SCEI Riverwatch Handbook:
A Guide for Student Monitoring of Water Quality

Tool Use Guide

South Central Eco Institute

in
Prairie Spirit School Division
South Central Manitoba
in the
Red River Watershed

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As primary team members, we would like to acknowledge the support of our many partners; we would not be where we are with this program without them.

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Our goal was to develop a program within the schools and surrounding community which would teach students, through their involvement in Water Related Scientific Research, and working in consultation with the local Conservation Districts, the importance of being aware of our effect on our water resources.

Within months of proposing this concept to local groups, we became aware that there was more interest than we had expected. We met with the managers of the Pembina Valley, La Salle Redboine and Assiniboine Hills Conservation Districts and were pleased that they were all interested in developing this concept. We arranged for the managers to meet with the principals of the Prairie Spirit School Division to promote the partnership concept. This meeting led to the organization of a pair of Workshops, held on April 24 and 27, 2009.

Suffice it to say, twenty-five of the twenty-seven schools in this division, covering the upper Pembina River Watershed, and components of the Boyne, and Assiniboine Watersheds agreed to send teams of teachers to be trained in the use of the Ducks Unlimited Project Webfoot and the Riverwatch program to be used as vehicles for the development of this awareness. Project Webfoot, provided by Ducks Unlimited, would serve as an introductory level for use with Grade Four students.

The Riverwatch program is accessible to junior high students, as for example, the photo on the cover of this document These students were involved in a training session which took place along the Pembina River during a trial session held in the autumn of 2008.

Using our on-site weather station, we wanted to provide an opportunity for the students to study long-term trends in weather patterns and their effect on water quality and quantity.

Through discussions with the International Water Institute (Wayne Goeken) and the American Riverwatch program and with the Alberta Riverwatch, we have developed a web site which allows field representatives to enter data fathered locally into the web site data banks. This data is reviewed by the web administrators and, after confirmation, the data is available to the public for review and analysis.

We wanted to include the students, through their collection of data, in the development of a Watershed Management Plan for the district.

The Pembina Valley, LaSalle Redboine, and Assiniboine Hills Conservation District have provided training for students in their districts. The Pembina Valley Conservation District has supported student learning through many components of their Water Management Plan and through their participation in the Envirothon program at the school. This process will be expanded to include the LaSalle Redboine and the Assiniboine Hills Conservation Distiricts, and others, as their partnerships with the schools develop.

Finally, we wanted to promote eco-environmental trades and careers through the development of an awareness of the work our partners do. Students work with these local technicians, from an early age. Students participate in internships during their senior high years through the school's Career and Technology Studies program.

We would like to thank all of the staff of Prairie Spirit School Division. This has become a much larger project than we initially believed possible. The dedication to a cause evident at the workshops held in April 2009 left us feeling rather overwhelmed. The need to expand the program has led to the necessity of dividing our school and conservation district partners into cohorts – smaller groups each working with one field kit. We appreciate the willingness to lead and the willingness to work in partnership which is implicit in this structure.

There will no doubt that the process of data collection and training is ongoing, as students grow and graduate, and as new staff and volunteers join the program. The goals of the project will be refined as we learn from experience. We have no doubt that the work will get done, though.

Please contact us if you have any questions or suggestions.

Thanks

Kent Lewarne

Lynda Matchullis

Al Thorleifson

September 2010

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c. Sample Data Sheet

3. Site Selection

a. What makes a good site?

River Watch recommends selecting a site on a river or stream that can be accessed from a bridge. This will enable classes to use the equipment included in the footlocker kit as described. It is the responsibility of the teacher/school doing the testing to obtain permission from the landowner if private property is involved. See Oak Hammock Marsh Guidelines in the Appendix for further site selection information. The primary concern when selecting a site should be the safety of the students!

b. How many sites should you monitor?

This is really up to the teachers involved. It would be better to routinely sample one site rather than to sporadically monitor two or more sites. Better to start small and expand than to overestimate what you can realistically handle.

c. How often should you monitor?

The best case scenario would have you monitor your site(s) once a month at roughly the same day and same time. This may be a bit unrealistic in a school setting. The bare minimum should involve monitoring your site(s) at least once in the fall and once in the spring. Again, our data will likely be more credible if we monitor fewer stations more often and routinely. Also, if possible, you may consider monitoring after any large event, like a heavy rainfall. This will be difficult to co-ordinate with large groups but if you have a small group you may be able to make this work.

