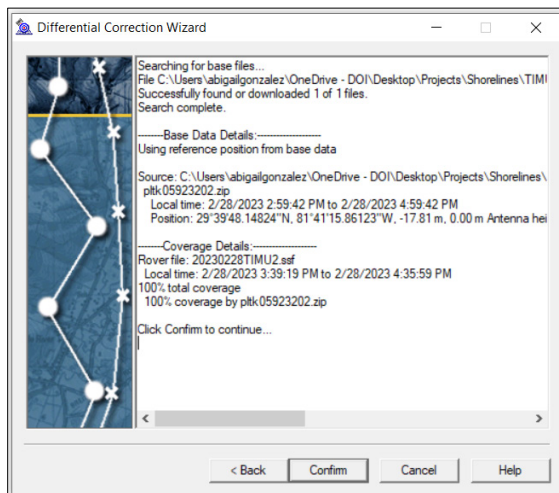


Figure 30. Screen capture of the “Differential Correction Wizard” window indicating 100% total coverage.

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 33).

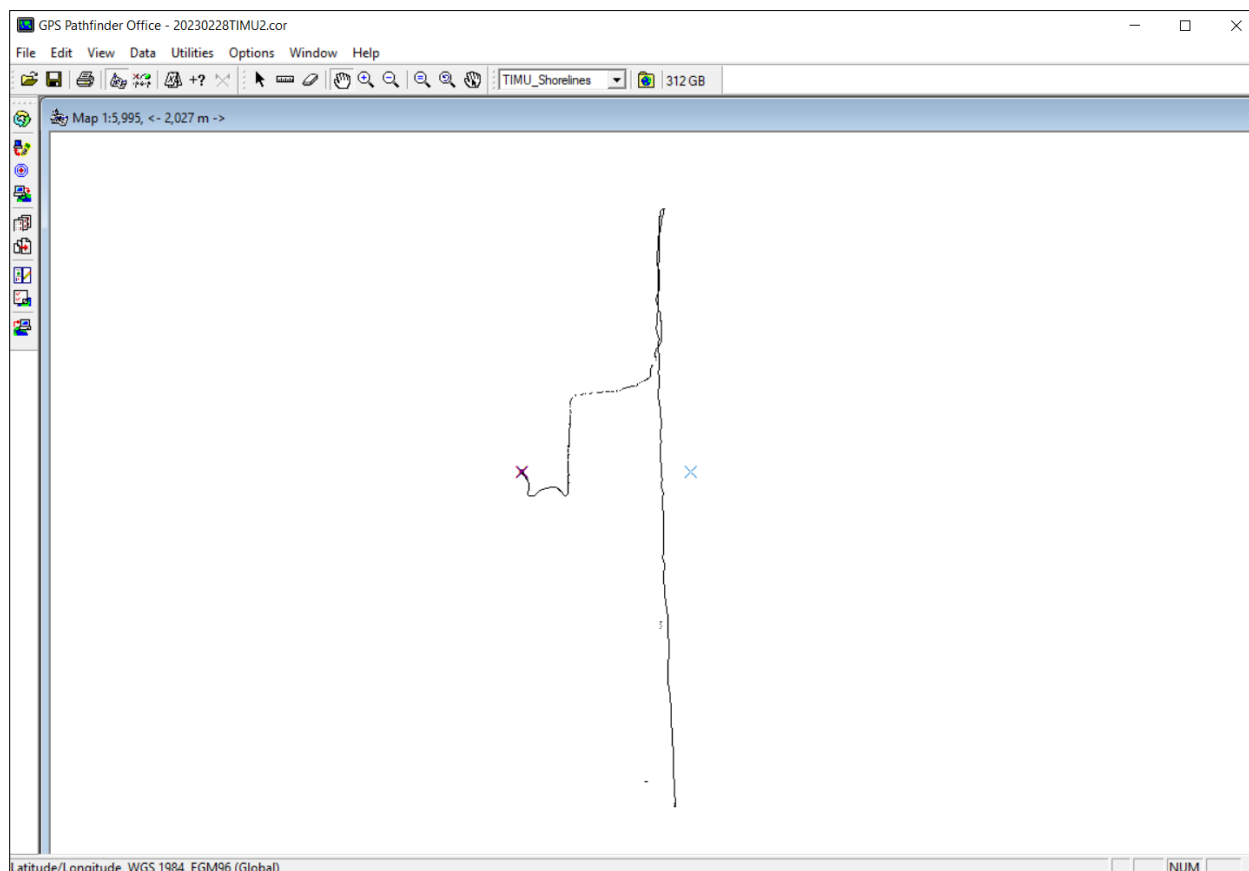


Figure 33. Screen capture of Pathfinder Office where the “Map” window is displaying the corrected GPS file.

2. Click **Utilities > Export...**
3. The “Export” window will appear (Figure 34).
 - 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 34).
 - c. In the “Choose an Export Setup” section, from the drop-down menu, select **Sample ESRI File Geodatabase Setup**.

- i. Note: The geodatabase file can be transformed into a shapefile on ArcGIS Pro, but if you need to export as a shapefile directly, select the option **Sample ESRI Shapefile Setup** from the drop-down menu. Remember, this format will not retain the naming scheme of the original GPS filename.

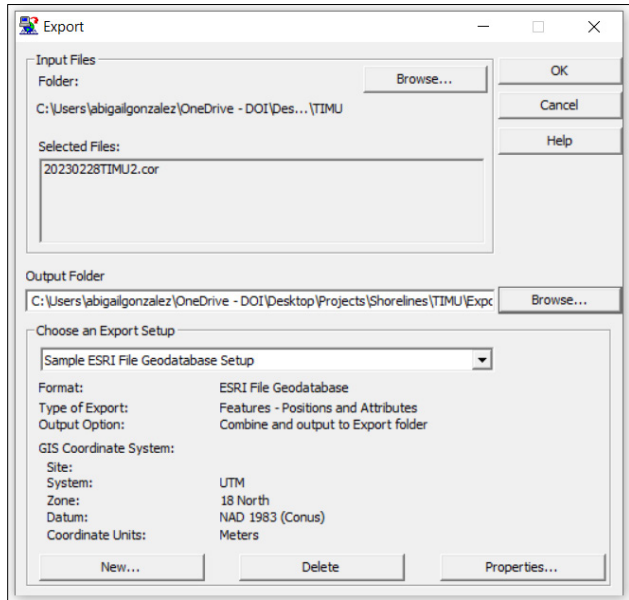


Figure 34. Screen capture of the “Export” window displaying the Input Files, Output Folder, and Export Setup. The Export Setup shows the ESRI File Geodatabase format selected.

Set Export Properties

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

1. On the “Data” tab (Figure 35), select the following options:
 - a. For “Features-Positions and Attributes,” select **Export All Features**.
 - b. Make sure the window matches Figure 35.

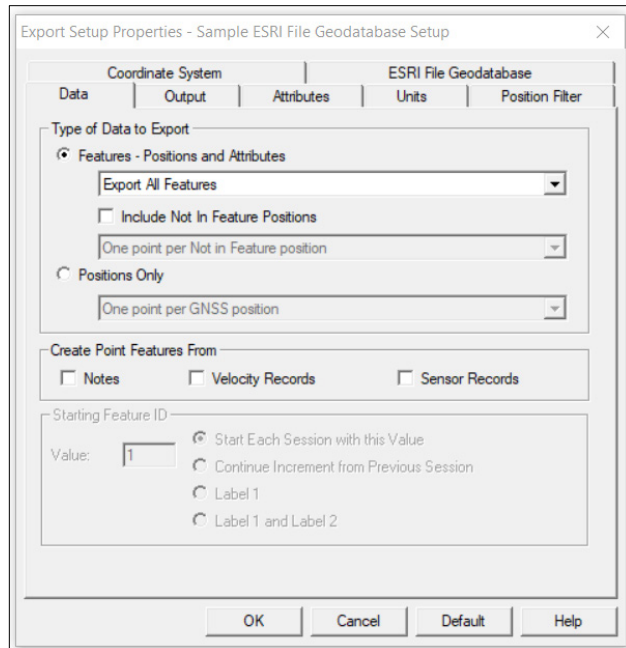


Figure 35. Screen capture of the “Export Setup Properties” window, showing the “Data” tab.

2. On the “Output” tab (Figure 36), select the following settings:
 - a. For “Output Files” select **Combine all input files and output to the project export folder**.
 - b. For “File Attribute Paths” select **Default** from the drop-down menu.
 - c. For “System File Format” select **Windows Files** from the drop-down menu. Select this if you are working on a Windows Operating System.
 - d. Make sure the window matches Figure 36.

