European Frog-bit Collaborative

FROG-BATT

European Frog-bit Before-and-After Treatment Tracker

Standard Operating Procedure

January 31, 2025

Great Lakes Commission
des Grands Lacs

Great Lakes RESTORATION

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Data use statement: This app collects a user's ArcGIS username and associated email address. If provided, it also collects their name and organization. The purpose of collecting this data is to facilitate quality checking of data and enhance collaboration within the EFB Collaborative's ArcGIS group. We do not share users' personal information when reporting data to external organizations without permission. However, this data is available to view by members of the EFB Collaborative's ArcGIS group. Users have the right to access, correct, or delete their personal information.

Frog-BATT overview

Goal: Enhance the effectiveness of European Frog-bit (*Hydrocharis morsus-ranae*; EFB) management plans across the Great Lakes basin by assessing control action efficacy.

Objective: Integrate adaptive management principles into EFB management and monitoring plans to develop best management practices (BMPs) for control. A scalable and interoperable methodology and data collection platform able to evaluate the impact of EFB management across treatment types, organizations, locations, and time.

Introduction

Implementing a region-wide standardized data collection protocol to assess EFB control actions can advance understanding of their impacts and enable the development of an EFB-focused best management practice document. The EFB Collaborative initially attempted to accomplish this with the Standard Treatment Impact Monitoring Protocol (STIMP; CMU 2020) to collect EFB, habitat, and management information before and after management actions. But after several years of implementation the protocol was unable to deliver the necessary information. Therefore, the EFB Collaborative has revised and renamed the protocol to correct various problems with the STIMP. The new protocol is titled "European Frog-bit Before-and-After Treatment Tracker (Frog-BATT)."

App and online resources

All data are collected on the "Frog-BATT for Field Maps" map in the ArcGIS **Field Maps** app (Figure 1). The Field Maps app is available for Apple and Android devices. The application ensures standardized data collection across all locations surveyed for EFB. All associated app resources can be found at the EFB Collaborative's ArcGIS Hub Site (http://hub.efbcollaborative.net), including this SOP, maps of EFB locations collected by app users, summaries of results, and instructional videos. An ArcGIS Online account and permission to use EFB-specific apps are required for using this application and the Hub site. Request access to join the EFB Collaborative's ArcGIS online group here: https://bit.ly/EFBapp. Don't have access to an ArcGIS account? The EFB Collaborative offers access upon request by granting an 'ArcGIS Community' account to a limited number of eligible organizations. Request an ArcGIS Community account on the EFB Hub Site. Step-by-step guides for using the app on Apple or Android devices can be found in APPENDIX A. Guides to using the Frog-BATT app. Have a question? Email us at efb@glc.org.

Figure 1. Frog-BATT's ArcGIS Field Maps thumbnail image.

When to use Frog-BATT

Ideally all areas where EFB control actions are undertaken will have Frog-BATT data collected. In addition to collecting data where management will occur, it is also important to collect Frog-BATT data from untreated (control) areas, when possible. However, implementing Frog-BATT across large scale treatments or waterbodies with numerous small treatment areas may be unreasonable. Therefore, at a minimum, Frog-BATT data should be collected from at least one of each habitat type

being treated within a waterbody (e.g., cattail marsh, waterlily filled bay, boat canal, etc.). Additionally, if a large (>0.5 acre) contiguous habitat type is going to be treated, it is acceptable to select a smaller, representative, area to collect Frog-BATT data. Specific criteria for delineating management zones, or the area where you will manage and monitor EFB, are found in the section Enrolling a management zone.

Order of operations

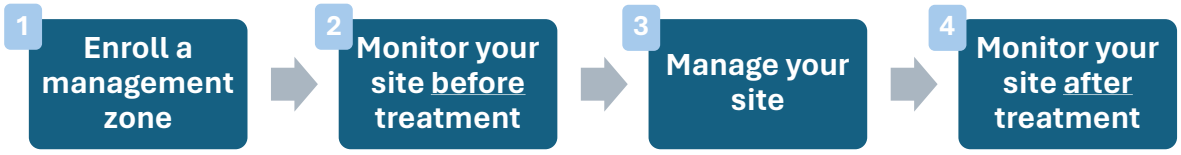


Figure 2. Order of operations in Frog-BATT.

1. **Enroll a management zone**
   Enrolling a management zone for use in the app can occur at any time of year. However, we recommend enrolling management zones while in the field during a time when EFB is growing so you can accurately map its extent using the app. Alternatively, you may map the zone manually in the app based solely on aerial imagery, but accuracy of your site boundaries will be reduced. If desired, you may enroll a management zone right before pre-treatment monitoring. There is no lag time in the app between enrolling a zone and being able to submit monitoring data. A zone can be designated as either a "Treatment site" (you plan to treat this site this year) or an "Untreated control site" (you do not plan to treat this site this year but will still conduct monitoring there before and after treatment at other "Treatment site(s)"). See Enrolling a management zone for more information.

2. **Pre-treatment monitoring**
   Pre-treatment monitoring should occur within the two weeks prior to the planned treatment date and as close to the treatment date as possible. This allows for flexibility to accommodate for potential weather restrictions and managing entity/contractor schedules. Pre-treatment data can be collected immediately prior to conducting control actions. See the Monitoring section for more details. Plan to monitor any untreated control management zones you may have registered around the same time (e.g., within 2 weeks).

3. **Treatment**
   Conduct the management actions within the waterbody. Complete the "Management records" section associated with each management zone (see Management records). The ideal time to conduct management actions is currently based on the annual lifecycle of the plant, specifically prior to the development of reproductive structures (seeds and turions). This will reduce the amount of EFB that will return in subsequent years. A new management record will need to be submitted for each new type of management action performed between pre- and post-treatment monitoring (e.g., one record for hand-pulling, and a second record for herbicide treatment at the same management zone). You do not need to add a management report for multiple actions of the same kind within a season, unless some important parameters have

changed (e.g., type of herbicide). If nothing has changed but you have performed the same action twice, just note the number of times management occurred and the start/end dates.

4. Post-treatment monitoring

Post-treatment monitoring visit timing must be scheduled to allow sufficient time for the implemented treatment to take effect. For most mechanical techniques the treatment effect is experienced immediately. The length of time required for physical techniques to take effect varies on the technique. For example, benthic barriers take effect immediately while shading techniques can take weeks to months to have an effect (e.g., Schooler 2008). The length of time required for chemical treatments to take effect varies based on the applied treatment. The active ingredients contained in chemical treatments have different modes of action and speeds of action which influence the length of time until they take effect (Table 1).

Table 1. Summary of herbicide active ingredients used for EFB control (CMU 2020). For each active ingredient, example trade names, mode and speed of action, time until susceptible plants exhibit visual symptoms, and time until susceptible plant control is listed. Information regarding specific trade names can be found on their specimen labels.

Herbicide	Mode of action	Speed of action	Time to visual symptoms	Time to achieve control
Diquat (e.g., Reward) [1,2]	Contact	Fast	Several hours	<1 week
Endothall (e.g., Aquathol) [1,2]	Contact	Fast	<1 week	1-3 weeks
Flumioxazin (e.g., Clipper) [1]	Contact	Fast	3-5 days	7-14 days
2, 4-D (e.g., Navigate) [1-3]	Systemic	Fast	Several hours – 1 day	Few days
Triclopyr (e.g., Renovate) [1,2,4]	Systemic	Slow	<1 day	Several weeks
Imazapyr (e.g., Habitat) [1,2]	Systemic	Slow	2+ weeks	2-6 weeks
Imazamox (e.g., Clearcast) [1-3]	Systemic	Slow	1-3 weeks	2-6 weeks
Penoxsulam (e.g., Galleon) [2-4]	Systemic	Slow	1-3 weeks	Several weeks - months
Glyphosate (e.g., AquaPRO) [1]	Systemic	Slow	2-3 days	>3 weeks

[1]UF/IFAS 2018, [2]AERF 2018, [3]Mudge and Netherland 2014, [4]WDNR 2012.

