

Standard Operating Procedure (SOP) #16

Managing Photographic Images

Version 2.0 (February 24, 2025)

Change History

New Version #	Revision Date	Author	Changes Made	Reasons for Change	Previous Version #
1.01	11/24/2009	Kelly Kozar	Updated workspace setup for images and YSI files linked to database.	To reflect updates for files linked to database.	1.0
1.02	2/26/2021	Kelly Kozar Kim Weisenborn	Updated workspace setup for images linked to database. Updated name of software for processing images. Updated file structure setup, downloading images from camera, processing and renaming images sections; updated to NRR formatting; renumbered SOP from #16 to #14; updated SOP references throughout this SOP.	To reflect updates for image files linked to database, and current software used. Some content was outdated; formatting needed to be applied; some SOPs were removed or renumbered within the protocol.	1.01
1.03	3/15/2022	Kim Weisenborn	Updated content to refer to new PACN I&M SharePoint. Updated figures to reflect change.	PACN data is no longer stored on a networked server (I:\ drive) and is now stored on the PACN I&M SharePoint site.	1.02
2.0	2/24/2025	Amanda McCutcheon	Updated content to reflect using ArcGIS Field Maps and procedures for watermarking and renaming using R. Renumbered SOP from #14 to #16. Updated SOP references.	Photos are now collected in the ArcGIS Field Maps Application. A new SOP has been added to the protocol therefore some SOP reference #s have changed.	1.03

Only changes in this specific SOP will be logged here. Version numbers increase incrementally by hundredths (e.g., version 1.01, version 1.02) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0). Record the previous version number, date of revision, author of the revision, changes made, and reason for the change along with the new version number.

Purpose

This SOP describes how to download and process photographic images collected by project staff or volunteers during the course of conducting Pacific Island Inventory and Monitoring Network (PACN I&M) Water Quality Monitoring. Images that are acquired by other means—e.g., downloaded from a website or those taken by a cooperating researcher—are not project records and should be handled separately.

The standards described herein pertain specifically to all digital photographs related to Water Quality Monitoring. In this SOP, digital photograph refers to any photo in electronic format regardless of acquisition by scanner or digital device. Most photos acquired and used by PACN I&M personnel should fit into one of the general categories.

1. *Library Photos*: These photos are final products that have been edited, documented, reviewed, and added to the photo archive in the [Pacific Island Inventory and Monitoring Network \(PACN\) Monitoring Archive Library](#)¹ in the [PACN I&M SharePoint site](#)². These photos are representative, unique, and instructive and can be used for multiple purposes by a variety of staff.
2. *Data Photos*: Data photos are photos collected as data. Care should be taken to distinguish data photos from incidental or opportunistic photos taken by project staff. Data photos are those taken for at least one of the following reasons:
 - Document a particular feature or perspective for the purpose of site relocation.
 - Capture site habitat characteristics and possibly to indicate gross structural changes over time.
 - Document a species detection that is also recorded in the data.

Data photos may be linked to specific records within the database and are stored in a manner that permits the preservation of those database links. Other photos (e.g., field crew members at work, or photos showing the morphology or behavior of certain species) may also be retained but are not necessarily linked with database records—these types may be considered miscellaneous (see below).

3. *Misc Photos*: Miscellaneous photos are photos taken during monitoring but that do not record data. Such photos, such as crew members at work or unknown species photos are miscellaneous photos.

¹ PACN Monitoring Archive Library, https://doimspp.sharepoint.com/sites/nps-PWR-PACNIM/monitoring_archive (last accessed 24 February 2025).

² PACN I&M SharePoint Site, <https://doimspp.sharepoint.com/sites/nps-PWR-PACNIM> (last accessed 24 February 2025).

Image Management Workflow

Effectively managing hundreds of photographic images requires a consistent method for downloading, editing, naming, and documenting. The general process for managing photos proceeds as follows:

1. [File structure setup](#)
2. [Image acquisition using ArcGIS® Field Maps](#)
3. [Syncing and uploading photos to ArcGIS Online \(AGOL\)](#)
4. [Exporting and downloading file geodatabase from AGOL](#)
5. [Watermarking and naming images in R Studio](#)
6. [Organizing Image Files onto SharePoint](#)
7. [Linking Images to the database](#)
8. [Final storage](#)

File Structure Setup

Prior to data collection for any given year, data management staff will set up new folders under the “[Images](#)” folder (Figure SOP 1.1) in the [Water Quality Monitoring project workspace](#) in SharePoint. Folder structures will be set up as follows:

[Images](#)

[YEAR]	The appropriate year (e.g., 2021, 2022, etc.; Figure SOP 16.1)
[PARK]	Arrange files by 4-letter park code (e.g., HAVO, KAHO, etc.; Figure SOP 16.2)
Data	Processed images arranged by date (Figure SOP 16.3)
Misc	Miscellaneous images taken by project staff and arranged by date (Figure SOP 16.3)

