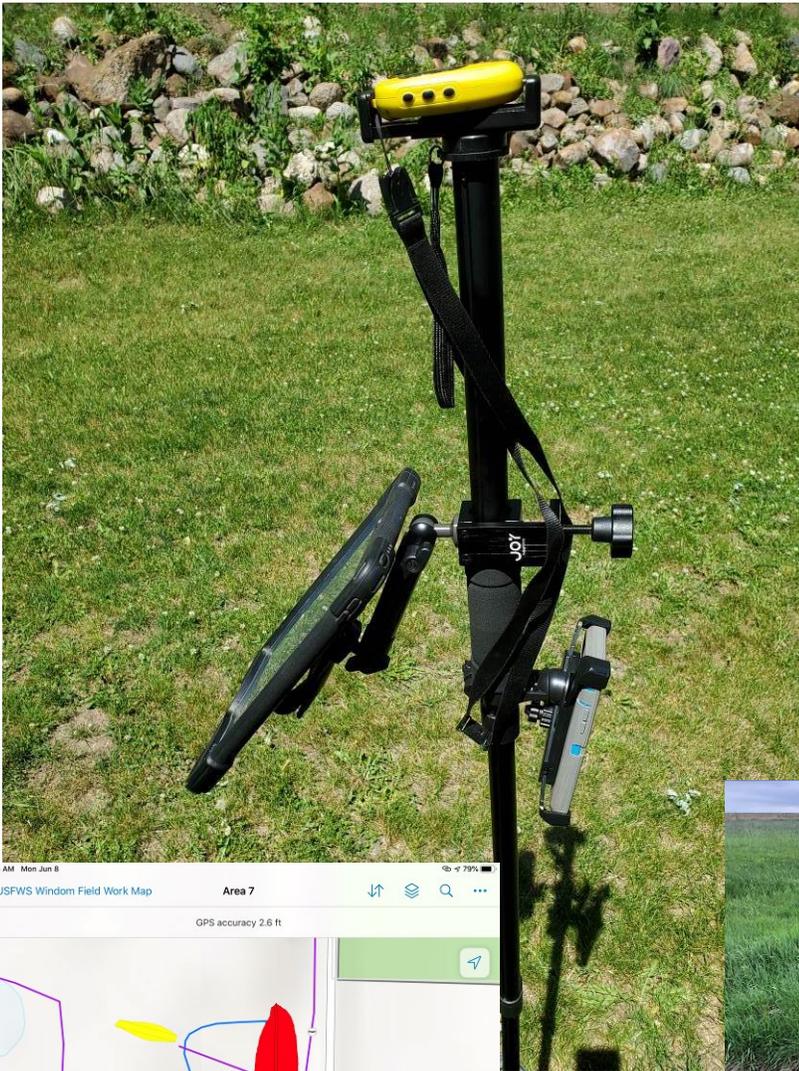


# Mobile Device with BadElf Bluetooth GPS for Construction Flagging & Basic Survey



*Last Updated June 2020  
Written By Scott Ralston  
Available for Download at:  
<http://skralston.com/USFWS/>*