It is also important to consider the phenology of EFB when scheduling post-treatment monitoring visits (Figure 3). Monitoring during or after annual senescence could falsely suggest that the treatment had an effect when it did not.

The goals and objectives of the local management plan are also important to consider when scheduling post-treatment sampling visits. To assess the single season impact of a treatment, post-treatment sampling should occur within the same season as the treatment. To assess the long-term impact of a treatment, post-treatment sampling should occur in the growing seasons following the season of treatment.

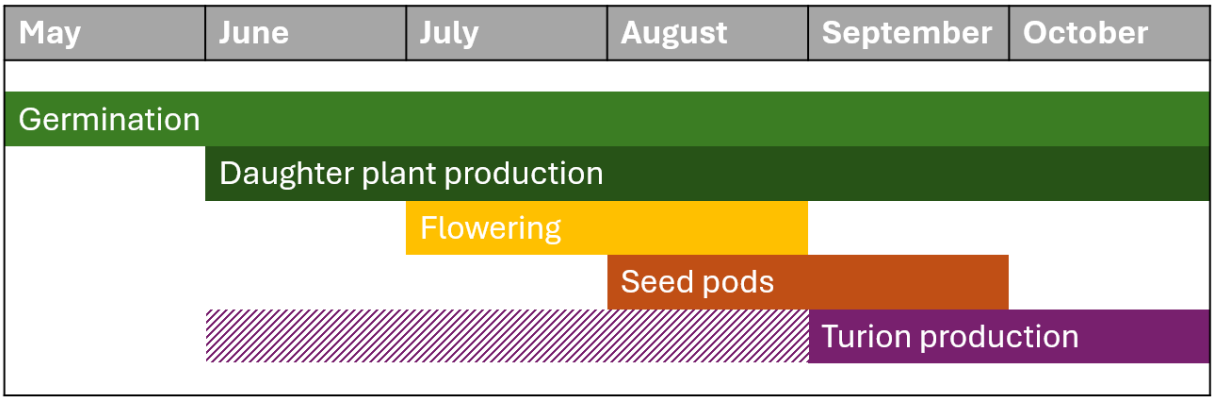


Figure 3. General timing of EFB's lifecycle in the Great Lakes region. Specific timing is dependent on latitude, temperature, and sunlight at the infestation site. Turion production is a stress response and generally occurs in autumn. However, other stresses such as becoming stranded when water levels drop can also trigger production. Summary of documented EFB germination and emergence from Michigan's Lower Peninsula and Upper peninsula (shaded bars) compiled from data by Cahill et. al 2021.

As with pre-treatment monitoring, plan to monitor any untreated control management zones around the same time.

Data collection

To use Frog-BATT, at a minimum you will need the following supplies: 1) access to GPS-enabled smartphone or tablet capable of running the Esri Field Maps app, 2) a 1-m^2 quadrat used in monitoring the percent cover of EFB and other plants, and 3) a tool to measure water depth (e.g., meter stick or gauge pole). See APPENDIX B. Equipment list for a complete list of supplies and a suggested tutorial for building a quadrat from PVC pipe.

Before heading into the field, you are encouraged to review the questions you will be asked either within the app or in the printable data sheets in APPENDIX C.

Managing your data

Frog-BATT data can either be added via the smartphone/tablet app or by desktop computer using ArcGIS Online. Most of this SOP's instructions reference the app but see the Data collection tips and tricks section for how to use the ArcGIS Online version for adding and editing data.

Keep in mind when collecting data in Frog-BATT that you should be logged into the ArcGIS Online user account you will use to manage your data throughout its entire life cycle. Make sure you are not logged into a testing account provided by the Great Lakes Commission or any other unintended account. While it is possible to change the user associated with a management zone, it is not a simple process on the backend. If you must change the username associated with your management zone, please contact us at efb@glc.org with the name of the management zone and the intended username exactly as it appears in ArcGIS Online.

Important! All data collected in Frog-BATT must be finalized yearly by **December 1**. At this point, Great Lakes Commission staff will process the data, and any un-synced/offline copies of the maps created by users may be deleted.

Enrolling a management zone

All Frog-BATT data collection revolves around the establishment of a management zone, or an area where you will be managing and monitoring EFB. This is represented by a polygon in the app. This same polygon will be used for data collection every year you are planning on using Frog-BATT — there is no need to create another one after the first year. See APPENDIX A for details about how to draw a management zone polygon in the Frog-BATT app. **Important: establishing the management zone must happen before any other data collection can occur.** The management zone polygon will serve as a repository for your associated records, including monitoring and management data. There are a few things to consider when deciding how big to make your management zone polygon or where to place it:

1. The management zone must not overlap another management zone polygon. This will lead to data calculation errors within the app.
2. Its minimum size should be at least 10 x 10 m. This accounts for both the average accuracy of a GIS-enabled device and for the minimum number of 1-m^2 quadrats (n = 4) that will need to fit within the polygon.
3. There is no maximum size, but we recommend enrolling a management zone that is less than one half acre in size. After that point, the number of monitoring quadrats required increases and traversing the management zone might become burdensome. If you are managing a larger area, consider enrolling only part of it in the management zone.
4. Because EFB is a floating leaf plant, it has the capability to move across the water with wind and wave action. Frog-BATT may best be utilized in areas where this type of movement is restricted (e.g., retention pond, stagnant wetland, cove along a lake, etc.) rather than wide, open water environments (e.g., in the middle of a two-acre lake). Regardless of habitat type, expand the boundary of the management zone around not only where you will be managing EFB, but to where you think it might move within its immediate vicinity.
5. Create a management zone you would feel comfortable returning to year after year if necessary (i.e., consider access, staff turnover, property lines, management goals, etc.).

Feel free to enroll as many management zones as you wish, but budget time accordingly to provide monitoring and management data for all that you have enrolled. It is better to enroll fewer, more representative units you can reliably traverse and provide data for than many units you may not have time to return to.

When enrolling, you will be asked a variety of questions about the zone's characteristics and its EFB invasion history (APPENDIX C. Paper data sheets). You will also be asked to designate the zone as a "Treatment site" (you plan to treat this site this year) or an "Untreated control site" (you will not treat the site this year but will conduct monitoring before and after treatment at your "Treatment site(s)"). Note that creating control sites alongside your treatment sites is **not required** but suggested. If you are not sure what kind of site (treatment vs. control) your management zone will be, you may select the option "To be determined" which can be modified later in the field season. If your zone has been designated as "To be determined" you will receive an email reminder to update its designation. Lastly, you are required to take at least one photo of your management zone. Ideally the photo will show most of the zone, as well as some identifying landmarks. Multiple photos or an attachment (e.g., PDF) can be submitted.

If you would like to change a zone's designation between years (i.e., from a control site to a treatment site) or change anything else about the zone, edit the enrollment form to reflect the changes and **add a note** about the change and the **date it occurred**.

Monitoring

Monitoring records

Pre- and post-treatment monitoring follow the same procedure. The first step is to submit a monitoring record by tapping on your management zone in the app, scrolling down the form, and clicking on "Monitoring records" (see APPENDIX A. Guides to using the Frog-BATT app for more detailed instructions). This will provide a form to fill out with some data relevant to the *entire* management zone, including: 1) whether you are conducted pre- or post-treatment monitoring, 2) the estimated percent cover of EFB across the *entire* management zone using the Midwest Invasive Species Network's (MISIN) cover categories, and 3) whether EFB flowers, fruits, or turions are observed. You may attach a photo or notes to the entry, but they are not required.