4. The Data

a. Data Collection – General Protocols

Preparing for the Field Work

If time permits and the equipment is available, it is strongly recommended that students be allowed to see the equipment and be given a demonstration in class before going to the field. Using the kit checklist provided, ensure that all the equipment needed is in the kit and in proper working order. Unless you are working with a very small group (say less than six students) you will likely want to have groups or individuals “specialize” at a certain River Watch Task. This will allow you to complete the testing much quicker as several groups can be working simultaneously. For example, once the midstream point is found and the mid depth is obtained, one group can be obtaining a water sample as another group records the Site Information and Weather Information.

b. Data Collection – Saving, Sharing and Submitting Data

Proper collection of data is a vital part of this monitoring program. The data will only become valuable as it begins to show patterns and trends over time.

In the field, the data can be entered on the SCEI Water Sampling Data Sheet. A sample sheet is included in Support Documents folder of the SCEI WebSite. Once the data has been collected in the field, and the chemical analysis has been completed, the data will need to properly entered and saved on the SCEI Web Site. The data will be reviewed by a site administrator and will then be uploaded onto the data banks of the site. From there, the data can be shared with our American Riverwatch and Oak Hammock partners.

OAK HAMMOCK MARSH
INTERPRETIVE CENTRE

Red River Center
For Watershed Education

InternationalWaterInstitute

Once the data has been uploaded into the data banks, it can be reviewed by the general public. Students will be able to see how their data fits in with the history of the site.

c. Data Interpretation – What does the data tell us?

How you use the data you collect will be up to you and your students. The Indianna department of Natural Resources Hoosier Riverwatch Web Site

http://www.in.gov/dnr/nrec/2945.htm

has some excellent background information.

The site, written in a series of chapters, outlines why each parameter is collected and what constitutes an “acceptable” value. There is also an excellent Power Point Training presentation. Although their data collection is different, much of the scientific explanation is extremely relevant.

5. The Tests and Tools.

a. Arriving at the Site

Be sure to park in a safe area where students will be able to get in and out the bus/vehicles safely. Never block traffic or allow students to walk on the road. If possible, access an open area to discuss the monitoring with students and demonstrate equipment use is desirable.

b. Getting to Work

The South Central Eco-Institute would like to recommend the following sequence. You may choose to modify the sequence to fit the needs of the class. If working with a small group you may choose to have the entire group work through each step as a group. An alternative for larger groups is to assign individuals, pairs or small groups of students a single task to complete. Although some steps need to be completed sequentially, once the midstream point is found, and water obtained, other testing components can be occurring at any time.

NOTE : The term stream is used in these guidelines to refer to any river, creek or steam.

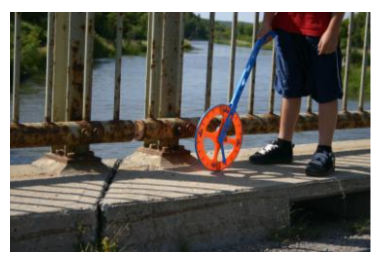
The “Footlocker Kit” you have received from the South Central Eco Institute has almost everything you will need to begin your monitoring program.

You may wish to include some basic supplies like glassware (beakers, droppers, Rinse Bottles), a lab thermometer and some paper towels.

1. **Sample Site Information**
    a. GPS Unit
        i. On arrival to the site, turn on the GPS unit.
        ii. While the GPS Unit acquires satellites, record the necessary Sampling Organization Information and Individual Observer Information on the Data Sheet.
        iii. Do NOT record your GPS co-ordinates until the midstream point has been determined. Your co-ordinates should reflect where your work was done, NOT where you are parked.

2. **Stream Width** – Use the Trundle Wheel to find the width of the river/stream.

    a. Find the edge of the river/stream while standing on the bridge. Adjust the Trundle wheel so it is at “0”. Be sure to check that the Trundle wheel is set to “click” with each passing metre. Place the mark directly above the edge of the river/stream.
    b. Be sure the trundle wheel counter is set to zero. Slowly push the Trundle wheel across the bridge. The trundle wheel measures in metres (m).
    c. Continue across the bridge until you are directly above the farther shore of the river.
    d. Record the width of the river/stream to the nearest 0.1m. See Water Body Width on the Data Sheet.
    e. Divide the stream width by two to find the distance to the middle of the stream.
    f. Use the Trundle Wheel to measure back half the distance of the stream width. This is where the remaining testing will take place.



