EXPLORER product demonstration prop building instructions

Regional competitions may build product demonstration props out of materials other than PVC pipe. Your regional coordinator will inform you of any changes to materials for your regional competition. NOTE: Look for a regional information document posted on your regional website. This document will list any changes to the product demonstration props.

Companies should be aware that tolerances in lengths of cut pipe and length of pipe inserted into joints can change the overall dimensions of product demonstration tasks. Except where noted, companies should expect tolerances in all product demonstration props and should build their ROVs and tools accordingly. In no case should the dimensions given in this document for a product demonstration prop be used to calibrate a measuring device.

Online links and Home Depot part numbers are given for certain construction items. However, some Home Depot stores may not carry the listed items or Home Depot may not be available in your area. MATE recommends checking other local hardware stores or online sources, such as those listed below, for the required component.
https://www.pvcfittingsonline.com/
https://pvcpipesupplies.com/pvc-fittings/schedule-40-pvc-fittings/

SolidWorks files will be available soon for all product demonstration props. SolidWorks Student Edition is free for MATE competitors. The eDrawings Viewer is a free download that allows the Solidworks files to be viewed dynamically.

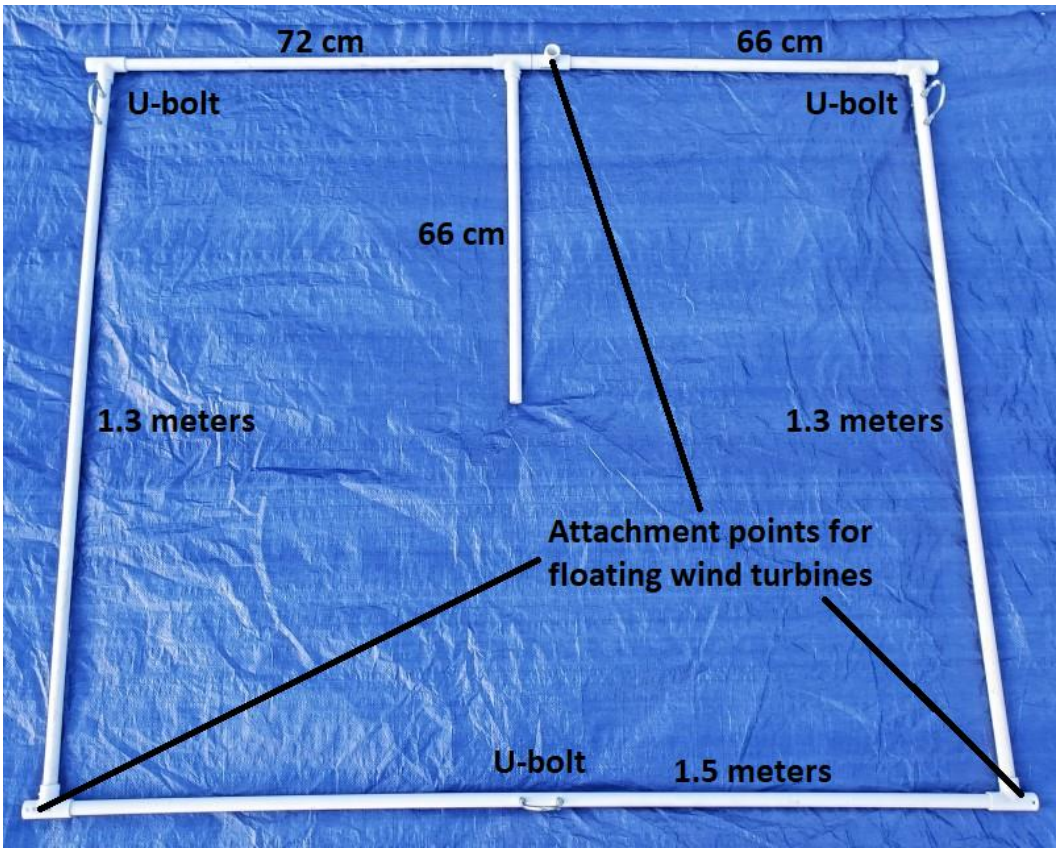
See last page for update notes (if any).

General

The 1-meter square. Companies must launch through a 1-meter square area on the surface, side of the pool.

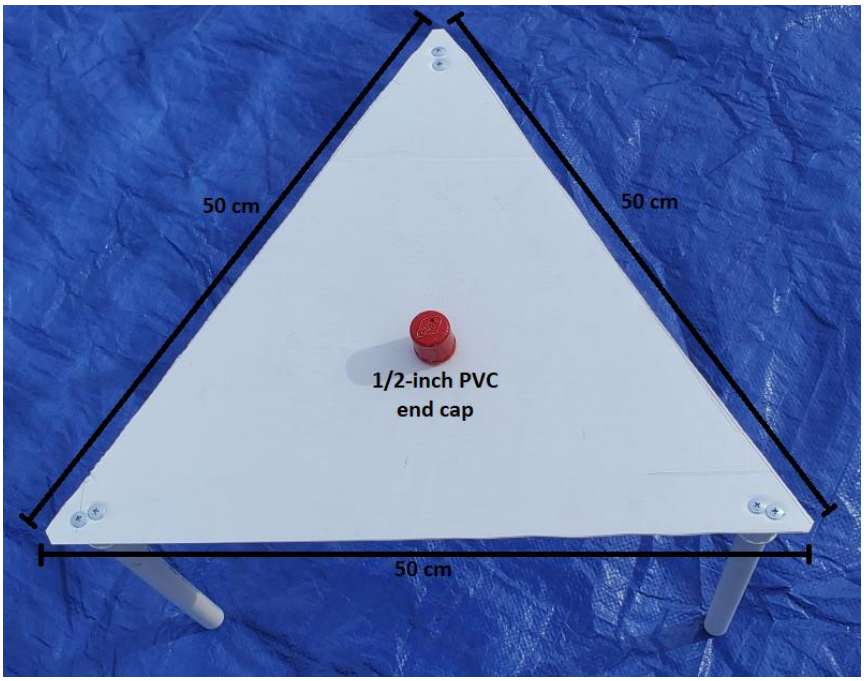
Task 1: Marine Renewable Energy

Task 1.1 Install a floating solar panel array

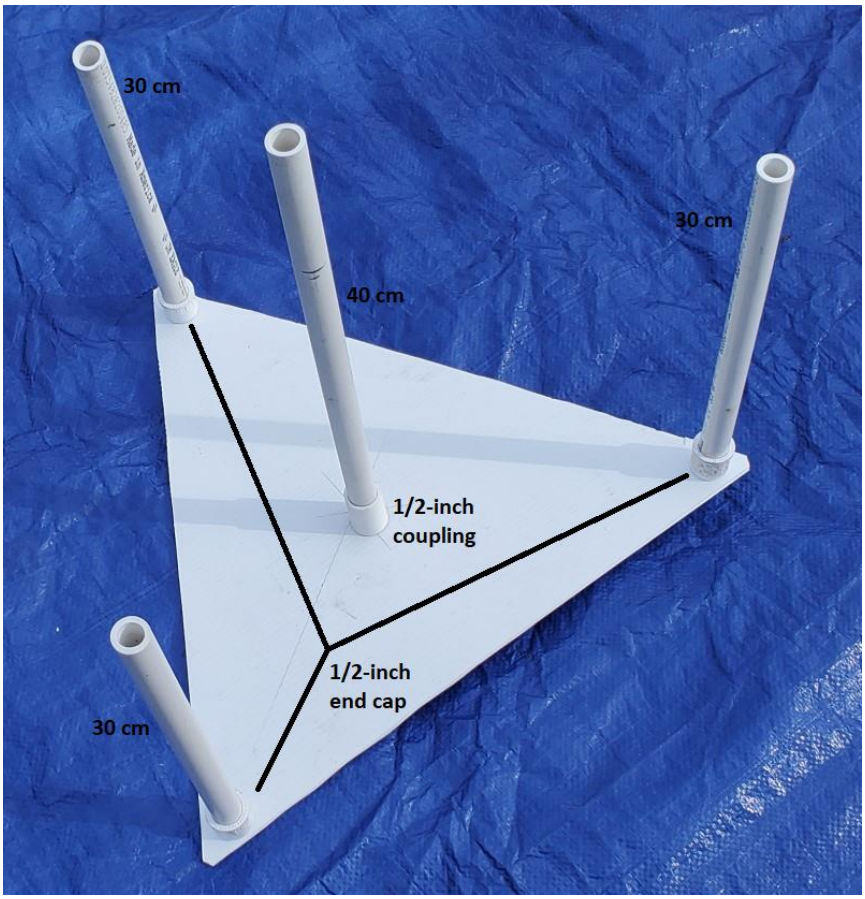


The base structure for the wind turbines and solar panel array. Wind turbines are connected to the indicated tees by rope. The mooring connectors attach to the anchor points, #310 U-bolts, on the base of the structure. Note that #385 U-bolts may be substituted for #310 U-bolts.

A wind turbine. The blades are constructed from corrugated plastic sheeting. The rope will be long enough to reach from the floating turbine to the PVC framework on the bottom. Note the indicated water line. Flotation is used to hold the wind turbine upright in the water. Additional flotation may need to be added around the base to keep the turbine upright.

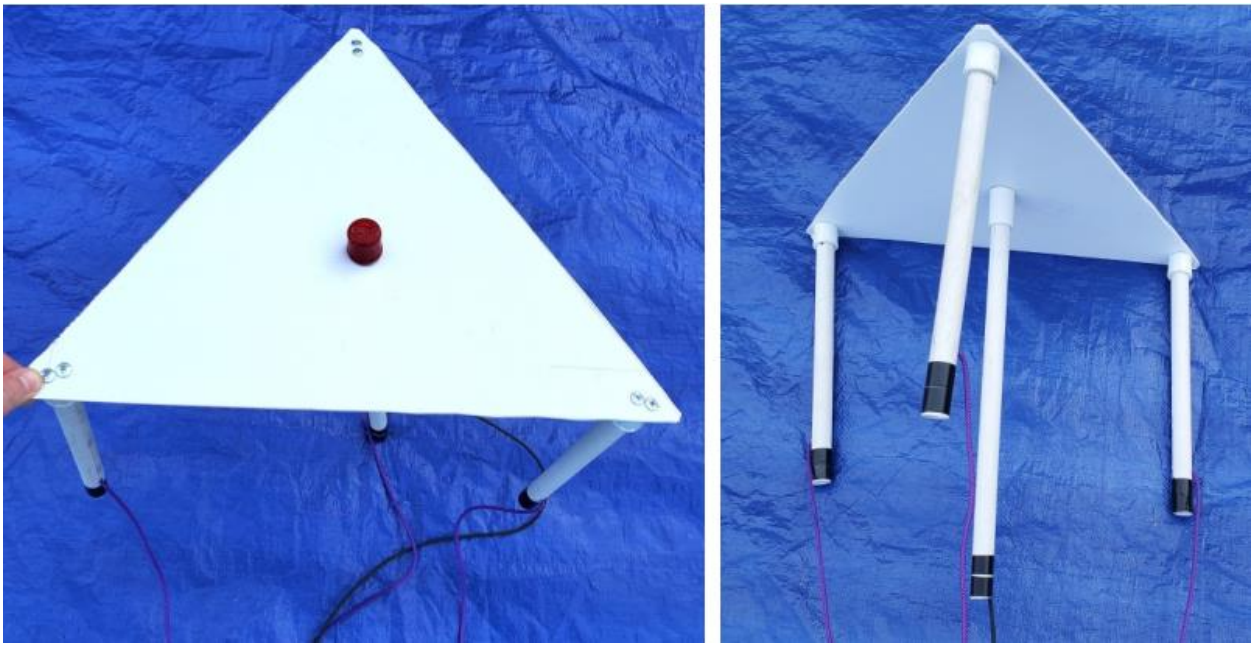


The solar panel array is constructed from corrugated plastic sheeting.



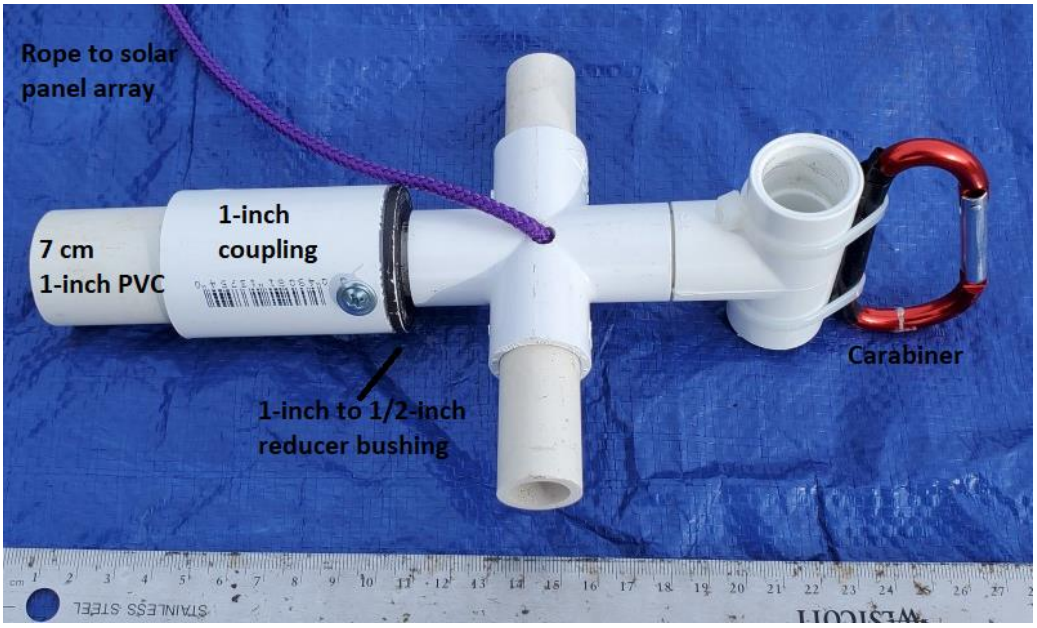
Four ½-inch PVC pipes extend down from the three corners and center of the corrugated plastic sheet.

One of the four pipes extending down from the corrugated plastic sheet. Each length of PVC pipe has two layers black plastic (electrical) tape provide thickness. This thickness provides additional tension to hold the mooring connectors and power connector onto the ½-inch pipe. Lengths of rope connect the pipes in the corner to the mooring connectors and the pipe in the center to the power connector.

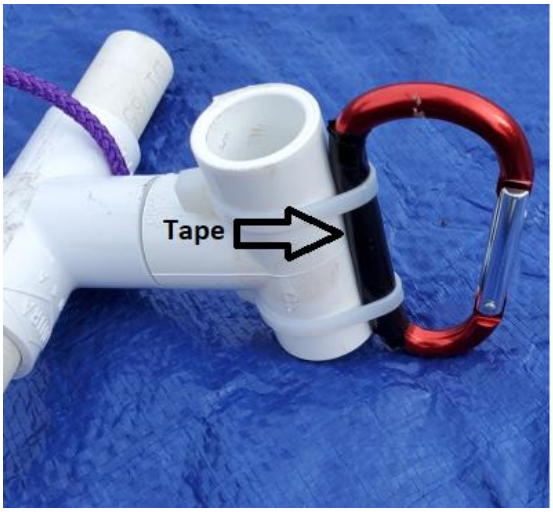


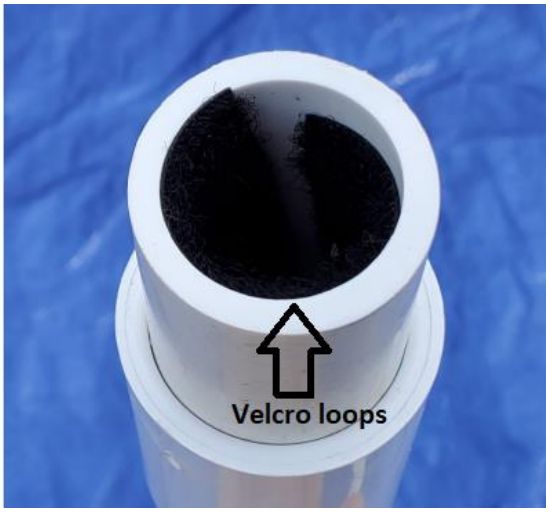
Four PVC pipes with tape and rope extending down from the three corners and center of the corrugated plastic sheet. Left: Top view. Right: Bottom view.