Important: this form MUST be filled out before you can add monitoring quadrat points. Quadrat points will pull in data from the last-submitted monitoring record, so one must first exist! This form also displays the recommended number of quadrats to collect data from based on the size of your management unit. Remember this number for the next step!

Placing quadrats

After providing the zone-wide data in the monitoring record, you will collect quadrat-specific data. See APPENDIX A. Guides to using the Frog-BATT app for specifics about creating quadrat points in Field Maps. Each quadrat point will be automatically named after the management zone and labeled with the last monitoring form's pre/post-treatment status. You will collect data from a minimum of four quadrats, but this number could be higher if you have a large management zone (view your Monitoring Record to see how many quadrats you need data from).

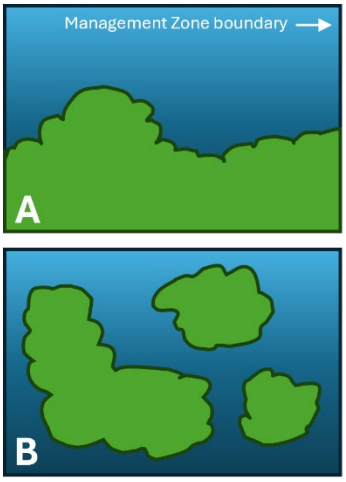


Figure 4. A. EFB forms one large mat. B. EFB is distributed in patches across the zone.

There are four rules to placing quadrats in your management zone:

1. Quadrats must contain EFB, unless there is no EFB found, or if there is not enough EFB to be contained within the required number of quadrats.
2. Quadrats must not overlap one another.
3. Quadrats should be placed randomly.
4. **Important: In the Field Maps app, your quadrat points must be placed within the bounds of the management zone.** They will then pull in the data from the latest monitoring report to function properly.

To determine where your quadrats should be randomly placed, consider the distribution of EFB in your management zone (Figure 4). If EFB forms one large or long mat, consider placing quadrats along a transect (for how to establish these points randomly, see APPENDIX D. Establishing quadrat monitoring locations in a single patch). Alternatively, if EFB forms multiple patches, or is otherwise spread out across the landscape, consider placing quadrats using the flowchart in APPENDIX D. Establishing quadrat monitoring locations in across multiple patches. The goal is to ensure that quadrats are placed randomly but also distributed across the management zone. Therefore, quadrats should be distributed amongst EFB patches rather than clustered all in one area (Figure 5).

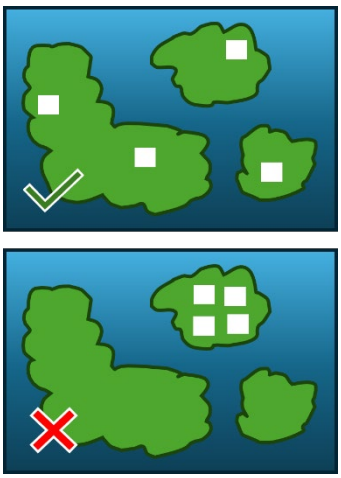


Figure 5. Top: Quadrats should be distributed amongst EFB patches. Bottom: Quadrats should not be clumped in one small patch of EFB.

Quadrat data collection

First, take a photo of the plants within your quadrat (as centered above the quadrat as possible) and attach it to your record. **A quadrat photo is required.** Within each quadrat you will collect information not only about EFB (percent cover, condition/health, and percent senescent/wilting), but also the water depth and the plant community composition. For quadrats you will be asked to provide estimates of percent cover (e.g., 50%) rather than a range (e.g., 25-50%). Marking the PVC on your quadrat at regular intervals with electrical tape or paint may assist with improving the accuracy of percent cover estimates (e.g., Figure 6).

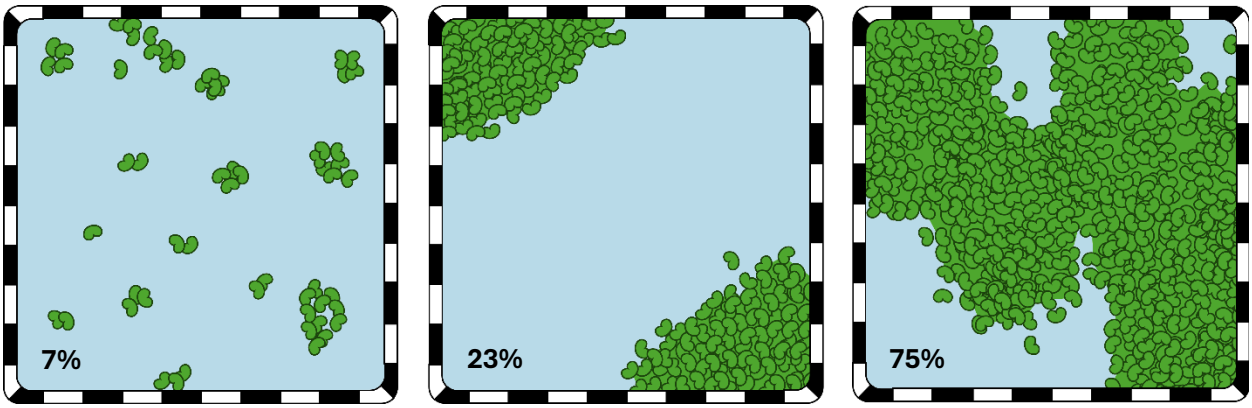


Figure 6. Examples of percent EFB cover within a quadrat.

You are required to collect "Tier 1" plant community information for each quadrat: the percent cover of emergent plants, floating-leaved plants, free-floating plant cover, and submergent plants. **Important: your estimate of free-floating plants must *include* EFB!),** Collecting "Tier 2" plant community data requires more plant identification skills and is therefore optional. Tier 2 data collection involves identifying the plants within your quadrat to the genus or species level and providing their percent cover. If you would like to report only a single species of interest (e.g., you are only able to identify *Phragmites*) or a few species (e.g., multiple invasive species) you may submit a partial plant list (select "Yes" for the question "Is this a partial plant list?"). Otherwise, you must report each species observed. You may submit multiple "unknown" species with notes

about their characteristics. These can be changed to the correct species if you are able to identify them later.

Management records

Like submitting Monitoring records, the first step is to submit a management record by tapping on your management zone in the app, scrolling down the form, and clicking on "Management records" (see APPENDIX A. Guides to using the Frog-BATT app for more detailed instructions). This will provide a form to fill out with some data relevant to the *entire* management zone. The management record form has been formatted to match the questions and content of the MISIN Treatment Tracker, which is used by many groups managing invasive species.

If you plan to enter your management information into the MISIN Treatment Tracker, rather than entering that information twice, you will indicate in that you are using the MISIN Treatment Tracker and will enter very minimal additional information relevant to Frog-BATT (namely, the percentage of live EFB in the management zone that was managed, the number of times management occurred, any notes, and optional photos). To link your account, you will need to enter the name of your Treatment Tracker site exactly as it is shown in Field Maps, including capitalization/punctuation. This information needs to be entered yearly by **December 1**.

If you are not submitting management data to MISIN, you will indicate that in the management record form by setting "I'm using the MISIN Treatment Tracker" to "No" and additional questions will appear that are relevant to the type of control being performed (bio-control, chemical, manual, or mechanical control). See APPENDIX C for a list of all questions you can expect to see. This form may be easier to fill out when you are not in the field due to the specificity of some of the questions, especially those related to chemical control.

