NEON Standard Operating Procedure: Aqua & Level TROLL Data Management Procedure

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See configuration management system for approval history.

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Change Record

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A	09/11/2019	ECO-06240	Initial release.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1 DESCRIPTION

1.1 Purpose

The purpose of this document is to provide Field Science and HQ Repair Lab standard instructional guidance on how to enable and disable logging, in addition to downloading, storing and transferring data for both In-situ, Inc. Aqua and Level TROLLs.

1.2 Scope

The operating procedures herein apply to managing data for In-situ, Inc. Aqua TROLL 200 and Level TROLL 500 sensors at stream, lake and river Aquatic Instrument Sites (AIS). Data management procedures include data collection (logging), transmission and storage (downloading the data from log files and transferring them to the network drive) using Win-Situ 5 software.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

The following applicable documents (AD) contain mandatory requirements and/or supplementary information that are directly applicable to the topic and/or procedures herein. Visit the NEON Document Warehouse for electronic copies of these documents.

AD [01]	NEON.DOC.004362	NEON Preventive Maintenance Procedure: AIS Groundwater Level Sensor
AD [02]	NEON.DOC.004361	NEON Preventive Maintenance Procedure: AIS Surface Water Level Sensor

2.2 Reference Documents

The reference documents (RD) listed below may provide complimentary information to support this procedure. Visit the NEON Document Warehouse for electronic copies of these documents.

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms
RD [03]	NEON.DOC.001175	NEON Sensor Command, Control, and Configuration - Level TROLL
RD [04]	NEON.DOC.001173	NEON Sensor Command, Control, and Configuration - Aqua TROLL
RD [05]	NEON.DOC.004471	WATER LEVEL/ CONDUCTIVITY/ TEMPERATURE, GROUNDWATER WELL FORMAL VERIFICATION PROCEDURES
RD [06]	NEON.DOC.004419	Stream or Lake Water Level Formal Verification Procedure
RD [07]	NEON.DOC.003880	NEON Preventive Maintenance Procedure: AIS Stream Infrastructure
RD [08]	NEON.DOC.004886	NEON Preventive Maintenance Procedure: Aquatic Portal & AIS Device Posts

2.3 External References

The external references (ER) listed below contains supplementary information relevant to this procedure. These documents are external to the NEON program and Battelle.

ER [01]	In-Situ, Inc. Win-Situ 5 Software. *https://in-situ.com/support/documents/win-situ-5-software/*
ER [02]	In-Situ, Inc. YouTube Channel, Win-Situ5 Software Training Instructions. *https://www.youtube.com/watch?v=umfmSOWohf4*
ER [03]	In-Situ, Inc. TROLL Com Communication Device Instruction Sheet – Combined. 0056142 rev 001 01/09 *https://in-situ.com/wp-content/uploads/2016/01/TROLL_Com_Communication_Devices_Instruction_Sheet.pdf*

2.4 Acronyms

.csv	comma-separated values
.wsl	windows subsystem for Linux

A/R	As Required
AIS	Aquatic Instrument Site
AQU SCI	Aquatic Science
C	Celsius
CARI	Caribou Creek, Caribou-Poker Creeks Research Watershed
CFG Location	Configured Location (in Maximo)
GMT	Greenwich Mean Time
GWC	Groundwater Chemistry
GWW	Groundwater Well
kPa	Kilopascal
OKSR	Oksrukuyik Creek
P/N	Part Number
psig	Pounds per square in gauge
S1	Upstream
S2	Downstream
µS/cm	microSiemens
UTC	Coordinated Universal Time

3 OVERVIEW

3.1 Components

This document includes components from the following sensors and parts:

- **0317730000** Sensor, In-Situ Aqua TROLL 200 15 psig Vented Conductivity/Temperature/Water Level Sensor
- **0317680000** Sensor, In-Situ Level TROLL 500 15 psig (gauged) Surface Water Level Sensor
- **0374140000** Sensor Accessory, Troll Battery Pack

3.2 Subsystem Location and Access

Surface water level TROLL sensors and groundwater aqua TROLL sensors reside at both core and relocatable AIS sites. Access to AIS sites require Aquatic PPE and may require a boat.

Level TROLL sensors reside on an anchor at AIS upstream (S1) and downstream (S2) sites, which are near Aquatic Met Station subsystems. Subsystem components reside with the sensor on the infrastructure and/or onshore nearby.

Aqua TROLL sensors reside in groundwater wells (GWWs) and at inlet/outlet lake locations near a lake buoy. Number and location of GWWs vary per site. For lake sites, subsystem components reside with the sensor on the infrastructure and/or onshore nearby. However, for Domain 19 Caribou Creek, Caribou-Poker Creeks Research Watershed (CARI) and Domain 18 Oksrukuyik Creek (OKSR), an Aqua TROLL resides in place of a Level TROLL at both S1 and S2 locations.

4 FIELD DATA MANAGAMENT PROCEDURE

4.1 Equipment

Table 1. Equipment Table

Part Number (P/N)	NEON P/N	Description	Quantity
0051450	0374140000	Sensor Accessory, TROLL Battery Pack	A/R
	HB08410020 0320030020	Subsystem, Groundwater Well, Cable, 20 foot Cable 20 feet length with twist lock connectors on both ends, vented made from TPU. Works with In-Situ Aqua TROLL and Level TROLL sensors.	A/R
0056140		RS232 TROLL COM Cable Connect (See ER [03]) Connects to a 9-pin RS232 serial port. Male connector mates with the Twist-Lock connector on the instrument cable	A/R
GENERIC		USB to RS232 Serial Cable	A/R

PRO TIP: *Recommend downloading WinSitu 5 software on a loaner laptop to use in the field to prevent damaging the laptop you use daily for the program or to have the ability to download data or set up logging on Trolls simultaneously.* ***Install USB TROLL Com drivers when installing Win-Situ****.*

4.2 Connect to a TROLL: Communication Settings

The Aqua TROLL and Level TROLL connect to the external battery pack and laptop the same way (Figure 1). *Reference KB0011788 for additional information on connecting a TROLL to external power and basic troubleshooting tips. AD [01] also provides additional information on how to connect the TROLL to your laptop.*

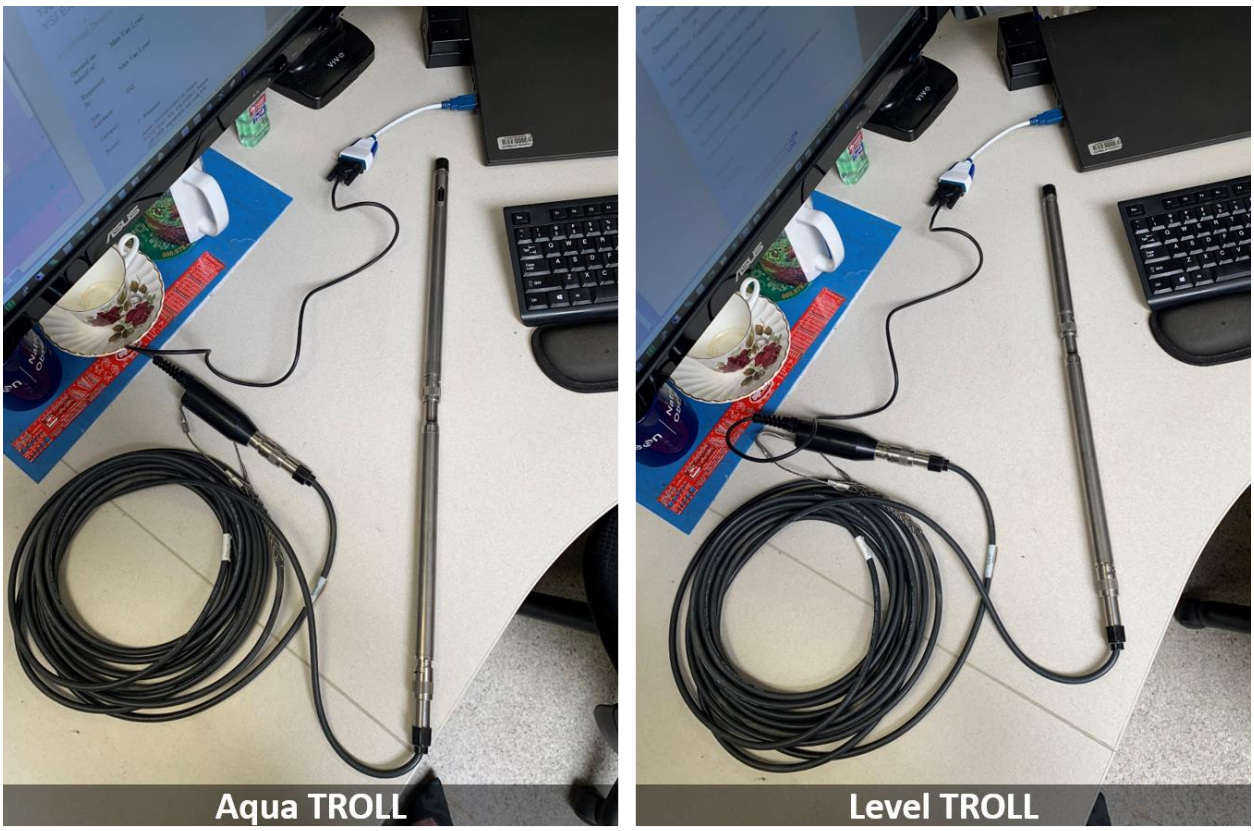

Figure 1. Aqua and Level TROLL Connecting to a Laptop

Important: Verify the TROLL EPROM ID via the settings tab in the software (Figure 2). Ensure it matches what is in Maximo. If you ever use "**Reset all devices**", it may wipe the EPROM ID from the TROLL and require reconfiguration.

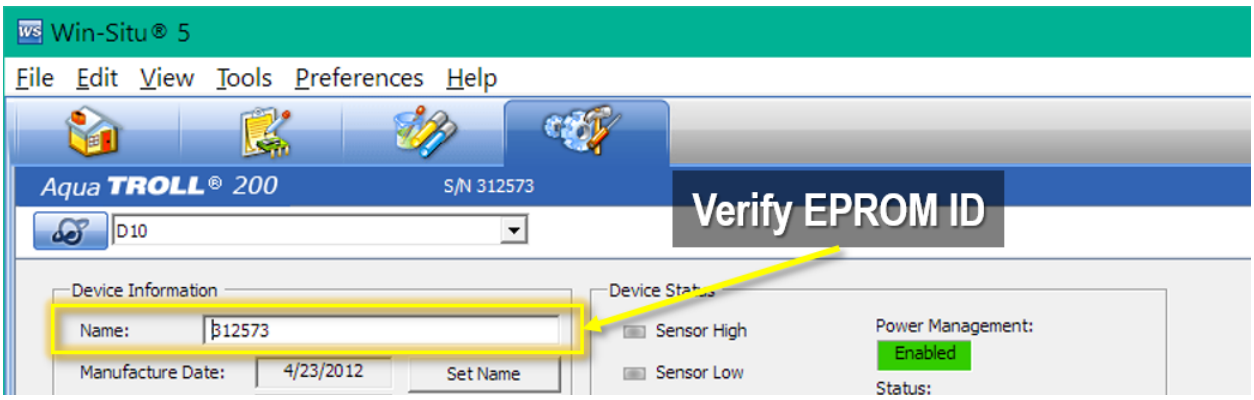

Figure 2. TROLL EPROM ID

1. Synchronize NEON program Laptop time to UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time).

2. Launch the Win-Situ5 software application (Figure 3).

Figure 3. Win-Situ5 Icon

3. A pop-up window may appear asking you to select a COM port for communication if this is your first time opening the software. Select "**No**" (Figure 4).

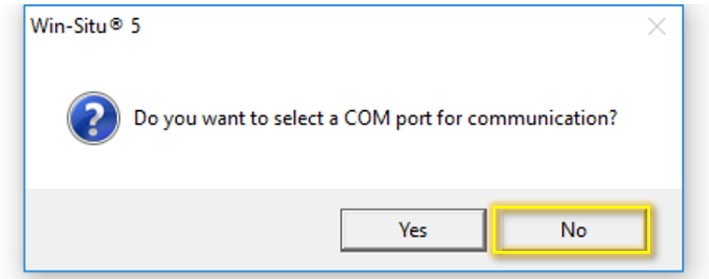

Figure 4. COM Port Pop-up Window

4. The pop-up window most users will experience is one asking if you would like to "**Connect to device now?**" pop-up window. Select "**No**" (Figure 5).

Figure 5. Connect to Device Pop-up Window

5. If a "**Failed to connect at settings: Comm ## Addr: # (ASCII, 9600, 8, N, 1). Do you want to try other common settings?**" pop-up window appears, select "**No**".

6. In Win-Situ5 main program window, select the "**Preferences**" tab in the upper left-hand corner of the screen and select "**Comm Settings…**" from the dropdown options.