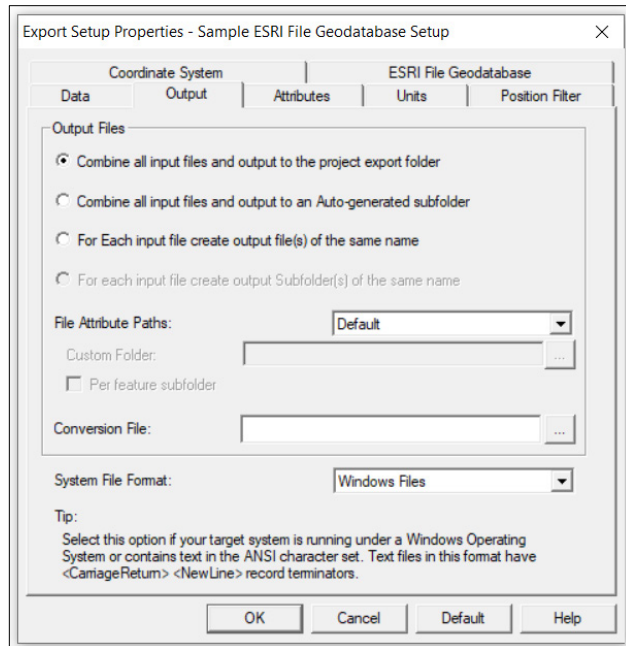


Figure 36. Screen capture of the “Export Setup Properties” window, showing the Output tab.

3. On the “Attributes” tab (Figure 37), select the following:
 - a. For “Export Menu Attributes As” select **Attribute Value**.
 - b. In the “Generated Attributes” section, select the following:
 - i. For “All Feature Types” —Toggle **ON** all attributes
 - ii. For “Line Features” —Toggle **ON** all attributes
 - iii. For “Point Features” — Toggle **ON** all attributes
 - iv. For “Area Features” —Toggle **ON** all attributes.

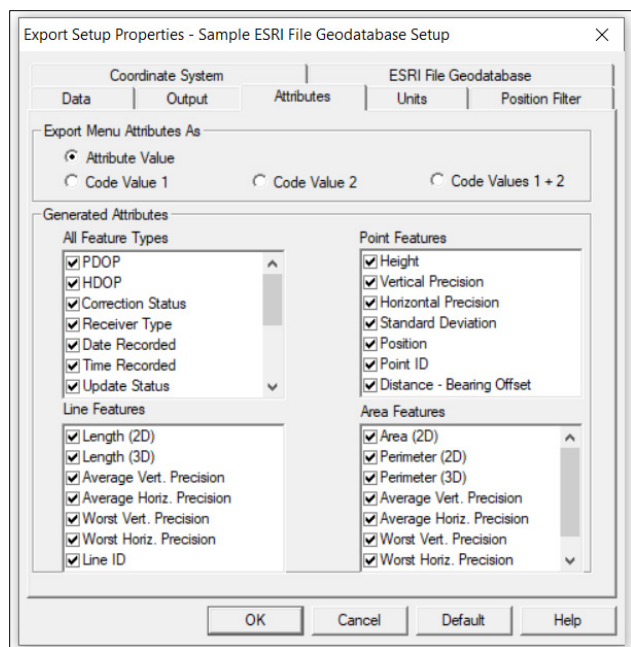


Figure 37. Screen capture of the “Export Setup Properties” window, showing the “Attributes” tab.

4. On the “Units” tab (Figure 38) select the following settings:
 - a. In the “Units” tab, select the **Use Current Display Units** option. Make sure the units are as follows (if the PFO settings were set in the beginning, these should already be meters):
 - i. Distance—**Meters**
 - ii. Area Units—**Square Meters**
 - iii. Velocity Units—**Meters Per Second**
 - b. In the “Decimal Places” section, type the following numbers for each setting:
 - i. Lat/Long: **9**
 - ii. North/East: **3**
 - iii. Height: **3**
 - iv. Distance: **3**
 - v. Area: **3**
 - vi. Velocity: **3**
 - vii. Precision: **1**

viii. Time: 0

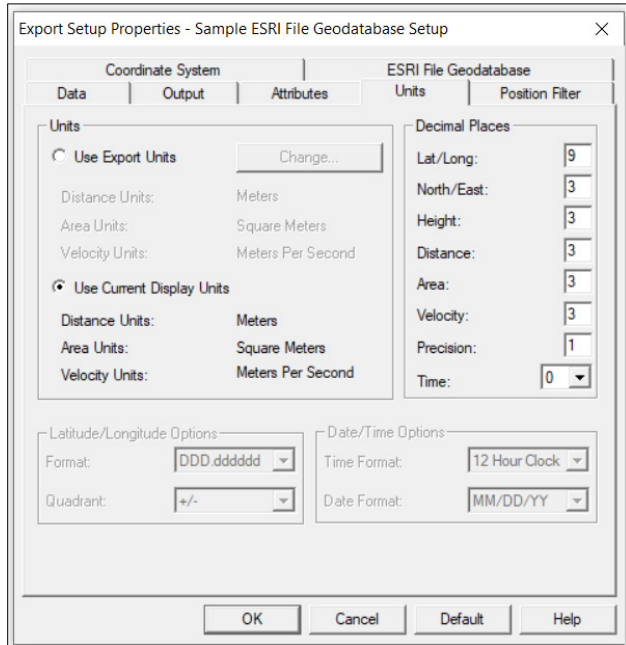


Figure 38. Screen capture of the “Export Setup Properties” window showing the “Units” tab.

5. On the “Position Filter” tab, select the following default criteria (Figure 39):
 - a. In the “Filter by GNSS Position Info” section, select the following:
 - i. For “Minimum Geometry” select **2D (3 or more measurements)**.
 - ii. For “Maximum PDOP” select **Any**.
 - iii. For “Maximum HDOP” select **Any**.
 - b. In the “Include Positions That Are” section, select the following:
 - i. If the differential correction is <100% toggle **ON Uncorrected**. If differential correction was 100% toggle **OFF Uncorrected**
 - ii. “P(Y) Code” – toggle **ON**
 - iii. “Real-Time SBAS” – toggle **ON**
 - iv. “Real-Time Code” – toggle **ON**
 - v. “Post-processed Code” – toggle **ON**
 - vi. “Real-time Carrier “ – toggle **ON**
 - vii. “Post-processed Carrier Float” – toggle **ON**

- viii. “RTK Fixed” – toggle **ON**
- ix. “Post-processed Carrier Fixed” – toggle **ON**
- c. Toggle **ON** “Include Non-GNSS Positions.”

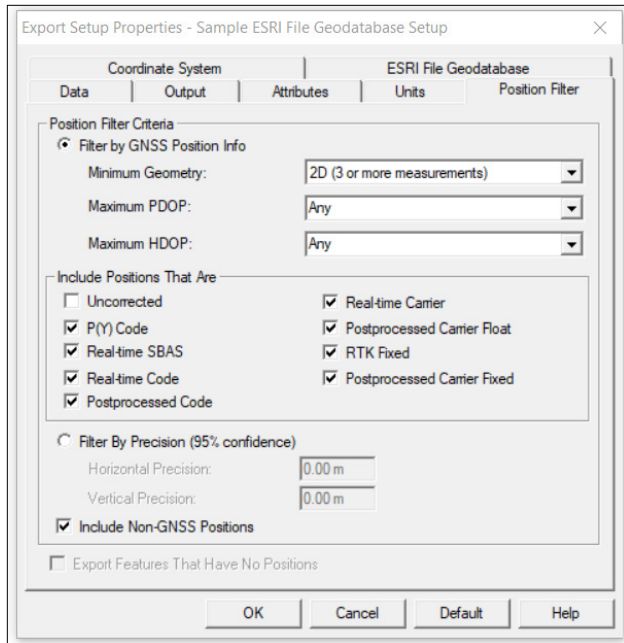


Figure 39. Screen capture of the “Export Setup Properties” window, showing the “Position Filter” tab.

- 6. On the “Coordinate System” tab (Figure 40), select the following:
 - a. Toggle **ON** “Use Export Coordinate System.”

