



European Frog-bit Collaborative

Delimitation of European frog-bit (*Hydrocharis morsus-ranae*) populations in Great Lakes waterways

Delimitation App Standard Operating Procedure

DRAFT: Last updated June 15, 2023

A. Introduction

Detecting an invasive species early provides the most realistic chance for management activities to successfully eradicate the population. However, aquatic invasive plants are often cryptic and difficult to locate before widespread population growth. Detecting a species requires thorough surveillance of all preferred habitat for a given species. Documentation of surveillance efforts provides critical information on where the target species is found and where it is not.

European frog-bit (*Hydrocharis morsus-ranae*; EFB) has continued to spread across the Great Lakes, including inland expansion in Michigan since 2016 and the initial discovery in Green Bay, Wisconsin in 2021. Efforts are being made by various conservation groups and agencies to better understand EFB distribution. This document is intended to provide a standardized process for detecting EFB and, if found, how to delimit the population.

B. Objectives

1. Document European frog-bit presence or absence in a waterbody
2. Delimit European frog-bit populations once located in a waterbody

C. Survey site selection

EFB is a free-floating plant that flourishes in areas protected from wave/water energy. Bays, wetlands, and backwaters can provide suitable habitat. Additionally, areas with dense emergent and floating leaf vegetation such as cattails, water lilies, reeds, or woody plants can provide needed shelter for EFB. When conducting surveys for EFB, select waterbodies or locations within a waterbody that have such habitat.

A second factor for determining survey locations is recreation access points. Anecdotal evidence suggests EFB is most likely spread via recreational boaters transporting EFB between waterways. There may be a link between popular waterfowl hunting locations and EFB presence. Recreational access is not a definitive factor for locating EFB populations but has a strong correlation with many recently discovered populations. It is important to note that other factors such as watershed connectivity or wildlife may also aid in spreading EFB and should be taken into consideration when selecting locations.

D. Field Methods

Data collection procedure

All data will be collected on the *EFB Collab AIS Survey* map in the ArcGIS Field Maps app. The application ensures standardized data collection across all locations surveyed for EFB. A guide for using the app on Apple or Android devices can be found in Appendices A and B, respectively. There are several requirements for using this application, including an ArcGIS Online account and permission to use the EFB specific app. Request access to join the group here: <https://bit.ly/EFBapp>.

A critical aspect of EFB surveillance is ensuring all available habitat is surveyed. This includes sampling from the water's edge to open water areas. Achieving this level of surveillance often requires a combination of wading and boating and may be physically challenging. Conducting surveys from kayaks or boats alone is inadequate as the water shoreline interface is a common

location of EFB that is often missed. Figure 1 demonstrates locations where EFB can often be found in comparison to emergent vegetation edge and the water's edge. Seasonal fluctuations in water levels may dictate survey location boundaries. EFB has been found outside the water's edge (e.g., behind break walls), where high spring water levels allowed EFB to float into secluded places before water levels receded, trapping the plants (Figure 2).

