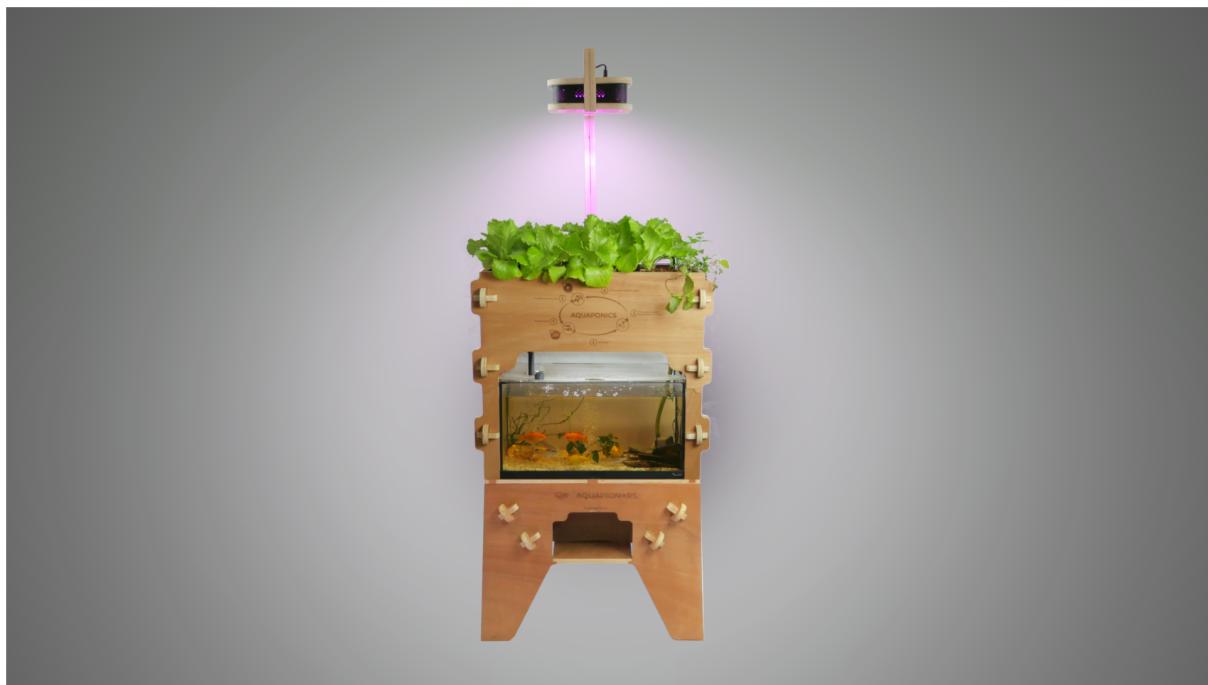




Download kit

*Free documentation & blueprints for Aquapioneers Kit v1.6
Part II - Water Irrigation system - The Blood*





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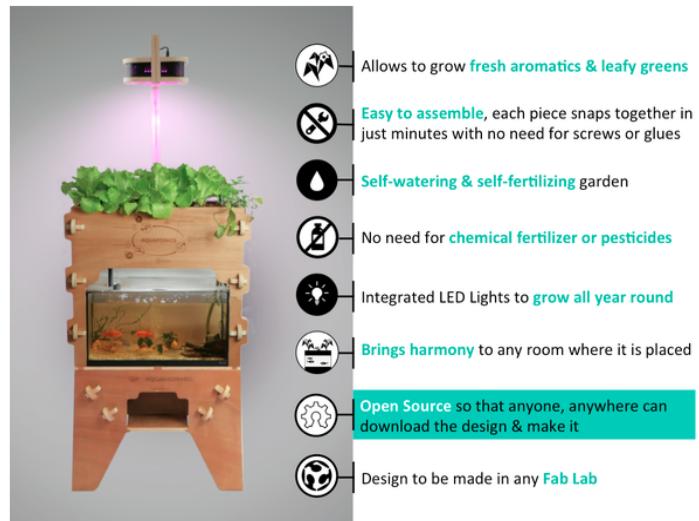
<https://github.com/aquapioneers/Aquapioneers-Kit-Barcelona-Design>

AQUAPIONEERS KIT MAIN FEATURES



The Aquapioneers Ecosystem is a thoughtfully crafted fun, educational, and rewarding experience.

At the intersection of hardware and ecology, it allows you to grow fresh and tasty food all year round. This little piece of nature, will engage and inspire you, your family and your friends.



You can watch the following 30s timelapse [Youtube video](#) that sum up the overall assembly process and show a one month growing period with lettuces.



Please note that the blueprints for Aquapioneers Kit v1.6 have been designed for a **specific aquarium dimension (60x30x30cm)** which is the most common in Europe. Please make sure you can find these dimensions in your area before you proceed. If you can not source an aquarium with these dimensions, you will have to modify the structure design to be compatible.

SOME HERBS & LEAFY GREENS YOU CAN GROW



LETTUCE



STRAWBERRY



PARSLEY



MINT



BASIL



SHISO

SOME SPECIES OF FISH THAT CAN INHABIT YOUR ECOSYSTEM



GOLD FISH



GUPPY



HEMICHROMIS



TETRA NEON

Contents

Project Overview	6
AQUAPIONEERS - What is this ?	6
Open Source Non Commercial - Why ?	6
Project toolkit	8
Download-kit	8
Forum	8
Local Manufacturing	8
Tutorials	8
Project Goals	8
AQUAPIONEERS ECOSYSTEM ANATOMY	10
THE BLOOD	12
BILL OF MATERIALS	12
ASSEMBLY	13
ASSEMBLY 5: Water proof the growbed with an EPDM membrane	13
ASSEMBLY 6: THE BELL SIPHON	21
BELL SIPHON COMPONENTS	23
ASSEMBLY 7: THE WATER INLET	30
WATER INLET COMPONENTS	30
ASSEMBLY 8: THE AQUARIUM & PUMP	36
COMPONENTS NEEDED	36
Thanks to all our ULULE backers that make this project possible	38



Project Overview



AQUAPIONERS - What is this ?

AQUAPIONERS is a Barcelona based social enterprise that aims to combine the unbeatable advantages of Aquaponics as a sustainable method of urban agriculture and the power of Digital Fabrication to unlock social innovation. Locally we develop creative services around aquaponics for schools, businesses and individuals and globally spread the word using open source tools.

The Aquapioneers Ecosystem is our first open source product. Its design and user manual documentation release has been possible thanks to our 248 backers that supported our [crowdfunding on ULULE](#) closed on July 2017.

This document contains the information you will need to download, fabricate, assemble and use the Aquapioneers ecosystem v1.6 with confidence and grow aromatics all year round.



Open Source Non Commercial - Why ?

The CC-BY-NC license we have chosen gives anyone the right to download, edit and remix their own versions of the AQUAPIONERS ECOSYSTEM designs. We think participation in design is something to be actively encouraged. By adapting, improving and creating new variations of the ecosystem we hope to encourage research, innovation and a spirit of collaboration.

Because empowering people is one of the fundamental pillars of our project, we believe that everybody should have free access to this documentation to explore aquaponics and digital fabrication. Unfortunately in 2017 it is not yet possible to make a living out of free work.. this is why we have decided to limit the free use of our work to individuals. While we hope to inspire sustainable innovation with our work, we believe that economic value created from inventions should also benefit the inventors. This is why commercial use of this documentation will only be permitted through formal collaboration agreements. If you are interested in making commercial use of this work, please get in touch with us and we'll do our best to find a way to work together!



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Project toolkit

	
<h2>Download-kit</h2> <p>Free documentation & blueprints</p> <p>Starting an aquaponic system can be tricky, because quality information is rare and scattered all over the web. By open sourcing our design and its user guide, we want to break down the barriers of entry by ensuring that you work with the same system as the entire community and benefit from our collective experience.</p> <p>We use Github to host our designs and file repositories. It allows anyone access to download files, make changes, "fork" new versions and work in a distributed and networked fashion. If you'd like to contribute to the project, Github is the place to make comments and add your work: https://github.com/aquapioneers/Aquapioneers-Kit-Barcelona-Design</p>	<h2>Forum</h2> <p>A place to meet & help each other</p> <p>If we don't share what we know, how can we learn from each other? We would like to encourage all participants to contribute what they can to improve the project. This might be peer review, debugging existing designs, creating entirely new design, sharing tips to grow amazing veggies, and collectively study the mystery of aquaponics.</p> <p>This forum is a place to share pictures, skills, knowledge and interests through ongoing conversation: http://aquapioneers.io/community-forum/</p>
	
<h2>Local Manufacturing</h2> <p>+1200 maker spaces to build your kit</p> <p>Check out these links to locate one in your city: www.themakermmap.com. The Fablabs network: www.fablabs.io and also www.fabhub.io</p>	<h2>Tutorials</h2> <p>Video tutorials to grow with confidence</p> <p>Youtube channel : https://bit.ly/2JKHAYU</p>

Project Goals

1 Developing open source aquaponics designs that are suitable for local and digital manufacturing and that can be optimised for locality.

- Developing a number of aquaponics designs that are used as a base for adaptation.

