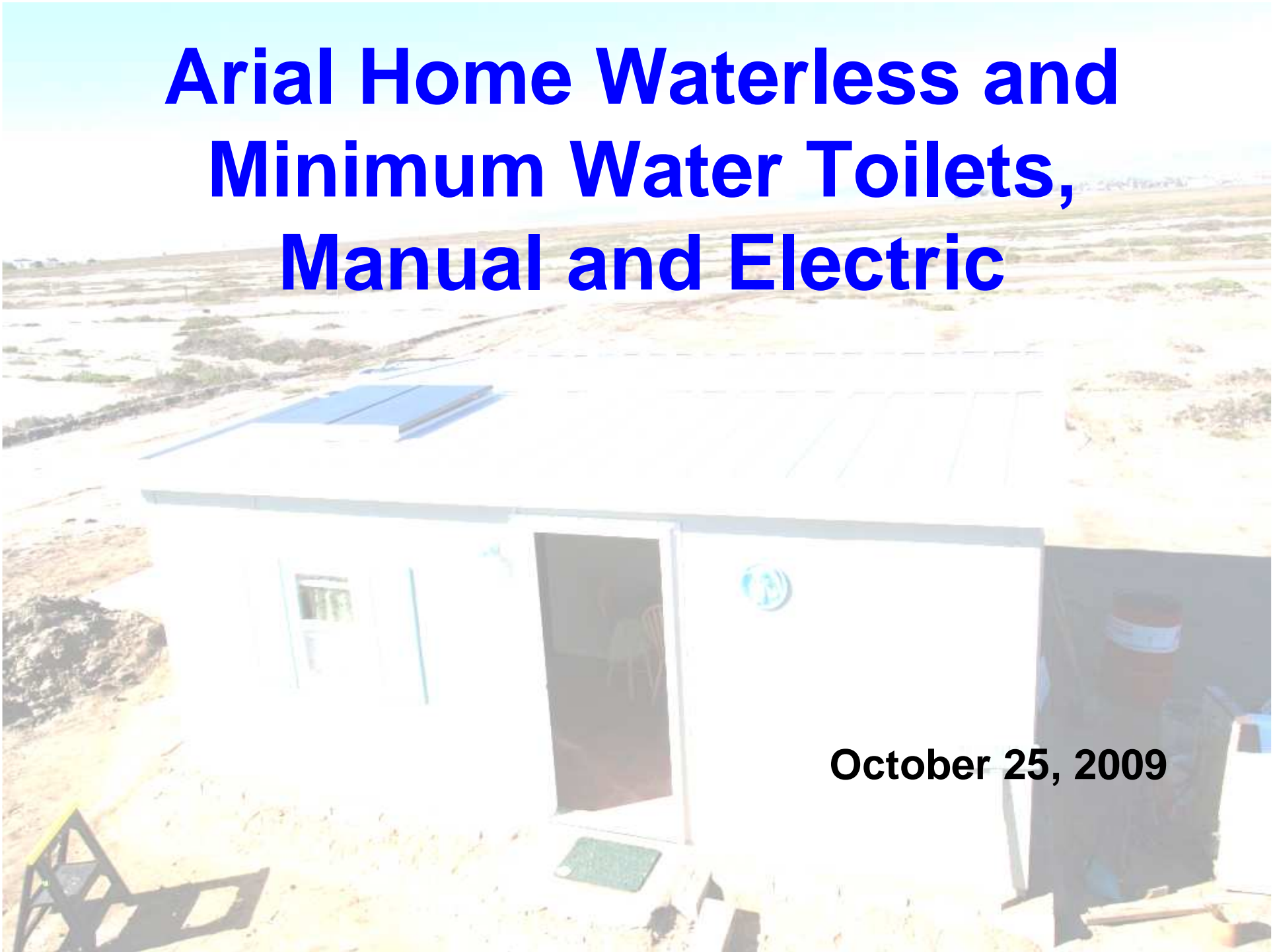


Arial Home Waterless and Minimum Water Toilets, Manual and Electric

October 25, 2009



The Problem

- **Our 300 home Arial Community in Ensenada, with its 1,500 residents, would use 3 million gallons of water per year just to flush toilets**
- **The land is located in a desert with very little water**
- **A water based sewage treatment plant and associated sewer system would cost as much as \$500,000 and annual operating costs could be as much as \$100,000 per year**

The Solution

- **A waterless or a minimum water system that does not allow odors into the house**
- **Two versions will be prototyped, one using electricity and one completely manual using a foot pedal with a spring return**
- **The electric version is easier to build and we have electricity at the Arial Community site so the Arial team will focus on perfecting that design first**