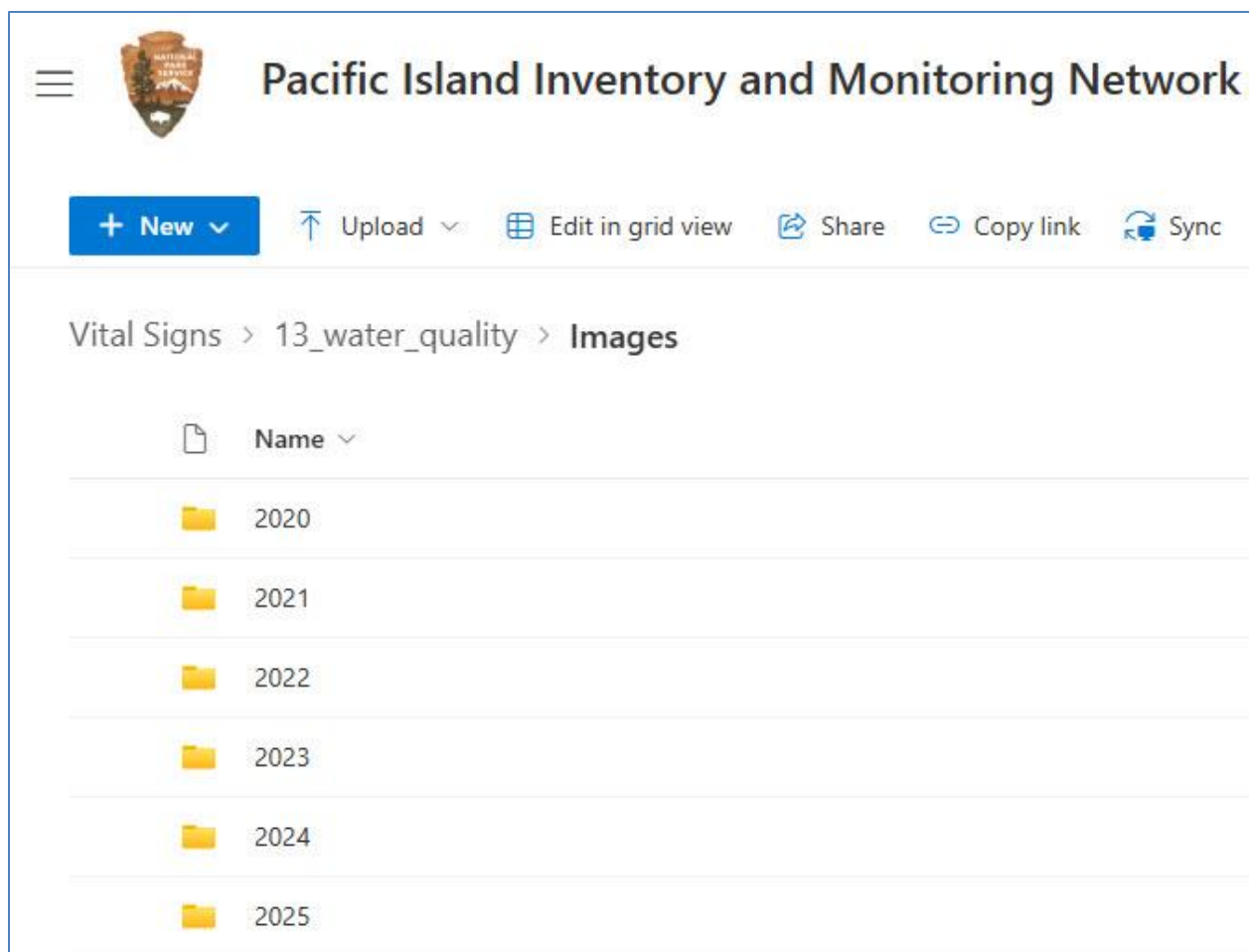


Figure SOP 16.1. Sampling year folders should be created within the “Images” folder each season in SharePoint.