Flotation on the underside of the solar panel array.



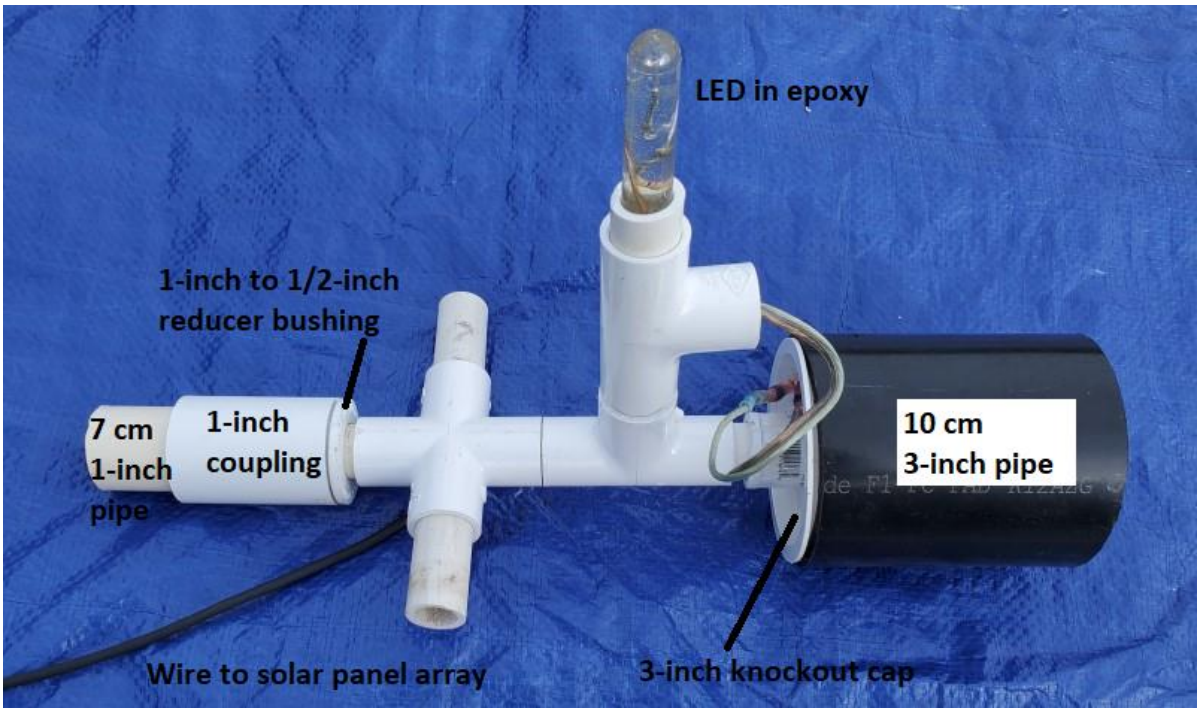
A mooring connector. One of these will be attached to each of the three lengths of PVC extending from the corners of the corrugated plastic sheet. The rope will be approximately 1.25 times the depth of the pool.





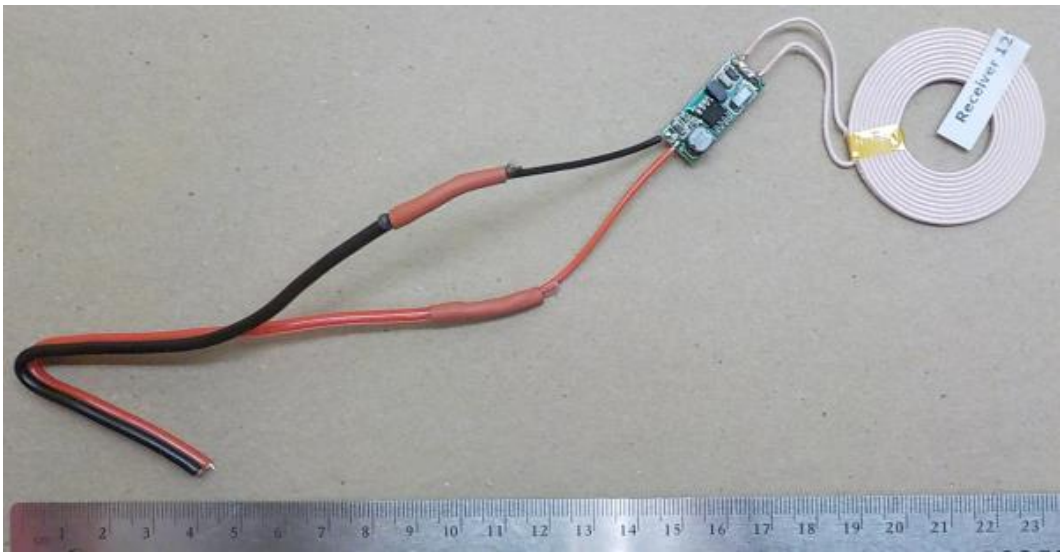
Left: 3” aluminum carabiner on the mooring connector. Three layers of tape on each side of the carabiner will prevent it from rolling against the ½-inch tee when secured with cable ties. Right: Velcro loops inside the 1-inch PVC coupling.

A mooring connector attached to an anchor point.



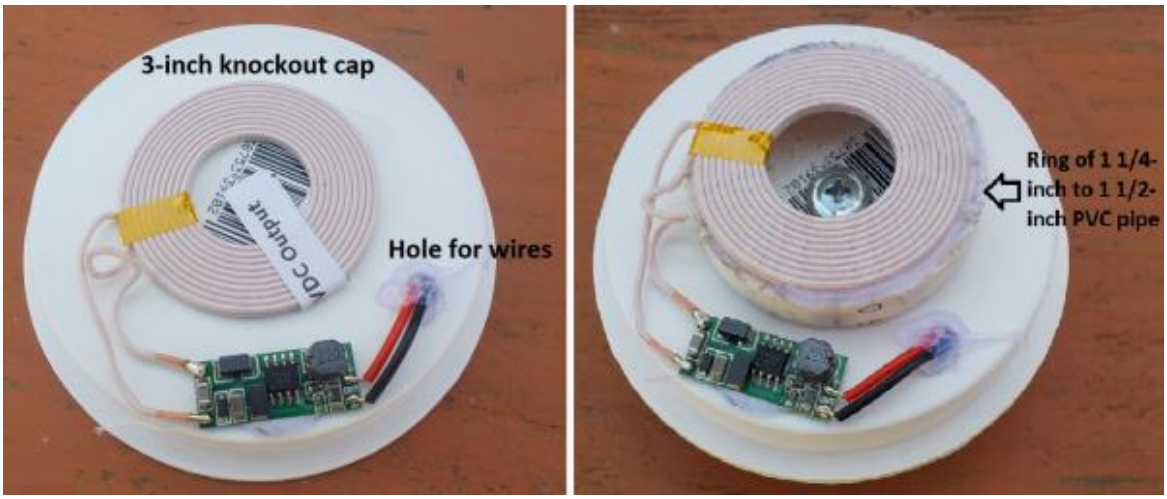
The power connector. The power connector will use a 12-volt inductive coupling power connector to illuminate LEDs.

The following explains how the power connector (receiver side) is constructed.



15 cm red/black extension wires are soldered to the receiver side of the inductive coupling power connector. The solder joints are waterproofed.

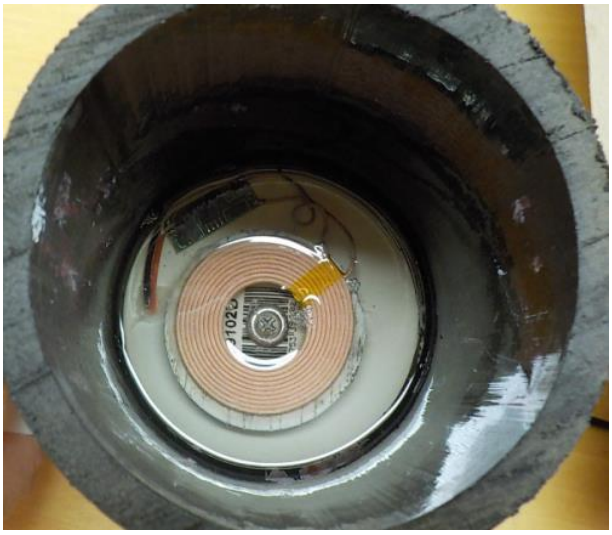
The 3-inch knockout cap with ½-inch end cap attached.



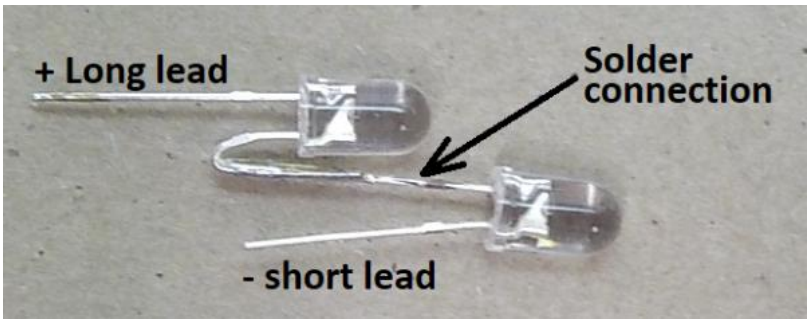
The receiver (output) side of inductive coupling power connector is mounted on the inside of a 3-inch knockout cap. Left: Note the hole for the wires to pass through the knockout cap and the hot glue to hold the electronics and wires in place. Right: A ring of 1 ¼-inch or 1 ½-inch PVC pipe positions the coil above the electronics.

The power connector side view.

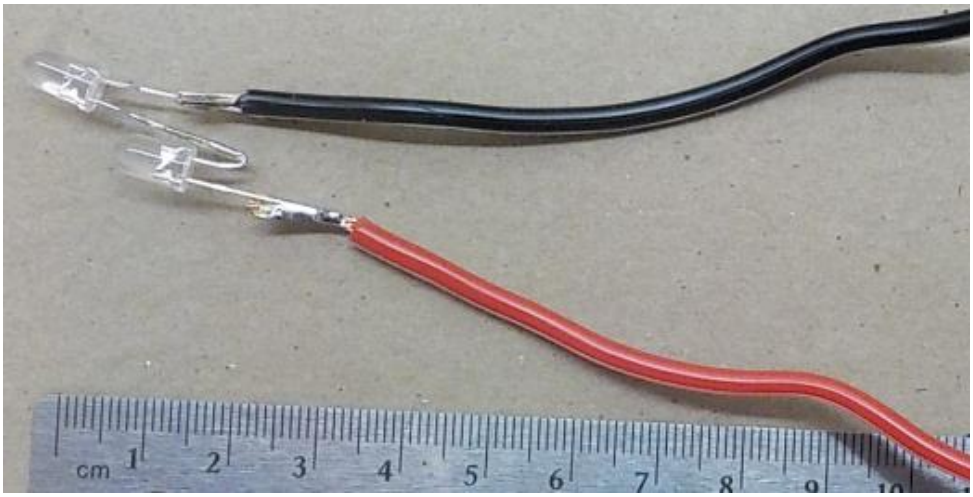
A slow curing epoxy (Envirotex Lite) is used to waterproof the receiver side of the inductive coupling power connector. Note that fast curing epoxies may release enough heat to damage the electronics. The layer of epoxy should be as thin as possible (less than 2 mm) but still cover and waterproof all the electronics.


Power connector electronics waterproofed.

Power Connector LEDs

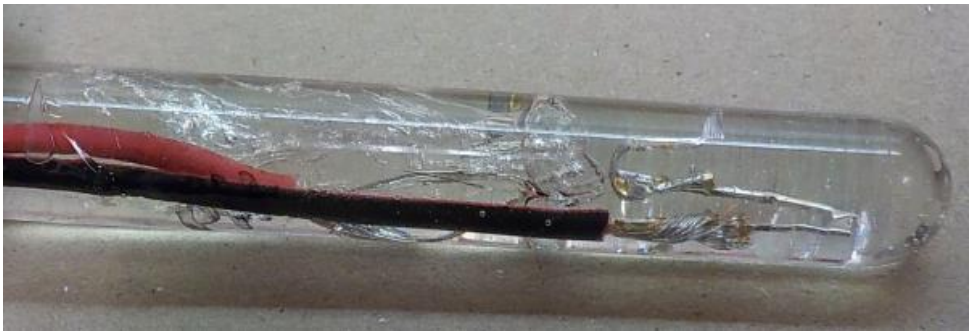


Two LEDs soldered together in series.

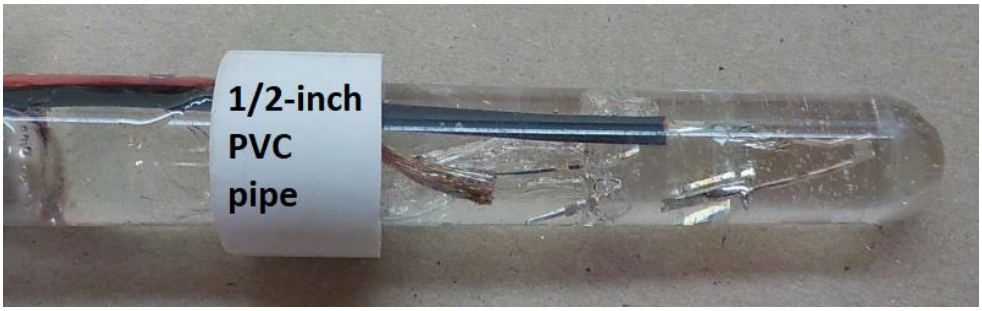


15 cm extension wires are soldered to the two LEDS.


The two LEDs inside a plastic test tube. Note (make sure the wires and LED leads are not touching / shorting).