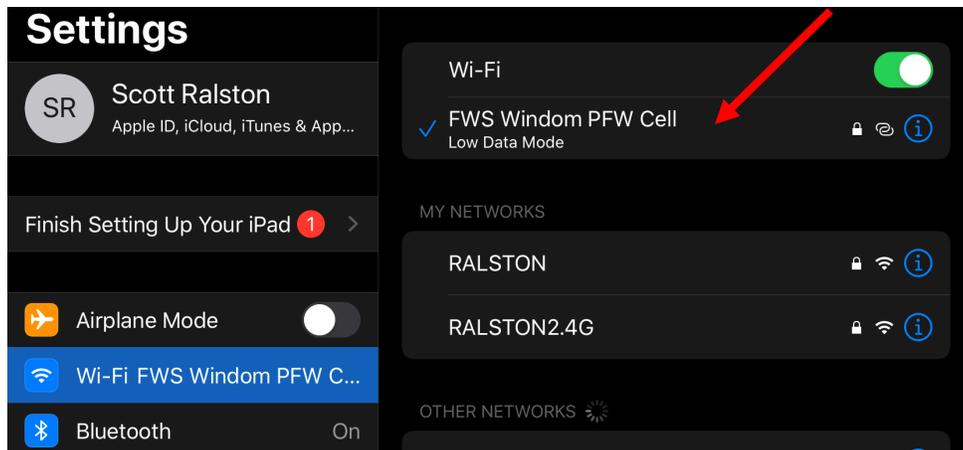
## 1. Devices & Account

- a. For more complete tutorial on setting up and using Collector databases see the Mobile GIS tutorial at <http://skralston.com/USFWS/>
- b. This can work on any mobile device. If not already installed, go to the app store on your device and search for “Collector” by ESRI and install for free.
- c. This tutorial suggests using the Bad Elf GNSS Surveyor GPS as it is the most accurate external Bluetooth GPS at the moment but the same process works for the Garmin GLO or other Bluetooth GPS units, just may not have the same degree of accuracy. Bad Elf has introduced their new Flex model that gets within about 1ft but has not been tested yet and price is over \$2k.
- d. Charge all devices before going in the field. Also bring an external battery pack and cables in case you need to charge in the field.
- e. You will need a FWS AD log in and have previously signed into an AGOL account on a computer to activate the account. To access any maps the administrator for that map will need to have added you to that map permission group.
- f. GPS works best when it is up high and unobstructed view of the sky. The Bad Elf unit has a lanyard attachment to wear around your neck but will not get full accuracy against your body so must hold it out. Thus highly recommend you use the survey staff with a clip in the top for the GPS and operate fully extended for consistent height. Wrap the lanyard around the top of the staff so if it falls out of the mounting bracket it is still attached to the rod. Survey staff has a mount for the mobile device also to make carrying it together easier.
- g. Bad Elf Unit: <https://bad-elf.com/pages/be-gps-3300-detail>
- h. Survey Pole: <https://bad-elf.com/collections/accessories-1/products/gis-pole-mount>
- i. Pole Mount for Ipad <https://thejoyfactory.com/magconnect-c-clamp-single-arm-mount-only/>  
Use with their aXtion Bold case



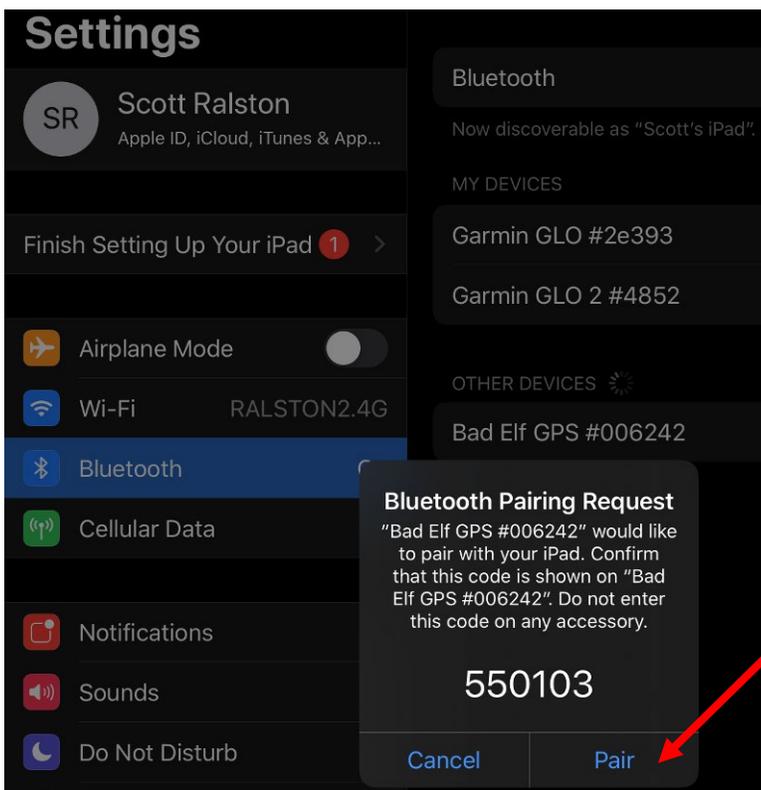
## 2. Wifi

- a. Collector can work without a wifi or cellular connection in the field if you set up the map BEFORE going into the field.
- b. Live streaming does work the best if you have internet in the field on your device or a mobile hotspot. However has the disadvantage if you get into a low cell coverage area and lose internet in the middle of your survey so best practice to work on a local copy if there is any chance of not having constant internet connection.
- c. If the mobile device like and ipad does not have cellular data plan you can link it to any other hotspot. Open the settings and Wifi option. Look for the network you want to join and tap to connect and enter a network password if needed. Note if using an Iphone as a hotspot the sending device iphone must be open in the settings – Personal hotspot screen for other devices to recognize it and hotspot must be enabled.