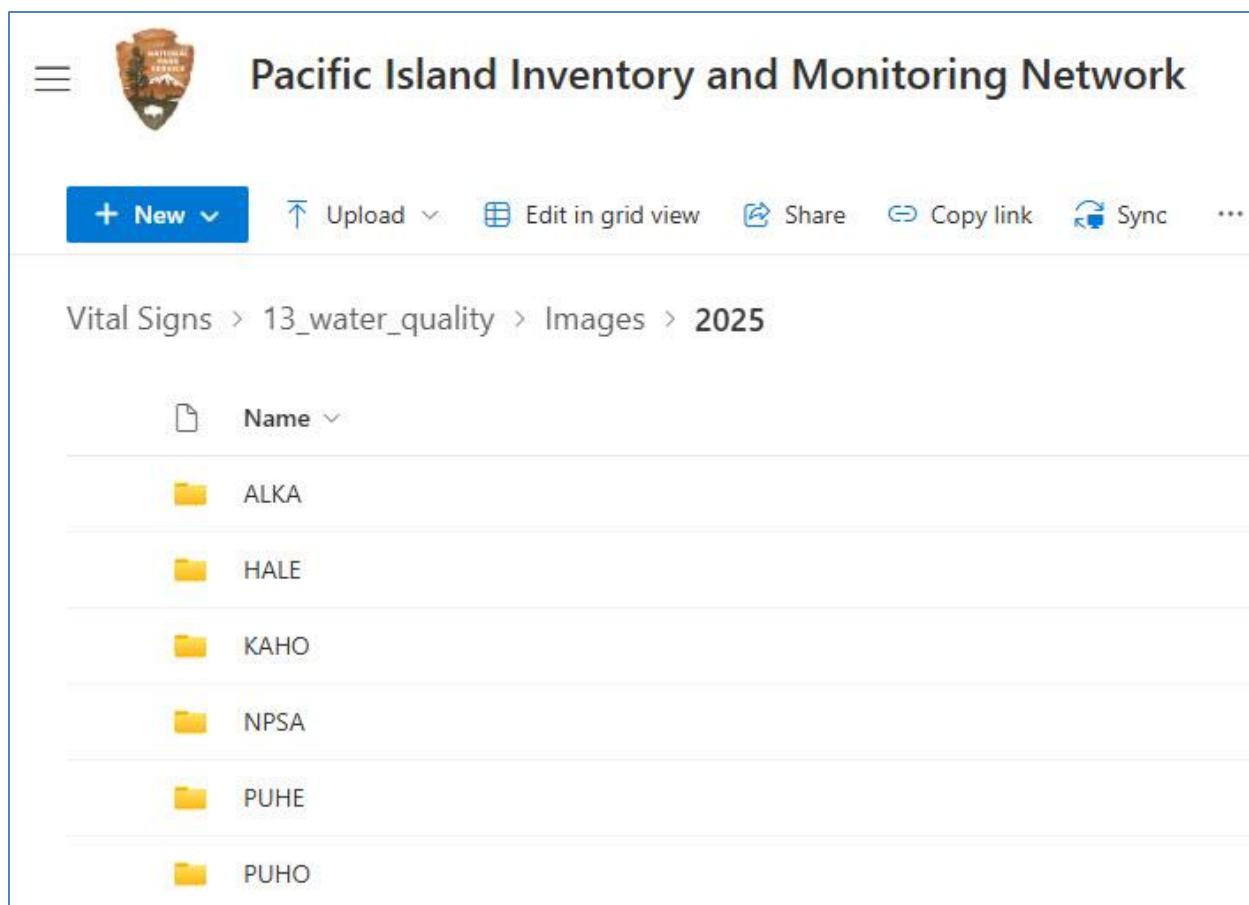


Figure SOP 16.2. Park folders should be created within each sampling year folder in SharePoint.

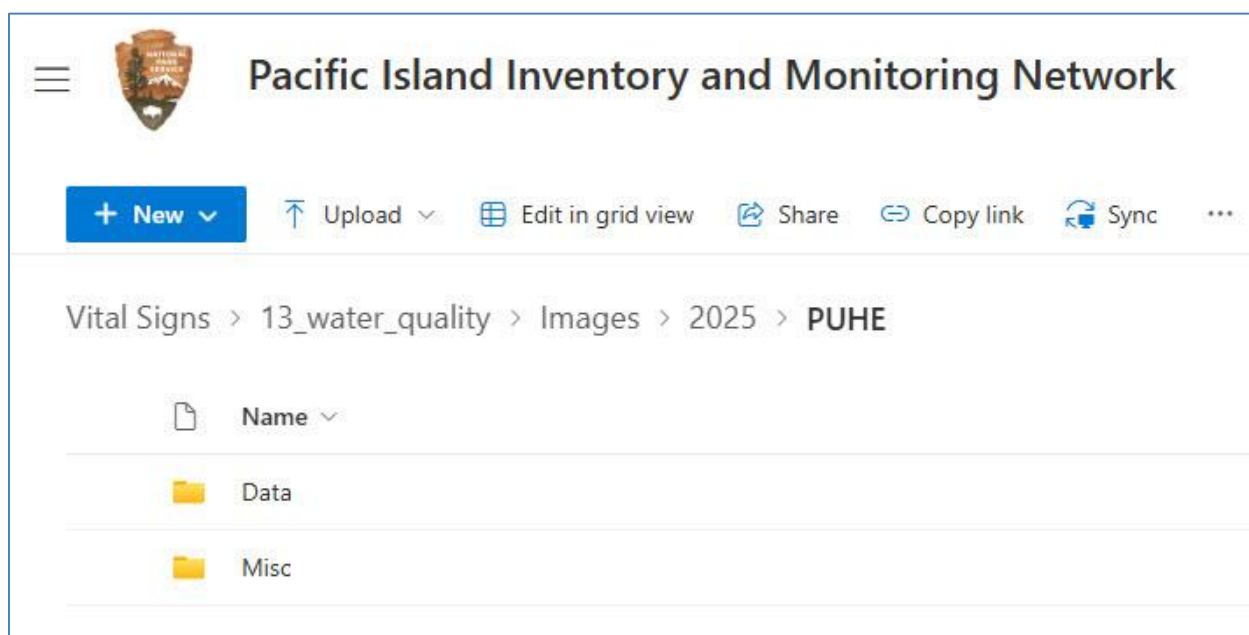


Figure SOP 16.3. "Data" and "Misc" folders should be created within each park folder in SharePoint.