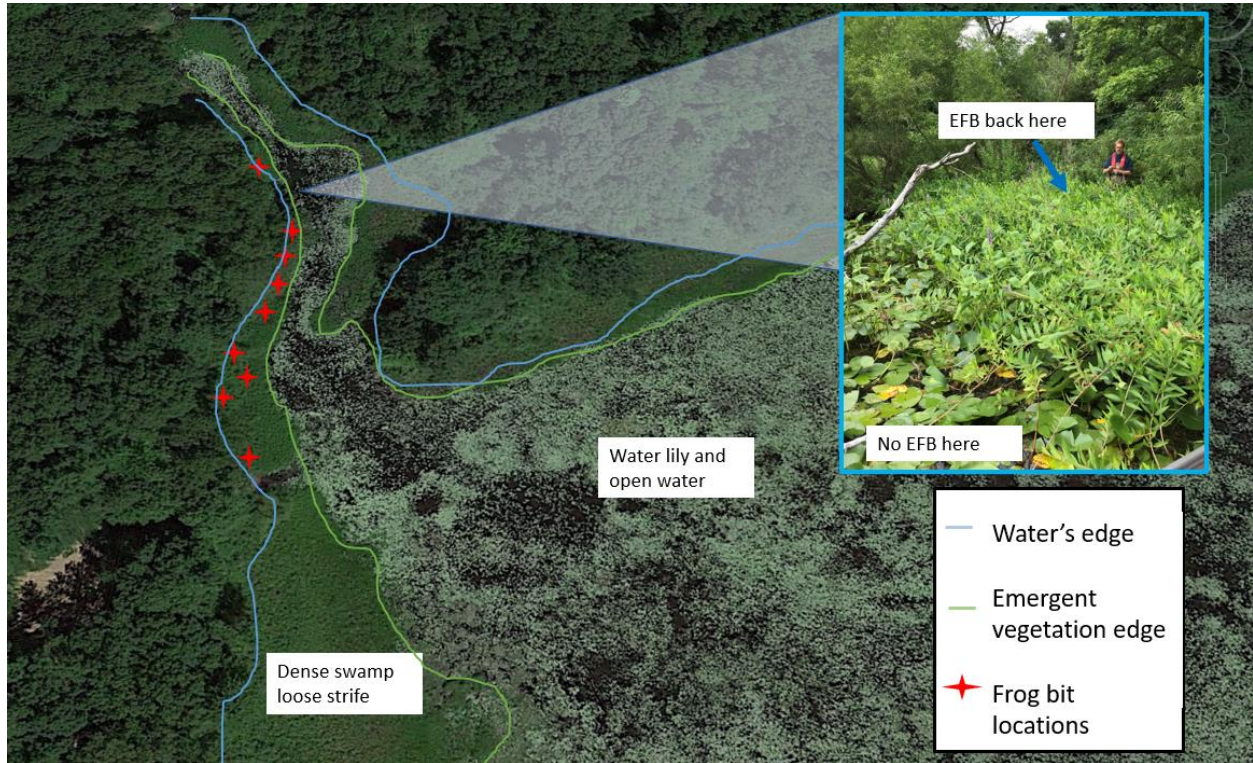


Figure 1. Actual locations of European frog-bit in relation to water's edge and emergent vegetation along lake shoreline. A combination of wading and kayaking was used to locate European frog-bit.

Sampling schedule

Sampling can occur from the time EFB emerges for the season until senescence begins. In the southern portion of the Great Lakes basin, EFB often emerges in mid-May and begins senescence in late September. The farther north, the later the emergence timing. In the northern basin, emergence often is not observed until July 1st. Senescence may also occur earlier in northern areas where the growing season is more constrained. Typically, the most effective time to survey for EFB is prior to full-leaf out of water lilies (June in the southern basin) as water lily leaves can block EFB plants, making them harder to see.

Sampling crew

Surveys are most effective when completed in teams of two or more. Working as a team provides better surveillance coverage and a safer work environment should an accident happen. In addition, surveying areas can be physically exhausting, with risk of overheating, becoming physically stuck, and overexertion. Working as a team provides a safer work environment and is highly recommended. Crews should always maintain visual contact with one another and stay within hearing distance.

Sampling equipment

Conducting delimitation and early detection surveys for EFB can be accomplished with a modest amount of equipment. The basic materials include a smart device (with Field Maps app installed), a portable battery to charge the smart device, safety equipment (e.g., life jacket, first aid kit, sunscreen, bug repellent, etc.), decontamination equipment (e.g., bleach sprayer, brush, etc.), waders, and, depending on the habitat being sampled, a kayak/boat. Appendix C has a more thorough equipment list.



Figure 2. European frog-bit behind break wall. Surveyors should pay close attention to refuge areas like this

E. Data Collection

Delimitation line

This survey is designed to collect EFB surveillance data across a broad range of environments including large waterbodies such as coastal wetlands, inland lakes, or large rivers but may still be used on smaller systems such as wetlands, small inland lakes, or ponds. See Appendix A or B for a step-by-step process for using the app. The general process for conducting the delimitation line is provided below Figure 3.

