

Standard Operating Procedure 2: Routine Visits to Continuous Water Quality Monitoring Sites

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Change History

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Overview

Continuous water quality monitors (hereafter, monitors) are complex instruments that require careful and thorough attention to ensure high quality data. The instructions in this Standard Operating Procedure (SOP) outline the steps necessary for routine visits related to Eastern Rivers and Mountains Network (ERMN) continuous water quality monitoring sites. Specific instructions are provided for every site because equipment differs among sites. These procedures were adapted from Bennett et al. (2014) and must be followed closely for trends in river water quality to be documented accurately.

Routine visits to all sites are typically conducted on a monthly basis, particularly during growing seasons when biological activity (hence fouling likelihood) is greatest. Site visits are usually not required as frequently during winter at the two sites that are operational year-round; furthermore, hazardous conditions (e.g., low air and water temperatures) to ERMN staff and equipment often preclude access or removal of monitoring equipment during winter. Experience at sites operated year-round has demonstrated that, barring damage to equipment, monitoring systems can be left unattended for several months and still produce high quality data.

Primary objectives of routine visits are to: 1) download data from data collection platforms, 2) document monitor fouling error by collecting before and after cleaning measurements, 3) document electronic drift of sensors by checking their accuracy against standard calibration solutions, and 4) ensure that all system components (e.g., batteries, pumps) are operating correctly. All observations associated with routine site visits should be recorded in the ERMN River Water Quality Monitoring Database (SOP 5).

Calibration checks are required at least once every three months but should be done for sensors whenever there is a noticeable difference (Table 1) between the deployed monitor (hereafter, site monitor) and field monitor readings after the site monitor has been cleaned.

Table 1. Eastern Rivers and Mountains Network after-cleaning criteria for continuous water quality monitoring sensors. Calibration drift checks are required if the difference in sensor readings between cleaned site monitors and field monitors exceed these criteria; otherwise, calibration drift checks are conducted every three months.

Parameter	After-Cleaning Criteria
Temperature	$\pm 0.2^{\circ} \text{C}$
Specific Conductance	$\pm 5.0 \mu\text{S/cm}$
pH	± 0.25 units
Dissolved Oxygen	$\pm 0.4 \text{ mg/L}$
Turbidity	$\pm 5.0 \text{ FNU}$

tbl_Site_Visits

Continuous WQ Monitor Site Visit Form

Site Name: LORDVILLE Visit Type: Routine Date: 10/12/2017 Military Time: 12:15 Tech:
 Field Monitor: 1-MM11100553_10/9/2017 Last_Visit: 9/14/2017
 Site Monitor: 5-MM11100555 Was Data Downloaded? Yes
 Site Visit Comments: pH electrolyte replaced and pH readings checked on monitor calibration form. Final site readings were taken at 14:00 local time, 18:00 was the Greenwich mean time.
 Data Verified By: Date:
 Were Calibration Checks Done? Yes
 Checks: 5-MM11100555_10/12/2017 Open
 New Calibration
 Was Site Monitor Replaced? No
 Final Monitor: 5-MM11100555

Fouling Checks

Before Cleaning			After Cleaning			Error	After Cleaning Criteria*
	Site	Field		Site	Field		
Temp (°C)	14.85	14.77	14.89	14.81	0.08	+/- 0.2°C	
SC (µS/cm)	135.9	135.8	136.1	135.8	0.3	+/- 5µ/cm	
pH (units)	7.66	7.76	7.73	7.66	0.07	+/- 0.25 units	
DO (mg/L)	9.88	10.04	9.88	10.04	-0.16	+/- 0.4 mg/L	
Turb (FNU)	0.7	0.7	0.7	0.2	0.5	+/- 5.0 units	

*After Cleaning Error = (After Site) - (After Field)

Final Site Readings

Mil. Time: 18:00
 Temp (°C): 15.3
 SC (µS/cm): 88.2
 pH (units): 7.46
 DO (mg/L): 10.5
 Turb (FNU): 7
 Is Parameter Order Correct? Yes

Record: 1 of 1 Filtered Search

Figure 1. Example Site Visit Form in the Eastern Rivers and Mountains Network River Water Quality Monitoring database that must be filled out completely when performing site visits.

