2014 Lagoon Design Challenge

Design Submittals

Classes Represented:

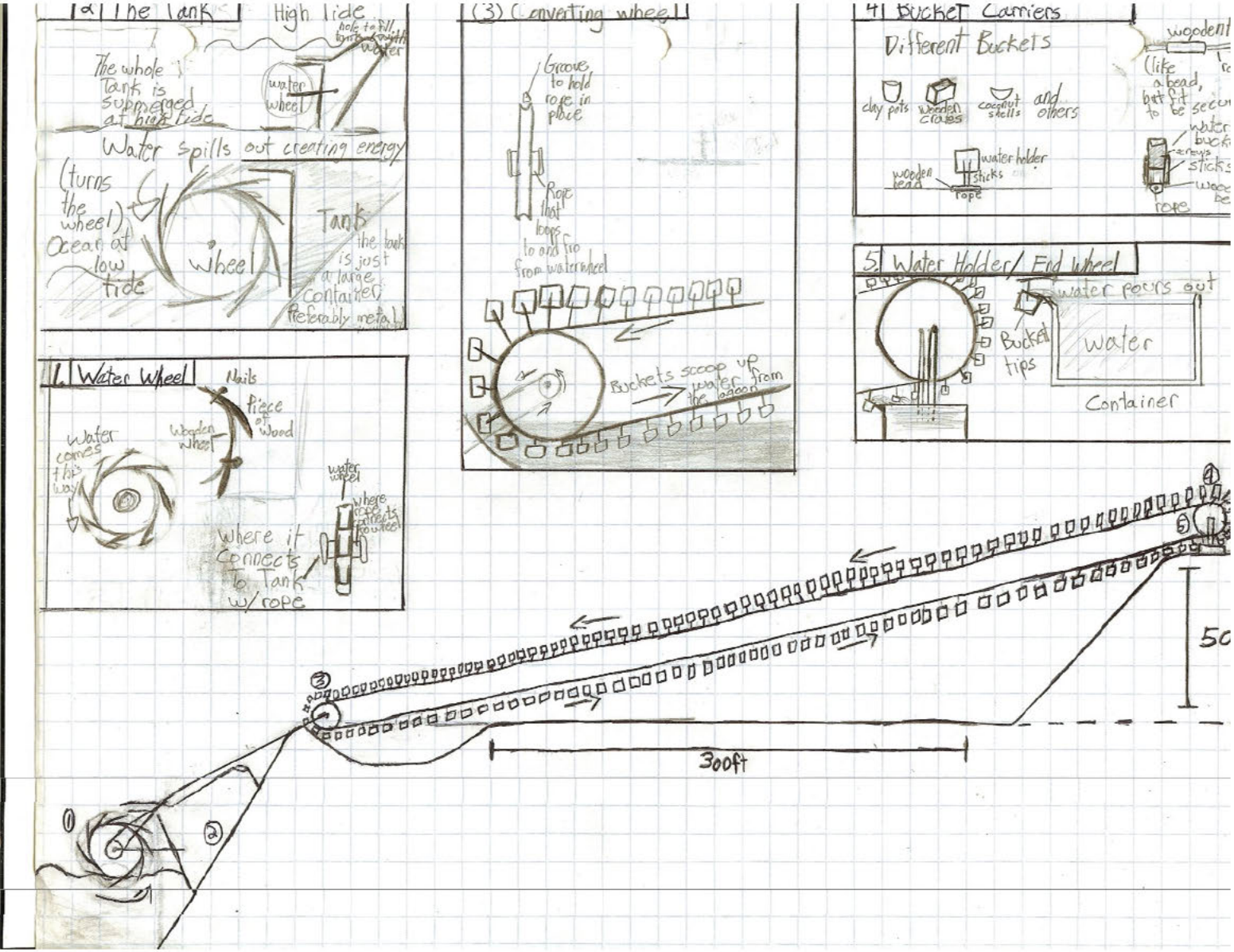
- Principles of Engineering
- Civil Engineering & Architecture

Instructor: K. Johanson

Lagoon Design Challenge

Design Statement:
“Design a mechanism to transport water from a Lagoon to a storage tank next to your Hut”

Note: The designs depicted herein are shown in the order they were submitted. They are not rated or ‘ranked’ in any other order.



Design 1: Bucket conveyor system with unique ocean tidal-power drive unit, bucket clamping mechanisms with 4 optional bucket configurations, and special tipping device