2 Creating a public library of aquaponic recipes through innovative forms of citizen science.

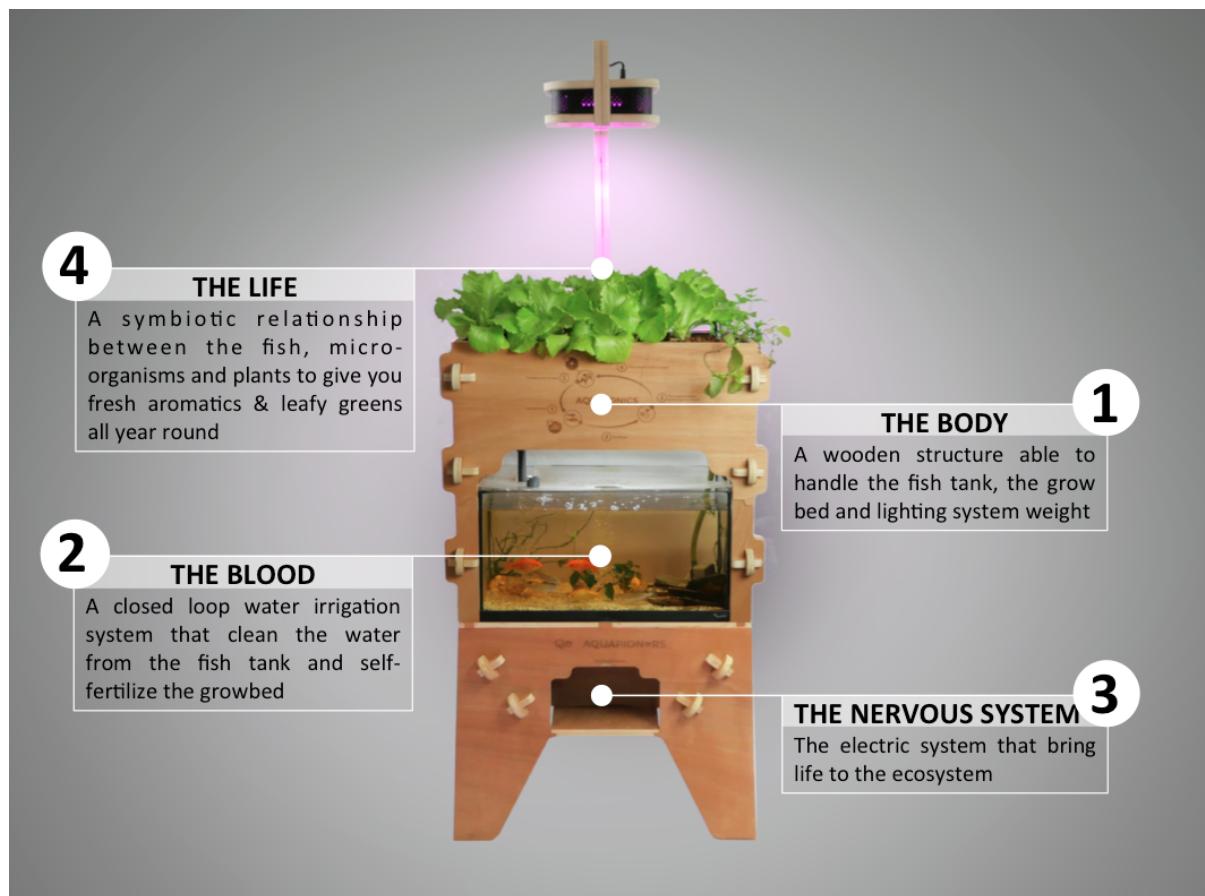
- Imagine a public library of aquaponic recipes, where each recipe is associated to a particular plant and tells you how to set your ecosystem (i.e. fish density, lighting and environmental conditions, etc) to suit this plant's needs. Just like a cooking book!
- Together we are smarter! This library will be collaborative, meaning that each user will be encouraged to share his cultivation experience with the community. This way we can use our collective intelligence to figure out the best aquaponic recipes for each plant. The more the community participates, the better the recipes will be!
- Develop protocols and pathways for 'Citizen Science'.

3 Bridging the information gap between aquaponics enthusiasts and maker communities

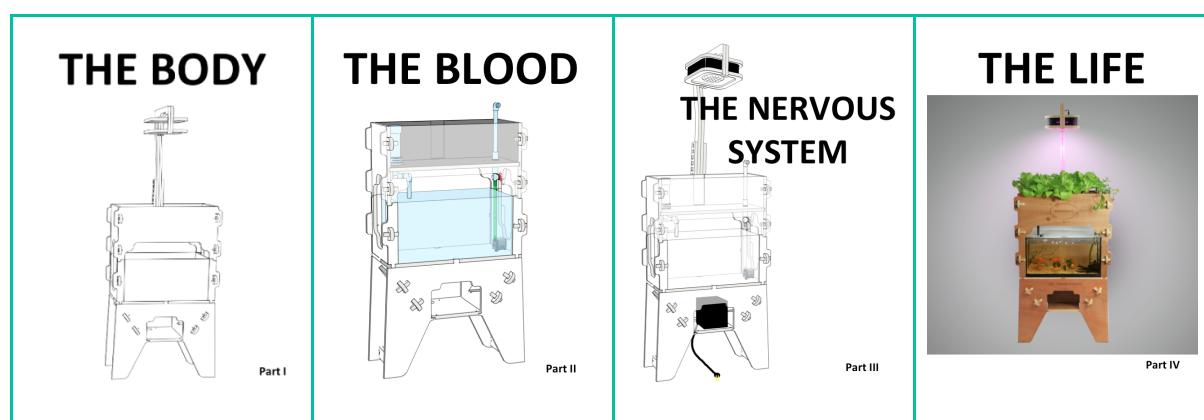
- Encouraging information sharing between people with differing backgrounds and expertise.
- Developing a range of communication tools (forum, tutorials, download kit, tutorials) to facilitate innovation in local aquaponic farming.



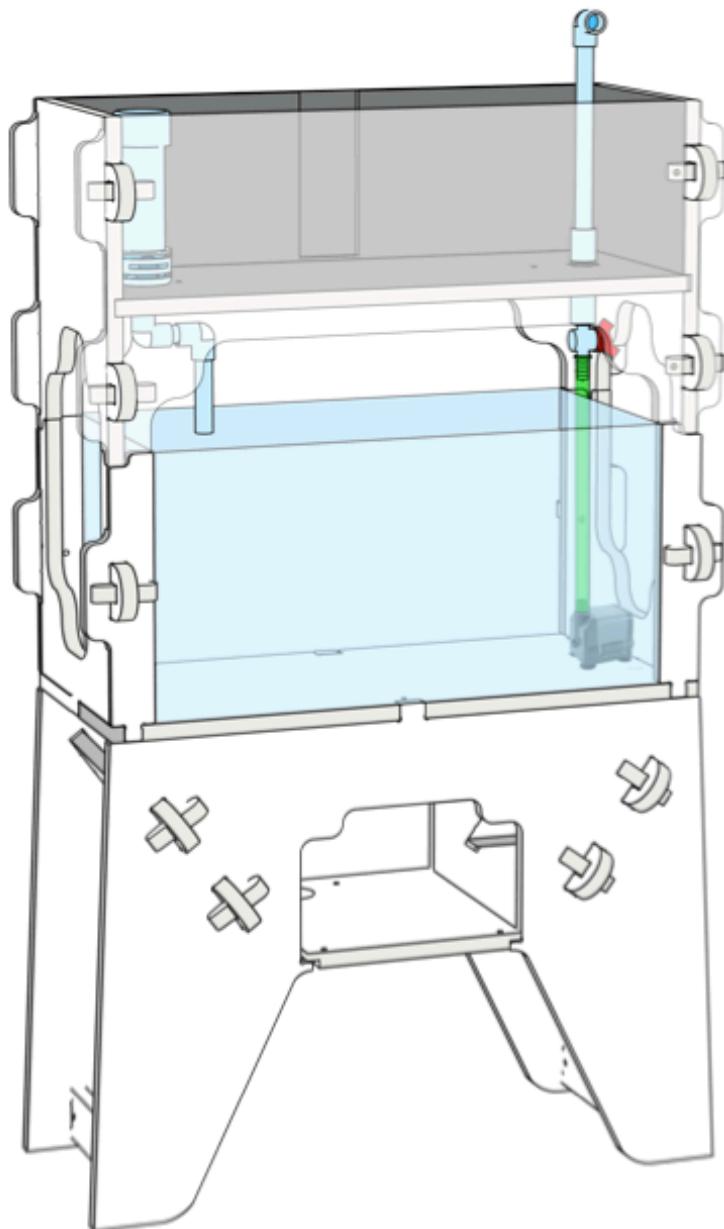
AQUAPIONEERS ECOSYSTEM ANATOMY



The user manual has been divided into four blocks following the Aquapioneers Ecosystem anatomy to ease its construction, assembly and use.



THE BLOOD

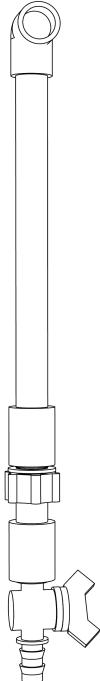
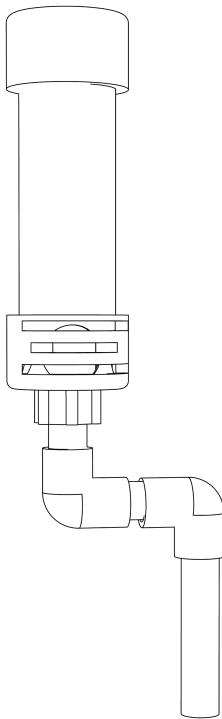
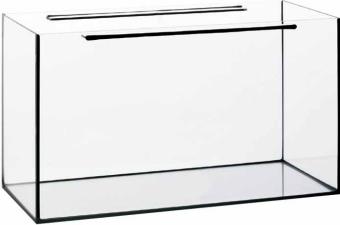


Part II

THE BLOOD

BILL OF MATERIALS

The water irrigation system is made of 5 interconnected sub parts that help keep cleaning the water from the fish tank and self-fertilizing the growbed

		
The water inlet, to bring the nutrient rich water from the fish tank to the growbed	The bell siphon, to bring back the clean water from the growbed to the fish tank	
 <small>Sico copyright</small>		
The water pump, to feed the water inlet	An EPDM membrane to water proof the growbed	The aquarium

ASSEMBLY

ASSEMBLY 5: Waterproof the growbed with an EPDM membrane

Tools you will need for this part:

Staple gun	Cutter	Clamps	Meter
			

23



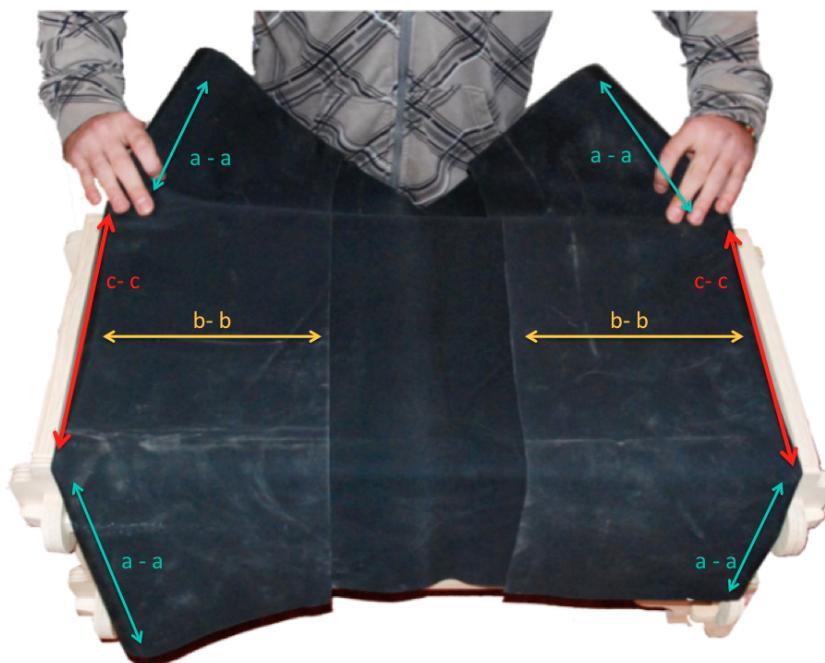
Cut a 110x75 cm piece of pond liner (f.ex. EPDM) and place it on the growbed, the long side matching the long edge of the media bed.

24



Fold the longer side of the liner inwards equally on both sides, in a way that the folds match exactly the edges of the growbed.

25



The setup should be as symmetrical as possible, meaning that the **distances a-a** should all be the same, and the **2 distances b-b** should be same length as well. Use a **meter** and adjust the liner until this is achieved. Remember that the edge of the liner needs to perfectly match the inner edge of the media bed on the short side (**line c-c**).

26



Fold over the liner over the media bed as shown in the picture. Hold the corners between your thumb and index.

27



Pull the corners of the liner you are holding down into the corners of the media bed.

28



Without moving the corners you just pulled, repeat the procedure on the other edge so that the four EPDM corners lay exactly on the four bottom media bed corners. Make sure the base of the growbed is evenly covered with EPDM liner.

29



Now, lift the edges inside the growbed up from the center and hold it against the side walls. Then flatten the sides against the walls until you obtain 4 folds as on the picture. Use the clamps to hold your arrangement in place. Make sure that all the sides of the growbed are completely covered by the liner (→ the liner must stretch beyond the edges of the bed) and that the liner is flat and even on all sides. You may have to rearrange the liner several times until you get it right.

30



Only when you are sure the liner covers all sides, and is flat and even, use a staple gun to fix the liner to the growbed.

31



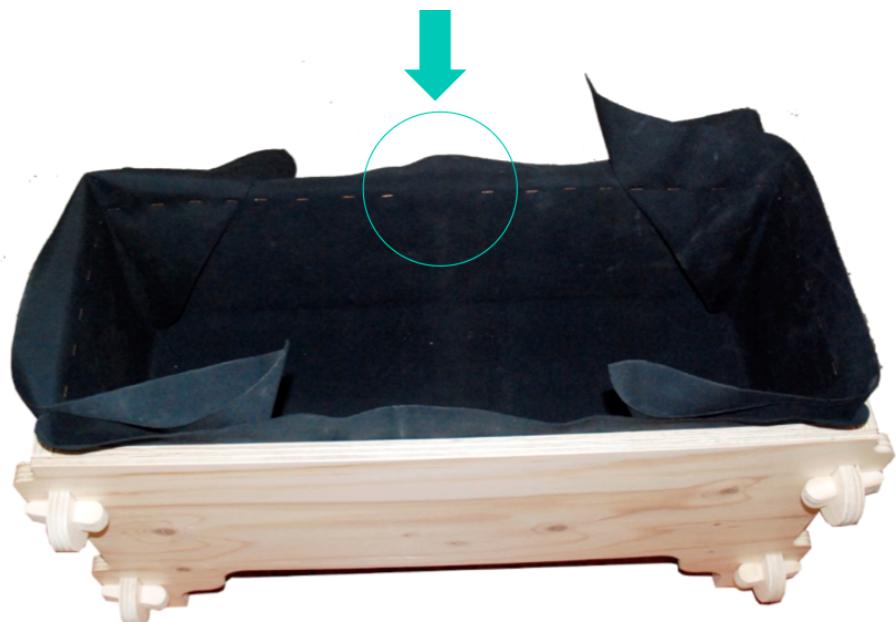
Place the staples about 5mm below the edge and space them evenly leaving about every 5cm.

32



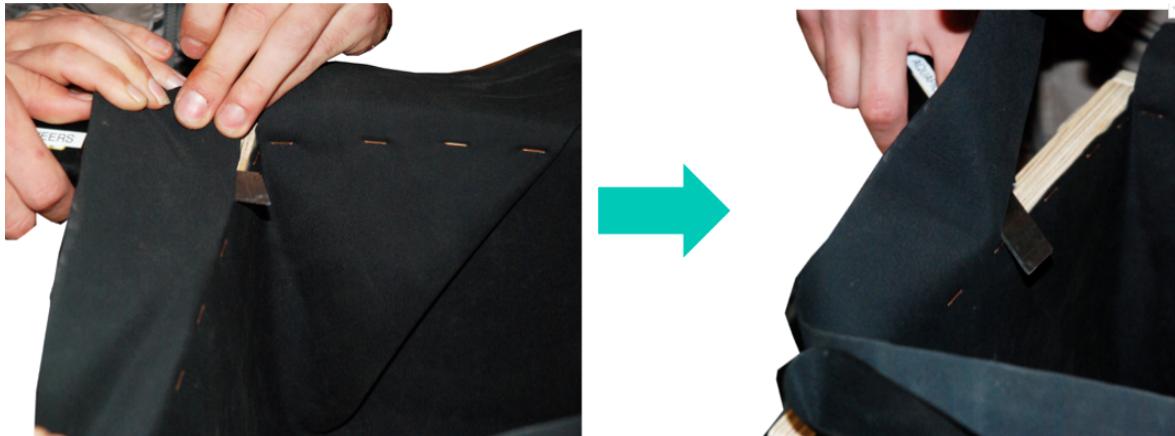
Work your way through in a single direction, flattening the liner as you go, until you went full circle and get back to where you started.

33



Be careful NOT TO STAPLE the carved section at the inner back of the bed, because this is where the light support needs to slide in later!

34



Use a cutter to remove the superfluous liner. First, at a corner, cut through the material until you reach the edge of the media bed.

Then, remove the rest of the material sliding the knife along the edge as shown on the picture. For a clean cut, keep the blade horizontal, pressing it slightly against the flat edge. As you cut, slightly pull the material towards you in an angle 45 degrees upwards and 45 degrees out of the media bed. Hold the knife at a 45 degree angle and slide the knife along the edge. Avoid any sawing motion as this will leave "teeth" at the edge.

35



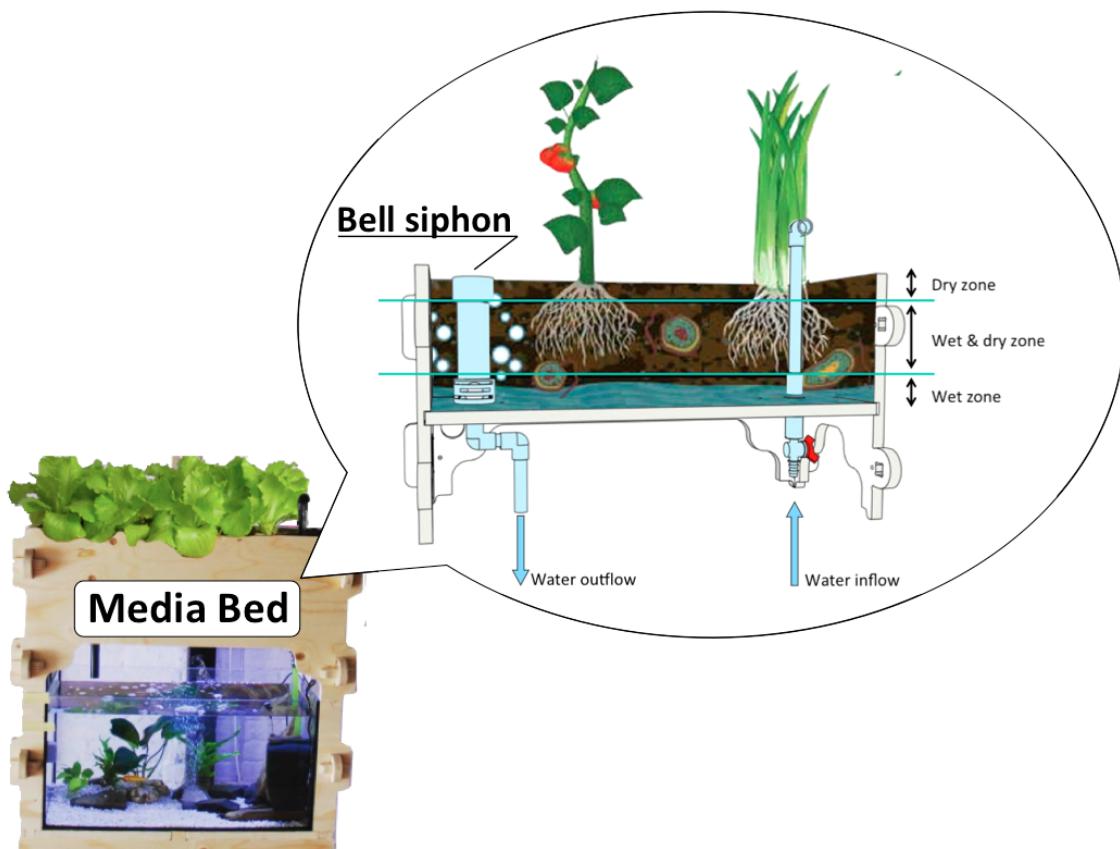
As you finish removing the material, your media bed should look as on the picture.