Example: If the stream is measured with the Trundle Wheel to be 76.4 m across, then 76.4m/2 = 38.2 m. The students would count back 38.2 m from the far edge of the stream toward the start point. At 38.2 m (midstream) testing will take place.

3. Stream Depth

a. Use the calibrated rope to determine the stream depth.
b. This will be done in the middle of the stream as determined above.
c. Securely attach the lead mass (bob) to the calibrated rope using the clip on the rope.
d. Slowly lower the mass over the bridge. Hold the rope to a set point on the bridge (top of railing for example). Each red mark on the rope represents 1m. Each yellow mark represents 5m. Record the depth at the surface (when bob just reaches the water). Record to the nearest 0.1m. See Water Depth at Surface on the Data Table.
e. Continue to lower the bob until the bob reaches the bottom of the stream. Record the depth to the set point. Record on the data table. See Water Depth at Bottom.
f. Using the above two measurements find the Actual Water Depth to the nearest 0.1m (Actual Water Depth = Depth at Bottom – Depth at Surface).
g. You have now determined the mid-depth point. This is the point where the water will be collected in the next step.

For example. The bob is lowered over the rail of a bridge. As the mass (bob) just reaches the surface of the stream it is noted that 5.7 m of rope have released. This measurement is noted in the Data Table. The mass is then lowered to the bottom of the stream. It is noted that the measurement to the rail is now 8.2m. This measurement is also recorded on the Data Table. You can now calculate the depth of the stream:

Actual Water Depth = Water Depth at Bottom - Water Depth at Surface
Actual Water Depth = 8.2m – 5.7m
Actual Water Depth = 2.5m

This information will be needed when collecting the water sample in a later step.

4. Sampling Site Information

a. Use the GPS unit to record the exact location of your site.

b. Press the rocker lever (at tip of arrow) straight down to "mark" the waypoint of your location. Record the locations on the data sheet. Include the Zone, Easting and Northing.

c. Record the date in the format DD – MO- YEAR. September 10, 2009 would be recorded as 10-09-2009.

d. Record the military time for your location, 1:30 pm would be recorded as 13:30. We will be assuming that we are all on Central Standard Time (CST) or Central Standard Time – Daylight Saving Time (CDT)

5. **Site Weather Information**

(This can be done at any time during the site visit)

a. Air Temperature

   i. Use the Dial Thermometer to determine the air temperature.

   ii. Hold the thermometer by the "dial" NOT the metal probe and hold it at chest height, away from the body. Wait 2 minutes or until the reading is stable.

   iii. Record the Air Temperature on the Data Sheet. See Site Weather Information, Air Temperature on Data Sheet.

b. Wind Speed

   i. Use the Dyer Anemometer to obtain the wind speed.

   ii. Hold the anemometer at chest height, away from the body. You should have the wind in your face (with the face of meter toward you)

   iii. If necessary (ie wind is greater than 10 mph, place your finger over the hole to change scales.- see directions on Anemometer package for details)

   iv. Record the reading on the Data Sheet. See Site Weather Information – Wind Speed on Data Sheet.

v. NOTE – Wind speed is to be reported in kph and some anemometers are recording mph. The conversion factor is 1mph = 1.61kph

c. Wind Direction

i. Use the Suuto compass to determine the wind direction.
ii. Hold the compass at chest height, away from the body with the wind in your face.
iii. Turn the dial on the compass so that the red arrow (north) is in the "house" (black arrow rotating on dial.
iv. Read the wind direction from the dial.
v.

d. Precipitation

i. Has there been any precipitation in the past 24 hours? Yes or No. Record on the Data Sheet.
ii. Has there been any precipitation in the past 3 days? Yes or No. Record on the Data Sheet.

e. Percent Cloud Cover

i. Done by looking and estimating cloud cover as a percentage. Overcast is 100% and absolutely no clouds is reported as 0%.
ii. Record the percentage. See Site Weather Information – Cloud

6. Secchi Disc – Optional

a. If stream flow and time allow, you may wish to use the Secchi disc at this time.
b. Lower the disc until it just reaches the surface of the water. Adjust the yellow mark to the same set point used when finding the steam depth.
c. Lower the disc into the steam until the pattern is not visible keeping track of the yellow marks (1m) that pass as you lower the disc.
d. Record Secchi depth on the Data Sheet.