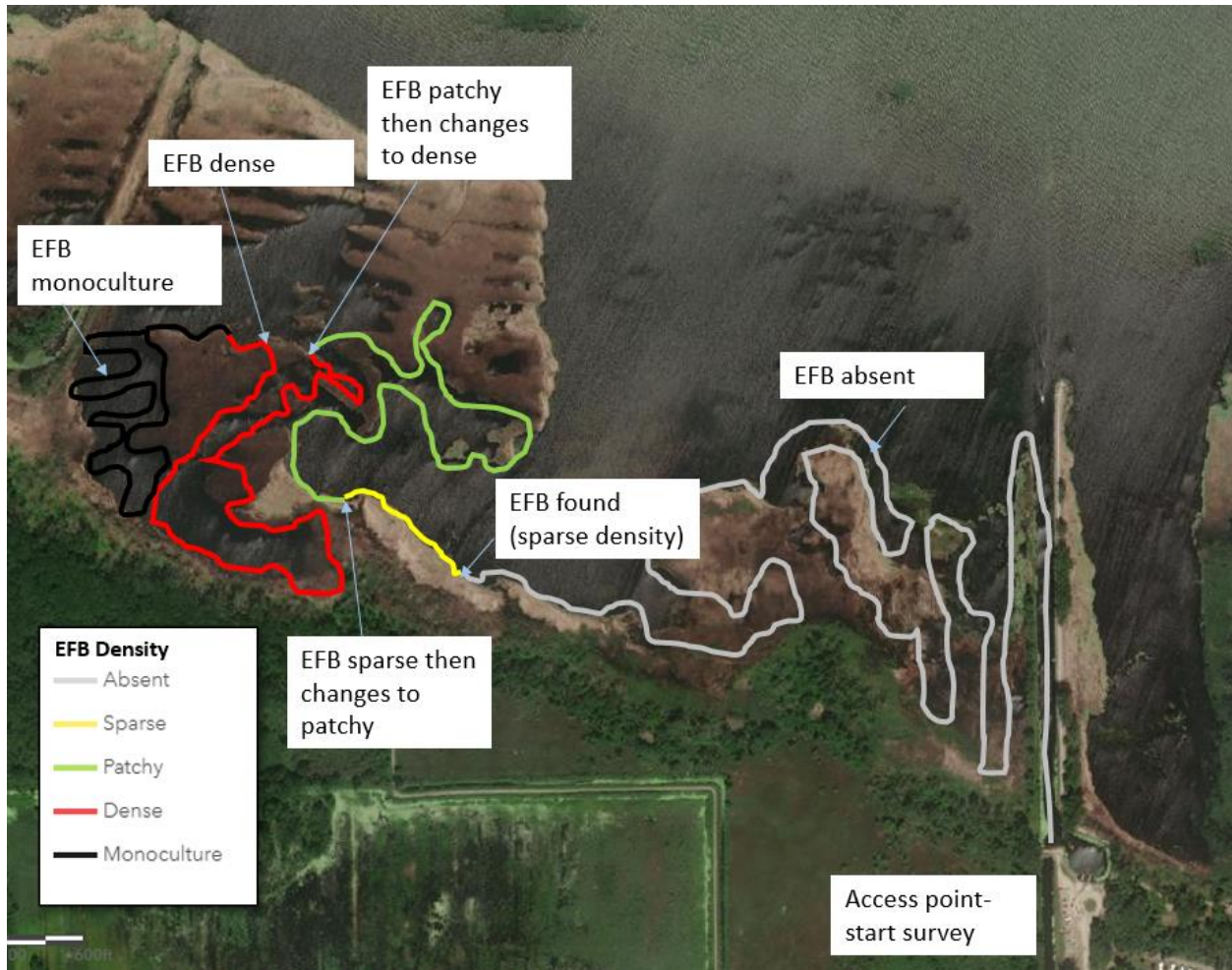


Figure 3. Example schematic of conducting EFB delimitation survey.

- Crews begin survey at the access point or navigate to their desired survey location.
- Use the Field Maps app to collect an EFB density line with the *AIS EFB line (streaming capability)* map. The goal of the line is to demonstrate where surveillance was conducted. Therefore, if multiple teams are surveying the waterbody, each should collect a line.
- Meander through the search area slowly looking for EFB. Sampling should occur from water's edge to open water. This can range widely in size and in coastal wetlands may be over a quarter mile. A kayak may be used in areas where vegetation densities allow for travel. Wading should be used when kayaks can no longer navigate through dense vegetation, provided site conditions allow for safe wading.
- Crews should pay special attention to locations most likely to harbor EFB, such as floating debris mats that may trap EFB plants and dense vegetation stands which act as a refuge for floating EFB plants.
- When EFB density changes during the survey, submit the current line and begin a new line with the appropriate EFB density in the app and continue surveying. If EFB is removed during the survey, please select the appropriate data field to ensure this information is accurate and that EFB-positive information does not exist for areas that no longer have EFB. Density categories are aligned with the Midwest Invasive Species Information Network (MISIN);



table 1 and figure 4). Keep in mind accuracy with a typical cell phone is about 30 feet, therefore subtle changes in EFB density over a short distance (every 10 feet) isn't as critical to document as changes over a larger scale (every 100 feet). Use best professional judgement to characterize EFB within a site.

