

South Florida/Caribbean Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure WT08

QA/QC of Newly Imported HOBO® Data Files into Aquarius—Version 2.0

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Purpose

The water temperature data used to be stored in a Microsoft Access database. In 2018, the program shifted water temperature data storage to Aquarius Time-Series, a NPS-wide continuous water quality database. This SOP describes how data uploaded into Aquarius are checked for errors and verified. This SOP also describes the documentation of any data gaps in Aquarius. Data that are free of errors are marked “Approved” and given a grade of “Good” which allows it to be visible through the [Aquarius web data portal](#) on the NPS [Integrated Resource Management Applications](#) (IRMA) portal.

This standard operating procedure (SOP) is for users who already have access to Aquatic Informatics’ Aquarius v2019.4 on the NRSS server (inp2300fcvgate4.nps.doi.net). If you do not have access, contact Judd Patterson (judd_patterson@nps.gov), the SFCN Data Manager. Dean Tucker (dean_tucker@nps.gov), a Natural Resource Specialist in the Water Resource Division, manages the Aquarius system and will also need to be contacted to set up a login and access.

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
4/15/2020	Lee Richter	Data are now uploaded to Aquarius Time-Series database	MS Access database no longer used	2.0

Requirements

- Login and access to Aquatic Informatics Aquarius v2019.4 (or “Aquarius” for short)
- AQAssistant.rdp (remote desktop connection) downloaded and available on your computer

Procedures

1. These steps occur immediately after *.csv files are uploaded to the Aquarius database in SOP WT12 *Importing data to Aquarius Database—Version 1.0* (SFCN 2020a). Follow the steps 1–7 in SOP WT12 to open Aquarius Springboard (Figure 1). By following those steps, you should locate the folder with the data to be checked for errors and verified.

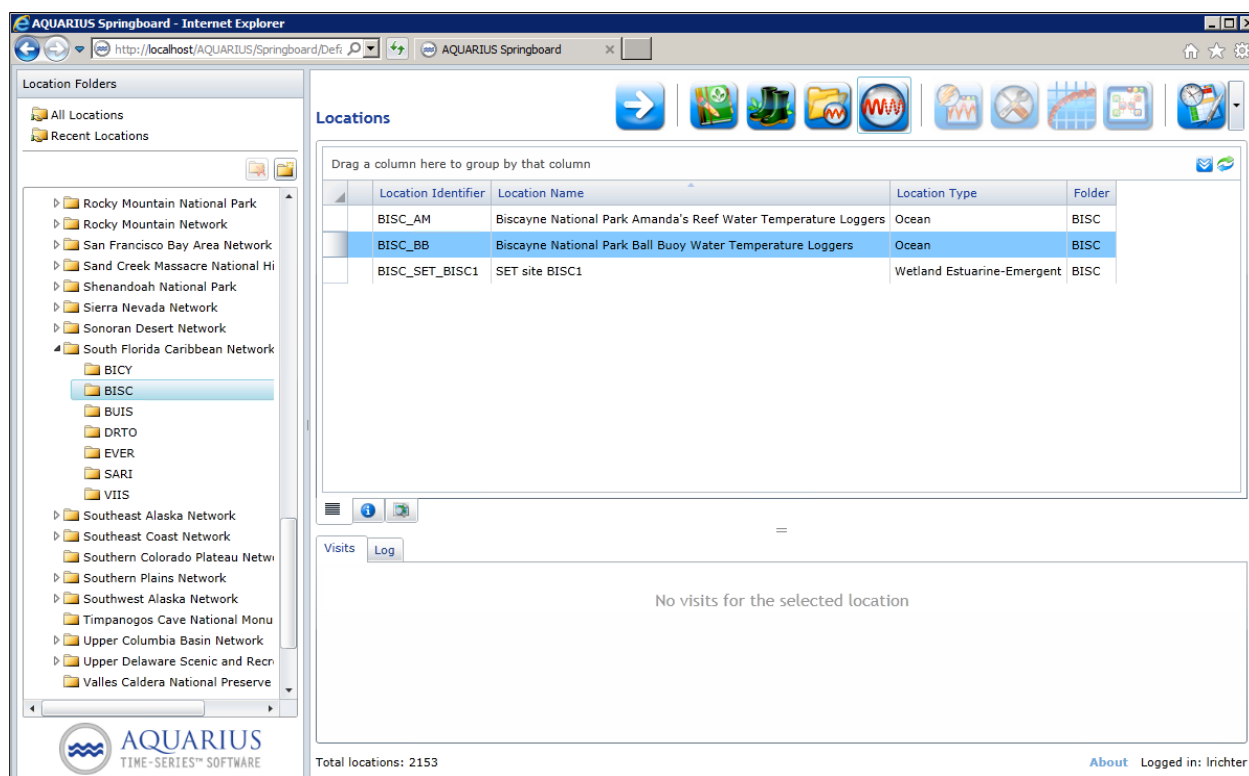


Figure 1. Screenshot showing the Aquarius Springboard interface.

2. Once your site location is selected under the Location Folders pane, click the blue arrow icon to view the data sets for that site (Figure 2).

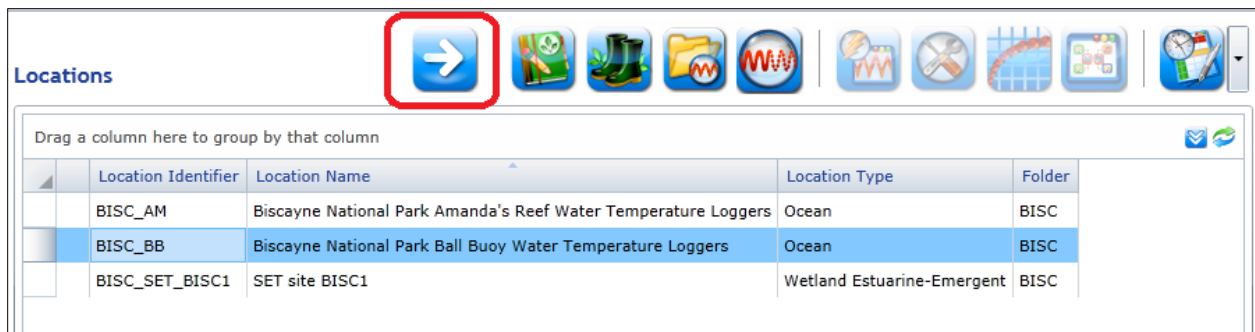


Figure 2. Screenshot showing the blue arrow icon highlighted in the Aquarius Springboard interface.