Delaware River near Delaware Water Gap, PA

1. Be sure to bring a calibrated field monitor, keys, all necessary tools and supplies and fully charged 12V (28 Ah minimum) sealed lead-acid batteries from the ERMN laboratory.
2. Communicate with the DCP via PC and stop the Satlink program by:
 - a. Connecting a personal computer (PC) that has 'Sutron Satlink Logger Communicator' software to the Data Collection Platform (DCP) using the RS-232 communication cable.
 - b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.
 - d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - e. Stop the Satlink program by clicking on the 'Stop' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
3. Download log file by:
 - a. Clicking on the 'Data' tab at the top of the 'Sutron Satlink Logger Communicator' screen.
 - b. Click on the 'Export Log' box near the bottom right-hand corner of the screen.
 - c. In the 'Log Download' box, select the 'Since last download' radio button and ensure that the 'Log Format' is 'Satlink Standard'.
4. Carefully disconnect DCP communication cable from monitor and insert plug into communication cable port and reattach the 'ON/OFF switch plate' until PC or Amphibian is plugged into monitor.
5. Unscrew monitor from flow-cell paying attention to not disturb any potential fouling on the monitor sensors.
6. Attach sensor guard to monitor to protect sensors during transport to river for fouling checks. Avoid contacting sensors or disturbing potential fouling.
7. Obtain 'Before and After Cleaning Readings'
 - a. Perform calibration checks and recalibrate water-quality sensors (if needed) on a field water-quality monitor (see SOP 3). This should have been done in the laboratory but do it now if it was not.

- b. Take both monitors to a safe location at the river edge. Rinse the sensors on the field monitor with river water before placing it in the river. This will remove residual standards from the sensors.
 - c. Place the field monitor in the river as close to the continuous site water quality monitor as possible. After both monitors have sufficiently equilibrated (i.e., at least four minutes), record 'before cleaning' readings from both the site monitor and the field monitor. Readings from both monitors should be within five minutes of each other but it is generally best to work 'parameter by parameter' – that is, record temperature from the field monitor then temperature from the site monitor; next, record specific conductance from the field monitor then specific conductance from the site monitor, and so on.
 - d. Clean the site monitor and all sensor surfaces using deionized water, a soft bristled brush, cotton swabs, and lint-free wipes. Avoid using detergents or other cleaners, but if fouling is particularly abundant, use a mild solution of dishwashing detergent. Do not use abrasive cleaners, harsh detergents or chemicals (e.g., hydrochloric acid or alcohol) and be sure to thoroughly rinse sensors with native water.
 - e. After cleaning the site monitor and sensors, place the site monitor back in the river alongside the field monitor and record 'after cleaning' readings from both monitors once they have equilibrated. Record these measurements in the same manner as 'before cleaning' measurements.
 - f. Upon completion of field readings, disconnect the site monitor and insert plug into communication cable port and reattach the 'ON/OFF switch plate' until monitor is reconnected to DCP.
8. Ensure that there is no visible water/condensation anywhere inside the monitor body or within junction ports. If water intrusion is apparent, replace monitor with 'new' calibrated monitor. If necessary, clean and lubricate communication cable port.
9. Conduct calibration checks on the site monitor (SOP 3) *if*: 1) they are scheduled (i.e., every 3 months) or results of 'Before and After Cleaning Readings' suggest that sensor(s) need calibrated.
10. Swap discharged 12V batteries with fully charged batteries. Batteries at this site need to be swapped every month. The DCP will operate off of one 28 Ah battery whereas the pumping system requires a battery bank comprised of at least two 28 Ah batteries connected in parallel (i.e., connect positives of both batteries with a jumper wire and negatives of both batteries with a different jumper wire).
11. Remove sensor guard from site monitor and carefully screw it back into the flow-cell. Reinsert DCP communication cable into the monitor and reattach the 'ON/OFF switch plate'. Hang monitor on wall hook.