Within the “Data” and “Misc” folders, additional folders should be created for each sampling event in the format YYYYMMDD³ (Figure SOP 16.4). When a sampling event is multiple days long, use the first date of the sampling event for folder name. All data images for a sampling event should go in the appropriate sampling event folder.

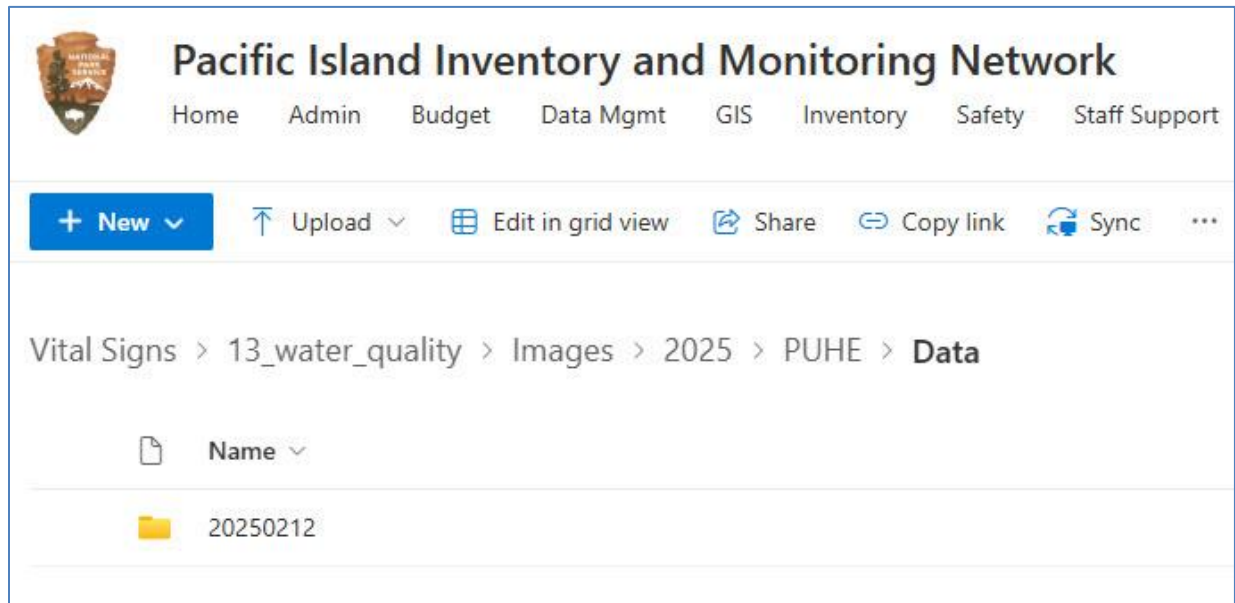


Figure SOP 16.4. Example of a sampling event folder created within the “Data” folder for a year and park.

This folder structure permits data images to be stored and managed separately from miscellaneous images collected during the course of the project. For additional information about the project workspace, refer to [SOP #14 Workspace Setup and Project Records Management](#).

Folder Naming Standards

In all cases, folder names should follow these guidelines:

- No spaces or special characters in the folder name
- Use the underscore (“_”) character to separate words in folder names
- Try to limit folder names to 20 characters or fewer
- Dates within folder names should be formatted as YYYYMMDD (for better sorting)

³ YYYYMMDD = 4-digit year, 2-digit month, 2-digit day

Image Acquisition

Water quality images will be taken using the ESRI ArcGIS Field Maps application on a mobile phone or tablet. For steps on collecting ArcGIS Field Maps images see [SOP #6 Using ArcGIS Field Maps App](#). If access to ArcGIS Field Maps is not available, a digital camera may be used, and images can be uploaded into the collection layer on ArcGIS Online (AGOL). This alternative is time consuming and should be avoided if at all possible.

Syncing & Uploading Images

Syncing from Field Maps to AGOL

During field collection, ArcGIS Field Maps images and corresponding attribute information are stored offline (locally on the mobile device) and must be synced to ArcGIS Online once a wireless internet connection is available. See [SOP #6 Using ArcGIS Field Maps App](#) for steps to complete data synchronization.

Uploading Images from a Digital Camera to AGOL

If a digital camera is used rather than ArcGIS Field Maps to capture images, then the images must be downloaded from the camera and manually uploaded into the collection layer on AGOL in a web browser. In order to upload images from a digital camera, the AGOL user may need special permission. Contact the PACN GIS Specialist for assistance.

Exporting and Downloading File Geodatabase from AGOL

After images are synced or uploaded into AGOL, the metadata and images must be exported as a geodatabase file (.gdb) and downloaded using the following steps:

1. Navigate to the collection layer for the current year in AGOL (the URL will be provided by the PACN GIS Specialist at the beginning of the calendar year). Near the bottom of the screen select the feature layer containing the photo points (Figure SOP 16.5, below).