3. Link GPS via Bluetooth

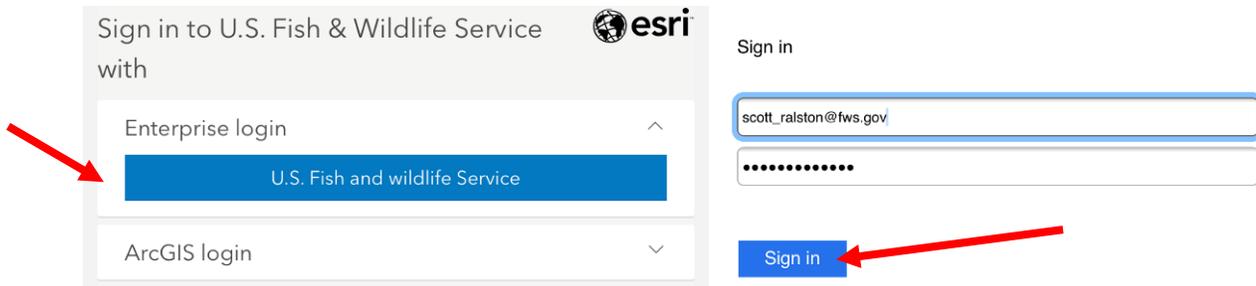
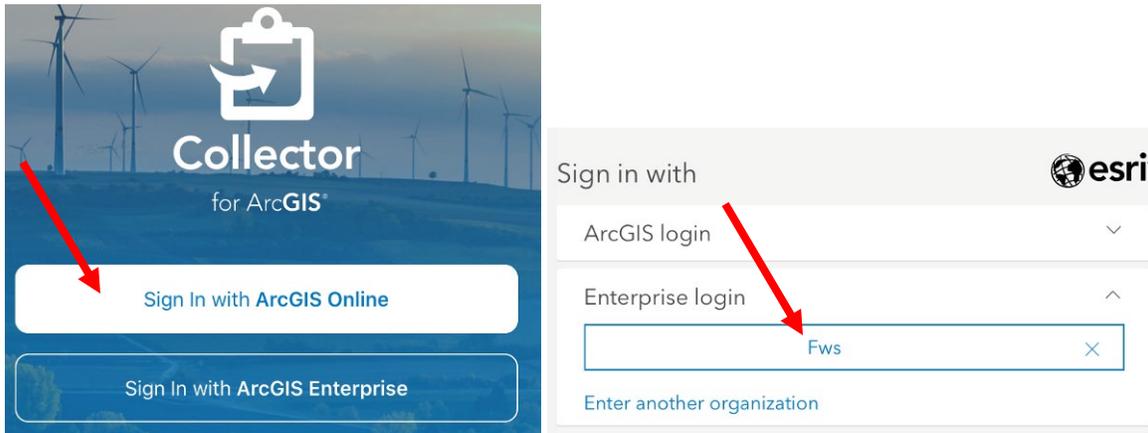
- a. Turn on both the mobile device and GPS unit
- b. Open settings on the mobile device and go to Bluetooth
- c. Bad Elf GPS should show in the list. If it has connected before it should automatically connect again or tap to connect.
- d. If it hasn't connected before it should be listed as other available devices and tap to connect. It will give a pairing code and tap to confirm AND tap on the GPS screen will also display the same code and needs to be conformed on that device.



4. Log in to Collector

- a. Open the collector app
- b. If you previously logged in it may remember your account in which case skip to the next step.

- c. Hit Sign in with ArcGIS
- d. Under Enterprise Type FWS or if you previously logged in with it then just click the FWS already saved
- e. Hit USFWS under Enterprise login
- f. Enter your FWS account email and AD password. PIV option won't work if your device doesn't have a PIV card reader.
- g. Once logged in it should bring up a list of maps available to you.