12. Verify that system is working correctly and record 'Final Readings' by:
 - a. Connecting a PC that has 'Sutron Satlink Logger Communicator' software to the DCP using the RS-232 communication cable.
 - b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.
 - d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - e. Restart the Satlink program by clicking on the 'Start' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
 - f. If the pump location is safely accessible, record 'Final Readings' with the field monitor near the pump at the same time as the site monitor records scheduled measurements at four minutes past the top of the next hour (e.g., 12:04).
 - g. Verify that the system pumped and recorded measurements correctly and without issues (e.g., water leaks).
 - h. Compare 'Final Readings' from the field and site monitors to ensure that all system components are functioning properly. Slight differences may exist between the site and field monitor field readings taken at four minutes past the hour (e.g., 12:04) but they should be very comparable (i.e., within data quality objectives). If site monitor measurements are suspect, troubleshoot.
 - i. To obtain 'Final Readings' from site monitor:
 1. In the 'Data' tab of 'Sutron Satlink Logger Communicator', click on the 'Multiple' radio button under the 'Show Measurements' header.
 2. The most recently acquired measurements will be displayed. Record these measurements and ensure that they are reasonable for the monitoring site.
13. If the system is working correctly, double check that all tools, supplies, and equipment are accounted for then lock the equipment shelter before leaving.

Delaware River at Lordville, NY

1. Be sure to bring a calibrated field monitor, all necessary tools and supplies (including keys) and one fully charged 12V (28 Ah minimum) sealed lead-acid battery from the ERMN laboratory.
2. Communicate with the DCP via PC and stop the Satlink program by:
 - a. Connecting the ERMN Toughbook personal computer (PC) into the Data Collection Platform (DCP) using the USB cable.
 - b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.
 - d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - e. Stop the Satlink program by clicking on the 'Stop' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
3. Download log file by:
 - a. Clicking on the 'Data' tab at the top of the 'Sutron Satlink Logger Communicator' screen.
 - b. Click on the 'Export Log' box near the bottom right-hand corner of the screen.
 - c. In the 'Log Download' box, select the 'Since last download' radio button and ensure that the 'Log Format' is 'Satlink Standard'.
4. Carefully pull site monitor up through deployment pipe by pulling on nylon suspension cord. As the cord comes up, gently pull on the monitor communication cable so that it does not become lodged between the monitor and deployment pipe.
5. Disconnect nylon suspension cord and then thoroughly wipe water and sediment from top of monitor around communication cable port and 'ON/OFF switch plate'.
6. Carefully disconnect DCP communication cable from monitor and insert plug into communication cable port and reattach the 'ON/OFF switch plate' until PC or Amphibian is plugged into monitor. Close the DCP box and aluminum shelter lid while the equipment is left unattended.
7. Obtain 'Before and After Cleaning Readings'
 - a. Perform calibration checks and recalibrate water-quality sensors (if needed) on a field water-quality monitor (see SOP 3). This should have been done in the laboratory but do it now if it was not.

- b. Take both monitors to a safe location at the edge of the stream (Humphries Brook) that flows into the Delaware River just upstream of the monitoring location. This stream is used because there is not a safely accessible/convenient location nearby on the Delaware River; moreover, nearby river water that can be safely/efficiently accessed near the site is affected by Humphries Brook which makes *in-situ* measurements erratic. Rinse the sensors on the field monitor with stream water before placing it in the stream. This will remove residual standards from the sensors.
 - c. Place the field monitor in the stream as close to the continuous site water quality monitor as possible. After both monitors have sufficiently equilibrated, record 'before Cleaning' readings from both the site monitor and the field monitor. Readings from both monitors should be within five minutes of each other but it is generally best to work 'parameter by parameter' – that is, record temperature from the field monitor then temperature from the site monitor; next, record specific conductance from the field monitor then specific conductance from the site monitor, and so on.
 - d. Clean the site monitor and all sensor surfaces using deionized water, a soft bristled brush, cotton swabs, and lint-free wipes. Avoid using detergents or other cleaners, but if fouling is particularly abundant, use a mild solution of dishwashing detergent. Do not use abrasive cleaners, harsh detergents or chemicals (e.g., hydrochloric acid or alcohol).
 - e. After cleaning the site monitor and sensors, place the site monitor back in the stream alongside the field monitor and record 'after cleaning' readings from both monitors once they have equilibrated. Record these measurements in the same manner as 'before Cleaning' measurements.
 - f. Upon completion of field readings, disconnect the site monitor and insert plug into communication cable port and reattach the 'ON/OFF switch plate' until monitor is reconnected to DCP.
8. Ensure that there is no visible water/condensation anywhere inside the monitor body or within junction ports. If water intrusion is apparent, replace monitor with 'new' calibrated monitor. If necessary, clean and lubricate communication cable port.
9. Conduct calibration checks on the site monitor (SOP 3) *if*: 1) they are scheduled (i.e., every 3 months) or 2) results of 'Before and After Cleaning Readings' suggest that sensor(s) need calibrated.
10. Verify that the 12V battery is in good working order. It is unlikely that the battery will need replaced at this site but if it was determined that it failed during deployment or is near its lifespan, replace it at this point.
11. Ensure that DCP communication cable plug is clean and thoroughly lubricated, then insert it into the site monitor and reattach the 'ON/OFF switch plate'.

