Bellwether Innovations, LLC

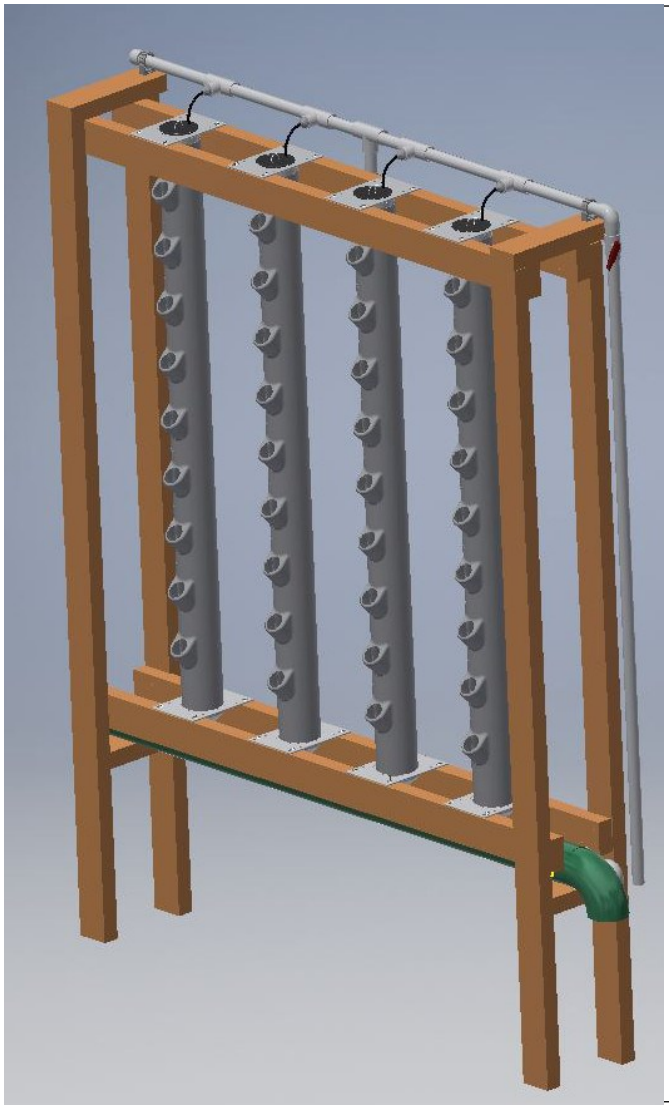
Wood Frame for Quick Mount GroPockets

Building Instructions

Contents

Chapter 1 – Overview

You can mount your GroPockets towers into an inexpensive and easy to build frame made from standard dimensioned lumber (2x4's) and standard sizes of PVC pipe.



Features of the Stand Design

- Can be located in a green house or outdoors since water path is protected from rain.
- Insect netting or other coverings can be easily added.
- It can be built for any number of towers.
- The irrigation water supply is mounted behind the towers where it is not in your way during planting and harvesting.
- All GroTowers are suspended above the drain water so that no anaerobic zones form.
- The stand includes integrated support for the irrigation system and the drain pipe.
- The wood can be painted, stained, or oiled to match the surroundings.
- Can be freestanding (with some wider feet) or anchored to:
  - Fence or wall
  - IBC Totes
  - Grow Bed

Chapter 2 – Before You Begin

Reservoir/Sump Tank Size

Whatever your situation, the tank location and plumbing needs to be designed before starting on your frame planning.

Existing Installations (hydroponics or aquaponics)

If you already have an existing tank installation, you can either put the stand near the sump tank or you can run a drain to it in some other location. In either case, you need to know how far off the floor the drain pipe at the bottom of the stand needs to be in order for the water to flow down into the reservoir.

New Installations

If you are starting an aquaponics system just to run the towers, follow this link for tips on reservoir sizing:

http://www.greenlifeaquaponics.com/reservoir-fish-tank-sizing/

Once you have selected the tank, you will know how tall it is and where you want to put it in relation to the GroPockets stand. In order to size the stand, you need to know how far off the floor (or ground) the drain pipe needs to be in order for the water to flow back to the tank.

Anchoring the Stand

The frame is narrow and tall (8-1/4" wide and 6+ feet tall). It needs to either have some wider feet or to be attached to something else so that it can't easily fall over.

Lumber Options

"2x4s" are the most common size of framing lumber. They are actually 1-5/8 x 3½".

2x4 lumber is available in at least 3 ways:

- Untreated white wood (pine, fir, unspecified)
- Untreated cedar – more expensive, but looks nicer
- Pressure treated pine to make it rot resistant

Outdoor Stands

If your GroTower frame structure will spend time outside without a cover, you should paint untreated wood carefully. You could also:

- Buy cedar or wood that is naturally rot resistant (additionally, applying an exterior oil helps with longevity & looks)
- Buy pressure treated lumber

If you live in a semi-tropical or tropical climate, you may need to buy pressure treated wood and then paint it. It would also help to get the wood up off of the dirt.

Plant Density

The website has a long discussion at this location about plant density.

http://www.greenlifeaquaponics.com/plant-density/

The gist is that the root system and height of the plants you want to grow dictate the quantity of pockets on one tower and the distance between towers on your stand. Feel free to build your stand so that some of the towers are closer together than others and not all the towers have the same number of GroPockets.

Hole Saw Drilling Notes

For ease in locating the 2” holes, drill a pilot bit sized hole first with a different bit. This procedure will make it easier to get the large holes in the correct place.

In addition, use a hole saw with a pilot bit especially if you are using a hand held drill.

The hole in the drain pipe has to be 2-½” in diameter in order to accommodate the roots from the plant at the bottom of the GroTower.

If you have several sizes of hole saws, ideally, you would use a 2” hole saw for the towers and a 2-½”.hole saw in the drain pipe

If you are buying a hole saw just to create the stand, you can get by with one which is 2-½” in diameter.