Table 1. MISIN density categories.

| EFB Density | General description of plant density |
|-------------|---------------------------------------------|
| Sparse | Scattered individual plants |
| Patchy | A mix of densities such as sparse and dense |
| Dense | Greater than 40% |
| Monoculture | Nearly 100% if area |

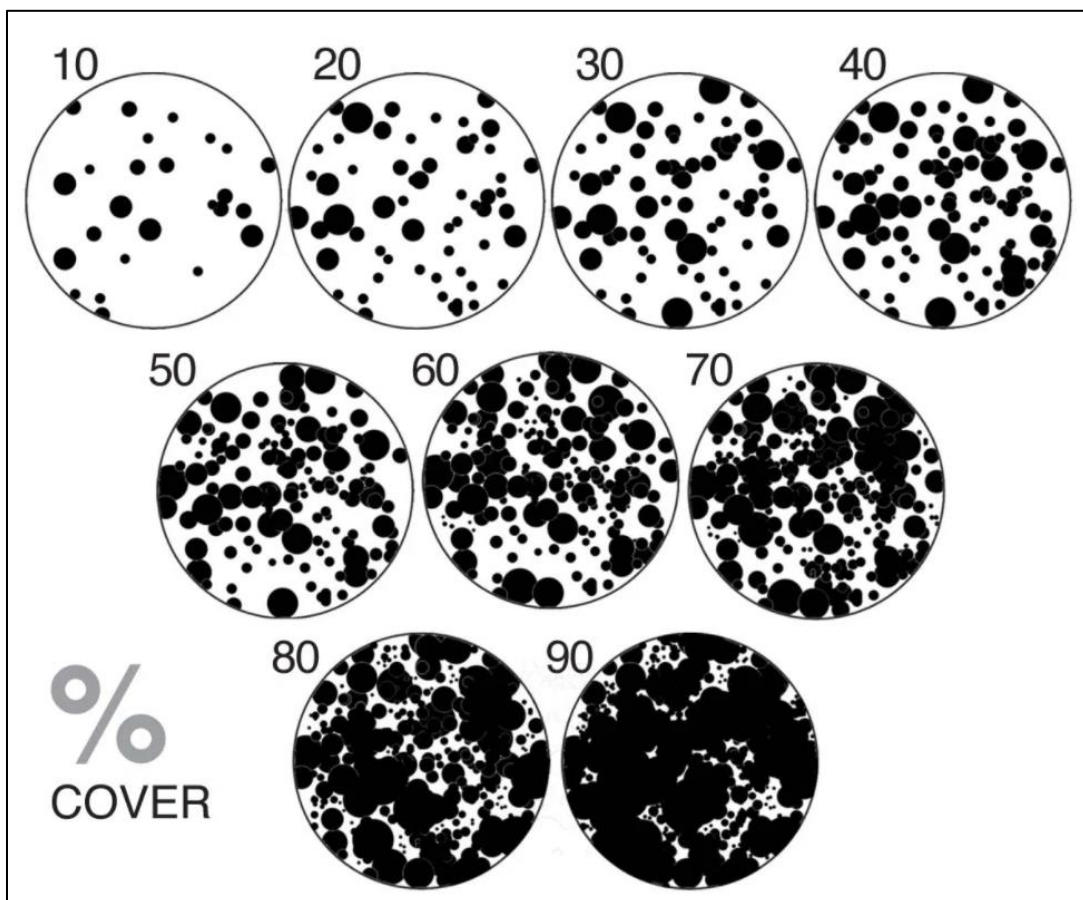


Figure 4. Diagram for estimating percent (%) cover. Source <https://johnmuirlaws.com/wp-content/uploads/2019/03/Untitled-1.jpg>

- Continue line survey until area is searched completely or until crew is satisfied with survey coverage (use best professional judgement). Submit data if cell coverage is available or next time the device links to a Wi-Fi connection.
- The intention of this survey is to provide a coarse EFB delimitation within a site in addition to displaying overall EFB presence and absence at the site level.

Point feature

This portion of the Field Maps app is designed to capture detailed information at the site level and includes specific information about the area surveyed and overall observation. See Appendices A and B for guidance on collecting point data. If EFB is not found at a location, a minimum of 1 of these points should be taken at each location surveyed (e.g., one point for an inland lake, pond, or wetland) upon completion of the Delimitation Line Survey. Additional points should be taken if habitat within the survey area changes to accurately capture EFB survey information. Multiple points may be taken if crews find isolated patches that may elicit different management actions or are separated from other EFB patches in the system. Use best professional judgement on when to collect additional information. Within a single patch, one survey point is ideal. If multiple patches are spread across a system, additional points may be warranted to characterize that location. This is more critical when there are differences among patches within a system. The following guidance should be used to determine if additional points should be collected.

Examples when more than one point could be taken when EFB is not found:

- Significant habitat changes within a system when EFB is present (e.g., open cattail wetland to forested wetland). An additional point will help better characterize the habitat surveyed.
- Changes in area surveyed such as transfer from an inland lake to outlet creek or channel. Often these types of habitats vary widely, and an additional point will help better characterize the habitat surveyed.
- EFB is found in more than one location within a site separated by some distance or habitat type (e.g., EFB patch A and B are found over a half mile apart on an inland lake).
- EFB is found in isolated patch with density two levels of separation or more from other patches (e.g., new patch found with dense EFB whereas previous EFB was only sparse).