12. Carefully lower the site monitor into the deployment pipe by holding the nylon suspension cord while maintaining tension on the communication cable so that it does not become lodged between the monitor and inside of the deployment pipe.
13. Verify that system is working correctly and record 'Final Readings' by:
 - a. Connecting the ERMN Toughbook PC into the DCP using the USB cable.
 - b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.
 - d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - g. Restart the Satlink program by clicking on the 'Start' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
 - h. 'Final Readings' cannot be easily obtained with a field meter within, or next to the deployment location (nearly 60' below the DCP); therefore, 'Final Readings' are compared to the last recorded measurements of the previous deployment period.
 - i. The DCP will prompt the monitor to record measurements every 15 min. Wait for the next measurements to record and then record them as 'Final Readings'.
 - ii. To obtain 'Final Readings' from site monitor:
 - i. In the 'Data' tab of 'Sutron Satlink Logger Communicator', click on the 'Multiple' radio button under the 'Show Measurements' header.
 - ii. The most recently acquired measurements will be displayed. Record these measurements and ensure that they are reasonable for the monitoring site.
 - iii. Compare the Final Readings to the latest measurements of the previous deployment period to ensure that all system components are functioning properly. Slight differences may exist between these measurements but they should be very comparable (i.e., within data quality objectives) unless an unusually long period of time elapsed between measurements. If 'Final Readings' are suspect, troubleshoot.
14. If the system is working correctly, double check that all tools, supplies, and equipment are accounted for then lock the equipment shelter before leaving.

Delaware River at Montague, NJ

1. Be sure to bring a calibrated field monitor, all necessary tools and supplies and one fully charged 12V (28 Ah minimum) sealed lead-acid battery from the ERMN laboratory.
2. Open equipment shelter and unplug pumps (if water is flowing through the system allow it to finish before unplugging) from switch-controlled (left-hand) AC outlets.
3. Communicate with the DCP via PC and stop the Satlink program by:
 - a. Connecting a personal computer (PC) that has 'Sutron Satlink Logger Communicator' software to the DCP using the RS-232 communication cable.
 - b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.
 - d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - e. Stop the Satlink program by clicking on the 'Stop' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
4. Download log file by:
 - a. Clicking on the 'Data' tab at the top of the 'Sutron Satlink Logger Communicator' screen.
 - b. Click on the 'Export Log' box near the bottom right-hand corner of the screen.
 - c. In the 'Log Download' box, select the 'Since last download' radio button and ensure that the 'Log Format' is 'Satlink Standard'.
5. Carefully disconnect DCP communication cable from monitor and insert communication cable port from PC or Amphibian and reattach the 'ON/OFF switch plate'.
6. Obtain 'Before and After Cleaning Readings'
 - a. Perform calibration checks and recalibrate water-quality sensors (if needed) on a field water-quality monitor (see SOP 3). This should have been done in the laboratory but do it now if it was not.
 - b. Place the field monitor in the flow through basin alongside the site water quality monitor as closely as possible. Reposition flow basin lid to minimize splashing inside the shelter.
 - c. Plug both pumps into the 'hot' (right-hand) AC outlet which will turn on both pumps so that water will begin flowing through the system.