As mentioned above, a new management record will need to be submitted for each new type of management action performed between pre- and post-treatment monitoring (e.g., one record for hand-pulling, and a second record for herbicide treatment at the same management zone). If you are performing the same management action multiple times between pre- and post-treatment monitoring but just on different dates, you may submit just a single management record and note the start and end dates during which management occurs. Optionally, you may list additional dates on which management occurred in the notes.

Data collection tips and tricks

Device and app limitations

Older devices may not have the capacity to run the Field Maps app. It is recommended to use a relatively new device with an up-to-date operating system. We also highly recommend making sure your Field Maps app is updated to the latest version. Using older versions of the app may result in an error: "The form contains unsupported data."

Battery

Running this app can quickly drain a device's battery, especially if you are actively using the app and adding features frequently. Plan your battery usage and device charging accordingly. A portable battery charger is recommended.

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. Follow these instructions when you will be in areas with no or inconsistent cellular service:

- Before heading out into the field, **make sure to download an "Offline Area" while you have good internet or Wi-Fi service** (see APPENDIX A. Guides to using the Frog-BATT app). This will create a local version of the map area selected (Maps: On Device) and allow you to create points and polygons as you normally would.
- **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. Guides to using the Frog-BATT app).
- **The "On Device" map can be deleted once you have successfully synced your data and the offline map is no longer needed.**

Tips 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 that GPS accuracy is within 30 feet or less of the known position.
- Make sure to open the app on your device when you have service prior to going into the field to ensure the app loads properly.
- If you are having issues, see the troubleshooting guide in APPENDIX E. Troubleshooting.
- Pairing your device with an external GPS receiver will help in offline areas.
- When you regain reliable cellular service or reconnect to Wi-Fi, review points and polygons to ensure accuracy. Edit incorrect features by tapping on the feature you want to edit and selecting the pencil icon in the lower left to edit as needed.

If you are having difficulty using the app in remote areas, consider printing and filling out physical data sheets (APPENDIX C. Paper data sheets) you can reference to enter data when you have internet access again.

Using ArcGIS Online

To add or edit features on your computer, login to your ArcGIS Online and navigate to "Frog-BATT for Field Maps" in the EFB Collaborative Group's content. Open in Map Viewer. To add or edit data, click on the "Edit" button on the left side of the screen. If you want to create a quadrat point, click on "frogbatt_quads" in the edit menu and walk through the steps, for a management zone, select "frogbatt_sites_". To edit a feature, click "Select" from the edit menu, find your feature on

the map, and click on it. From there, correct any information or move your feature around/move its vertices on the map and click “Update” to update the feature.

Attachments

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

Decontamination

After monitoring 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, perform field surveys from least infested to most infested areas (considering all known invasive species) or from upstream to downstream on flowing systems to reduce the likelihood of spread to uninfested waters. If possible, allow your gear to fully dry between sites or have two sets of gear that you can switch between to allow for drying time.

Post field work

All uploaded data collected will be available through ArcGIS Online. Crews should regularly review their data submitted to the app to ensure accuracy. Ensure that all test points on the 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 or within the Field Maps app.

References

(AERF) Aquatic Ecosystem Restoration Foundation. 2018. Aquatic Herbicides/Agents. Website. http://www.aquatics.org/herbicides.html. Accessed July 3, 2024.

(CMU) Central Michigan University. 2020. Standard Treatment Impact Monitoring Protocol. *Central Michigan University, Mount Pleasant, Michigan*. http://dx.doi.org/10.13140/RG.2.2.23351.24484

Cahill, B., R. Goebel, and A. Monfils. 2021. European frog-bit (*Hydrocharis morsus-ranae* L.) phenology and reproductive biology in Michigan. *Central Michigan University, Mount Pleasant, Michigan*. http://dx.doi.org/10.13140/RG.2.2.35095.29607

Mudge, C. R., and M.D. Netherland. 2014. Response of invasive floating plants and nontarget emergent plants to foliar applications of imazamox and penoxsulam. *Journal of Aquatic Plant Management 52*, 1–7.

Schooler, S.S. 2008. Shade as a management tool for invasive submerged macrophyte, *Cabomba caroliniana*. *Journal of Aquatic Plant Management* 46:168–171.

(UF/IFAS) University of Florida Institute for Food and Agriculture Science. 2018. Imazamox Considerations. Website. https://plants.ifas.ufl.edu/manage/management-plans/chemical-control-considerations/imazamox-considerations/ Accessed July 3, 2024.

(WDNR) Wisconsin Department of Natural Resources. 2022. Aquatic Plant Management Fact Sheets. Website. https://dnr.wisconsin.gov/topic/lakes/plants/factsheets. Accessed July 3, 2024.

APPENDIX A. Guides to using the Frog-BATT app

The following pages contain cheat sheet guides to using the Frog-BATT Field Maps app for both Apple and Android devices.

Frog-BATT Reference Sheet

For iPhone and iPad

Getting Started – Sign in

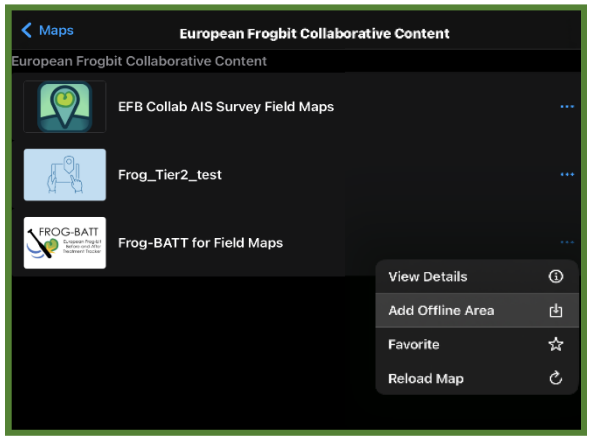
Open Field Maps App. Sign into your ArcGIS Online Account.

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

Online Data Collection: In the list of maps, open: **Frog-BATT for Field Maps**

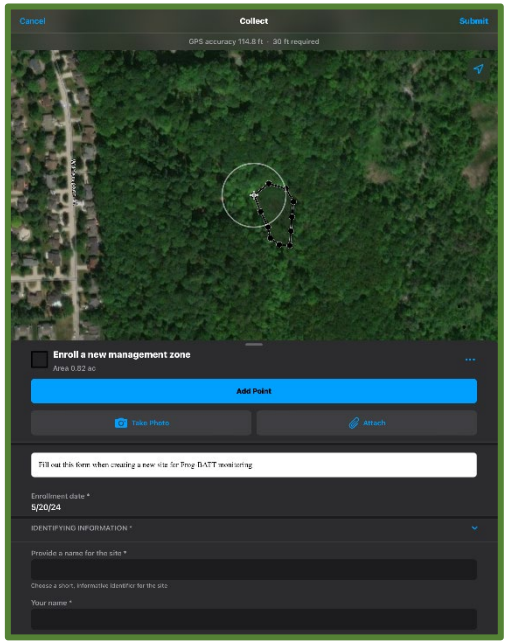
Offline Data Collection:

1. In the list of maps, select the Overflow ••• on the right of the map name: **Frog-BATT for Field Maps**
2. Select **Add Offline Area** to download your sample area.
3. Choose **Download Area** once you pick your offline area in the map. Multiple areas can be downloaded.



Record a Management Zone (polygon)

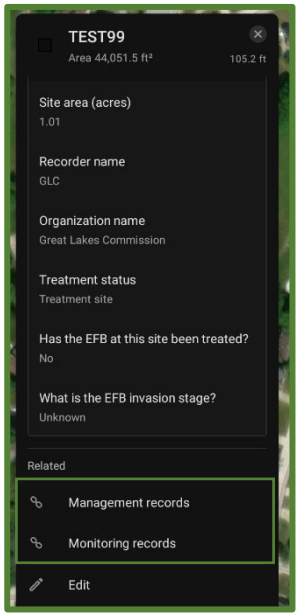
1. Tap Add (+) (on the map).
2. **Choose to create frogbatt_sites by selecting the first option.**
3. **Create a line segment by streaming your location:** select the **overflow menu** ••• and select **Start Streaming**. Or manually draw the line segment by adding vertices on the map by clicking the **Add Point** button.
4. Completely fill out the form attached to the management site.
5. Click **Submit** to end 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.