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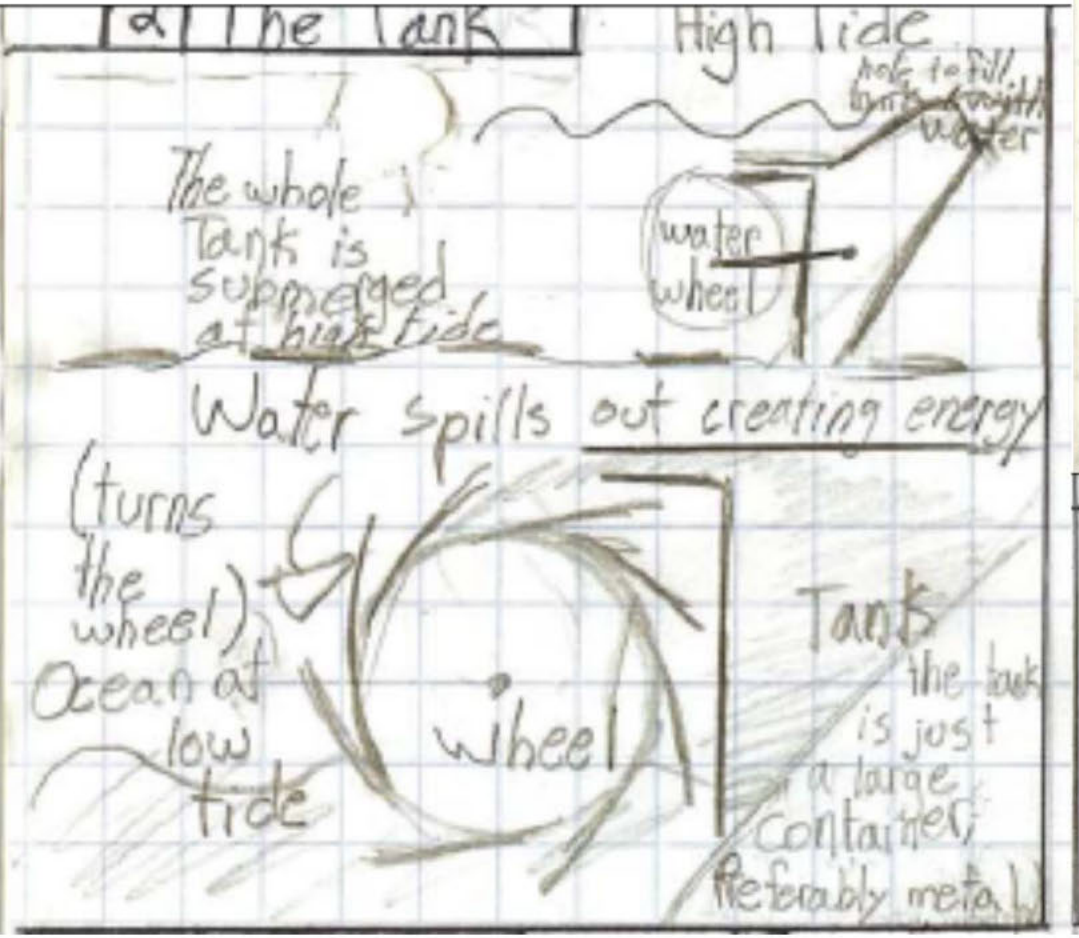
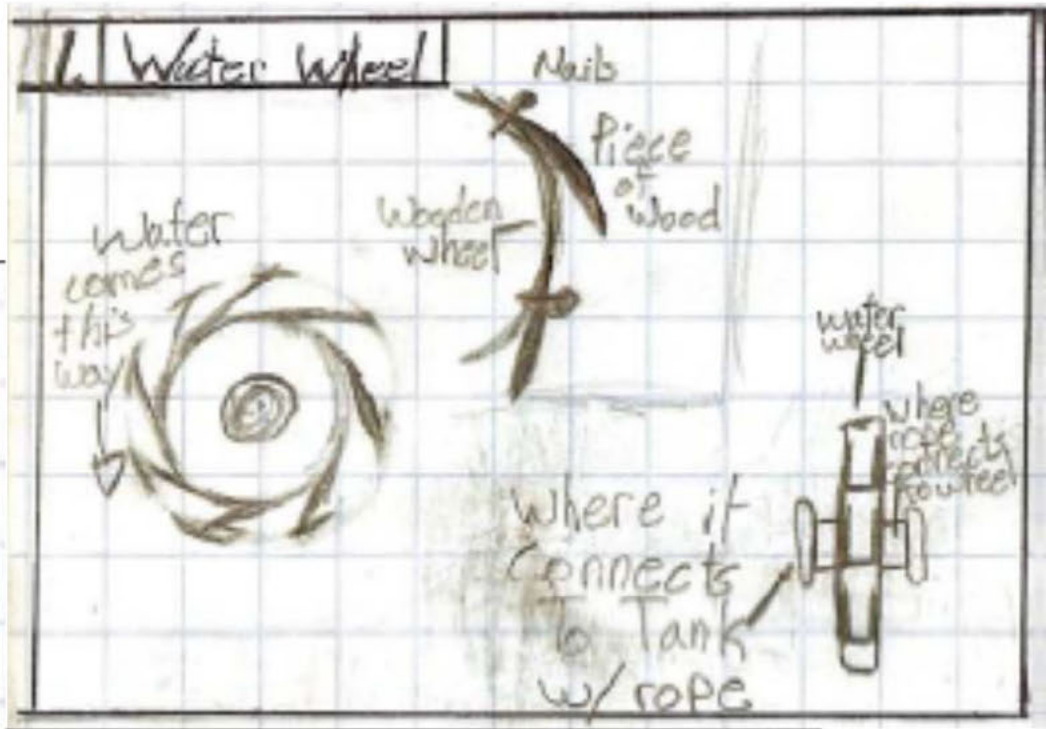
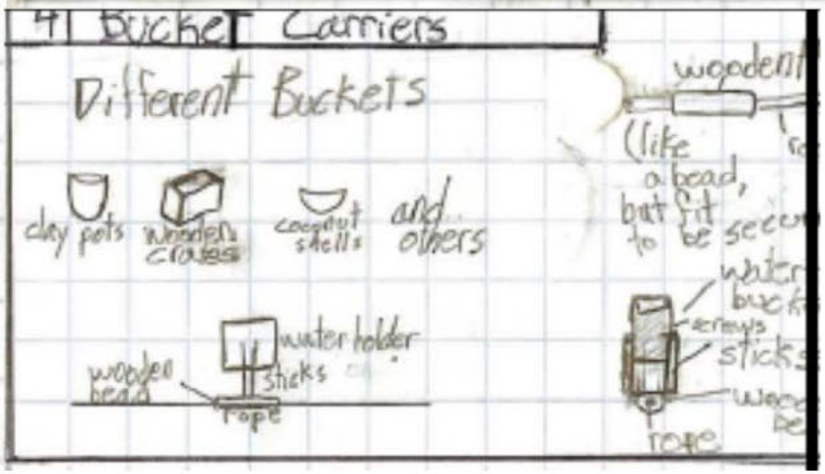
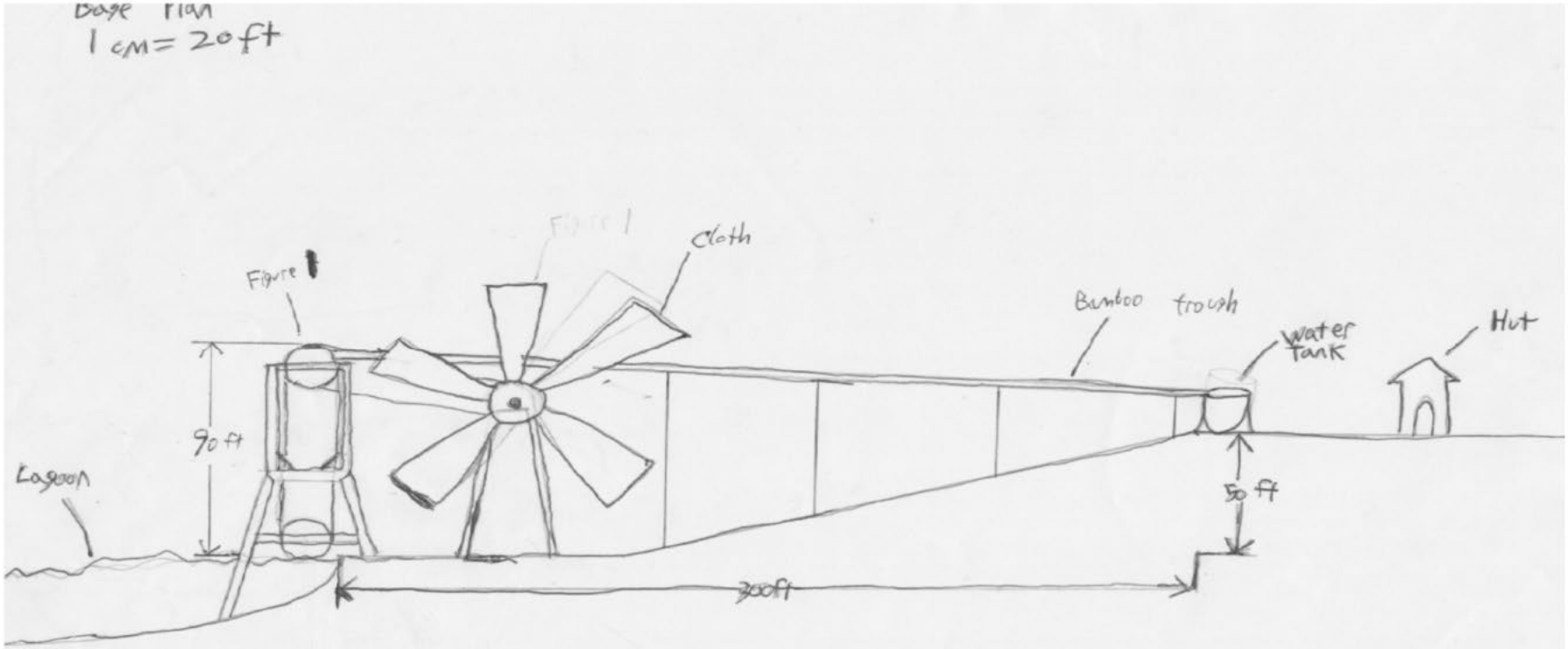
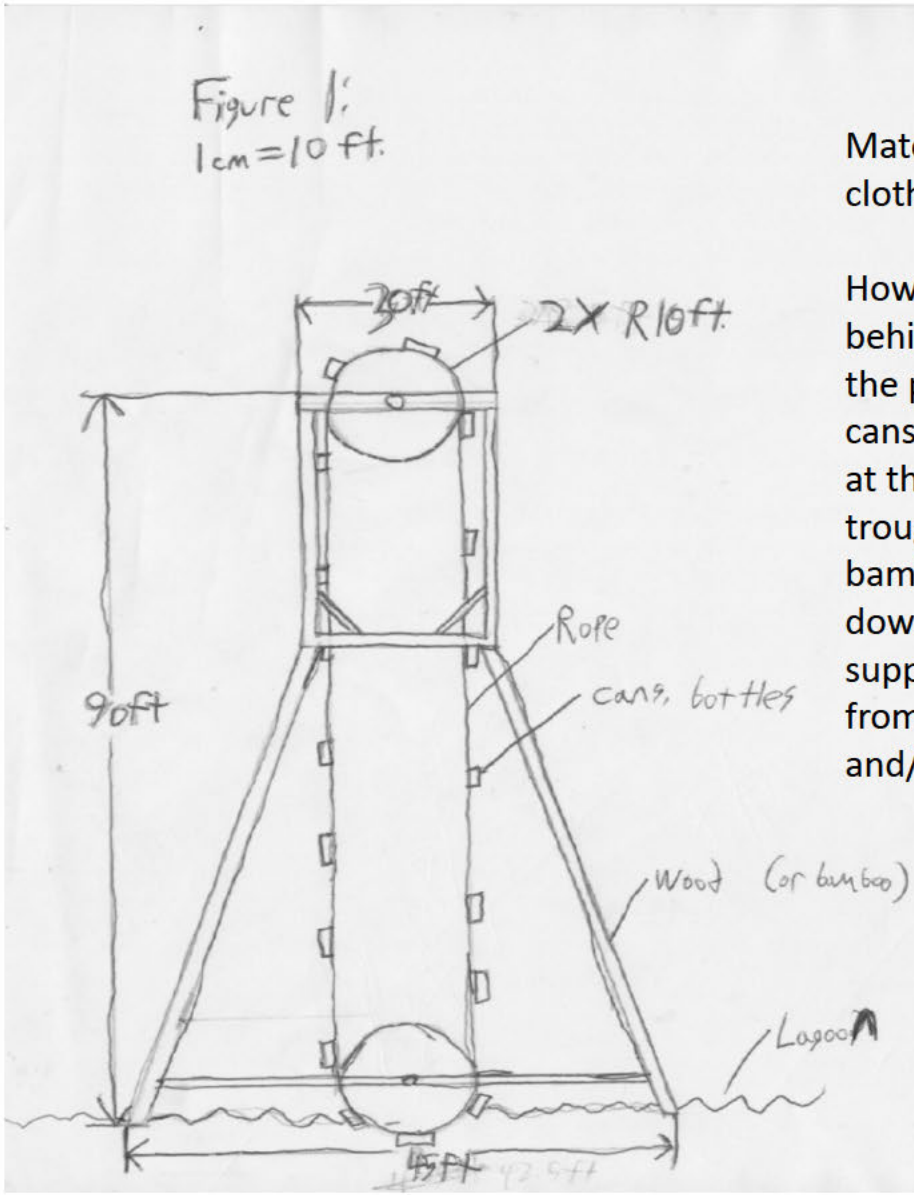








Design 2: Vertical lift pump with partially-submerged intake structure, and gravity fed 2nd stage 90-ft high trestle-supported trough/channel



Materials required: Bamboo, rope/vines, cans, bottles, cloth/fabric, 3 wooden wheels.

How it will work: The windmill will turn a wheel just behind the sails that is attached to a rope. This will turn the pulley system in Figure 1, making the bottles and cans go around in a constant cycle, filling up with water at the base and pouring the water into the bamboo trough at the top and then repeating the process. The bamboo trough is at an angle so the water will flow down until it empties into the water tank. The trough is supported by bamboo poles along the way to keep it from falling. All the parts are held together by rope and/or vines tied together at the connection points.

Design 2: Vertical lift pump with partially-submerged intake structure, and gravity fed 2nd stage 90-ft high trestle-supported trough/channel

Design 3: Wind powered bucket conveyor system w/special tipping mechanism at point-of-delivery