- d. After both monitors have sufficiently equilibrated (approximately four min), record 'before Cleaning' readings from both the site monitor and the field monitor. Record temperature from the field monitor then temperature from the site monitor; next, record specific conductance from the field monitor then specific conductance from the site monitor, and so on. Do not leave pumps running for any longer than necessary as this decreases pump life.
 - e. Clean the site monitor and all sensor surfaces using deionized water, a soft bristled brush, cotton swabs, and lint-free wipes. Avoid using detergents or other cleaners, but if fouling is particularly abundant, use a mild solution of dishwashing detergent. Do not use abrasive cleaners, harsh detergents or chemicals (e.g., hydrochloric acid or alcohol).
 - f. After cleaning the site monitor and sensors, place the site monitor back in the flow through basin alongside the field monitor.
 - g. Plug both pumps into the 'hot' (right-hand) AC outlet which will turn on both pumps so that water will begin flowing through the system.
 - h. After both monitors have sufficiently equilibrated (approximately four min), record 'after Cleaning' readings from both the site monitor and the field monitor. Record temperature from the field monitor then temperature from the site monitor; next, record specific conductance from the field monitor then specific conductance from the site monitor, and so on. Do not leave pumps running for any longer than necessary as this decreases pump life.
 - i. Upon completion of field readings, disconnect the site monitor and insert plug into communication cable port and reattach the 'ON/OFF switch plate' until monitor is reconnected to DCP.
7. Ensure that there is no visible water/condensation anywhere inside the monitor body or within junction ports. If water intrusion is apparent, replace monitor with 'new' calibrated monitor. If necessary, clean and lubricate communication cable port.
 8. Conduct calibration checks on the site monitor (SOP 3) *if*: 1) they are scheduled (i.e., every 3 months) or results of 'Before and After Cleaning Readings' suggest that sensor(s) need calibrated.
 9. Plug pumps back into switch-controlled (left-hand) AC outlets
 10. Verify that system is working correctly and record 'Final Readings' by:
 - a. Connecting a PC that has 'Sutron Satlink Logger Communicator' software to the DCP using the RS-232 communication cable.
 - b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.

- d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - e. Restart the Satlink program by clicking on the 'Start' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
 - f. Record 'Final Readings' with the field monitor in the flow-through basin at the same time as the site monitor records scheduled measurements at four minutes past the top of the next hour (e.g., 12:04).
 - g. Verify that the system pumped and recorded measurements correctly and without issues (e.g., water leaks).
 - h. Compare 'Final Readings' from the field and site monitors to ensure that all system components are functioning properly. Slight differences may exist between the site and field monitor field readings taken at four minutes past the hour (e.g., 12:04) but they should be very comparable (i.e., within data quality objectives). If site monitor measurements are suspect, troubleshoot.
 - i. To obtain 'Final Readings' from site monitor:
 1. In the 'Data' tab of 'Sutron Satlink Logger Communicator', click on the 'Multiple' radio button under the 'Show Measurements' header.
 2. The most recently acquired measurements will be displayed. Record these measurements and ensure that they are reasonable for the monitoring site.
11. If the system is working correctly, double check that all tools, supplies, and equipment are accounted for then lock the equipment shelter before leaving.

New River at Thurmond, WV

1. Be sure to bring a calibrated field monitor, all necessary tools and supplies and two fully charged 12V (one 12 Ah, and one 28 Ah minimum) sealed lead-acid batteries from the ERMN laboratory.
2. Communicate with the DCP via PC and stop the Satlink program by:
 - a. Connecting a personal computer (PC) that has 'Sutron Satlink Logger Communicator' software to the Data Collection Platform (DCP) using the RS-232 communication cable.
 - b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.
 - d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - e. Stop the Satlink program by clicking on the 'Stop' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
3. Download log file by:
 - f. Clicking on the 'Data' tab at the top of the 'Sutron Satlink Logger Communicator' screen.
 - g. Click on the 'Export Log' box near the bottom right-hand corner of the screen.
 - h. In the 'Log Download' box, select the 'Since last download' radio button and ensure that the 'Log Format' is 'Satlink Standard'.
4. Carefully disconnect DCP communication cable from monitor and insert plug into communication cable port and reattach the 'ON/OFF switch plate' until PC or Amphibian is plugged into monitor.
5. Unscrew monitor from flow-cell paying attention to not disturb any potential fouling on the monitor sensors.
6. Attach sensor guard to monitor to protect sensors during transport to river for cleaning. Avoid contacting sensors or disturbing potential fouling.
7. Obtain 'Before and After Cleaning Readings'
 - i. Perform calibration checks and recalibrate water-quality sensors (if needed) on a field water-quality monitor (see SOP 3). This should have been done in the laboratory but do it now if it was not.