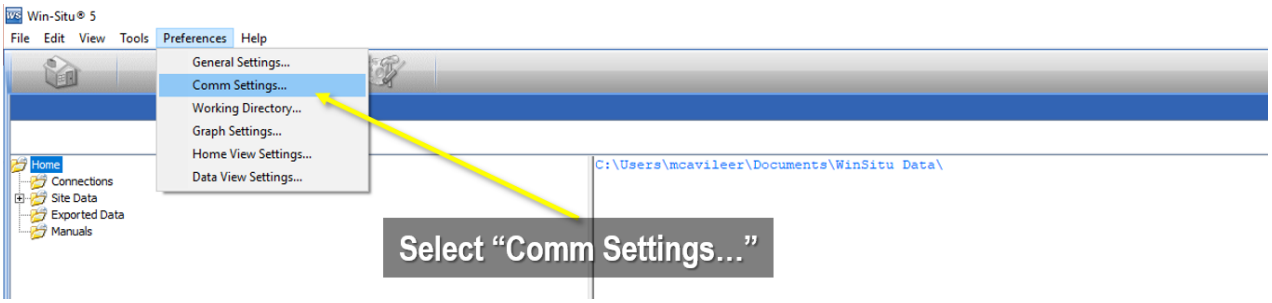

Figure 6. Select "Comm Settings…"

7. In the "Default Communication Settings" window, set the following serial communication settings in Figure 7.

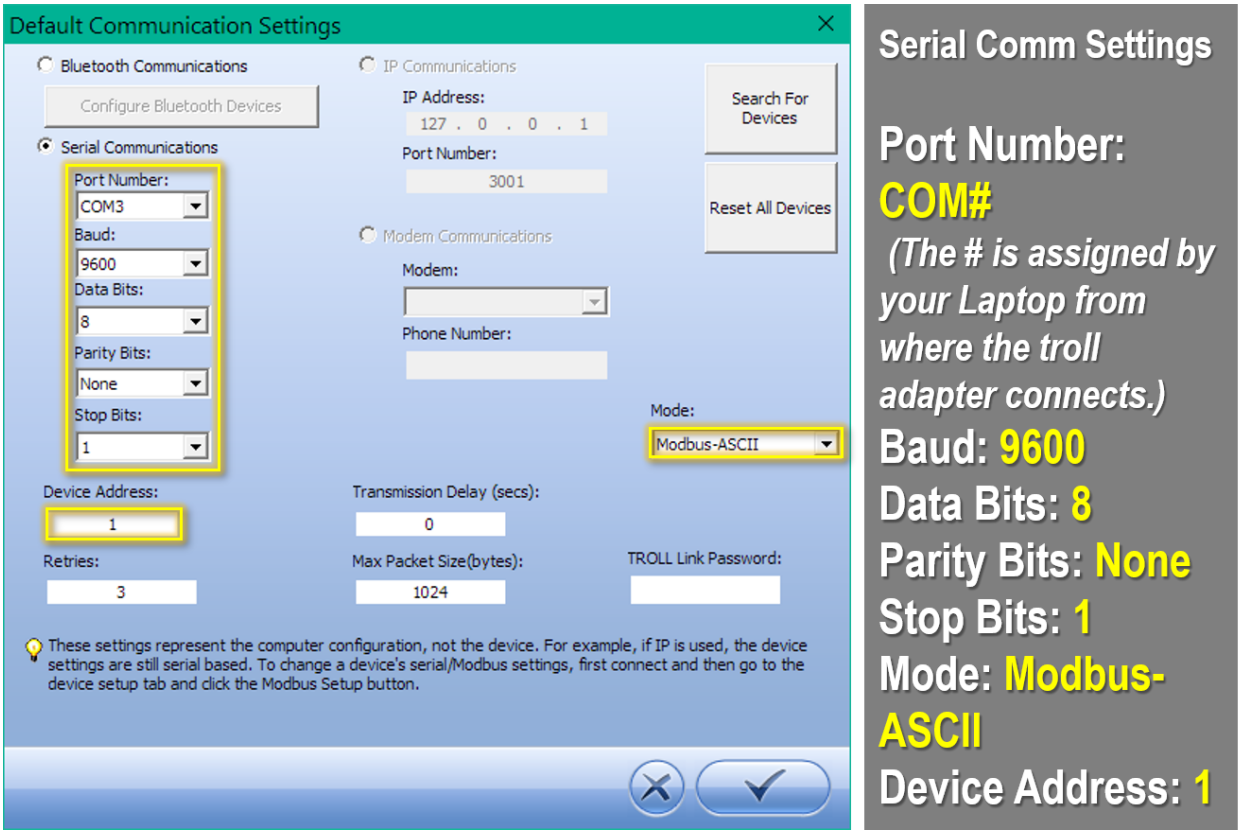

Figure 7. Configure Default Communication Settings

PRO TIP: *The **Port Number (COM#)** varies across computers. It may also vary from the connector selected for use. To determine which port you are using or verify the port the computer is using is correct, check the **Device Manager** settings.*

IMPORTANT: CVAL configures the TROLLS **Device Address** to "**1**" as a default setting. If FOPS is initially connecting to an Aqua or Level TROLL from HQ to configure its settings, the **Device Address** must be "**1**". However, post-installation and verification of the sensor, the **Device Address** may correspond to the GWW, Stream or Inlet/outlet number (e.g., for example, the **Device Address** for an Aqua TROLL at GWW 4 is "**4**" instead of "**1**" or S**2** is "**2**"). Reconfigure the Aqua TROLL back to "**1**" prior to shipping the instrument back to CVAL for Sensor Refresh. If you cannot connect to the Aqua TROLL, try another number. DO NOT HIT "**RESET TO DEFAULT**" unless you know the sensor EPROM ID. This is the nuclear option and wipes the sensor configuration in accordance with RD [03] from the sensor. If you use "**RESET TO DEFAULT**", reconfigure the sensor per RD [04]. Submit an informational ServiceNow ticket to CVAL with screenshots of the sensor configuration post-reconfiguration.

4.3 Battery Management

Monitor the internal and external battery usage of the Aqua and Level TROLL via the External and Internal Voltage level. The sensor may not be reliable when the battery reaches below 40%. Table 2 provides the internal and external voltage level of each TROLL and the external battery pack in millivolts.

Table 2. TROLL & External Battery Pack Voltage Specifications

Device	Millivolts
Aqua TROLL Internal Voltage	3600 (3.6VDC)
Level TROLL Internal Voltage	3600 (3.6VDC)
TROLL External Battery Pack	14000 (14VDC)

1. Check the internal and external voltage by navigating to the **Settings** tab in WinSitu and selecting the **Diagnostics** button (Figure 8). This is the same for both the Aqua and Level TROLL.

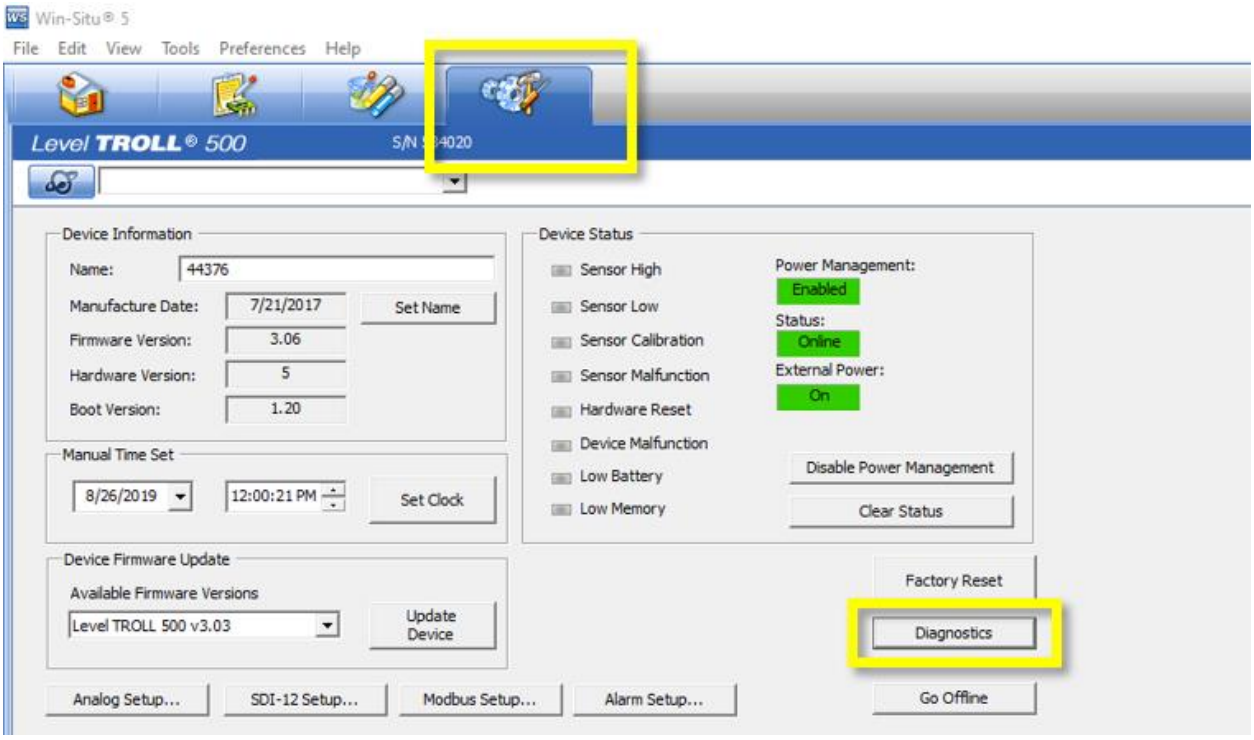

Figure 8. Navigate to the Settings Tab and Select Diagnostics to Check Internal and External Voltage

2. In the **Diagnostics** pop-up window, monitor and verify the **External Voltage** and **Internal Voltage** under the **Device Settings** section for each TROLL (Figure 9). In Figure 9, the Aqua TROLL Diagnostics is on the left and the Level TROLL Diagnostics is on the right.

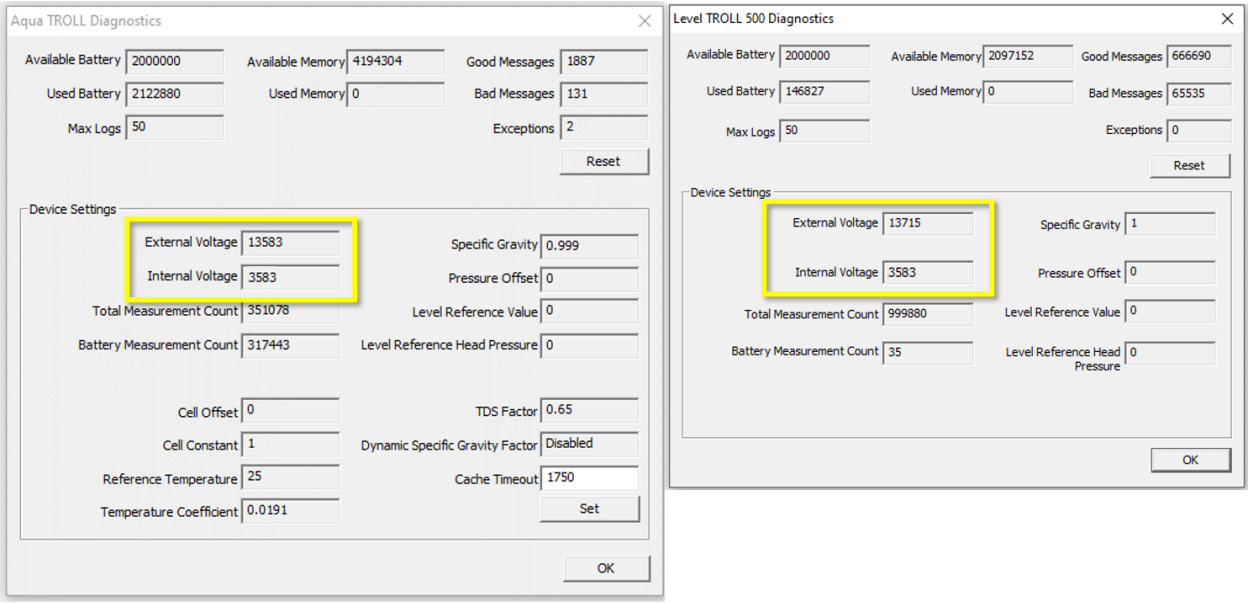

Figure 9. Aqua TROLL (left) and Level TROLL (Right) Diagnostics Window to Verify External & Internal Voltage Levels

The TROLLs start become unreliable at around 40%; therefore, when the TROLLs internal voltage reaches 50%, which his 1800 millivolts, and an external battery source is unavailable, request a new Aqua or Level TROLL as soon as possible.

3. Click "**OK**" to close the Diagnostics pop-up window.

4.4 Enable Logging Procedure

Enable logging on TROLLs to act as a redundancy to collect data to fill in data gaps at sites with alternate power options (e.g., Fuel Cells), poor data availability, in addition to ensuring data collection continues during local area power outages and/or in the event of poor solar productivity for sites that rely on solar energy for power.

***Note**: Logging may drain the internal battery on the sensor. This constitutes as irreparable damage to the sensor and the site must request a new Aqua TROLL assembly. Monitor the internal and external battery usage using the instructions in Section 4.3. If the internal battery is below 40% and an external power source is unavailable, request a new Aqua or Level TROLL ASAP. Do not stop logging on the TROLL. (An external battery pack is likely to revive the internal sensor battery and enable you to pull the log files from the sensor. If unable to revive a dead TROLL with an external battery pack, submit a trouble ticket.)*

1. Launch the Win-Situ 5 software.
2. Select the **Logging** tab in the upper right-hand corner of the window (Figure 21).