ASSEMBLY 6: THE BELL SIPHON

As the user guide will explain in more detail, the bell siphon is one of the most sensitive parts. All aquaponic systems share several common and essential components. These include: a fish tank, a mechanical filter, a biofilter, and hydroponic containers. However, there are three main designs of the plant growing areas including:

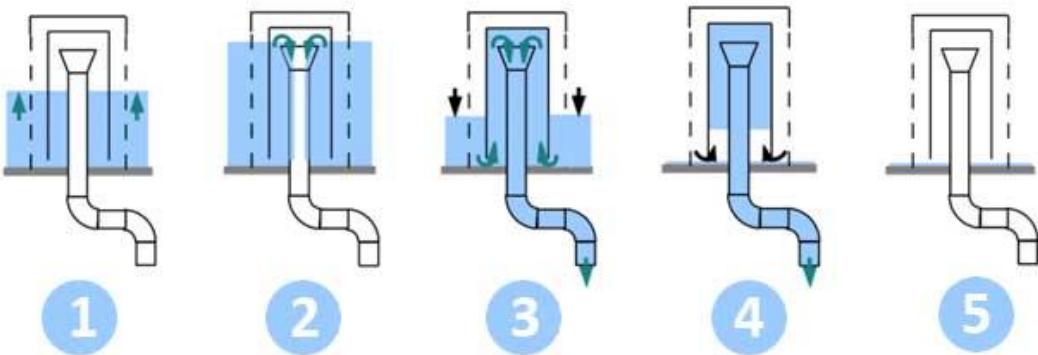
- Media bed
- Nutrient Film Technique (NFT)
- Deep Water Culture (DWC)

For small scale aquaponic systems, as the Aquapioneers ecosystem, the most common plant growing technique is **Media Bed**



Media Bed technique works with a Bell siphon which is a type of autosiphon that exploits a few physical laws of hydrodynamics and allows the media bed to flood and drain automatically, periodically, without a timer. The action, timing and ultimate success of the siphon are dependent on the water's flow rate into the bed, which is constant.

A bit of water dynamics to understand how it works: Water flows into the grow bed at a constant flow rate (1). As the water fills the grow bed it reaches the top of the standpipe (2), and begins to drip through the standpipe back (3) to the fish tank. Without the bell portion of the bell siphon, this would create a condition of constant water height. Instead, as the water continues to fall through the standpipe (4), the bell, which sits over the standpipe something like a hat, acts as an air tight lock and produces a siphon effect. This suction within the bell starts

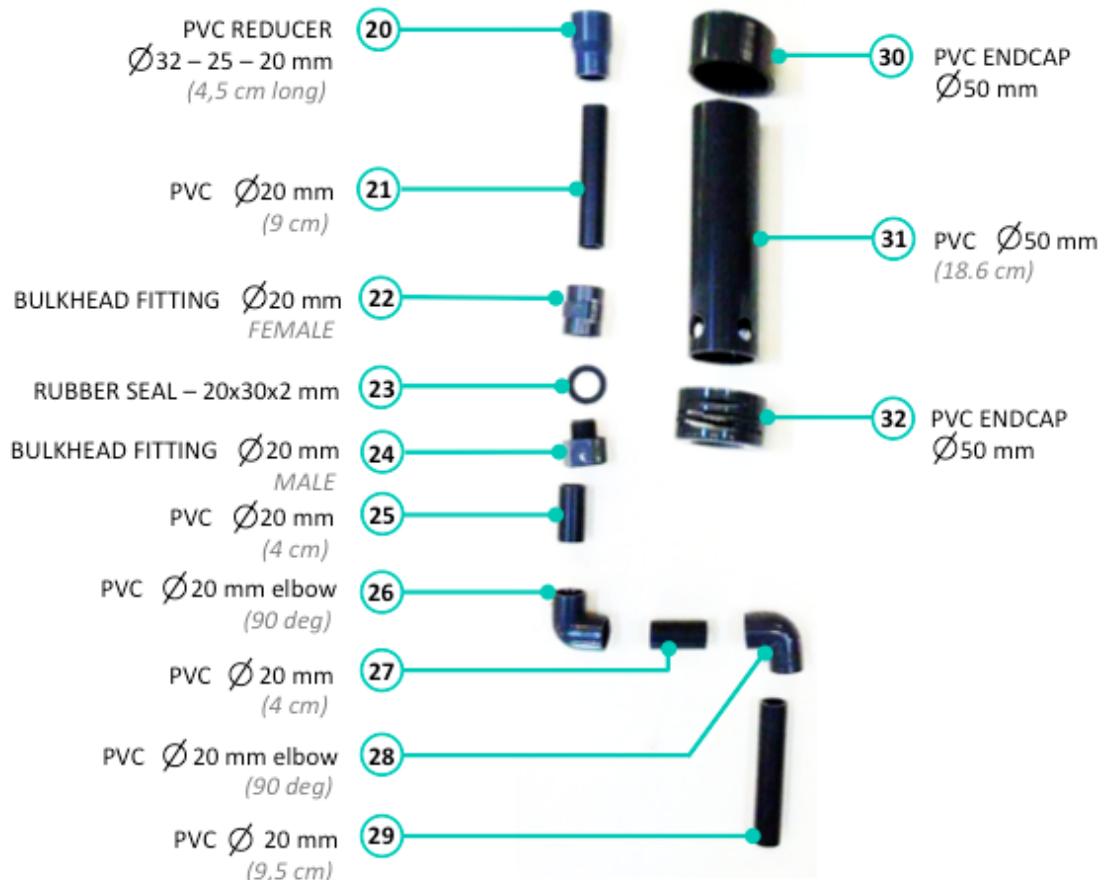


the siphon. Once started, all the water from the bed starts to rapidly flush down the standpipe as the bell keeps its airtight seal. The draining through the standpipe is faster than the constant inflow from the fish tank. When the water in the grow bed drains all the way down to bottom (5), air enters the bottom of the bell and immediately stops the siphon. The water then slowly fills back up and repeats the whole cycle again continuously.



You can watch one of our [Youtube video](#) to see how it works in action

BELL SIPHON COMPONENTS



Tools you will need for this part:

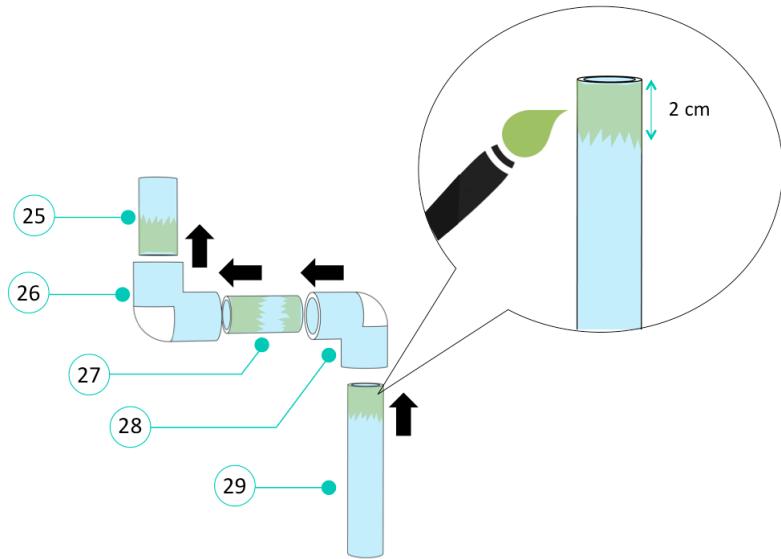
Electric wood saw	Cutter	PVC glue	Silicon	Brush

36



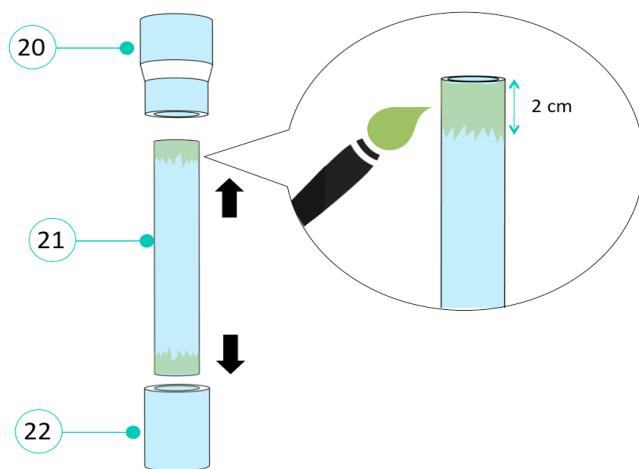
The PVC end cap will prevent clay pebbles from entering the siphon while allowing a strong water flow. This part is made from a 50mm PVC end cap as described below. Drill a hole through the base, large enough to slide part no. 20 through it. We use 32 mm, but you may have to adapt to your local piping connectors if they are different. Drill slots about 3-6 mm thick. You can use a circular / hand saw, a dremel. Do not use angle grinders or metal cutting tools as they will melt the plastic and create both a mess and toxic vapors!

