How to Make an OPIHI Quadrat

The OPIHI monitoring program uses a 12" x 12" square quadrat strung to make 25 points and 36 squares within the quadrat (Figure 1).

**Supplies (per quadrat):**
- ½" diameter Schedule 40 PVC (4 feet)
- ½" PVC 90 degree angle elbow connectors (4)
- PVC primer
- PVC cement (we use P700 PVC cement)
- Fishing leader line (We recommend red, which is easier to see in the water than clear line. Use a heavy gauge to withstand student abuse.) You can also use string (e.g. packing).
- Old newspaper (to cover area as primer stains)
- Gloves (to protect hands as primer stains)

*Work outside or in well-ventilated area when using PVC primer and cement

**Tools:**
- Saw (ie. hack saw) or PVC cutters
- Drill with drill bit (we recommend 1/8" size)
- Ruler
- Needle with large eye (if using fishing line or string using is very flexible)
- Pencil

**Instructions**
(as with all directions, read entire instructions before you begin)

1. Mark length of PVC pipe into 12" sections using ruler.
2. Cut PVC with saw or PVC cutters.
3. Using a tape measure, mark the 12" PVC lengths on the spots where the holes will be drilled, at 2", 4", 6", and 10" (five holes equally spaced 2" apart).
4. Once marked, drill the holes straight through the two walls of the PVC.
5. Without gluing, assemble the four PVC lengths together with their elbows.
   - Face the drilled holes of the PVC sections into the center of the quadrat.
   - The elbows should be securely joined to the straight PVC sections, they do not have to be jammed as hard or as far down the PVC as you can manage.
   - After assembling, make sure the quadrat sides are of equal length (make sure the square is actually a square) and the completed quadrat will lay flat. You can adjust your square by pushing the longer PVC sections more securely into the corners.
6. When all sides are aligned properly, mark the PVC lengths and their corresponding elbows with a pencil at the point where they meet (Figure 2).
   - The “A” lines in the figure trace where the elbow joins the pipe. These lines are so you know where to put the glue, and where to stop pressing the elbow and straight length together during final assembly.
- The “B” lines in the figure are drawn as straight as possible from the elbow onto the straight piece. During final assembly, you will make sure these meet up so the elbow angles are correct and your quadrat lies flat.

7. Lay out newspaper, put on latex gloves, and primer inside of elbow and outside of PVC pipe where they will join.

8. Put a thin layer of the PVC cement on top of the primer, then put the elbow and the length of PVC together. Press down on the elbow until you reach the “A” line, and make sure the “B” lines on both pieces line up. Adjust alignment and let dry. Be careful – PVC cement dries very quickly!

- In order to ensure you build a flat quadrat, we recommend cementing the quadrat pieces in the following order:
  1. Cement an elbow to each straight PVC piece.
  2. Cement the two PVC pieces of opposite corners together (e.g. corner 1 and corner 3, Figure 3).
  3. Cement corners 2 and 4 at the same time (Figure 3). By gluing the two final corners together at the same time to complete the quadrat you'll be able to twist the frame slightly to ensure it lies flat.

9. Once quadrat is assembled, cut two long pieces (approx. 100") of fishing line per quadrat.

10. Leaving a few inches free, wind the line a few times around a length of PVC near where you will start stringing (one of the holes closest to an elbow). Tie the line tightly (tie the short line end you left free to the long line end you will string the quadrat with).

11. Weave the string through the needle, and pass the needle through the holes on opposite sides of the quadrat to create a set of parallel lines (Figure 4).

12. At the end, wind the end of the fishing line around PVC near your last hole and tie as tightly as possible.

13. Repeat on the remaining two sides of the quadrat, but this time alternately go over and under the first string (Figure 5).
**Figures**

**Figure 1:** Completed Quadrat

**Figure 2:** Mark PVC lengths and elbows with pencil before gluing

**Figure 3:** Cement opposite PVC corners together first

**Figure 4:** String quadrat to create set of parallel lines

**Figure 5:** Alternate going over and under previously laid string.