3. You should see two files for each site location, for each logger present there. Right-click one of the files and select Data Correction. Alternatively, select (highlighted in blue) the file you want to view and click the Data Correction button (Figure 3).



Figure 3. Screenshot showing the Data Correction tool icon highlighted in the Aquarius Springboard interface.

4. The window that opens should display the temperature data for that logger. The orange bar at the bottom of the graph shows the “grade” of the data and the green bar at the bottom of the graph shows the “approval” of the data. The light blue bars represent the span of the newly appended data and show that no grade or approval has been set yet (Figure 4).

Note: In order for the data to be viewable in the Aquarius web data portal on IRMA, the data need to have an approval rating of “Accepted” and a grade rating of “Good” (or higher). If those are not set, the data will only be viewable to those who login to Springboard. Data given an approval rating of “Rejected” will not appear on the Aquarius web data portal.

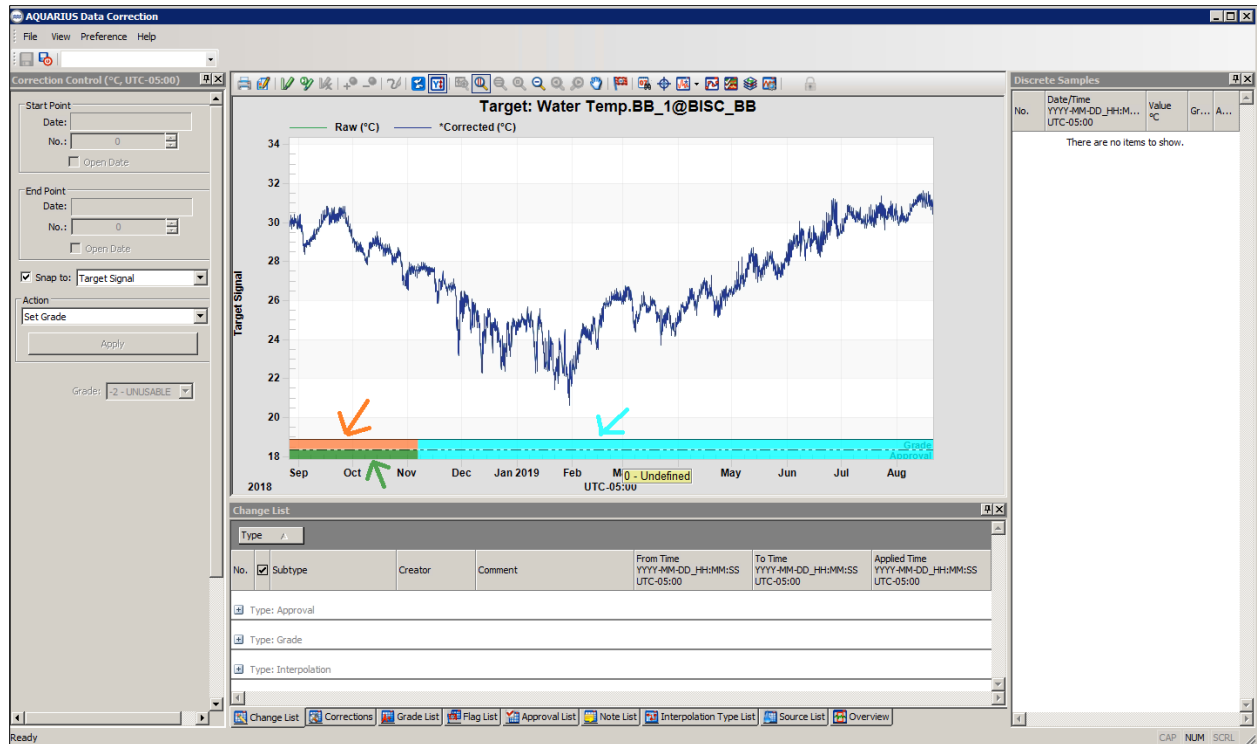


Figure 4. Screenshot showing the Aquarius Data Correction window within the Aquarius Springboard interface.

5. Hover over the light blue bars and double-click to select the newly appended data (Figure 5).

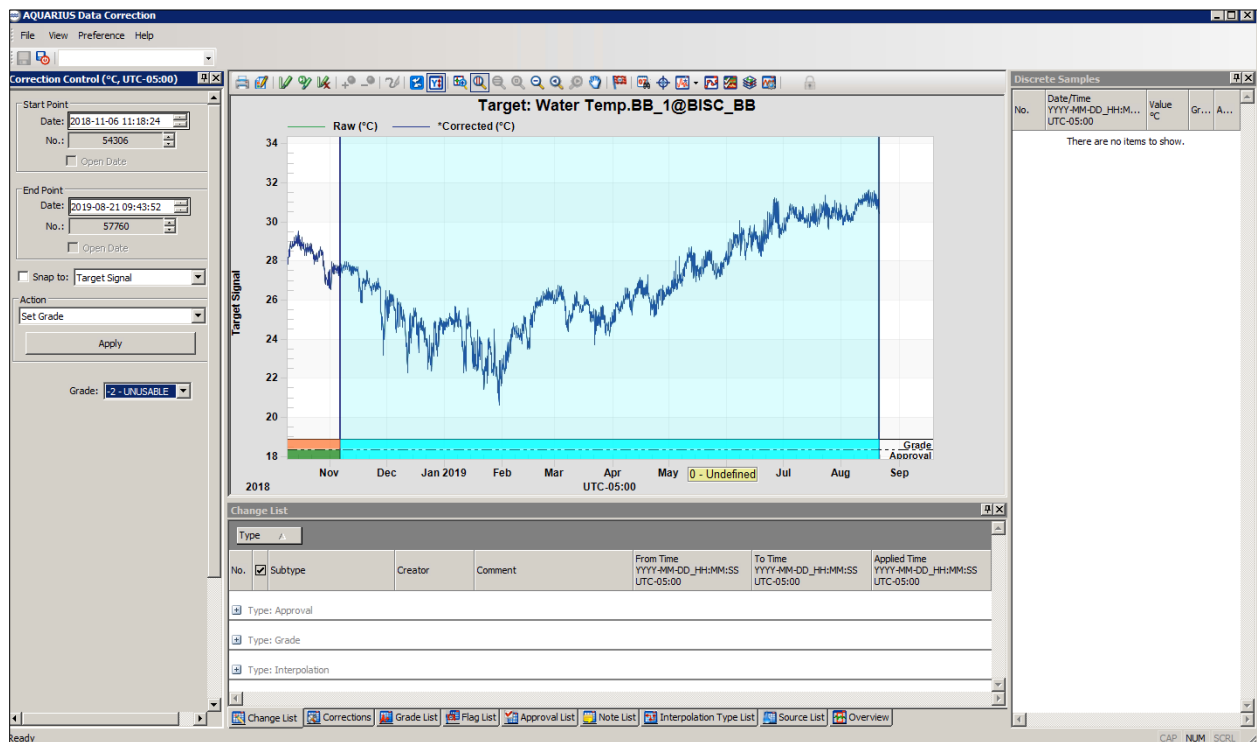


Figure 5. Screenshot showing the Aquarius Data Correction window with undefined data selected.