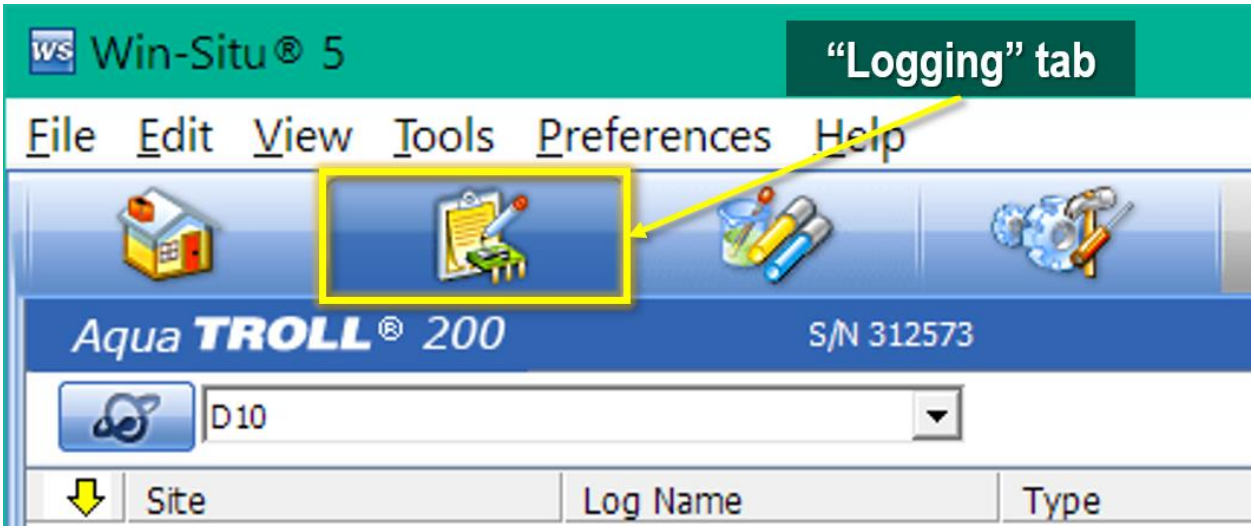

Figure 10. Select the "Logging" Tab

3. Create a new Log by clicking on the **Document** icon in the lower left-hand corner of your screen (Figure 11).

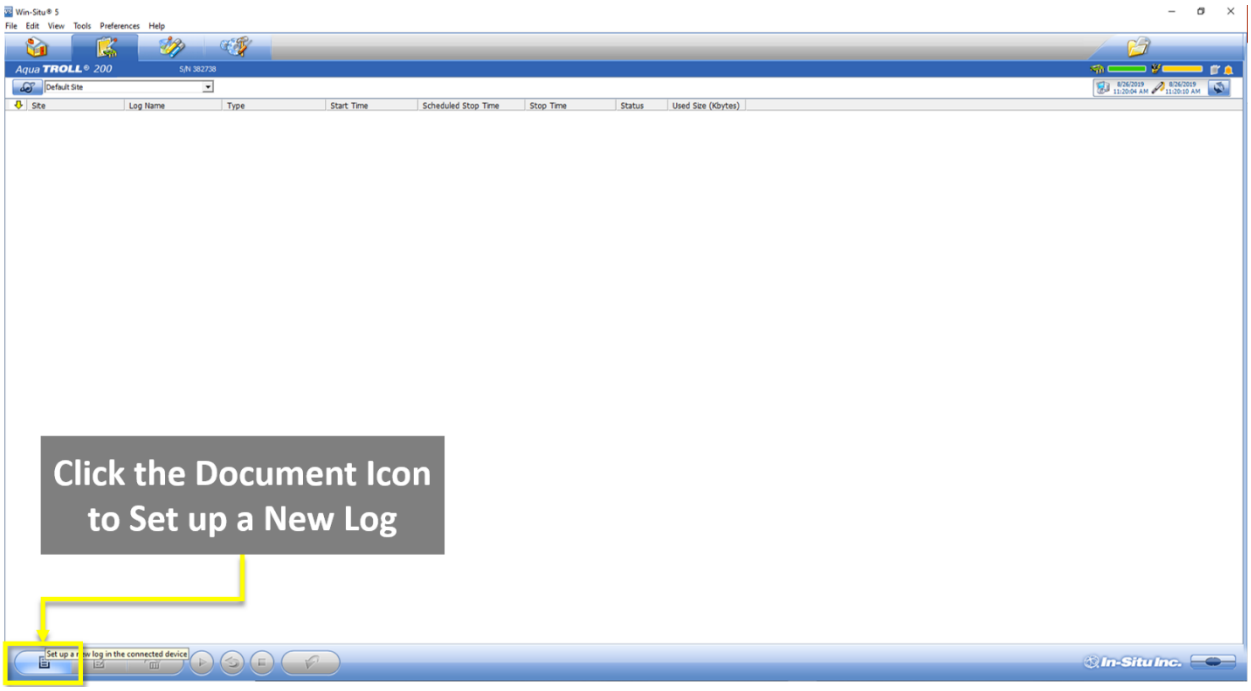

Figure 11. Create a New Log by Clicking on the Document Icon in the Lower Left-hand Corner

4. In the **Logging Setup Wizard** window, select your **Site Name** from the dropdown options and name the log file in the **Log Name** field (Figure 12). *See Section 4.9 Add Site Name Procedure on page 24 if your Site Name is not available from the dropdown list.*

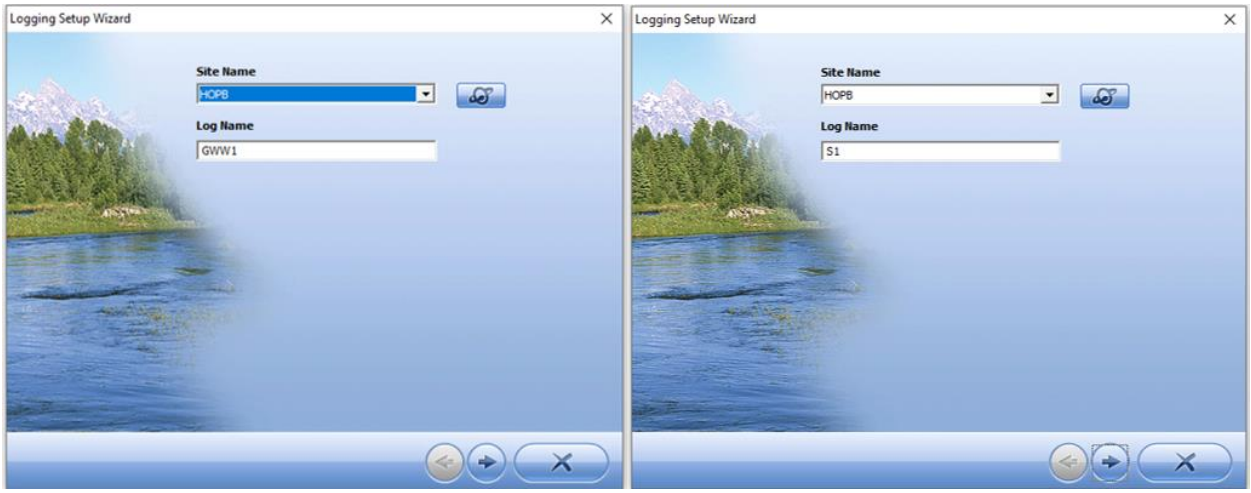

Figure 12. Select Site and Name the Log File

5. Set the parameters and units to log for the Aqua or Level Troll referencing the information in Table 3 and Table 4. Each parameter you select requires a unit selection. After selecting parameters, select a unit from the dropdown for each parameter under **Log parameters and order** field (Figure 13).

Table 3. Aqua TROLL Log Parameters and Units

Aqua TROLL Log Parameter	Unit
Pressure	Kilopascal (kPa)
Temperature	Celsius (C)
Actual Conductivity	microSiemens (µS/cm)

Table 4. Level TROLL Log Parameters and Units

Level TROLL Log Parameter	Unit
Pressure	Kilopascal (kPa)
Temperature	Celsius (C)

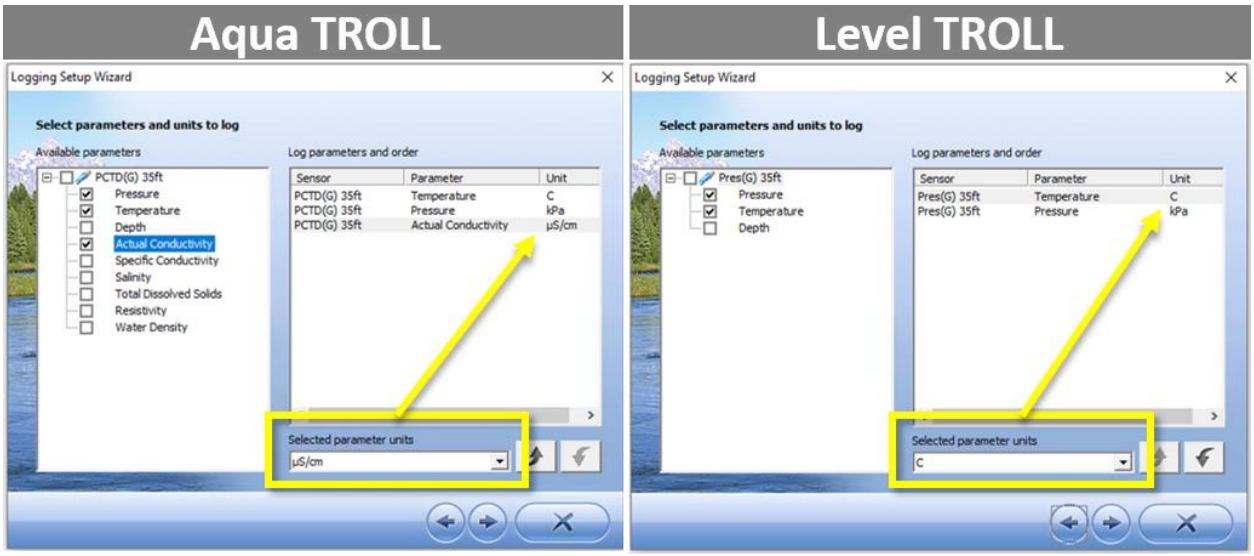

Figure 13. Set the Parameters and Units to log for the Aqua (Left) or Level TROLL (Right)

6. Under **Choose a logging method** (Long-Term Monitoring), select **Linear Average** for Aqua TROLLs and **Linear** for Level TROLLS (Figure 14).

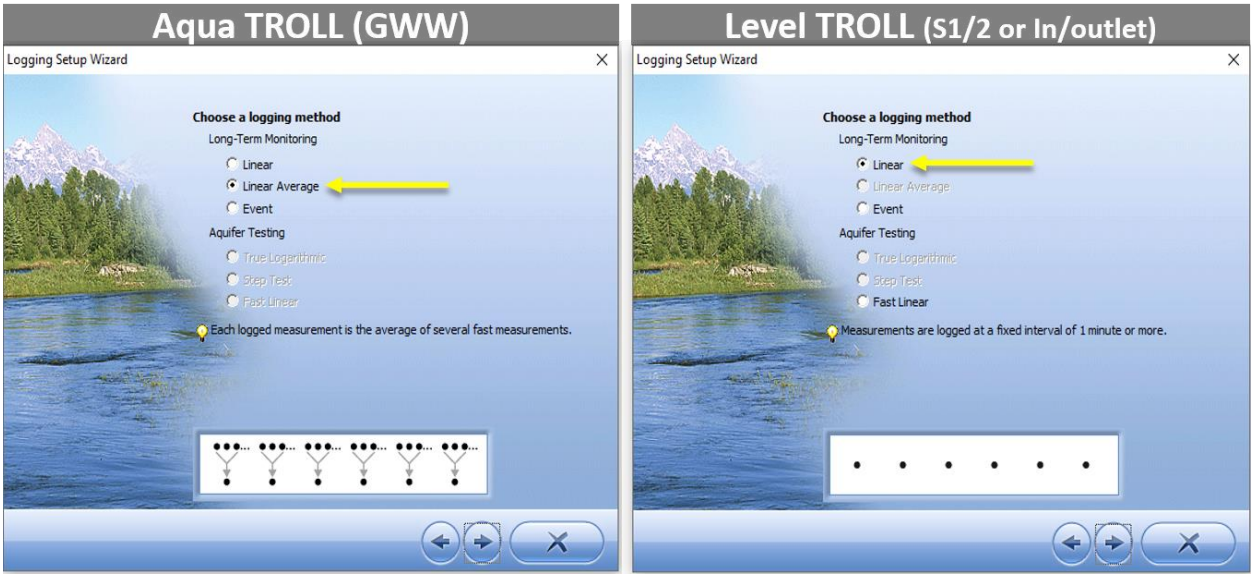

Figure 14. Choose a Long-Term Logging Method - Linear Average for Aqua TROLL & Linear for Level TROLL

7. Set up the number of measurements for the Aqua TROLL or Level TROLL (Figure 15).

   a. GWW Aqua TROLL: Take **3** measurements at an interval of **15** seconds and log an average every **5** minutes.

   b. Lake/Stream (CARI/OKSR) Aqua TROLL: Take **3** measurements at an interval of **15** seconds and log an average every **1** minute.

   c. Level TROLL: Take and store a measurement every **1** minute.