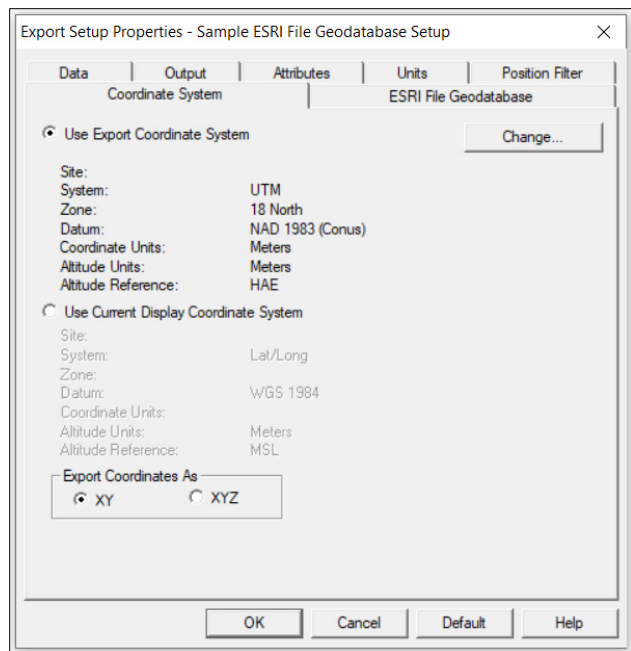


Figure 40. Screen capture of the “Export Setup Properties” window, showing the “Coordinate System” tab.

- b. Click **Change**.
- c. In the Export Window (Figure 41), select the following criteria:
 - i. For the “Select By” section, toggle **ON “Coordinate System and Zone.”**
 - ii. For “System” select **UTM**.
 - iii. For “Zone” select **17N or 18N (CANA, FOMA, TIMU, and CUIS are 17N; CAHA and CALO are 18N).**
 - iv. For “Datum” select **NAD 1983 (Conus)**.
 - v. In the “Altitude Measured From” section, toggle **ON “Height Above Ellipsoid (HAE).”**
 - vi. For “Coordinate Units” select **Meters** from the drop-down menu.
 - vii. For “Altitude Units” select **Meters** from the drop-down menu.

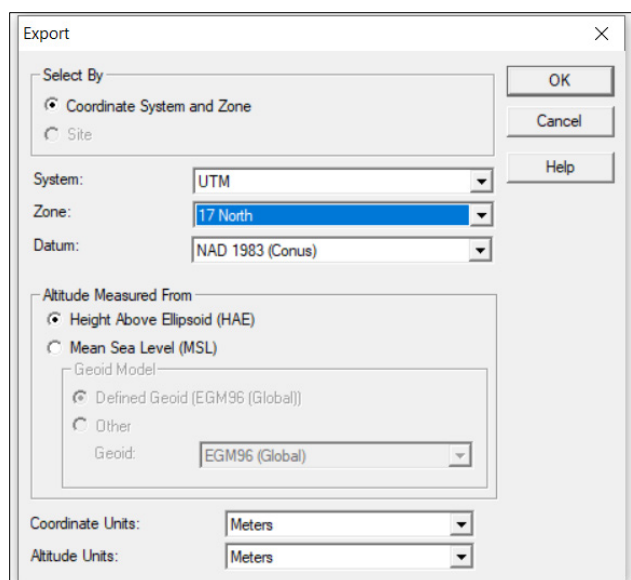


Figure 41. Screen capture of the “Export” window displaying the newly coordinate system.

- viii. Click **OK**. The settings selected will be displayed under **Use Export Coordinate System** (Figure 42).

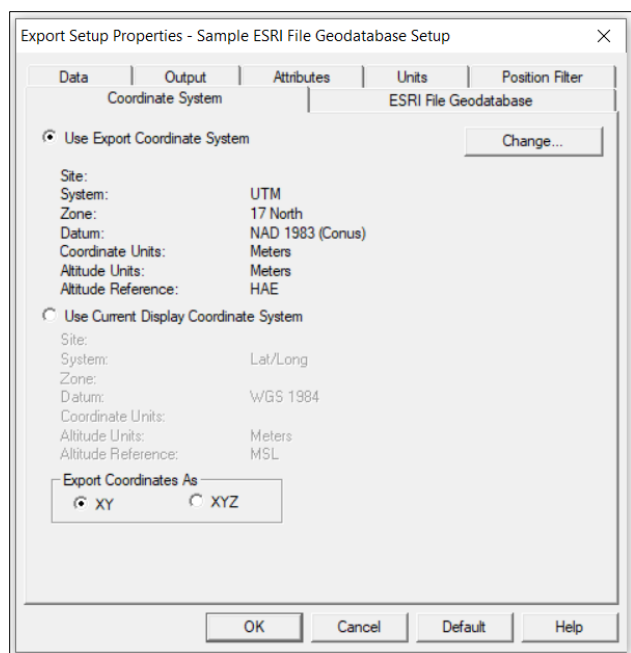


Figure 42. Screen capture of the “Export Setup Properties” window, showing the “Coordinate System” tab.

7. On the “ESRI File Geodatabase” tab (Figure 43), select the following:
 - a. Toggle **OFF** the **Use Alias Names** option.

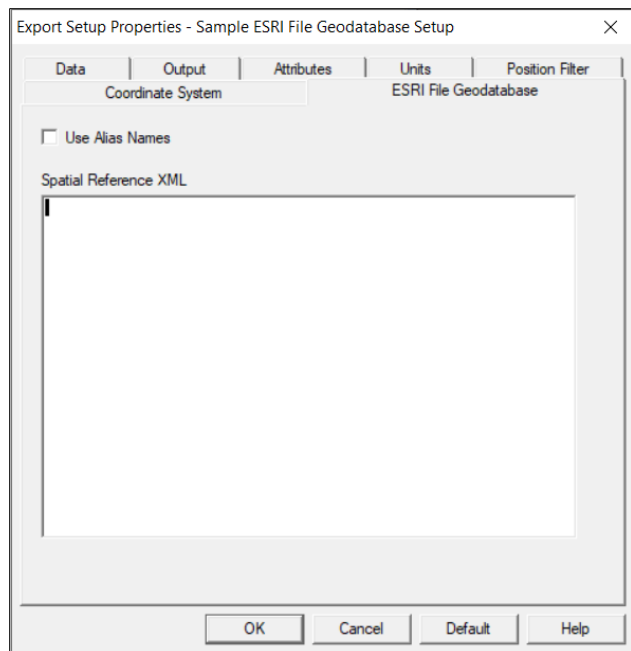


Figure 43. Screen capture of the “Export Setup Properties” window, showing the “ESRI File Geodatabase” tab.

- b. You need a spatial reference XML to export the geodatabase file. XML is required to target the spatial reference of your data. Follow the instructions on this link: [Microsoft Word – ExportToFileGeodatabasePFO.docx \(frontierprecision.com\)](#) (Frontier Precision 2016).
 - i. Remember the zones should be **17N** or **18N** (**CANA**, **FOMA**, **TIMU**, and **CUIS** are **17N**; **CAHA** and **CALO** are **18N**).
- c. Once you have the Spatial Reference XML, copy the information within the `<SpatialReference></SpatialReference>` brackets and paste under “Spatial Reference XML” section (Figure 44).

10. A window will appear with the information about the exported data (Figure 46).

- a. Once the export is complete, click **Close**
- b. You can then close GPS Pathfinder Office.

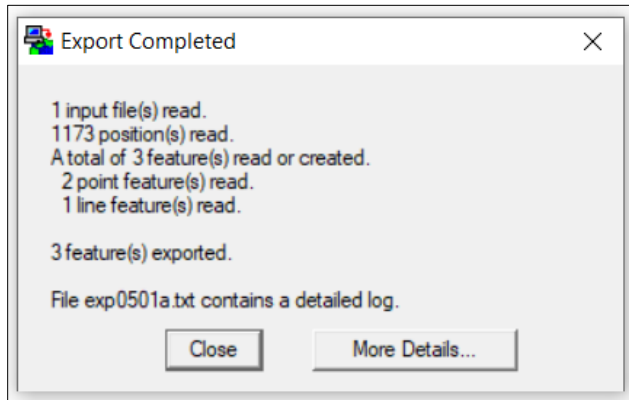


Figure 46. Screen capture of an information window informing that the export was completed and indicating the number of features exported.

Rename Exported Files

Before the QA/QC of the data, you will have to rename the files to keep them organized by park and date. Also, because you always want to have a file with unedited data for reference.