Add or edit Management/Monitoring Records:

1. Tap a management zone polygon.
2. **Scroll down to the Management and Monitoring records links to submit.**
3. Click on either record, if no management or monitoring records exist click the blue **Add** button to submit a record. If a record already exists, click on it and scroll to the bottom of the form to edit.



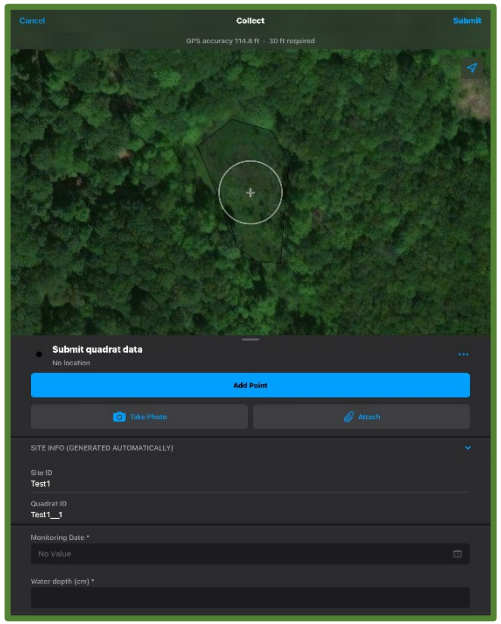
Editing Data – Sites and Quadrats

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**.

Frog-BATT for Field Maps - Apple Products

Record a Quadrat (point)

1. Make sure you have first added a **monitoring record** before adding quadrats.
2. Tap Add (on the map).
3. **Choose to create <u>frogbatt_quads</u> by selecting the second option.**



4. Manually drop a **point** within the management area to mark your quadrat by clicking **Add Point**.
5. The **quadrat** name should be automatically filled with the **management zone** that you placed it in.
6. Completely fill out the form attached to the quadrat point.
7. **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.
8. Tap **Submit** to confirm edits.

Delete

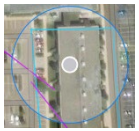
1. Using the map, tap a record you'd like to delete.
2. Tap **Overflow** ••• at the bottom of the screen, tap **Delete**, and choose **Delete**. **NOTE: This action cannot be undone.**

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.

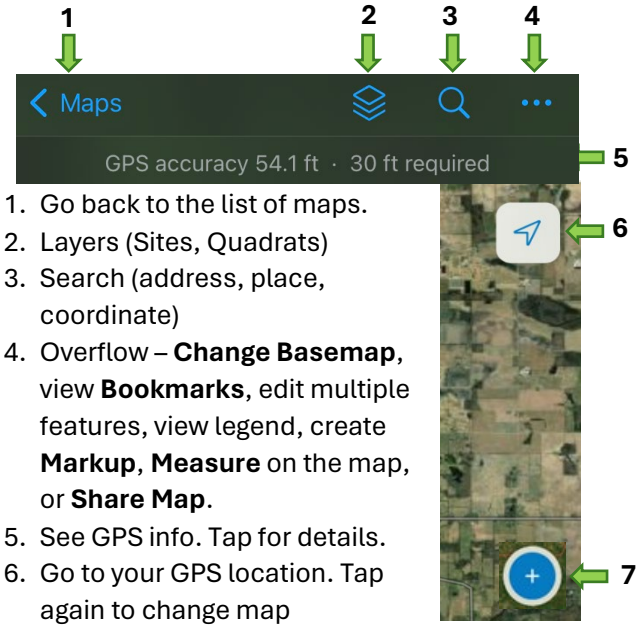
Quick reference – Asset location tools



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.

Quick reference – Map tools



1. Go back to the list of maps.
2. Layers (Sites, Quadrats)
3. Search (address, place, coordinate)
4. Overflow – **Change Basemap**, view **Bookmarks**, edit multiple features, view legend, create **Markup**, **Measure** on the map, or **Share Map**.
5. See GPS info. Tap for details.
6. Go to your GPS location. Tap again to change map orientation.
7. Add a new point, line or polygon.

Frog-BATT Reference Sheet

For Android phones and tablets

Getting Started – Sign in

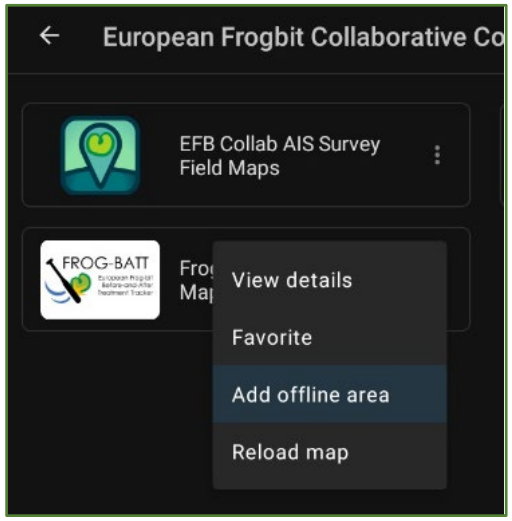
Open Field Maps App. Sign into your ArcGIS Online Account.

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

Online Data Collection: In the list of maps, open: **Frog-BATT for Field Maps**

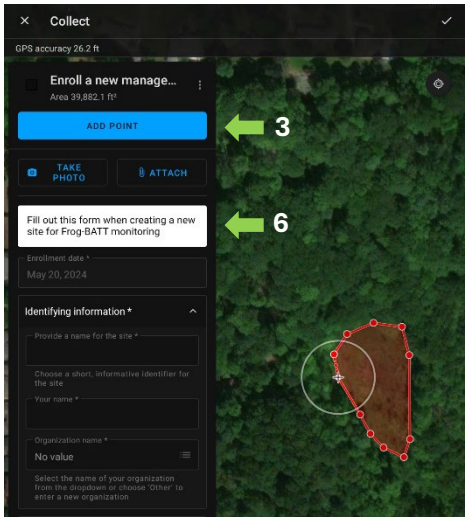
Offline Data Collection:

1. In the list of maps, open: In the list of maps, select the Overflow on the right of the map name: **Frog-BATT for Field Maps**
2. Select an **Add Offline Area** to download your sample area.
3. Choose **Download Area** once you pick your offline area in the map. Multiple areas can be downloaded.



Record a Management Zone (polygon)

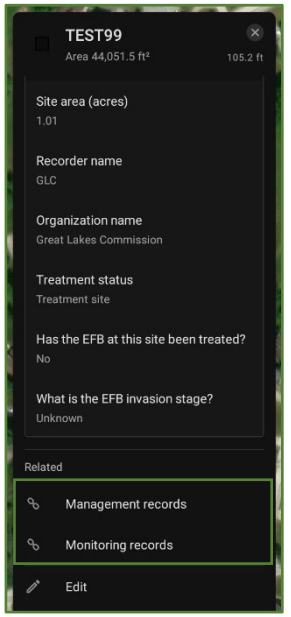
1. Tap Add (+) (on the map).
2. **Choose to create a frogbatt_site by selecting the first option.**
3. **Create a line segment by streaming your location:** select the **overflow menu** and select **Start Streaming**. Or manually draw the line segment by adding vertices on the map.
4. Completely fill out the form attached to the management site.
5. Click the **check mark** to end the 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 the **check mark** in the top right corner to confirm edits and submit data.