Arial Home Eco-San Waterless Toilet

Vent to height above roof attached to wall panel

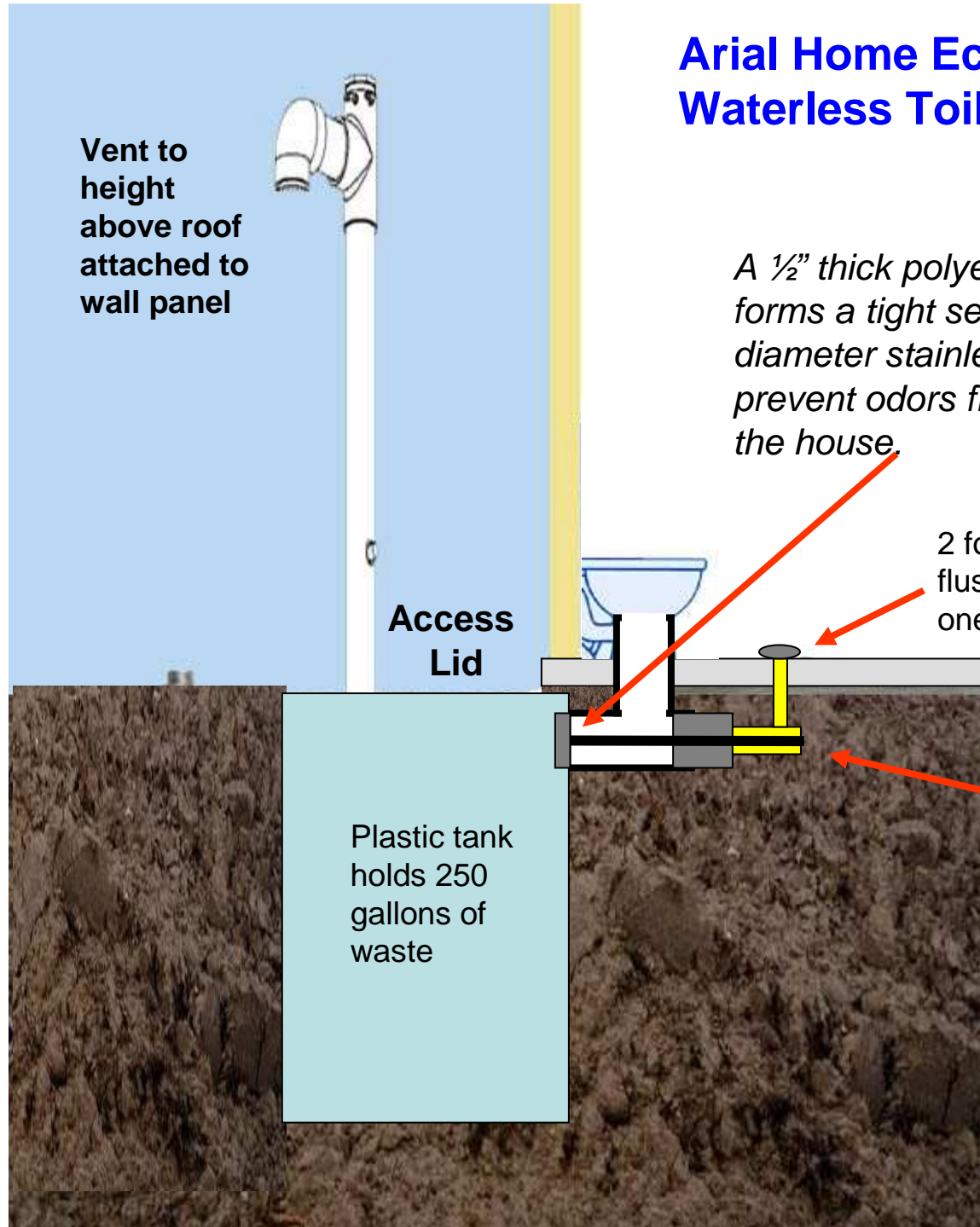
A 1/2" thick polyethylene plate forms a tight seal with the 6" diameter stainless steel pipe to prevent odors from seeping into the house.