7. **Obtaining a Water Sample.**
   a. Use the Horizontal Alpha Water Sample (also known as a Van Dorne) to obtain the water sample.
   b. Ensure valves on each end of the Van Dorne are closed.

   c. Open the Tube ends and hook to the center. (See Alpha Horizontal Water Sample handout in the resource binder.)

   d. Triple rinse the tube with stream water.
   e. Lower the Van Dorne to midstream using the above two depth measurements. Make sure you have and keep the messenger at the top of the bridge. Once the Van Dorne reaches the top of the stream, carefully lower the Van Dorne to the mid-depth point determined above. Since the rope on the Van Dorne is not calibrated you will have to estimate the depth to lower the Van Dorne (ie if the stream is 2 m deep, lower the Van Dorne about 1m into the stream).

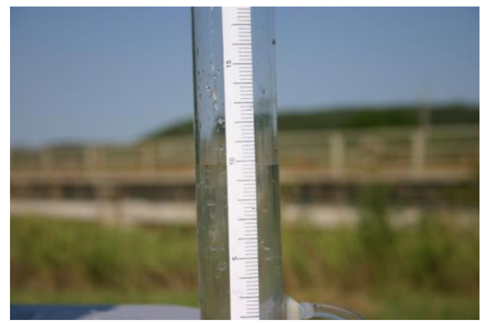
   f. Release the messenger. Both tube ends should close.
   g. Pull the Van Dorne out of the water. If both ends did not close, reload and begin again. If both ends closed you now have the water sample you will need for the Transparency Tube and Water Chemistry Tests.

8. **Transparency Tube**

   a. Ensure the pinch clamp sealing the drain tube on the Transparency Tube is pinched closed.
   b. Use the valve on one end of the Van Dorne to add water from the Van Dorne to the Transparency Tube. You may need to open the opposite end to allow air into the Van Dorne.

c. Fill the Transparency Tube until you cannot see the pattern on the bottom of the tube.
d. One person should stand with the sun to their back, holding the tube perpendicular to the ground, looking straight down at the pattern on the bottom of the tube.

e. Another person, using the pinch clamp on the drain tube, will release water from the Transparency Tube until the first person can JUST see the pattern on the bottom of the tube. Close the pinch clamp and read the depth of the water in the tube.
f. Record the depth of water in the tube to the nearest 0.1cm. See Transparency – First Reading on the Data Sheet.



g. Continue to release water from the tube until pattern is clearly visible (ie you can see the screw in the middle of the crossing pattern).
h. Record the depth of water to the nearest 0.1cm. See Transparency Second Reading on the Data Sheet.
i. Calculate the average of the two depths and record on the Data Sheet. (if using the Excel Spread Sheet this will be done for you).

9. Water Chemistry

There will be four water quality tests performed during this testing component. All tests will use the La Motte Colorimetric Test Kits. The directions for each test are included in the appropriate kit.

Although everything you need to perform the test is included in the kit, you may find it convenient to add some small beakers, dropper, paper towels and a rinsing bottle to your kit.

a. Use the water from the Van Dorne to complete the following Water Chemistry Analyses:
    i. Temperature – Once the water sample is obtained, use the thermometer to obtain the temperature. Record to the nearest 0.1^{o}C. You will either need to bring a second thermometer with you or use the dial thermometer from the Site Information Kit. If using the dial thermometer be sure to take the air temperature first while the thermometer is DRY. A wet thermometer will give an inaccurate air temperature reading!

ii. pH - Phenol Red Test – Follow the directions in the La Motte Kit. Record the pH on the Data Sheet .
iii. Dissolved Oxygen – Follow the directions in the La Motte Kit. Record the DO on the Data Sheet.
iv. Ammonia – Nitrogen – Follow the directions in the La Motte Kit. Record the Ammonia – Nitrogen levels on the Data Sheet.
v. Phosphates – Follow the directions in the La Motte Kit. Record the Phosphate level on the Data Sheet. Be sure to ket the treated solution sit for five minutes before taking the reading.