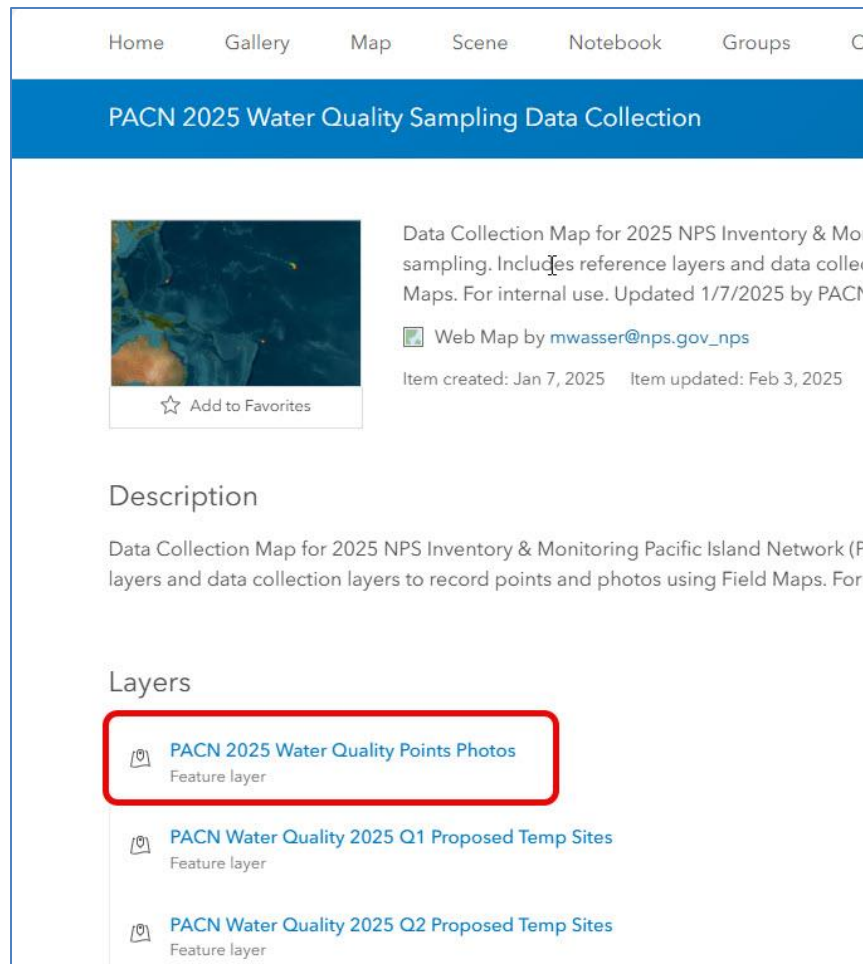


Figure SOP 16.5. Example of AGOL view of Data Collection Layer with Points Photos Feature Layer highlighted.

2. In the right-hand panel, click “Export Data” and select “Export to FGDB” (Figure SOP 16.6, below). If you do not see “Export Data” listed in the panel, you do not have the proper permissions to perform this function and should contact the PACN GIS Specialist for assistance.

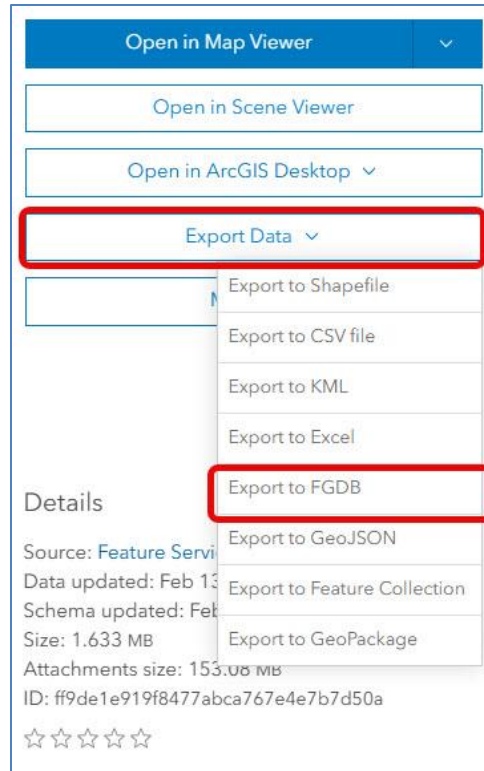


Figure SOP 16.6. Export Data dropdown menu on Points Photos Feature Layer in AGOL.

3. Update the export “Title” field to include the date of export in the format YYYYMMDD followed by “_PACN_WQ_Field_Images” and then click “Export” (e.g., “20250221_PACN_WQ_Filed_Images”) (Figure SOP 16.7, below).

Figure SOP 16.7. Export to File Geodatabase window for Points Photos Feature Layer in AGOL.

4. It will take several minutes to export the file. Once complete, you can click “Download” in the right-hand panel (Figure SOP 16.8) and download the file onto your local workspace. If you will be watermarking the images, you will place it in the “geodatabase” folder within your R project (**note:** if this is your first time following these procedures, see Step 1 under [Initial Setup](#) below, which downloads a series of R files and folders, one being the “geodatabase” folder mentioned here). It will download as a zip file (.zip).

Figure SOP 16.8. Download option in view page for exported file geodatabase in AGOL.