37



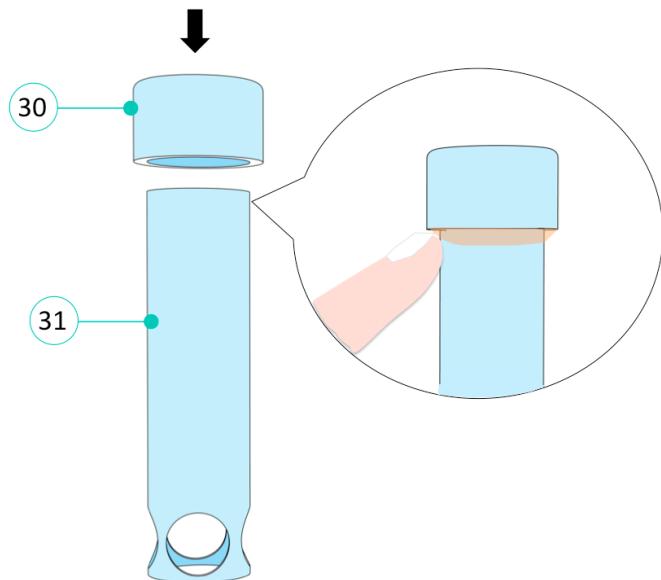
Let's start with the bottom of the autosiphon. Glue all pieces together with PVC glue as shown on the picture. When working with PVC glue, clean all surfaces which will overlap with PVC solvent or rubbing alcohol. Then quickly apply glue on both the male and female surfaces of the junction. Now fit the piece into the female one in a single push, without twisting. Keep applying pressure for about 10 seconds. PVC glue hardens very fast, so make sure to do this in less than 10 seconds. It is recommended to practice this beforehand. Work in a ventilated area as the vapors from the glue should not be inhaled.

38



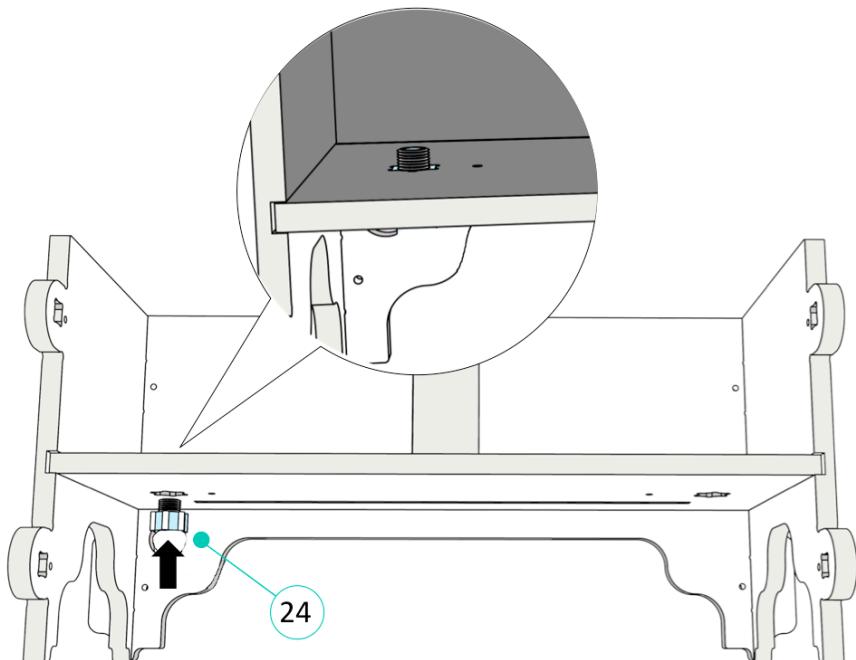
Repeat the same procedure for the upper part of the siphon.

39



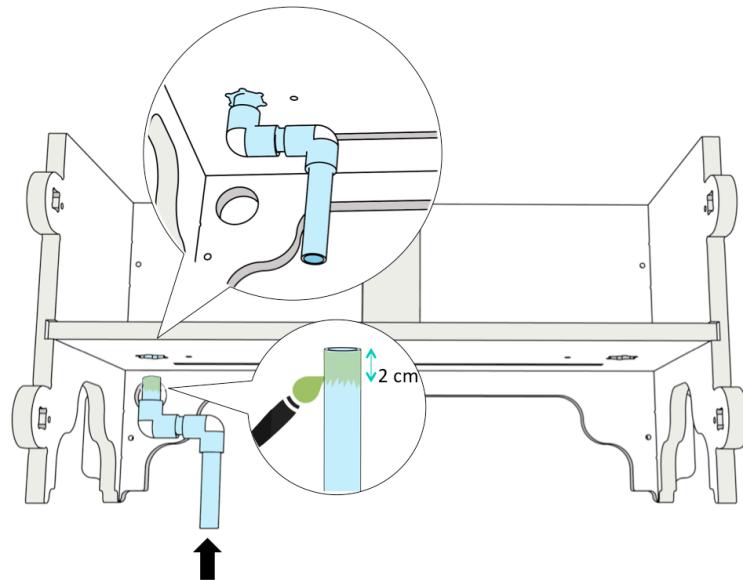
Drill 3 to 4 holes about 16mm large at the bottom of piece no. 31. For the bell of the siphon, **DO NOT USE PVC GLUE**. Simply press the end cap on the 50mm pipe and seal with a bit of silicone, so it can be opened in case of necessity.

40



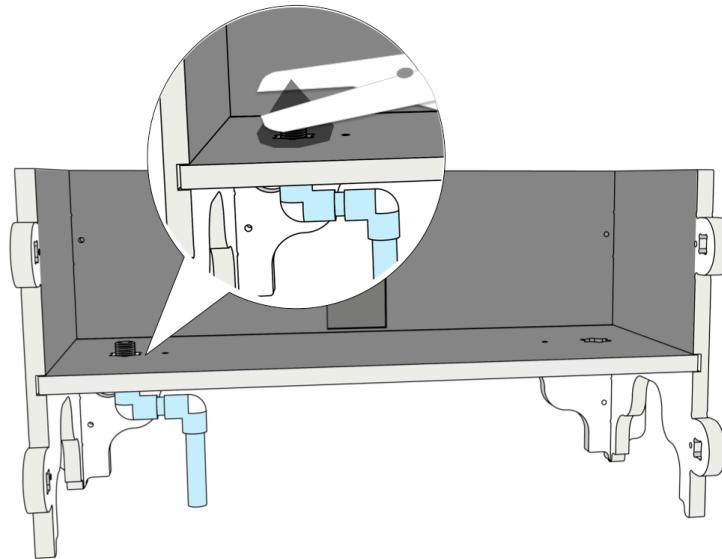
To fix the bottom part of the siphon, first fit piece no. 24 into the growbed base. The threaded part should be entirely above the base plate.

41



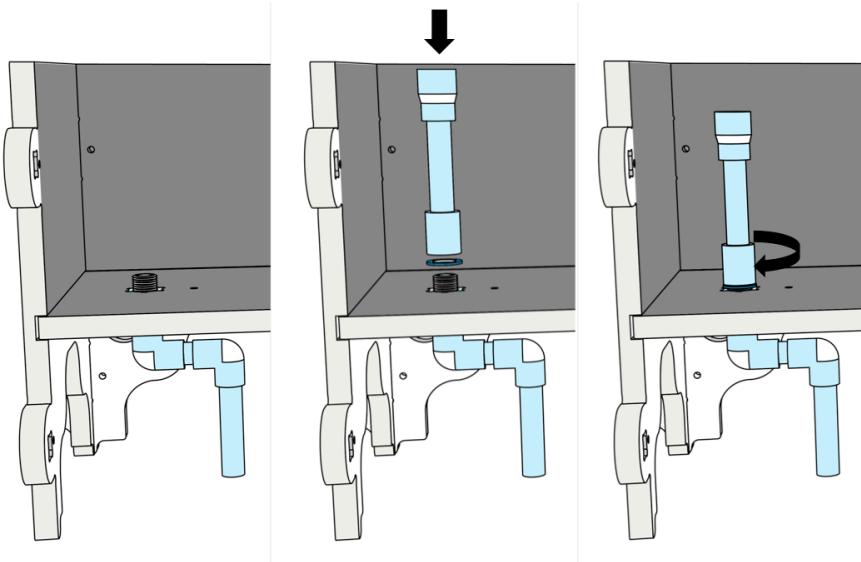
Now glue your pre-assembled siphon part to it, in a way that the pipe exit is at the center of the base width (the way it esthetically makes the most sense! ;))

42



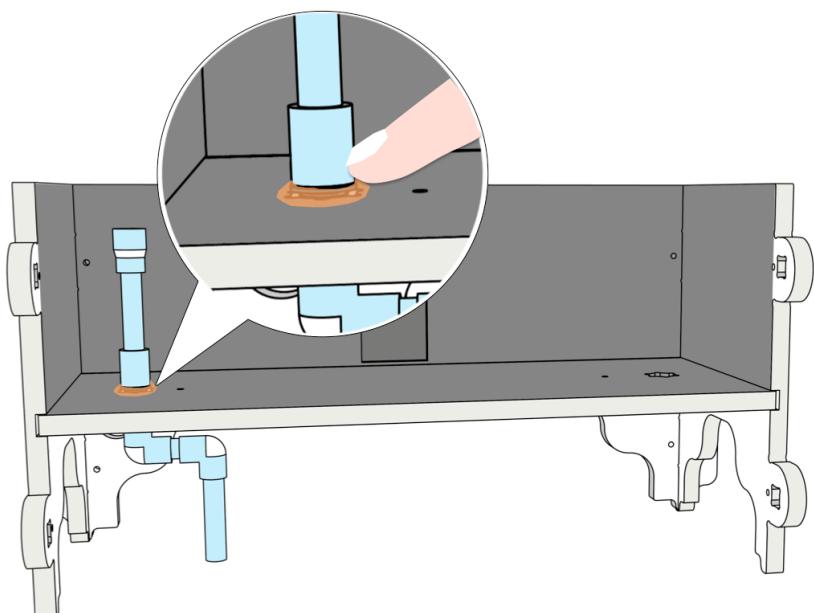
In order to fit both parts of the siphon together, you must pierce the liner around the thread. Be extremely careful here as a wrong move might ruin your liner and make it useless! You should make a round hole exactly the size of the thread. To do this, mark the center of the hole while you press it against the liner. Then pull the liner towards you so that you can fold it on itself. Now use a small pair of scissors to cut a half circle around the marked hole, exactly the same diameter as the thread. As you unfold, you should be left with a circular hole through which you can now fit the piping thread.