6. Also, the “Mark Region” tool can be used to select specific regions in the dataset (Figure 6).

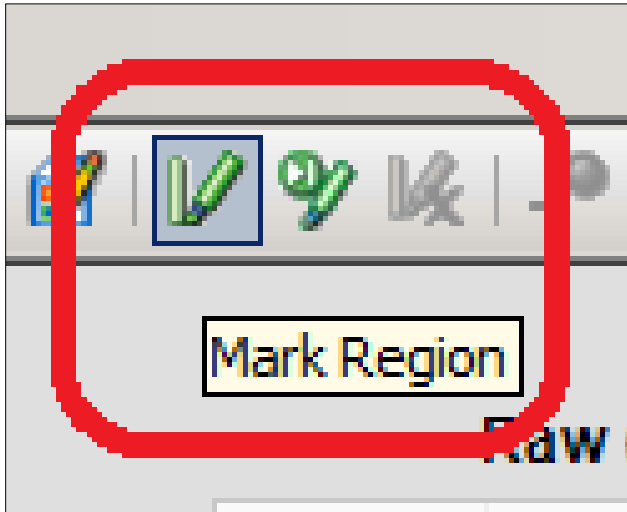


Figure 6. Screenshot showing the Mark Region tool within Aquarius Data Correction window that allows the user to select specific regions in the data set.

7. There will be occasions where erroneous data may appear in the data set. These are generally typified by spikes or gaps in the dataset that are outside the typical seasonal and daily temperature patterns. While abrupt changes in water temperature are possible (e.g. upwelling events in Dry Tortugas), any sudden change in temperature will be investigated for possible error. Possible common errors to look for include:
- A logger was collecting air temperature readings prior to deployment or after retrieval
 - A shuttle that was not launched prior to logger download can cause the date and time stamp of the data to be completely wrong
 - A faulty logger (inherent software, firmware, or battery issue) can cause data gaps or wild, clearly false fluctuations in temperature (e.g. below 0°C [32°F] to above 100°C [212°F])
 - Gaps from data sets that were not uploaded or verified correctly
8. Review the graphed data (and individual values, if necessary) to ensure that the data appear as they should. If they look good, the Grade is set to “GOOD” and the Approval is set to “APPROVED” (Figure 7). On the left side of the window, select the option “Set Grade” from the “Action” drop-down menu. Under the “Grade” drop-down menu that appears, select “31 – GOOD.” Click Apply. Click OK in the window that appears. The top bar should now be orange instead of light blue, denoting a “GOOD” grade.

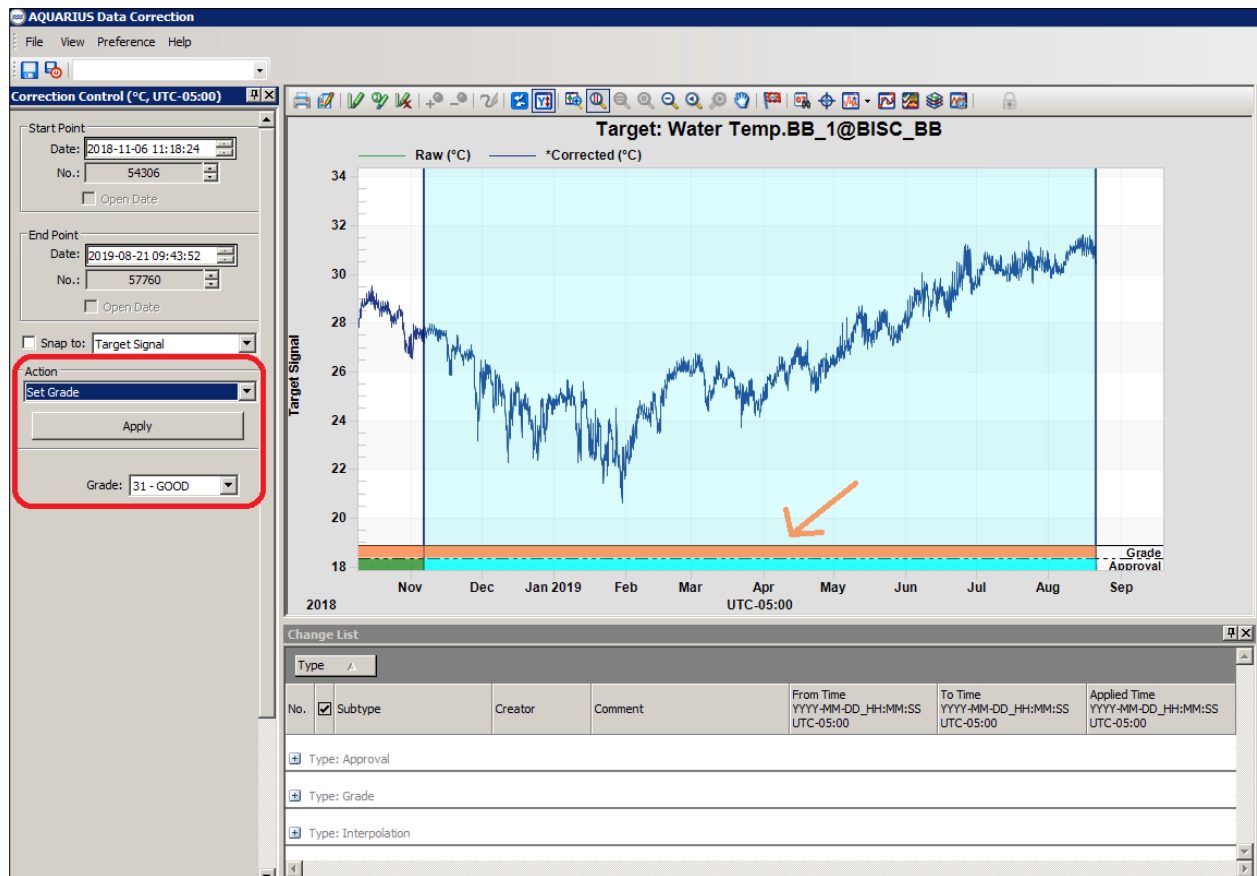


Figure 7. Screenshot showing the Action drop-down menu highlighted within the Aquarius Data Correction.