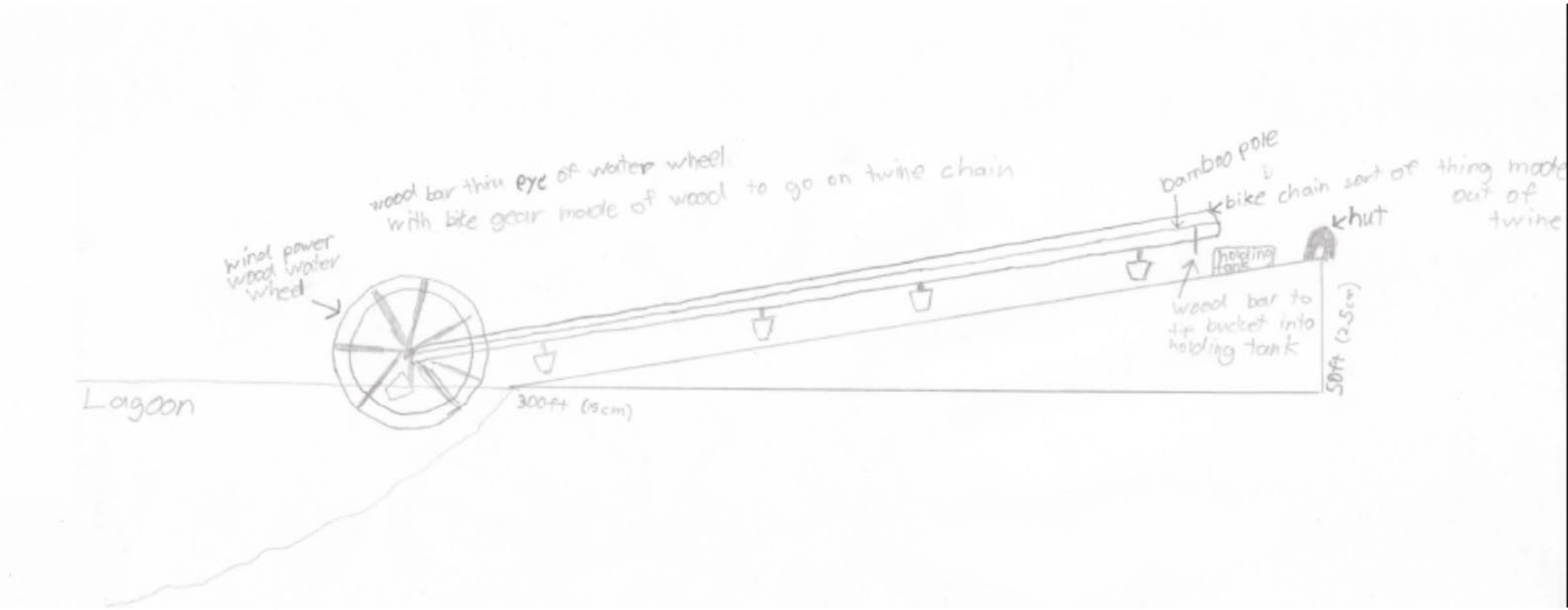
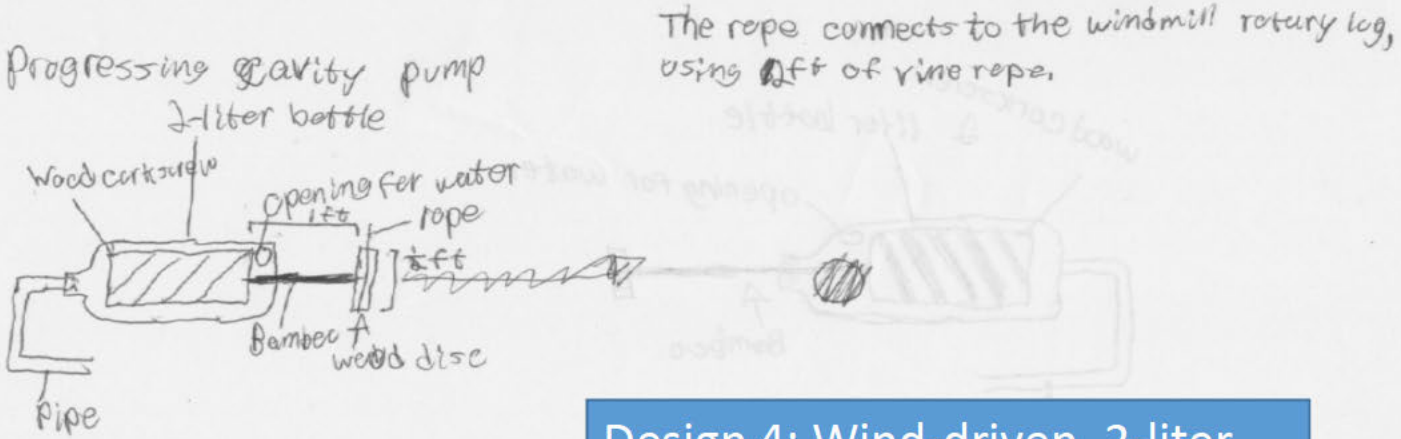
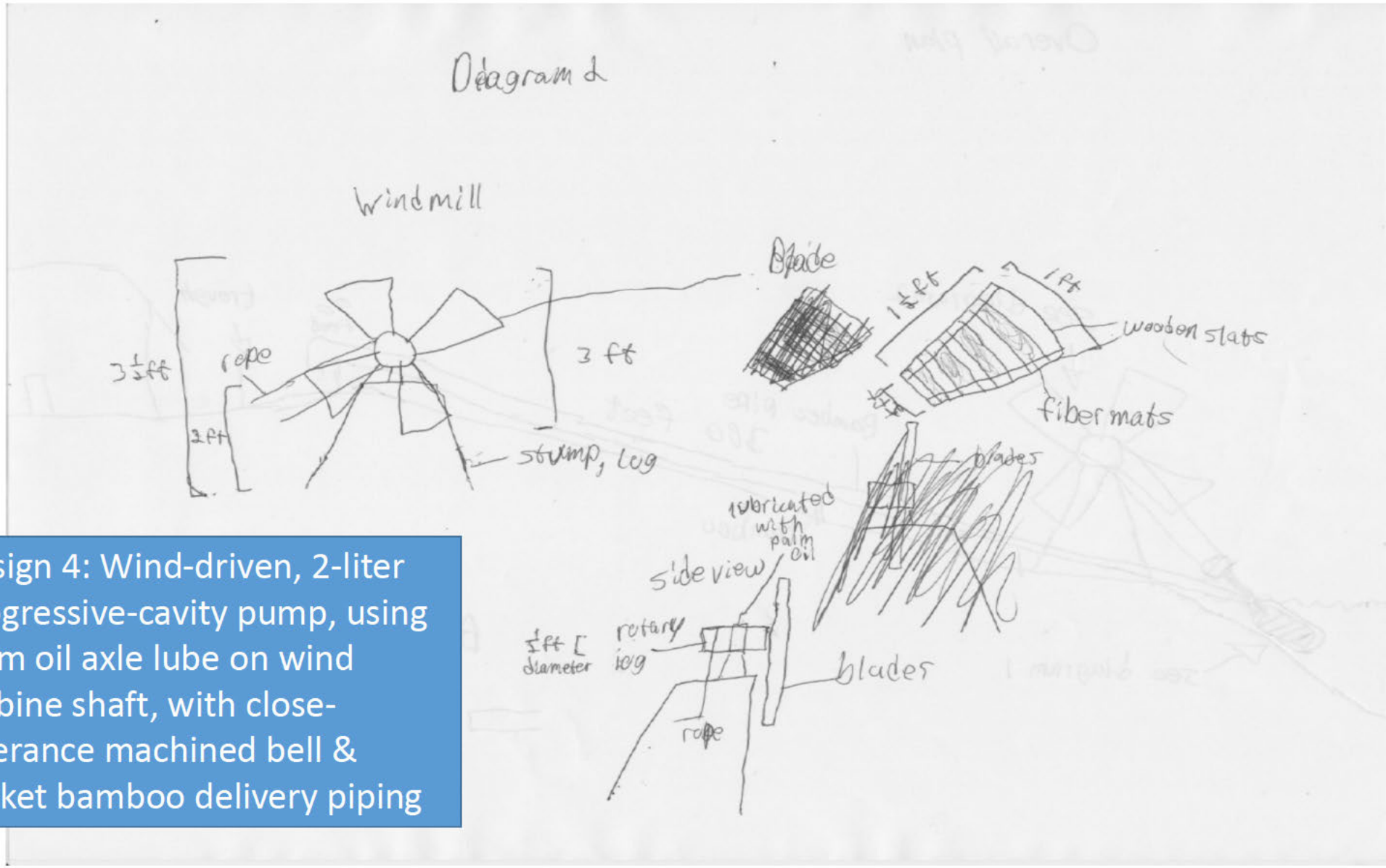


Diagram 1



Design 4: Wind-driven, 2-liter progressive-cavity pump, using palm oil axle lube on wind turbine shaft, with close-tolerance machined bell & socket bamboo delivery piping