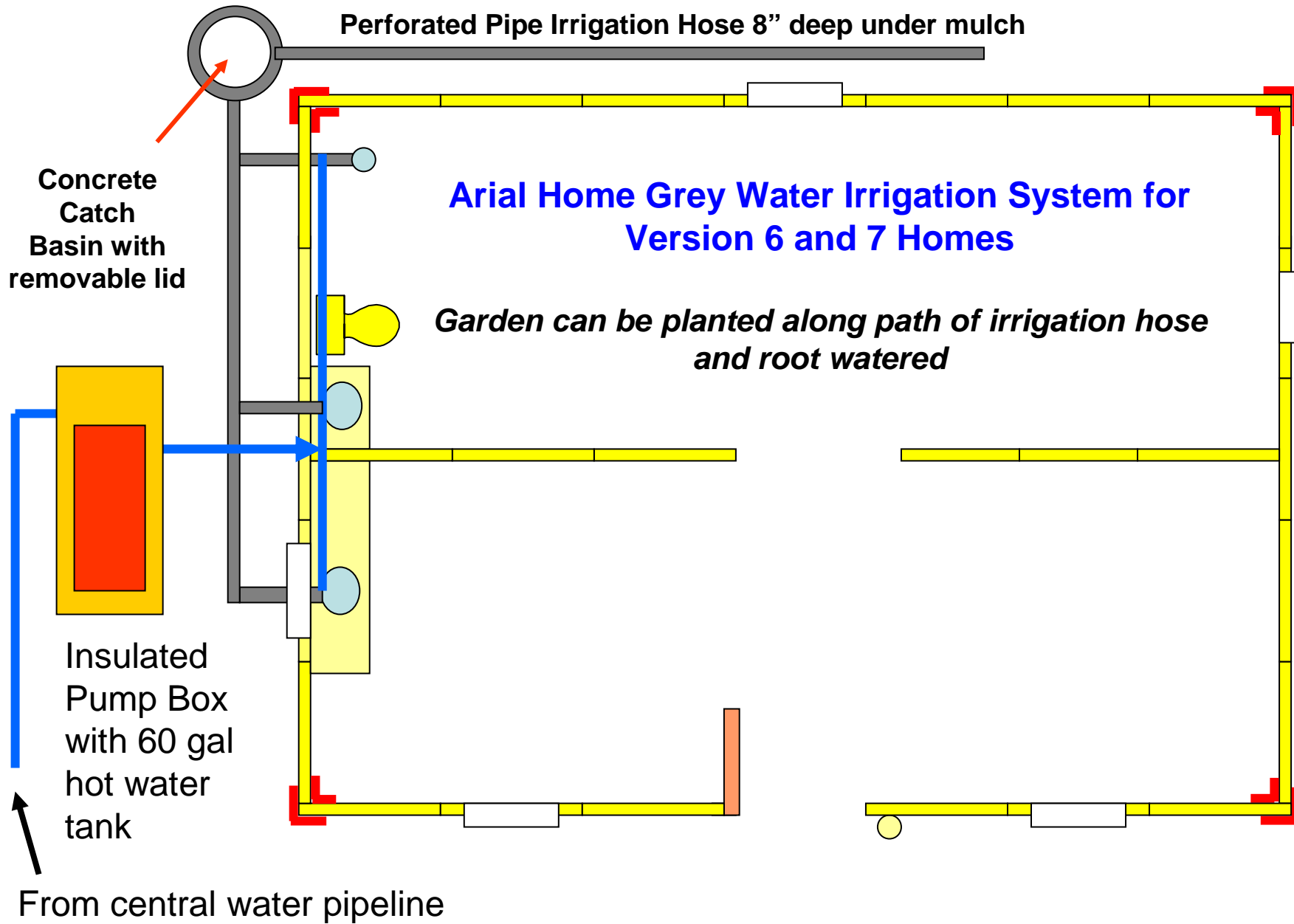
2 foot switches to flush, one for solids, one for liquids

Access Lid

Plastic tank holds 250 gallons of waste

An electric actuator piston moves the waste into the tank while sealing the downpipe from sewer gases.





Buried PVC Pipes, Pump Box and Buried Hot Water Tank

Square Toilet with 6" Round Downpipe

Small AC motor exhaust fan runs continuously to aerate holding tank and evacuate odors from downpipe