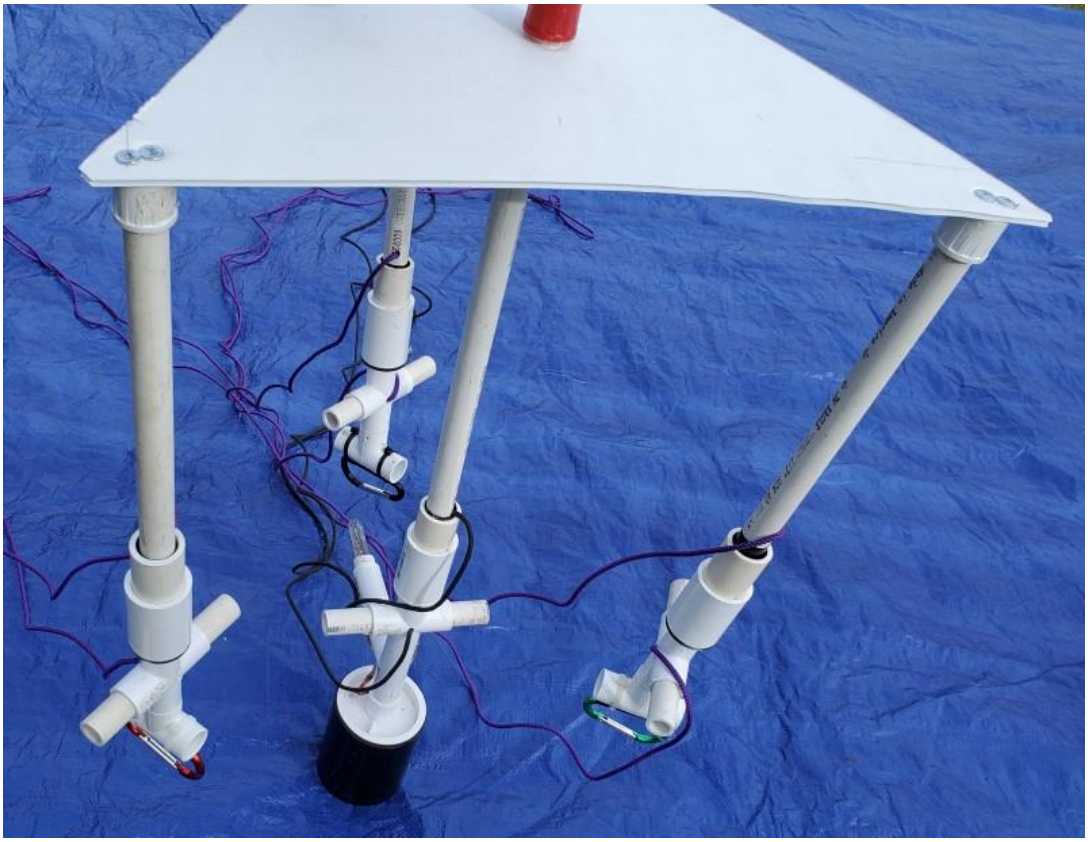


Epoxy (Envirotex Lite) waterproofing is added to test tube. Note that when the epoxy hardens, it will leave small lines and bubbles in the tube (as seen above).

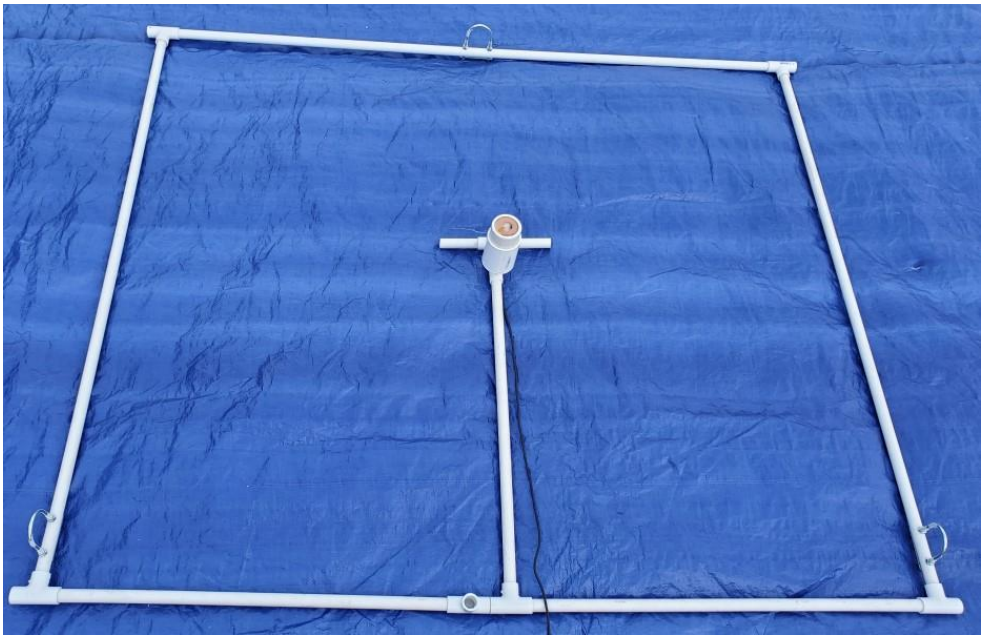


A 1.5 cm ring of ½-inch PVC pipe is added to outside of test tube.

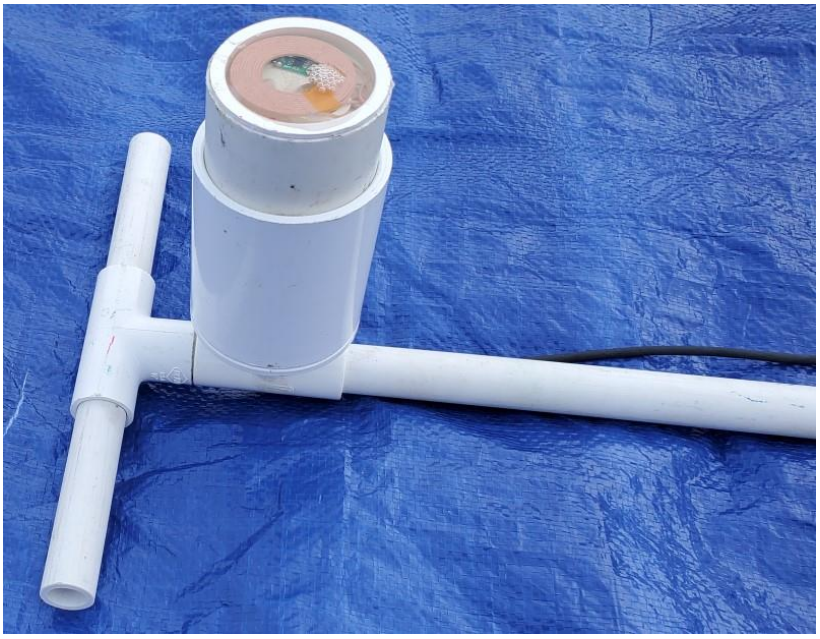
The ½-inch PVC ring is inserted into the side opening of a tee. The extension wires should be run through the middle opening of the tee and be soldered to the receiver side of the inductive coupling power connector, which is located in the power connector.



The three mooring connectors and power connector attached to the solar panel array.

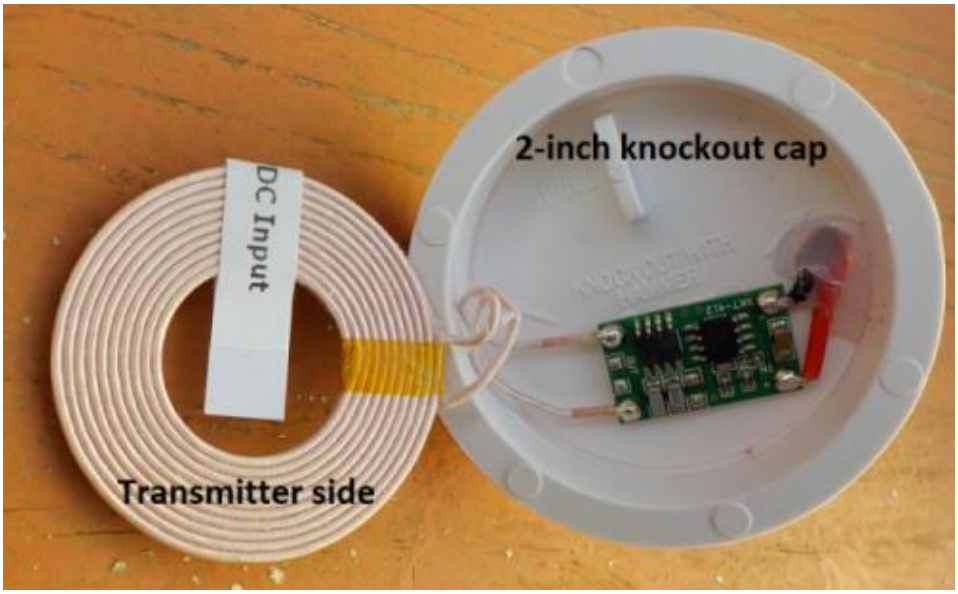


The power port located in the center of the base framework.



The power port. The power port will use an inductive coupling power connector to illuminate LEDs.

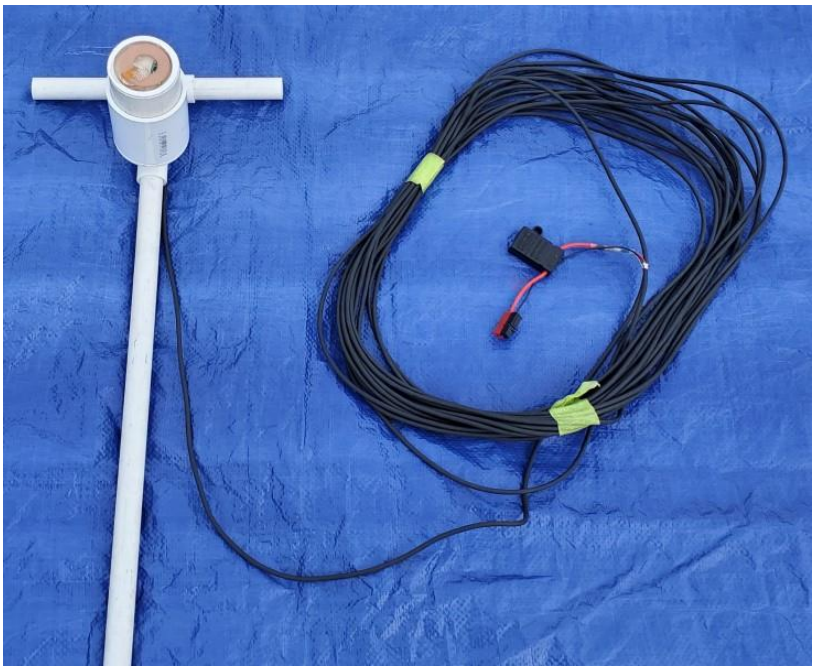
The following explains how the power connector (receiver side) is constructed.



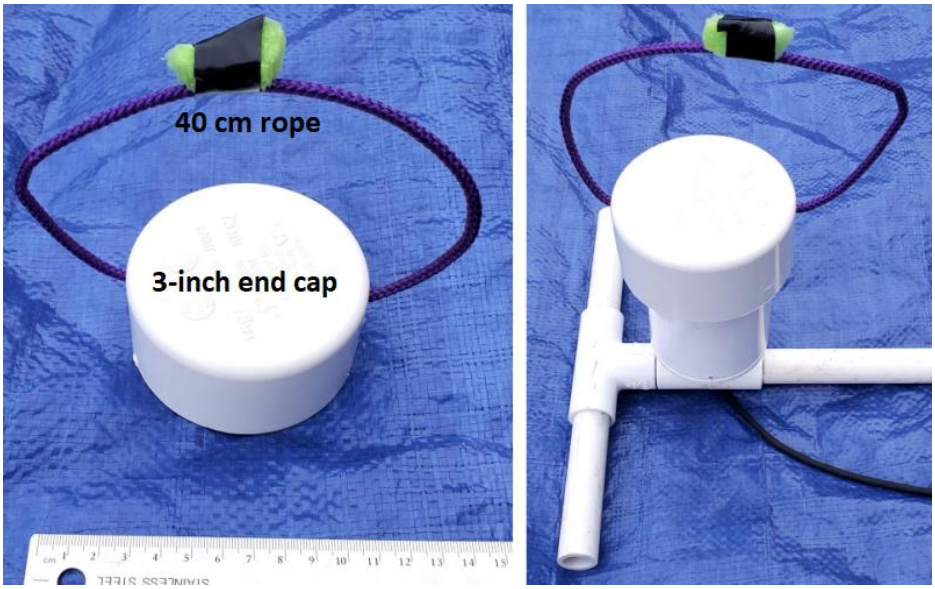
The transmitter side of the inductive coupling power connector in a 2-inch knockout cap. Note the wires pass through a hole in the knockout cap. Hot glue is used to seal the hole.

Left: The coil is raised above the electronics and flush with top of 2-inch knockout cap. Right: The coil is waterproofed with a slow curing epoxy (Envirotex Lite).

The transmitter side of the inductive coupling is attached to a wire that runs to the surface.
Left: The solder connection is waterproof. Center: The wires pass through a hole in the ½-inch tee of the connector handle. Right: Anderson powerpole connectors are attached to the top end of the wire.



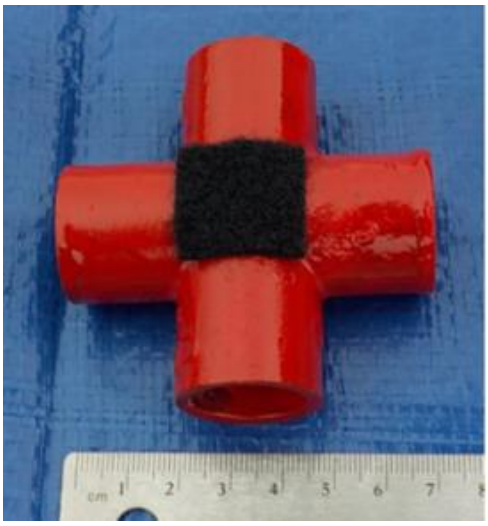
The MATE power port connects to a 12VDC power supply on the surface.



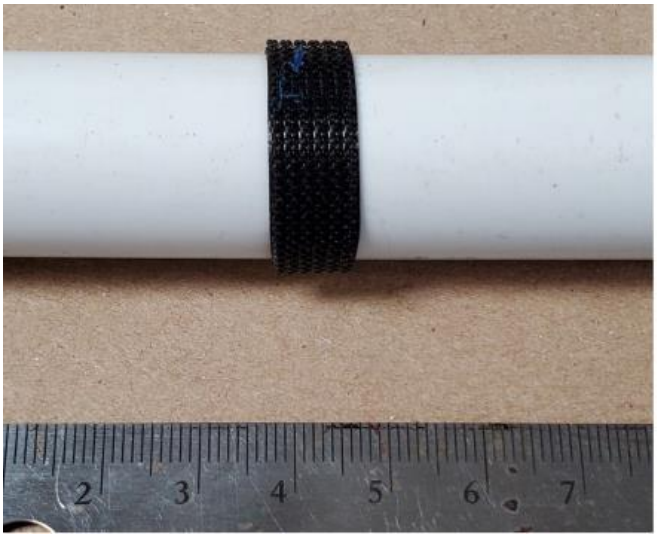
Left: The power port cover constructed from a 3-inch end cap. Right: The cap on the power port.


The power connector installed over the power port.