Polygon feature

This portion of the Field Maps app is designed to capture detailed information at the patch level and includes specific information about the infested area. This feature allows the user to capture a known area of infestation and may be used for monitoring changes over time based on total area. See Appendices A and B for guidance on collecting a polygon in Field Maps.

F. Data Collection Tips and Tricks

Device limitations

Older devices may not have the capacity to run the app. It is recommended to use a device that is no more than a couple of years old with an up-to-date operating system.

Battery

Running this app can quickly drain a device's battery, especially if you are actively using the app and changing features frequently. A portable battery charger is recommended and can be purchased at various retailers. It is unlikely you'll be able to complete a full field day on a single charge so plan accordingly with battery usage and charging.

Offline use

Offline use may be required when conducting field work in remote areas without consistent or stable Internet/cellular network connections. This app can be used offline (e.g., in airplane mode) but accuracy may be reduced. Survey lines may have gaps and that's okay, just do the best you can. Follow these instructions when you will be in areas with no or little cellular service:

- Before heading out into the field, **make sure to download An Offline Area while you have good internet service** (see Appendix A and B). This will create a local version of the map area selected (Maps: On Device), and allows you to create lines, points, and polygons as you normally would within this local version.
- **Make sure to sync the data as soon as you are connected to the internet.** You do this by hitting the sync button in the offline "On Device" map area (see Appendix A and B).
- **The On Device map can be deleted once you have successfully synced your data and the offline map is no longer needed.**

These tips will help to ensure the best possible offline data collection:

- Verify your device can properly run the app offline ahead of time by using airplane mode to manually turn off Internet/cellular connectivity to your device. With the app open in offline mode, verify GPS accuracy is within 30 feet or less of the known position.
- Make sure you open the app on your device when you have service prior to going into the field to ensure the app loads properly.
- Monitor your progress throughout the day. If you are having issues, there may be some ways to troubleshoot the issue. See Appendix D or collect a survey line using a handheld GPS.
- Using an external GPS receiver paired with your device will help in offline areas.
- When in reliable cellular service or connected to Wi-Fi, review lines, points, and polygons to ensure accuracy. Edit incorrect features by tapping on the feature you want to edit, then select the pencil icon in the lower left and edit as needed.

Attachments

Photos and notes can be attached to each feature layer if you want to capture that information. It is highly recommended to submit the base feature layer first (e.g., a polygon, , or point) then go back and edit the feature to add a picture to it. In areas with poor cell service, this step is highly recommended.

G. Decontamination

After surveys are complete, ensure all gear and equipment is properly decontaminated following proper decontamination procedures such as the [Invasive Species Decontamination for Field Operations in Michigan](#). When possible, work from least infested to most infested areas (considering all known invasive species) or from upstream to downstream on flowing systems to reduce likelihood of spread to uninfested waters.

H. Post field work

All uploaded data collected will be available through an ArcGIS Online web application titled [EFB Collab AIS Survey](#). Crews should regularly review the data submitted to ensure accuracy. Ensure that all test points on the Delimitation app are deleted before the data is set to be analyzed. If errors are found, they should be corrected using the “edit” function in ArcGIS Online.

APPENDIX A. EFB Collab AIS Survey Guide (Apple Products)

ArcGIS Field Maps Reference Sheet – EFB Collab AIS Survey

For iPhone and iPad


Getting Started – Sign in

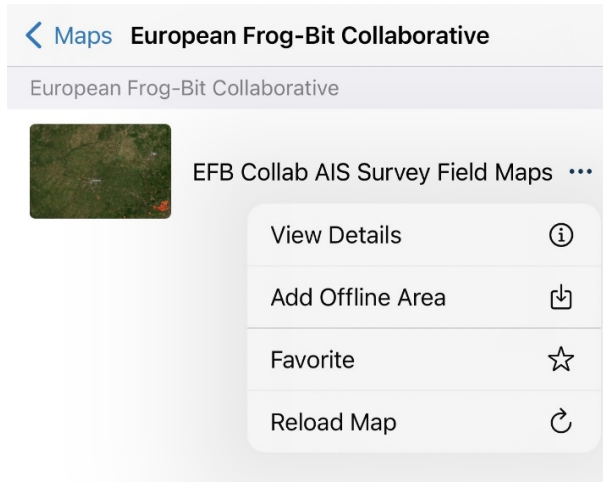
Open Field Maps App. Sign into your ArcGIS Online Account.