Air Vent PVC pipe to BioFilter above roof

Air Flow inlet through bug screen

Exhaust Fan

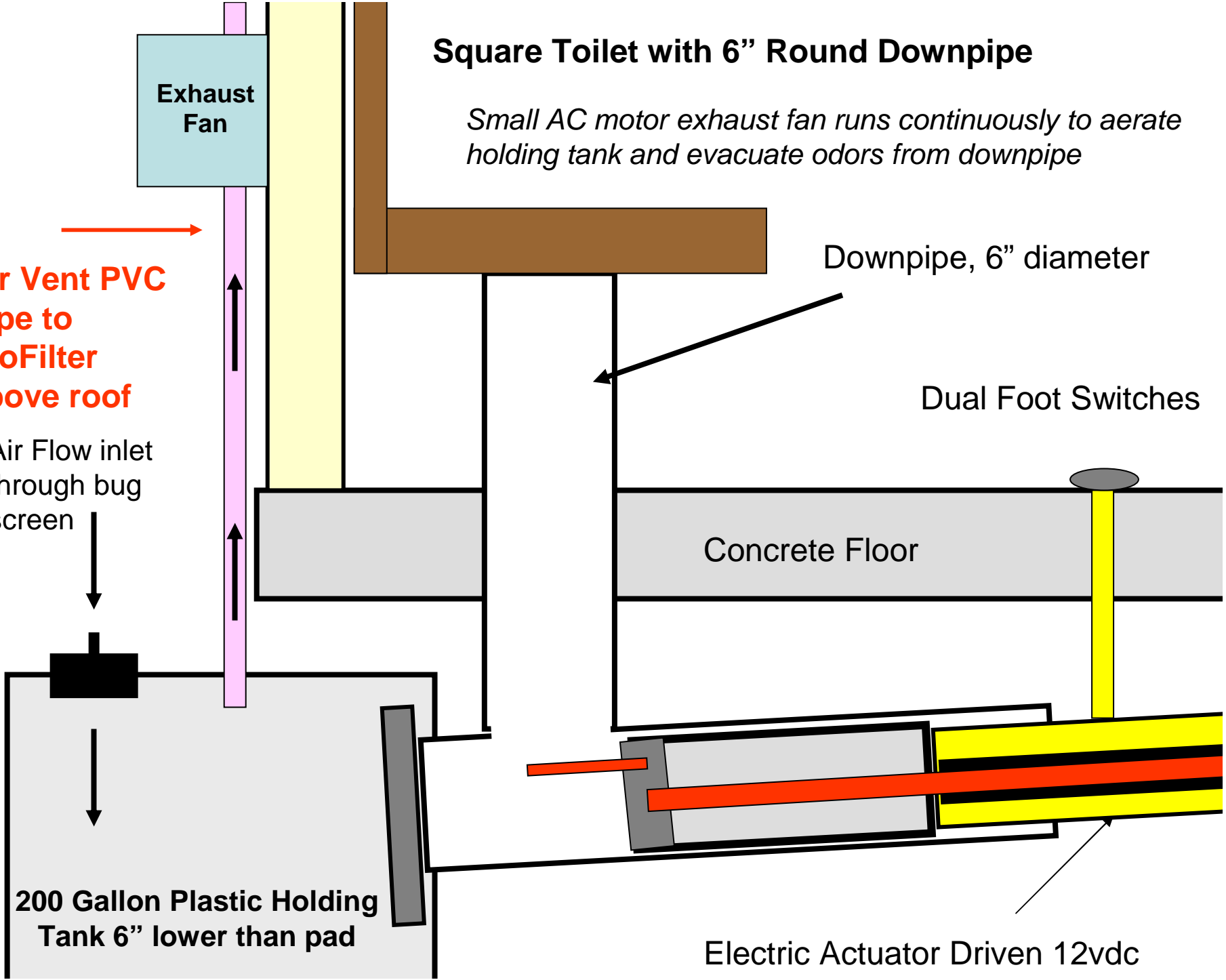
Downpipe, 6" diameter

Dual Foot Switches

Concrete Floor

200 Gallon Plastic Holding Tank 6" lower than pad

Electric Actuator Driven 12vdc



RV Toilet with Custom Downpipe

Small AC motor exhaust fan runs continuously to aerate holding tank and evacuate odors from downpipe

