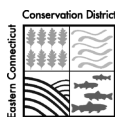


The Last Green Valley
Volunteer Water Quality
Monitoring Program

Jean Pillo
Watershed Conservation Coordinator
Eastern Connecticut Conservation District



Funding Support for Coordinator

The Last Green Valley Volunteer Water Quality Monitoring Program is sponsored in part by The Last Green Valley, Inc, the managing entity of the Quinebaug-Shetucket Heritage Corridor.

Office space for the Coordinator is generously provided by CT Audubon Society Center at Pomfret .

The Quinebaug and Shetucket Rivers National Heritage Corridor

- Designated in 1994
- Expanded in 1999
- The Last Green Valley
- 26 Connecticut towns
- 9 Massachusetts towns
- Reauthorized until 2015
- Funded in part by the National Parks Service
- Water subcommittee initiated a water quality monitoring program in 2006




TLGV Volunteer Water Quality Monitoring Program

- In-situ monitoring with the Troll 9500
- Nutrient monitoring with Smart2 Colorimeter
- Bacteria monitoring (Connecticut only)
- Rapid Bioassessment program
- Visual assessments using Stream Walk protocol -

QAPP

- Quality Assurance Project Plan
- Assures everybody using the same equipment will use it the same way
- Comparable results between users
- QAPP is a four letter word

The Last Green Valley "umbrella" QAPPs

In-situ Troll 9500

- Dissolved O₂
- Temperature
- pH
- Turbidity
- Conductivity
- Oxidation/Reduction Potential (ORP)
- Depth

LaMotte Smart2 Colorimeter

- ortho-Phosphates
- Nitrate Nitrogen (low range)
- Ammonia Nitrogen (high range)
- Total Phosphorus*
- Total Nitrogen*

*needs a special COD adaptor

In-situ Monitoring with the Troll

Benefits

- All in one unit
- Portable
- Meets EPA standards
- High tech O₂ sensor
- With training, can be deployed by "citizen scientists"

Draw backs

- Cost of equipment
- Annual cost of consumable supplies
- Need a knowledgeable team leader to troubleshoot occasional issues

A Very Big Thank-you

- Ken Parker, The French River Connection
- Al Huefner, Webster Lake Association
- Gloria Ricker, Webster Lake Association
- Thompson Library

TLGV Trolls

Unit 1 purchased with funding provided by the Massachusetts Executive Office of Energy and Environmental Affairs

Unit 2 donated to TLGV

Another special thanks to the Webster Lake Association for their willingness to share a rented Troll prior to TLGV being able to purchase Unit 1



General Tasks and Timetable

- Previous year - begin to define new project area
- January - team leaders meet with TLGV WQM coordinator to review SOPs*
- February - new project areas presented to TLGV water subcommittee for approval (done)
- March - some groups will begin data collection
- April - October - data collection
- October - Data summary (spreadsheet) to TLGV WQM Coordinator (maybe November?)
- November - Team leaders/TLGV WQM meet to review season/discuss modifications
- December - Final WQ data to be disseminated to agency staff/public

* This is what we are doing today.

New protocols for 2011

- Between monitoring locations, sensors will be immersed in water to keep pH probe hydrated
- Calibration or pre-calibration check necessary 48 hours before monitoring event
- Mandatory monthly re-calibration
 - Requires use of fresh calibration fluids
 - Must be "certified" to perform calibration process
- Between monthly re-calibration, probes will be pre-checked to see if they are already calibrated
 - Calibration fluids can be reused for one month
 - An attempt to reduce costs and volunteer time

Important safety information Troll Calibration

- Material Safety Data Sheets (MSDS) sheets to be stored with calibration solutions
- Safety goggles and gloves provided
- Instructions for solution disposal provided in SOP guide
- Be sure to check expiration dates on calibration solution bottles. Do not use expired solutions