1. Open Arc Catalog and navigate to the location of the exported geodatabase file (Figure 47).

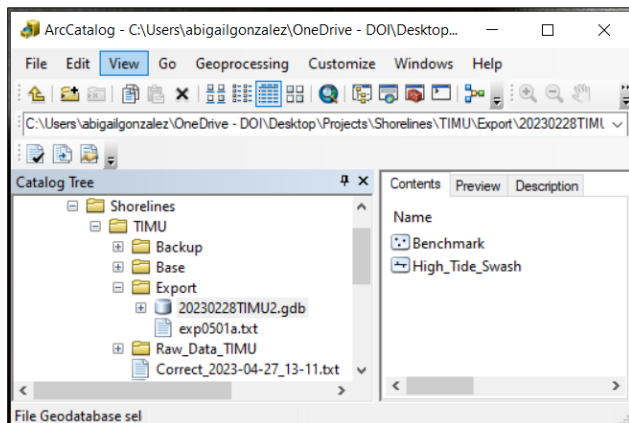


Figure 47. Screen capture of the “ArcCatalog” window displaying the exported files.

- a. Rename each of the exported files so that the GPS filename is followed by the exported name and complete the “Benchmark” and “High_Tide_Swash” clipped exported file names (Figure 48). There will also be a “Discontinuity” feature class if a discontinuity was collected during the survey.

- i. For example, “Benchmark.shp” will be renamed “PARKYYYYMMDD_Benchmark.shp” and “High_Tide.shp” will be renamed “PARKYYYYMMDD_High_Tide.shp”. Where “PARKYYYYMMDD” is the GPS file from which the data are exported. You will have to put the park code first because ArcCatalog will not let you save the feature class name if it begins with a number.

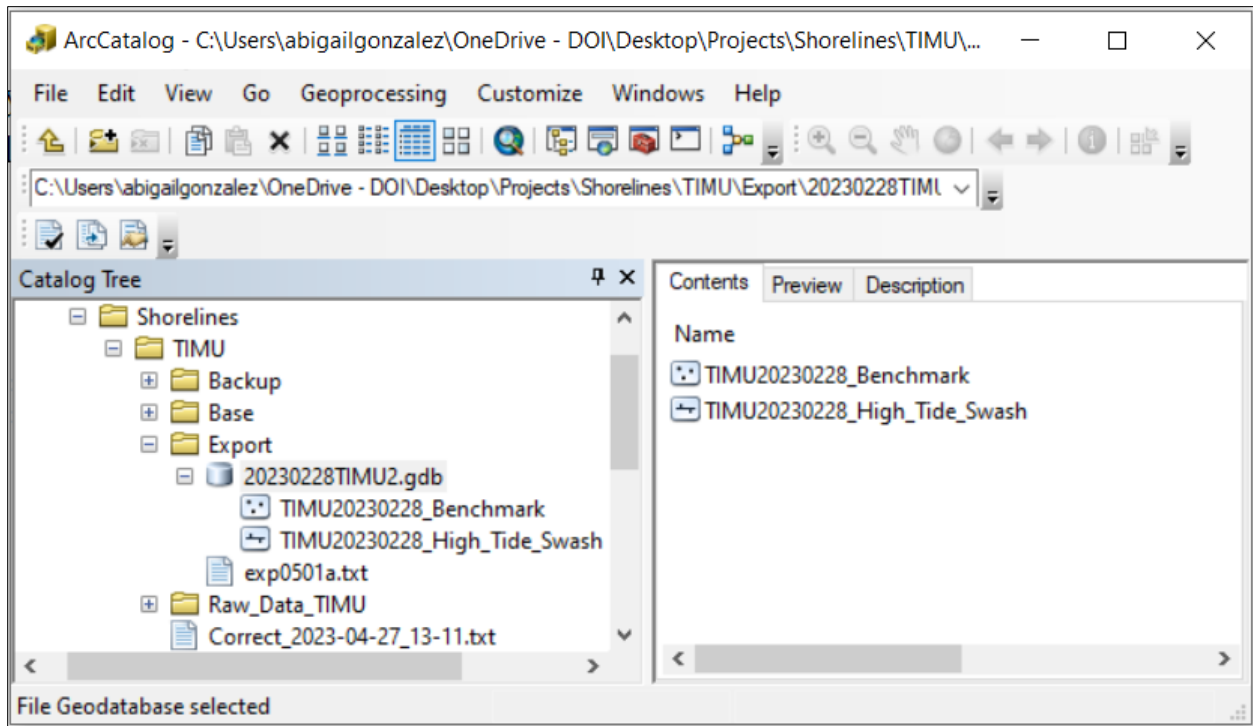


Figure 48. Screen capture of the “ArcCatalog” window displaying the renamed files.

2. Copy each of the feature classes above and paste them on that same geodatabase file and rename it with “_Edit” at the end (Figure 49). You must do this prior to beginning QA/QC so you have an unedited file at hand.

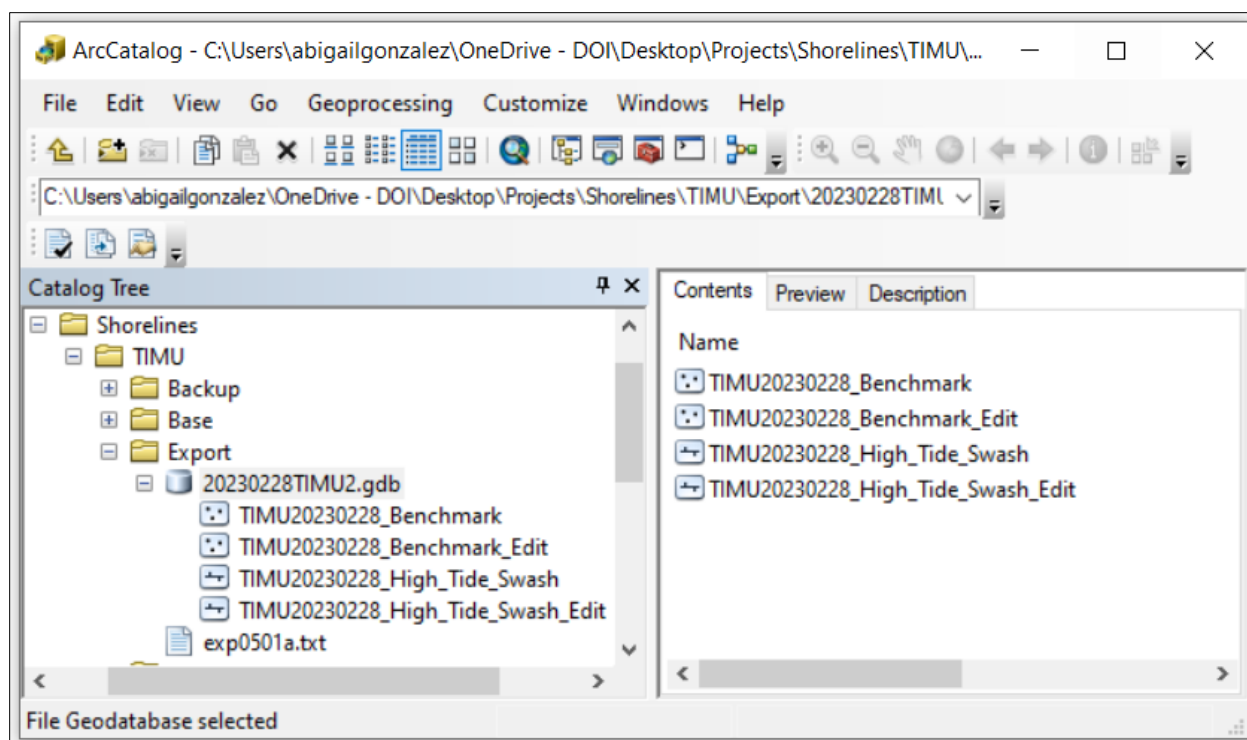


Figure 49. Screen capture of the “ArcCatalog” window displaying the renamed files.

Prepare GIS Files for Analysis

QA/QC, Editing and Formatting for DSAS

Once the GPS files have been differentially corrected, exported as feature classes, 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 feature classes for analysis, and creating metadata.

1. Open ArcGIS Pro.
2. Open the geodatabase containing the shoreline data.
 - a. Look at the feature classes with “_Edit” at the end (Figure 50).