Exhaust Fan

Air Vent PVC pipe to BioFilter above roof

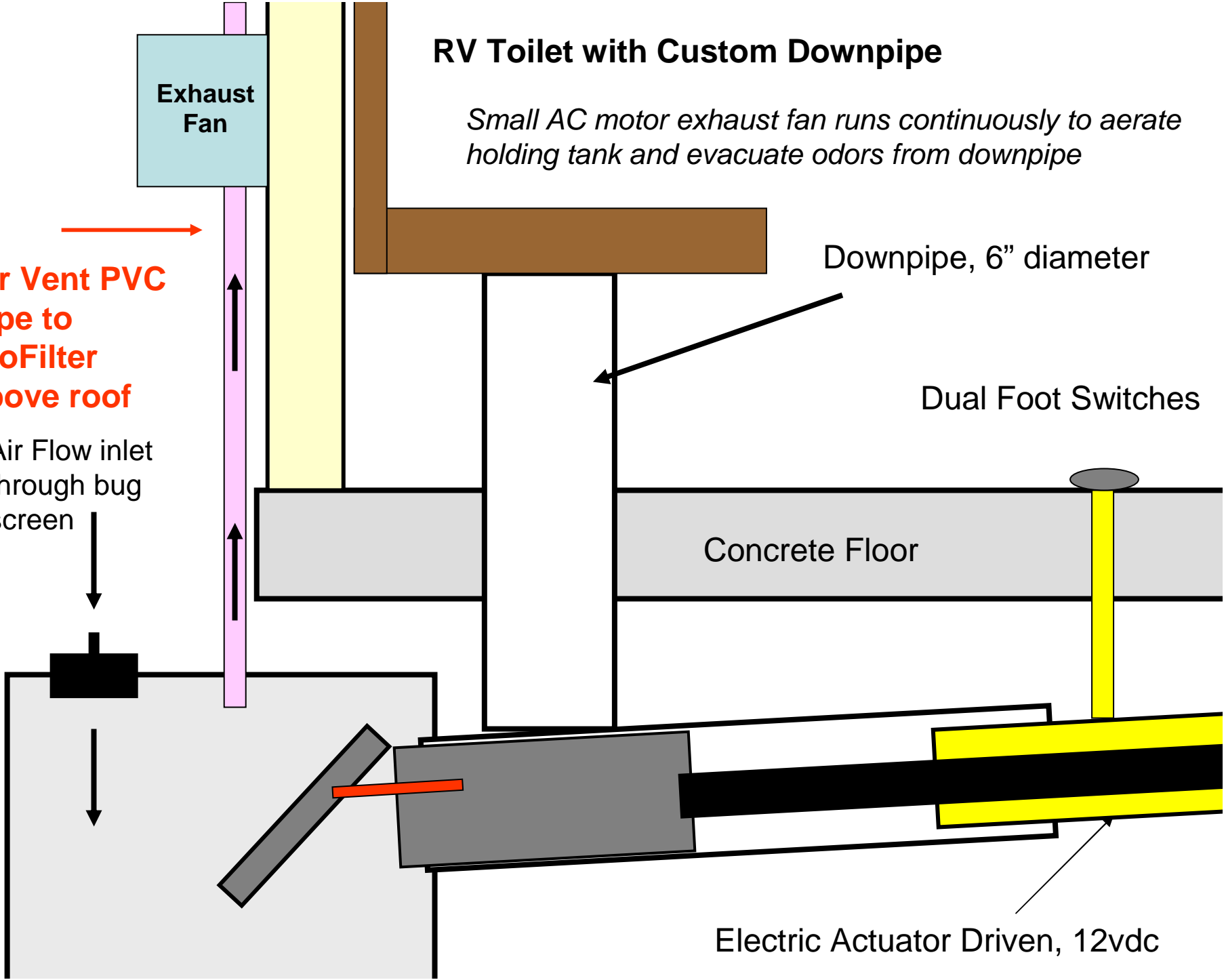
Air Flow inlet through bug screen

Downpipe, 6" diameter

Dual Foot Switches

Concrete Floor

Electric Actuator Driven, 12vdc



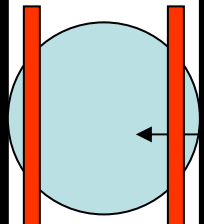
**Top View of Piston Mechanism
In "Ready" Position**

Hinged polyethylene seal plate, 9" square pressing against a rubber gasket on the end of the pipe

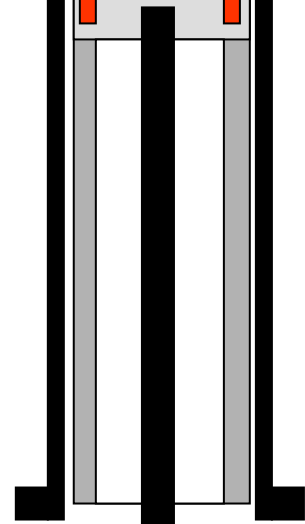


Outer wall of the plastic tank

Stainless Steel downpipe from toilet, 6" in Diameter welded to Horizontal SS Pipe, 6" in Diameter



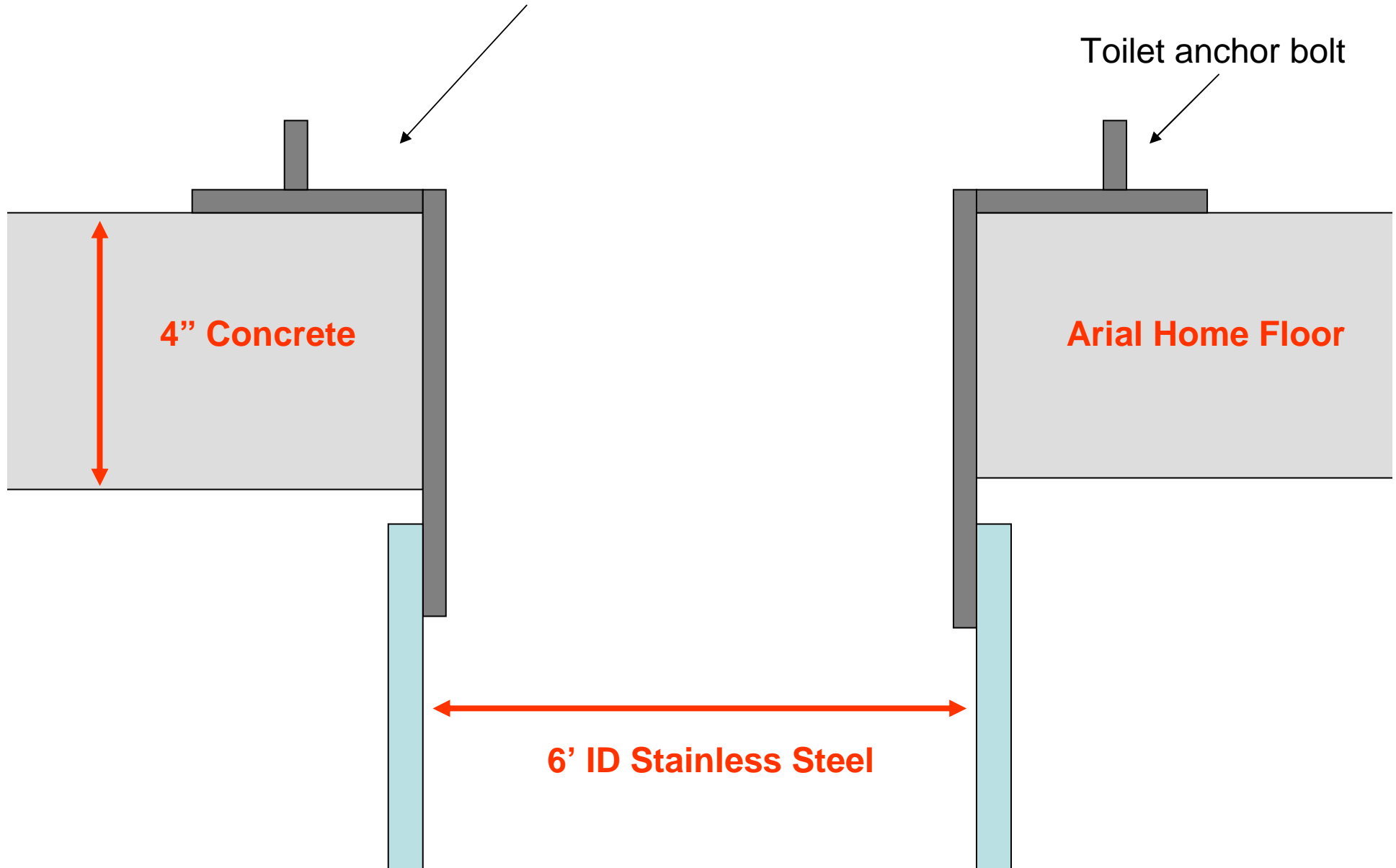
Plastic "Piston", Hollow Inside, with O Rings and Teflon Glides, 18" long