- j. Take both monitors to a safe location at the river edge. Rinse the sensors on the field monitor with river water before placing it in the river. This will remove residual standards from the sensors.
 - k. Place the field monitor in the river as close to the continuous site water quality monitor as possible. After both monitors have sufficiently equilibrated (i.e., four minutes), record 'before Cleaning' readings from both the site monitor and the field monitor. Readings from both monitors should be within five minutes of each other but it is generally best to work 'parameter by parameter' – that is, record temperature from the field monitor then temperature from the site monitor; next, record specific conductance from the field monitor then specific conductance from the site monitor, and so on.
 - l. Clean the monitor and all sensor surfaces using deionized water, a soft bristled brush, cotton swabs, and lint-free wipes. Avoid using detergents or other cleaners, but if fouling is particularly abundant, use a mild solution of dishwashing detergent. Do not use abrasive cleaners, harsh detergents or chemicals (e.g., hydrochloric acid or alcohol).
 - m. After cleaning the site monitor and sensors, place the site monitor back in the river alongside the field monitor and record 'after cleaning' readings from both monitors once they have equilibrated. Record these measurements in the same manner as 'before Cleaning' measurements.
 - n. Upon completion of field readings, disconnect the site monitor and insert plug into communication cable port and reattach the 'ON/OFF switch plate' until monitor is reconnected to DCP.
8. Ensure that there is no visible water/condensation anywhere inside the monitor body or within junction ports. If water intrusion is apparent, replace monitor with 'new' calibrated monitor. If necessary, clean and lubricate communication cable port.
 9. Conduct calibration checks on the site monitor (SOP 3) *if*: 1) they are scheduled (i.e., every 3 months) or results of 'Before and After Cleaning Readings' suggest that sensor(s) need calibrated.
 10. Swap discharged 12V batteries with fully charged batteries. Batteries at this site should be checked every month and swapped if necessary. The DCP will operate off of one 12 Ah battery whereas the pumping system requires a 28 Ah battery.
 11. Remove sensor guard from site monitor and carefully screw it back into the flow-cell. Reinsert DCP communication cable into the monitor and reattach the 'ON/OFF switch plate'. Hang monitor on wall hook.
 12. Verify that system is working correctly and record 'Final Readings' by:
 - a. Connecting a PC that has 'Sutron Satlink Logger Communicator' software to the DCP using the RS-232 communication cable.

- b. Open 'Sutron Satlink Logger Communicator' then 'Connect to Satlink directly'.
 - c. The PC should 'communicate' with the DCP; if not, troubleshoot with Sutron guidance.
 - d. After communication has been established with DCP, close out of DCP status screen and proceed to main page of 'Sutron Satlink Logger Communicator'.
 - e. Restart the Satlink program by clicking on the 'Start' button in the bottom right-hand corner of the 'Sutron Satlink Logger Communicator' screen.
 - f. If the pump location is safely accessible, record 'Final Readings' with the field monitor near the pump at the same time as the site monitor records scheduled measurements at four minutes past the top of the next hour (e.g., 12:04).
 - g. Verify that the system pumped and recorded measurements correctly and without issues (e.g., water leaks).
 - h. Compare 'Final Readings' from the field and site monitors to ensure that all system components are functioning properly. Slight differences may exist between the site and field monitor field readings taken at four minutes past the hour (e.g., 12:04) but they should be very comparable (i.e., within data quality objectives). If site monitor measurements are suspect, troubleshoot.
 - i. To obtain 'Final Readings' from site monitor:
 - 1. In the 'Data' tab of 'Sutron Satlink Logger Communicator', click on the 'Multiple' radio button under the 'Show Measurements' header.
 - 2. The most recently acquired measurements will be displayed. Record these measurements and ensure that they are reasonable for the monitoring site.
13. If the system is working correctly, double check that all tools, supplies, and equipment are accounted for then lock the equipment shelter before leaving.

Literature Cited

Bennett, T.J., Graham, J.L., Foster, G.M., Stone, M.L., Juracek, K.E., Rasmussen, T.J., and Putnam, J.E., 2014. U.S. Geological Survey quality-assurance plan for continuous water-quality monitoring in Kansas, 2014: U.S. Geological Survey Open-File Report 2014–1151, 34 p. plus appendixes, <http://dx.doi.org/10.3133/ofr20141151>.