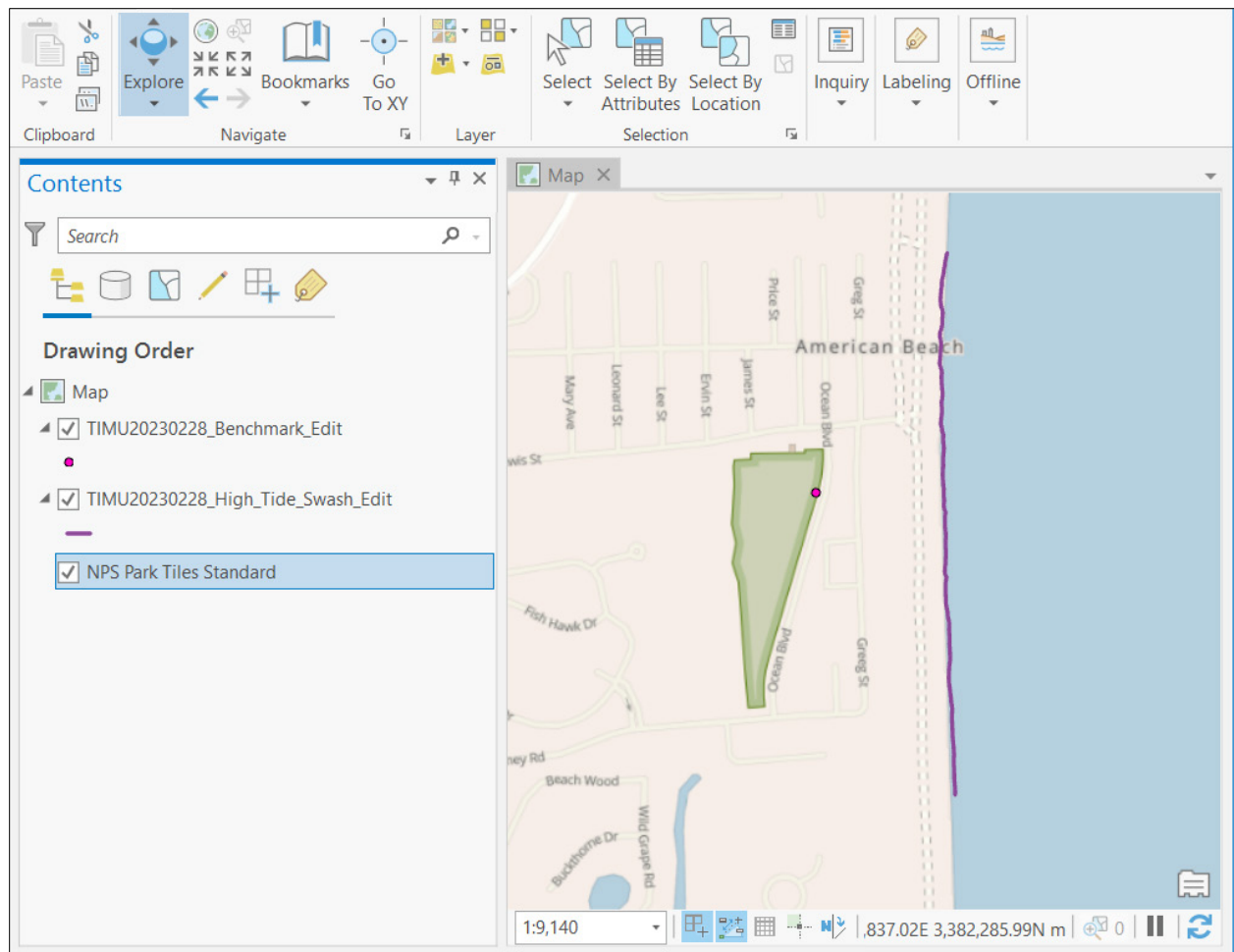


Figure 50. Screen capture of the ArcGIS Pro window displaying the imported feature classes.

3. Using the “Go To XY” tool, input the coordinates of the benchmark used for reference at the beginning of the survey. You can find these on the NOAA Benchmark website.
 - a. For example, the benchmark located at Nana Dune near American beach has coordinates of Long: -81.4450137611 and Lat: 30.5728540889. Input these into the “Go To XY” tool and notice the  icon (Figure 51). You can see that the points collected during the survey are nearby the recorded location of the benchmark during the shoreline survey.

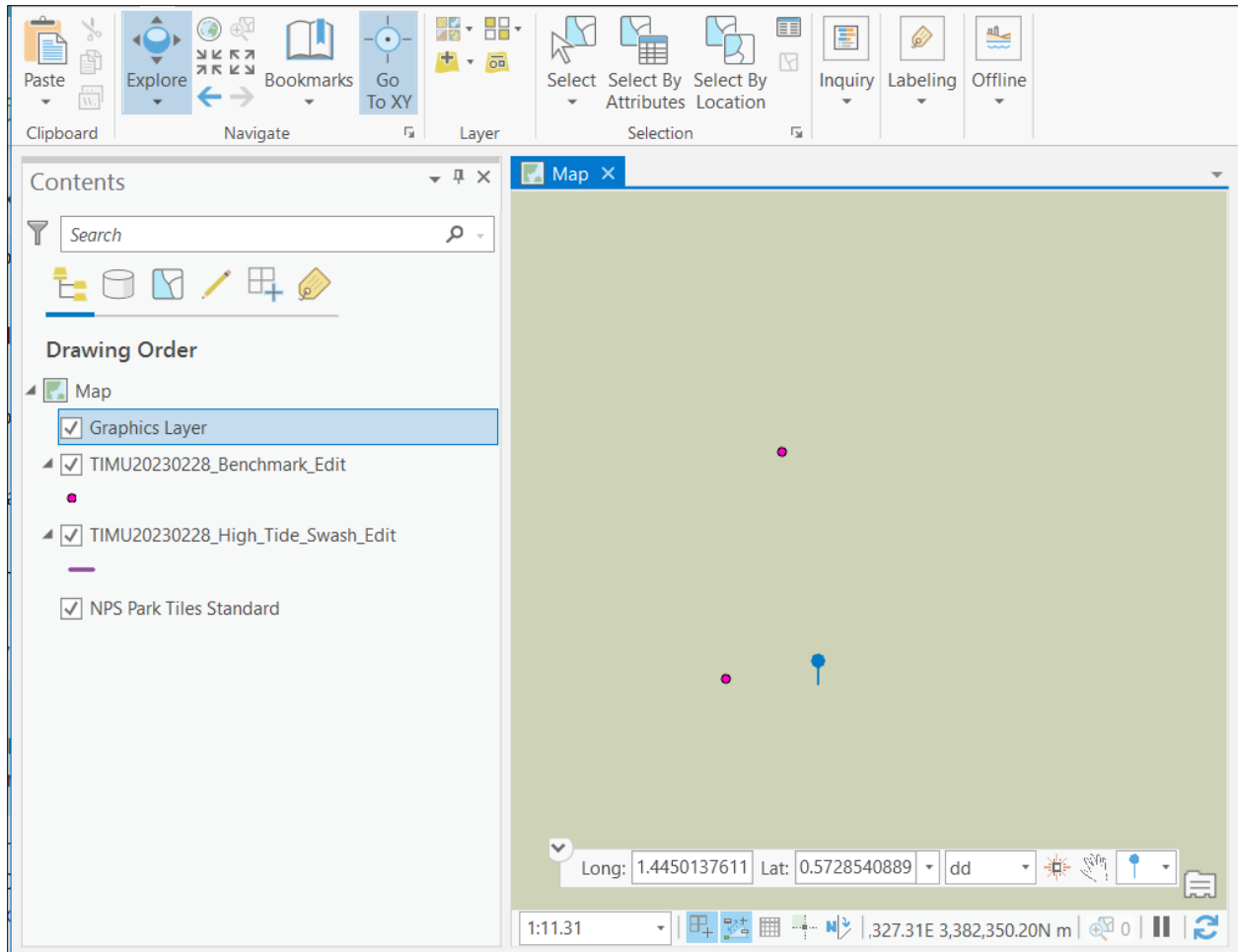


Figure 51. Screen capture of the ArcGIS Pro window displaying the “Go To XY” tool.

- b. Use the measure tool, measure the distance of the benchmarks to the location on the imagery (Figure 52). The most recent imagery available for the surveyed area should be used to check the benchmark locations. 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 recorded GPS location of the benchmark is greater than five meters, the shoreline may need to be re-surveyed.
 - i. Note: The error associated with imagery varies. The accuracy of 0.3 meter (1 foot) resolution Digital Orthophoto is 1.5 meters (4.9 feet).
- c. Once you have checked for that distance, and it meets the above criteria, you can remove the benchmark feature class from the “Contents” pane on ArcGIS Pro.