5. Setup GPS settings

- a. At the top there should be a menu setting button, usually with a person profile icon. Tap it to open settings
- b. Set a minimum accuracy needed to collect a point. This depends on your needs and the type of GPS you are using. Internal GPS for and Iphone will probably never read better than about 16ft. Some android may get closer to 10 and Garmin or other Bluetooth GPS may get less than 10. The bad Elf often gets 2-3ft. To keep it broad yet reasonable for general work 20-30ft may be sufficient.



**Profile** Done

SR **Scott Ralston**  
scott\_ralston@fws.gov\_fws Sign Out

COLLECTION

Accuracy 30 ft >

GPS Averaging 15 Points >

Streaming Distance 10 ft >

Photo Upload Size Large >

Related Types Filtered >

Offset None >

Snapping On >

LOCATION

Provider Integrated >

Profile Default >

GENERAL

Units >

Directions Always Ask >

Download & Sync >

**GPS Averaging**

GPS Averaging

Points to Average 15

Set the number of points you would like to average. Minimum number of points is 2.

- c. Look at GPS point averaging and turn that on to something like 15 points. To improve accuracy it will take multiple readings when you collect a point and average them. You will need to hold at one spot for the duration of the collection but 15 seconds is usually short enough that by the time you type your description or notes the averaging is done anyway.
- d. Under Location Provider, Integrated is the GPS built into the device. We want to select the external Bluetooth GPS. You should have previously connected the Bluetooth GPS above in step 3. If it was connected before it will be in the Provider list. If not hit the Add button, select the Bad Elf or other GPS you are using, hit add, set antenna height. If using the survey staff it is about 6ft tall (1.8m). and hit done. Check next to the external GPS you are using and tap profile to return to the settings.

< Profile Add

**Location Providers**

Integrated  
Antenna ht 1.8 m i

Bad Elf, LLC #006242 Add

To pair a new receiver to your device, go to Bluetooth Settings.

Integrated Done

✓ Bad Elf, LLC #006242 1.8

Connected - Antenna ht 1.8 m i

Antenna Height (m)