43



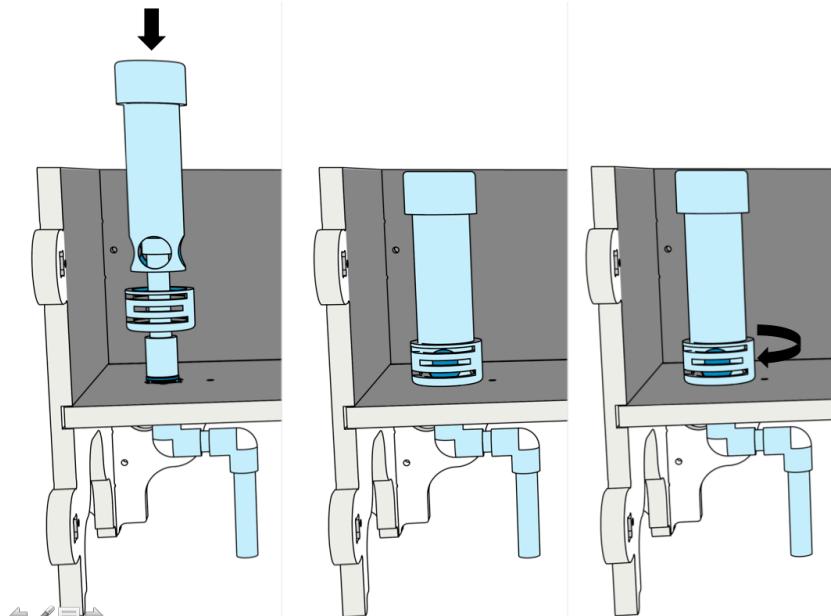
Once the liner rests against the base of the thread, place a rubber seal (piece n°23) on top of it. Make sure there are no folds in the liner, and that it exactly wraps the thread at its base. If the seal is not flat, or the overlap not complete, this may potentially cause disastrous leaks in your kit. Screw in the upper part of the siphon with enough pressure to feel a tight fit, but not as tight as to deform the seal. For more safety, put a tiny bit of silicone on the threads before twisting them together.

44



For additional leak protection, seal the junction with neutral silicone once it is tight.

45



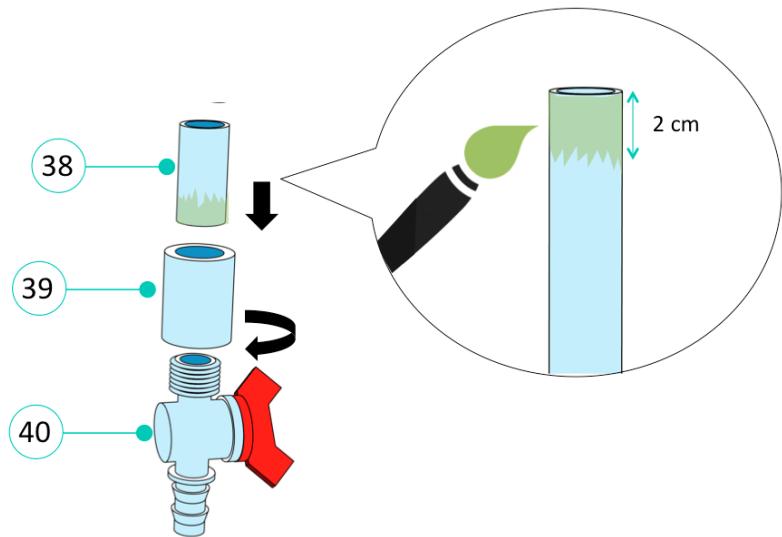
Finally, place the bell over the inner pipe, making sure its base rests flat on the liner so it is completely vertical.

ASSEMBLY 7: THE WATER INLET

WATER INLET COMPONENTS

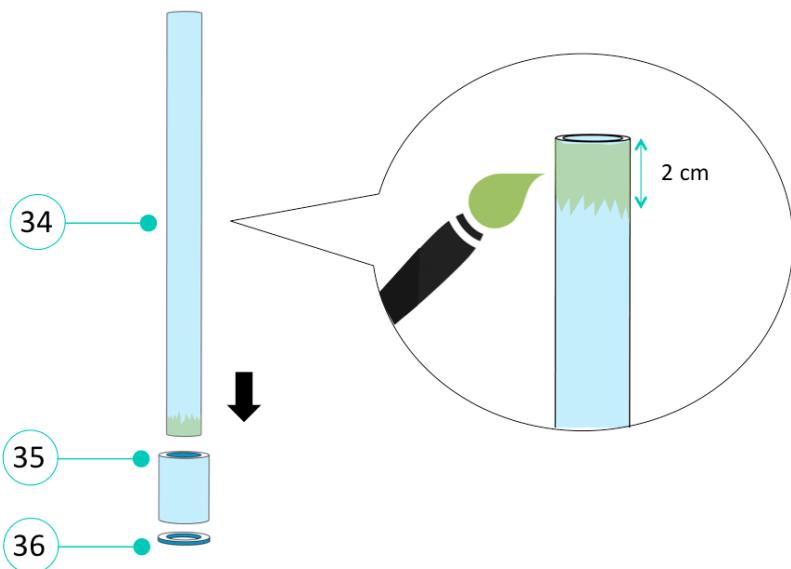


Now we'll assemble the water inlet piping which connects the pump to the growbed.



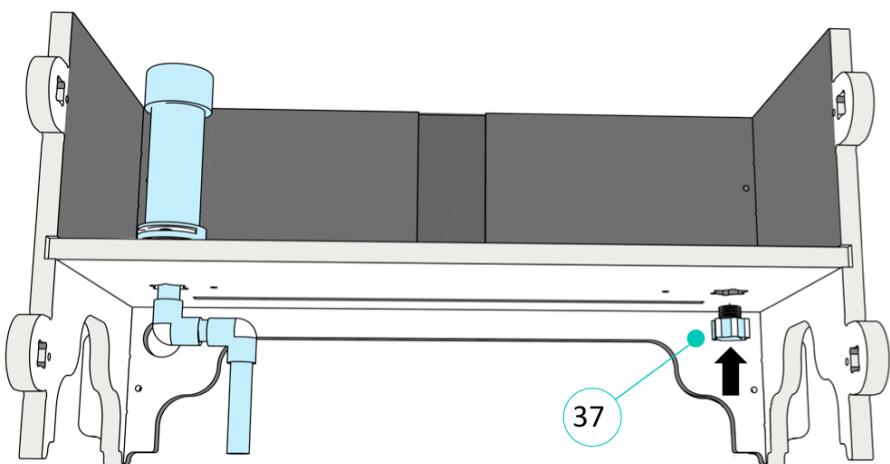
To get started, glue only pieces 38 and 39. Then, connect the irrigation valve to the bulkhead fitting. For a watertight seal, either use teflon or apply a little silicone on the thread.

47



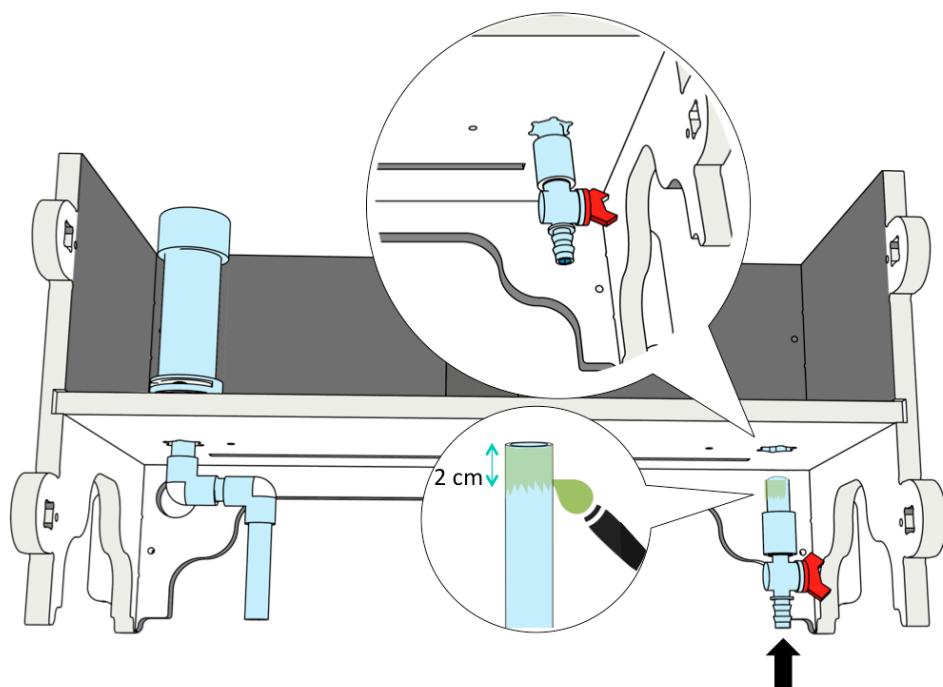
Glue together pieces 34 and 35 of the water inlet as shown on the sketch.