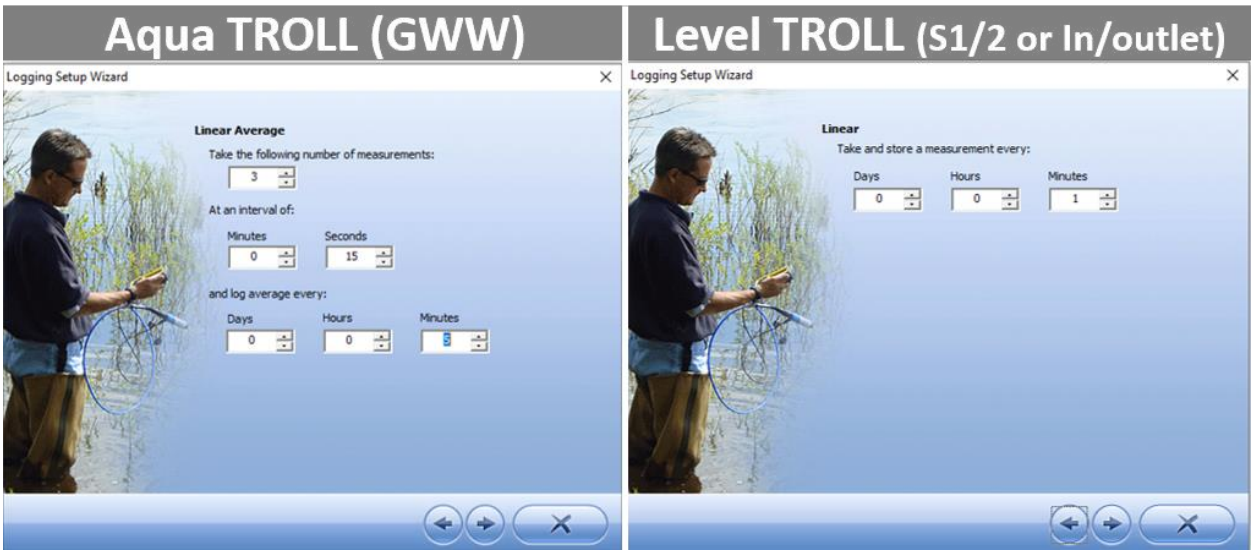

Figure 15. Set the Number of Measurements for each respective TROLL

8. In the pop-up warning about excessive battery use, select "**Yes**" (Figure 16).

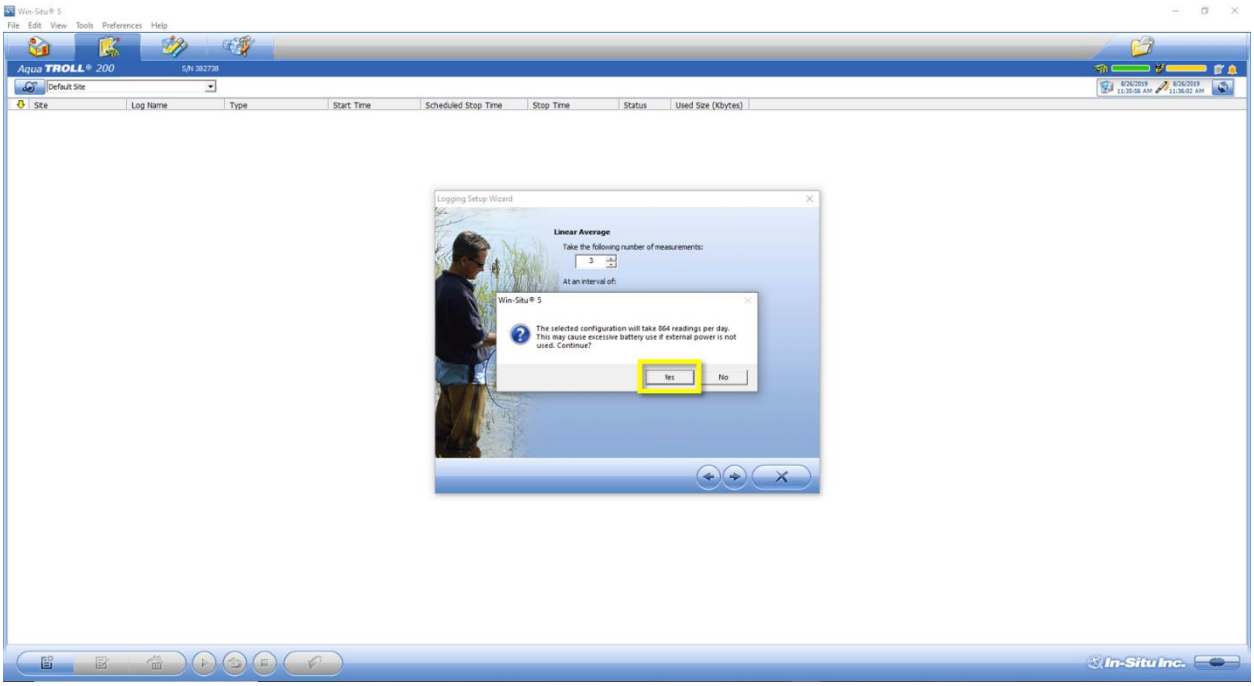

Figure 16. Ignore the Pop-Up Window & Click "OK"

9. Select **Scheduled Start for** the **Start Condition** (Figure 17). *The **Start Time** must start on an even five (5) minute interval to align timestamps.* Leave "**None**" for the **Stop Condition**. Leave the **Wrap Condition** blank. Click the "**X**" to continue.

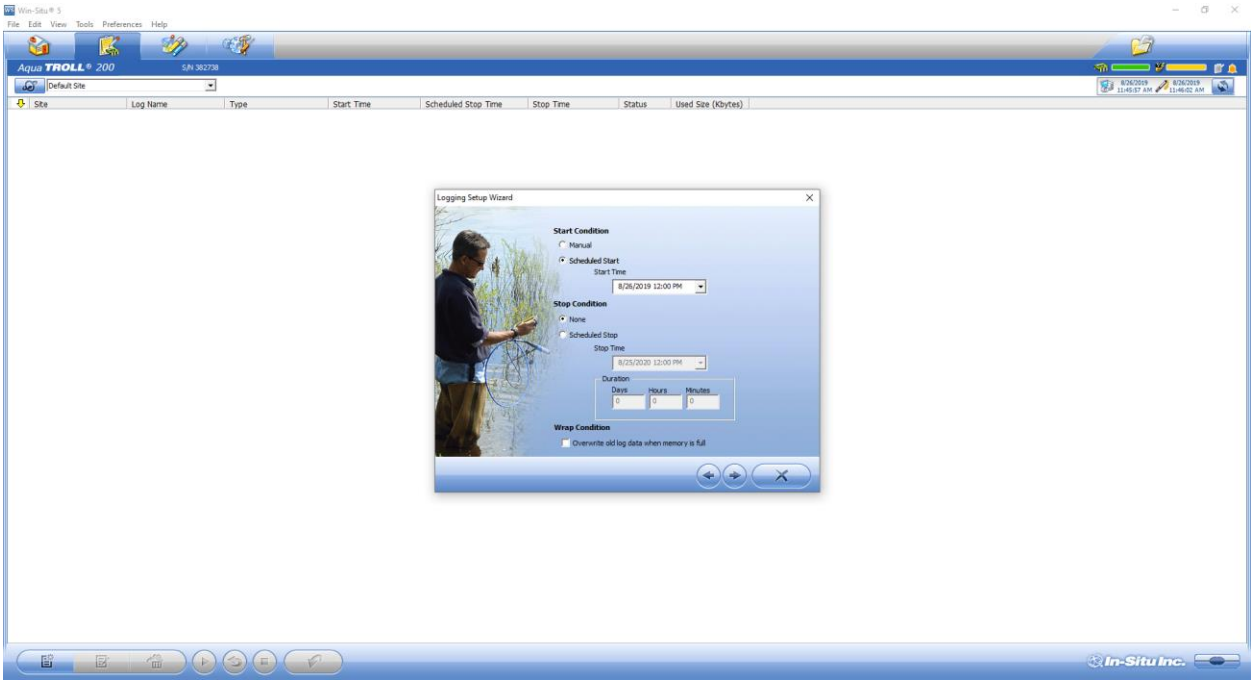

Figure 17. Schedule Start Condition to Start at an Even 5 Minute Interval to Align Timestamps

10. Confirm the logging configuration settings by reviewing the final Summary. Figure 18 provides an example summary for an Aqua TROLL in a GWW and a Level TROLL at a stream site. Click the "**√**" to continue.

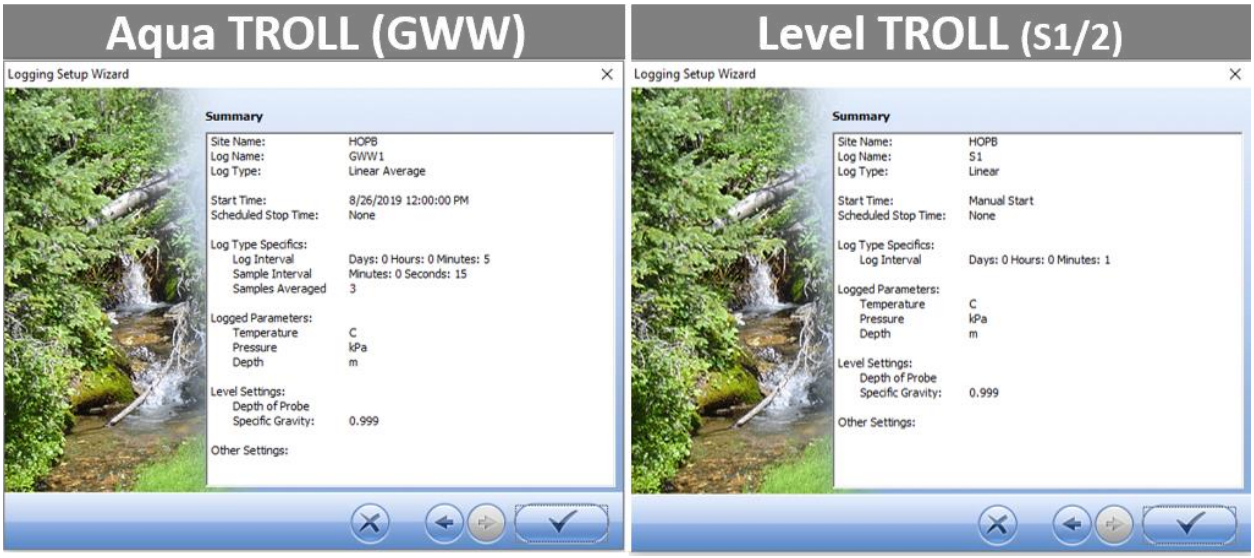

Figure 18. Logging Configuration Summary Examples

11. Once complete, the log file will show up under the logging tab as shown in Figure 19.

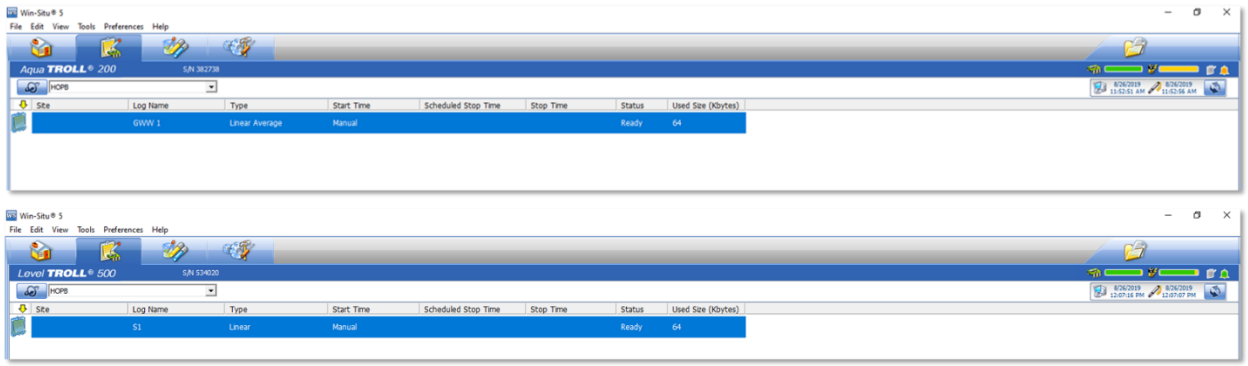

Figure 19. Select Log File - Aqua TROLL (Top) and Level TROLL (Bottom)

After setting the TROLL to log, monitor and verify the data for 24 hours to ensure there are no issues with the sensor data. Conductance L0 data may display abnormal values after configuring or conducting basic maintenance on an Aqua TROLL (see below Figure 20 for an example of this error).

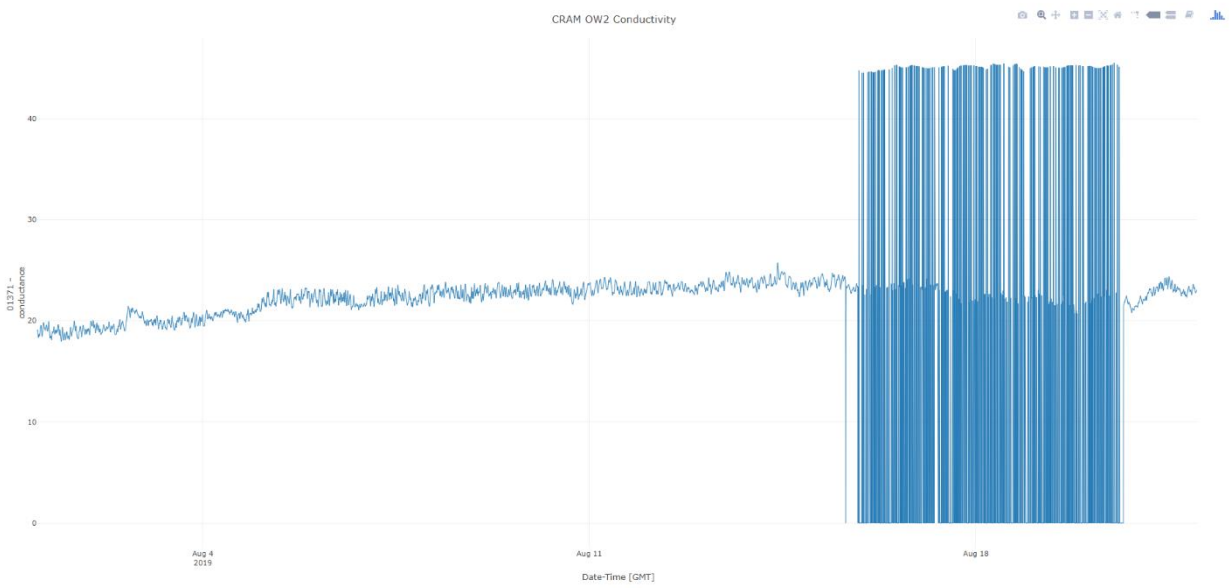

Figure 20. Common Conductivity L0 Data Error

If you notice abnormal values after sensor refresh, groundwater chemistry (GWC) sampling or after updating configuration settings/downloading log data/enabling or disabling logging, report it in ServiceNow via an incident ticket. Establish a data quality iTask for AQU Science listing the dates/times of the abnormal values and troubleshooting steps executed remotely or onsite. A common solution is to power-cycle the sensor via the Grape or by physically disconnecting the cable for a few minutes from the Radio/Comm box onsite.