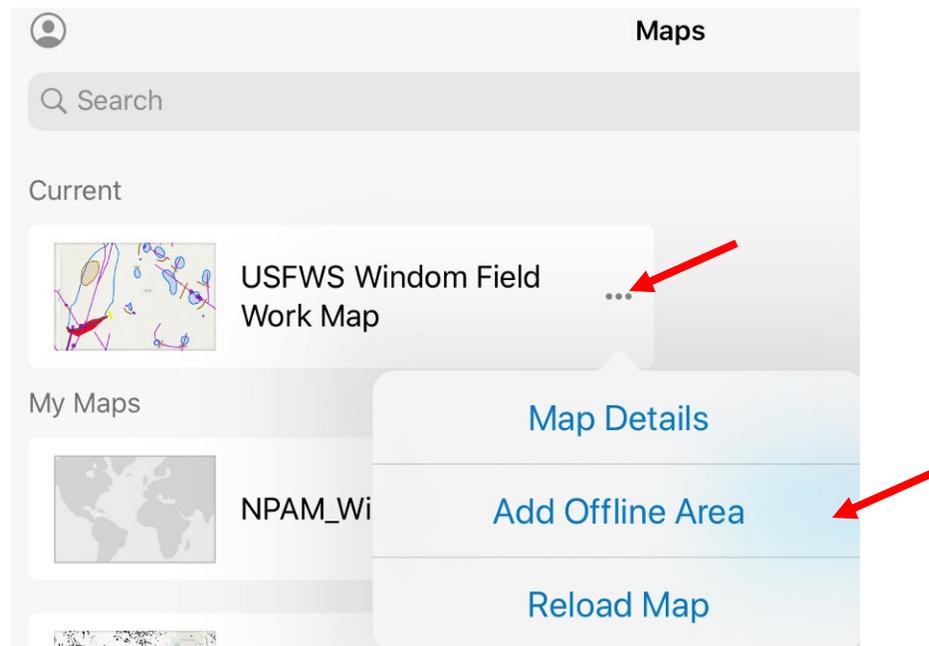
Garmin #000000000000 i

Not Connected - Antenna ht 0 m

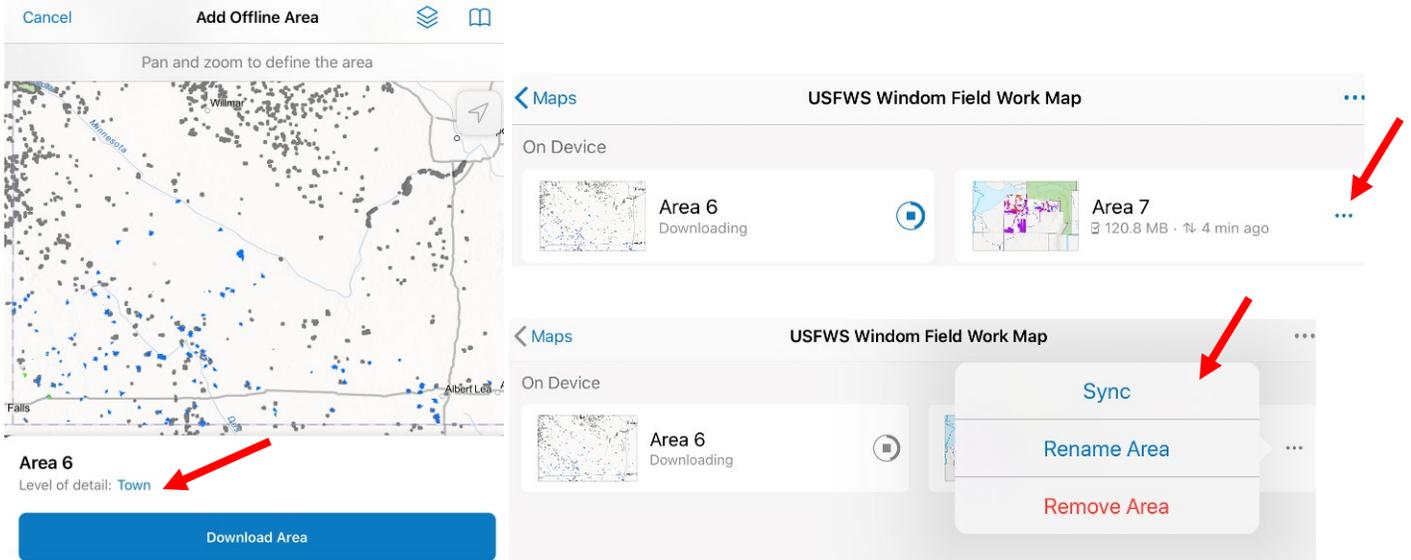
This is the distance measured from the ground to the antenna phase center.

- e. Under General settings you may want to set units to US standard Feet
- f. Under Download and Sync set to Auto-Sync if you have an active internet connection or turn off or set to wifi-only if you want to save cellular data use

- g. Tap done to leave the settings menu
6. Opening the Map
- a. If you haven't download a copy of the map to your device you can just click the desired map to open the live streaming version
  - b. If you previously downloaded a local copy, tapping the map will bring you to the download screen and you can tap to select the download map in your list or create a new download area. Highly suggested to synchronize the map if you are using a previous map before you leave for the field. Hit the 3 dots next to the map to Sync.
  - c. Hit the 3 dots to the right of the map name and select Add offline area to get to the download screen



- d. Select Level of detail. This is just the detail in the base map so less detail on the base map is usually fine as the important content is in the field work point, line and polygon layers. Generally I wouldn't use map detail below about Town level unless you need the base map specifically for road navigation but google maps may be better for that need.
- e. At the top is a layer icon which you can turn on or off different layers to include in the download if you don't need certain layers for your application. Generally for our purpose you would mainly need the field work point, line and polygon layers and the refuge boundaries.
- f. Pan or pinch/zoom to get the area you want to download in view. It will clip and download whatever is on the viewable area of the screen. If an extent is greyed out it is because the level of detail is too high and too large of a file size so would limit how large of an area you can download.
- g. Hit Download Area to complete the download and wait for it to finish.
- h. You can manage your maps on that download page hitting the 3 dots next to any maps to Sync, rename or remove.
- i. Then tap to open the map when done.