Calibration pre-check

- Solutions should be at room temperature
- Remove sensor guard
- pH probe is stored in long term storage solution. Remove hydration bottle from pH probe and refill with pH 4 buffer solution one hour before starting
- Assemble Troll as outlined in Troll SOP 2 and mount probes on ring stand as shown
- Turn on RR-Remove the pH probe hydration bottle before starting calibration pre-check
- Select **Profile** from RR menu option



Rugged Dissolved Oxygen (RDO) Calibration pre-check

- Rinse sensors with tap water followed by a distilled water rinse.
- Set up RDO Bubbler Calibration Kit
- Fill container with distilled water
- On Rugged Reader (RR), set RDO to % saturation
- Immerse RDO sensor in water
- Turn bubbler on (adjust to keep sensor out of direct bubble stream)
- Allow 15 minutes for temperature and O₂ to equilibrate
- Read RDO value - it should read 100% +/- 1%. Record the value on the Troll calibration form
- If it does not read within the acceptable range, then a 2 point recalibration is required.

Turbidity Calibration pre-check

- Dry sensors with a paper towel
- Inspect guard to be sure inside of guard is clean. Wipe away debris with paper towel
- Install guard over probes
- Fill beaker $\frac{1}{2}$ full with distilled water
- Tap probe to dislodge trapped air pockets
- Read profiler - if results are 0 +/- 0.2 NTU, then probe is calibrated. Record outcome on Troll calibration form.
- If it does not read within the acceptable range, then a one point calibration is required.

Oxidation/Reduction Potential (ORP) Calibration Pre-check (optional)

- Requires Zobell solution (not provided)
- Zobell solution must be refrigerated
- Readings are temperature sensitive, so remove required quantity from refrigerator in advance to reach room temp.
- Immerse dried sensor into calibration cup
- Record reading in millivolts and temperature on Troll calibration sheet.
- Compare reading to chart on bottle and correct for temperature.
- If solution strength +/- 20 mV, then unit is calibrated.
- If it does not read within the acceptable range, then a one point recalibration is required.

pH Calibration pre-check

- Soak pH probe in pH 4 buffer for 1 hour prior to the calibration check (complete)
- Soak in distilled water for 15 minutes (complete)
- Rinse sensors with tap water followed by distilled water rinse (if necessary). Dry with a paper towel
- Fill calibration cup $\frac{1}{2}$ full with pH 7 buffer solution
- Immerse sensors, wait for a steady value, may be several minutes
- If pH is between 6.9 and 7.1, the sensor is calibrated. Record outcome on the Troll calibration form
- If it does not read within the acceptable range, then a two point recalibration is required.

Conductivity calibration pre-check

- Rinse sensors with tap water followed by distilled water and dry with a paper towel
- Fill a calibration cup with conductivity standard (447 $\mu\text{Sm/cm}$)
- Immerse sensors in calibration cup
- Record actual conductance and temperature from the RR on Troll calibration form. May take several minutes for reading to settle.
- Use table to correct for specific conductance. If value is $\pm 2 \mu\text{Sm/cm}$, then the sensor is calibrated.
- If it does not read within the acceptable range, then a one point recalibration is required.

Finishing up calibration pre-check

- Rinse sensors with tap water followed by a distilled water rinse
- Dry with a paper towel
- Put pH 4 solution in hydrating bottle
- Screw hydrating bottle back onto cap attached to pH probe. Replace sensor guard
- Complete all info on Troll calibration form, and put a copy in the Troll calibration binder to be kept with the unit.
- Send a copy of the form to Jean.Pillo@ConserveCT.org or fax to 860-928-2939.
- Report near expired calibration solutions or other inventory issues to Jean.Pillo@ConserveCT.org

What to do on Monitoring Day

- Assemble Troll, remove pH probe hydration bottle, rinse sensors with tap water/distilled water
- Turn unit on and set up for profiling
- Conduct the "bucket" test
 - Immerse Troll sensors in a bucket of tap water aged overnight
 - Wait 5 minutes
 - Record date and results on Troll Calibration Report (bottom of page)
 - Close profiler, and turn off RR to save the battery