1. Tap **Sign in with ArcGIS Online**
2. Enter your credentials.
3. Tap **Sign in**.

Online Data Collection: In the list of maps, open: **EFB Collab AIS Survey Field Maps**

Offline Data Collection:

1. In the list of maps, select the Overflow  on the right of the map name: **EFB Collab AIS Survey Field Maps**.




2. Select **Add Offline Area** to download your sample area.


1

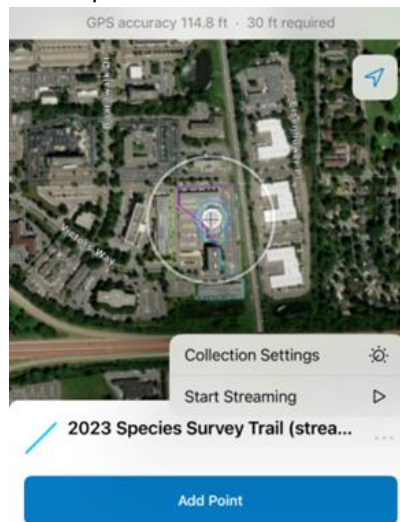
3. Choose **Download Area** once you pick your offline area in the map.

Record AIS EFB Line Segment

1. Tap Add  (on the map).
2. **Choose to create an AIS EFB Line by selecting the density you wish to record.**



3. **Create a line segment by streaming your location:** select the **overflow menu**  and select **Start Streaming**. Or manually draw the line segment by adding vertices on the map.




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4. **Click submit** to end line segment.
5. **To change EFB density:** repeat the process and create a new line segment.
6. **Taking Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to rename it, save it to your device, or remove it from the asset.
7. Tap **Submit to confirm edits**.

Record Polygon


1. Tap Add  (on the map).
2. **Choose to create a Polygon by selecting the density you wish to record.**



3. **Manually draw the polygon** by adding vertices on the map. Or use Streaming.
4. **Click submit** to create a polygon.
5. **To change EFB density:** repeat the process and create a new polygon.
6. **Taking Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to rename it, save it to your device, or remove it from the asset.
7. Tap **Submit to confirm edits**.

3


Record AIS EFB Point

1. Tap Add  (on the map).
2. **Choose the AIS EFB Points option.**
3. **Complete the form.**
4. **Taking Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to rename it, save it to your device, or remove it from the asset.
5. Tap **Submit to confirm edits.**

Editing Data – Point, Line or Polygon



1. Tap the record you'd like to edit on the map.
2. Tap **Edit** in the available actions.
3. **Editing Data:** Update the form by tapping an entry to edit it.
4. **Editing Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to remove it. Once an attachment is downloaded, long press it to rename it or save it to your device.
5. Tap **Submit**.

Delete

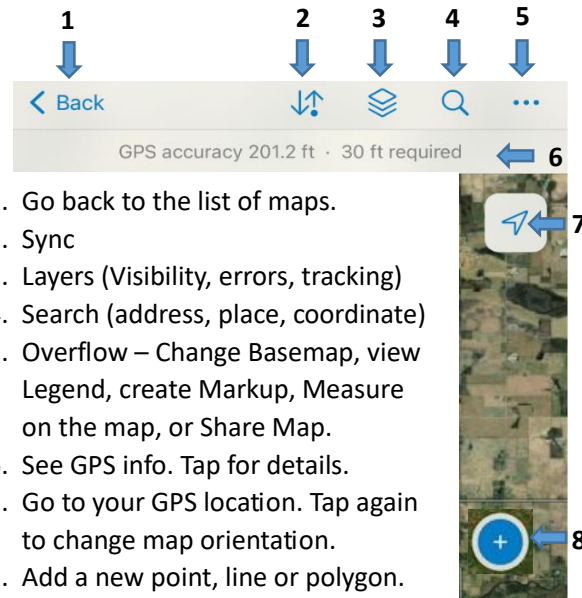
1. Using the map, tap a record you'd like to delete.
2. Tap **Overflow**  at the bottom of the screen, tap **Delete**, and choose **Delete**.
NOTE: This action cannot be undone.

Sync – If working offline

You should sync when you have good connectivity. It's recommended that you sync whenever you can, and that you enable auto-sync.

1. Tap **Sync**  to open the Sync panel. (If there is no dot in the icon , you have no edits to sync.)
2. Review the edits you made (if any) and tap **Sync**.
3. Wait for it to complete.

Quick reference – Map tools








1. Go back to the list of maps.
2. Sync
3. Layers (Visibility, errors, tracking)
4. Search (address, place, coordinate)
5. Overflow – Change Basemap, view Legend, create Markup, Measure on the map, or Share Map.
6. See GPS info. Tap for details.
7. Go to your GPS location. Tap again to change map orientation.
8. Add a new point, line or polygon.