7. Navigating on screen

- a. Pinch/zoom and swipe to pan on screen.
- b. Hitting the arrow button in the corner of the screen will center the location on the GPS and the blue dot shows your location or if moving it shows an arrow for direction of travel.



- c. Tapping the GPS accuracy bar at the top will open more GPS information

**GPS Details** ✕  
Updated Just Now

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Provider  
Bad Elf, LLC #006242

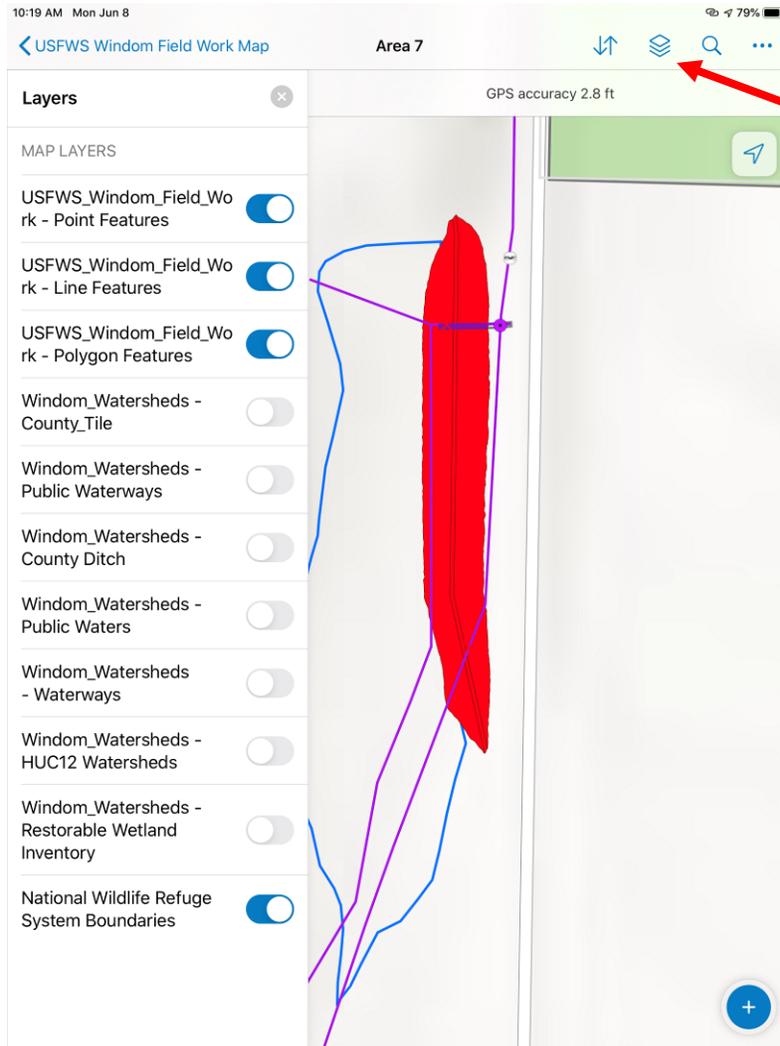
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Profile  
Default

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Altitude	1,428.8 ft
Horizontal Accuracy (RMS)	2 ft
Vertical Accuracy (RMS)	3.1 ft
Fix Type	Differential GPS
Station ID	138
Correction Age	--
Satellites (Used/Visible)	10/13