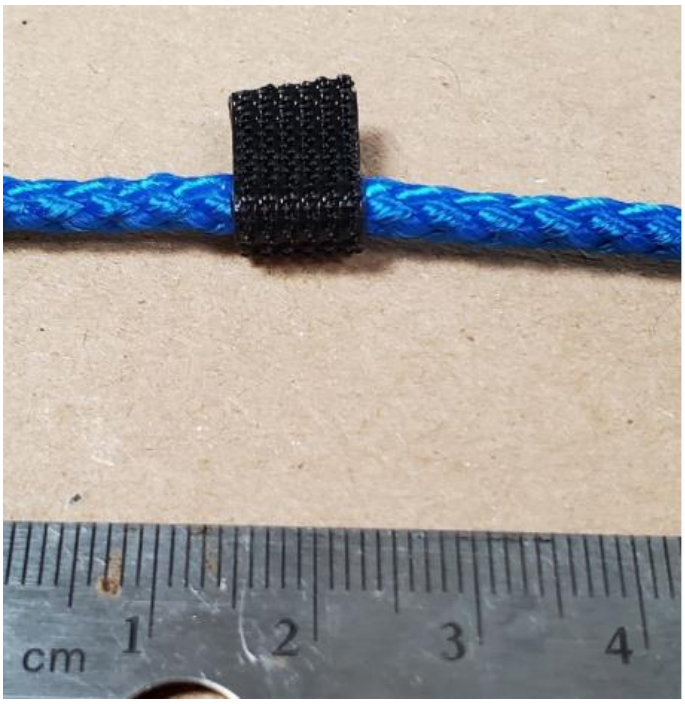
Task 1.2 Remove biofouling from the floating wind turbines



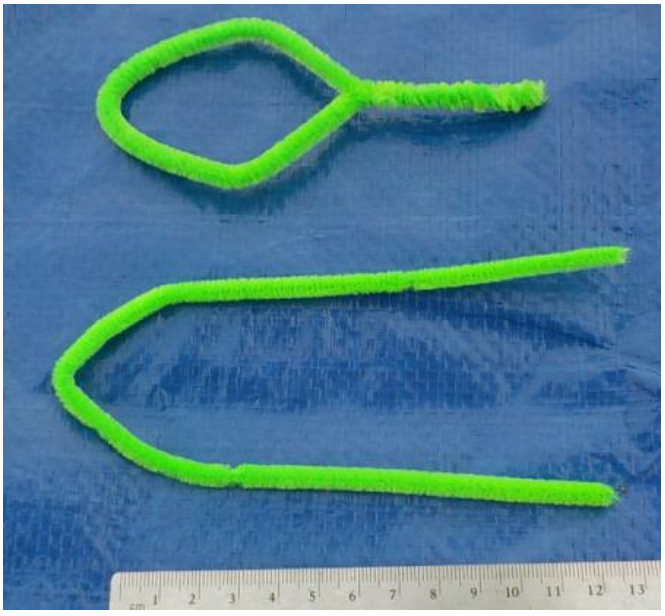
Encrusting marine growth.



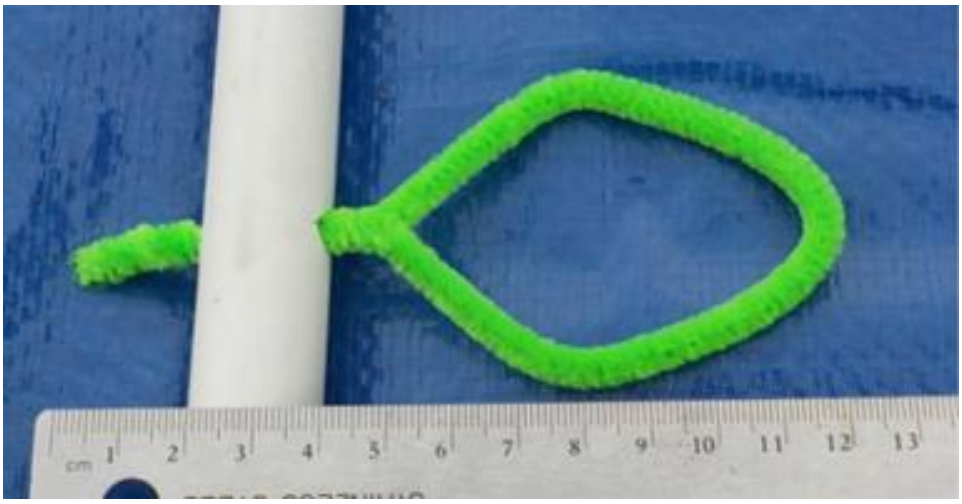
Left: Velcro hooks on ½-inch PVC pipe. A 0.8 cm wide length of Velcro hooks is wrapped around the ½-inch PVC pipe. Right: Encrusting marine growth attached to PVC pipe.



Left: A 2 cm x 0.8 cm length of Velcro hooks is wrapped around the rope. Right: Encrusting marine growth attached to a rope.



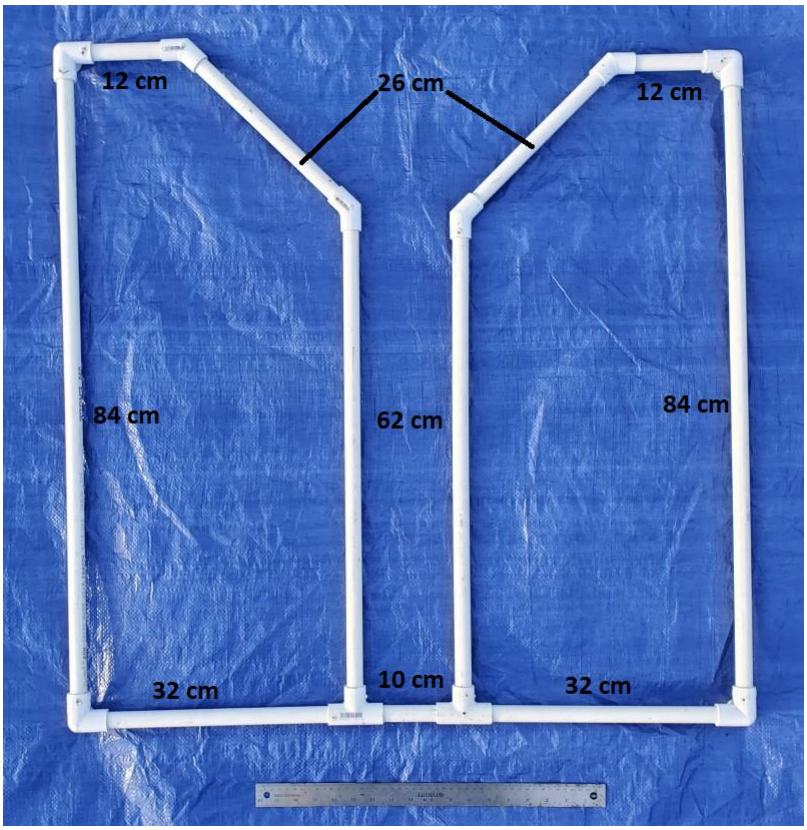
An algal marine growth. Four cm of the two ends of the chenille strip (pipe cleaner) are twisted together to create the algal marine growth.



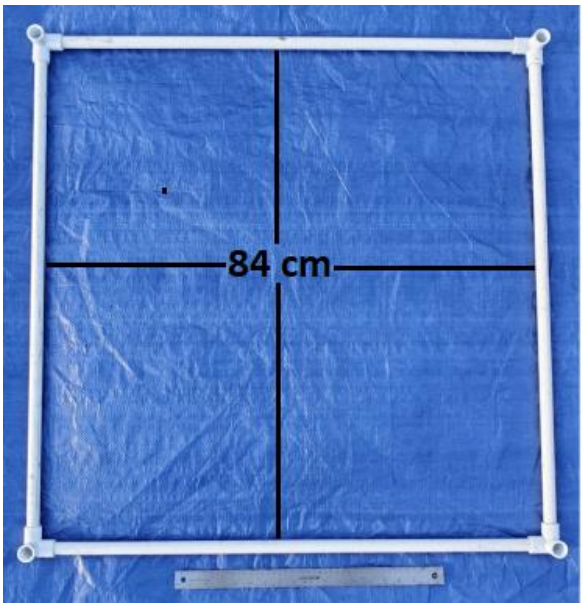
The algal marine growth inserted into a 3/16-inch hole.

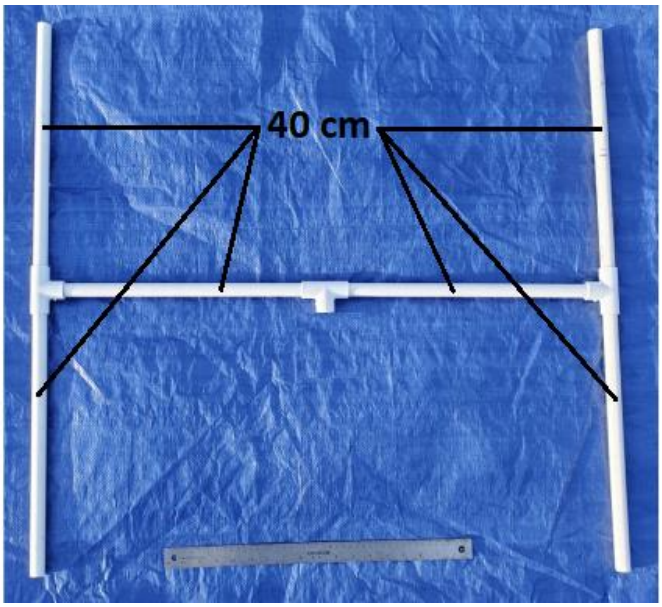

The algal marine growth inserted into a 3/16-inch hole in a short (variable) length of PVC pipe attached to the rope of a floating wind turbine.

Task 1.3 Piloting into "resident ROV" docking station

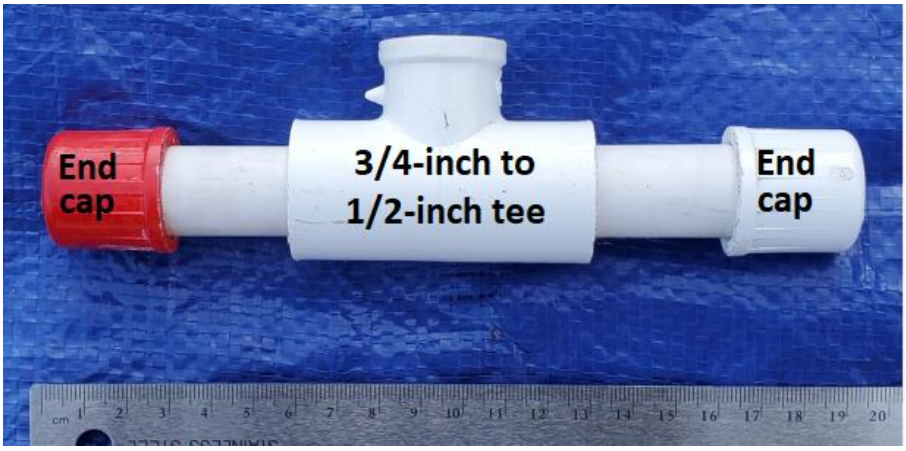


The top of the docking bay constructed from ½-inch PVC pipe.

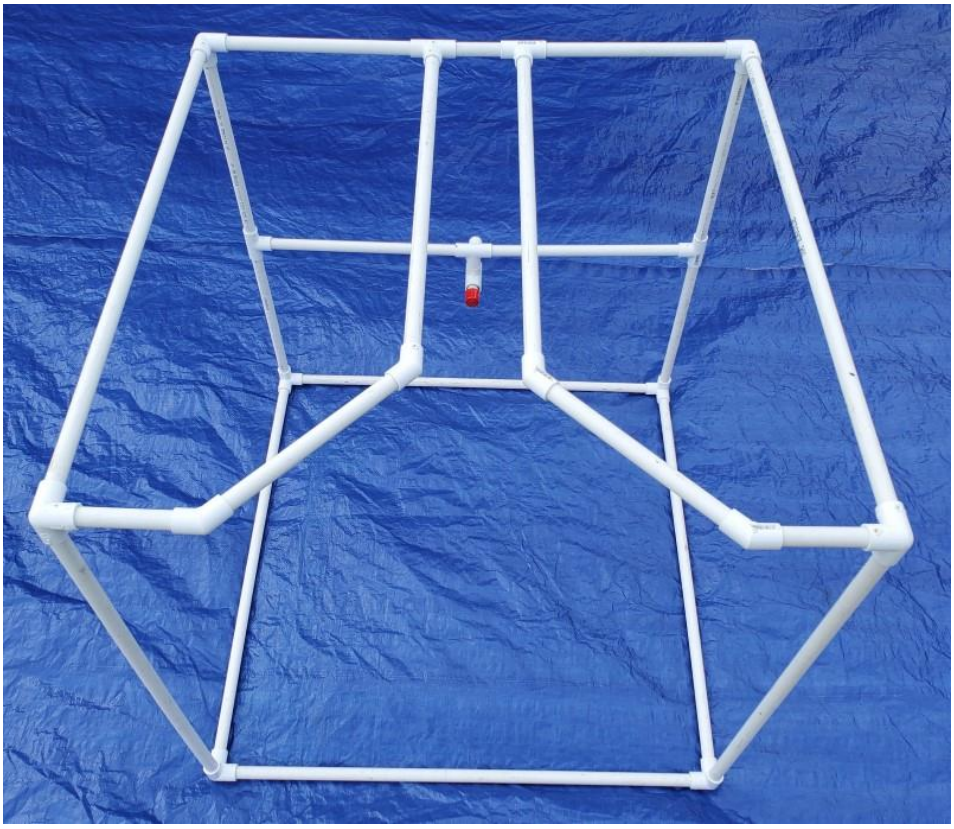




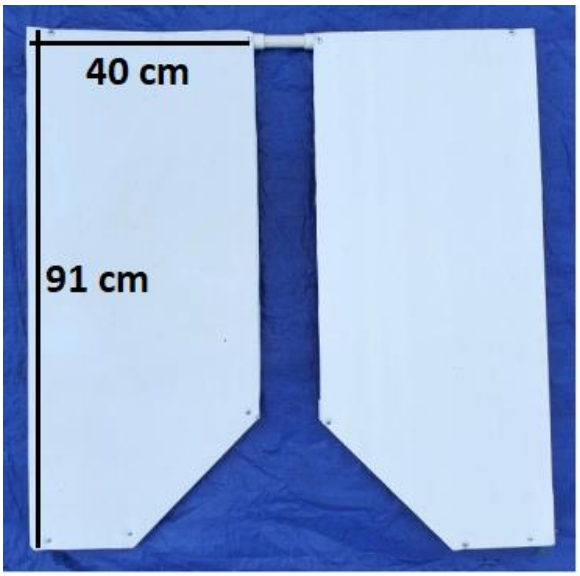
Left: The base of the docking station constructed from ½-inch PVC pipe. Right: The rear of the docking station constructed from ½-inch PVC pipe.

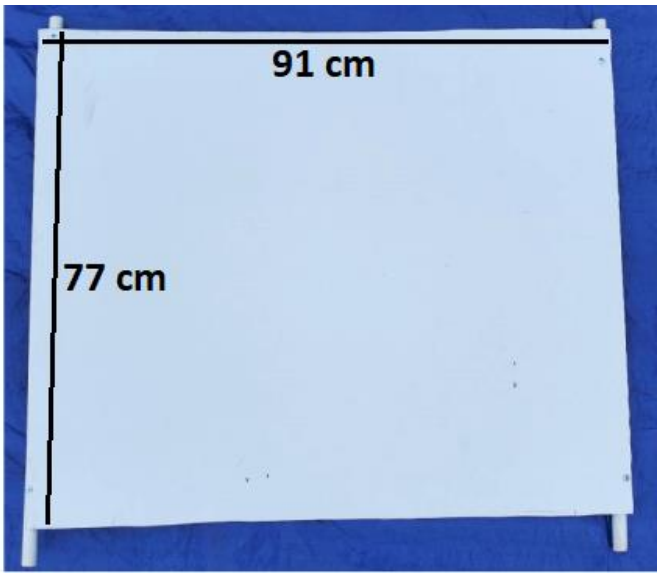


Left: Side view of the push button at the back of the docking station constructed from ½-inch PVC and a ¾-inch x ¾-inch x ½-inch tee. Right: Front view.



The docking bay framework.