Field Safety

- Work in teams of at least 2 people
- Tell a responsible adult where you will be and when you plan to return
- Wear reflective vests
- Carry a first aid kit, cell phone for emergencies
- Use discretion - avoid dangerous situations
- Lake monitoring (no paddle craft) obey state regulations for safe boat handling and wear an approved PDF

Stream Monitoring

- Fill in Field Sheet for Troll Monitoring with date, sampling team members and other information
- Turn on RR, set up for Profiling
- Record data for each station as appropriate
- It will be necessary to use more than one sheet if you have more than 7 sampling locations
- Remember to close the profiler before turning off the power between sampling sites or you may need to restart the whole system

At the monitoring site Stream Monitoring

- Sample stream in the main current
- Approach sampling location carefully to avoid stirring up sediments (if wading in stream, approach from downstream)
- Don't rest sensor on the bottom
- Avoid bio-fouling of sensors

At the monitoring site Lake Monitoring

- Use GPS to locate predetermined sampling location (deep hole)
- Anchor boat in location
- Use boat depth finder or a weighted metered line to determine depth
- Start profiler and take surface reading. Record results
- Use depth reading on RR to lower probe and record data at 2 foot intervals
- Stop before probes come in contact with the bottom or any weedy growth.

Quality Control

- For stream monitoring, before each monitoring event, randomly assign one station to be the QC station
 - Start profiling, record results, close profiler and return probe to hydration bucket for 5 minutes, then repeat
 - Record each set of results independently on the Field Sheet
 - Label second data set with site number followed by QC

Quality Control

For lake monitoring, at least once per season, repeat the entire depth profile over your sampling location.

Quality Control

Parameter	Relative Percent Difference (RPD) Acceptable Range
Temperature	5%
pH	5%
RDO	5%
Conductivity	5%
Turbidity	20% or 50% if <5 NTU
ORP	5%
Nitrate (WLA only)	10%

RPD(%) = Absolute Value of:

$$\left[\frac{(x_1 - x_2)}{\left(\frac{x_1 + x_2}{2} \right)} \right] \times 100$$

Where:

x1 = Concentration Observed in Original Sample
x2 = Concentration Observed in Duplicate Sample

How long to wait before recording data?

- Manufacturer claims probes take less than 1 minute - field experience shows it can take up to 5 minutes for the O₂ sensor to settle depending on flow rate of water
- For lake monitoring, surface sample may take up to 5 minutes, but at increasing depths, changes are more subtle and O₂ sensor reacts faster

At the end of the monitoring day

- Check data sheets to be sure all information was recorded. Sign sheet
- Before storing the Troll
 - Post monitoring check (remember the bucket?)
 - Temperature will vary, but other parameters should be relatively close
 - Any parameter that drifted beyond RPD should be re-checked against standard solution and results recorded on Troll Calibration Sheet at bottom of page

At the end of the monitoring day

- Disconnect RR from cable and Troll. Replace moisture barrier caps to ends and return equipment to protective case
- Remove guard and clean
- Rinse probes with tap water, followed by distilled water rinse and dry with a paper towel
- Fill pH hydration bottle with long term storage solution and screw back over pH sensor
- Replace guard over sensors
- Be sure to get the unit to the next user in time for their monitoring event
- Complete Troll incident report if necessary. Email or fax a copy to Jean.Pillo@ConserveCT.org or 860-928-2939

QA - data entry

- QA person signs Field Data sheet to indicate receipt of information.
- Field data will be entered onto a spreadsheet and checked for transcription errors.
- Calculate RPD's for QC stations and note if within an acceptable range
 - If not, report to Team Leader who will review field techniques for errors.
- Data sheets to be kept for 3 years. Electronic data to be sent to Jean.Pillo@ConserveCT.org

Trouble shooting

- Did you remember to charge the RR?
- pH always 4 - did you remember to remove the hydration bottle?
- If RR won't connect to the sensors, check batteries in the sonde.
 - Caution: while unscrewing the battery cover, the cable connector at the top of the unit should not turn. If it does: STOP! The unit needs service.
 - Lithium batteries (Unit 1) are either charged or dead. Test with multi-meter.
 - Lithium batteries must be disposed as Hazmat.
 - Report battery change on Troll incident report and email or fax to Jean Pillo