Shaft of mechanism from actuator that will move forward 18" then back



Ground movement slip sleeve for anchoring toilet



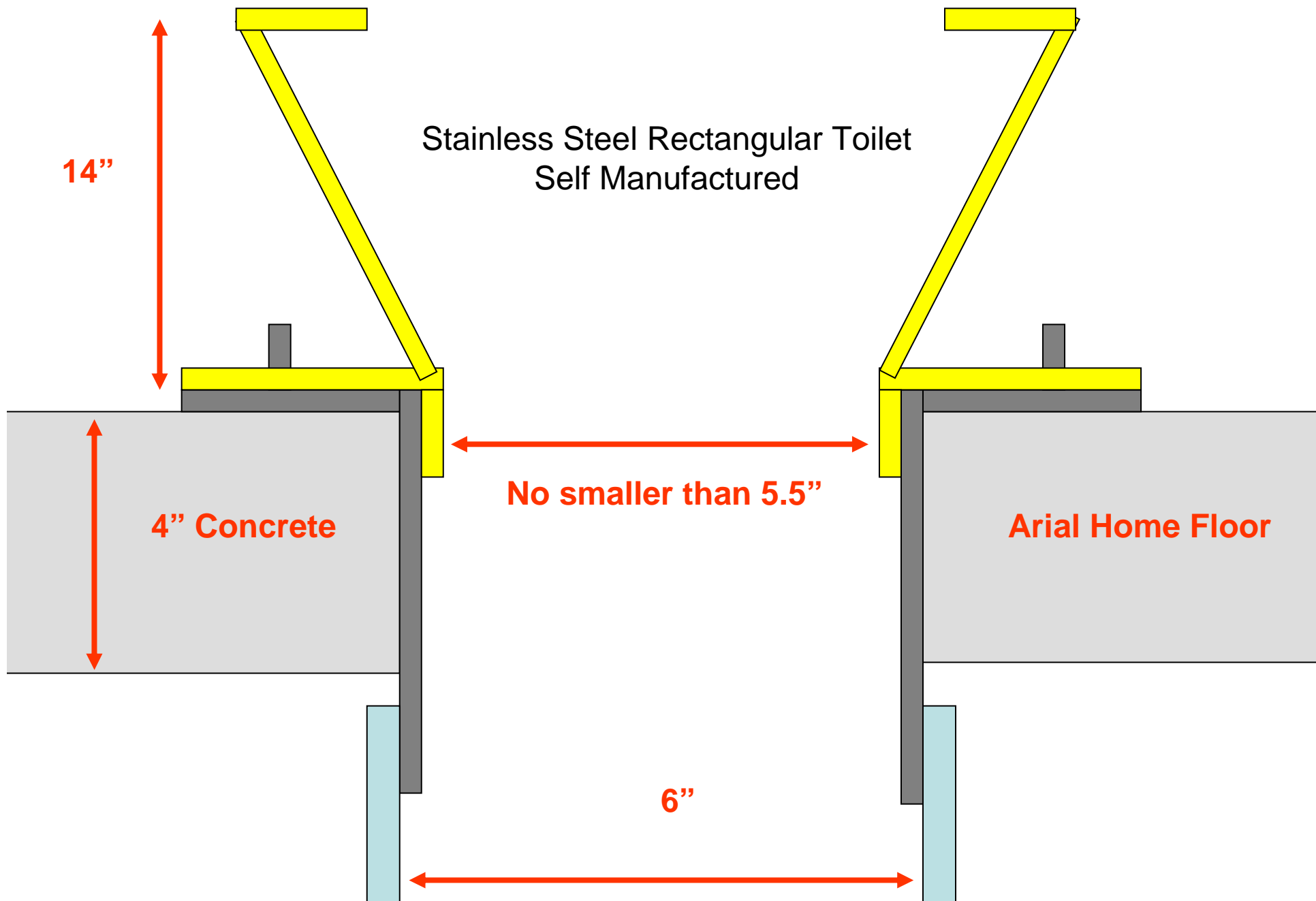
Square Toilet Design





Stainless Steel Toilet

The plan is to use a custom welded stainless steel toilet as the top part of the Arial Home toilet, modified so that it does not need to use water.