Quick Latch Pipe Hangers

We have a kit of these items which makes hanging the 1” irrigation system off the frame quick and easy. Here is the link:

https://www.greenlifeaquaponics.com/quick-mount-wood-frame-pipe-hangers-kit/

Chapter 3 - Design Tools

To make building this easier for you, we have created several tools which are available for download here:

http://www.greenlifeaquaponics.com/build-a-quick-mount-wood-frame/

You will see these choices:

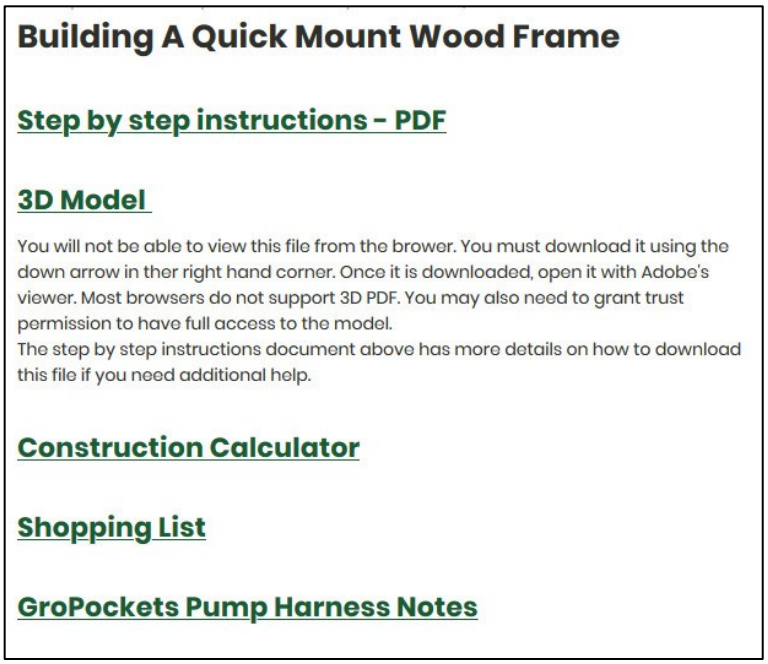


Figure 1 - Website Options

3D PDF of 4 Tower Drawing

The second link on that page is a 3D drawing which can be manipulated (rotate, zoom in and out, etc.) using **Acrobat PDF reader**.

It may not appear or work properly in your internet browser, so be sure to save it to your local hard disk or other storage and open it with Adobe Acrobat Reader. Here are detailed instructions for that.

1. Set up a location on your local storage (hard disk, USB flash drive, etc.) for files related to GroPockets. Make a note of the drive letter and file folder name.

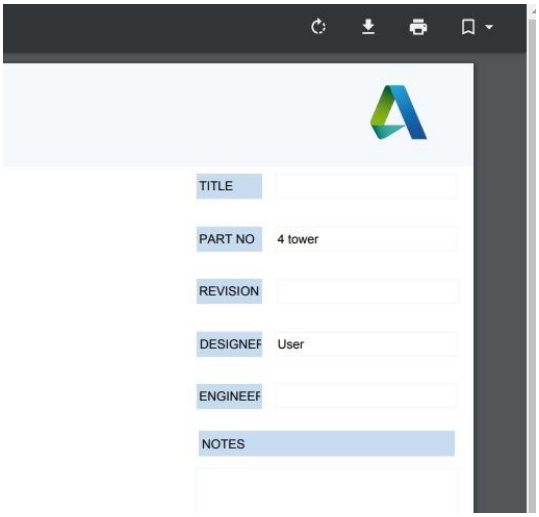
Once you click on this button at the website:

There are two possibilities:

One is that a new tab will open in your browser with an empty screen. The other is a dialog box.

Empty browser window

Put your cursor in the upper right corner and it should look like this:

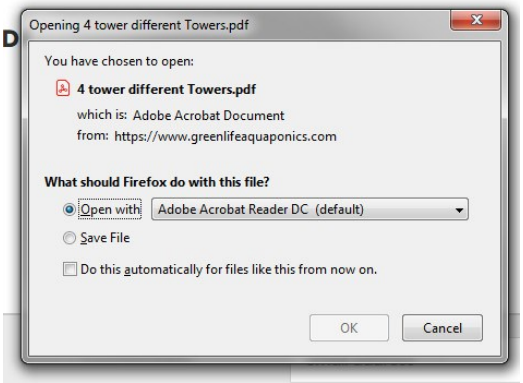


In this case, the important section is in the black ribbon at the top:

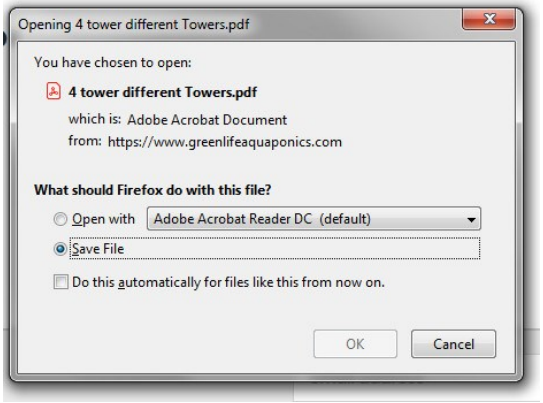
When you click the download button, you can choose the location for saving the PDF drawing. If your browser does not offer you an option at which to save the file, you will need to find the "Downloads" folder on your computer (probably under 'Users' and then 'Public' or your name). That is where the PDF file will be found.

Dialog Popup

You will see a dialog box, offering to open the file, which looks like this: (don't click OK yet)



Click Save file; the dialog box will look like this:

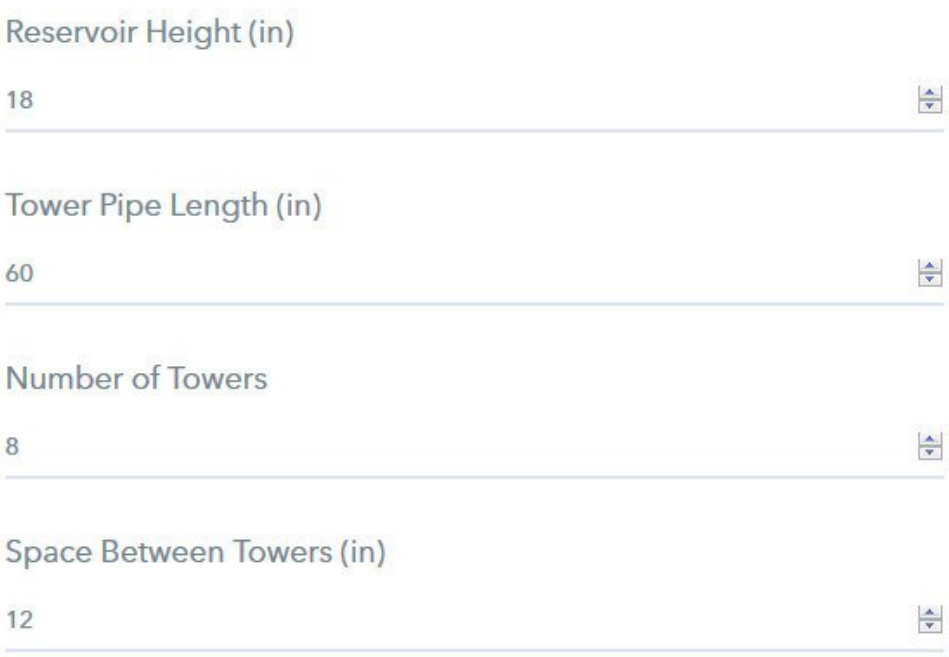


When you click OK in this dialog box, find the location you established in Step 1 and save the file there.