Add or edit Management/Monitoring Records:

1. Tap a management zone polygon.
2. **Scroll down to the Management and Monitoring records links to submit.**
3. Click on either record, if no management or monitoring records exist click the blue **Add** button to submit a record. If a record already exists, click on it and scroll to the bottom of the form to edit.



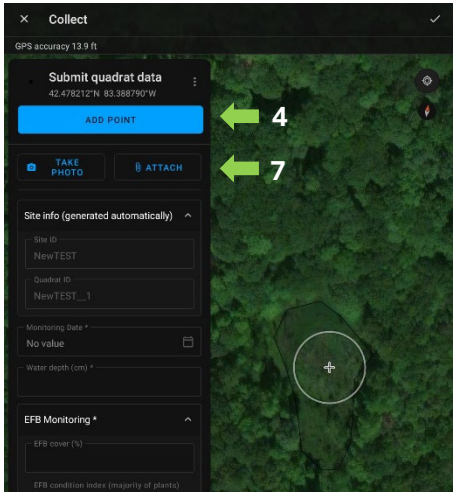
Editing Data – Sites and Quadrats

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 the **check mark**.

Frog-BATT for Field Maps - Android Products

Record a Quadrat (point)

1. Make sure you have first added a **monitoring record** before adding quadrats.
2. Tap Add (+) (on the map).
3. **Choose to create <u>frogbatt_quads</u> by selecting the second option.**



4. Manually drop a **point** within the management area to mark your quadrat by clicking **Add Point**.
5. The **quadrat** name will automatically be filled in with the **management zone** that you placed it in.
6. Completely fill out the form attached to the quadrat point.
7. **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.
8. Tap the **check mark** in the top right corner to confirm edits and submit data.

Delete

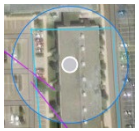
1. View the form of the data to delete.
2. Tap **Delete** in the available actions and choose **Delete**.
   NOTE: This action cannot be undone.

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 – Asset location tools



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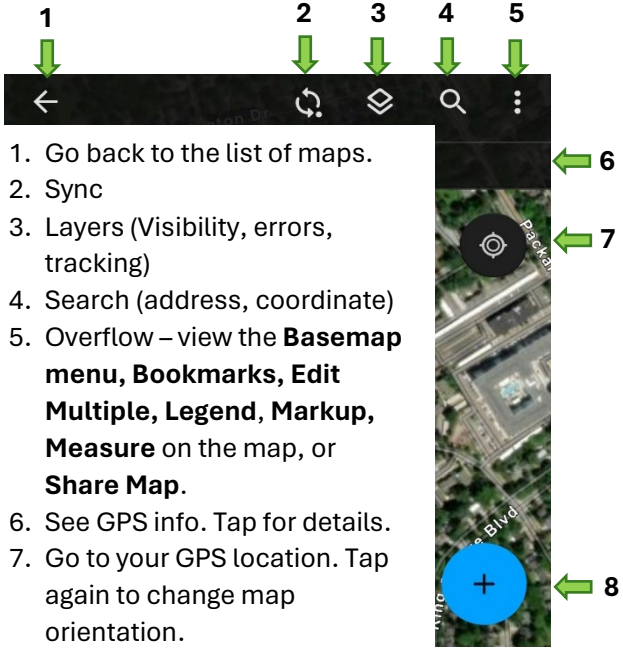
- Tap **Add Point** to add a point under the location target. By default, the location target is over your location and moves with you. Move the map to position it manually. Use the GPS button to center it over your location.
- Use streaming to add multiple points to a length or area automatically while 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.

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 **Basemap menu, Bookmarks, Edit Multiple, Legend**, **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.

APPENDIX B. Equipment list

- ☐ Emergency contact and numbers for all crew members*
- ☐ Cell phone or tablet with **ArcGIS Field Maps** app and **Frog-BATT for Field Maps** downloaded (Join the ERSI group)*
- ☐ 1-m^2 quadrat (for instructions on building your own, check out this guide)*
- ☐ Meter stick or gauge pole to measure water depth*
- ☐ Auxiliary GPS receiver if surveying in areas with poor cellular coverage (Example here)
- ☐ Auxiliary battery for charging devices (including appropriate charging cables)
- ☐ 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
- ☐ AIS Watchlist identification field guide
- ☐ Personnel gear such as water bottle, food, and rain gear
- ☐ Printed paper forms for enrollment, management, and monitoring records (if needed)

*Required

APPENDIX C. Paper data sheets

The following pages contain enrollment, monitoring, and management data sheets you can print and fill out in the field.

Enroll management zone

FROG-BATT
European Frog-bit Before-and-After Treatment Tracker

Fill out this form when creating a new management zone for Frog-BATT monitoring.
* = Required field.

Enrollment date:* _____

Identifying information

Provided a name for the site:* _____
Choose a short, informative identifier for the site. It must not share a name with any other zone in our database.

Your name:* _____

Organization:* _____

Site details

Type of waterbody (circle one)*:
Great lake / Inland lake / Reservoir / Pond / River / Stream / Ditch/canal / Wetland / Other
If "Other", describe:* _____
If "Wetland", type of wetland (circle one)*:
Great lakes marsh / Emergent marsh / Submergent marsh / Wet meadow / Other
If "Other", describe:* _____

Is water at the site flowing? (circle one)*: Yes / No

Is this area within 500 meters of a boat launch or access site? (circle one)*: Yes / No

What is the current EFB invasion stage at this site? (circle one)*:
Previously detected / Newly detected / Unknown

Treatment

Will this be a treatment site or an untreated control? (circle one)*:
Treatment site / Untreated control site / To be determined

Has the EFB at this site previously been treated? (circle one)*: Yes / No / Unknown

If yes, list the years in which EFB was treated:* _____

Notes: _____
_____
_____
_____
_____

Required: take one or more photos of the site!

Monitoring record

FROG-BATT
European Frog-bit Before-and-After Treatment Tracker

Site name: _____

Number of quadrats: _____ (The app predetermines this for you based on the size of the management zone)
Monitoring date*: _____
Is this pre- or post-treatment monitoring? (circle one)* Pre-treatment / Post-treatment
Your name(s): _____

Estimate the amount of EFB cover across the management zone:*

- ☐ None
- ☐ Sparse (scattered stems/very small stands)
- ☐ Patchy (a mix of sparse and dense areas)
- ☐ Dense (>40% of area)
- ☐ Monoculture (nearly 100% of area)

Are flowers present? (circle one):*
Yes / No
Are fruits present? (circle one):*
Yes / No
Are turions present? (circle one):*
Yes / No

Notes: _____
_____
_____
_____
_____
You have the option to add a photo or attachment for the whole monitoring record. This is not required.

Quadrat data
All quadrat data in the table below are **required**. Data should be collected from a minimum of four quadrats, but if your management zone is larger, more may be required.

	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Water depth (cm)				
EFB cover (%)				
EFB condition index Use codes below table				
Percentage of senescent/wilting EFB rosettes (%)				
Tier 1 Plant community data				
Emergent plant cover (%)				
Floating-leaved plant cover (%)				
Free-floating plant cover (%) This estimate should **include** EFB!				
Submergent plant cover (%):				

EFB condition index codes: **0:** No longer alive or intact, disintegrated; **1:** leaves wilted and brown; **2:** leaves wilting with chlorosis; **3:** leaves rigid with plenty of chlorosis; **4:** leaves rigid with some chlorosis; **5:** leaves green and rigid; **6:** N/A

*** REQUIRED: Take a photo of each quadrat!***

Monitoring record

FROG-BATT
European Frog-bit Before-and-After Treatment Tracker

<u>OPTIONAL:</u> Tier 2 Plant community data

In the table below, list the plant species found and its percent cover for each quadrat ("Q").