Quick reference – Asset location tools

While creating or editing a feature you can edit its location. You'll see a location target. The target is blue when at your location and the GPS



meets required accuracy. When red, the GPS doesn't meet required accuracy. A grey target is positioned manually (by moving the map).

- Tap **Add Point** to add a point under the location target. By default, the location target is over your location and moves with you. Move the map to position it manually. Use the GPS button to center it over your location. (With GPS averaging, an average is calculated with each point added with GPS.)
- Use streaming to add multiple points to a length or area automatically while you walk or drive: Tap **Overflow**  and tap **Start Streaming**. To change the frequency of what points are added, update **Streaming Interval** in **Overflow** . Tap **Stop Streaming** to collect locations manually.
- Tap **Update Point (Update Selected Point)**, in **Overflow**  for lengths and areas) to move the selected point.
- Tap **Delete Selected Point**, in the **Overflow**  to delete the selected point.
- Use **Overflow**  to undo and redo changes.

Contact information



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www.glc.org/work/efb
 Sam Tank, project manager
 734-396-6055

ArcGIS Field Maps Reference Sheet – EFB Collab AIS Survey

For Android phones and tablets

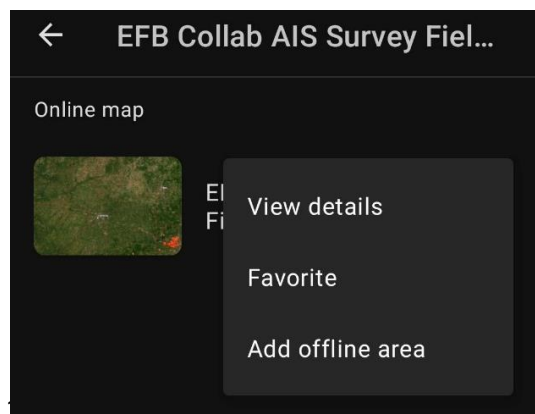
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Offline Data Collection:

1. In the list of maps, select the **Overflow** on the right of the map name: **EFB Collab AIS Survey Field Maps**.




sample area.

3. Choose **Download Area** once you pick your offline area in the map.

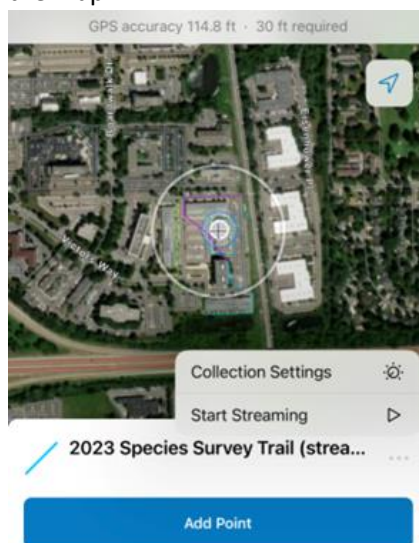
1

Record AIS EFB Line Segment

1. Tap Add  (on the map).
2. **Choose to create an AIS EFB Line by selecting the density you wish to record.**



3. **Create a line segment by streaming your location:** select the **overflow menu** and select **Start Streaming**. Or manually draw the line segment by adding vertices on the map.




4. **Click submit** to end line segment.

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5. **To change EFB density:** repeat the process and create a new line segment.
6. **Taking Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to rename it, save it to your device, or remove it from the asset.
7. Tap **Submit to confirm edits**.

Record Polygon

1. Tap Add  (on the map).
2. **Choose to create a Polygon by selecting the density you wish to record.**




3. **Manually draw the polygon** by adding vertices on the map. Or use Streaming.
4. **Click submit** to create a polygon.
5. **To change EFB density:** repeat the process and create a new polygon.
6. **Taking Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to rename it, save it to your device, or remove it from the asset.
7. Tap **Submit to confirm edits**.

3

APPENDIX B. EFB Collab AIS Survey Guide (Android Products)

Record AIS EFB Point

1. Tap Add  (on the map).
2. **Choose the AIS EFB Points option.**
3. **Complete the form.**
4. **Taking Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to rename it, save it to your device, or remove it from the asset.
5. Tap **Submit to confirm edits.**

Editing Data – Point, Line or Polygon



1. Tap the record you'd like to edit on the map.
2. Tap **Edit** in the available actions.
3. **Editing Data:** Update the form by tapping an entry to edit it.
4. **Editing Photos:** Tap **Take Photo** to take and add a photo or tap **Attach** if attaching an existing item. Long press an attachment to remove it. Once an attachment is downloaded, long press it to rename it or save it to your device.
5. Tap **Submit**.