Then, open Adobe Acrobat Reader and open the file you saved. You will see the 3D PDF we have created for you.

Construction Calculator

This calculator computes the length of the dimensioned lumber and other parts needed. It will also create a partial shopping list for you. Here is what the screen looks like with the default answers. You need to know the answers to all these questions.



Shopping List

The final tool is a PDF shopping list. You can download this and print it out, filling in the quantities of lumber, pipe, and fittings you will need for your stand based on the output from the calculator. The 2x4 lengths are based on what is common; lengths available near you may vary slightly.

Explanations of some of the items on the list are in Appendix A – Shopping List Annotations.

Chapter 4 – Constructing the Front and Back

If you assemble the stand and plumbing in the order we have laid it out here, you will achieve the best results. The idea is not to attach the GroPockets onto the towers until you have somewhere to hold the towers standing up.

If you intend to paint the frame, two options.

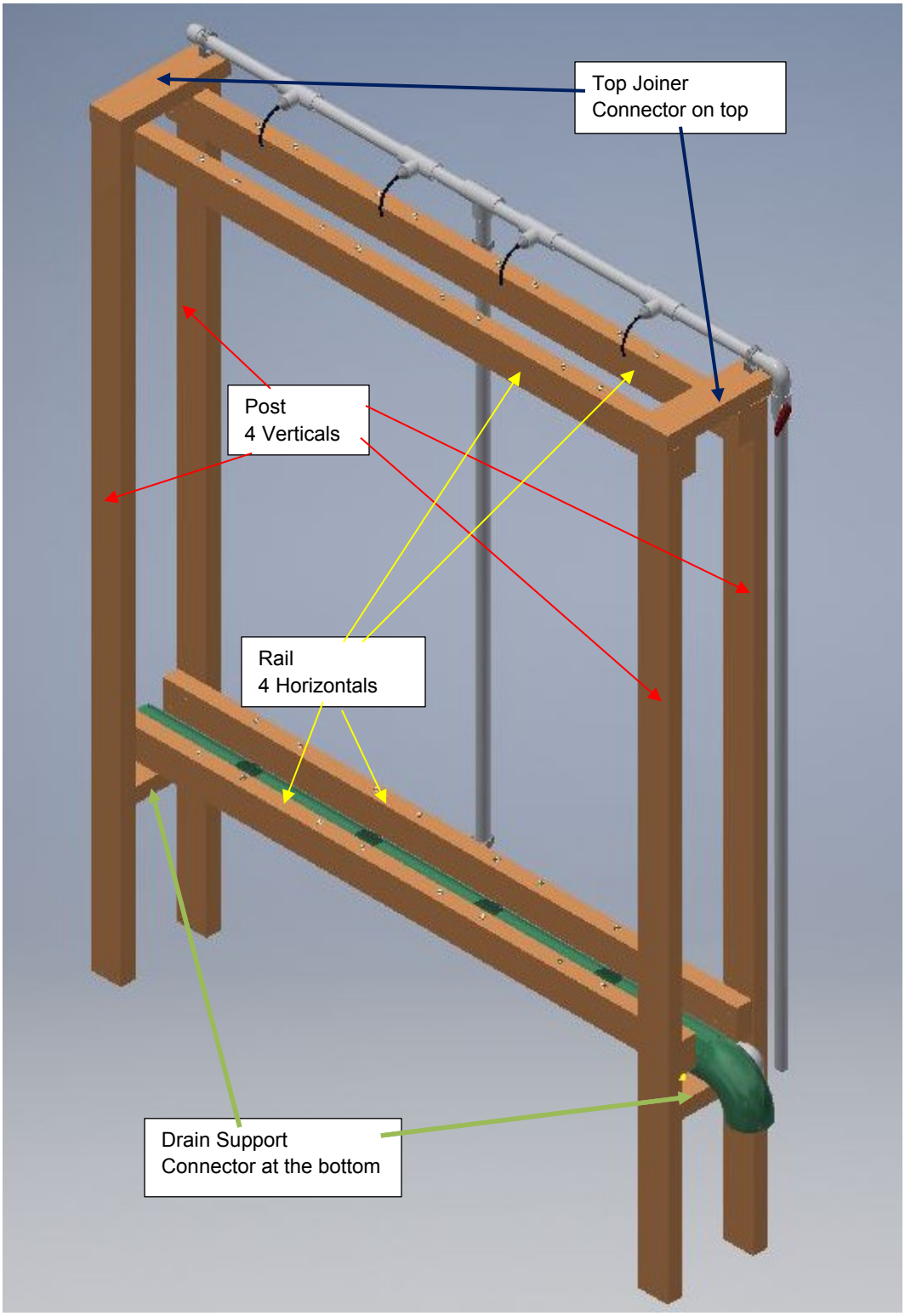
1. Mark the lumber, drill the holes for screws, assemble both halves and join them together temporarily. Then, take it all apart and paint all the pieces. No markings will show once finished and all the inside surfaces will be protected with paint.
2. Paint it first and mark lines on the paint or use masking tape for lines.