48



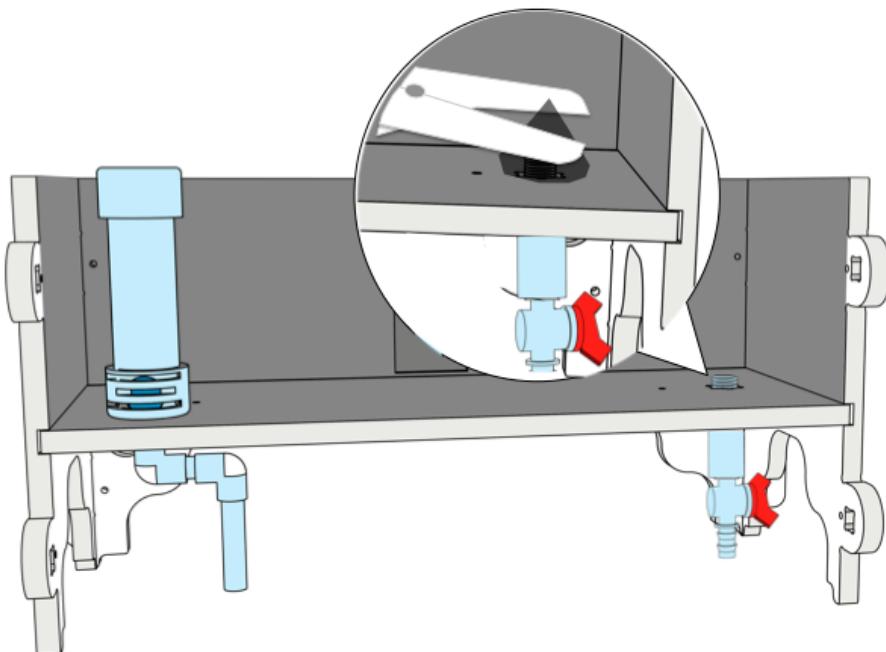
Proceed exactly as with the siphon before. Fit piece n. 37 in the engraving of the growbed.

49



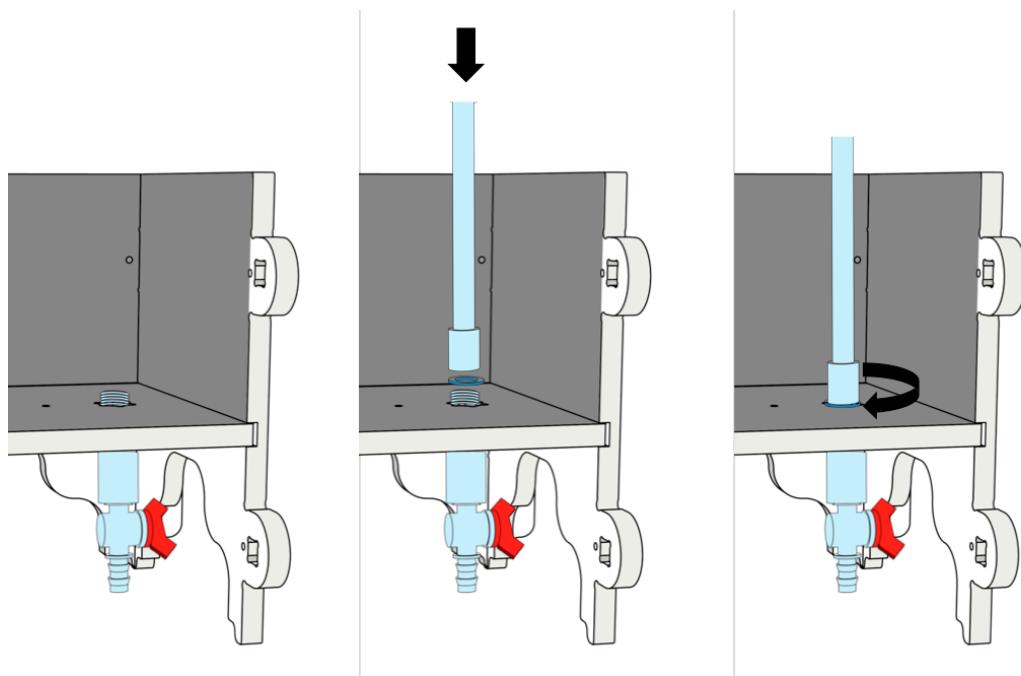
Choose a practical orientation for the valve as shown, and then glue piece n.37 to the rest of your preassembled part.

50



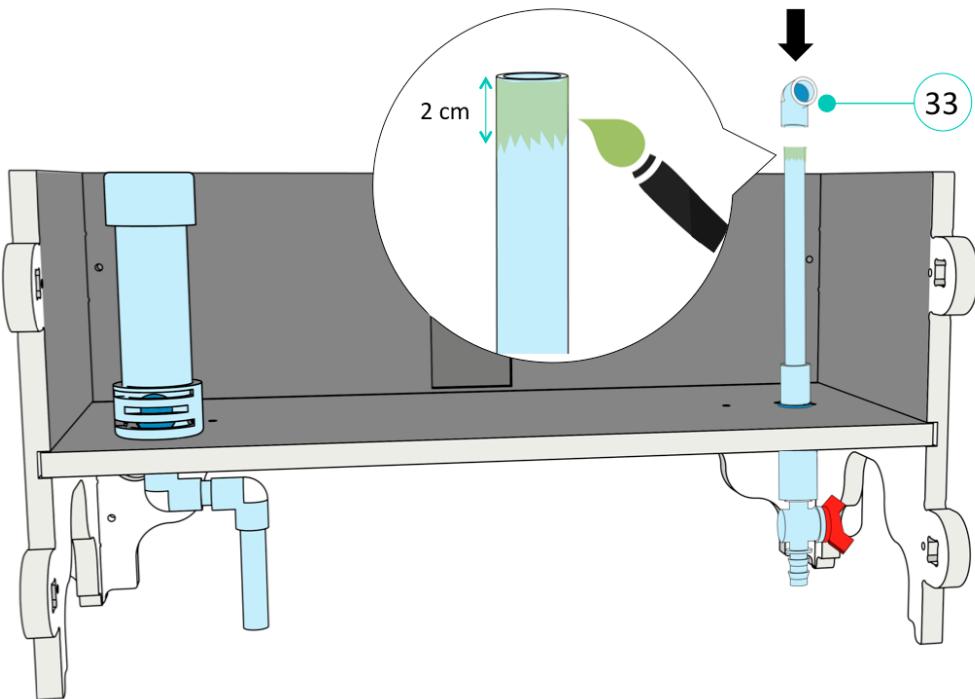
Then proceed exactly as before to pierce the liner around the thread of part 37, being very careful to cut a round, perfectly fitting hole.

51



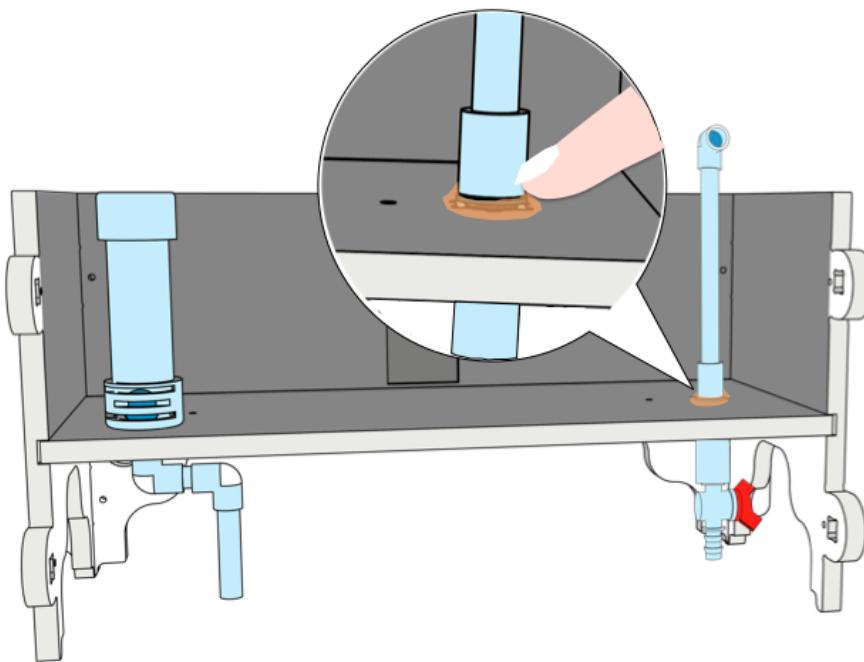
Proceed as before with the siphon to fix the water inlet.

52



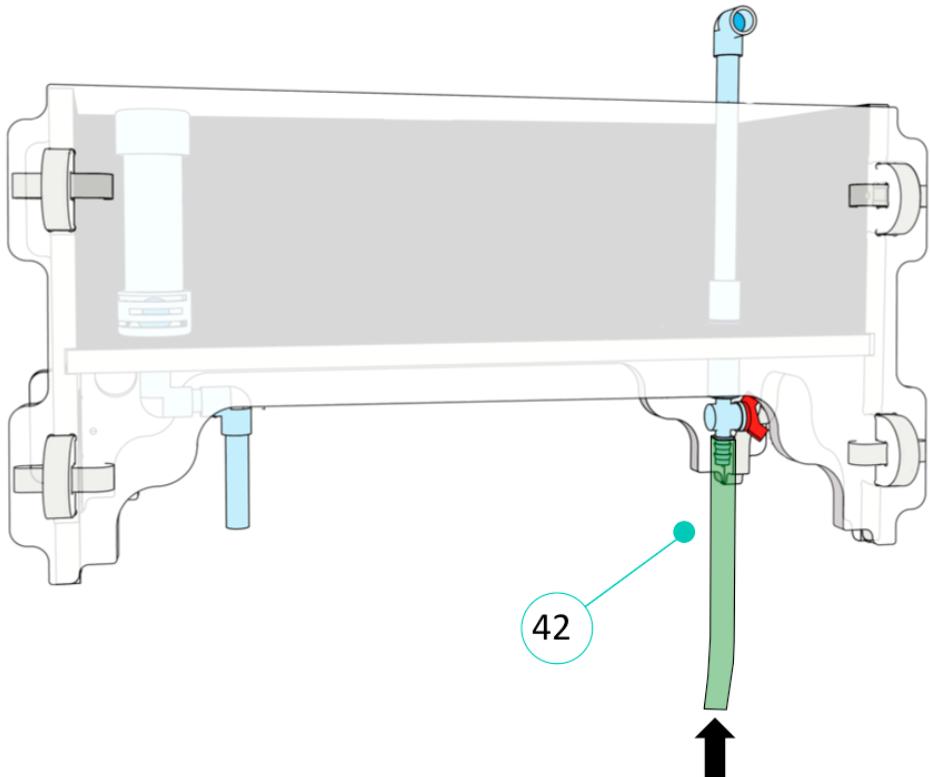
Once it is in place, glue piece n. 33 on top, facing the front of the growbed.