It is best if these tests can be done immediately. However, if time or weather prevents immediate testing, a water sample can be collected and taken back to the lab/school and these tests performed later.

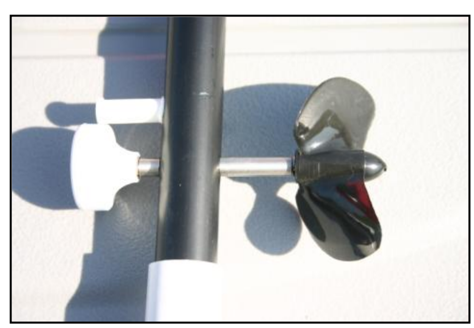
10. Turbidity

Turbidity will be measured using the Hach 2100Q Portable Turbidity Meter.

The documentation that comes with the Hach 2100Q should be consulted for more detailed instructions and for calibration – verification procedures.

11. Stream Flow

Steam conditions or weather may dictate whether this measurement can be safely obtained. Student safety should not be jeopardized to obtain this measurement. Do not allow students to be near the banks of fast moving water (ie high spring water in the Pembina River for example).



a. Remove the Flow Meter from the storage container.
b. Assemble the plastic rods, including the one with the impellor. Attach the cable to the meter. DO NOT OVERTIGHTEN.
c. In shallow water, you may choose to add a depth tube to the bottom of the impellor tube so that water velocity can be determined at a consistent depth.
d. To take a reading, place the impellor in the stream to the desired depth. Turn the

meter on and make sure the meter is set to "Water" and "m/s".

e. Record the stream velocity in m/s. See Flow Rate on the Data Sheet.

12. Other Water Considerations

a. Quality Assurance.

i. Report N/A on the Data Sheet unless a water sample is being taken for analysis by an accredited lab.
ii. If a duplicate water sample is taken, record FD (Field Duplicate) on the Data Sheet. This is NOT likely to occur.

b. Stream Condition

i. This is a qualitative judgement made by looking at the water.
ii. Choose one letter/description from each column in the table below that best describes the stream TODAY.

N – Normal	SW - Swift	C - Clear
L - Low	SL - Slow	M - Muddy
H - High	MO - Moderate	O - Other

iii. Record three abbreviations on the data sheet. See Other Water Considerations – Stream Condition.

For example, if testing in the fall and the stream is at a normal level (depth) with a slow flow and it looks quite muddy, you would record N, SL, M on the data sheet.

c. Recreational Suitability

i. This is also a judgement call made while looking at the water in the Transparency Tube.
ii. Choose the description that best fits the stream TODAY.

1	Beautiful, could not be better!!!
2	Very minor aesthetic problems. Excellent for body-contact recreation. (ie swimming)
3	Body-contact recreation and aesthetic enjoyment slightly impaired.
4	Recreation potential and level of enjoyment of the stream is substantially reduced (would not swim but boating/canoeing is okay).
5	Swimming and aesthetic enjoyment of the stream are nearly impossible.

iii. Record the number corresponding to the best description on the Data Sheet. See Other Water Observations – Recreational Suitability.

d. Appearance

i. Again, this is done while looking at the water in the Transparency Tube.
ii. Choose the description below that best describes the appearance of the water.

1	Clear	Crystal, clear, transparent water.
2	Milky	Not quite clear. Slightly cloudy white or gray.
3	Foamy	Natural or from pollution
4	Tea-colored	Clear but tea colored due to wetland or bog influencees
5	Muddy	Cloudy brown due to high sediment levels.
6	Green	Might indicate excess nutrients released into the stream.
7	Green or Muddy	Extensive floating “scum” and/or strong foul odour

iii. Record the number corresponding to the best description on the Data Sheet. See Other Water Observations – Appearance.

13. Field Notes

a. Record all field observations on the Data Sheet.
b. This should include all wildlife actually seen such as birds and mammals or signs of wildlife like tracks, scat, etc.
c. The description should include the location, vegetation status (leaf out, cropping, harvest).
d. Record all that you see during your visit. Identify as much as possible using the Field Guides in the Text Resources Tub.
e. You may wish to take a digital photograph(s) of the site. This can be useful to compare changes over time. You should try to take the picture(s) from the same location and in the same direction during each visit.