O rings are important

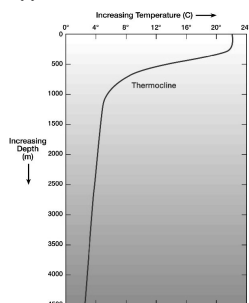
- Inspect o-rings for damage.
- If you suspect the an o-ring failure, report it and don't use the unit until the o-ring can be replaced.



Using the Troll to determine the Thermocline

Use the temperature data at 2 foot intervals to plot a simple line graph.

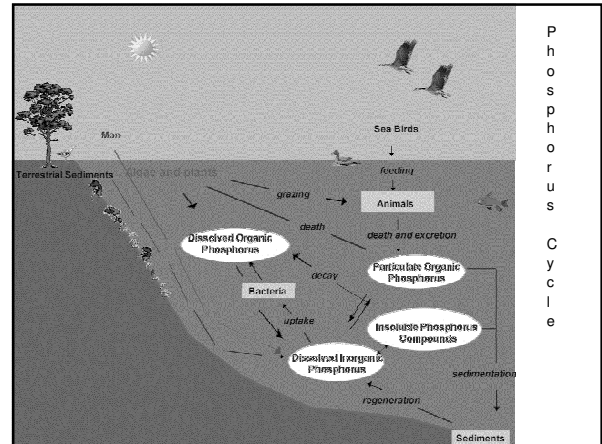
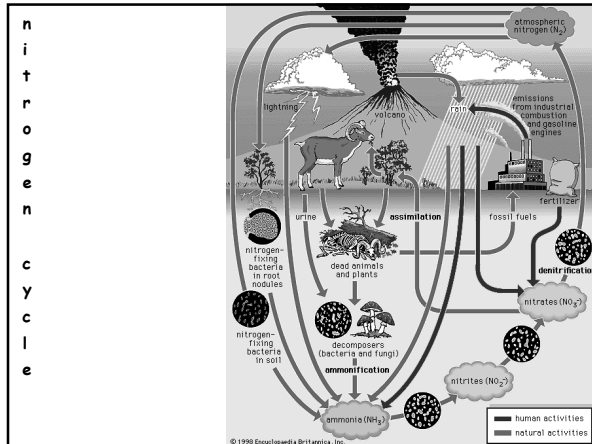
The thermocline is where the temperature changes most rapidly.



LaMotte Smart2 Colorimeter

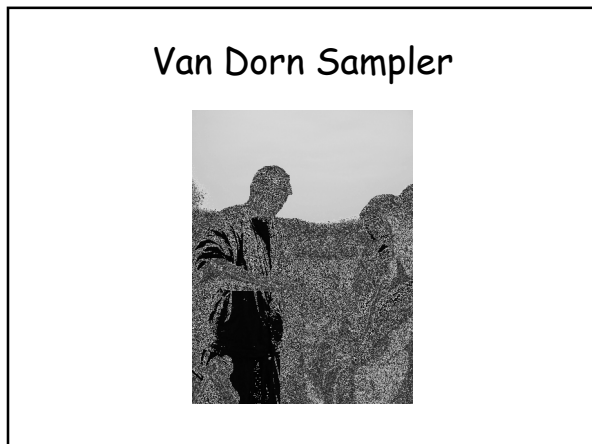


- Uses light to detect color changes from chemical reactions when reagents are in contact with certain chemicals in the environment.
- TLGV WQM uses this to detect certain plant nutrient concentrations
- 2 units awarded to TLGV through the EPA Equipment Loan Program