53



For additional leak protection, seal the junction with neutral silicone once it is tight

54



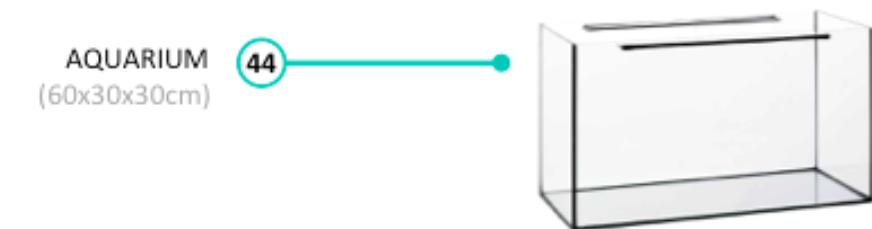
Well done ! the growbed is almost ready. Time to connect the flexible pipe to the valve. Thread it in the lower part of the valve with enough pressure to feel a tight fit.

ASSEMBLY 8: THE AQUARIUM & PUMP

COMPONENTS NEEDED



FOAM MATERIAL
(5mm x60x30cm)



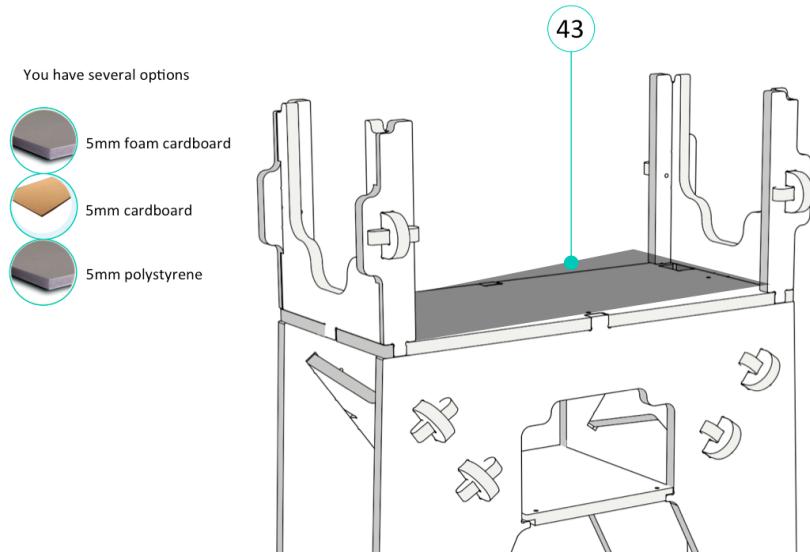
AQUARIUM
(60x30x30cm)



WATER PUMP
(600l/h o 158 US gph)

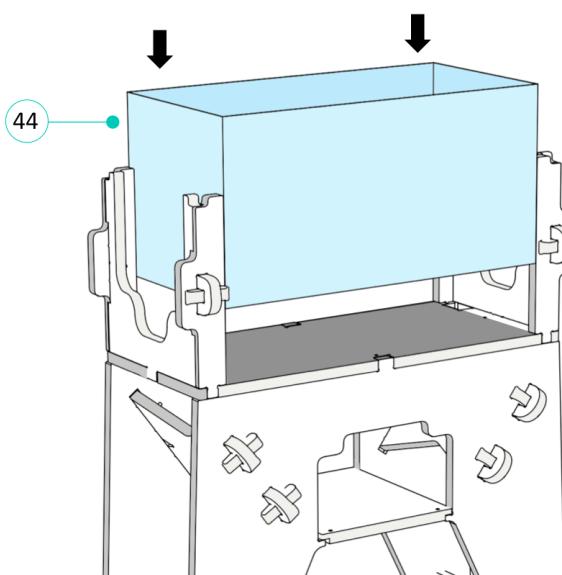
Note: Please note that the aquarium dimensions should be exactly 60x30x30cm, otherwise it will not fit the wooden structure.

55



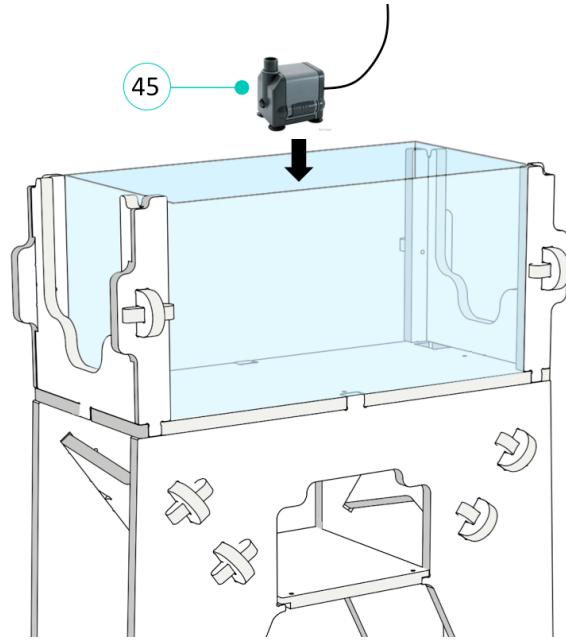
Before you put the aquarium on the stand, it must be perfectly leveled. Use a level tool, either electronic or the good old bubble level. Do not trust your eye. Do not put the aquarium directly on the stand. Remember, your aquarium will likely stay in place for several years, it's better to plan ahead. To absorb any such deformation of the stand, it is suggested to put a layer of 5mm foam material (polystyrene or foam cardboard or even cardboard) under the tank. This will ensure your tank lies completely flat and doesn't risk cracking. Cut a piece of "60 x 30 cm" and place it between the aquarium sides panels to fit the outer perimeter of the aquarium support frame.

56



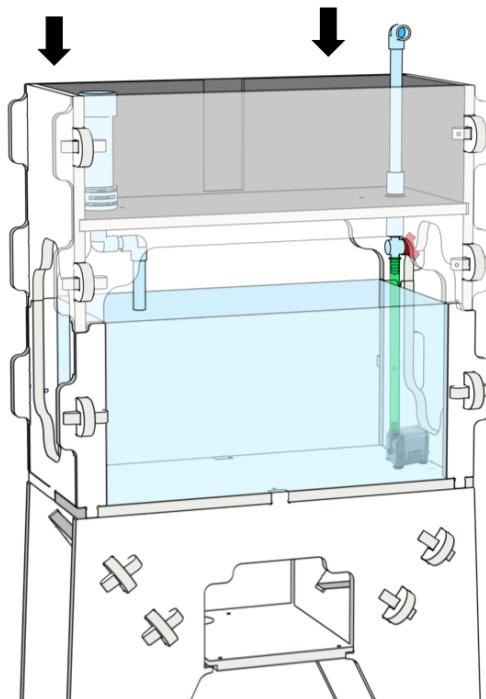
Carefully slide the aquarium between the side pieces and be sure it fits the outer perimeter of the 5mm insulation layer.

57



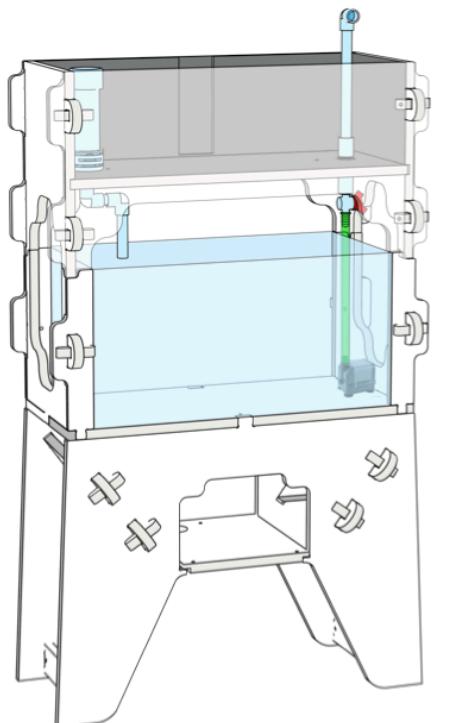
Place the water pump into the aquarium

58



Carefully slide the growbed on top of the aquarium's side panels be sure it fits correctly. Then connect the flexible pipe to the water pump connector.

The entire irrigation system is in place now and you are almost ready to add water in it.



Part II

However, to do that, we will need to work out the electrical system. This information is available in the third part of our documentation manual aka « The nervous system ».



Part III

Thanks to all our ULULE backers that make this project possible



<https://www.ulule.com/aquapioneers/>

Dinis Mendes	Miren Garrido	'Marco Sanalitro	Benny Krimeur	Pascale TEYSSIE
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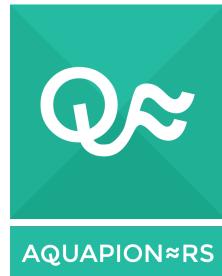
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