14"

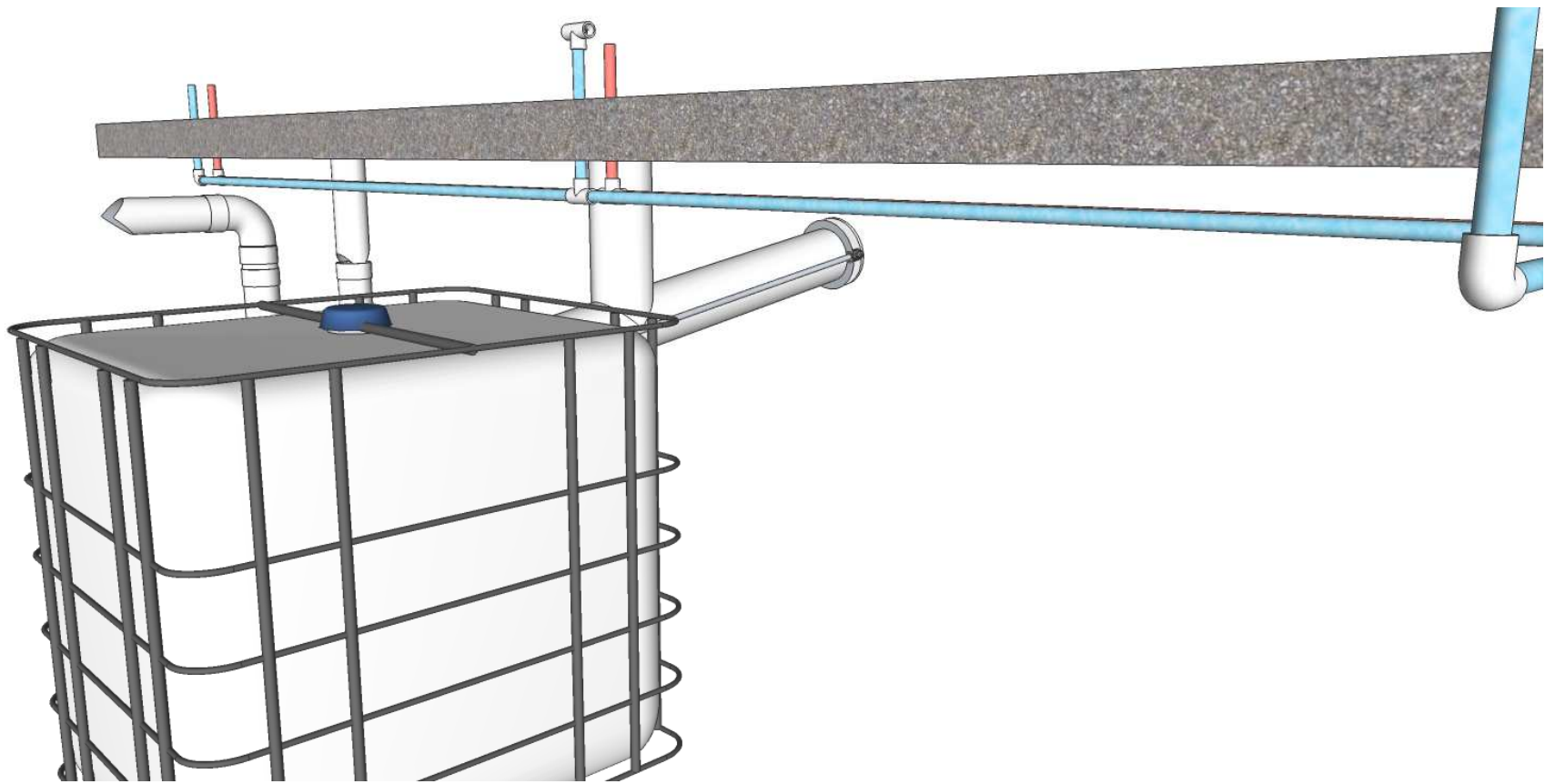
Stainless Steel Rectangular Toilet
Self Manufactured