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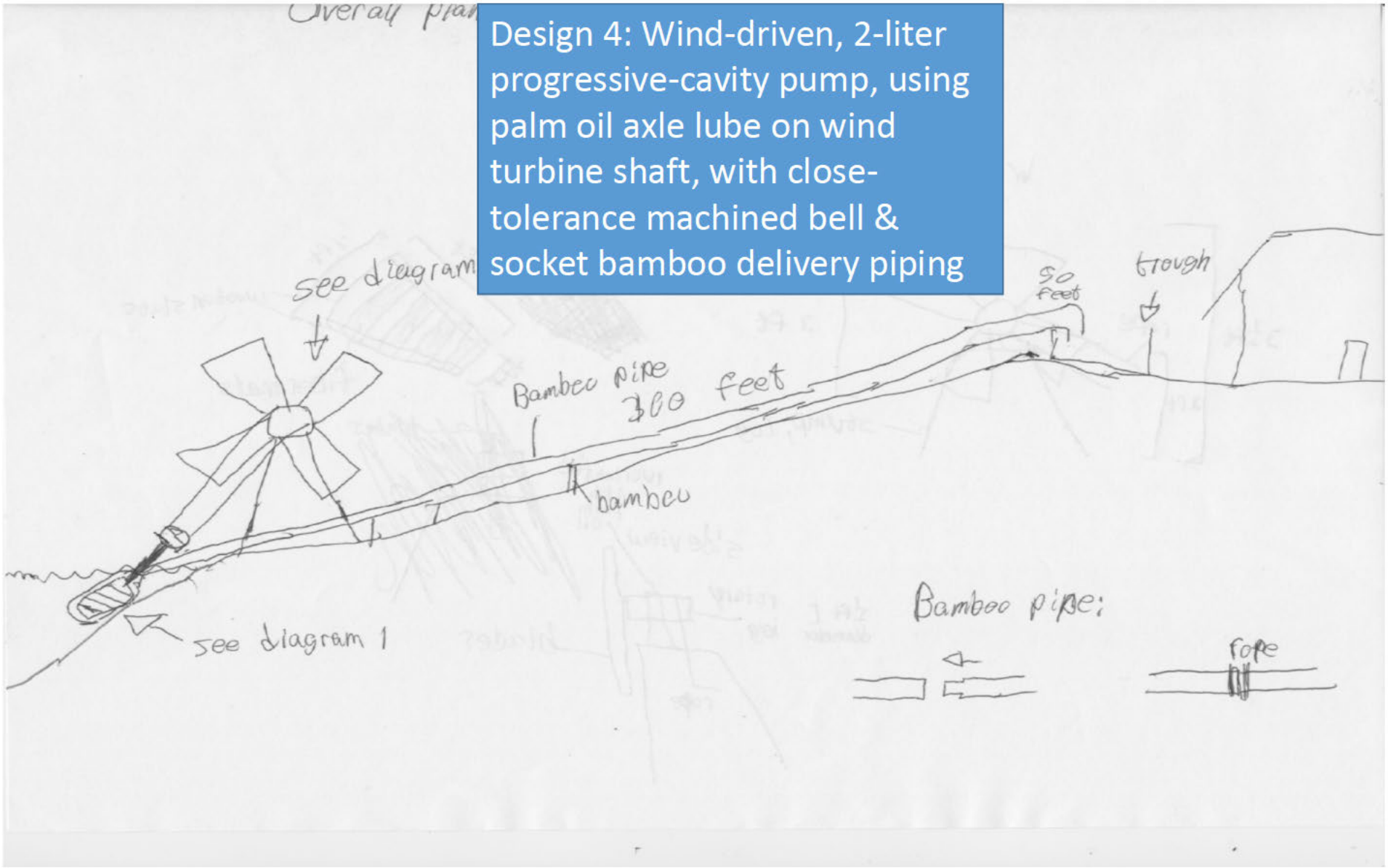
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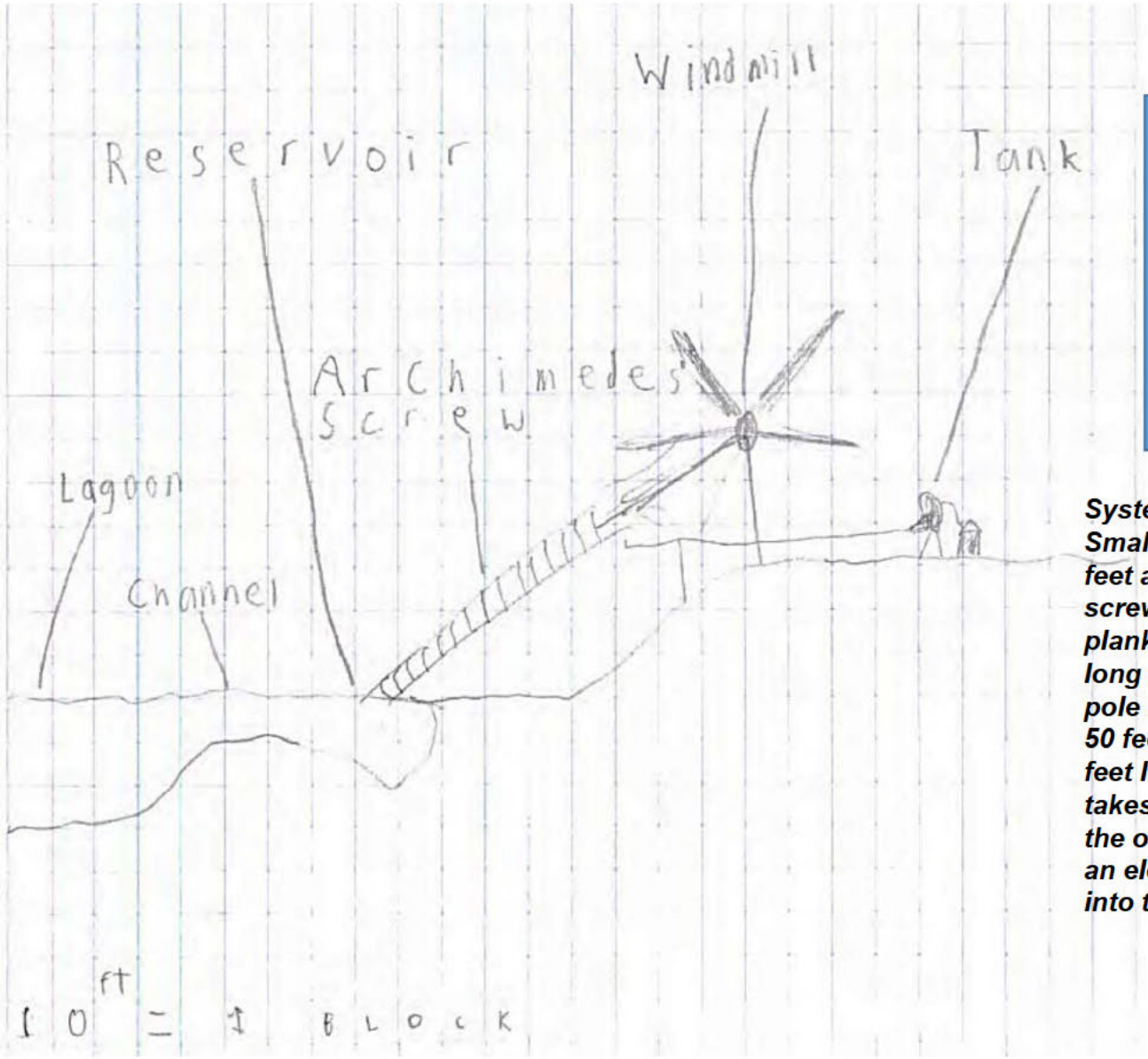
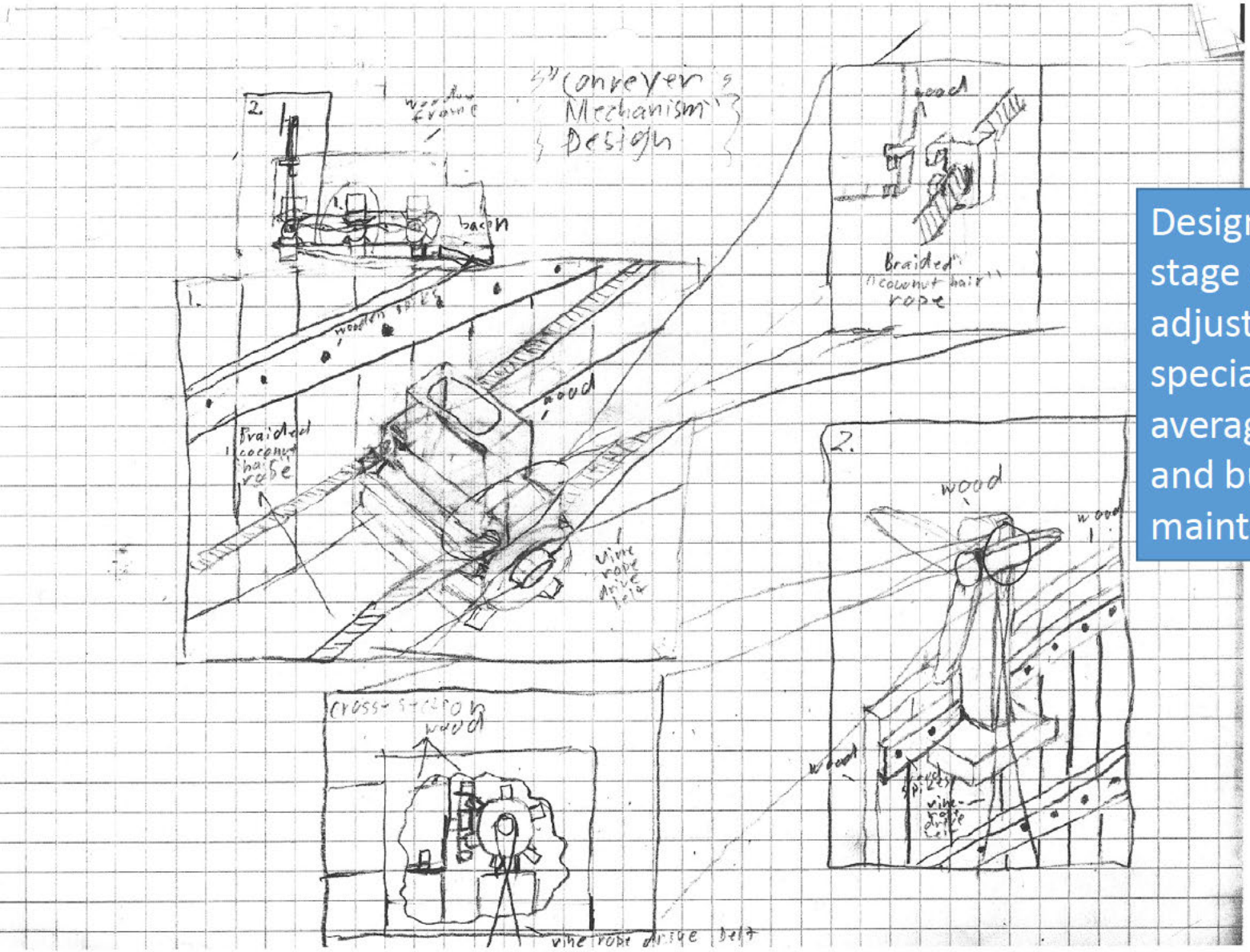
See diagram
Bambeo pipe
300 feet
50 feet
Trough
bambeo
see diagram 1
Bamboo pipe:
rope



Design 5: Wind-driven, 60-ft 45 degree Archimedes screw pump with channel intake scheme, using gravity fed 2nd-stage piping and 15' elevated water storage tank

System Description

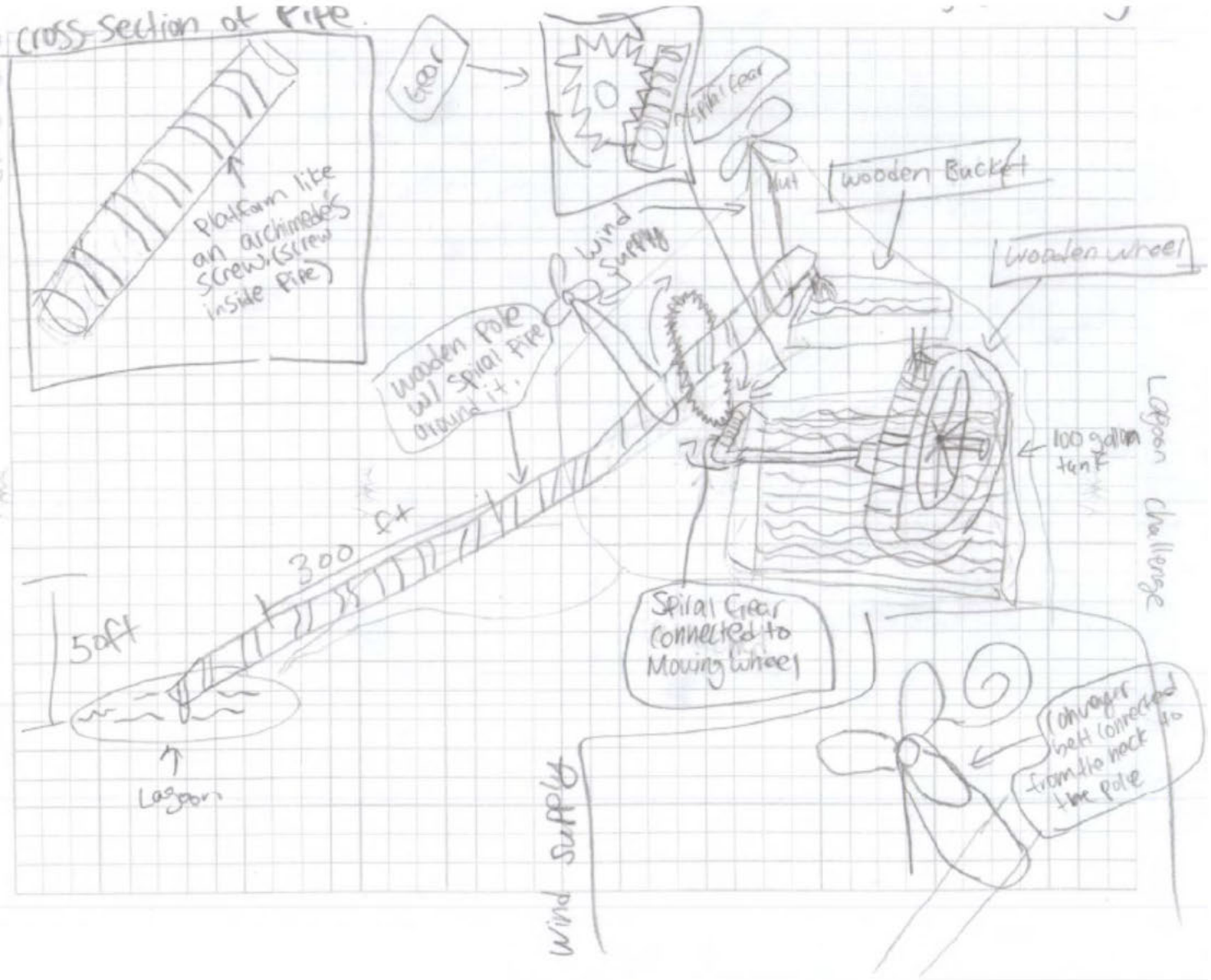
Small channel brings water to a reservoir roughly 200 feet away from the water tank. An Archimedes' screw powered by a windmill made from wooden planks and two small gears that is roughly 60 feet long and crafted from wood strips and a long bamboo pole brings water up a 45 degree slope that is 50 feet tall. A bamboo pole split in half and about 45 feet long underneath the Archimedes' screw takes the water to the water tank that is 300 feet from the original lagoon. The water tank is also at an elevation of about 15 feet to provide gravity flow into the hut next to the tank.



