

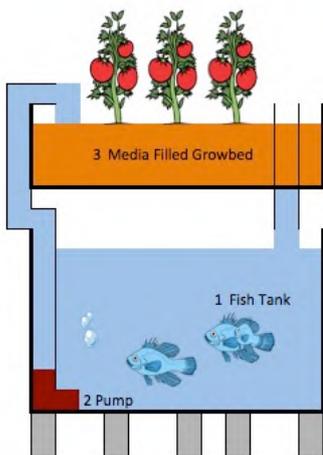
Japan Aquaponics DIY Aquaponics Guides

Plumbing Part 2

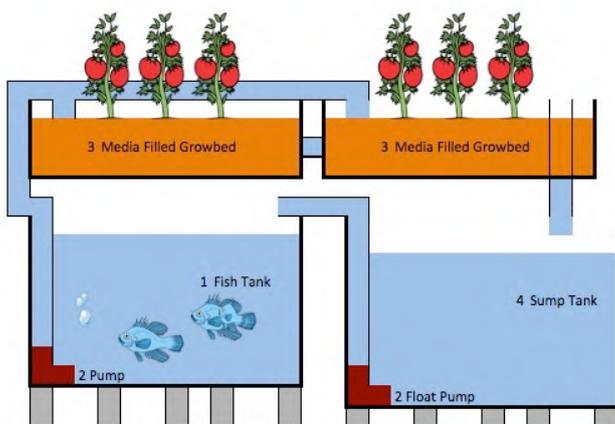
This is Part 2 of the Aquaponics Plumbing guide and we will discuss some more specific issues about plumbing your system and how to set up different configurations. Aquaponics plumbing and Aquaponics system design are of course inseparable, but in this guide we will try to focus more specifically on how to put all the plumbing components together. The choice of how you configure your system will depend on your personal circumstances, space available, growing objectives and so forth, but in this article we are going to focus on growbed media systems, as we will cover NFT and DWC systems in a separate guide.

How you configure the plumbing of your growbed media system will depend on how you have decided to set up your aquaponics system, and we can outline here several considerations and common ways to set everything up.

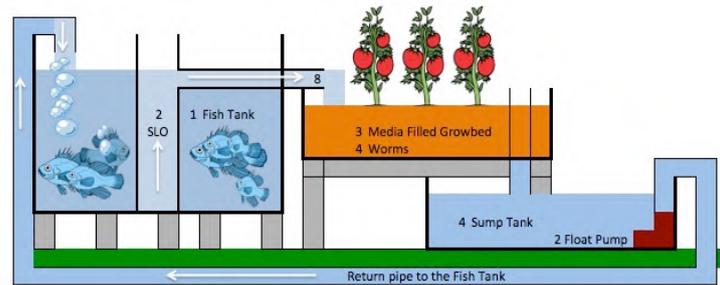
System Configuration:



Fish Tank at the lowest point. Water Pump in the Fish Tank – pump up to the Growbed. Growbeds at the highest point. Simple gravity drain back to the Fish Tank. No Sump.



Fish Tank at the lowest point. Water Pump in the Fish Tank – pump up to the Growbed. Growbeds at the highest point. Simple gravity drain to a Sump Tank. Float Pump in the sump tank pumps water back to the Fish Tank.



Fish Tank at highest point. Water gravity flows (via S.L.O. or Solids Lift Overflow) to the growbeds. Growbeds drain into the Sump Tank. Water Pump pumps the water back to the Fish Tank.

The second consideration after component configuration is how you will flood and drain the growbeds as this will of course affect how you will need to plumb your system. There are three main methods that are commonly used:

- Constant Flood
- Timed Flood and Drain
- Flood and Drain with Siphons or some similar mechanical way to drain the growbed.

So effectively you can mix and match any of the main component configurations with any of the water flow methods noted above. This list is not exhaustive as there are some incredibly creative and complicated systems out there – but these are the main configurations that are commonly used by probably 90% of backyard aquaponics growers.

So which is best?

Before we answer that it may be best to make some general observations about the plumbing for our aquaponics systems, and things we should take into consideration:

Keep It Simple! The more complicated it is – the more likely it is to break!

Keep it Short. Shorter pipework reduces temperature variations, reduces friction and is easier to maintain.

Cleaning. At some point you may need to clean out your pipes so think about this in advance.

Accessible. It will be difficult if pipes are hidden away, or blocked in.

Redundancy. Make sure that you plan in overflow pipes and fail-safes. Think of your fish first!

Easy water flow. Complicated joints and connections, or under-sized piping will slow your water down.

Solid waste. Think about how you will move solids, and how you will deal with them.

Expansion. You may want to upgrade your system or add new growbeds and so forth in the future.

Considering these guidelines it is my personal preference to use the model where the fish tank is the highest point in the system and water gravity flows down to the growbeds and then on to a sump from where it is returned to the fish tank. This method has several benefits:

Safety:

The Fish Tank will never be drained if a plumbing problem should happen somewhere in the system.