9. To set the “Approval” to “APPROVED,” make sure the new data are still selected, then select “Set Approval” from the “Action” drop-down list at the left side of the window. Under the “Approval” drop-down menu that appears, select “3 – Approved.” Click Apply. Click OK in the window that appears. The bottom bar should now be green instead of light blue, denoting its approval (Figure 8).

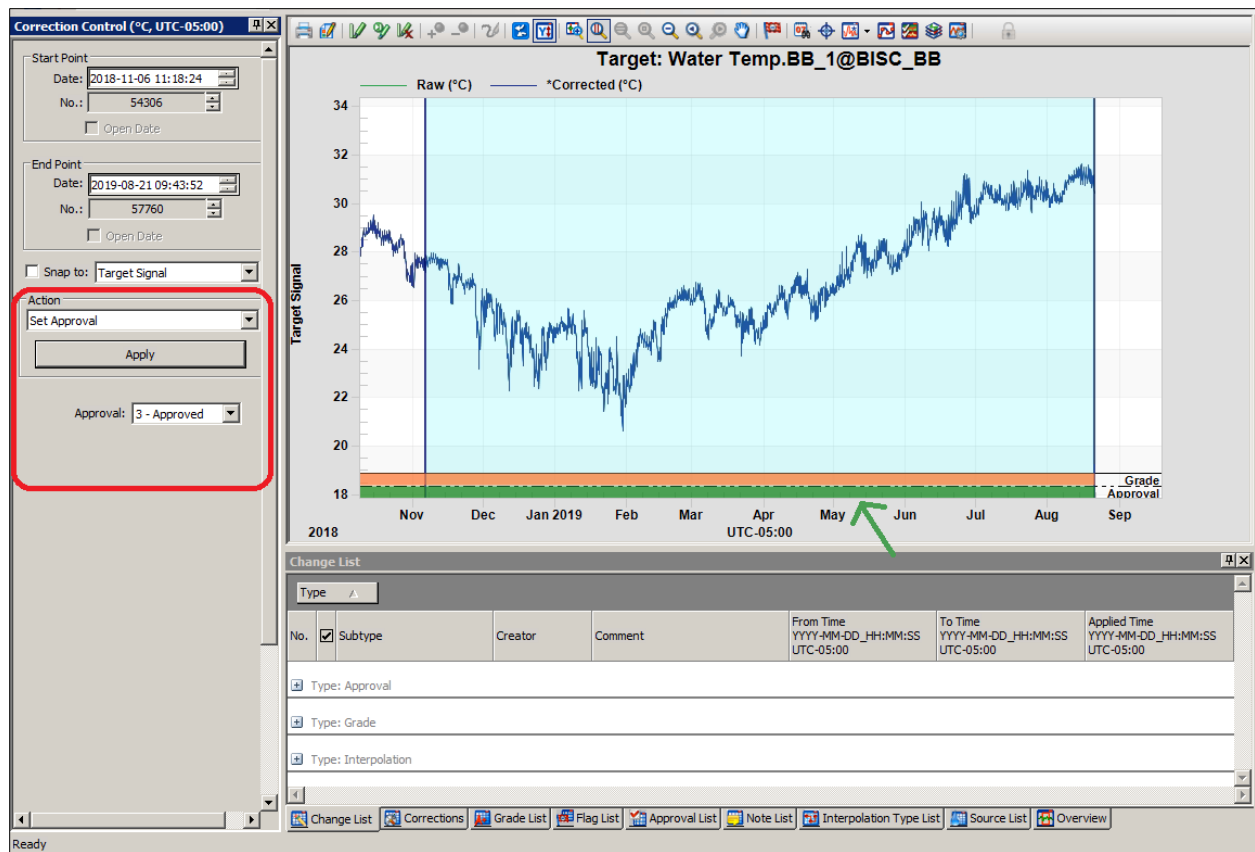


Figure 8. Screenshot showing the Set Approval option selected from the Action drop-down menu, highlighted within the Aquarius Data Correction.

10. The data from the co-located loggers at a site should mirror each other. Any differences greater than 0.3°C will be investigated. This can be done by comparing the individual values through an R-script.
 - a. Open the R script 'Logger_Comparison.R' in R Studio from the following folder:
Z:\SFCN\Vital_Signs\Coral_Reef_Water_Temperature\analysis\Logger_Comparison.
 - b. Update the temp.directory to a folder that has a full set of downloaded CSV files from Aquarius. See *SOP WT09 Reports, Graphing and Web page Data—Version 1.0* (SFCN 2020b) for a companion script that downloads the full period of record for each logger.
 - c. Run the script.
 - i. The script starts by loading all the CSV files for sensor 1 into one data frame and the CSV files for sensor 2 into a second. Readings with “Unacceptable” approval and grade ratings are removed.

- ii. Then the `round_date` function within the `lubridate` package is used to round timestamps to the nearest five minutes to accommodate for slight time discrepancies between loggers.
 - iii. Everything is then merged together on a key that is comprised of the Park, Site, and rounded timestamp. This ensures that co-located sensors with the same timestamp are in adjacent columns.
 - iv. The script then calculates the absolute value of the temperature difference between co-located sensor and reformats the data frame to improve readability and to only show discrepancies that are greater than 0.3°C.
 - v. As a final step, the script exports a CSV file named `YYYYMMDD_flagged_temp_differences.csv` with any readings that need to be investigated.
 - d. Review the output from the script (e.g. `20200714_flagged_temp_differences.csv`), and when readings are determined to be erroneous, adjust the Grade to “-2 – UNUSABLE” and Approval set to “4 – Rejected” within Aquarius.
11. In the event that there is erroneous data in the dataset, the erroneous sections of the data will need to have the Grade set to “-2 – UNUSABLE” and Approval set to “4 – Rejected.” The example below shows how a logger had questionable readings for a period of about two months and for that section of data the Grade was set to “-2 – UNUSABLE” (red) and Approval set to “4 – Rejected” (purple; (Figure 9).