Delete

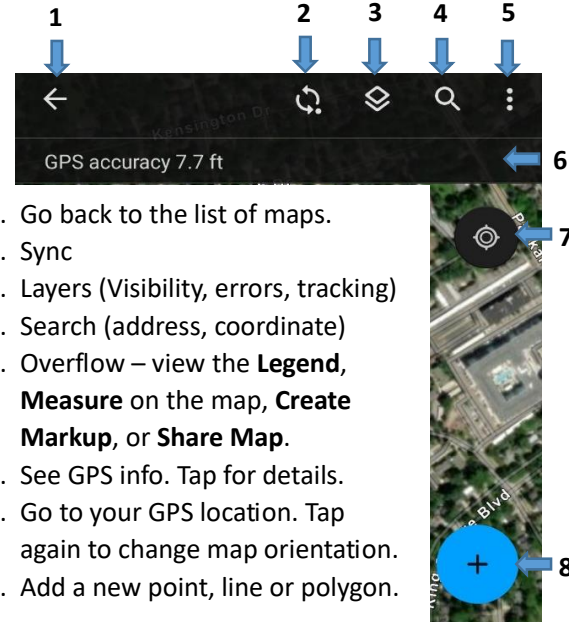
1. View the form of the data to delete.
 2. Tap **Delete** in the available actions and choose **Delete**.
- NOTE: This action cannot be undone.**

Sync – If working offline

You should sync when you have good connectivity. It's recommended that you sync whenever you can, and that you enable auto-sync.

1. Tap **Sync**  to open the Sync panel. (If there is no dot in the icon , you have no edits to sync.)
2. Review the edits you made (if any) and tap **Sync**.
3. Wait for it to complete.

Quick reference – Map tools








1. Go back to the list of maps.
2. Sync
3. Layers (Visibility, errors, tracking)
4. Search (address, coordinate)
5. Overflow – view the **Legend**, **Measure** on the map, **Create Markup**, or **Share Map**.
6. See GPS info. Tap for details.
7. Go to your GPS location. Tap again to change map orientation.
8. Add a new point, line or polygon.

Quick reference – Asset location tools

While creating or editing a feature you can edit its location. You'll see a location target. The target is blue when at your location and the GPS meets required accuracy. When red, the GPS doesn't meet required accuracy. A grey target is positioned manually (by moving the map).



- Tap **Add Point** to add a point under the location target. By default, the location target is over your location and moves with you. Move the map to position it manually. Use the GPS button to center it over your location.
- Use streaming to add multiple points to a length or area automatically while you walk or drive: Tap **Overflow**  and tap **Start Streaming**. To change the frequency of what points are added, update **Streaming Interval** in **Overflow** . **Stop Streaming** to collect locations manually.
- Tap **Update Point (Update Selected Point)**, in **Overflow**  for lengths and areas) to move the selected point.
- Tap **Delete Selected Point**, in the **Overflow**  to delete the selected point.
- Use **Overflow**  to undo and redo changes.

Contact information



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www.glc.org/work/efb
 Sam Tank, project manager
 734-396-6055

APPENDIX C. Equipment list

- Emergency contact and numbers for all crew members
- Cell phone or tablet with ArcGIS Field Maps app and EFB Collab AIS Survey downloaded ([Join the ERSI group](#))
- Auxiliary GPS receiver if surveying in areas with poor cellular coverage (Example [here](#))
- Auxiliary battery for charging devices (including appropriate charging cable(s))
- Waders
- Kayak or small boat
- Life jackets
- Garbage bags (if removing any EFB plants)
- Bug repellent and sunscreen
- First Aid kit
- Portable sprayer with bleach solution for equipment decontamination
- Watch list identification field guide
- Personnel gear such as water bottle, food, and rain gear

APPENDIX D. Troubleshooting

1. I can't sign in:

- Need to be connected to the internet for initial sign in.
- Check for typos in username and password. Password is case sensitive.

2. Can't add an asset:

- Make sure it has a location (check the map).

3. Can't get GPS fix (no location available):

- Go to an open area (away from trees, buildings, etc.) until you get to a location, then go back to a point of interest.
- Make sure Field Maps can use your location (in your device's settings).

4. Get poor location accuracy message and can't collect a feature.

- Wait and see if accuracy improves.
- Override the required accuracy by tapping **Add point**.
- Manually place the point with location target.

5. Sync failed:

- Make sure you have good connectivity.
- Make sure you aren't in airplane mode.
- Specify a smaller photo upload size in **Profile**, delete images, and retake them.

6. Sync takes forever:

- Specify a smaller preferred attachment size in **Profile setting of Field Maps settings**, delete images, and retake them.
- Sync more frequently.

7. Enable logging:

- See and share information about download and sync issues by enabling logging.
- Go to **Profile in Field Maps Settings**, choose **Troubleshooting**, and enable **Logging**.