Design 6: Wind-driven, 10-stage conveyor lift system with adjustable torque-drive, special forward-slanting belts, average 9.1-degree incline, and built-in ease-of-maintenance features.

My method of transporting water the distance stated in the assignment (300 feet horizontally, and 50 feet up) is using a series of conveyer belt mechanisms, and ending with an Archimedes screw "water elevator" to lift the water from the underground storage to inside the hut. As illustrated on page 2 of my submission, a series of ten "modules" will be sufficient to cover the 300-foot distance to the hut. As illustrated on page 3, each of the modules consists of an individual power source, (a windmill) a "conveyer belt" that has six wooden "tree-sap lacquered" containers, rollers to move the conveyer belt, and a small basin on the rear end that the containers empty into. Most of the components are crafted from wood; with the exceptions being the vine rope drive belts, and the "coconut hair" ropes. Designing a system with separate modules appealed to me for several reasons, one being the fact that replacement is much easier than if you have to switch out the entire conveyer belt, which would be 300 ft. long or more. Even the replacement of the parts within each module is easy. One example of this would be the containers on the conveyer belt, which separate from the ropes as illustrated in the magnification of sub-diagram 1 (page 3). On a different note, even though it's hard to see in the diagram, the drive belt connected to the windmill is set up to deliver more torque to the rollers powering the conveyer belt. As a result, the machine is able to carry a greater volume of water. Of course, in the real world, measurements would need to be taken on many different things, (wind speed for example) and integrated into the system. I haven't learned that yet though, and hope that perhaps I will gain the skills to do that this year. Regarding orientation, the belts will be set up so that they are slanted slightly towards the previous belt. This will allow the moving containers to clear the lip of the basin they are collecting water from, rotate all the way around, and dump the water in the containers into the basin attached to each module. (The exception being the final module, which will dump the water into the storage basin.) The final stage, the Archimedes screw is just an easily made, manually powered, wooden screw, designed to transport the water from the underground storage basin when needed. One great thing about this system is that it is very adaptable. I had it set up on a gradual slope, with an average angle of around 9.1 degrees. You can also set it up however, on a completely flat surface, a very steep one, or even a hybrid of the two. Unfortunately, one drawback of this design is that it is, of course, wood, and we must save the trees at all costs...

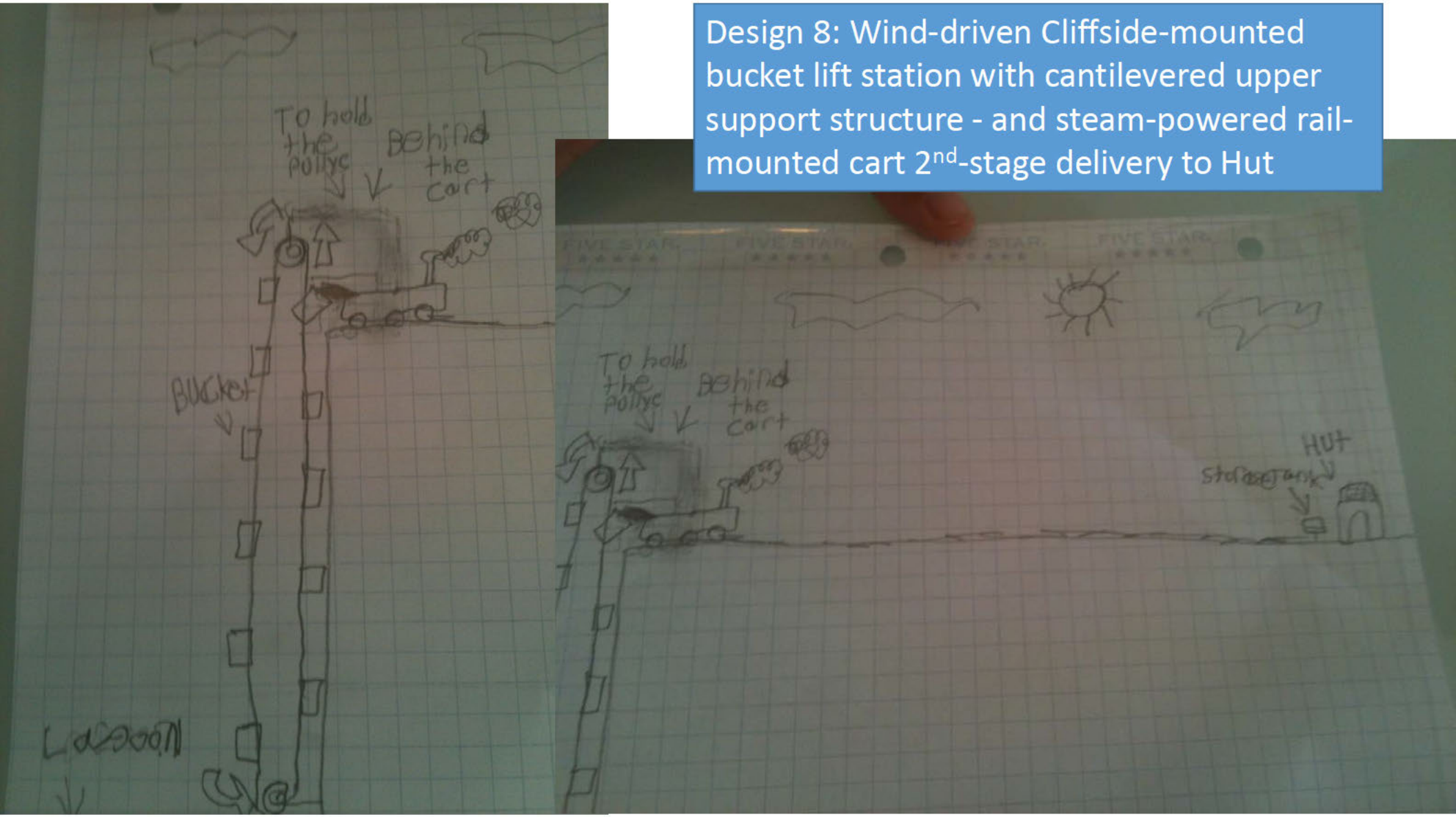
Design 6: Wind-driven, 10-stage conveyor lift system with adjustable torque-drive, special forward-slanting belts, average 9.1-degree incline, and built-in ease-of-maintenance features.



Design 7: Mammoth 300-ft Archimedes screw pump, featuring an integral worm-drive Pelton wheel energy-recovery unit

In or next to the house there is the machine that I am about to describe. First of all, there is a big tank that can hold 100 plus gallons of water. In the the bucket, but not resting in it instead fastened on a wall, is a water wheel. The water wheel is moved when water is put into one of the platforms in the wheel. For the machine to initially start the man has to go down and get at least 5 gallons of water from the lagoon. That is the only trip he has to make. He has to go down there anyway to set the machine up. He then dumps this water into the bucket. The water that is put in the water wheel slowly feeds water from a bucket that is right above the tank and the wheel. There is a little spout on the side of the bucket that slowly feeds water into the wheel. (Enough to get it moving.) The water in the bucket is supplied from the water that is brought up from the lagoon through the archimedes screw that is in the pipe that goes around the pole. The pole starts from the lagoon to the hut. The pole is moved by two sources. The water wheel and the constant wind in the afternoon. The water wheel is moved, as mentioned before how. The wheel has an axle going through it. The axle has a spiral gear on it. This then connected to a regular teeth gear that is around and connected to the pole. The wind is caught by a couple of wooden fans that catch the wind. The fans are connected to a conveyer belt that is attached to the neck of the fan to the pole. The is just a cycle that goes. The water that is dumped initially turns the wheel, that turns the gear, that turns the pole, that brings the water up through the pole, and back into the bucket. After the water that turns the wheel goes through the wheel, it is just spilled into the big tank. This water then just accumulates until you probably have more or equal than 100 gallons of water. The only slight problem with this design is that the pole might be super big and heavy for the two sources to turn it. This design might take some time to assemble but it would last for a very long time. Assuming that it is a rainforest, as you said, there should be shortage of trees. Resources will not be a problem in this case.