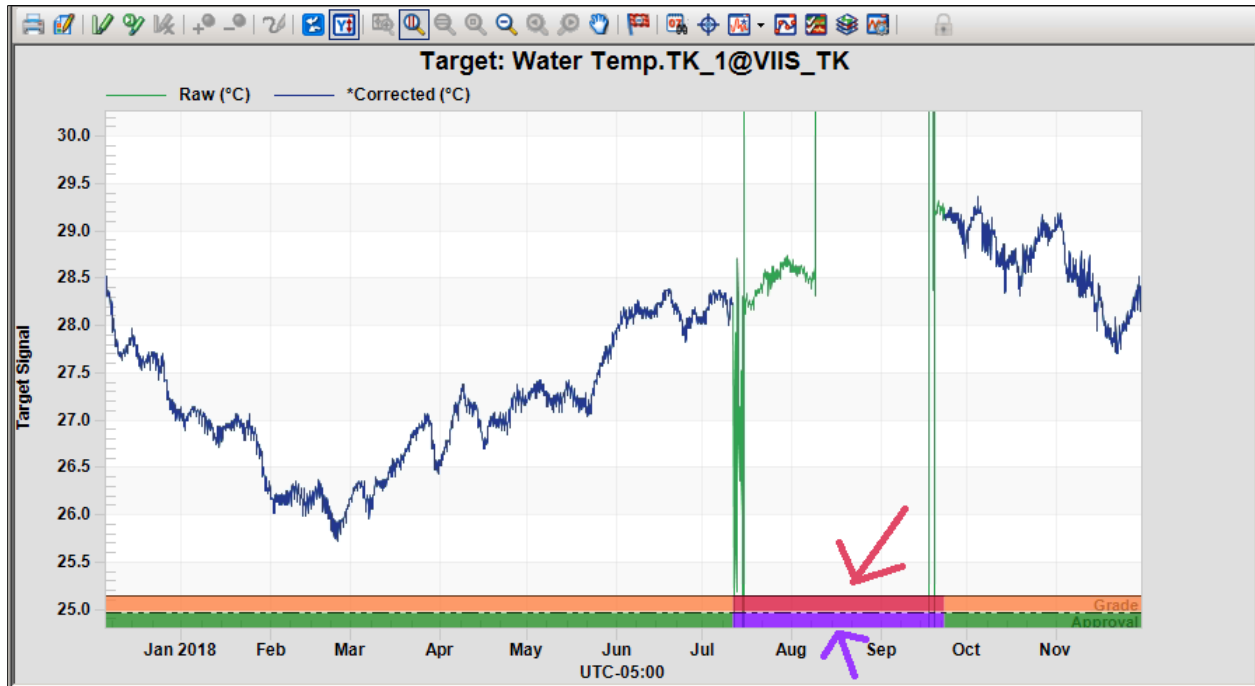


Figure 9. A zoomed-in screenshot showing the Aquarius Data Correction window with a region of data graded as unusable and approval rating set as rejected.

12. There are circumstances where data gaps occur in the dataset. In Aquarius, a data “gap” is considered any period of time greater than the logging interval of two hours where no data are present. Small gaps (less than 12 hours) can happen when new loggers are deployed (delayed launch until midnight of the following day) or if a logger has to be removed from the water for download. Larger gaps (more than 12 hours) likely indicate a technical issue with the dataset that needs to be documented. This can be done in the Data Correction window (see below). In the panel at the right-hand side of the window, there are a few tabs along the bottom. Select “Data Gaps” (Figure 10).

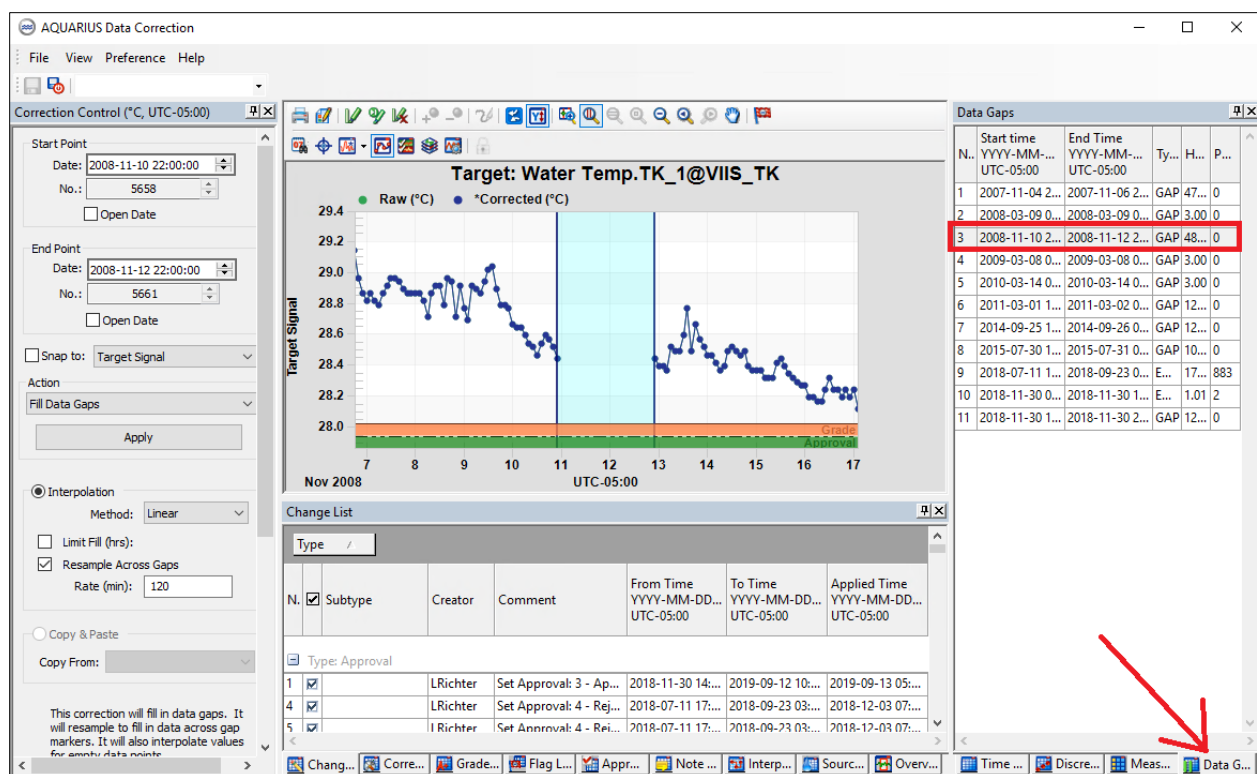


Figure 10. A screenshot showing the Data Gaps tab option on the Aquarius Data Correction window. The panel at the right shows all gaps in the dataset that are longer than two hours. Double-clicking an individual gap in the panel selects and zooms to that gap in the chart.