5. Navigate to the downloaded geodatabase file in Windows File Explorer. Right-click on the file and select “Extract All” to open the “Extract Compressed (Zipped) Folders” window. Set the destination to the “geodatabase” folder and click “Extract”.
6. Rename the extracted folder using the format “YYYYMMDD_PACN_WQ_Field_Images.gdb”. It is important to include “.gdb” in the file name as it will not automatically generate.

Watermarking and Naming Images in R Studio

An R package and R script have been created to facilitate processing and renaming images collected in ArcGIS Field Maps. As such it will be necessary to install R and R studio before images can be processed. The latest versions of both programs can be installed through Software Center. For assistance with installing these programs, please contact NPS IT.

Initial Setup

The first time you process images you will need to download and install the R package.

1. Download the R files from the PACN SharePoint site at “[R files for PhotoProcessing](#)”. This will usually download as a zip folder. Unzip the folder “PACN-Aquatic-PhotoProcessing” but leave “PACNAquaticWaterQuality.zip” as a zip file.
2. Open the file “PACN-Aquatic-PhotoProcessing.Rproj” with R Studio.
3. In the lower right-hand panel click “Install” to open the Install Packages window (Figure SOP 16.9).

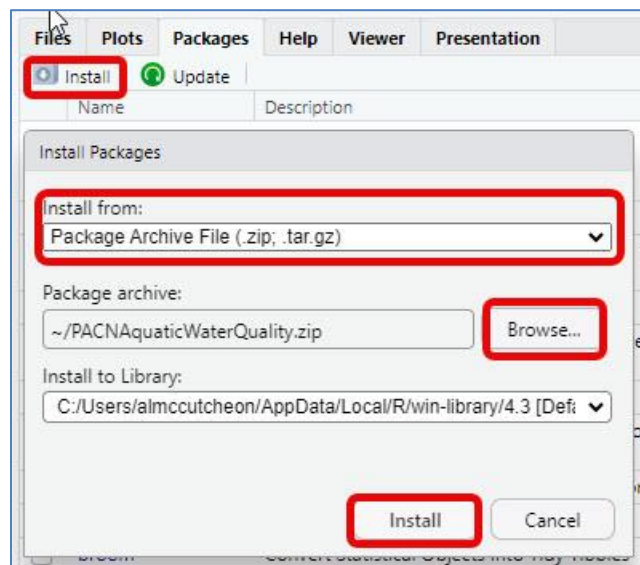
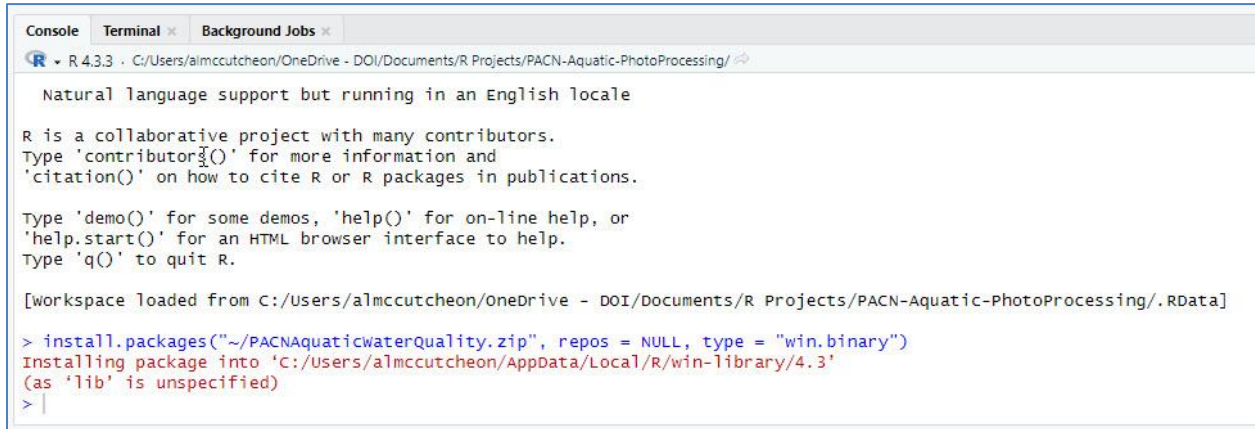


Figure SOP 16.9. Install Packages window in R Studio.

4. Select “Package Archive File (.zip; .tar.gz)” in the “Install from:” drop-down list and navigate to the file “PACNAquaticWaterQuality.zip” using the “Browse” button, then click “Install” (Figure SOP 16.9, above).
5. If the install is successful, you will see a message similar to Figure SOP 16.10 in the console pane on the lower left.



```

R 4.3.3 - C:/Users/almccutcheon/OneDrive - DOI/Documents/R Projects/PACN-Aquatic-PhotoProcessing/
Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributor()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[workspace loaded from C:/Users/almccutcheon/OneDrive - DOI/Documents/R Projects/PACN-Aquatic-PhotoProcessing/.RData]

> install.packages("~/PACNAquaticWaterQuality.zip", repos = NULL, type = "win.binary")
Installing package into 'C:/Users/almccutcheon/AppData/Local/R/win-library/4.3'
(as 'lib' is unspecified)
>

```

Figure SOP 16.10. Example of messaging for a successfully installed package in R Studio console pane.