- ### Collecting Water Samples in the Field - Streams
- Attach labels to bottles before collecting the sample
 - Approach sampling location from downstream (avoid bottom disturbance)
 - Remove cap, rinse sample bottle with river water once before collecting sample.
 - Collect water sample from mid-depth.
 - Leave 1" headspace, recap bottle.
 - Never touch inside of sample bottle or cap
 - Store sample in a plastic bag inside an ice filled cooler until processed.
 - Complete all required information at each sampling location on Field Sheet for Water Samples for Nutrient Analysis

- ### Collecting Water Samples in the Field - Lakes
- Attach labels to bottles before collecting the sample
 - Using Troll or other equipment, determine the depth to the thermocline.
 - Collect water sample from surface, thermocline and 2 feet above the bottom using a Van Dorn sampler or equivalent.
 - If bottom sample contains sediment or plant debris, aggressively rinse sampler in lake, and resample a foot higher.
 - Remove cap, rinse sample bottle with lake water once before collecting sample.
 - Leave 1" headspace, recap bottle.
 - Never touch inside of sample bottle or cap
 - Store sample bottle in a plastic bag inside an ice filled cooler until processed.
 - Complete all required information at each sampling location on Field Sheet for Water Samples for Nutrient Analysis



- ### Quality Control
- Field Replicates - collect duplicate samples in separate sample bottles from the same sampling location
 - Field Blank - transfer distilled water to sample container in field environment
 - Lab Replicates - analyze water sample from same container twice
 - Lab blanks - analyze distilled water
 - Each QC method to be completed once per season for each parameter monitored.

Sample Analyzer

- Sign, date and indicate time on Field Data Sheet upon receipt.
- Water samples must be kept on ice until analyzed
- Samples must be process within 24 hours of collection
- Use LaMotte nutrient analysis "kits" and cookbook style recipe to process the samples.

Colorimetric wastes

Nitrate-nitrogen test

Contains trace amounts of Cadmium. Should not be disposed of down the drain. Collect sample waste in a labeled container marked POISON.

Ortho-phosphate test

Can be safely washed down the drain

Suggest a wide mouth canning jar with a screen under the jar lid
 - Evaporate off liquid
 - Dispose of solids at Hazmat Disposal with a copy of the MSDS

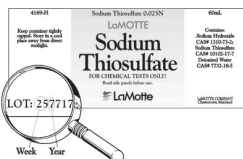
Handling colorimeter tubes

- Special grade of glass - prevent scratches
- Do not touch the inside of the tubes or the caps.
- Do not touch tubes below the fill line - finger prints will alter readings
- Dry outside of tubes before inserting in the colorimeter
- Line up arrow on colorimeter with index mark on colorimeter tube, and close top on the colorimeter before reading results

Care of lab equipment

- Keep colorimeter dry. Do not get water inside!
- Remove labels from sample containers between uses.
- Sample bottles, grab samplers and colorimeter tubes should be cleaned with phosphate free detergent
 - Rinse 3X with tap water
 - Rinse with Distilled water
 - Air dry inverted
- Do not use abrasive brushes to clean labware. Scratches may become traps for particles or damage optical properties of the colorimeter tubes
- Sample bottles used for phosphate monitoring should be soaked in 1% Hydrochloric Acid solution
 - Solution can be stored in a covered bucket and reused for the season

LaMotte Reagent shelf life code



- Mark each new batch of reagents with their expiration date on the package.
- Use oldest stock first.
- Do not use expired reagents.

On the lower, left corner of the label of each LaMotte reagent is a six or seven digit number. This is not a code number, but the lot number of that reagent. A lot number records the date of manufacture and identifies the reagent as part of a specific batch of reagent produced on that date. The first two digits of the lot number identify the week, and the third digit identifies the year of manufacture.

Lab Safety

- MSDS sheets for all reagents will be kept with the equipment
- Wear eye protection and gloves when handling chemicals
- Clean up spills immediately
- Instructions for disposal indicated in Volunteer handbook

Good analytical technique

- Read fluid measures from the bottom of the meniscus
- Hold eye droppers or dropper bottles vertical when dispensing drops for uniform drop size
- To accurately dispense powdered reagents with spoon, tap spoon on vial to remove excess reagent