4.5 Disable Logging Procedure

Disable logging on both the Aqua and Level TROLL sensors prior to shipping them back to HQ for Sensor Refresh or Repair Lab, if applicable. Repair lab tracks and verifies logging was disabled on TROLLs that are received from the field.

12. Launch the Win-Situ 5 software.

13. Select the **Logging** tab in the upper right-hand corner of the window to cease logging (Figure 21). This step is to verify the Aqua TROLL is not logging post-refresh or to turn off logging.

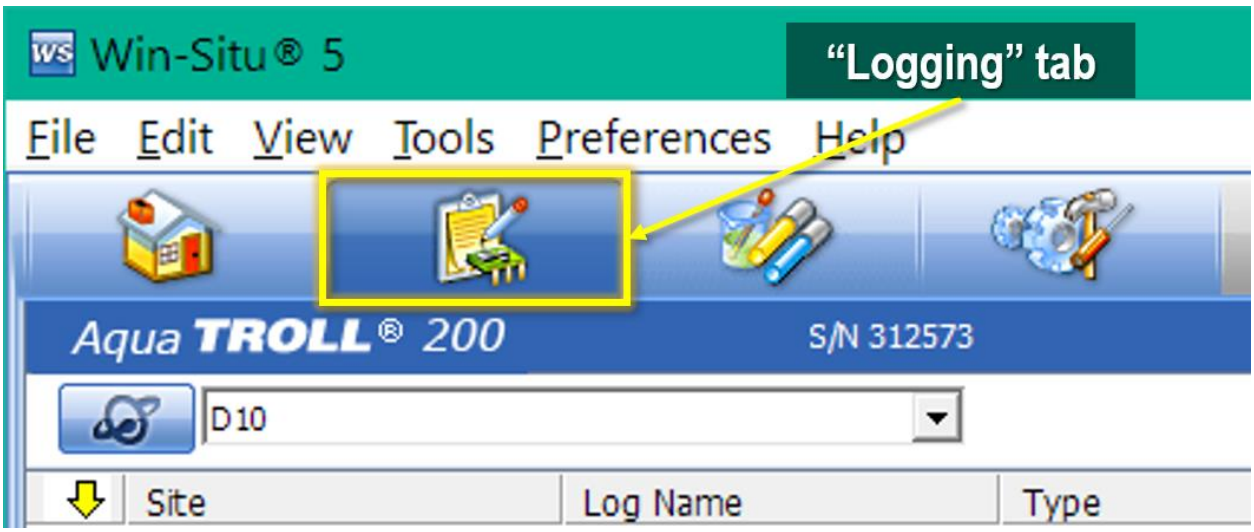

Figure 21. Select the "Logging" Tab

14. Select the log and click the "**Stop**" button at the bottom of the screen (Figure 22).

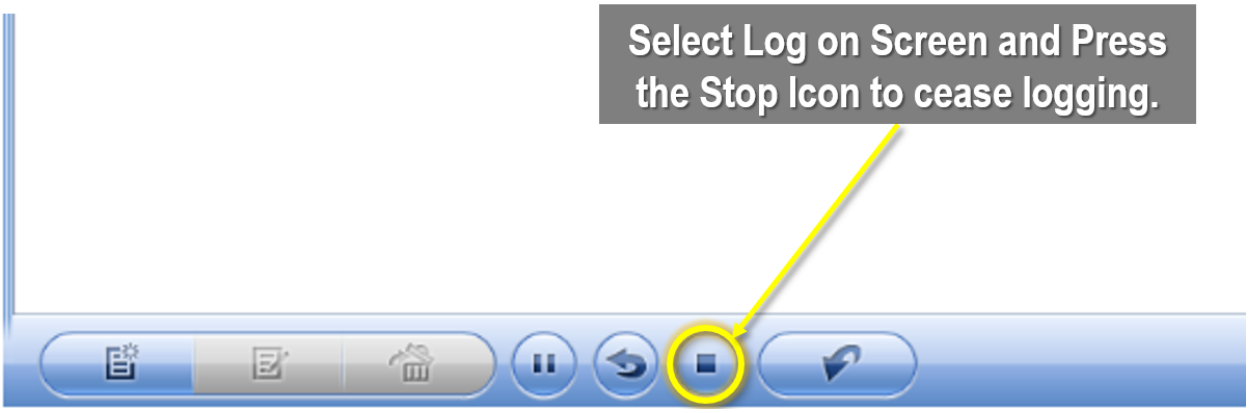

Figure 22. Select the Log File on the Screen and then select the "Stop" Button to Cease Logging

Another way to stop logging is to right click on the notepad icon of the log file and select "**Stop**" from the dropdown menu (Figure 23).

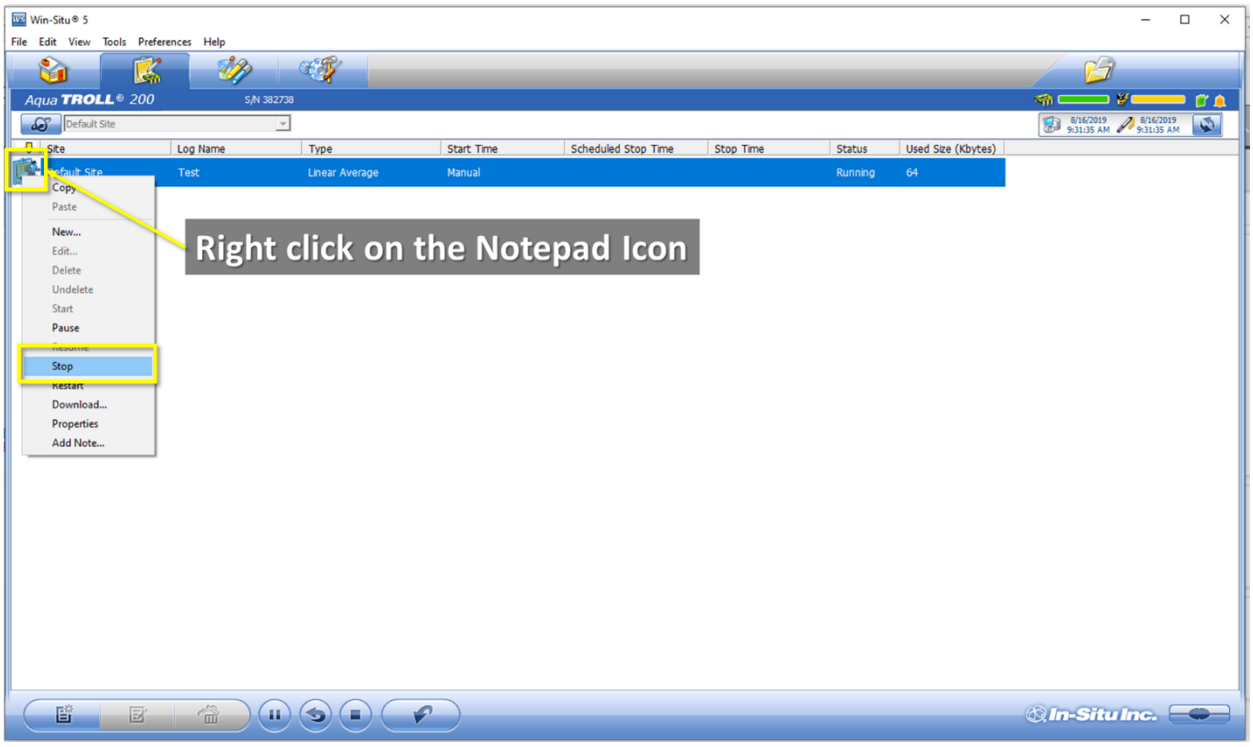

Figure 23. Right Click on the Log File Notepad Icon to also Stop Logging

15. Confirm the sensor is no longer logging data. The file status should change to "Stopped" when logging is disabled (Figure 24).

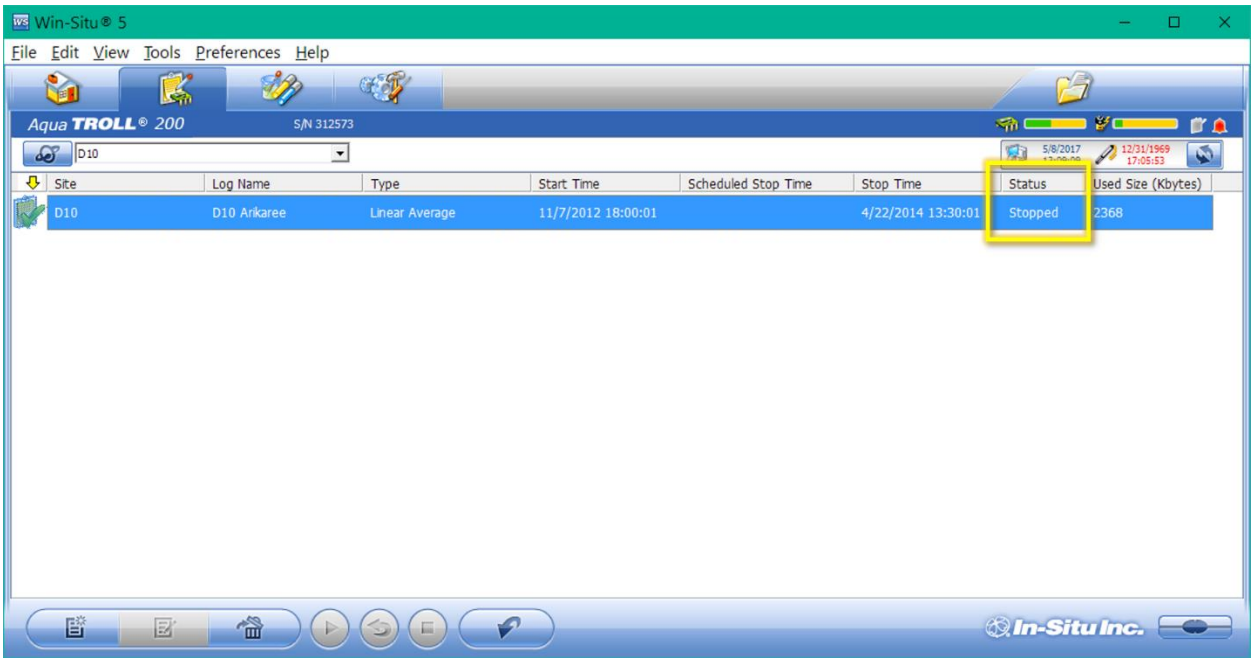

Figure 24. Verify Logging Stopped

4.6 Data Download Procedure

After you stop logging, download the data log files to a laptop to transfer them to the network drive for AQU SCI on a quarterly cycle, meaning every three (3) months (or 12 weeks) ± 2 weeks. This is subject to change depending on information gleaned from implementation, such as the time it takes to transfer the log files from the sensor or issues resulting from environmental/site variables. If there is no power at the site (i.e. TECR), download during biweekly PMs. Note the exact time you download the file and report it to AQU SCI (AQU SCI is testing time zone).

1. To download data from a TROLL to a NEON program laptop, select the log file and then select the downward pointed arrow from the bottom banner of the screen (Figure 25).