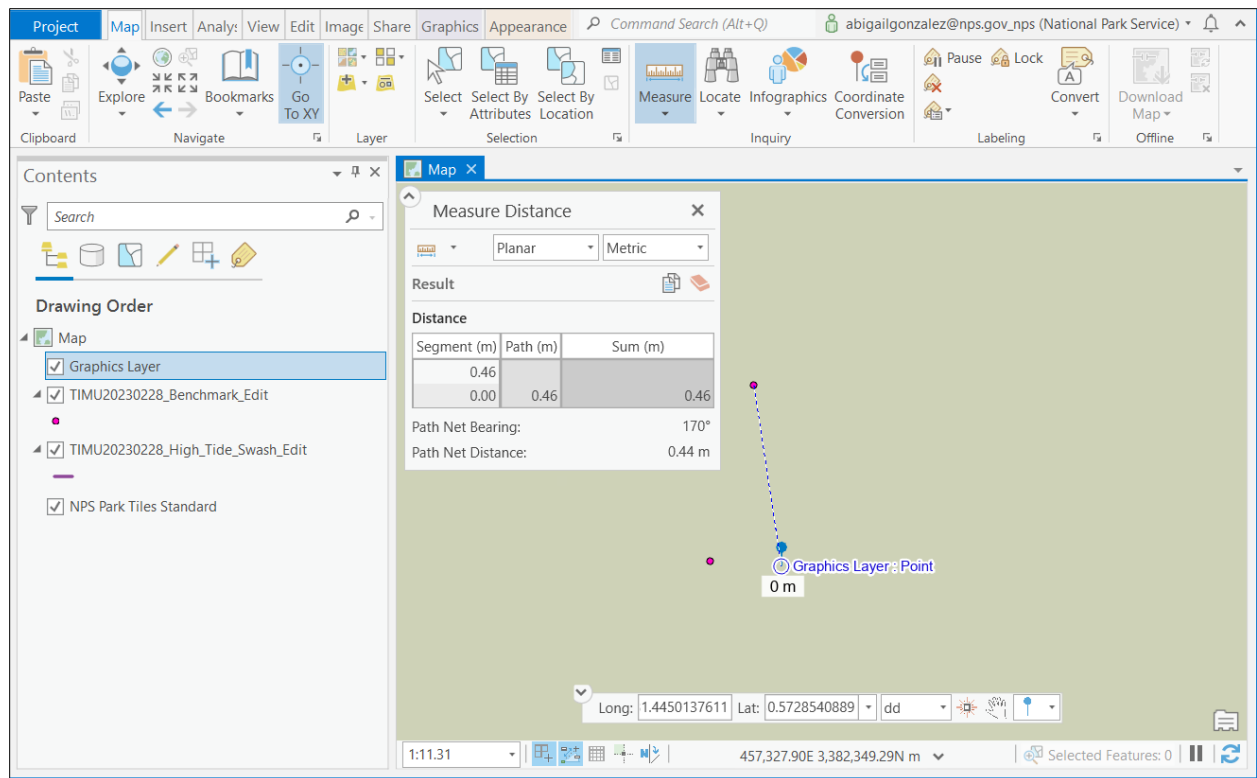


Figure 52. Screen capture of the ArcGIS Pro window displaying an acceptable resolution of the survey.

4. Visually assess the shoreline feature(s) and correct any errors (Figure 53). Use the Edit tool to fix any errors on the edited feature class (this is the QA/QC process).

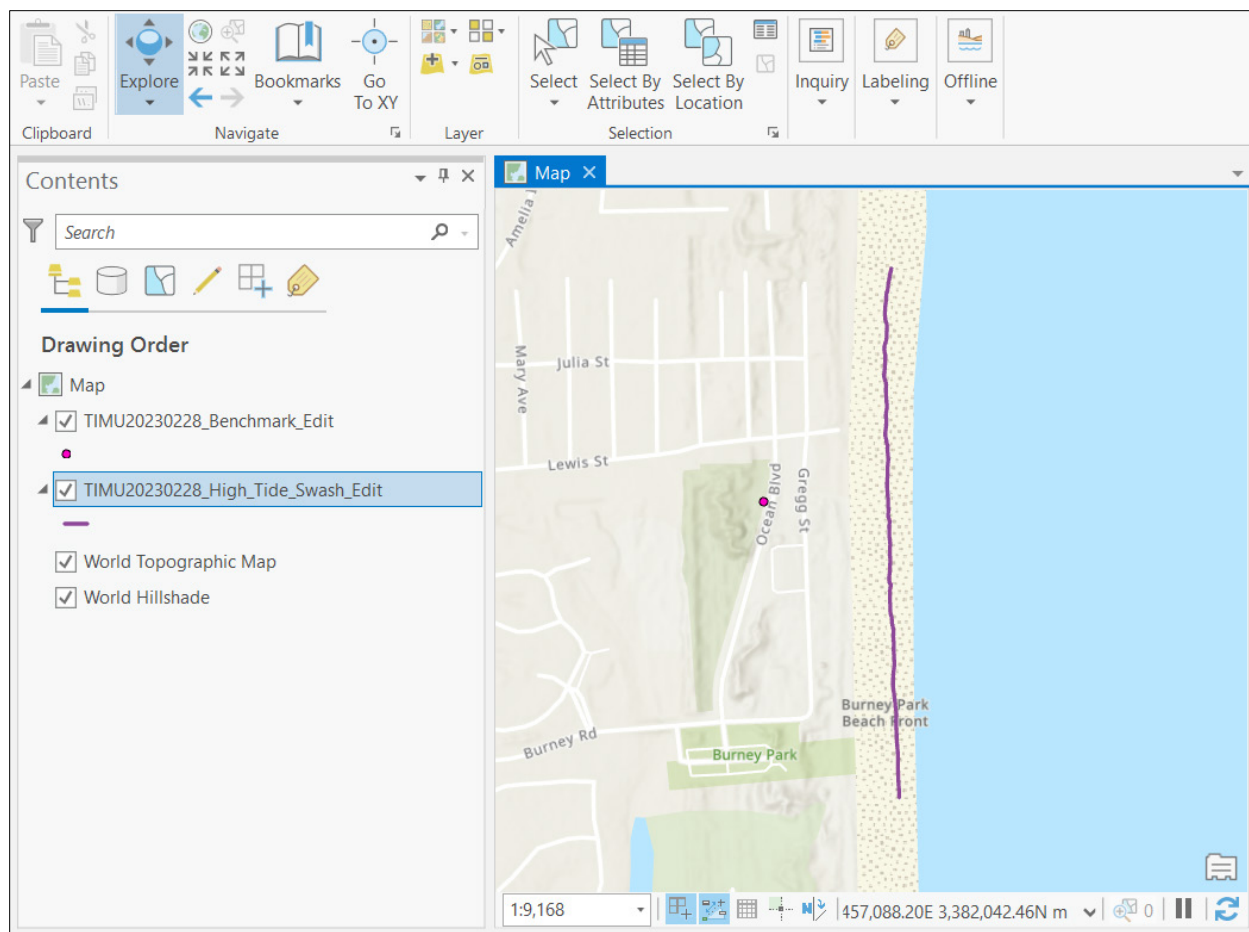


Figure 53. Screen capture of the ArcGIS Pro window displaying the shoreline survey.

- a. For an example of an error in the survey look at Figure 54. In this image, 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 54. Screen capture of the “ArcGIS” map view displaying erroneous data that will be edited. For this example, delete the portion of the line that extends landward of the red shoreline to clean up the data. The edited result should look like the screen capture below (Figure 55).



Figure 55. Screen capture of “ArcGIS” map view displaying the edited high tide feature class.

- b. **Note:** 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.

5. To be used in the DSAS routine (Himmelstoss 2009), once the shoreline feature classes have been edited it needs to be properly attributed. Additionally, if multiple features were created during the shoreline survey, they need to be merged into a single feature.
 - a. Use the “Merge” tool to perform this function.

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 must be in the MM/DD/YYYY format, as listed in Table 1. 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 1. 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

Metadata should be created for each shapefile and layer within the geodatabase according to SOP Dataset and Metadata Publication (Wright et al. 2023), currently under preparation, which complies with the Federal Geographic Data Committee standards.

1. To set the right metadata style, follow these steps:
 - a. Click on the **Project** Tab in the top right of the ArcGIS Pro window (Figure 56).