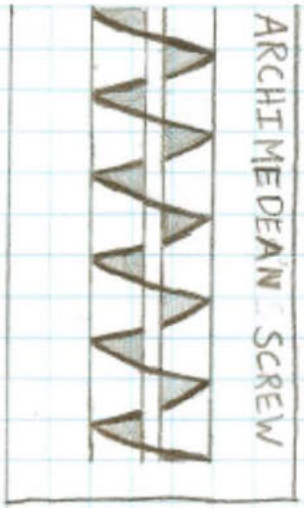
Design 7: Mammoth 300-ft Archimedes screw pump, featuring an integral worm-drive Pelton wheel energy-recovery unit

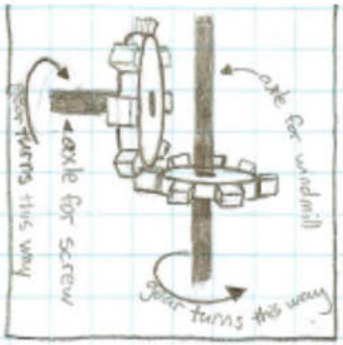


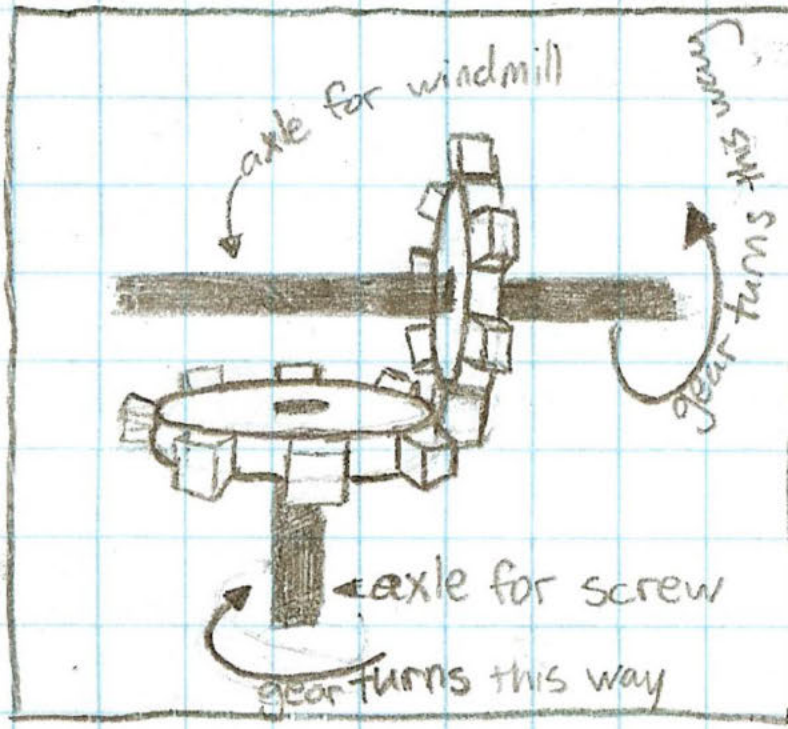
Design 8: Wind-driven Cliffside-mounted bucket lift station with cantilevered upper support structure - and steam-powered rail-mounted cart 2nd-stage delivery to Hut

My hut is 300 feet from the edge of a sheer drop cliff, there is a small decline of 20 feet which leads to the cliff, 50 feet below it is the lagoon. On the edge of the cliff I built a very sturdy wood and bamboo support structure that holds the top gears of my pulley system made of thick jungle vine, the other gear and pulley is at the bottom of the cliff attached into the rock with one of my only precious bolts. The bottom of the pulley is located 1 foot above the lagoon, there are 15 bottles attached to the vine with twine, there is also a set of wooden windmill blades attached to the top gear. The wind turns the blades which rotates the entire pulley system, the buckets go into the water and get filled up, a wood plank at the top of the cliff tips the bottles which fill a big cart. The cart is separated into two half's, in one half is a burning fire which makes steam, there is enough wood that every hour the steam pressure is big enough to push a piston to move the wheels which makes the cart move on a track and rail to my hut. It makes it to my hut where a suction power sucks the water into my storage tank. The cart (with no more steam) then rolls slowly back down the incline and resets.

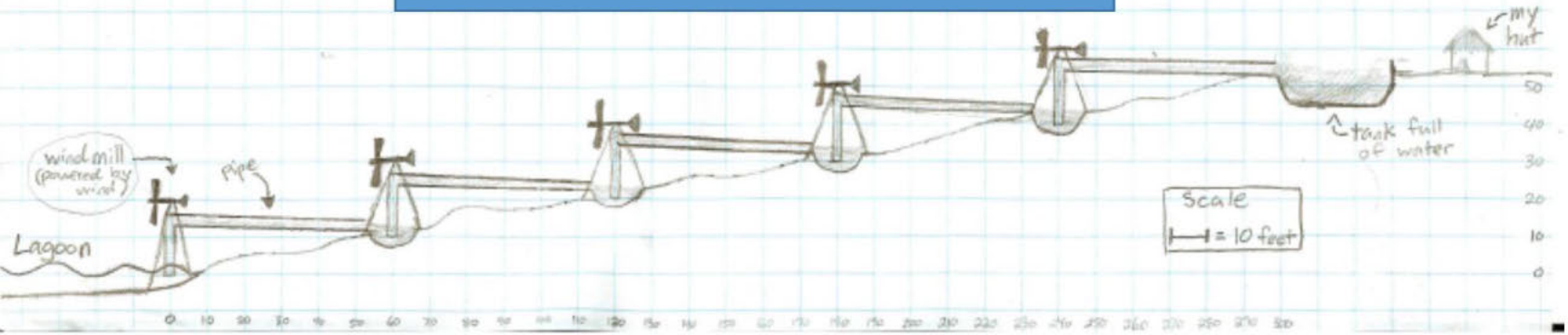
Design 8: Wind-driven Cliffside-mounted bucket lift station with cantilevered upper support structure - and steam-powered rail-mounted cart 2nd-stage delivery to Hut







Design 9: 5-stage wind-driven Archimedes lift system with close-tolerance hand-machined right-angle gear drive mechanisms



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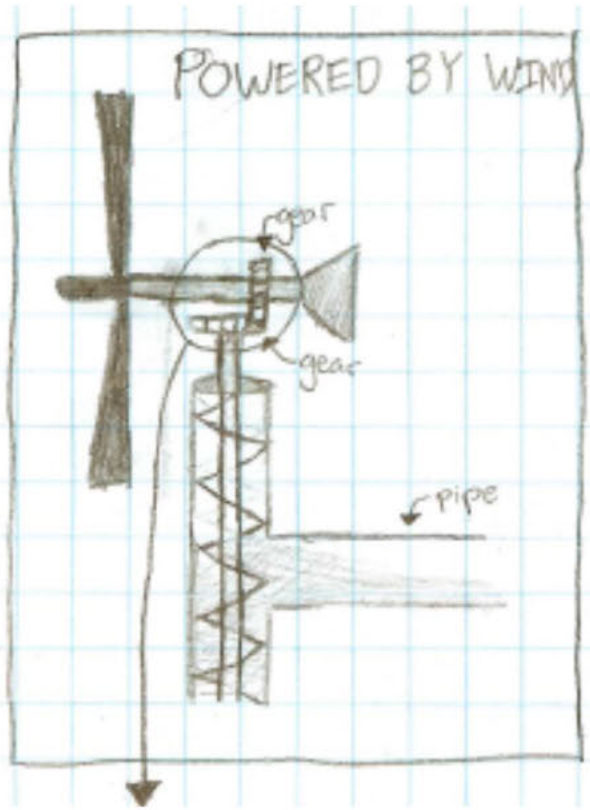
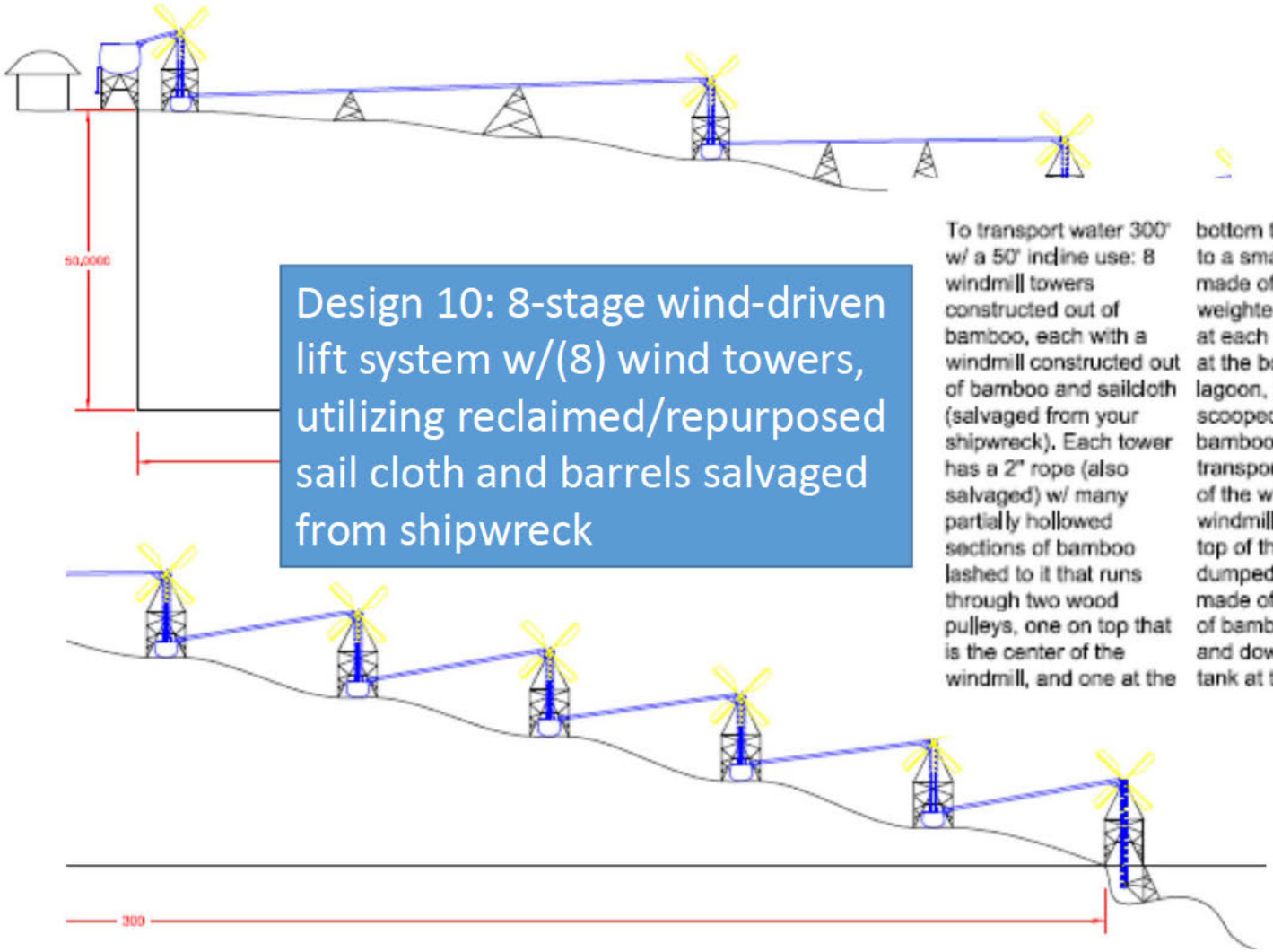
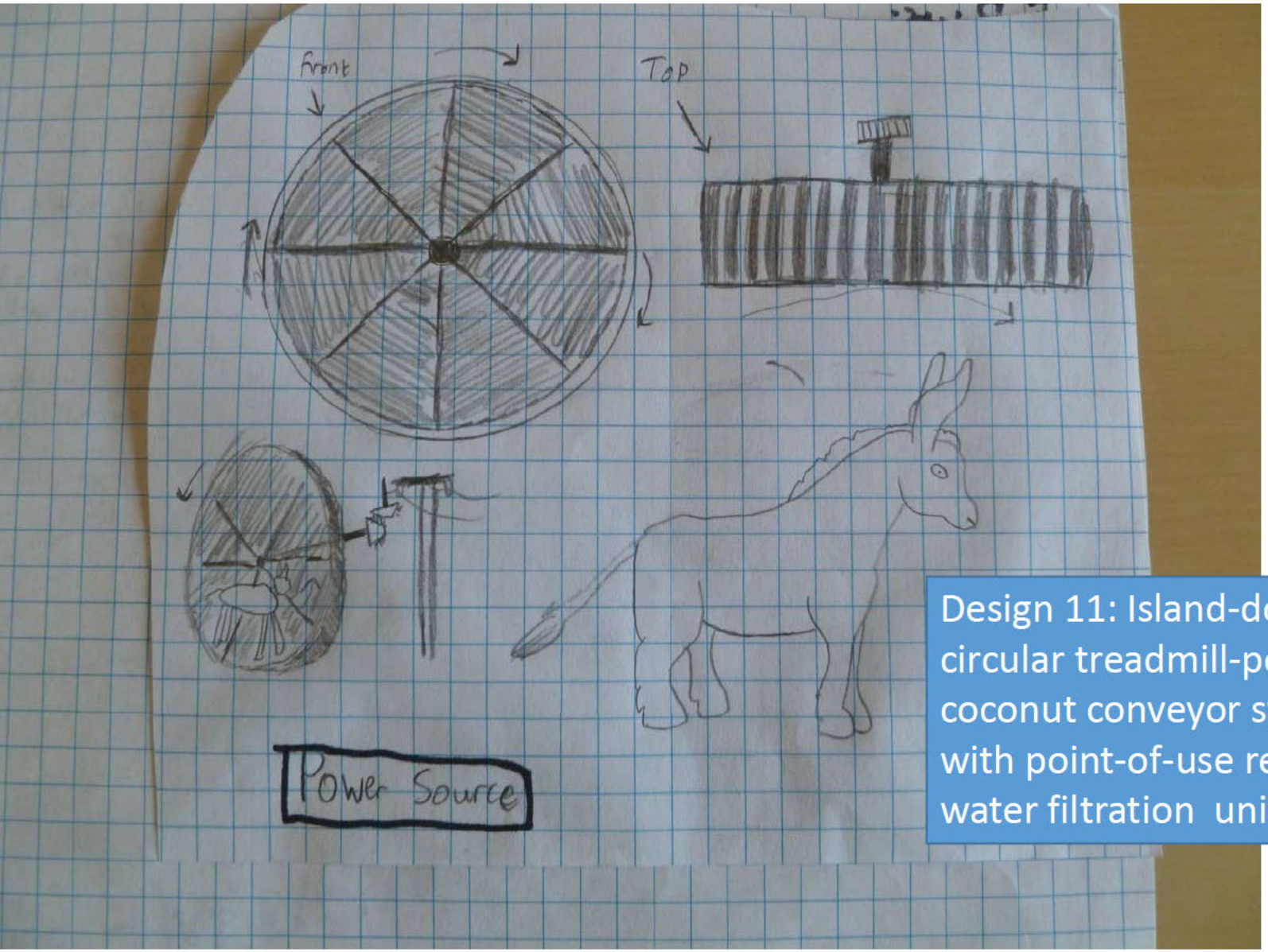