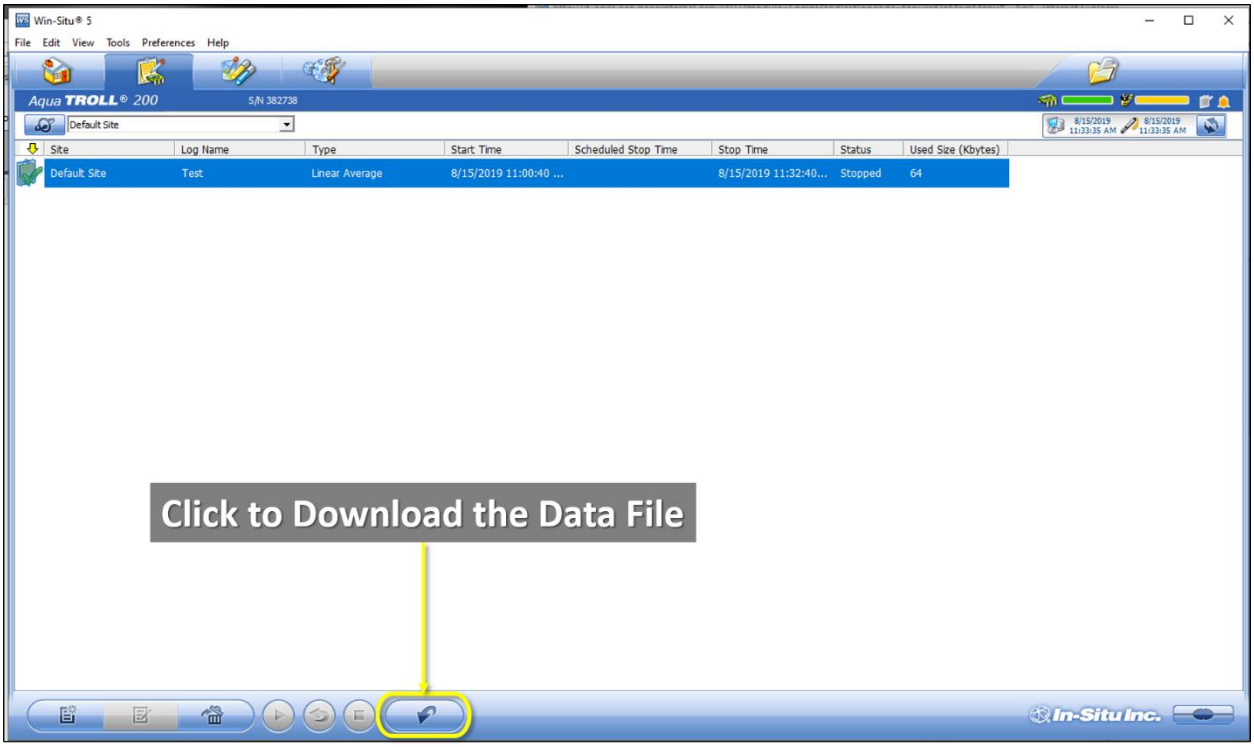

Figure 25. Select the Log file and then the Downward Pointed Arrow to Download the Log File Data

2. When the Download Options window appears, select "**Download all data**" and click on the checkmark to initiate the download (Figure 26).

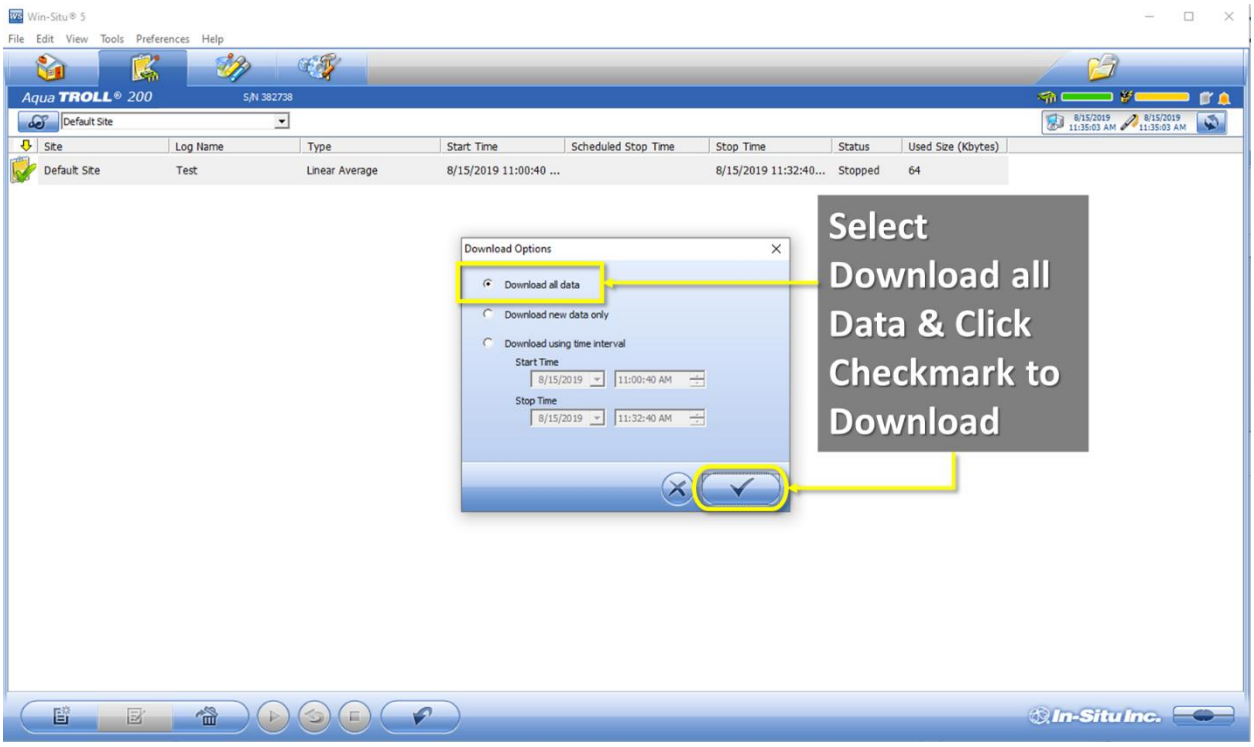

Figure 26. Select "Download all data" and Click on the Checkmark to Initiate Download

3. Once the download is complete, another pop-up window appears to confirm its completion. Click "**OK**" (Figure 27).

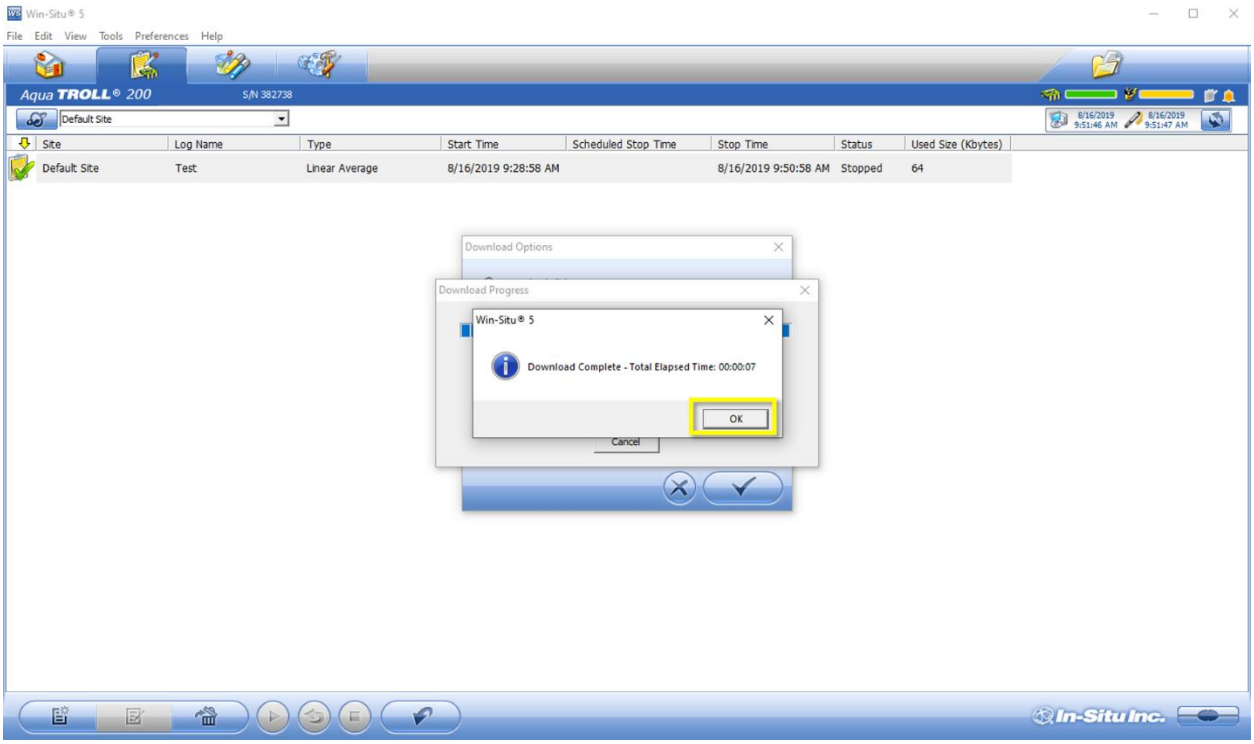

Figure 27. Click "OK" Again to Proceed

4. Another pop-up window appears to ask if you want to view the data. Click "**Yes**" to view the data file (Figure 28).

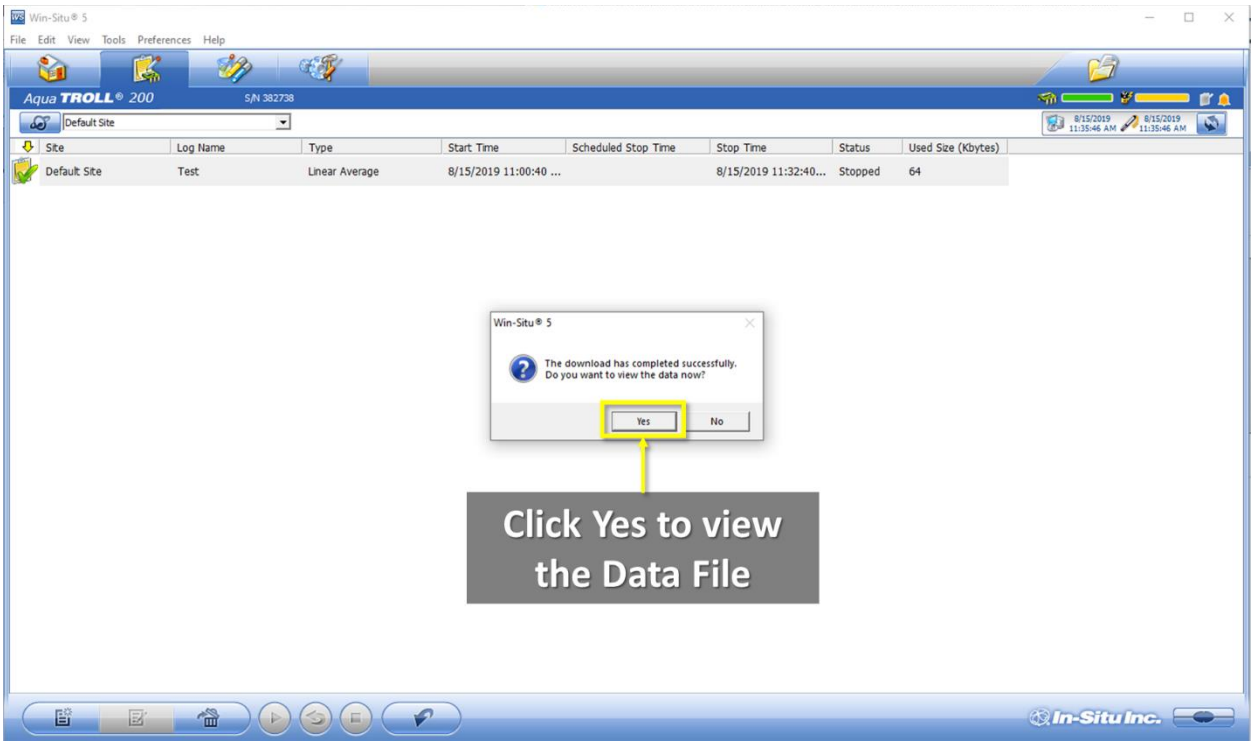

Figure 28. Click "Yes" to View the Data

5. This opens up a data view and your downloaded log file will be listed under your site as a **.wsl** (windows subsystem for Linux) file (Figure 29). This data saves to your C Drive under a **WinSitu Data** folder (Figure 30).