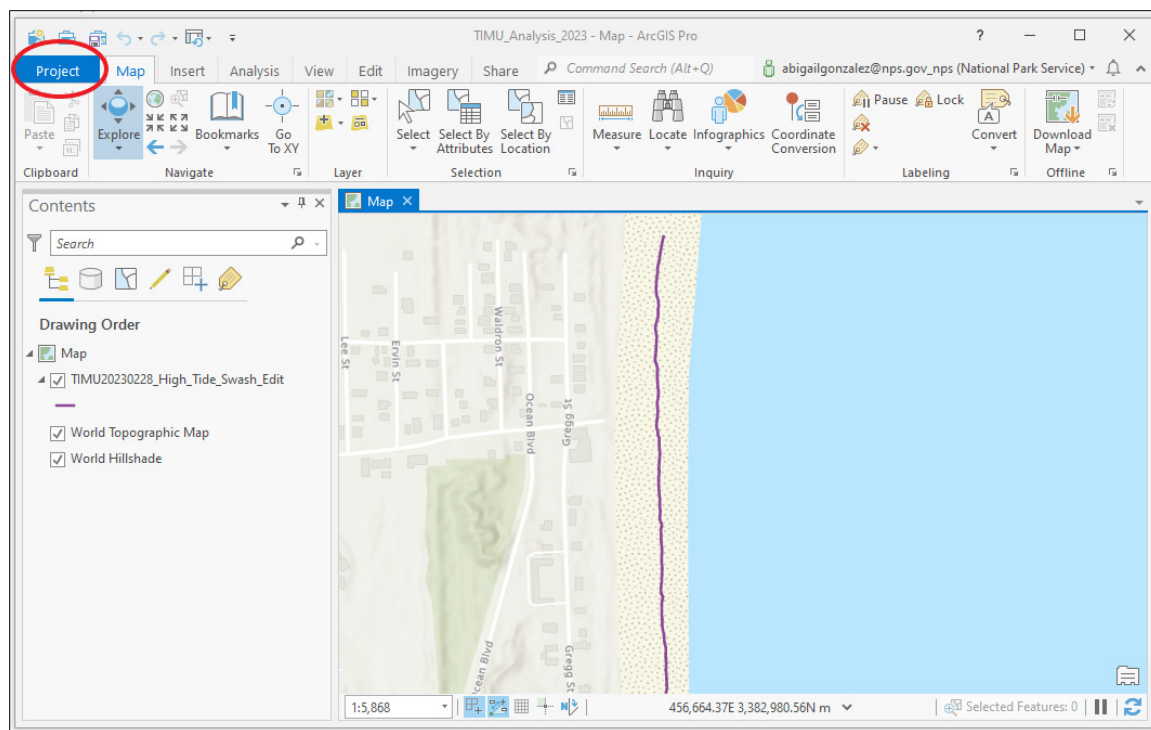


Figure 56. Screen capture of the “ArcGIS Pro” window showing the **Project** Tab.

b. Click **Options** (Figure 57).

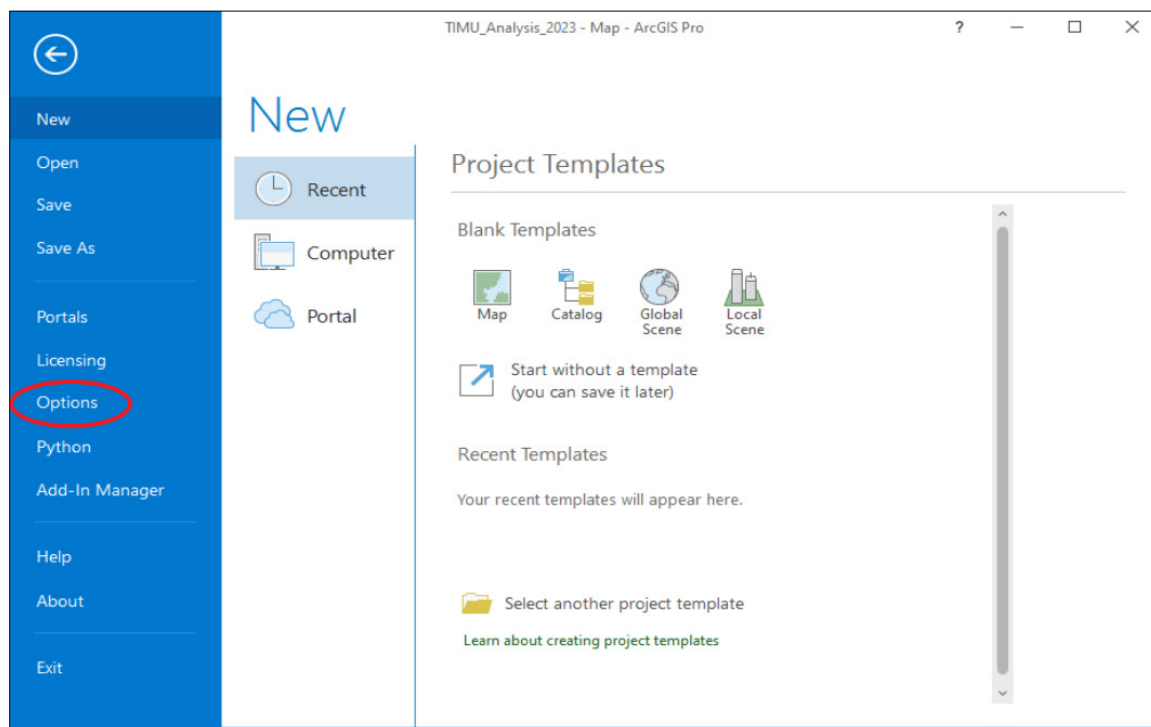


Figure 57. Screen capture of the “ArcGIS Pro” window showing the **Options** option.

- c. In the “Options” window, scroll in the “Application” pane and select the **Metadata** tab (Figure 58).

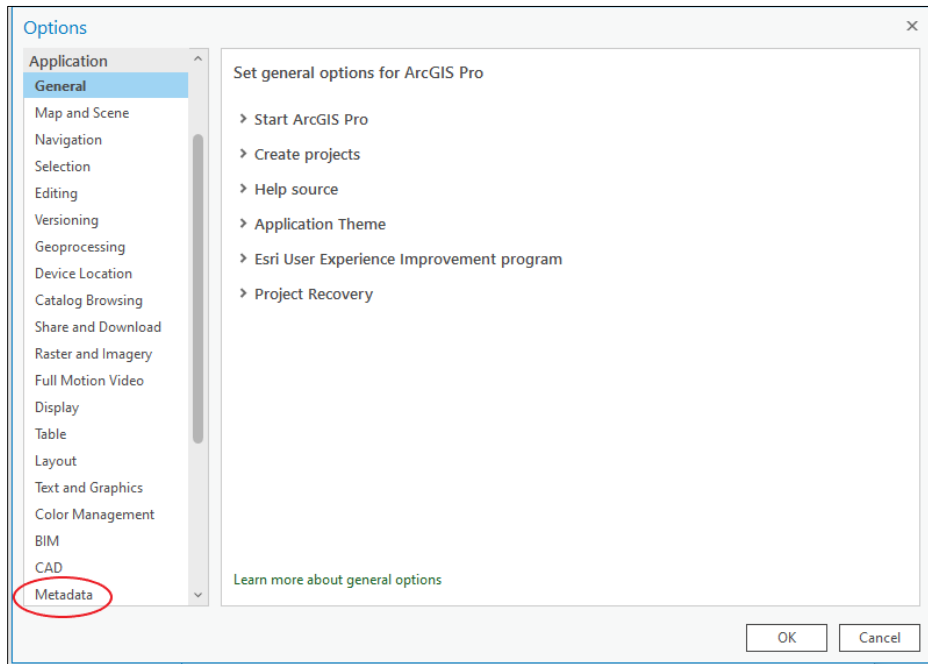


Figure 58. Screen capture of the “ArcGIS Pro” window showing how the **Metadata** tab.

- d. In the “Metadata Style” drop-down list select **FDGC CSDGM Metadata** (Figure 59).