13. Double-click on the individual data gap. This selects and zooms to the range in the dataset where the gap exists and highlights it in light blue (Figure 10). Using the aforementioned steps, the gap is assigned the Approval rating of “4 – Rejected” and Grade of “-2 – UNUSABLE.”
14. A note is also included with each data gap. This is done by selecting “Set Note” from the Action pull-down list on the left panel in the window and clicking Apply (Figure 11). In the window that pops up, write a short note in the Comment section that describes why the data gap exists. Click OK when finished to save the note.
15. To access all the metadata for Notes (associated with gaps) in a dataset, select File → Export Note List and save the CSV file. To access specific data gap information, select File → Export Data Gap List.

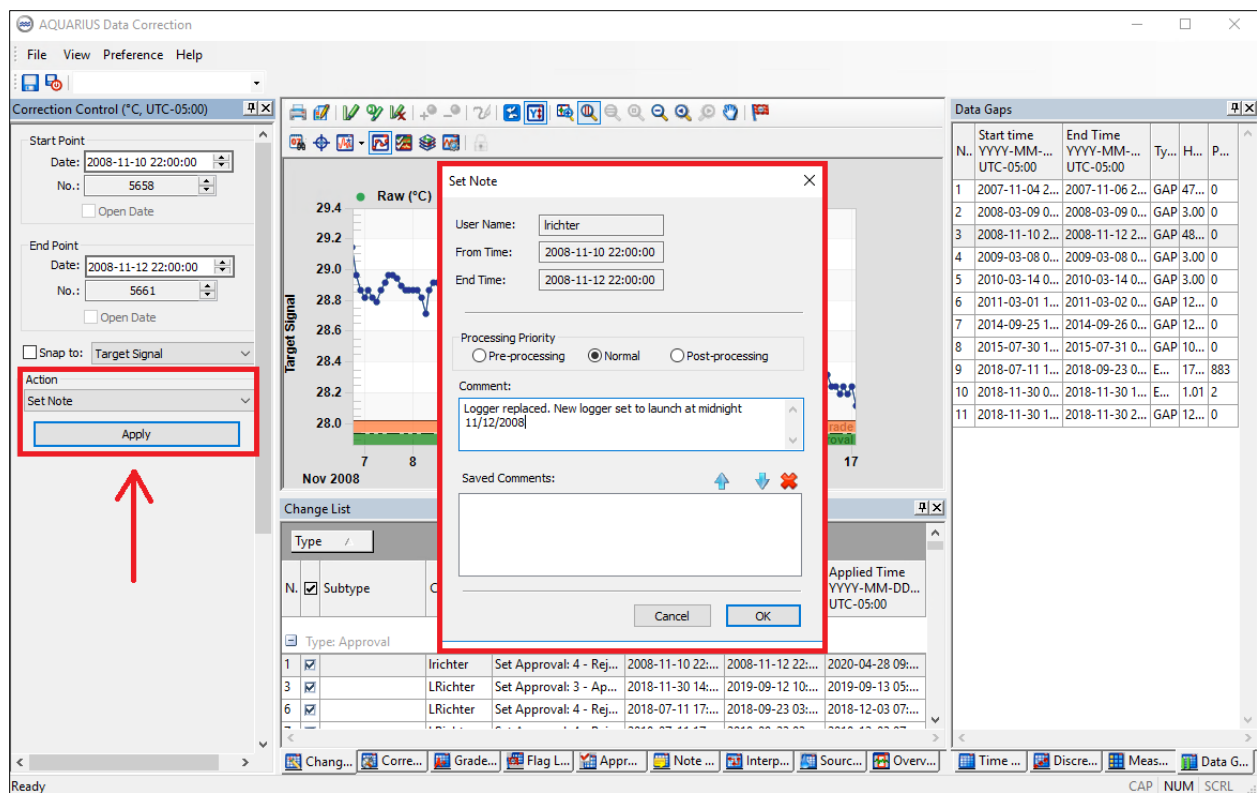


Figure 11. A screenshot showing the how to set a note for a data gap in the Aquarius Data Correction window. A comment is saved with a short description of why the data gap exists.

16. Once the data have been verified, it is important to select “Save & Exit” from the file menu. Simply exiting this window will not save your changes and could prevent the data from appearing as it should when accessed through the Aquarius web data portal (Figure 12).

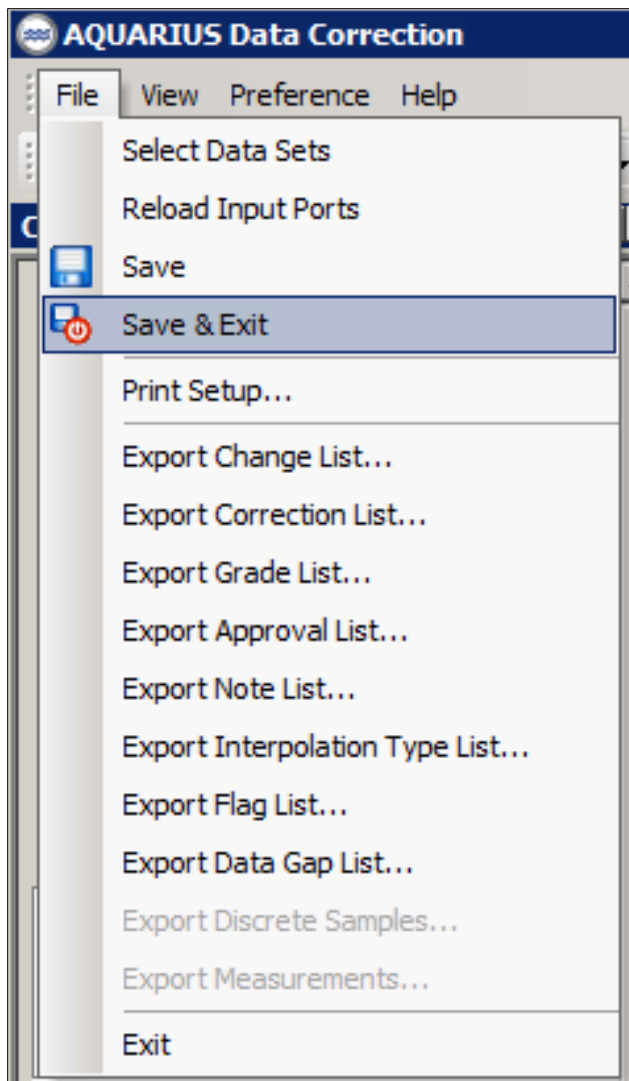


Figure 12. A screenshot showing the File tab option on the Aquarius Data Correction window.