14. Biological Monitoring

a. **E. coli – Coliforms** (bacteria of interest in the water)
   i. Obtain a water sample from the Van Dorn and take it back to the lab/school to complete this test. You may wish to use the “Whirl Pacs” to take a sample back or use another container. It is imperative the container used is clean and sterile.
   ii. Follow the directions in the Resource Binder for Coliscan Easygel.
      1. Use a 3-5 mL sample of water. It is important to note the exact volume of water used as later you will calculate the bacteria present per 100 mL of water.

2. Pour the water into the vial of Coliscan Easyget media which has been allowed to come to room temperature. (NOTE – Coliscan Easygel media is best kept frozen until needed. This will prolong its "shelf life" The media does need to be a allowed to melt prior to use).
3. Replace the cap on the vial and mix gently.
4. Carefully remove the top portion of the dish (larger diameter plastic piece)
5. Pour the complete contents of this vial into the PRETREATED COLISCAN DISHES. Replace the top.
6. Allow the dish to incubate for 24-48 hours, depending on the temperature.

iii. After incubation, compare the dish to the card in the resource binder. Count the colonies and calculate the colonies of Coliforms per 100mL of water and, if present, the E.coli per 100mL of water.

b. Macro-invertebrates

The South Central Eco-Institute is continuing to explore ways to quantify this monitoring parameter. Once a protocol has been established, information will be sent out to be added to the kits. Chapter 5 of the Hoosier Manual

http://www.in.gov/dnr/nrec/2945.htm

has a description of how Macro–invertebrates are monitored in their program.

Safety is again our first priority. Do not allow students to wade into fast moving streams. USE EXTREME CARE AND CAUTION if you are going to allow students to enter the stream. It is not recommended to allow students to enter any stream that is more than "knee deep"! For the time being, Macro-invertebrate sampling will be done qualitatively. Use the D-net to safely.

15. The Sonde Unit (Optional, if available)

If a Sonde Unit is available it will be calibrated for you. YOU DO NOT NEED TO CALIBRATE!

The Sonde Unit will collect the following Water Quality Parameters:

- Water Temperature (^oC)
- Conductivity (μS/cm or mS/cm)
- Dissolved Oxygen (%)
- Dissolved Oxygen (mg/L)
- pH (no units)
- pressure (mmHg)
- calibration factor

The Sonde Unit will also indicate the current atmospheric pressure. While there is no Data Field on the Data Sheet for pressure, you may wish to include it in the "Notes" area.

6. **Maintenance and Trouble Shooting**

a. **Regular Maintenance and Replacement of Disposables/Consumables**

The equipment provided in each kit was purchased as Field Quality equipment. It is meant to be used in the field by researchers. With proper care, each piece of equipment should work for many years to come.

Prior to Each Field Trip

- Ensure all materials are in the kit. See Check list.
- Do you have the extra things you may need? Paper towels, glassware?
-

Before Leaving the Site

- Have you collected all the equipment?
- Is equipment used in the water rinsed and dry?

Each fall, following fall monitoring (at freeze up, possibly) arrangements will be made for any required maintenance and replacement of consumables, such as the chemicals in the La Motte kits and the Coliscan Easygel. At this time, the exact cost of this maintenance and replacement of consumables is unknown. As the SCEI is funded entirely by "Grants", funds may become limited and there may need to be a charge to each Cohort for consumables.

b. **Who to contact if something is not working right.**

The SCEI hopes that we can get several years of monitoring with little or no equipment problems. Realisticly though, problems are going to occur. If a problem does occur, your first call should be to the leader of your cohort. If that person is unable to resolve the issue, you may try contacting the following individuals:

- Kent Lewarne – Nellie McClung Collegiate
- Al Thorleifson – Nellie McClung Collegiate
- Lynda Matchullis – PSSD Office

There is one set of equipment for training, back up, and monitoring/calibrating that will be at NMC. If necessary, you may use a piece of equipment from the training – back up kit. Borrowing equipment from other cohorts is discouraged as it will cause inventory problems if "entire" kits are not passed along from site to site.

c. **Packing Up for Storage and Transport**

It is the responsibility of each cohort to ensure that the Kit is properly packed up for storage and transport. The Kit itself, has one large grey container and several smaller “Rubber Maid” kits within the larger container. Each of the kits currently has a label indicating what is in each “kit”. Each item (provided it is not too small) also is labeled with the Kit Number on a SCEI sticker. Please ensure that these items are returned to the proper container.