Is this a partial plant list (circle one)*: Yes / No
You may want to submit a partial plant list if you want to note just one or a few plant species in a quadrat (e.g., invasive *Phragmites*, which often co-occurs with EFB). Note that EFB cover does not need to be reported here again.

Plant species	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)

Notes: _____
_____
_____
_____
_____
_____

Management record

FROG-BATT
European Frog-bit Before-and-After Treatment Tracker

Site name: _____

Management date(s): _____

Your name(s): _____

What percentage of the live EFB in the management zone was treated / removed? (circle one):*

0-10% / 11-25% / 26-50% / 51-75% / 76-100%

How many times was the site treated and on what dates?*_____

Notes: _____

_____

_____

_____

_____

_____

Optional: Take photo / add attachment

Treatment data

I'm using the MISIN Treatment Tracker (circle one):* Yes / No

If "Yes", you will fill out a MISIN Treatment Tracker record and it will be linked to your management record. You will NOT need to fill out any of the fields below. Treatment Tracker site name: _____

Total person hours: _____

Control method (circle one):* Bio-control / Chemical / Manual / Mechanical

If "Mechanical", Equipment used:* _____

If "Chemical", fill out all below:

Application method (circle one):*

NA / foliar spray/broadcast / hand-swipe / Other – see notes

Chemical # 1

Chemical used and active ingredient:* _____

Examples: Habitat (Imazapyr), Rodeo (Glyphosate), Alligare Diquat (Diquat)

Concentration (%): _____ Total active ingredient used in the mixture (oz):* _____

Mix rate (oz/gal)*: _____

Chemical # 2 (optional)

Chemical #2 used and active ingredient: _____

Concentration #2 (%): _____ Total active ingredient #2 used in the mixture (oz):* _____

Mix rate # 2 (oz/gal): _____

Adjuvant/surfactant used: _____

Total amount of adjuvant used in the mixture (oz): _____ Adjuvant Mix rate (oz/gal): _____

Dilutant (circle one):* NA / Bark oil / Water / Other – see notes

Total dilutant used (oz): _____

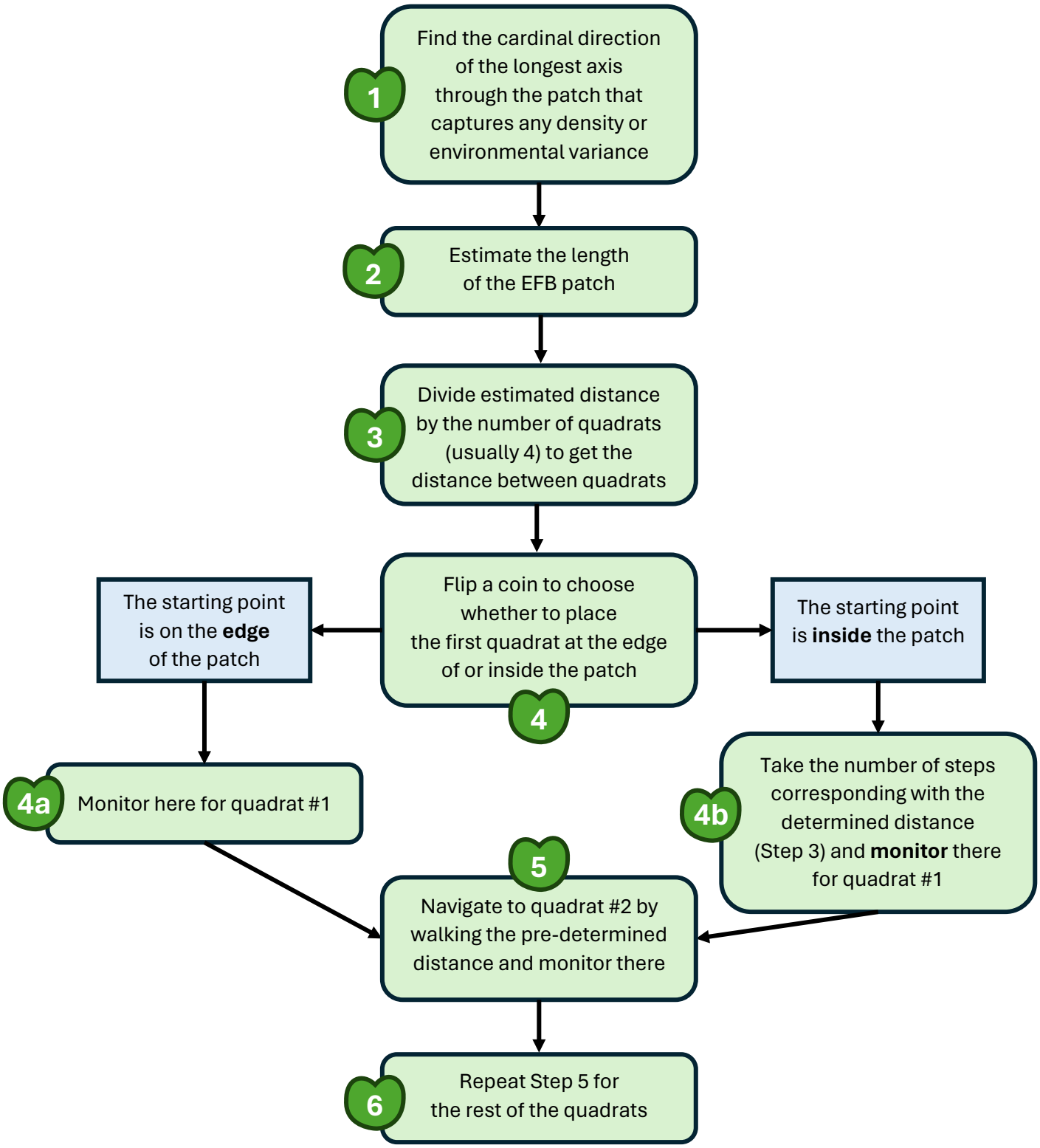
Amount of mixture used (gal) at the site*: _____