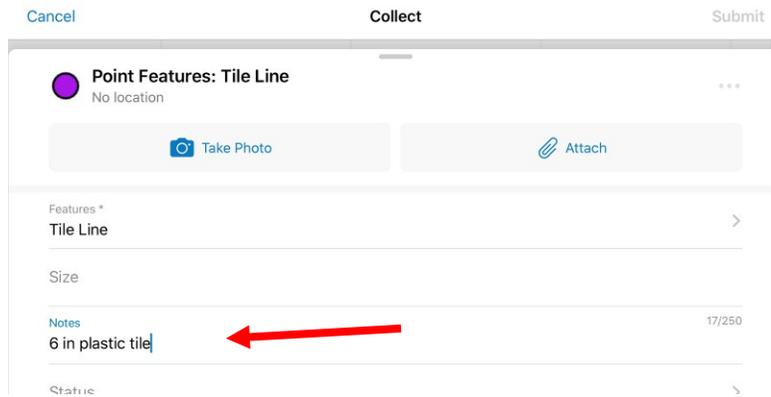
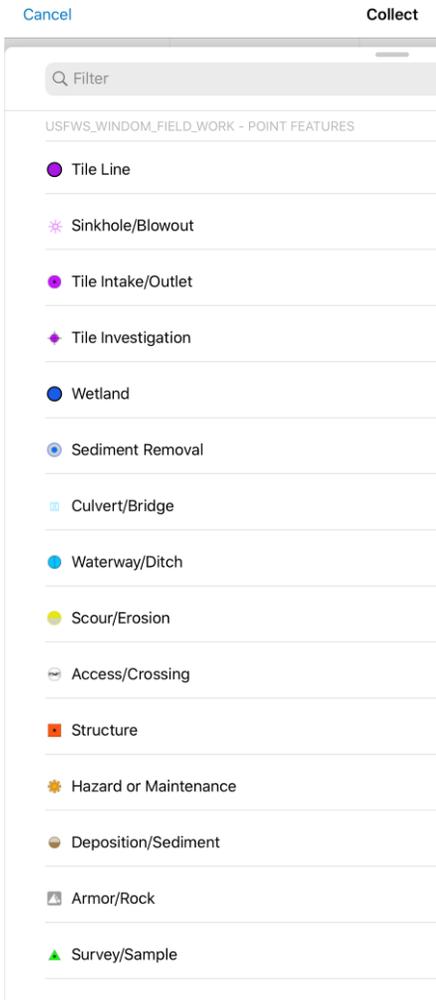
- d. The stacked boxes icon at the top will show map layers available and can turn on or off anything you don't want displayed.



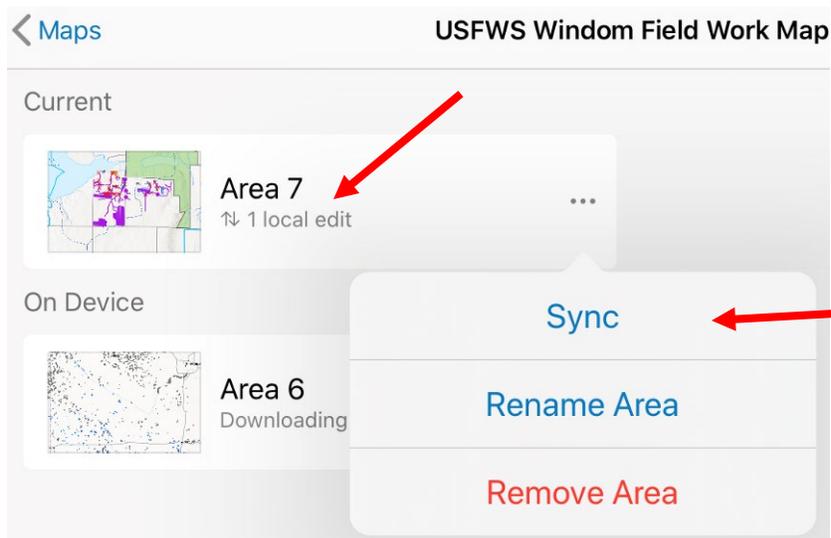
- e. Tap any feature to bring up properties of that feature
  - f. Tap and hold and spot on the map to bring up other options like collect a point there or get directions to that location.
  - g. 3 dots at the top opens other options like a measure tool.
8. Collecting a point

- a. To collect a new point hit the + button at the bottom of the screen.
- b. The template list will give a list of available features in the map to select from. In most cases you will just map a single point but there are options for creating lines or polygons in which case the first point collected will be a vertex and subsequent options for either hand drawing on screen for the other vertices of the polygon or line or moving and collecting those with the GPS location.
- c. Once the template feature type is selected the attribute window opens while the GPS position starts collecting and averaging. Fill in notes or any other attributes you want for that point.
- d. When done hit the Check box to save the point or the X to cancel it.





- e. If working in an offline mode, it will indicate in the top toolbar by the sync button there are un-synced features available. Once you return to a wifi connection, hit the sync button to synchronize those features online.