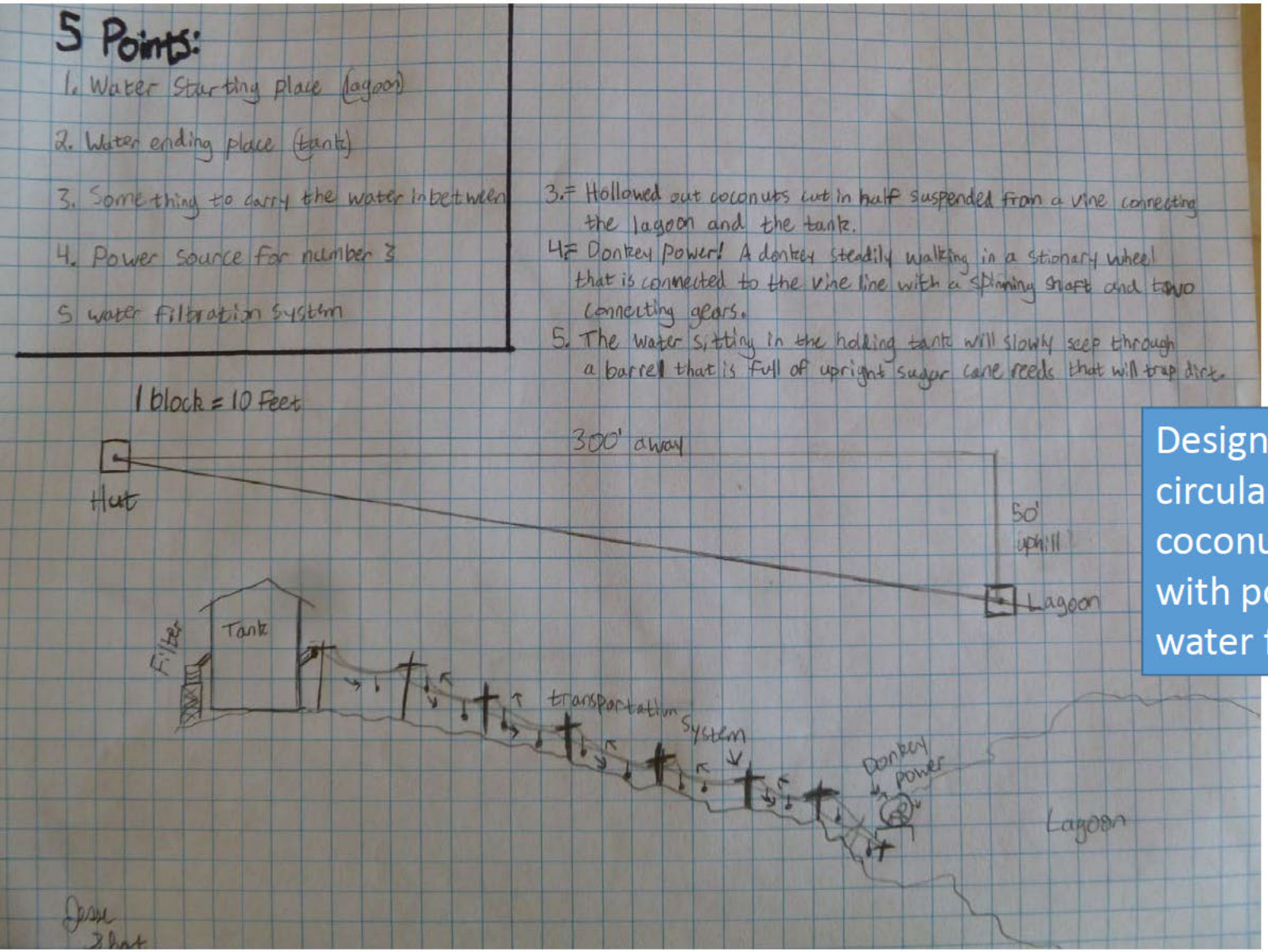


Design 10: 8-stage wind-driven lift system w/(8) wind towers, utilizing reclaimed/repurposed sail cloth and barrels salvaged from shipwreck

To transport water 300' w/ a 50' incline use: 8 windmill towers constructed out of bamboo, each with a windmill constructed out of bamboo and sailcloth (salvaged from your shipwreck). Each tower has a 2" rope (also salvaged) w/ many partially hollowed sections of bamboo lashed to it that runs through two wood pulleys, one on top that is the center of the windmill, and one at the bottom that is attached to a small frame also made of bamboo and weighted down w/ a rock at each corner, Starting at the bottom at the lagoon, the water is scooped up in the hollow bamboo "cans", transported by the action of the wind turning the windmill blades, to the top of the tower, it is dumped into a chute made of a thicker piece of bamboo hollowed out, and down to the holding tank at the bottom which is made of half a barrel that you have salvaged from the ship wreck when you first landed here, up to the top of the next tower and repeated until it gets to the top of the hill and your hut/water tank. (i've been on the island a loong time) also this is not perfect, i kinda ran out of time :| there are many variables that i failed to address, such as whether i have to much water being lifted at one time by the windmill and the like...