Rate of application (oz/acre): _____

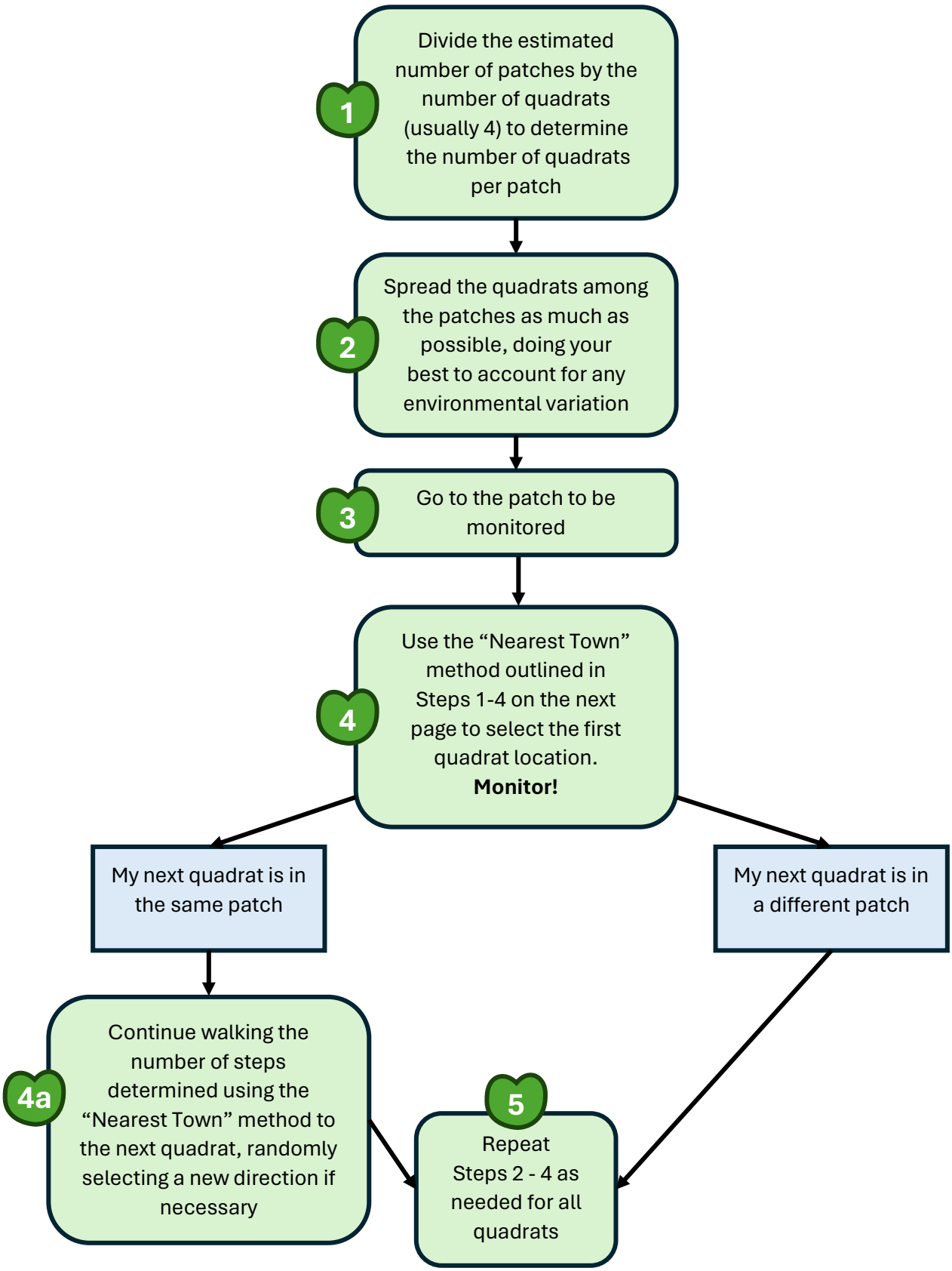
Application area (acres):* _____

APPENDIX D. Monitoring location flowcharts

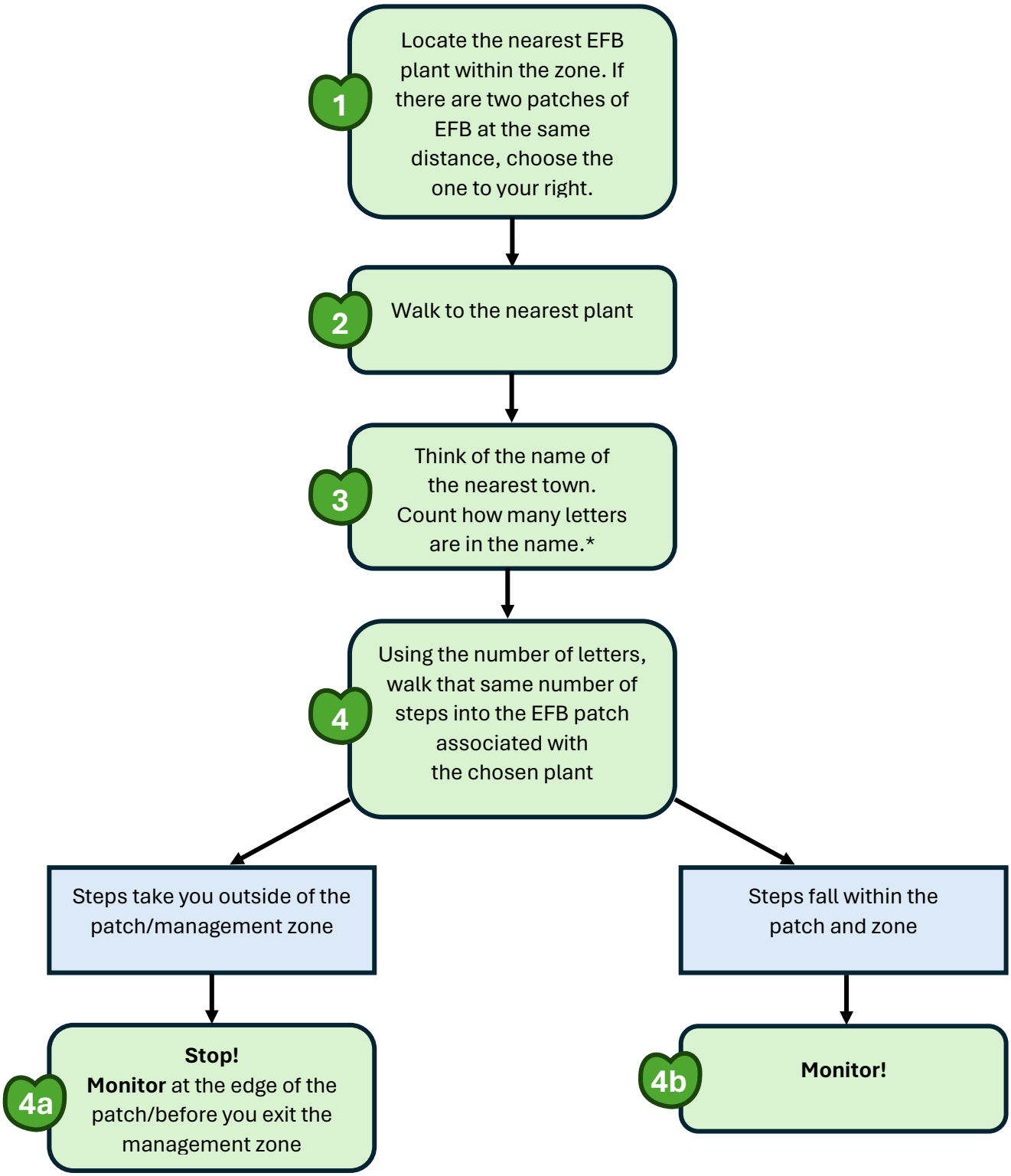
1. Establishing quadrat monitoring locations in a single patch



2. Establishing quadrat monitoring locations in across multiple patches



3. Establishing an individual monitoring location



*Alternatively, use a random number generator app/website. Many online number generators can generate numbers within a range, so if your patch is only 10 paces long, you could ask it to generate a number between 1 and 10, then place the quadrat at that many paces into the patch.

APPENDIX E. Troubleshooting

1. **I can't sign in:**
- You need to be connected to the internet for initial sign in.
- Check for typos in username and password. Password is case sensitive.

2. **I can't add an asset:**
- Make sure it has a location (check the map).

3. **Received error "The form contains unsupported data":**
- Update your Field Maps version to the latest available in your device's app store. The Frog-BATT app runs on the newest version of the Field Maps app.

4. **I 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 is allowed to use your device's location (in your device's settings).

5. **I am getting a 'poor location accuracy' message and can't collect a feature.**
- Wait a few moments and see if accuracy improves.
- Override the required accuracy by tapping **Add point**.
- Manually place the point with location target.

6. **Sync failed:**
- Make sure you have good internet/cell connectivity.
- Make sure your device isn't in airplane mode.
- Specify a smaller photo upload size in **Profile**, delete images, and retake them.

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

8. **Enable error 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**.
- To view your logs, go to your profile in the Field Maps app, scroll down to **Troubleshooting**, and then pressing the **View Logs** button. Check to see if anything unusual appears there, and if so, send a screenshot to efb@glc.org so we can check out what the issue could possibly be.