Required Tools for frame construction

- Saw to cut PVC pipe and 2x4's to length
  - (In order of preference: 1. Electric miter saw 2. reciprocating saw, 3. hack saw)
- Drill bit for assembly holes which is thicker than the deck screw and longer than 1-5/8" (allows the screw to slip through the wood)
- Pilot bit for drilling holes for the hole saw to follow (can be the same bit as above)
- 2-½" hole saw with pilot bit (on a drill press, if available)
- Electric drill (2, if available)
- Dead blow hammer
- Tape measure
- Large square for marking all 4 Posts at once
- Bubble level
- Marking pencil
- Masking tape

Tip: Best results are achieved by pre-drilling the holes in the Rails. Make the hole larger than the threads on the screw so that the screw falls completely into the hole. That way, you can bring the two parts tightly together. Using a finishing washer will keep the screw from being overdriven below the surface of the wood.

Identification of Parts



Mark all Posts and two Rails

1.Cut all Posts and Rails to length as specified on your cut list.

The Rails should be attached at the same height on all Posts. This can be accomplished by marking all 4 boards at once.

2. Find a level spot which is big enough to support all the Posts laying down.
3. Lay all four Posts parallel to each other.
4. Mark “Top” on one end of all 4 Posts.
5. Align the bottom edges with each other.
6. Measure up from the bottom the “height of the sump tank”. This is for the Drain Support.
7. Mark this with a square across the width of all four pieces.

Figure 2 - Marking Posts

8. Measure up 4-1/2” from the line made in Step # 7. Make another mark across the width of all 4 pieces. This is for the bottom Rails.

   The top Rails are aligned with the top of Post, no marks required.

9. Align two of the Rails. Mark them as rear stand pieces.
10. Find the center and mark it on both pieces. You will be installing a Quick Latch here.

Attach Pipe Supports to bottom of rear Rail

It will be easier to attach the Quick Latch pipe hangers to the underneath of the rail before attaching the Rail to a Post.

11. Designate one of the rear Rails for the bottom of the stand. One narrow side will be facing down.
12. Find the middle of Rail and move to the left a few inches for the first Quick Latch.
13. Then, fasten another one near where the vertical Post will be. The desired arrangement is shown in Figure 3.

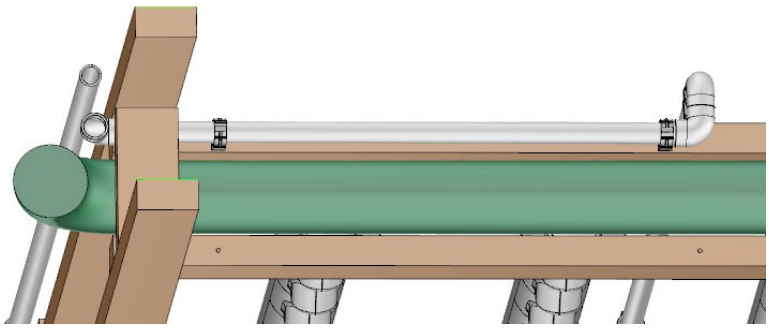


Figure 3 - View from underneath showing 1" Quick Latch on Rail

This image shows the Quick Latch from a different angle:

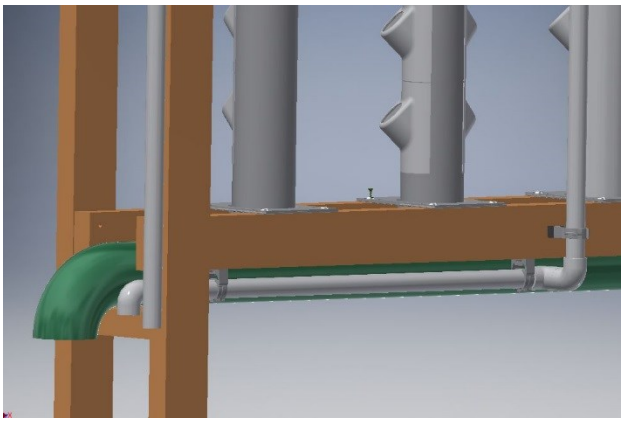


Figure 4 - View of Drain and Intake from the Rear

Build the Rear of the stand

Start building the rear rectangle at the top:

14. Spread the two Posts out the width of Rail.
15. Lay the Rail for the top at 90° to the Posts.
16. Fasten the Rail to the surface of both Posts using deck screws and finishing washers.
17. Find the Rail with the Quick Latches (2) attached; the quick latches hang from the bottom of the Rail.
18. Attach the Rail along the higher line (Step # 8) on the Posts at 90° to the Posts.