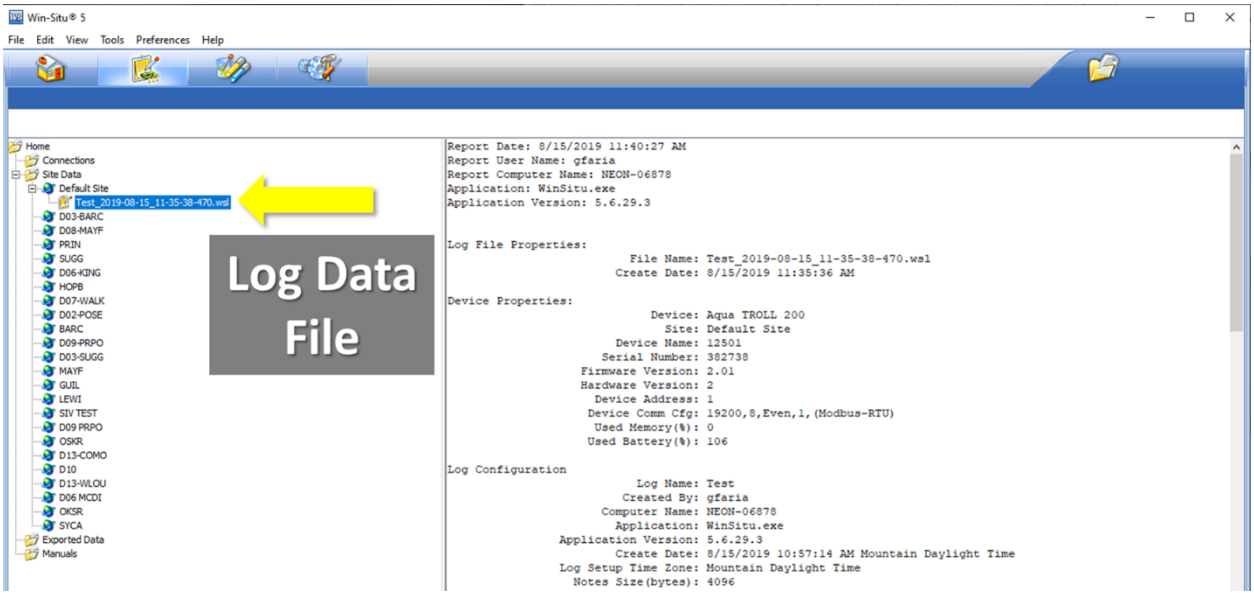

Figure 29. The Log File will be listed under your Site as a .wsl File

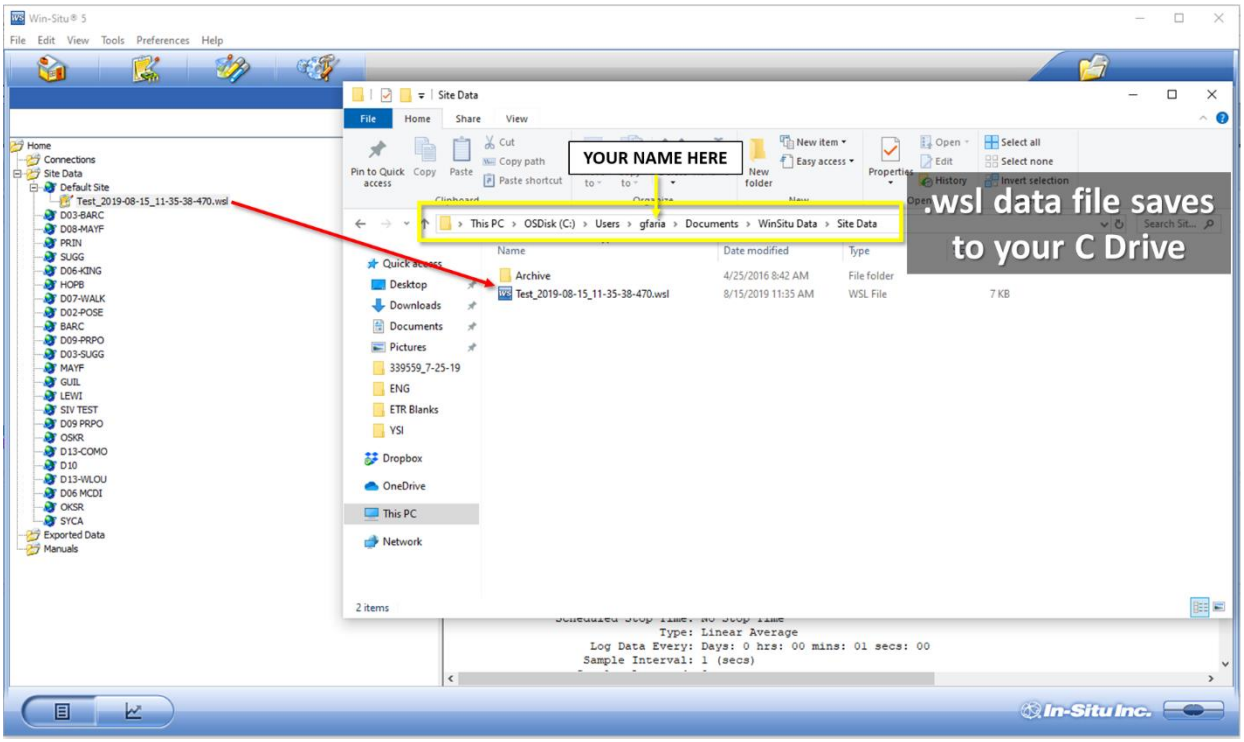

Figure 30. Data Saves to your C Drive under a "WinSitu Data" Folder

6. In order to upload the data file, you need to turn it in a **.csv** (comma-separated values) file. Right click on the data file and click "**Export to CSV**" from the dropdown menu (Figure 31). This saves the data under an **Exported Data** folder on your C drive (Figure 32).

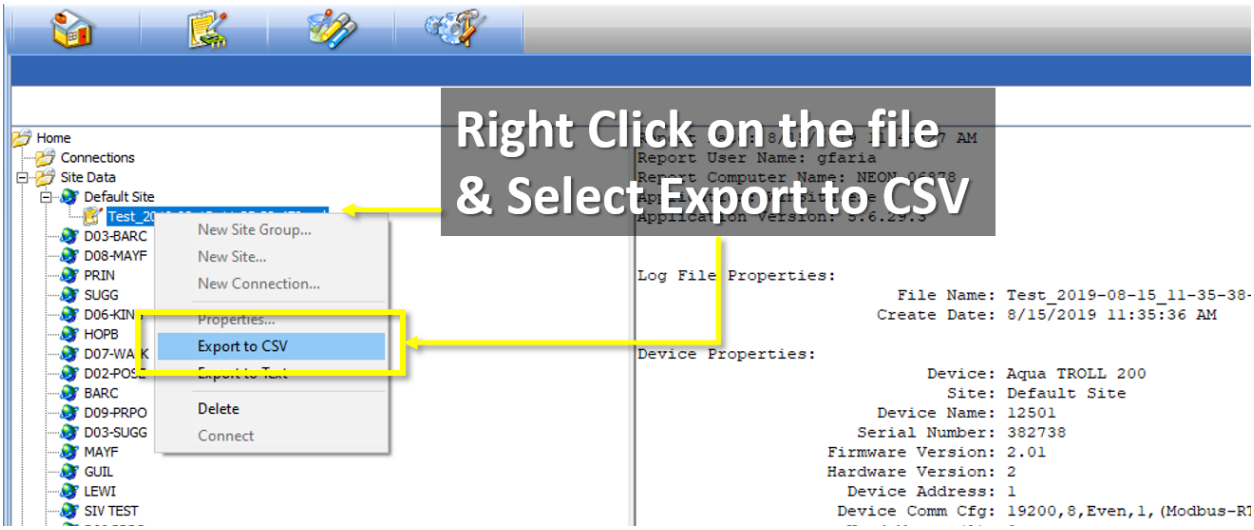

Figure 31. Right Click on the Data File & Select "Export to CSV" from the Dropdown Menu

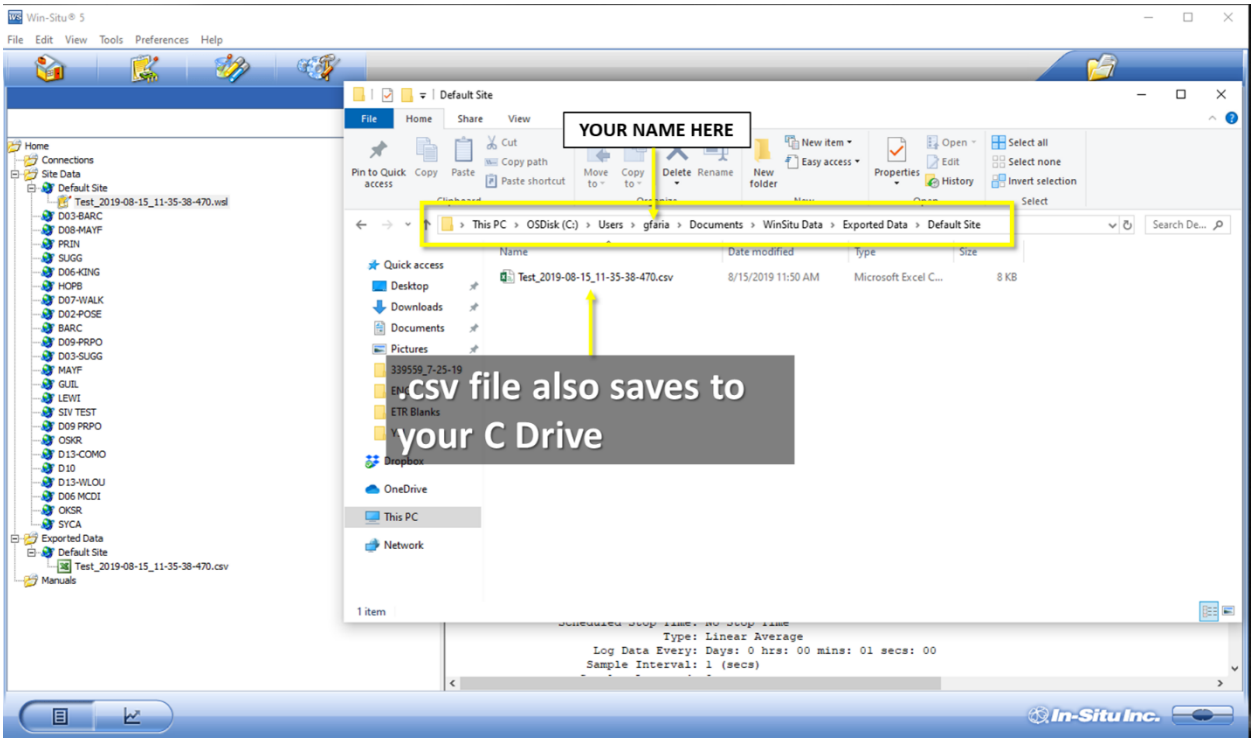

Figure 32. The Data Saves under an "Exported Data" Folder on your C Drive

Use the following naming convention for your .csv data files that you upload to the **Sensor Swap** folder:

- For Aqua Trolls inside Groundwater Wells: **SITE_YYYYMMDD_GWW#**
  (GWW# stands for Groundwater Well 1-8)
- For Aqua Trolls at Lake Inlets/Outlets: **SITE_YYYYMMDD_IN / SITE_YYYYMMDD_OT**
  (IN stands for Lake Inlet or OT for Lake Outlet)
- For Level Trolls at Stream sites : **SITE_YYYYMMDD_S#**
  (S# stands for S1 or S2)
- For Aqua Trolls at D## TOOK ONLY: **SITE_YYYYMMDD_IF/ SITE_YYYYMMDD_OF**
  (IF stands for inflow and OF stands for outflow)

Add a **_2** to the end of the file name if it is a duplicate.

After downloading data file(s) from a TROLL(s), delete the log file and restart logging following the procedure in Section 4.7 and Section 4.4.

4.7 Delete Log File Procedure

After downloading a log file onto your laptop, and you have **confirmed** the data was completely downloaded, delete the file on the sensor.

1. Right click on the notepad icon of the stopped file and select "**Delete**" (Figure 33).

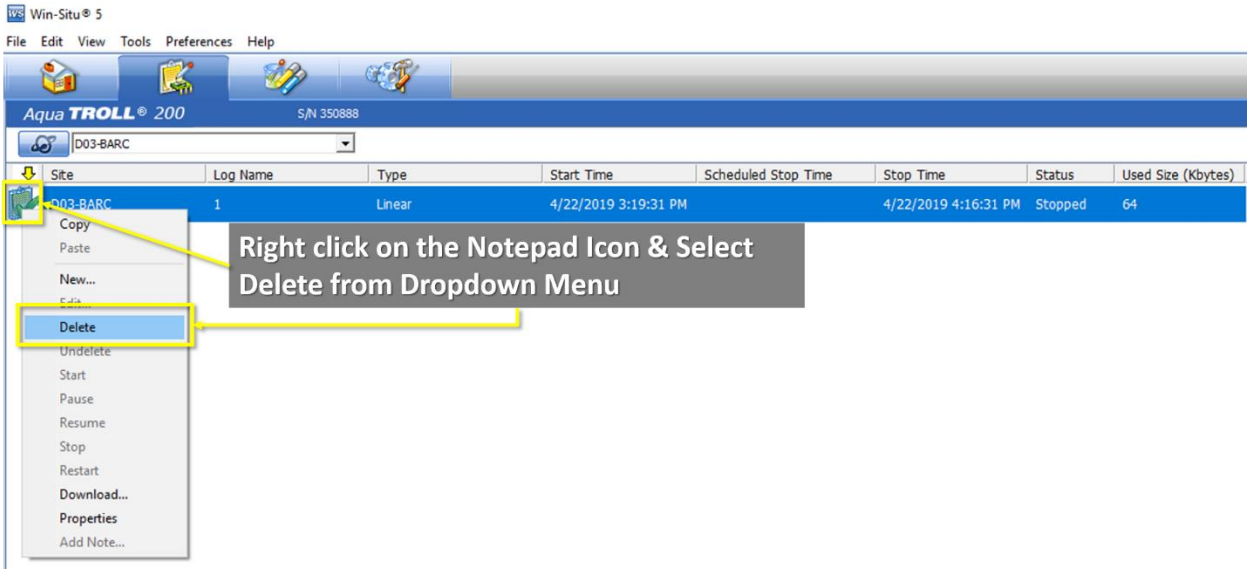

Figure 33. Right Click on the Notepad Icon of the Stopped Log File and Select "Delete"

2. A pop-up window appears stating the "**Selected log will be deleted! Continue?**" Click "**OK**" to continue (Figure 34).