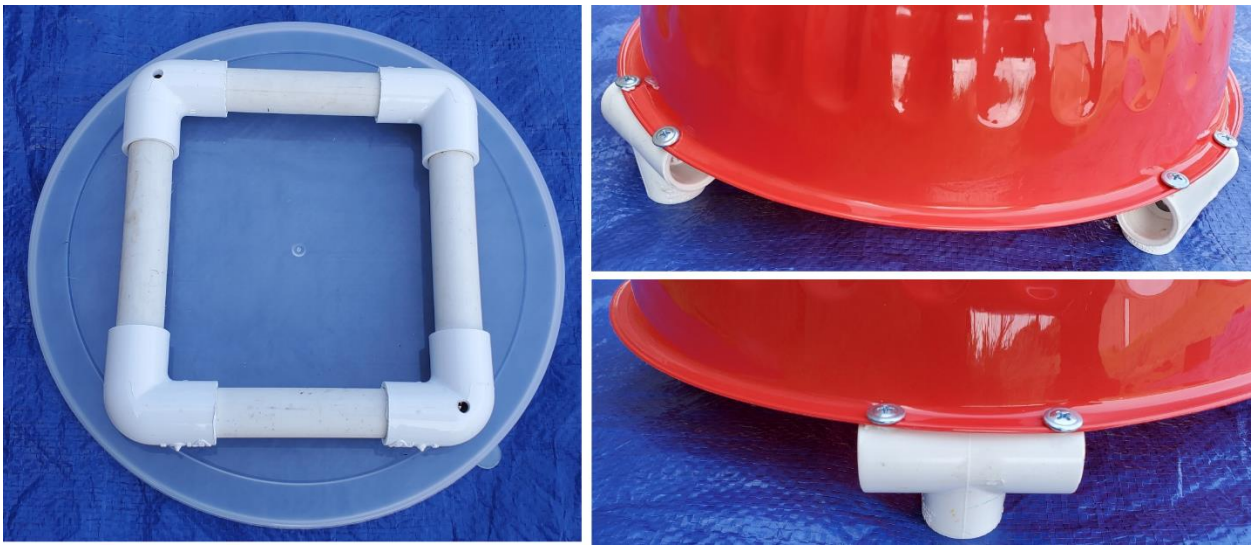


Left: Corrugated plastic sheeting on top of the docking bay. Right: Corrugated plastic sheeting on the sides of the docking bay.


The docking bay with corrugated plastic sheeting attached.

TASK 2: Healthy Environments from the Mountains to the Sea

Task 2.1 Create a 3D Model of a coral head

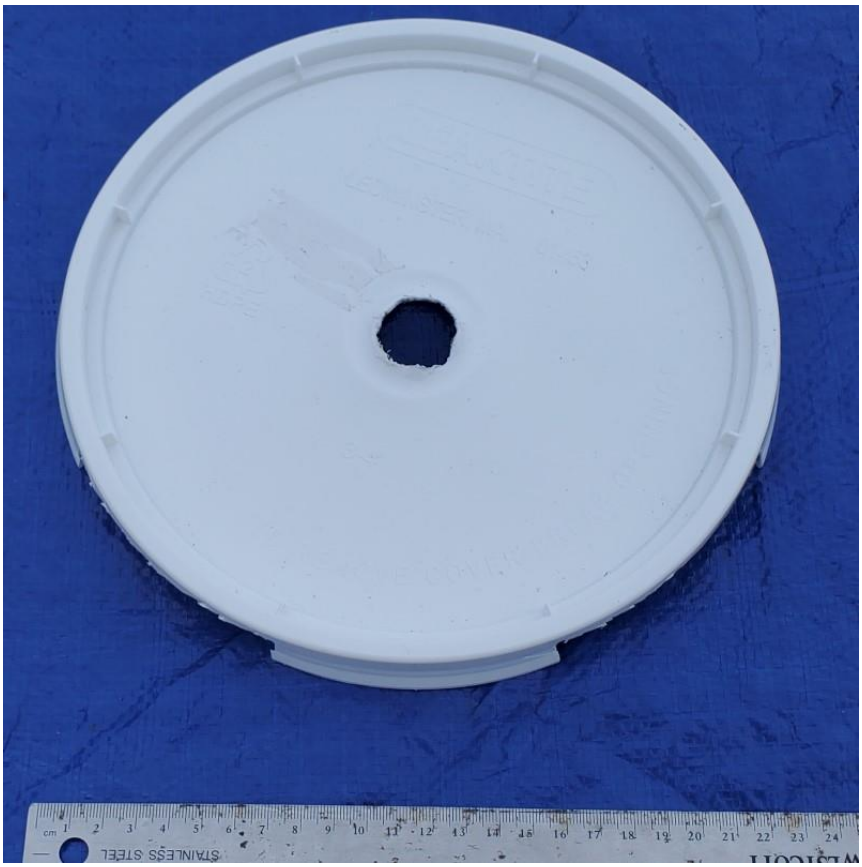


The coral head is constructed from a large plastic bowl on a ½-inch PVC pipe framework. A variety of plastic bowls, of various sizes, can be used to simulate the coral head. If the bowl has a lid, the PVC framework will be attached to the lid. If the bowl does not have a lid, the ½-inch PVC framework will be attached directly to the edge of the bowl. Left: ½-inch PVC base for plastic bowl with lid. Right: ½-inch tees as PVC base for plastic bowl without a lid.

Left: Coral head top view. Middle: Coral head, side view. Right: Coral head, opposite side view.

Task 2.2 Identify reef organisms using eDNA

A 1 liter soft water bottle. Epoxy is used to secure a ¾-inch male adapter to the mouth of the bottle.



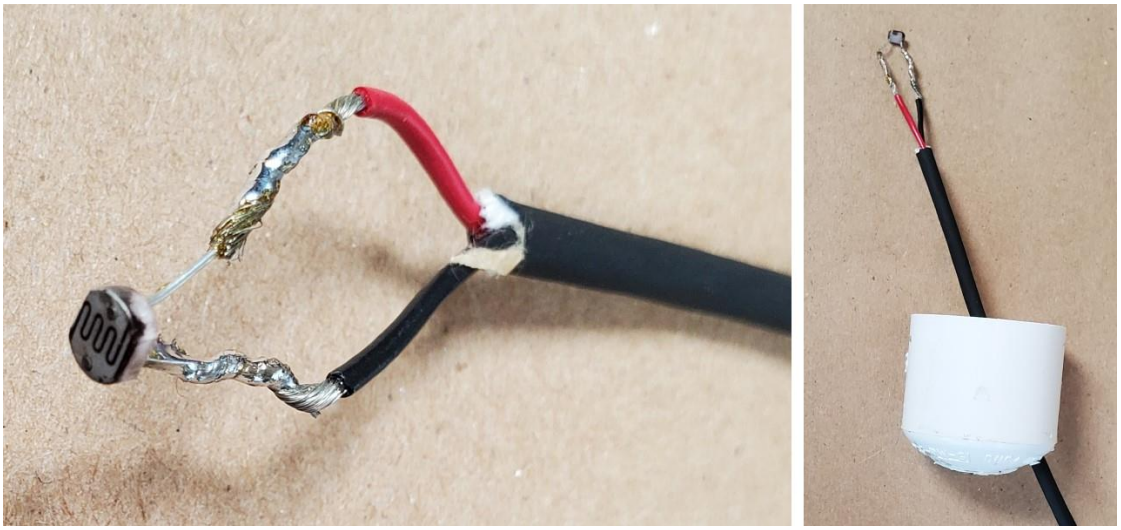
A 2-gallon bucket lid. The hole in the center is large enough for the threaded end of the ¾-inch male adapter to fit through.

The ¾-inch male adapter inserted through the hole in the 2-gallon bucket lid. Left: Top view. Right: Bottom view.

Left: The ¾-inch female adapter attached. Right: Plastic cling wrap secured over the top of the ¾-inch female adapter.

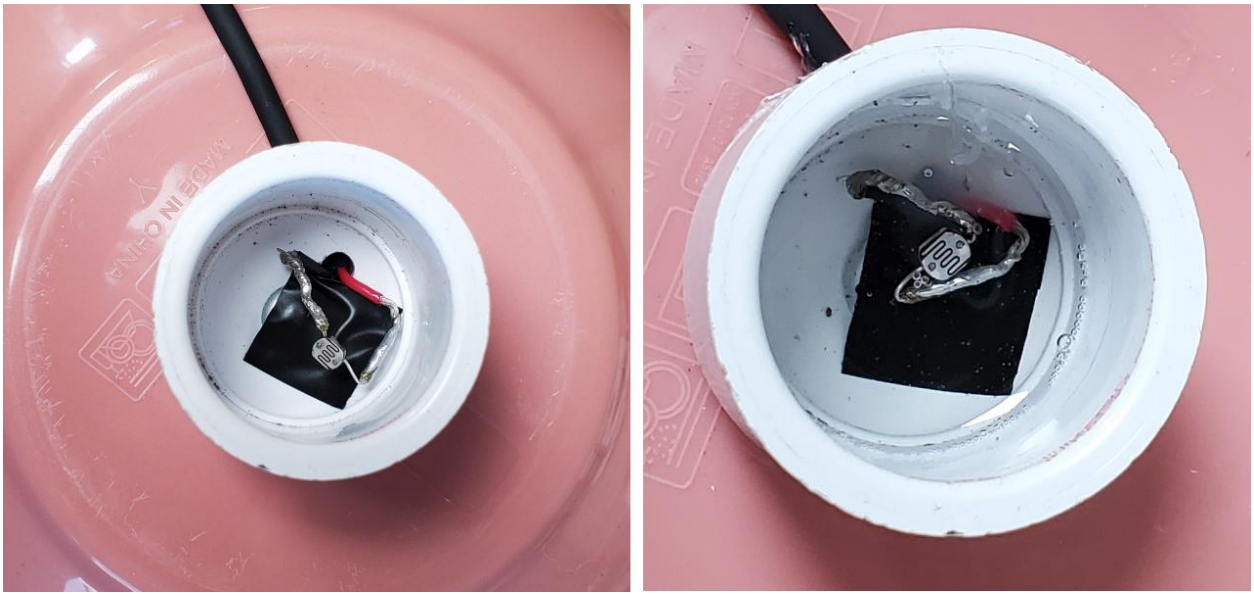
2-gallon bucket with lid attached. Weights are added inside the bucket.

Task 2.3 Administer Rx to diseased corals

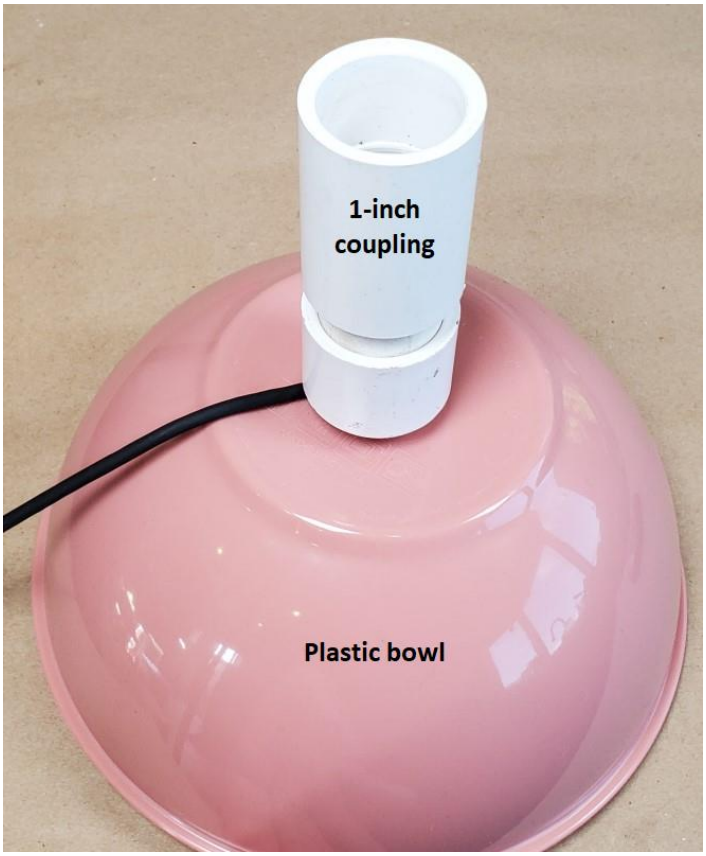


Left: The photoresistor soldered to wire. Right: The photoresistor wire through a hole in a 1-inch end cap.

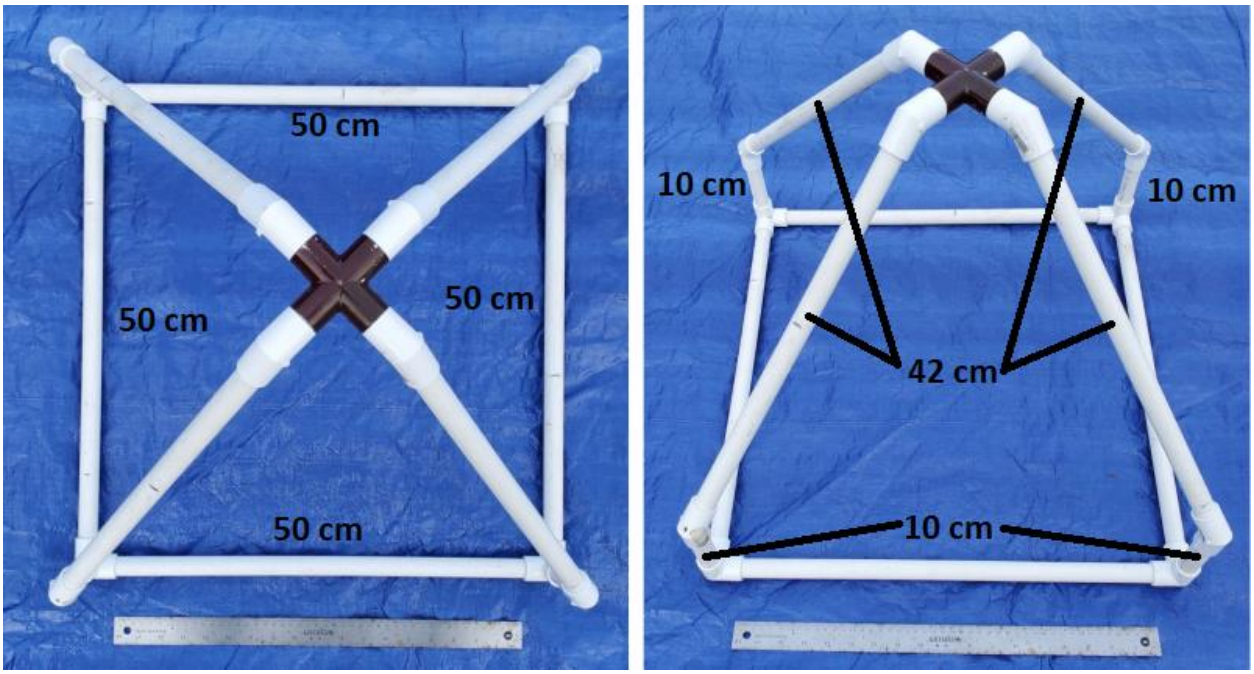
The 1-inch end cap secured to a plastic bowl coral head. Note that this is a different coral head / plastic bowl than the one covered by the tent.