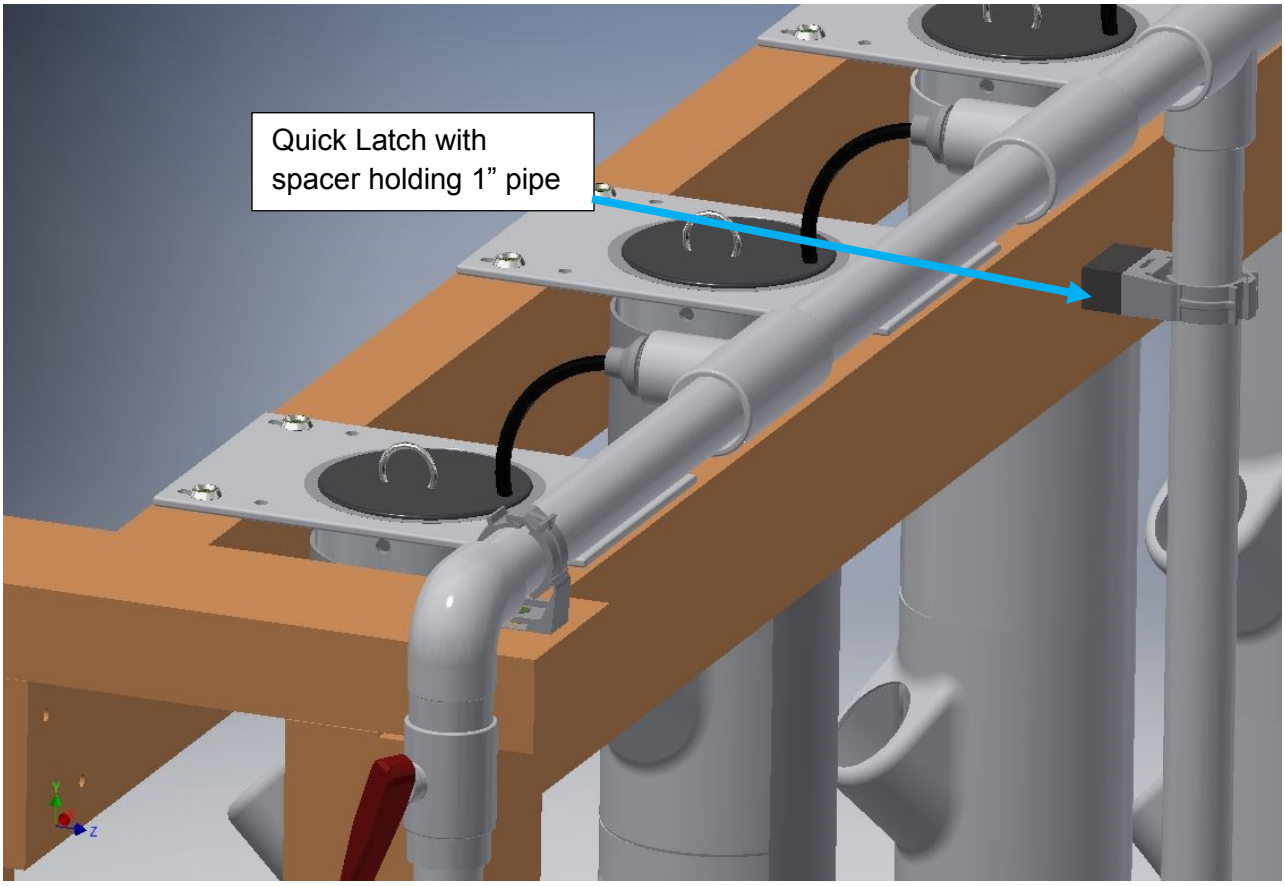


Figure 5 - Top View from the Rear

Build the Frame for the Front of the stand

19.Spread the two Posts out the width of Rail.
20. Lay the Rail for the top at 90° to the Posts.
21. Fasten the Rail to the surface of both Posts using deck screws and finishing washers.
22. Fasten another Rail along the higher line (Step # 8) on the Posts at 90° to the Posts

Now, you have two frames for the front and back of the stand.

Chapter 5 -- Join the Front and Back

You will be drilling and screwing from Post into Drain Support at the bottom of the stand and from the Top Joiner into the rail at the top.

Connect the Two Frames at the Bottom with Drain Support

Notice that the both Rails are on the inside of the stand. The 4" drain pipe rests on these parts. You may want to slant the drain pipe by lowering the Drain Support at one end by ¼" or so.

23. Attach a Drain Support at the lowest mark made on the Post (in Step # 12) on each side of the stand. The screw is driven from the outside of the post into the Drain Support end grain.
24. Use finishing washers here to keep from overdriving the screws.

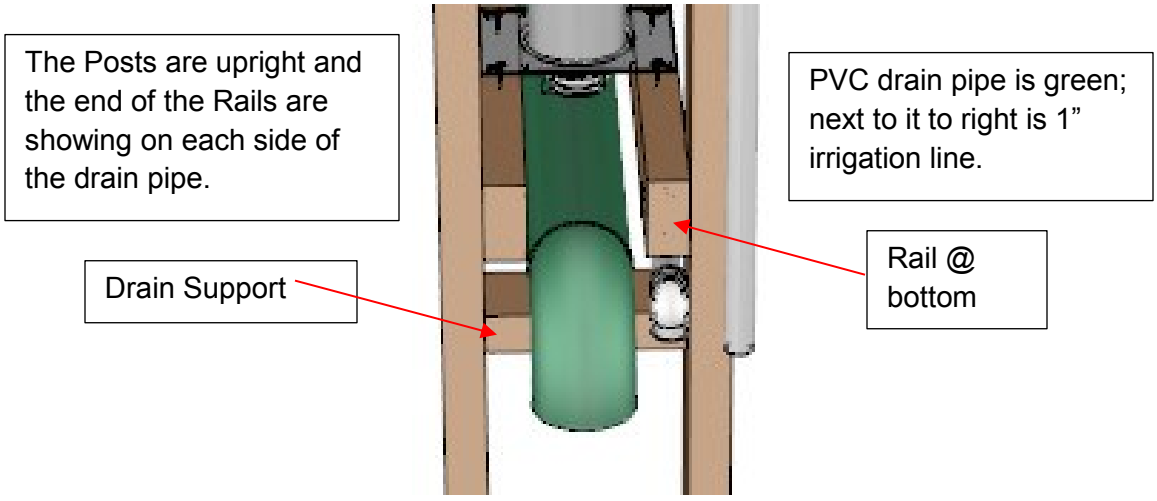


Figure 6 - View of Lower End of Frame

Connect the Two Frames at the Top with Top Joiner

The final connection between the two half frames is made by attaching Top Joiner across the tops. The front edge of Top Joiner should be flush with Post. There will be some extra inches on the rear side of the frame.

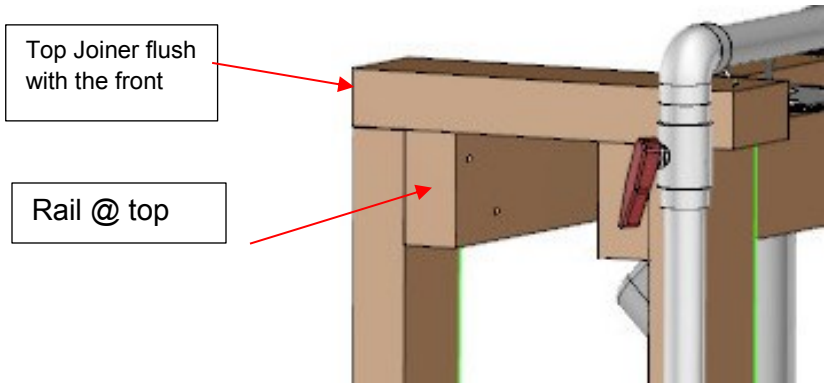
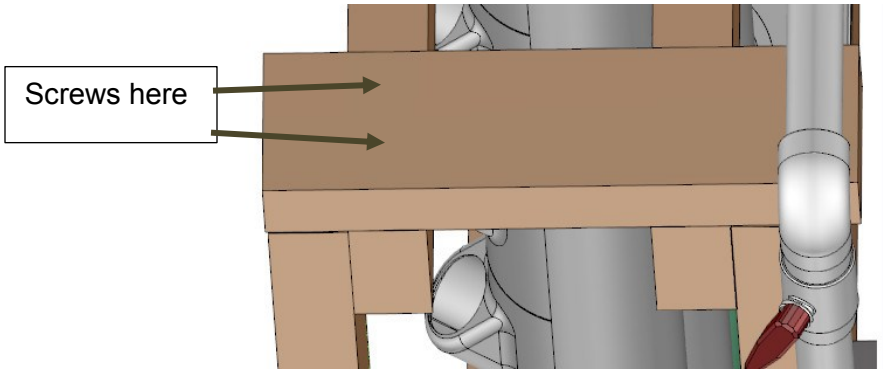


Figure 7 - View of Top Right from the Rear

Put the screws through Top Joiner into Rail, if possible. This avoids connections using the end grain of Top Joiner.