## 9. Flagging with the GPS

- a. This is only specific to directions for USFWS Windom. Others should follow your local guidelines. This is also for non-survey grade applications as at best accuracy is within 2-3ft so if the task requires greater accuracy than that switch to the Trimble survey grade GPS.
- b. Navigate to the features on screen such as a wetland boundary. Use the GPS staff to get the best and most accurate signal possible. Accuracy gets better when you stop so may need to pause for a moment and let the GPS signal settle at a location before marking it. General construction marking should be within about 5ft.
- c. Colored flagging is used for our purpose to differentiate types of features.
  - i. Blue is wetland or sediment removal boundaries
  - ii. Pink is for fill material like dikes or spoil piles
  - iii. White is excavation like spillway cuts, borrow areas, ditches etc
  - iv. Lime green/yellow is used for marking tile lines or tile breaks.
  - v. Orange is used for marking installation of structures or other materials like water control structures, culverts, sheetpile, rock, posts or any other physical feature being installed
  - vi. Florescent painted wood lath is used to give direction. Pound in the lath and write on it to tell what it is or what to do there or in tall vegetation use a combination of lath and flags as the lath may be higher and more visible, then when they get closer may see the flagging
- d. Location of marking
  - i. Specific features like tile, structures, installation points mark right on the point or line as close as possible with the GPS position and on-screen feature.
  - ii. Boundaries like a sediment removal or dike outline, mark a couple feet outside of the boundary around the perimeter. Contractors will generally leave the flags in place as a visual reference so will run equipment along the edge inside the flags without running it over. Thus marking a couple feet past the boundary gives them room to avoid the flag yet work on the correct perimeter.
- e. Density/spacing of flagging
  - i. How often to place a flag depends on the vegetation but consider conditions on only at the time of marking but at potential full grown for the season or until construction. Thus an open field with flag spacing at every 20ft may look good in spring but 3ft vegetation by late summer will hide many flags.
  - ii. General rule of thumb is at full vegetation growth you need to be able to stand at one flag and see the next flag in line.
  - iii. Generally place a flag, take 4-5 full steps and place another flag.
- f. Lath/Labeling
  - i. Pre-pain the lath so the paint is dry and you can write on it. Use large black sharpies to write on in bold.
  - ii. Place a lath at each feature or any point where there is a change of instructions.
  - iii. Write in big clear print with the same on both sides of the lath so it can be viewed either direction.

- iv. Wetlands label with wetland # and direction such as “Wetland 1 – 1ft Sediment Removal”. Place at the most visible point such as a direction most like to approach from or an outlet side where they will be going to do additional work at the outlet anyway.
- v. Dikes/Berms or spillway – Generally place a lath on each end of the dike or spillway and then also one on each farthest front and back toe of the dike/spillway to show the maximum width. On the ends write elevation & dimensions such as “Dike top – 1046ft MSL – 10ft wide – 5:1 slope”
- vi. Tile breaks – Usually mark at the most visible point along the break. In general the break will be from the edge of a wetland and go 100ft downstream or break under the outline of the dike so I would place the lath at the edge of the wetland over the tile and label “Tile Break 100ft” with flagging marking the rest.



g. Benchmarks

- i. Generally will be placed with a Survey grade GPS for accurate elevation however may be used with Bluetooth GPS to locate and reflag if needed.
- ii. Locate benchmarks central to the work area. Generally make them easy to use for a laser level so should be slightly higher than the feature they will use it but not more than about 5ft. Needs to be within line of sight of the work area. Place out of direct path of equipment travel so not in line with dike tops spillways or where spoil piles would be place in an excavation.
- iii. Spike nail or rebar will generally be driven in to the ground as a benchmark. Paint the head of it with fluorescent paint.
- iv. Put a bright orange pin flag in right next to the pin.
- v. Place 2 lath crossed like an X over top of the pin.
- vi. Label like “Benchmark 1605.3ft MSL”

- vii. GPS the benchmark when it is placed so it can be located if the flagging or lath falls down.
- h. Mowing
  - i. If the vegetation is thick and flags are hard to see consider mowing the site.
  - ii. Mowing off entire work areas is the best for contractors as less bulk vegetation will bind up less in big sod balls when they are digging.
  - iii. If limited with an ATV mower just do a couple passes around the flag perimeter.