4" Concrete

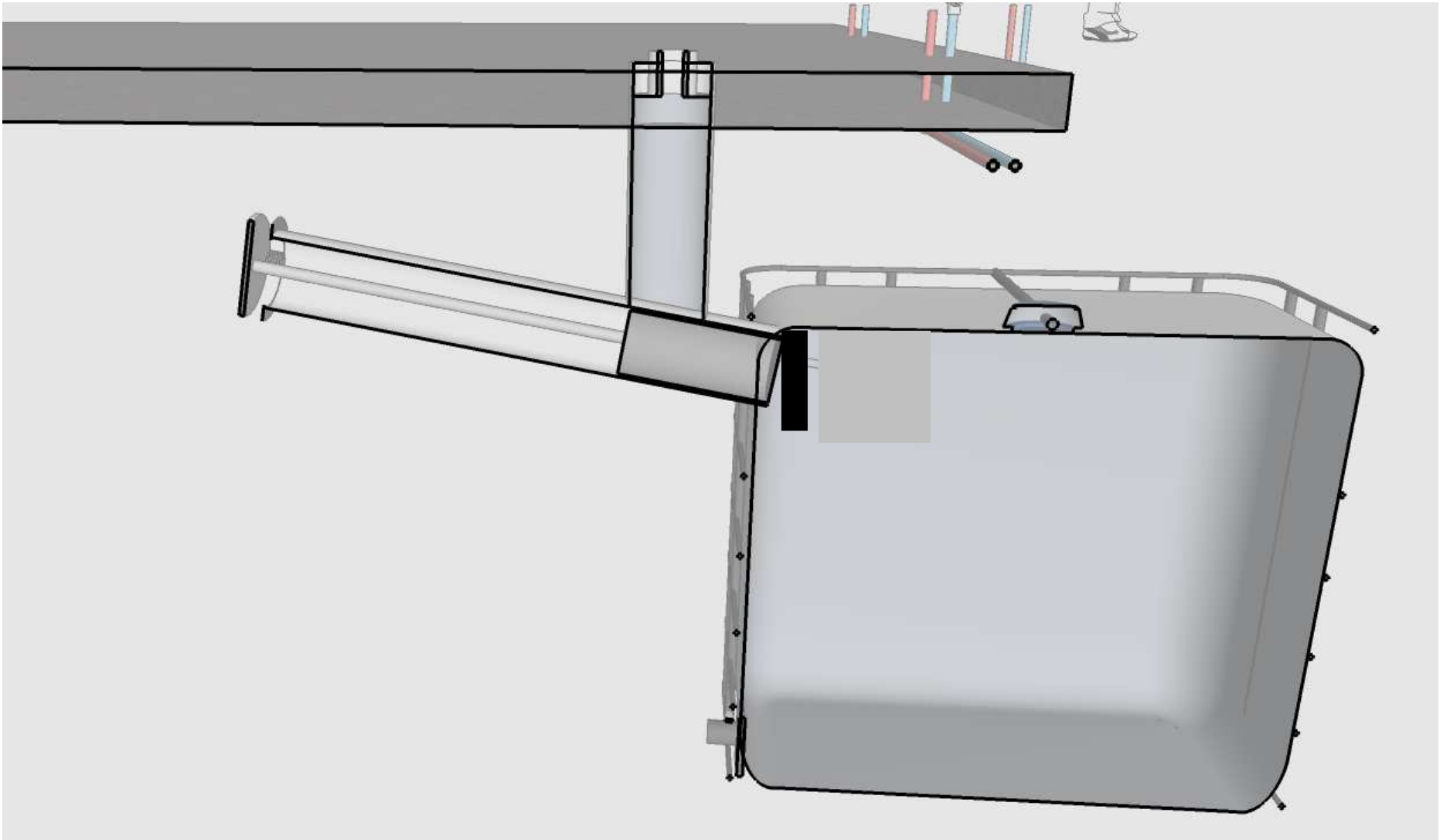
No smaller than 5.5"

Arial Home Floor

6"



Hinged cover keeps odors from house



A \$99 Odor Control Filter from Focus Industries will be used on the air vent exhaust above the roof of the Ariel Home

If you answered yes to any of these questions then we've got the answer for you.

The Wolverine Brand™ Family of Odor Control Products.

The Wolverine Brand™ Family of Odor Control Products will solve your odor problems

The Wolverine Brand™ Family of Odor Control Products are various types of air filtration Biofilters that install on plumbing vents or inside manhole openings to absorb noxious odors in any residential, industrial or commercial application. Each contains a specially formulated, catalytic, activated carbon called Sulfursorb that is specifically designed for the desulphurisation and removal of acidic contaminants such as Hydrogen Sulfide.

Also known as H₂S, it is the main source of sewer and septic gas odors. While catalytic carbon costs more than standard activated carbons, the end result is that its adsorptive capacity is greatly enhanced. This translates into better septic and sewer odor removal.



Arial Waterless Toilet Features for Electric, Micro-Controller Version

- **Floor switch button causes “flush” by closing a relay that causes the electric actuator to extend. The Arduino micro-controller times the forward and backward movements**
- **Continuous air flow causes urine to evaporate and solid waste to decompose and dry out**
- **Polyethylene plate keeps sewer gas from entering house. The piston blocks the down pipe when the plate is pushed back from the end of the horizontal pipe**
- **Tanks and pipes are buried before concrete floor pad is poured**
- **An access door on the floor in front of the toilet will enable periodic maintenance**
- **An electric water valve will send a spray of pressurized water down the sides of the downpipe and at the piston face for a few seconds to clean any sticky residue for the non-liquid flushes**

Micro-Controller Functions

Note: We already use an Arduino micro-controller for our solar hot water heating systems, so we know how to program it for the following sequence of actions:

- When the foot pedal is pressed, the Arduino sets the Air Exhaust Fan to “High” for 30 seconds
- A 12 vdc relay is closed for “x” seconds to enable the Linear Actuator to move the 14” piston forward a distance of 18”
- The pushrods do not engage until the piston has fully covered the down pipe to prevent sewer gases from entering the toilet when the polyethylene pipe cover is pushed forward
- At the end of the forward cycle, the Arduino closes a relay for “x” seconds to cause the return movement
- At the end of the reverse cycle, the Arduino opens an electric valve which sends a 3 second, pressurized burst of water against the down pipe walls and directly against the piston face
- The Arduino then initiates a second flush cycle to dump the water and slurry into the holding tank

Waterless Toilet Notes

- **The window over the toilet will be the best odor control of all**
- **The toilets will be mass produced in Arial Home factories**
- **The access cover to the holding tank will be 24” in diameter so we can get inside the new tank to install the hinged pipe cover**

Waterless Toilet Notes

- We will test with various quantities of water first
- Then we will test with peanut butter, mashed potatoes, brownie mix
- Next we will test with dog poop
- Finally, we will test with human activity