Chapter 6– Adding Quick Mounts to Stand

Now, you have the frame built, we will determine the holes in the drain pipe and 1” pipe by establishing the locations of the quick mounts.

25. Cut the 4” pipe into the tower lengths.
26. Drill the holes for the GroPockets.

Do Not Glue the GroPockets onto the towers yet.

27. Cut another piece of 4” pipe to the proper length for the drain at the bottom of the towers.
28. You will need these towers in order to visualize the tower arrangement on the stand.
29. Start by arranging the Quick Mount bases at the bottom of the stand. Each should look something like this:

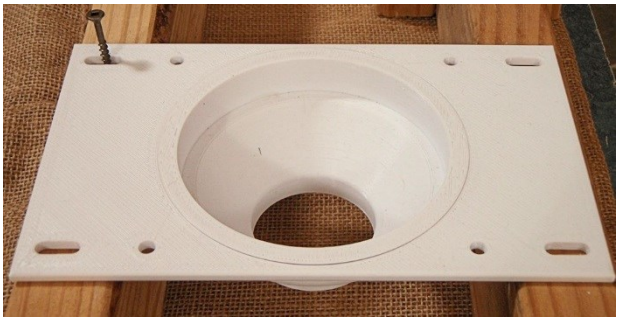


Figure 8 - Quick Mount Base Tacked down

30. Each base should be tacked down with one or 2 screws. No need to completely drive 4 screws all the way at this point. As discussed above, the center to center spacing may not be the same for all towers in your design.
31. For each tower, tack a cap flange and cap to the top rail directly above the base flange. Use a bubble level, if desired, to get the pipe straight. Accuracy on the cap flange is not critical at this point.
32. Insert the 4” tower pipe into the quick mounts.
33. Now, step back and check the arrangement of your towers. Make adjustments if required.
34. Once you are satisfied, remove the 4” pipes from the stand and set aside all but 1.
35. Permanently attach the Quick Mount Bases to the bottom rails with all 4 screws fully driven into the wood. Use a finishing washer, if desired.
36. Use one of your 4” pipe tower pieces and a bubble level to carefully locate each Quick Mount Cap Flange on the top horizontal Rail. Doing this correctly will result in plumb GroTowers (straight up and down). Fasten each one to the stand before moving to the next tower.

Chapter 7 -- 4″ Drain Pipe Setup

Once all the flanges are attached, mark the 4” drain pipe cut in step # 28 for drilling as described in this section. You will need to make two different sets of marks for 1. the flange edges and 2. the pilot holes. Figure 10 shows the drain pipe with holes.

If possible, fix the drain pipe so that it can’t rotate. Another option is to attach a string along the length of the pipe and make pilot hole markings along the string

37. Attach the cap to the drain pipe with PVC cement or just a dead blow hammer.
38. The end of the cap will be even with the vertical posts on that end.
39. Measure from the edge of the post to the edge of the first Quick Mount Base flange.

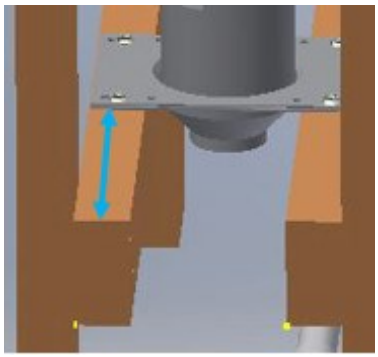


Figure 9 - Where to Measure

40. Mark this spot for reference to the next flange.
41. Add 3”. A pilot hole will go here. Mark a spot at this point on the 4” drain pipe.
42. Measure from the edge of the 1st flange to the near edge of the 2nd flange. Mark this point on the drain pipe.
43. Add 3”. A pilot hole will go here. Mark a spot at this point on the 4” drain pipe.
44. Measure from the edge of the 2nd flange to the near edge of the next flange. Mark this distance on the drain pipe.
45. Add 3” Mark for a pilot hole and continue with this process until all pilot holes are marked.

You should have as many pilot hole markings as you have towers.

46. Make sure all your pilot hole markings are in a straight line along the length of the pipe.
47. Drill a 2-½" hole with its center at the pilot hole for each tower.
48. Remove the screws holding the Drain Support to the Posts on both ends.
49. Install the 4” drain pipe underneath the Quick Mount Bases and reattach the Drain Supports at both ends.

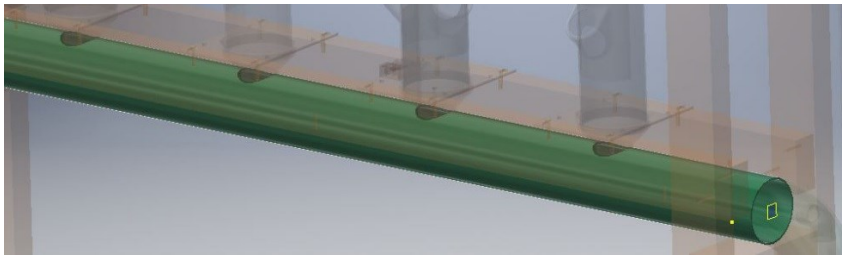


Figure 10 - Drain Pipe in Context

Chapter 8 – Attach 1″ Schedule 40 Pipe

The final step in building the stand is to attach the Quick Latch Pipe hangers and the 1” pipe in the locations shown in the 3D PDF.

A kit of Quick Latch pipe hangers and 2 spacers is found at this link:

https://www.greenlifeaquaponics.com/quick-mount-wood-frame-pipe-hangers-kit/

The Quick Latches should already be attached to the bottom of the rear rail.

Attach a Quick Latch with a ¾” spacer at the center of both the top and bottom of Rail on the back.

On the top of the rear rail, attach a Quick Latch at each end.