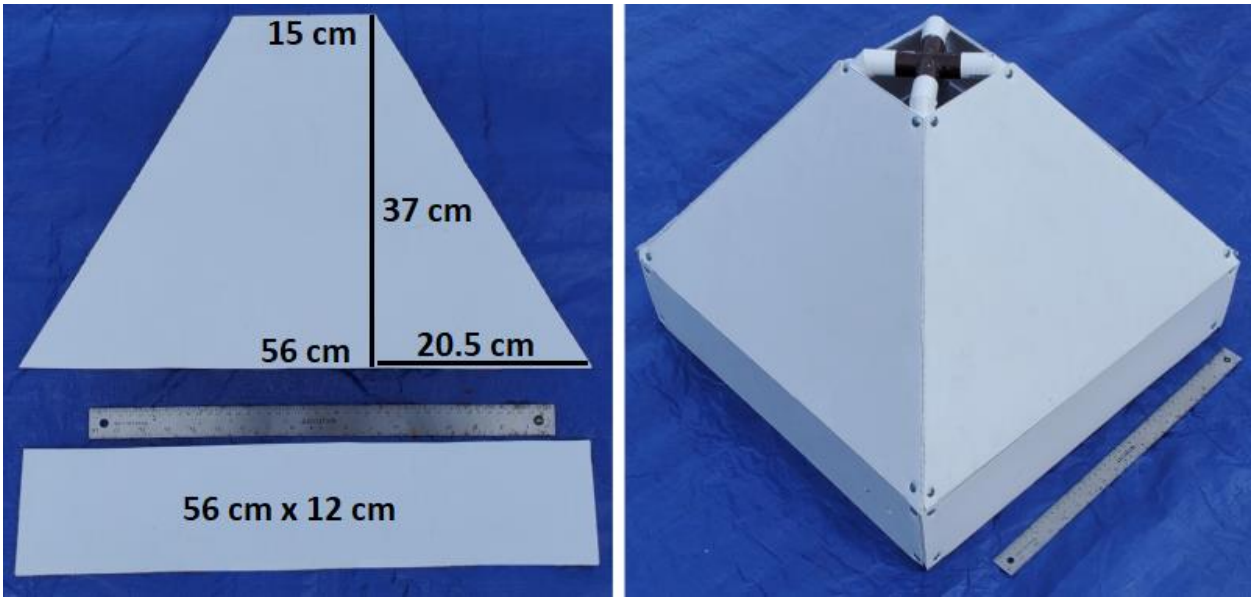
Left: The photoresistor inside a 1-inch end cap. The positive and negative leads cannot be touching. Hot glue fills the hole penetrated by the wire. Tape is attached over the screw securing the end cap to the plastic bowl. Right: The photoresistor is waterproofed with a slow curing epoxy (Envirotex Lite).



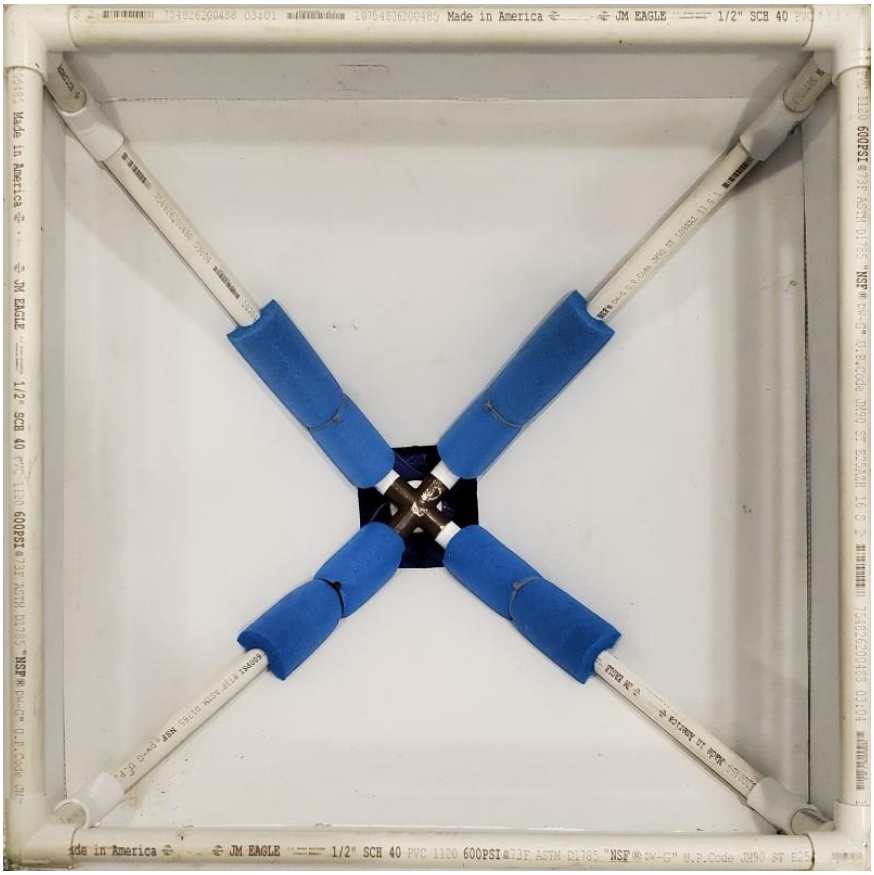
The diseased coral to be irradiated with simulated UV light.



The tent is constructed from ½-inch PVC pipe. Left: Top view. Right: Isometric view. Flotation inside the ½-inch pipe reduces the in-water weight of the tent.

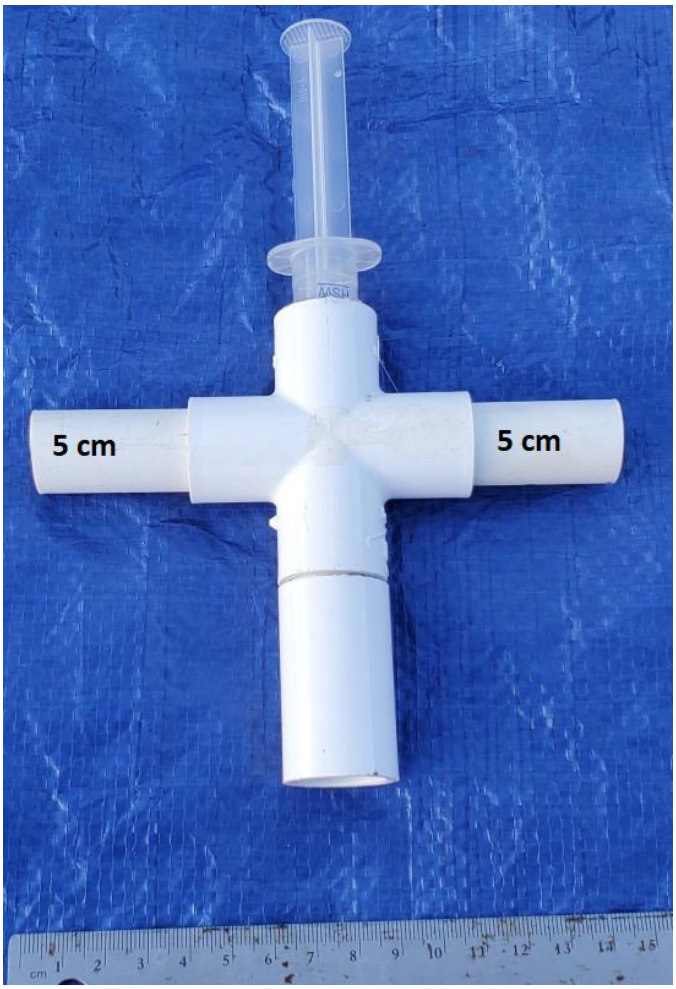


Left: The tent framework is covered in corrugated plastic sheeting. Right: The corrugated plastic sheeting attached to the ½-inch PVC framework. The corrugated plastic sheeting may need to be trimmed once attached to the PVC framework.



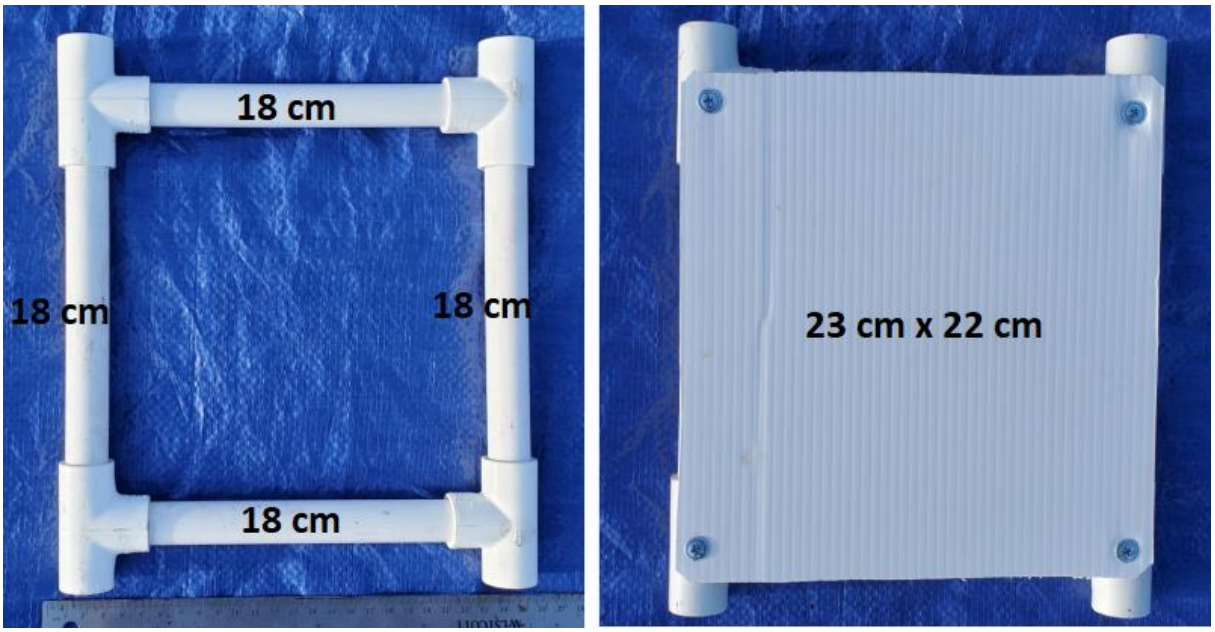
Additional flotation can be added to the inside of the tent.

Left: The 1 ½-inch end cap is screwed into the top of the tent. Right: A 60 cm length of rope attached to the top of the 1 ½-inch pipe.

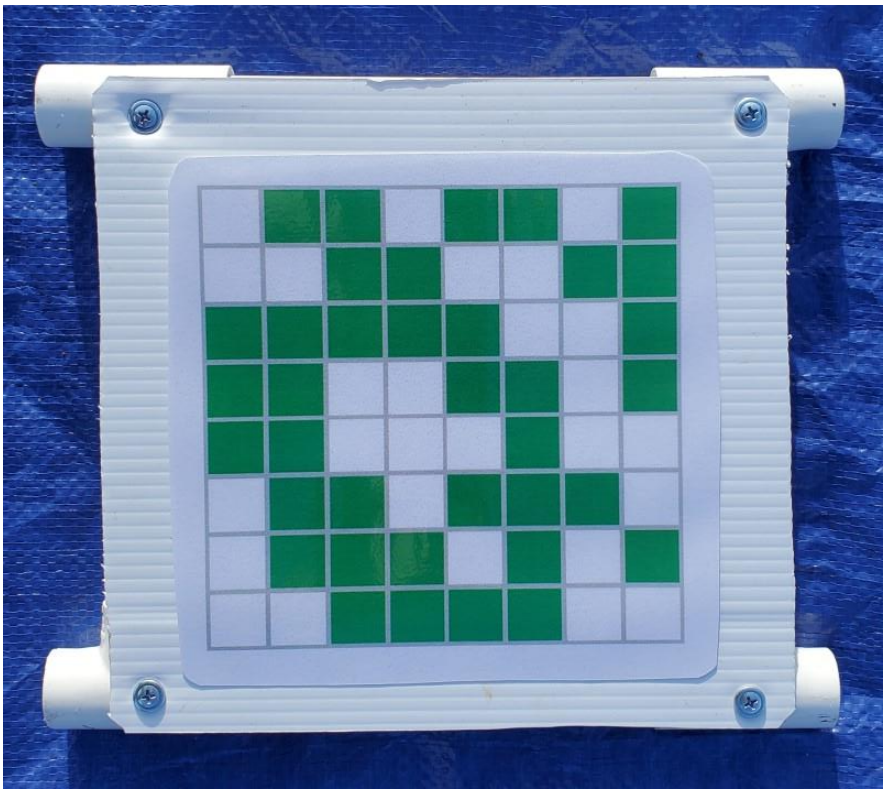


Hot glue is used to secure the syringe inside a ½-inch PVC cross and coupling.

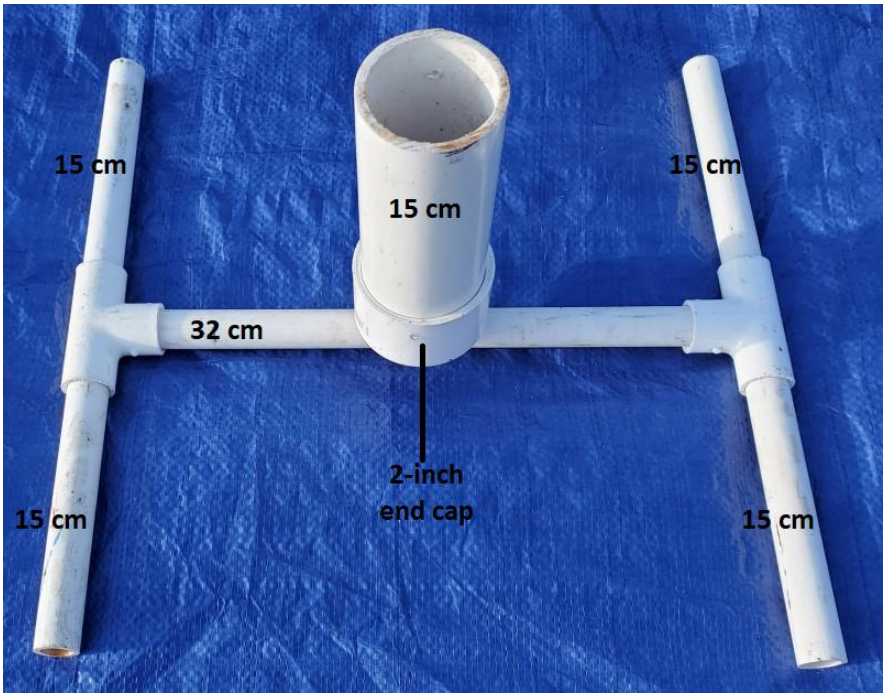
Task 2.4 Monitor and protect seagrass habitat



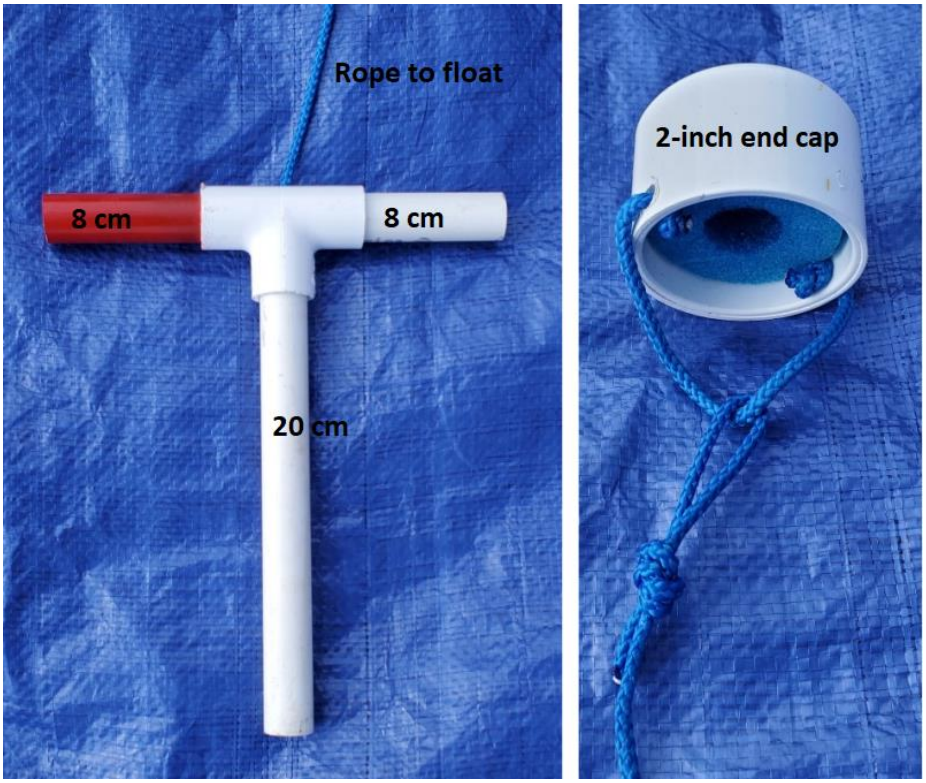
Left: The framework for the seagrass image is constructed from ½-inch PVC pipe. Right: A 23 cm x 22 cm rectangle of corrugated plastic sheeting is attached to the framework.