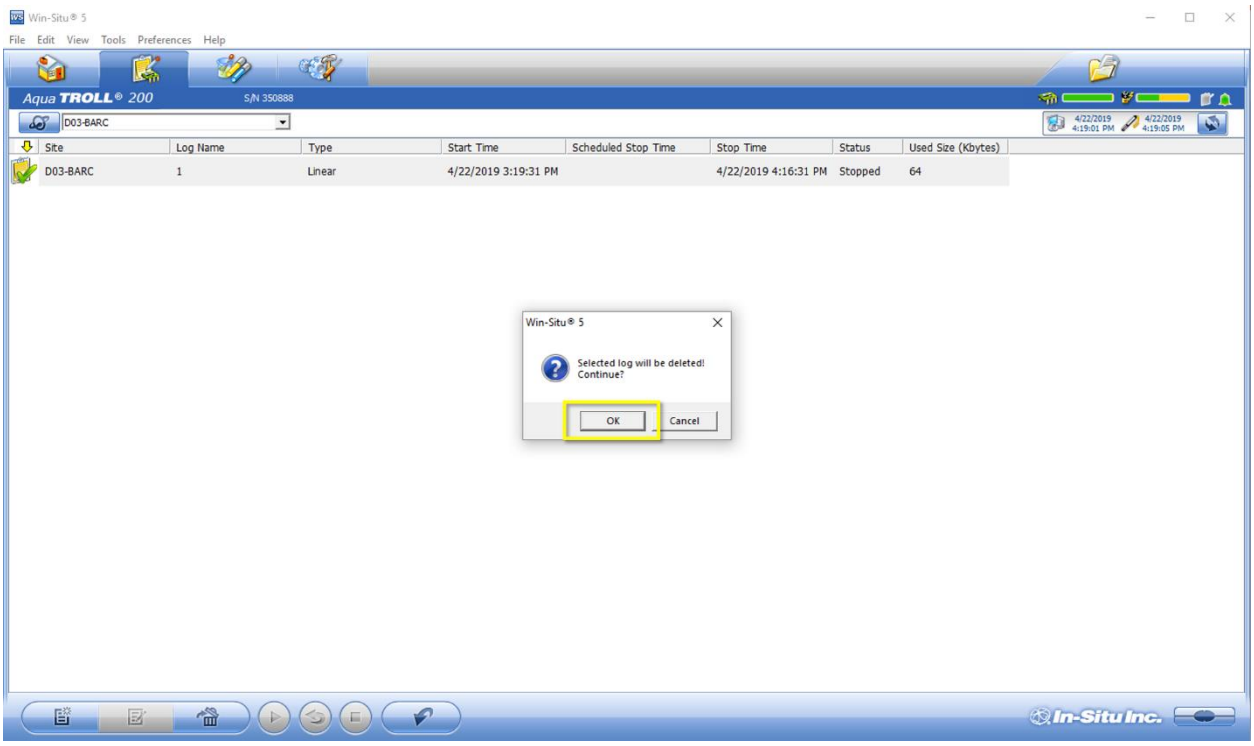

Figure 34. Click "OK" to Proceed when Prompted via the Pop-up Window

3. Complete Steps 1 and 2 again to completely delete the log file. A log file is completely deleted when it is no longer listed and when you hover your cursor over the memory bar in the upper-right corner, it states there is 0% memory used.

After deleting the log file, restart logging following the procedure in Section 4.4.

4.8 Data Upload Procedure

After returning to the Domain Support Facility or via VPN, save a copy of the .csv data file to the Network drive in the following folder (Figure 35): **N:\Science\Sensor Swap**

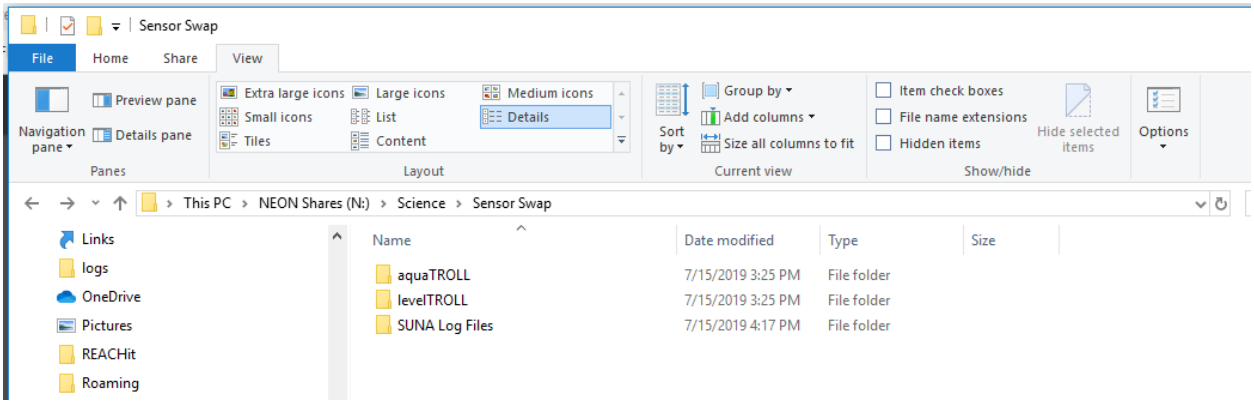

Figure 35. N:\Science\Sensor Swap

Use the following naming convention for your .csv data files that you upload to the **Sensor Swap** folder:

- For Aqua Trolls inside Groundwater Wells: **SITE_YYYYMMDD_GWW#**
  (GWW# stands for Groundwater Well 1-8)
- For Aqua Trolls at Lake Inlets/Outlets: **SITE_YYYYMMDD_IN / SITE_YYYYMMDD_OT**
  (IN stands for Lake Inlet or OT for Lake Outlet)
- For Level Trolls at Stream sites : **SITE_YYYYMMDD_S#**
  (S# stands for S1 or S2)
- For Aqua Trolls at D## TOOK ONLY: **SITE_YYYYMMDD_IF/ SITE_YYYYMMDD_OF**
  (IF stands for inflow and OF stands for outflow)

Add a **_2** to the end of the file name, if exporting multiple files from the same sensor on the same day.

Maintain a local copy of the files for at least two (2) years to have backup files in the event of an emergency (if HQ requires files to be re-uploaded to another or same location).

4.9 Add Site Name Procedure

If you do not find your site name from the dropdown option when initiating the logging wizard, follow the steps below to add your site name to the list.

1. From the WinSitu-5 homepage, select the Planet icon in the upper left hand corner of the screen (A in Figure 36). Then from the **Site List** pop-up window, select the New Document icon (B in Figure 36).

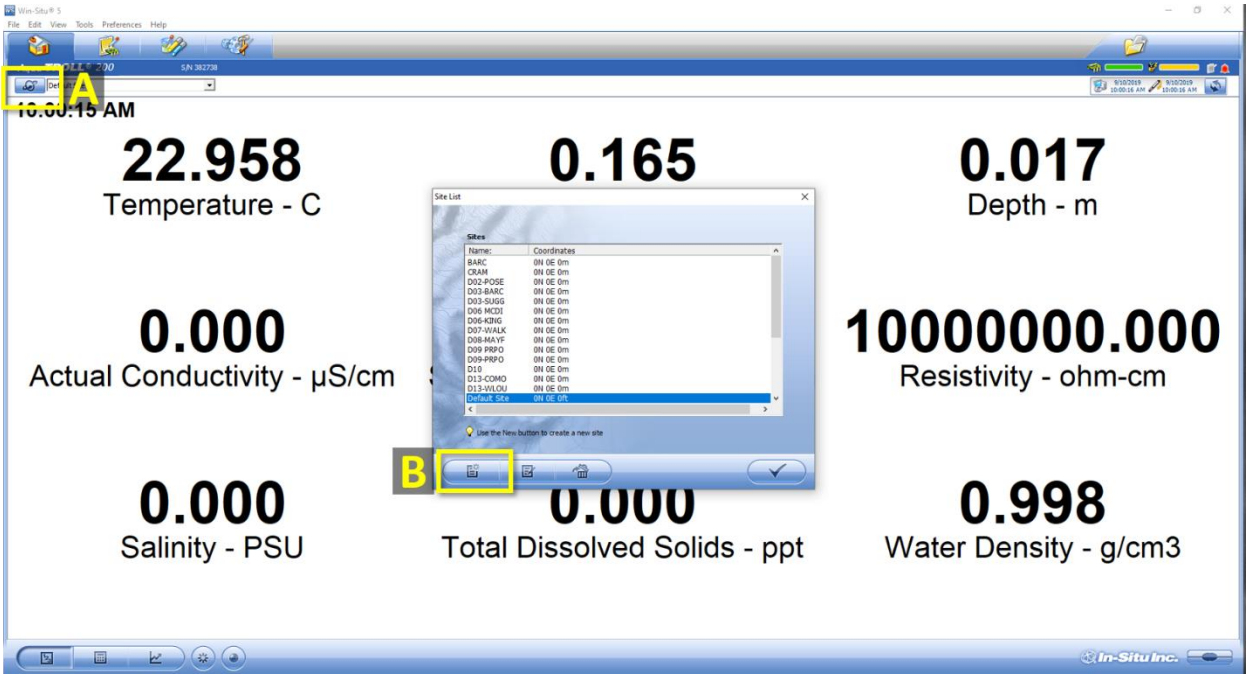

Figure 36. How to Add a New Site Name to the Logging Wizard Site List Dropdown from WinSitu Software Homepage

2. In the **Add Site** pop-up window, enter the site ID for the site that is missing from the dropdown options (Figure 37), for example, SYCA is the site ID for Sycamore Creek. Only the **Name** field is required. Click on the checkmark to save the site name to the **Site List**.

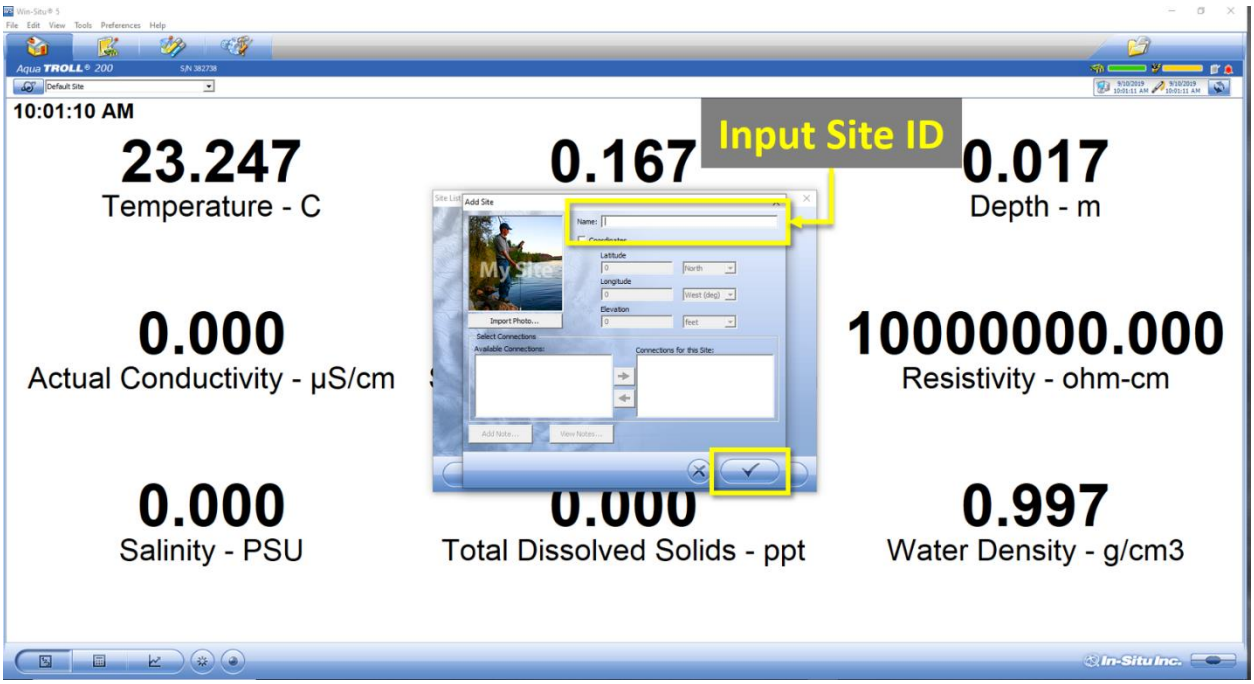

Figure 37. Input Site ID in Name Field and then Select the Checkmark to Save the Site to the Site List

5 QUICK REFERENCE

This section serves as a quick reference for the order of operations Aquatic Science expects these procedures to be performed by Field Science.

5.1 Receiving and Deploying TROLL Sensors for Sensor Refresh (Sensor Swap)

1. Connect and set Device Location (Section 4.2)
2. Check battery and install external battery packs, as necessary (Section 4.3 and KB0011788)
3. Set sensor to log data (Section 4.4)
4. Install sensor physically onsite (NEON.DOC.004362, NEON.DOC.004361 and NEON.DOC.005038)
5. Install sensor at the site (CFG Location) in Maximo (NEON.DOC.005038)

5.2 Quarterly Log Data Retrieval

1. Connect (Section 4.2)
2. Check battery (Section 4.3) and request an external battery pack, if necessary
3. Download data log files (Section 4.6)
4. Confirm data files downloaded onto laptop and delete log file on Sensor (Section 4.7)
5. Restart logging on sensor (Section 4.4)
6. Complete other preventive or corrective maintenance and reinstall sensor, if necessary (NEON.DOC.004362 and NEON.DOC.004361)
7. Upload data files to N drive from DSF (Section 4.8)
8. Monitor sensor data to verify sensor state of health (specifically conductivity, where applicable)

5.3 Removing and Shipping TROLL Sensors for Sensor Refresh (Sensor Swap) or for Corrective Actions (Repair)

1. Remove sensor and any external battery pack(s) from the field
2. Connect and set the Device Location back to 1 (Section 4.2)
3. Turn off logging mode (Section 4.5)
4. Download data (Section 4.6)
5. Confirm data files downloaded onto laptop and delete log file on Sensor (Section 4.7)
6. Upload data files to N drive from DSF (Section 4.8)
7. Uninstall from CFG Location in Maximo (NEON.DOC.005038)
8. Complete any other activities necessary for Sensor Refresh or Corrective Actions and ship sensor and external battery pack as a pair, if applicable, back to HQ (NEON.DOC.005038 and KB0011788)