After the initial setup, you will not need to install the PACNAquaticWaterQuality package again unless there is an update. However, if you run into any trouble with the R script or R package, please contact Amanda McCutcheon (PACN Biological Science Technician, amanda_l_mccutcheon@nps.gov).

Processing Photos after Initial Setup

To watermark and rename images from the downloaded file geodatabase use the follow steps:

1. Open the project “PACN-Aquatic-PhotoProcessing.Rproj” in R studio.
2. Open the R script “Watermark_Fieldmaps_Photos_WQ_v3.R” within the project by navigating to the file through the File menu > Open File.
3. Update the geodatabase *name* in line 26 to match the name of the geodatabase you downloaded. Update the *unit_code* and *loc_type* in lines 30 and 31 to indicate the park and location type for the sampling event images you are processing (Figure SOP 16.11, below).
4. Update the variable *select_months* in line 32 to include the numerical months when data were collected. Make sure to retain the vector format (For example: If data were collected in September this line should read “as.vector(c(9))”. If data were collected in August and September this line should read “as.vector(c(8,9))”). (Figure SOP 16.11, below).
5. Updated the *folder* name in line 33. “watermark/” creates a folder called “watermark” and the rest of the name creates a subfolder with the name of your choice. It is recommended that the

name include the sampling event date and the park name. These folders will appear in the PACN-Aquatic-PhotoProcessing folder when the script is run (Figure SOP 16.11, below).

6. Click *Source* on the top right in R studio to run the entire script (Figure SOP 16.11). Information will appear in the Console in the lower panel indicating that watermarked .jpg files are being created and added to the folder listed (Figure SOP 16.12).

```

16 # NOTE: The first time you run this you will need to install the three packages listed.
17 # Removed the # from the next line to install the required packages.
18 # install.packages("here", "dplyr", "PACNAquaticWaterQuality")
19
20 library(PACNAquaticWaterQuality)
21 library(here)
22 library(dplyr)
23
24 #### USER INPUT ####
25 location <- here("geodatabase") # Enter the folder name where the gdb is stored.
26 name <- "20250219_WQ_PACN_Field_Images.gdb" # Enter the name of the gdb file.
27 layer <- "PACN_2025_Water_Quality_Points_Photos_v03_" # Enter the layer name - this should stay the same unless Mark u
28
29 # Enter Sampling Event Info
30 unit_code <- c("PUHO")
31 loc_type <- "AP"
32 select_months <- as.vector(c(1,2,3))
33 folder <- "watermarked/20250213_PUHO"
34
35 #-----

```

Figure SOP 16.11. View of R Script for watermarking Water Quality field images from ArcGIS geodatabase with lines to be updated highlighted in red.

```

R 4.3.3 - C:/Users/almccutcheon/OneDrive - DOI/Documents/R Projects/PACN-Aquatic-PhotoProcessing/
[1] "C:/Users/almccutcheon/OneDrive - DOI/Documents/R Projects/PACN-Aquatic-PhotoProcessing/watermarked/20250213_PUHO/20250
213_FPUHO03_ap_WQ_AP_Site_1.jpg"
[1] "C:/Users/almccutcheon/OneDrive - DOI/Documents/R Projects/PACN-Aquatic-PhotoProcessing/watermarked/20250213_PUHO/20250
213_FPUHO03_ap_WQ_AP_Site_2.jpg"
[1] "C:/Users/almccutcheon/OneDrive - DOI/Documents/R Projects/PACN-Aquatic-PhotoProcessing/watermarked/20250213_PUHO/20250
213_FPUHO03_ap_WQ_AP_Site_3.jpg"
[1] "C:/Users/almccutcheon/OneDrive - DOI/Documents/R Projects/PACN-Aquatic-PhotoProcessing/watermarked/20250213_PUHO/20250
213_FPUHO04_ap_WQ_AP_Site.jpg"

```

Figure SOP 16.12. Example of Console panel in R Studio after Sourcing the R script to process images.

7. Navigate to the watermark folder in your project folder and review the images to ensure watermarks were created correctly and files are named as desired. All the labeling and naming should be automatic, so if there are any corrections needed, please consult with Amanda McCutcheon (PACN Biological Science Technician, amanda_l_mccutcheon@nps.gov).

- a. Watermarks should be in the format (Figure SOP 16.13 and SOP 16.14, below):

- i. Top Left (Line 1): Title – “PARK Water Quality Monitoring”
- ii. Top Left (Line 2): Location – Stream Name or Area (For anchialine pools this line will be blank.)
- iii. Top Center (Line 1): Direction

- iv. Top Right (Line 1): Site Name
- v. Top Right (Line 2): Pool Name (for anchialine pools only)
- vi. Bottom Left (Line 1): Date/Time
- vii. Bottom Right (Line 1): Latitude (in decimal degrees)
- viii. Bottom Right (Line 2): Longitude (in decimal degrees)



Figure SOP 16.13. Example of Water Quality image for anchialine pools with applied watermarks.



Figure SOP 16.14. Example of Water Quality image for streams with applied watermarks.

- b. Filenames should be in the format
[YYYYMMDD]_[Station_ID]_[type]_WQ_[TYPE]_[Direction]⁴.jpg (Figure SOP 16.15, below).