17. Once the data for both loggers have been appended with grade and approval set, check the online Aquarius web data portal on IRMA to make sure it appears correctly. This can be found at: <https://irma.nps.gov/aqwebportal/>
18. Use the map to find the location you want view. Select the site (Figure 13).

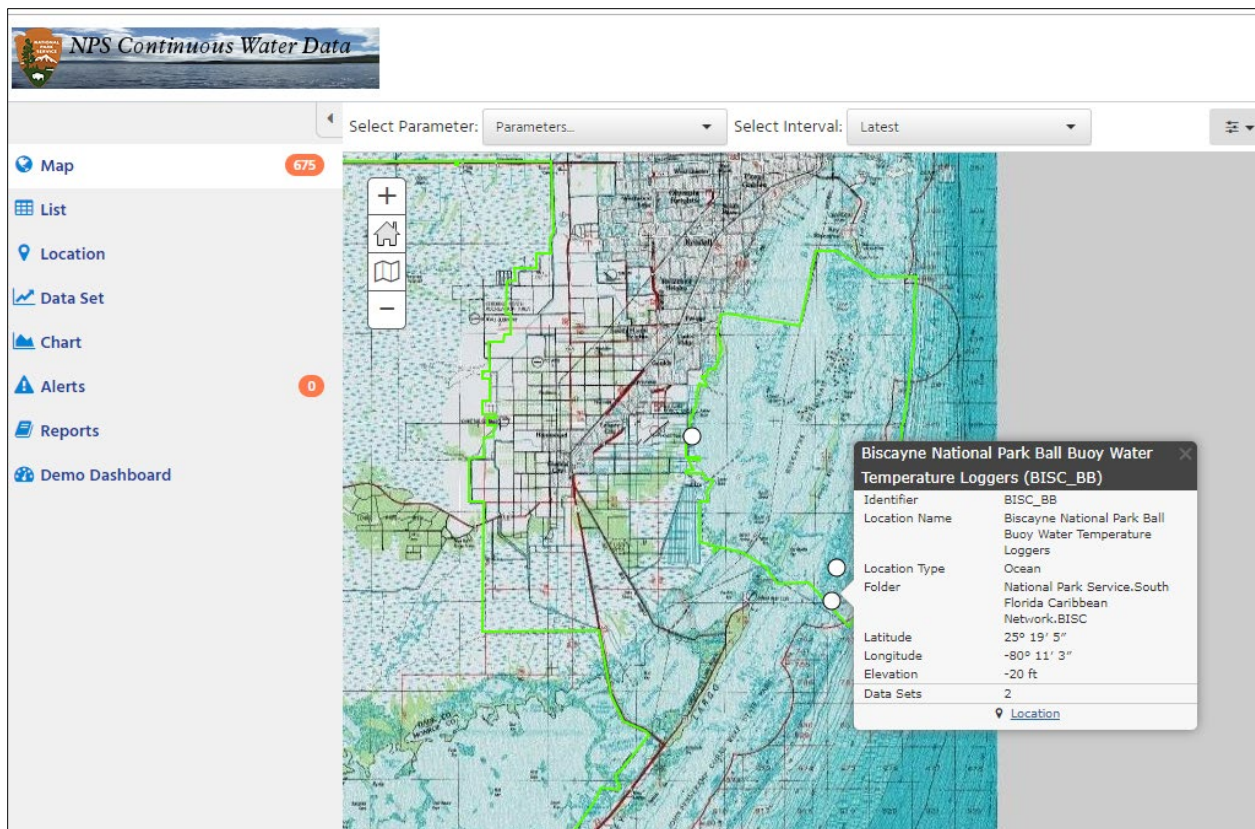


Figure 13. A screenshot showing the Aquarius Web Portal in Map View.

19. From the menu at the left side of the screen, select “Data Set.” On the main screen, look at the “End of Record” and “Last Updated” sections on the screen. The “End of Record” time stamp should be when the logger was last downloaded, i.e. the end of the data set. The “Last Updated” timestamp should be when the online portion of the Aquarius database was last updated (Figure 14). Please note that there may be a delay between when you complete your edits in Springboard and when they show up on the web data portal. An automatic service on the Aquarius server attempts to synchronize the web portal database every five minutes, but sometimes IT updates prevent this from occurring. If the updated data do not appear within 24 hours, please reach out to the SFCN data manager or directly to Dean Tucker (dean_tucker@nps.gov).