Then, add the 1” PVC as shown in the 3D PDF. Some explanation follows.

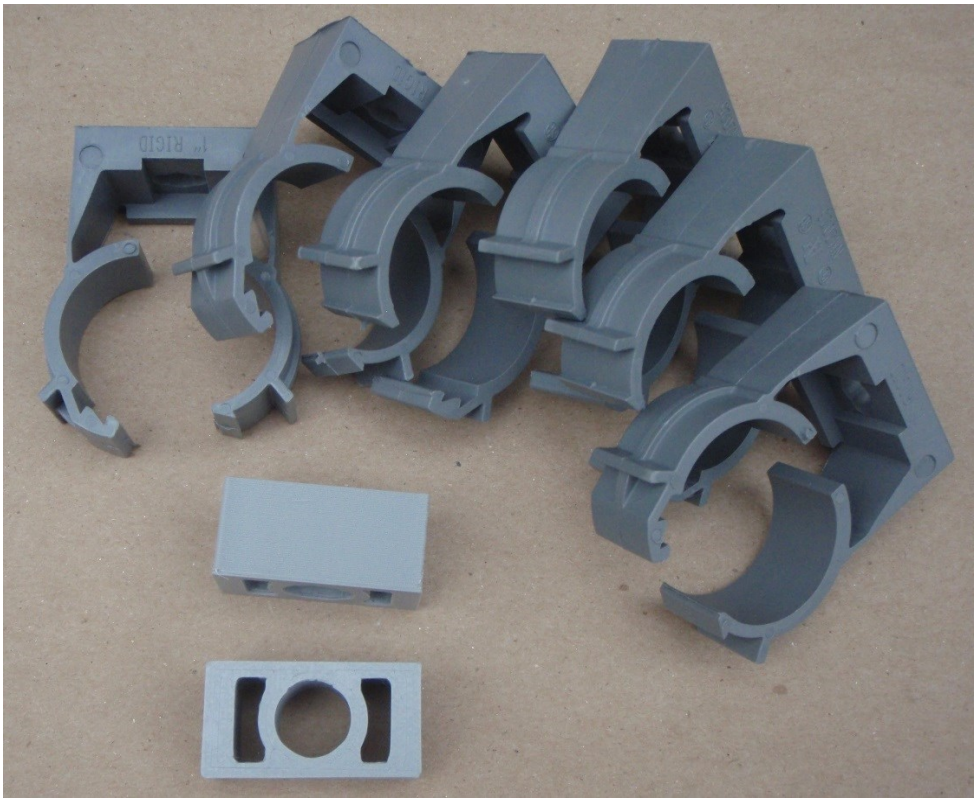


Figure 11 - 6 Quick Latch pieces & 2 Spacers

The illustration below shows the 1” pipe hanging from Rail and then the 2 elbows in the middle of the frame changing the water’s direction to vertical.

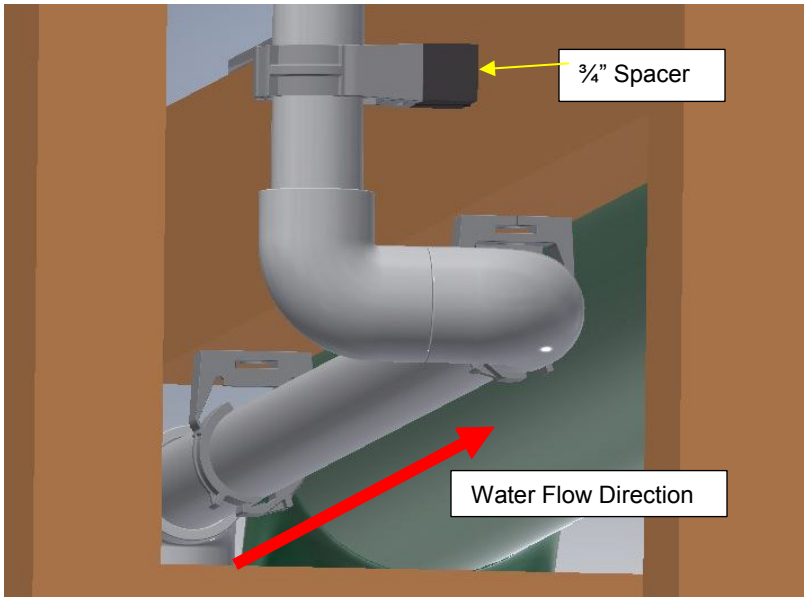


Figure 12 -- 1" Supply Line under Rail in the middle of the tower

Pipes out from the tee go to both sides of the stand. For each GroTower, you will need to insert a 1” x 1” x ¾” (SST) tee. Be sure that the ¾” side of the tee does not point down. It should point up or horizontal to inhibit solids in the water from flowing into the tubing (as much as possible).

In this illustration, you can see one tee in the middle and 4 other tees corresponding to the 4 GroTowers.

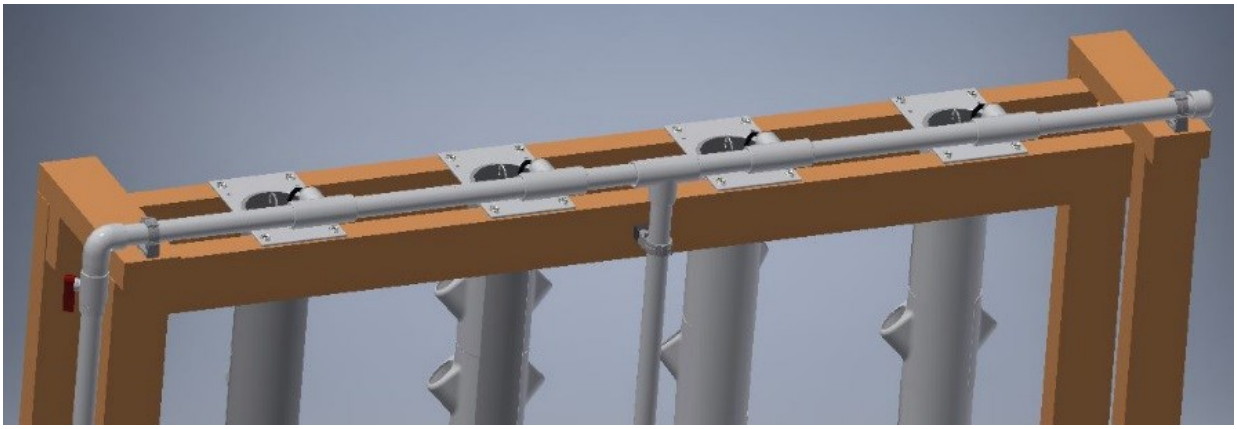


Figure 13 -- Top View showing tees

Then, the tubing adapter is screwed into the ¾” threaded side of the tee. The tubing fits into the small opening.