Solid waste

This is gently removed from the tank – a water pump does not chop the waste up.

Efficient.

This setup uses only one pump and can be arranged very efficiently. Gravity does a lot of the work needed.

Flexible.

More growbeds can be added relatively easily. Sump adds water capacity to the system.

These are just a few benefits that we have noted, but this is really just one way of setting your aquaponics system up. It requires more space than other methods and this may be a problem for you – so please choose whichever method is best suited to your circumstances.

Pumping from the Fish Tank to the Growbeds

The water pump works best when it is working at its full capacity and is not being throttled somewhere within the system. If the pump can work without impediment then it puts less strain on the motor. This means it will last longer. So what could throttle the pump? If we add a ball valve to the section of pipe where the water enters the growbed then this will throttle the water flow and affect the pump – probably shortening its lifespan.

If the pump is being used to draw solid waste from the Fish Tank up to the growbeds then it is worth checking that it can do this easily. Some pumps draw water from the sides, but not from underneath. This is a helpful ability and so a few carefully drilled holes under the grill for the pump can make it easier for solid waste to be drawn up into the growbed.



If we are pumping from the Fish Tank up to the Growbeds then there are a couple of things that we would recommend doing. The first is that we need some way of regulating the water flow from the pump and so one very good way of doing this is to incorporate a ball-valve bypass into your system. This bypass is shown here.

Add a T-connector to the pipe coming from the pipe and onto that add a ball valve. This will regulate how much

water flows out of this connection. This bypass does not impede the water flow from the pump and also has the added benefit of potentially adding circulation and aeration to your fish tank if it is set up properly. The bypass should be above the water level and allow the water to splash into the tank – this will create bubbles, and therefore food oxygenation. If the pipe is angled properly it will help to promote good water flow.

Alternatively you can add a 'spray bar' from the ball valve.

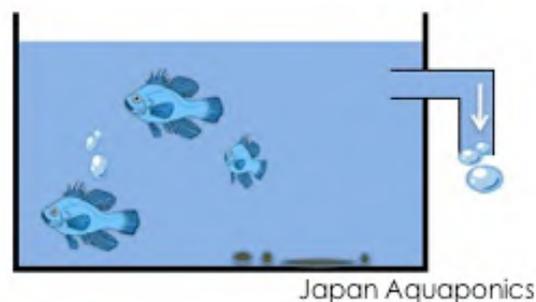


This is simply a length of piping that is capped at the far end, and has small holes drilled all along the length of the bar. This causes the water to spray out of the bar causing greater splashing and therefore oxygenation.

SLO or Solids Lift Overflow

When we have the fish tank positioned above the growbeds then we can use gravity to move the water. There are ways of moving the water and solids most efficiently though.

If we simply put an outflow on the side of the fish tank then the water would indeed flow out of the tank and into the growbeds - the problem, is that the solid waste is heavy and generally sinks to the bottom of the tank - so a hole high up on the side of the tank is not going to move the solid waste to where we need and want it.



In this case, we use what is known as an SLO or a Solids Lift Overflow. This draws the water and the solid waste from the bottom of the tank. The beauty of this system is that it is simple to implement using commonly available materials, it is effective, and it requires no power whatsoever.

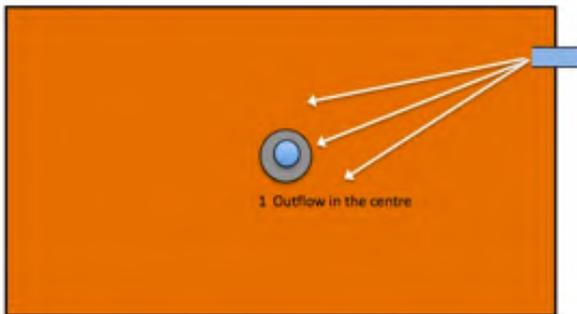
The Solids Lift Overflow is a wide diameter pipe that sits upright, usually in the centre of the tank. It is fitted with a T connector at the top and the piping then goes through the side of the tank and on to the growbed. We use a T connector instead of a 90 degree elbow so that we don't form a siphon and drain the tank.

Water entry and exit placement in the growbeds

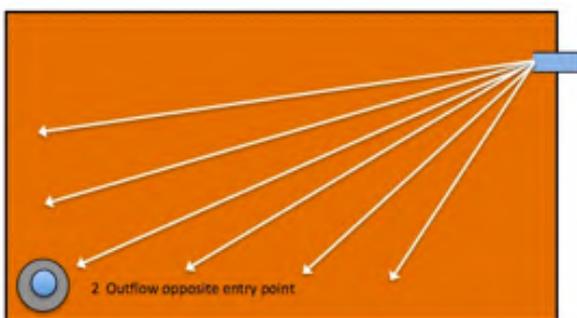
There are a number of ways that we can arrange the inflow of water into the growbeds, and the relationship between this, and the outflow from the growbed. We are generally trying to ensure that any solids are spread throughout the growbed so that we don't end up with a huge build up of solid waste on just one particular spot. This build up would lead to an anaerobic spot forming which will prohibit plant growth. Good relative placement of your inflow and outflow plumbing will allow for good water movement within the growbed, and an equal spread of nutrients.