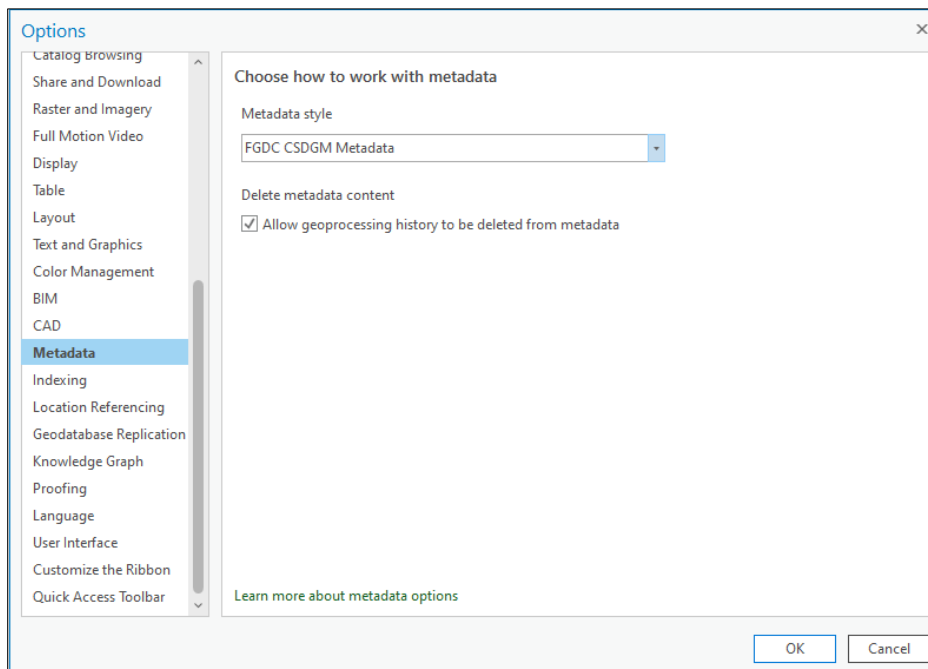


Figure 59. Screen capture of the “ArcGIS Pro” window showing the FDGC CSDGM Metadata “Metadata Style” option.

2. As mentioned before, metadata should be created for each shapefile and layer within the geodatabase according to SOP Dataset and Metadata Publication (Wright et al, 2023). That SOP will describe in detail what needs to be said under each attribute field metadata- please refer to that for more information. Before moving forward to the data analysis, fill out the following main fields for each feature class (or shapefile), as well as for each geodatabase:
 - a. **Title** – For title type “Shoreline data at Timucuan Ecological and Historic Preserve,” change the park name depending on the park the metadata belongs to.
 - b. **Type** – Will already be filled out automatically, but it not, make sure to indicate if this file is a "File Geodatabase Feature Class" or a "Shapefile."
 - c. **Tags**: Type the following tags separated by a comma each “NPS, National Park Service, Timucuan Ecological and Historic Preserve, TIMU, Florida, Shoreline” and change the four-letter PARK code, full park name, and state where the park is located depending on the park the metadata belongs to.
 - d. **Summary**: Indicate where the data was collected, for which park, and why it is for in a brief sentence. For example, “This data was collected at American Beach near Timucuan Ecological and Historic Preserve to be used to analyze shoreline change.”
 - e. **Description**: This section requires more detail regarding how the data was collected. Edit the location and season depending on each park: “This data is part of the Southeast Coast Inventory and Monitoring Network’s Shoreline Change Monitoring Project. The Southeast Coast Network is following Baron, L. C. 2018. Monitoring coastal shoreline change in Southeast Coast Network parks: Protocol implementation plan. Natural Resource Report NPS/SECN/NRR—2018/1744. National Park Service, Fort Collins, Colorado. This shoreline data was collected according to this protocol and processed and analyzed according the related standard operating procedures. The shoreline data in this feature class are located at American Beach near Timucuan Ecological and Historic Preserve, FL. The shoreline data were collected during the spring of 2023.”
 - f. **Credits**: “National Park Service, Southeast Coast Inventory and Monitoring Network, Region 2.”
 - g. Use **Limitations**: “The National Park Service (NPS) shall not be held liable for improper or incorrect use of the data described and/or contained herein. These data and related graphics, if available, are not legal documents and are not intended to be used as such. These data are not of survey quality and not intended to be used for survey purposes. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived. It is the responsibility of the data user to use the data appropriately and consistent within the limitations of geospatial data in general and these data in particular. The related graphics are intended to aid the data user in acquiring relevant

data; it is not appropriate to use the related graphics as data. The NPS gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data. It is strongly recommended that these data be directly acquired from an NPS source and not indirectly through other sources, which may have changed the data in some way. Although these data have been processed successfully on a computer system at the NPS, no warranty expressed or implied is made regarding the utility of the data on another system or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. This disclaimer applies both to individual use of the data and aggregate use with other data.”

3. The top section of metadata should look like Figure 60.

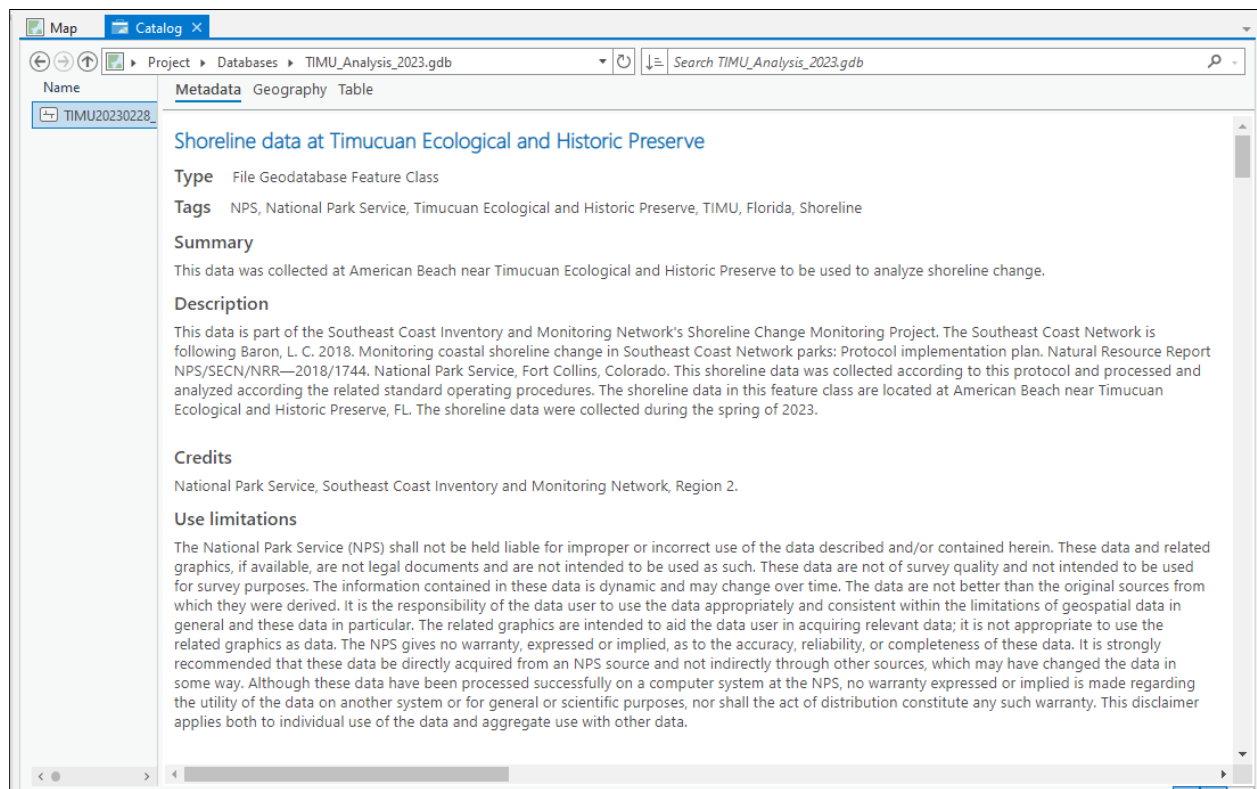


Figure 60. Screen capture of the “Metadata” tab showing the main fields of the metadata.

Once all metadata has been completed using the SOP Dataset and Metadata Publication (Wright et al. 2023) proceed to the analysis steps using Digital Shoreline Analysis System (DSAS) in ArcMap.

Literature Cited

- Baron, L. C. 2023. Conducting the Global Positioning System (GPS) Shoreline Survey—Version 1.1. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.3.22. Southeast Coast Network, Athens, Georgia. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2301098> (last accessed October 2023).
- Frontier Precision. 2016. Exporting Data to a File Geodatabase Using Trimble® GPS Pathfinder® Office. Bismarck, ND. Available at: [Microsoft Word - ExportToFileGeodatabasePFO.docx \(frontierprecision.com\)](https://frontierprecision.com/Microsoft%20Word%20-%20ExportToFileGeodatabasePFO.docx) (last accessed September 2023).
- Himmelstoss, E.A. 2009. “DSAS 4.0 Installation Instructions and User Guide” in: Thieler, E. R., E. A. Himmelstoss, J. L. Zichichi, and A. Ergul. 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).
- Wright W., S. C. Cooper, and A. Gonzalez. 2023. Dataset and Metadata Publication—Version 3.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—2.1.08. Southeast Coast Network, Athens, Georgia. (In prep).