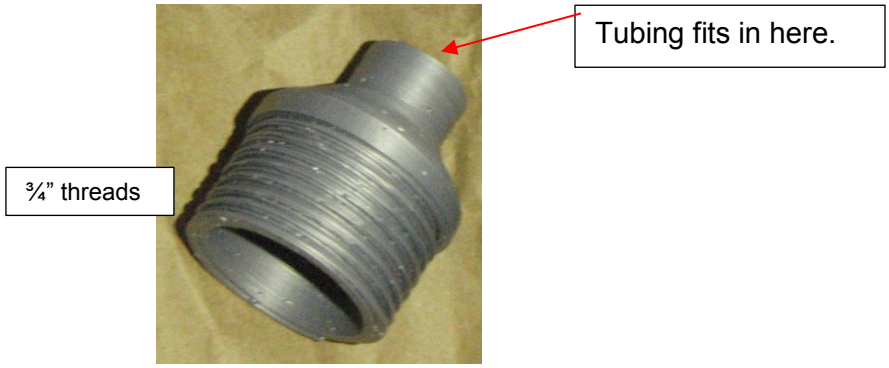
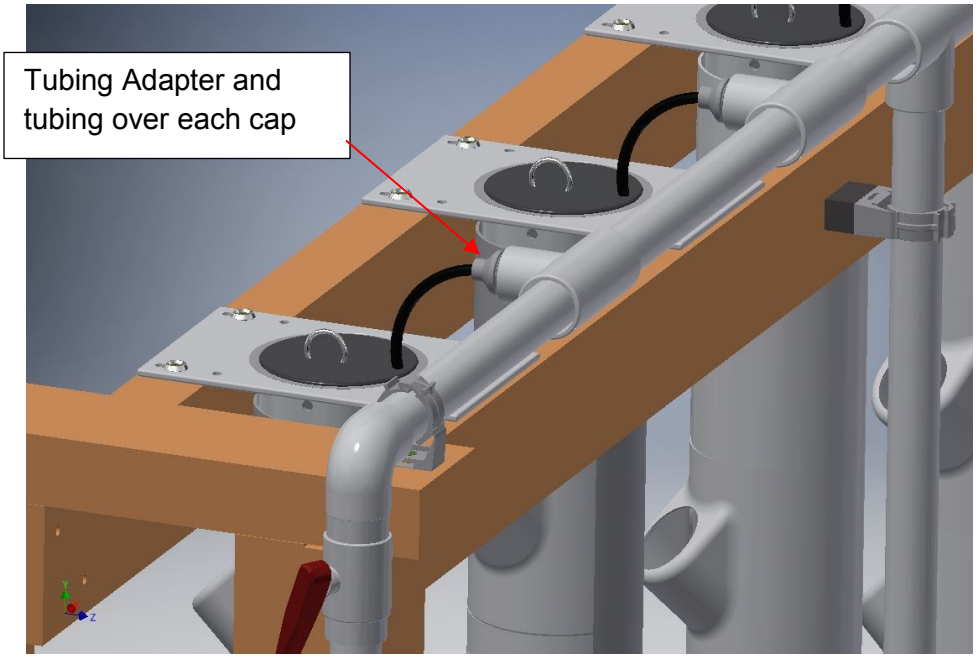


Figure 14 -- Special Tubing Adapter for Quick Mount Caps

Here is a close up of the right hand side of the 3D drawing:



On the left side of the stand, the pipe is terminated in a cap.

On the right stand, we have included an elbow which feeds into a 1” ball valve. Out of the valve is a straight pipe. This whole arrangement is optional; you may want it to clear blockages due to fish waste solids. If not, you can put a cap on this side as well.

Appendix A – Shopping List Annotations

4” PVC Thin Wall Pipe

Also known as S&D pipe. S&D stands for sewer and drain. You will only use it for the towers and a drain; it will not be under pressure. You may find its rating standard of D2729 printed on the exterior of the pipe. As far as we know, it is only available in 10’ lengths. Frequently, 6” of one end has been shaped into a bell for connection to another piece of pipe.

1” Schedule 40 PVC Pipe

This pipe will be under pressure since it is supplying water to the top of the towers. You should make sure the pipe you buy has Schedule 40 (or Sch 40) printed on it. It also usually comes in 10’ sticks. (Class 200 is a thin wall pipe which takes the same size fittings – don’t buy it.)

Plumbing Fittings

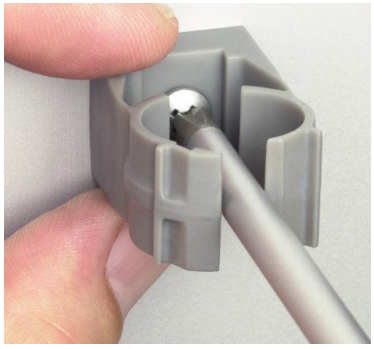
You need one 1” x 1” x ¾” tee for each GroTower in addition to the other plumbing fittings on the Shopping list.

PVC Cement

Medium bodied (or thick) and colorless.

Quick Latch Pipe Hangers

We sell a kit of 6 of these with which to attach the 1” PVC pipe to the frame to quickly keep this pipe straight on the back of the stand. Two ¾” spacers are required to align the 1” pipe on the back; they are included in the kit.



Here is the link to the Quick Latch kit on the website:

Deck Screws

To fasten the frame together, you will need a small box of 2½” coated deck screws or stainless steel screws (much more expensive). They need to be resistant to moisture, and if you are using pressure treated wood, the screw must be rated for pressure treated wood.

Finish Washers

Finish washers look better and keep the screws from being driven below the wood’s surface

Optional Consumables

- Nitrile or latex gloves to wear while applying PVC cement
- Zip ties to clamp pockets in place while cement is drying
- Alcohol to remove ink markings from pipe
- PVC stain from GroPockets
- MEK to mix with the stain
- Masking tape for marking parts

---------- End of document ----------