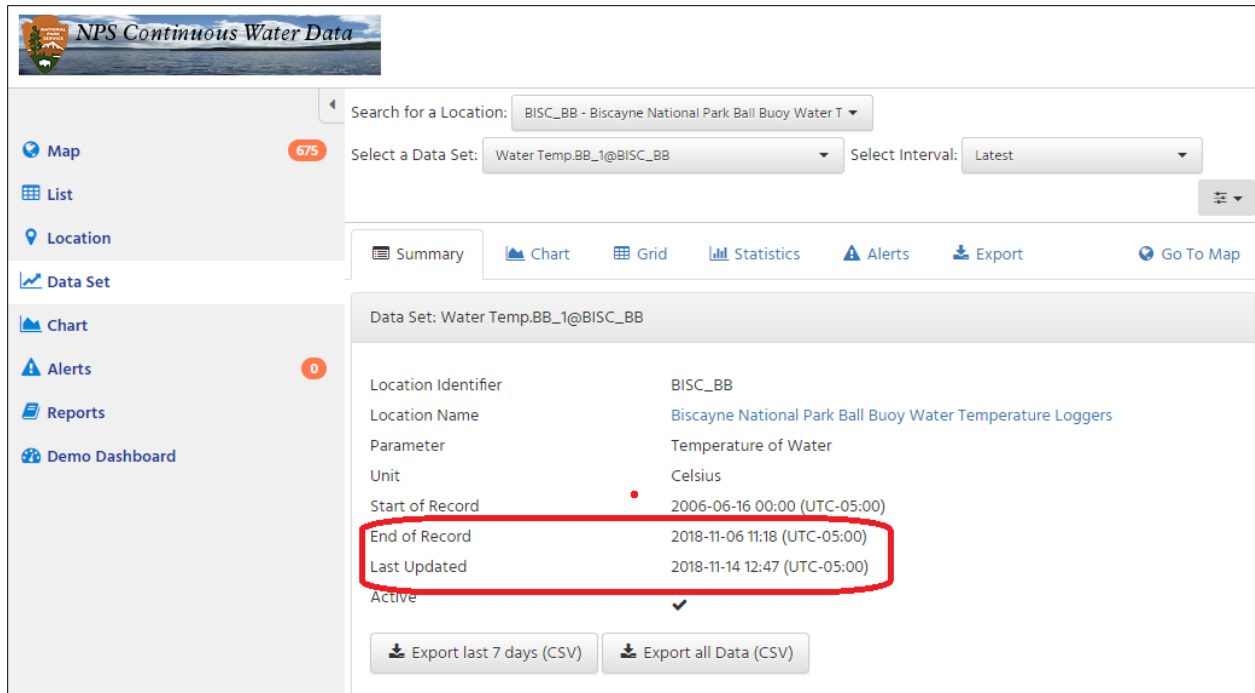


Figure 14. A screenshot showing the Aquarius Web Portal in Data Set View. The Summary tab is selected with the End of Record and Last Updated information highlighted.

20. From the same window, you can also select the Chart view to see the whole data set in graphical form (Figure 15):

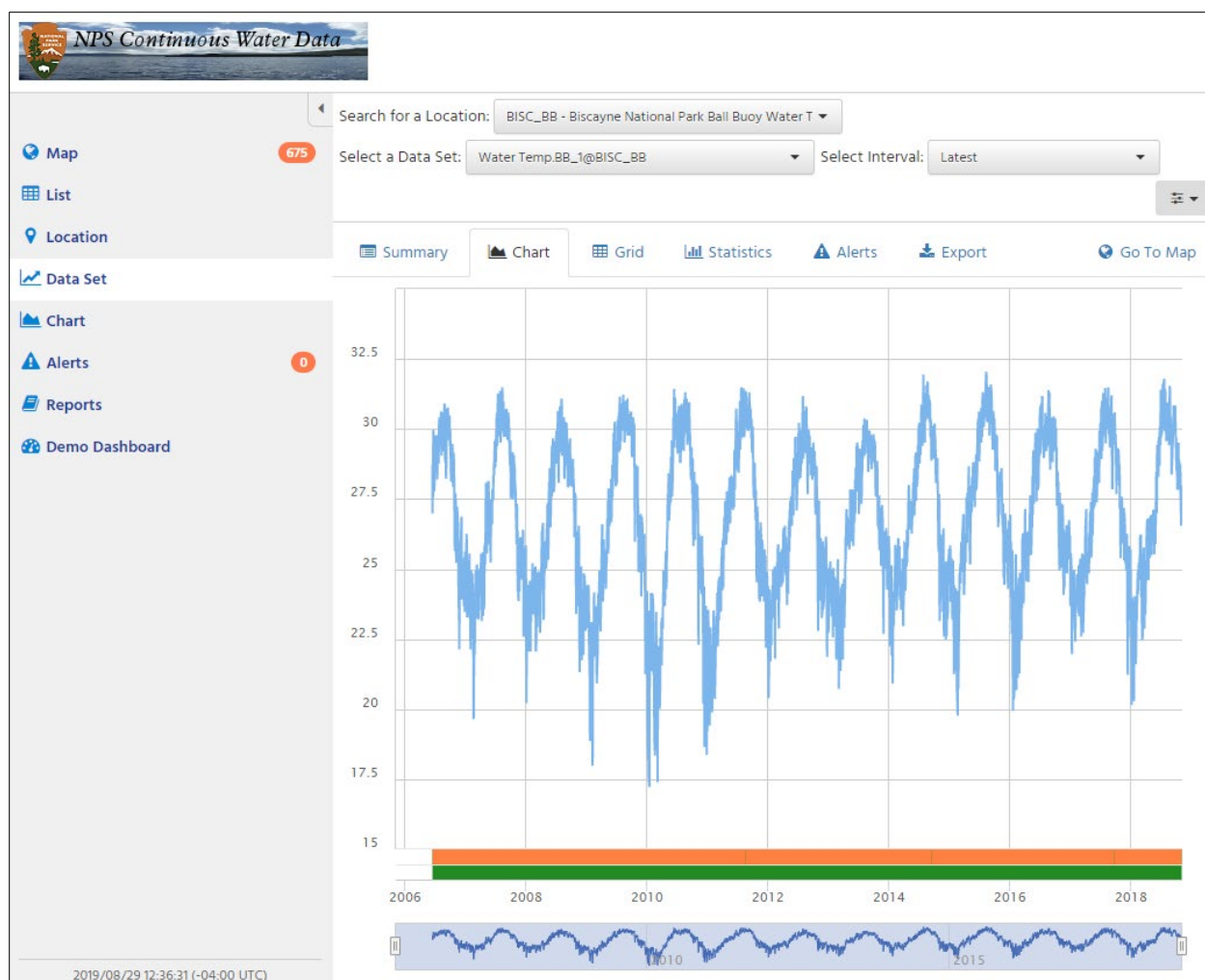


Figure 15. A screenshot showing the Aquarius Web Portal in Data Set View. The Chart tab is selected showing a graphical representation for the specified data set.

21. Once the data have been successfully uploaded into Aquarius, the *.csv and *.hobo files are stored on the server in the “Archive” subfolder found in the appropriate site folder:

Z:\SFCN\Vital_Signs\Coral_Reef_Water_Temperature\data\sites

Literature Cited

South Florida/Caribbean Network. 2020a. Importing data to Aquarius database—Version 1.0. South Florida/Caribbean Network Standard Operating Procedure NPS/SFCN/SOP—WT12. South Florida/Caribbean Network, Palmetto Bay, Florida. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2278941> (last accessed November 2020).

South Florida/Caribbean Network. 2020b. Reports, graphing, and web page data—Version 2.0. South Florida/Caribbean Network Standard Operating Procedure NPS/SFCN/SOP—WT09. South Florida/Caribbean Network, Palmetto Bay, Florida. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2278939> (last accessed November 2020).