Seagrass.



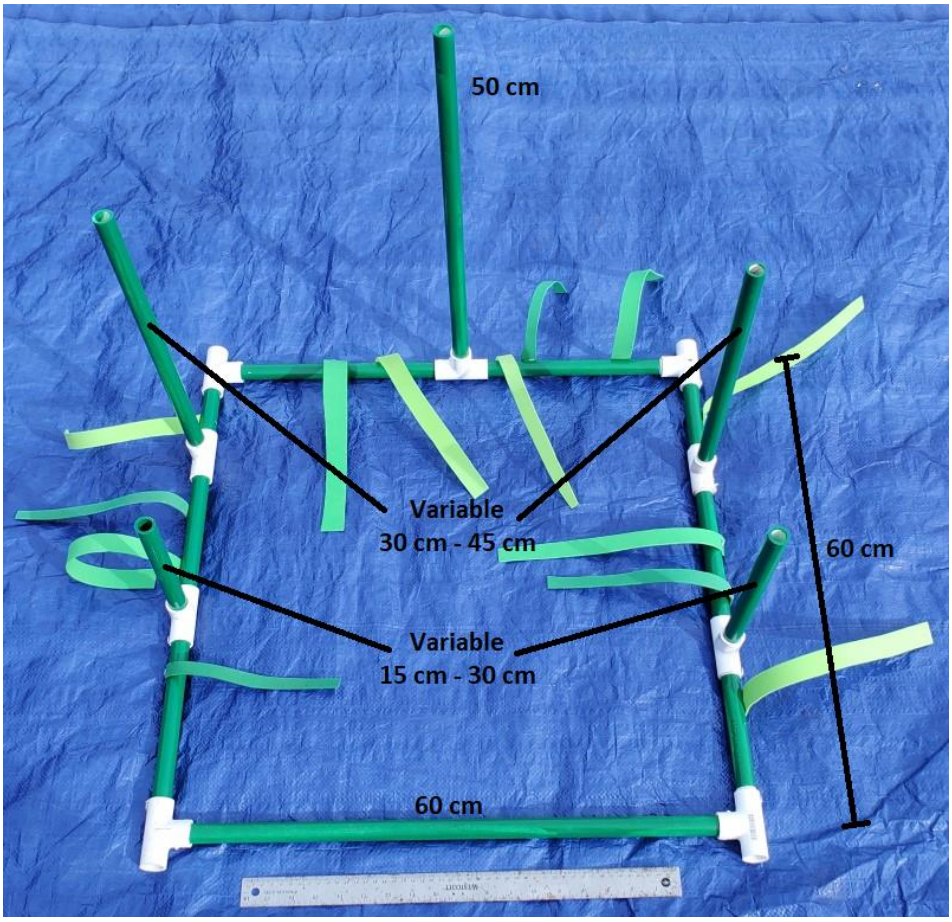
The Eco-Mooring base framework is constructed from ½-inch PVC.



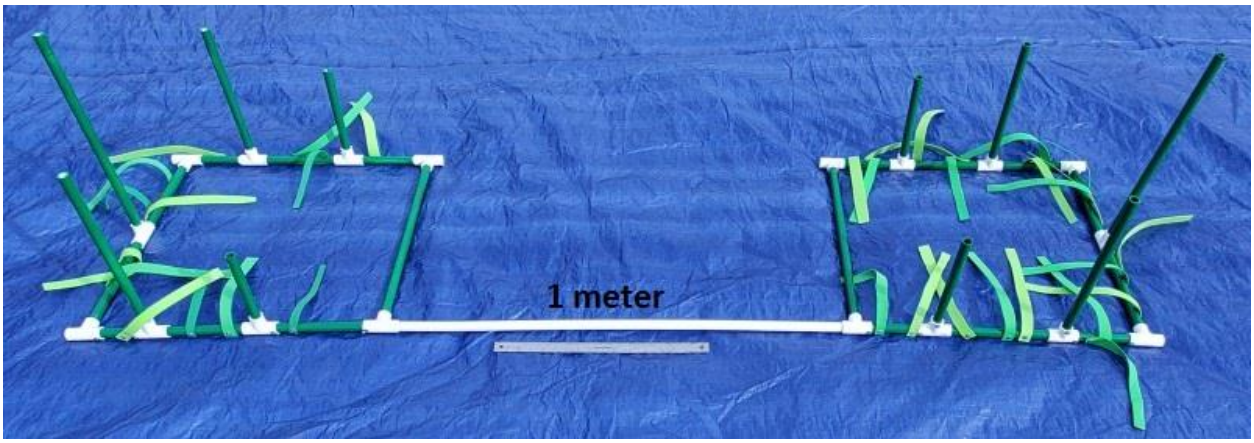
Left: The Eco-Mooring is constructed from ½-inch PVC pipe. Right: The float of the Eco-Mooring. The rope should be long enough so the float is on the surface when the Eco-Mooring is deployed into the base.

Task 2.5 Reintroduce endangered native Northern Redbelly Dace fry

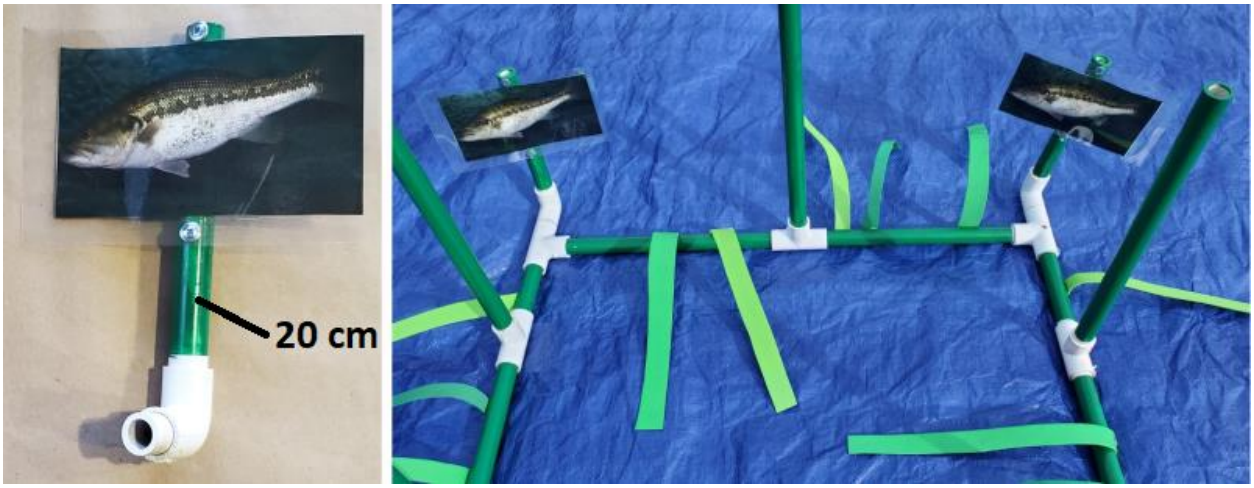
Northern Redbelly Dace fry. All hooks are removed.



A release site framework constructed from ½-inch PVC pipe with 30 cm lengths green foam sheeting.

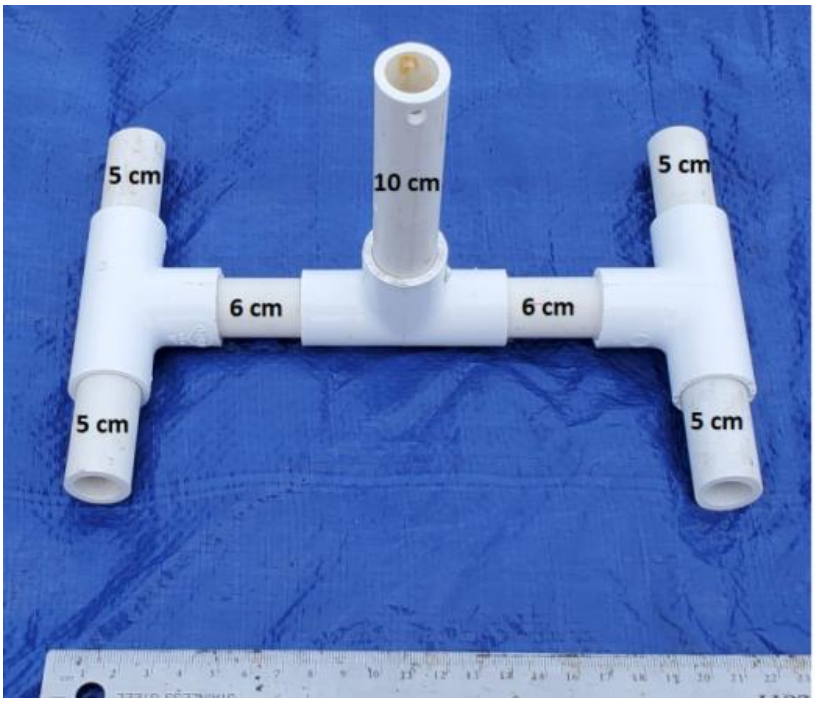


Both release areas separated by a 1-meter section of ½-inch PVC pipe.

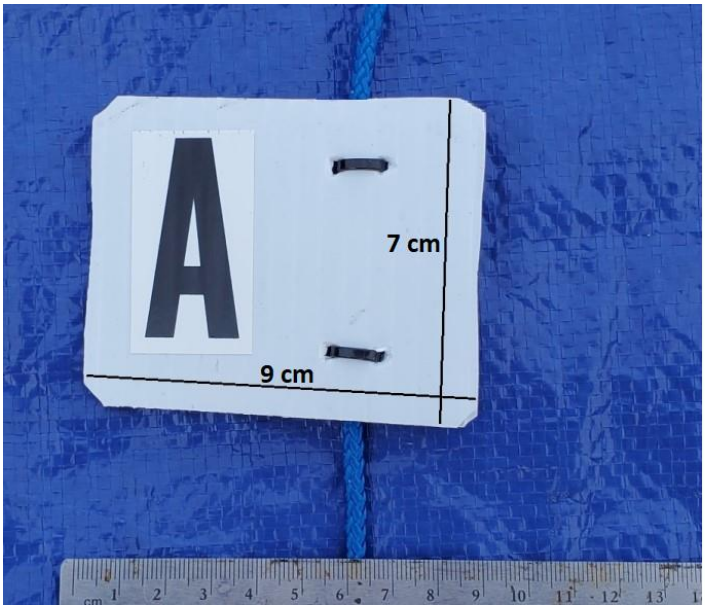


Left: A laminated image of a fish. Right: Images of fish attached to a release area.

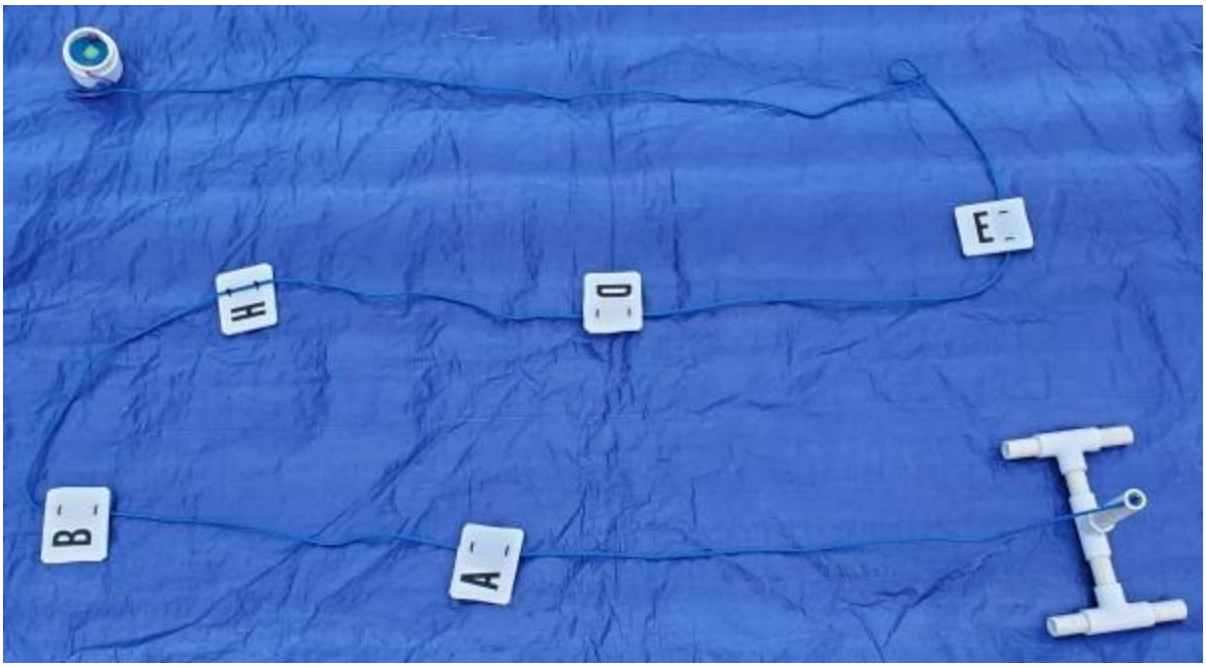
Task 2.6 Ensure the health and safety of Dillon Reservoir



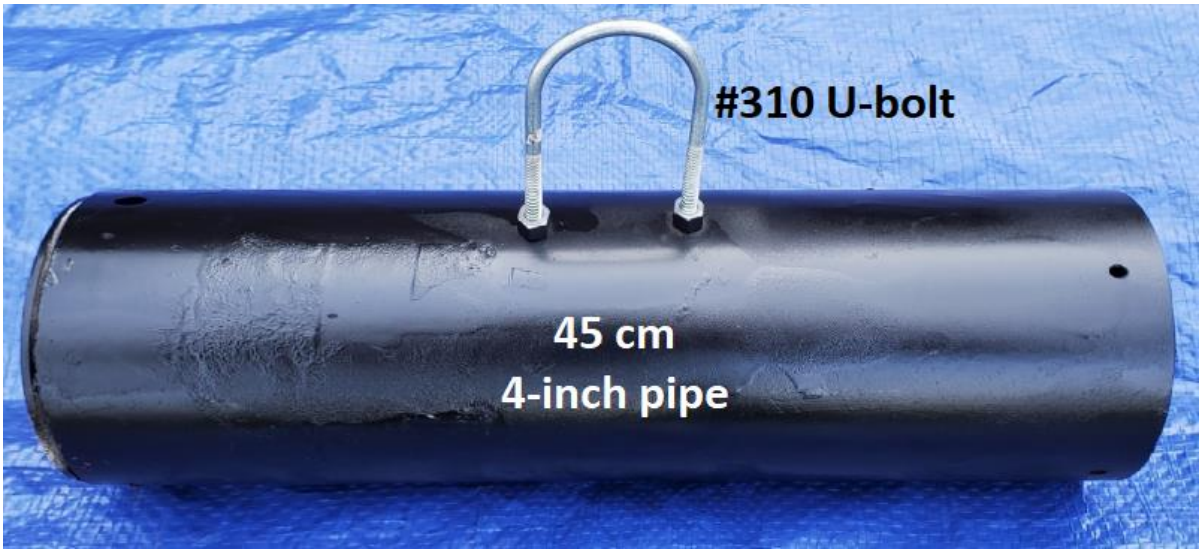
Left: The buoy rope base is constructed from ½-inch PVC. Right: The flotation for the buoy rope.