The following are a few common ways of setting up a growbed - the white lines show the direction of the movement of solid waste:

In the first graphic the water enters the growbed at one single point and exits via the outflow pipe in the centre of the growbed. As you can see, with this set up there is the potential for solid waste to have limited movement within the growbed. This is still however one of the most common setups and will still be relatively successful. It is also very easy to set up.

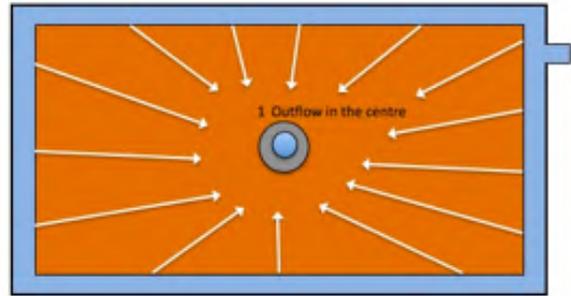


The second graphic is a slight modification, with the outflow placed opposite to the inflow. This means that the water will be dragged through the bed more ensuring better water flow and better movement of solid waste. This in turn will probably lead to less clogging and anaerobic (no oxygen) spots. This is also very easy to set up.



The final graphic shows the water entering the growbed via a piping grid. The grid runs all the way around the bed and has small holes drilled regularly around it. In this way the water is spread very evenly around the whole growbed and ensures maximum dispersal of solid waste and nutrients.

This is still relatively simple to plumb, but the holes will clog over time and so will need to be cleaned more regularly than the setups in examples 1 and 2. There is also an issue of the longer piping causing greater temperature fluctuations, and so you will have to decide if this method will be right for you.



An actual example of the grid method (Used at the Yokohama International School Aquaponics Project):



The Overflow

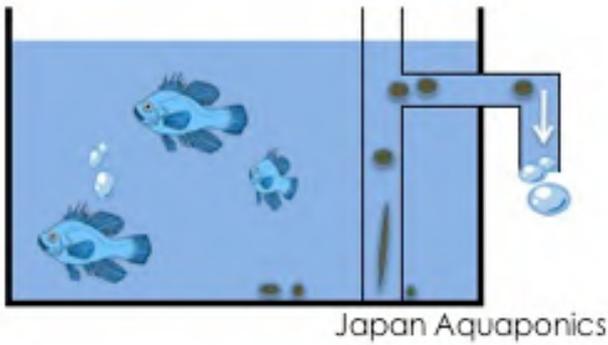
When designing a system it is best to add in fail-safes right at the very beginning. You should always allow for the fact that something may go wrong and that either the fish tank, or the growbed might overflow. In such a case it is important to have an overflow built into your system. This will simply be a hole strategically placed into the side of the growbed and the fish tank that will allow water to flow out



of those containers if the water should rise too high.

If the growbed is placed above the fish tank then the water should flow back either to the sump or to the fish tank. If the fish tank is at one of the highest points, then the water should flow either to the growbed or to the sump. Ideally we would like to try and keep the water in the system rather than wasting it.

The overflow should be screened so that neither fish nor media can get into the pipes.



You should make sure that the Media Guard is securely in place at the bottom of the growbed and that it extends beyond the level of the growbed media. It should allow air to enter at the top so that it does not form a siphon. In the example above, the yellow cap has holes around the side to allow air to pass freely, but it could in fact be completely removed.

The Media Guard

No matter which type of system you set up we need to get the water out of the growbed once we have put it in there. There are a variety of methods of doing this but almost all will also require what is called a Media Guard. The media guard can be seen in the photo above - it has the yellow cap on it.

The Media Guard is very simple - it is usually a piece of wide diameter piping (often 100mm pipe) with small holes or gaps drilled or cut into its sides. Its purpose is to allow the water to flow - but to block the media from getting into the plumbing.



The media guard does not necessarily have to be glued or stuck to the bottom of the growbed - it is a matter of preference, and how likely you think that the media guard might be accidentally moved or dislodged. In the photos above we have used a simple silicon sealant to secure the media guard. If the media guard is not secured then it could make it easier to rotate the media guard at a later date, thus helping to dislodge any roots that might have grown into the guard.



This Media Guard is very important as it performs a couple of functions. Firstly, it allows you access to the outflow plumbing in case you should need to change anything. Secondly, it also helps to stop the roots getting into the plumbing.

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