⁴ Refer to Appendix [SOP 14.a. Abbreviation Key for File Naming Conventions in SOP #14 Workspace Setup and Project Records Management](#).

Name
20210216_FHALE01_fw_WQ_FW_Downstream.JPG
20210216_FHALE01_fw_WQ_FW_Left_Bank.JPG
20210216_FHALE01_fw_WQ_FW_Right_Bank.JPG
20210216_FHALE01_fw_WQ_FW_Site.JPG
20210216_FHALE01_fw_WQ_FW_Upstream.JPG
20210216_THALE02_fw_WQ_FW_Downstream.JPG
20210216_THALE02_fw_WQ_FW_Left_Bank.JPG
20210216_THALE02_fw_WQ_FW_Right_Bank.JPG

Figure SOP 16.15. Example of image file naming standards for HALE 2021 Water Quality Monitoring images.

Organize Image Files

- Once data images have been edited, reviewed, and renamed, the watermarked images can be uploaded to the sampling event folder within the “Data” folder for the correct year and park in SharePoint (Figure SOP 16.4, above).
- Any other miscellaneous images should be uploaded to the “Misc” folder for the correct year and park in SharePoint (Figure SOP 16.3, above).
- Images that are to be linked to the database will need to go into a sampling event folder for the correct year and park in the “[VS WQ Database images](#)” folder in SharePoint. You can copy the sampling event folder from “Data” and paste it into the corresponding year and park folder in “[VS WQ Database images](#)” (Figure SOP 16.16).

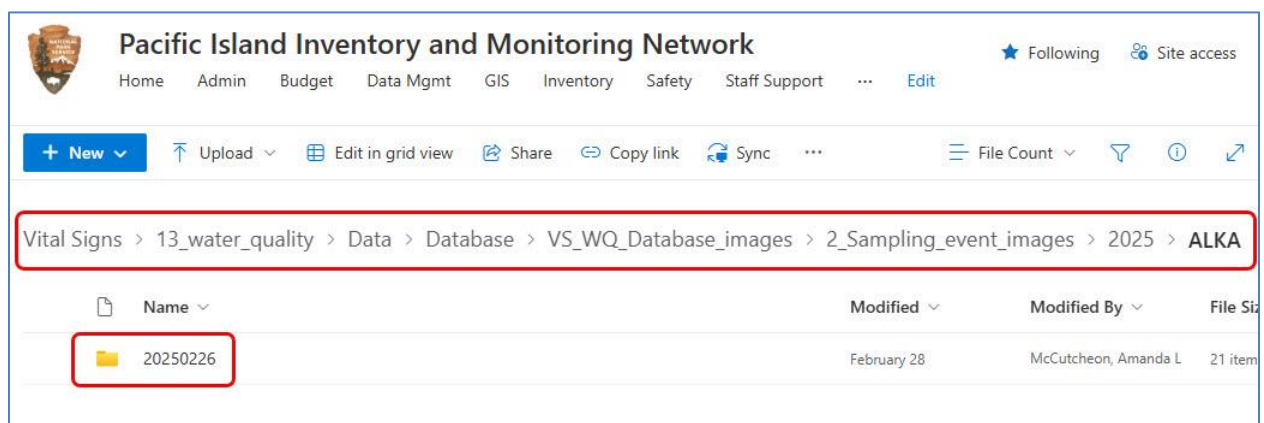


Figure SOP 16.16. Example of a sampling event folder for 2025 ALKA images in SharePoint that will be linked to the database.

Photos of interest to a greater audience will be copied to the [PACN Monitoring Archive Library](#) in SharePoint by the PACN Data Manager. Generally, these images are high quality, high resolution, but lower quality images may be included if the subject matter has broad appeal and is special, rare, or unique.

Establish Database Links

Images for the Water Quality Monitoring protocol can be directly linked to the data in the Water Quality Monitoring Database. During data entry and processing, the database application will provide the functionality required to establish a link between each database record and the appropriate image file(s). To establish the link, the database prompts the user to indicate the root project workspace directory path and the specific file name. This way, the entire workspace may be later moved to a different directory (i.e., the PACN Monitoring Archive Library) and the links will still be valid after changing only the root path. Refer to [SOP #14 Workspace Setup and Project Records Management](#), and [SOP #18 Data Entry and Verification](#) for additional details on setting up the database images structure and establishing these links.

Note: It is important that the files keep the same name and location once these database links have been established. Users should not rename or reorganize the directory structure for linked image files without first consulting with the PACN Data Manager.

The procedures for linking images to the Water Quality Monitoring Database can be found in [Water Quality Monitoring Database User Guide](#), located in the “[Database Documentation](#)” folder in SharePoint.

Final Storage

At the end of the season, and once the year’s data are certified, data images for the year will be moved to the PACN Monitoring Archive Library in SharePoint for archival. Before data is certified all data images should be checked for completeness and linked to the database. Since the project images are on the network server, simply inform the PACN Data Manager that the images are ready to be archived. These files will be loaded into the [PACN Monitoring Archive Library](#) in SharePoint, and the database links to data images will be updated accordingly.