Left: Lettering on corrugated plastic base attached to rope (front side). Right: Lettering on corrugated plastic base attached to rope (back side).

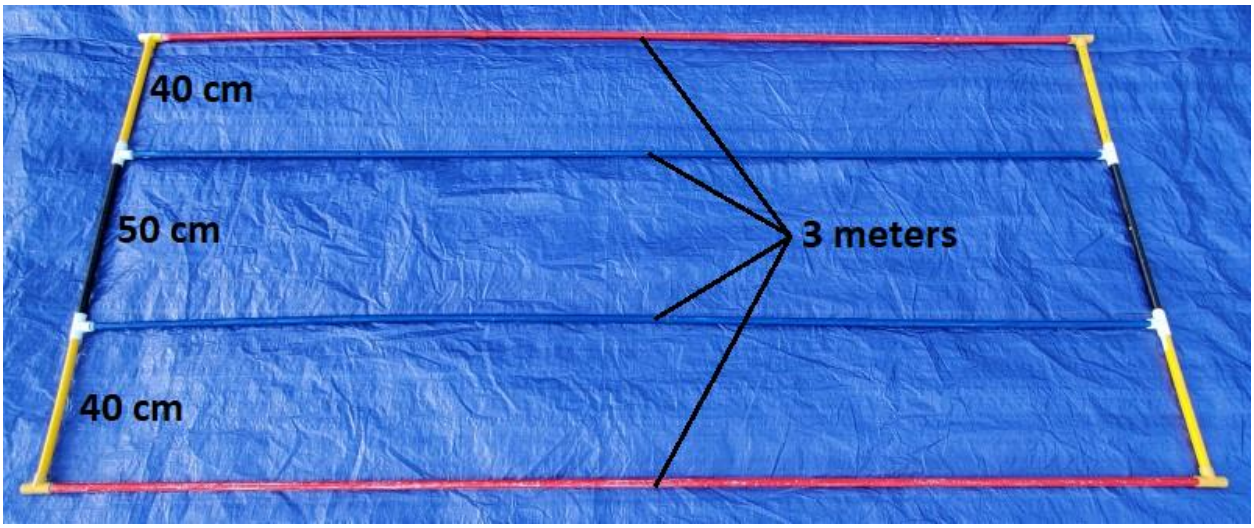


The buoy rope with base and lettering.



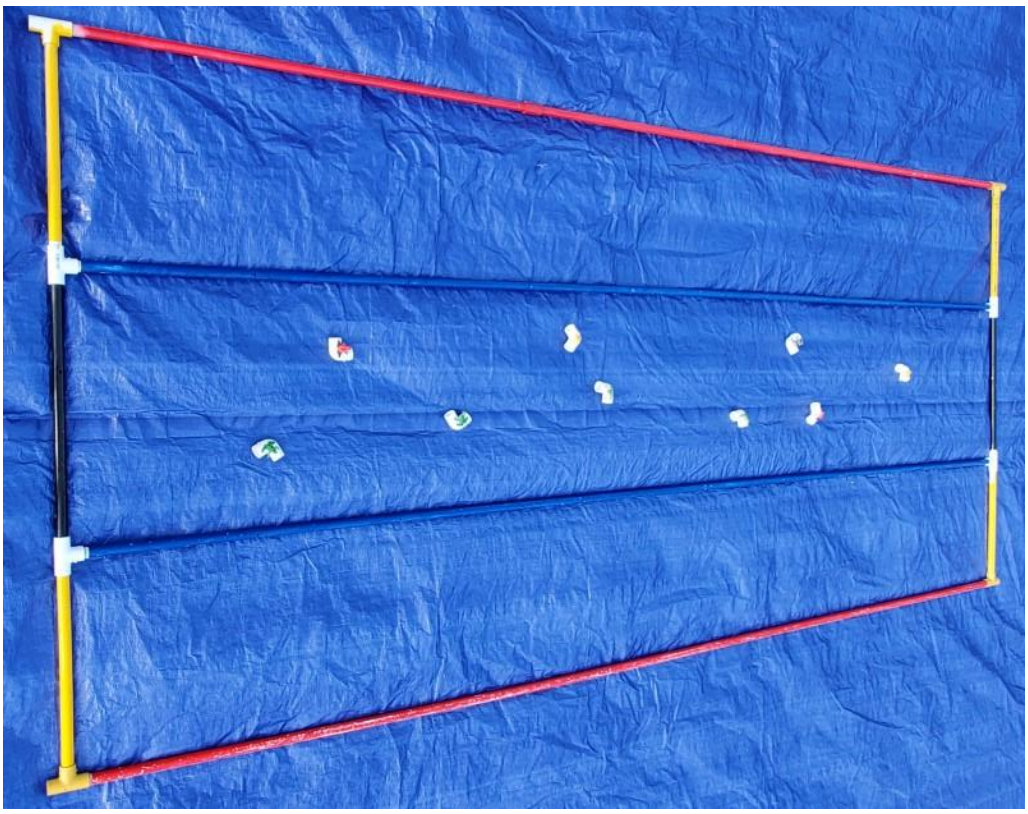
Heavy container (lead weights inside) constructed from 4-inch pipe. Note that this is a change from the manual posted on December 20, 2022. The size of the pipe has been changed from 3-inch to 4-inch.

Task 2.7 Monitor endangered Lake Titicaca giant frogs



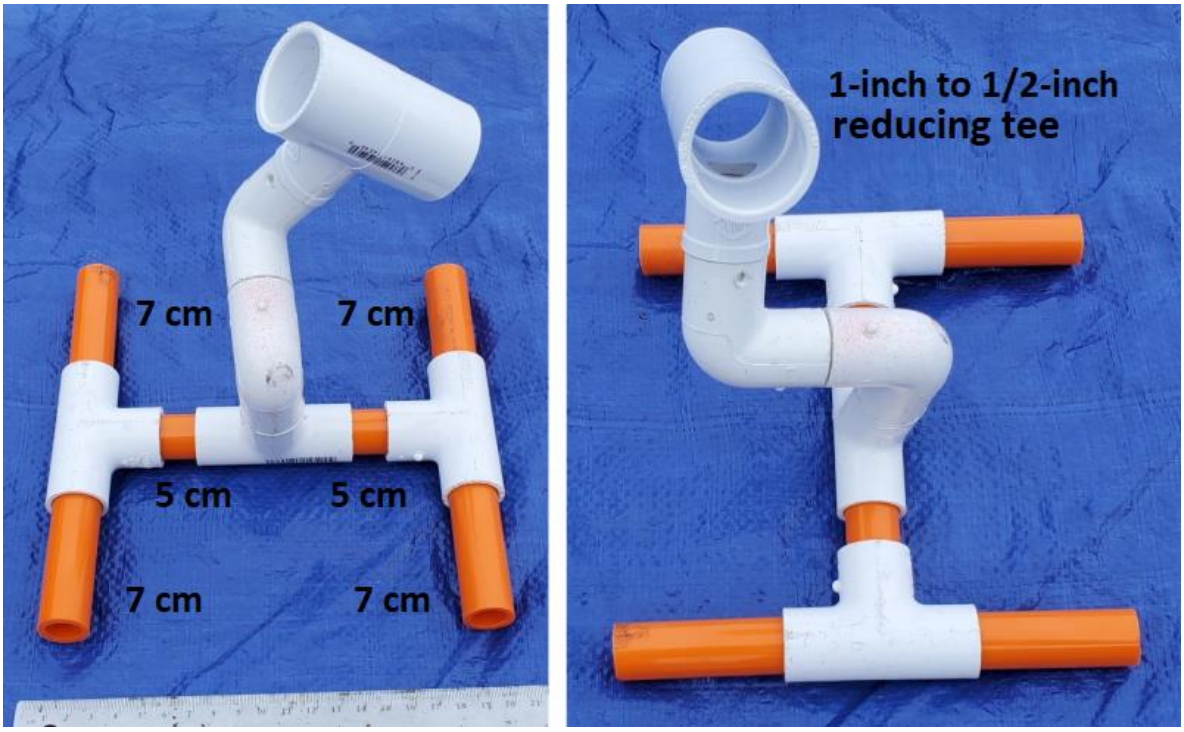
The transect area constructed from ½-inch PVC pipe.


Plastic frogs epoxied to ½-inch 90° elbows.



Frogs in the transect area.

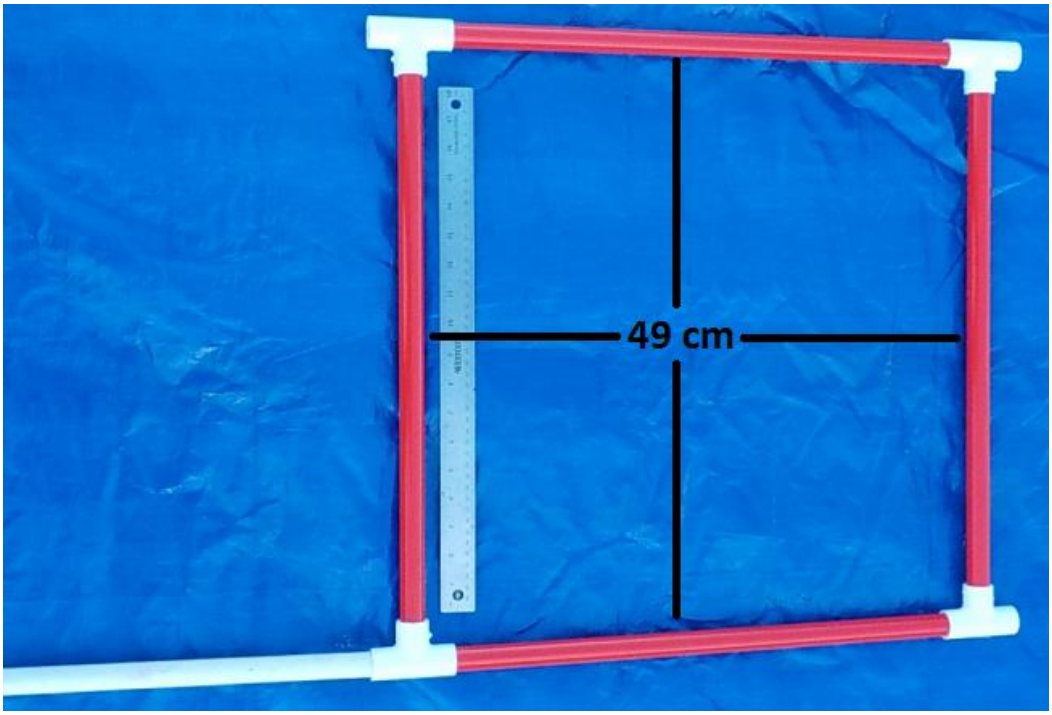
Designated area for camera.



Left: Camera front view constructed from ½-inch PVC pipe. Right: Camera side view.

Task 3: *MATE Floats!*

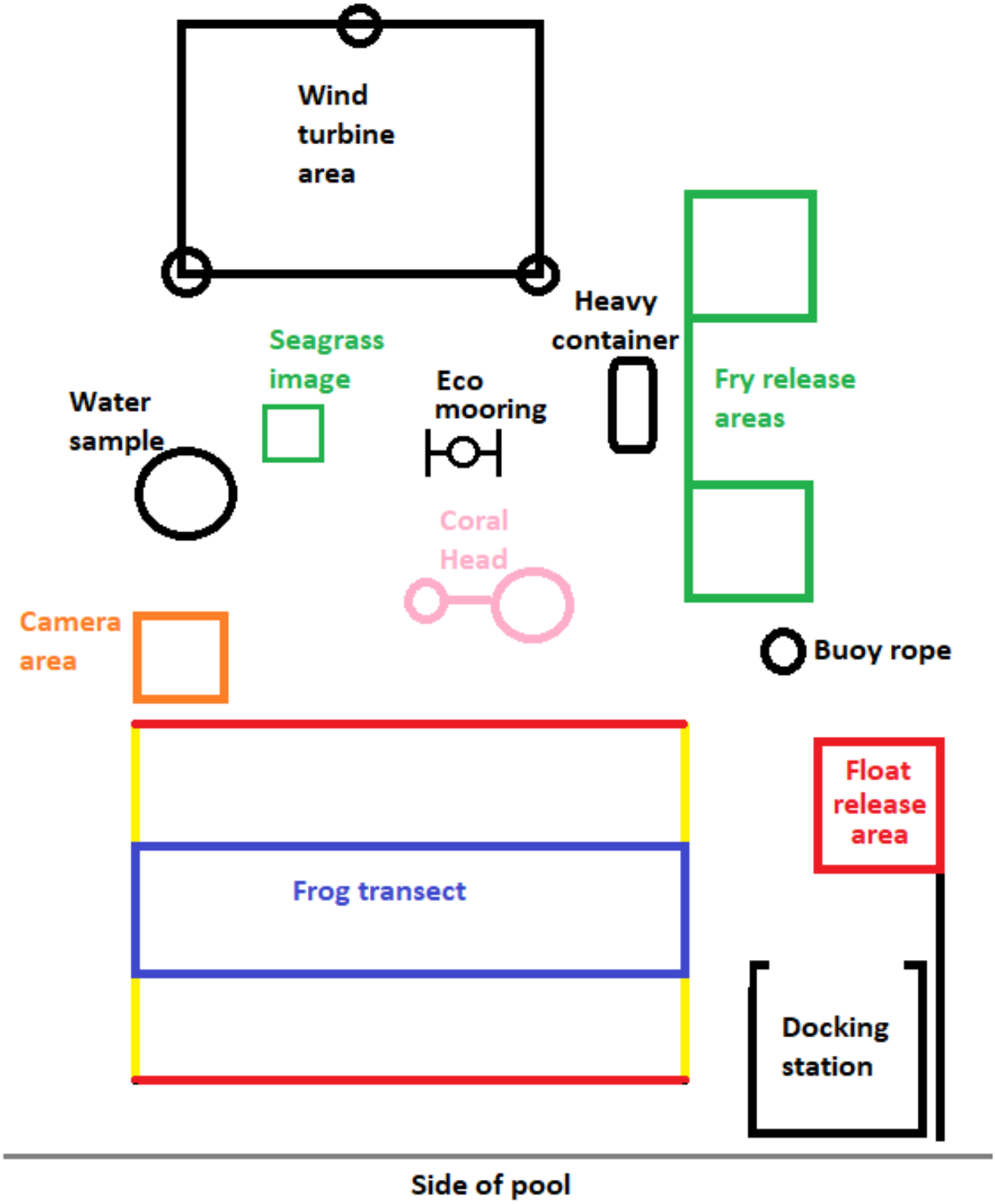
Task 3.1 Design and construct an operational vertical profiling float



The area to deploy the vertical profiling float is constructed from ½-inch PVC pipe.

EXPLORER class product demonstration set up:

The following is a possible underwater set up for the EXPLORER class product demonstration. The set up at regional events and/or the World Championship may vary.



Update Notes:

Updates are highlighted in yellow.

EXPLORER prop building instructions.
2-1-2023. Pg. 39. Camera side view photo: The tee is a 1-inch to ½-inch reducing tee, not a reducer bushing.