Design 11: Island-donkey, circular treadmill-powered coconut conveyor system, with point-of-use reed-bed water filtration unit



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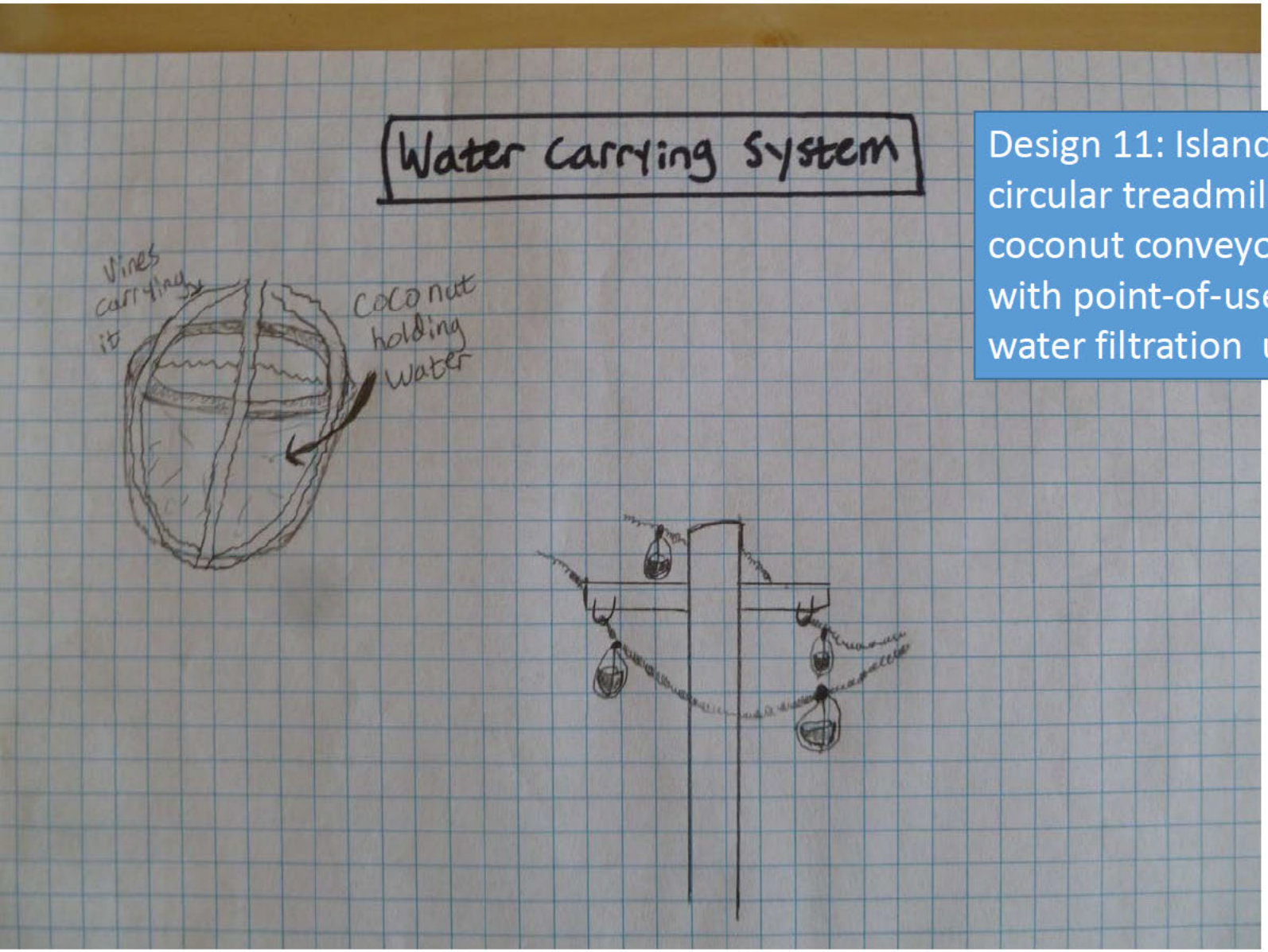

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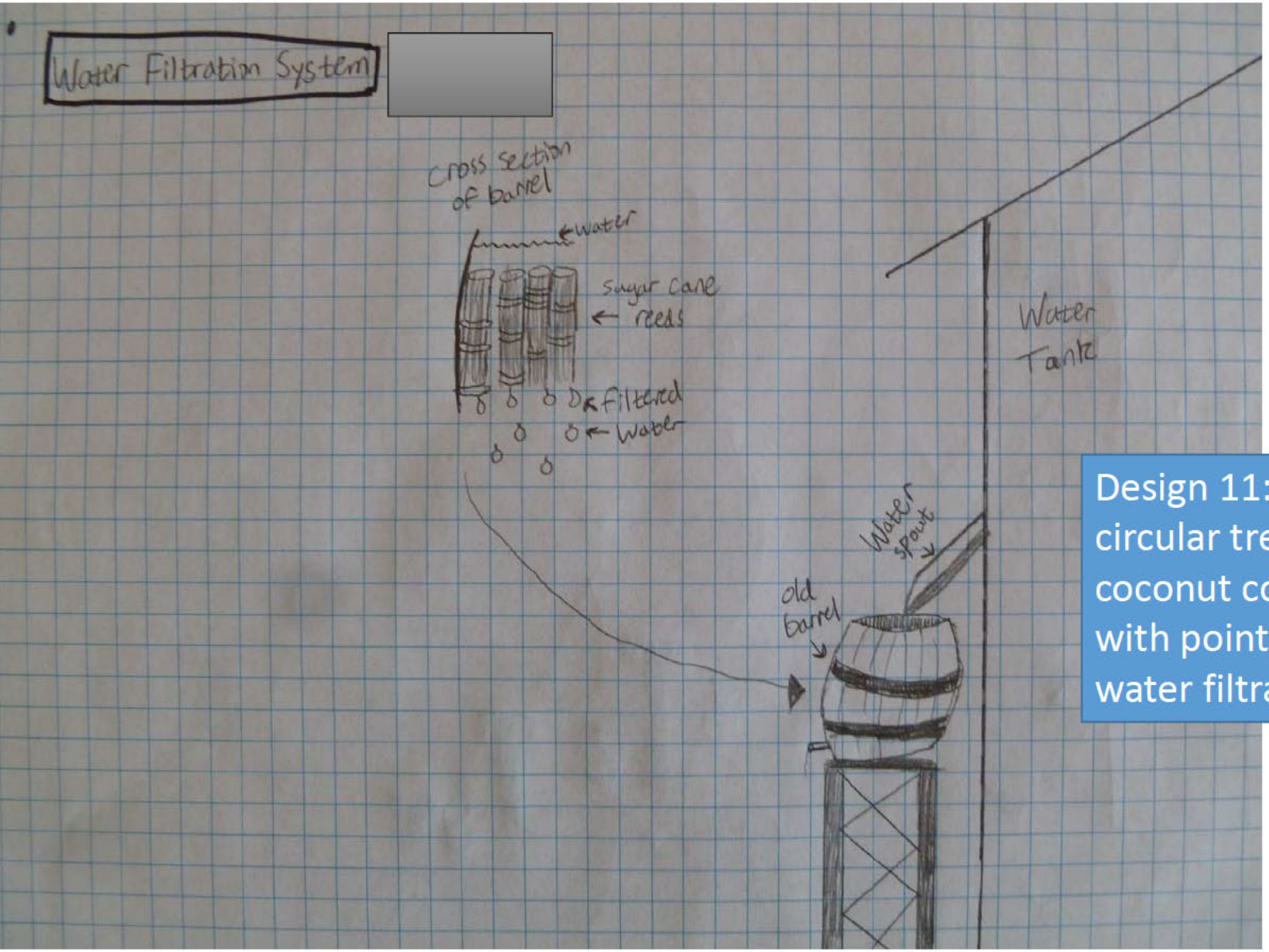


Design 11: Island-donkey, circular treadmill-powered coconut conveyor system, with point-of-use reed-bed water filtration unitcc

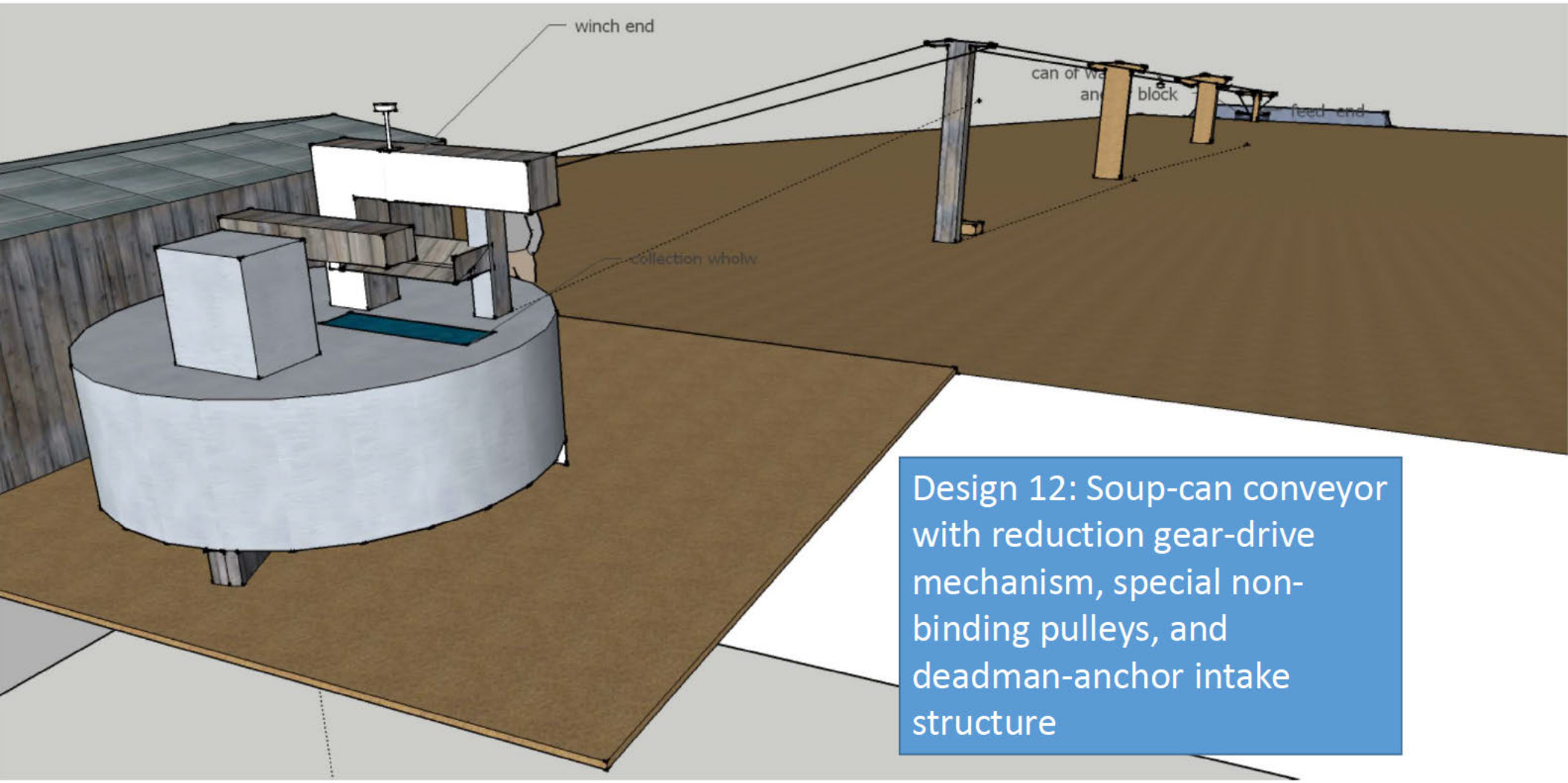
There are 4 pictures showing my basic principles of the design: The lagoon and the water tank, something to carry the water between the lagoon and the water tank, a power source to power the last point and a water filtration system.

One drawing shows the water carrying system, which uses coconuts to hold the water and a telephone-like system with wooden poles and vines to carry it over the land from the lagoon to my water tank.

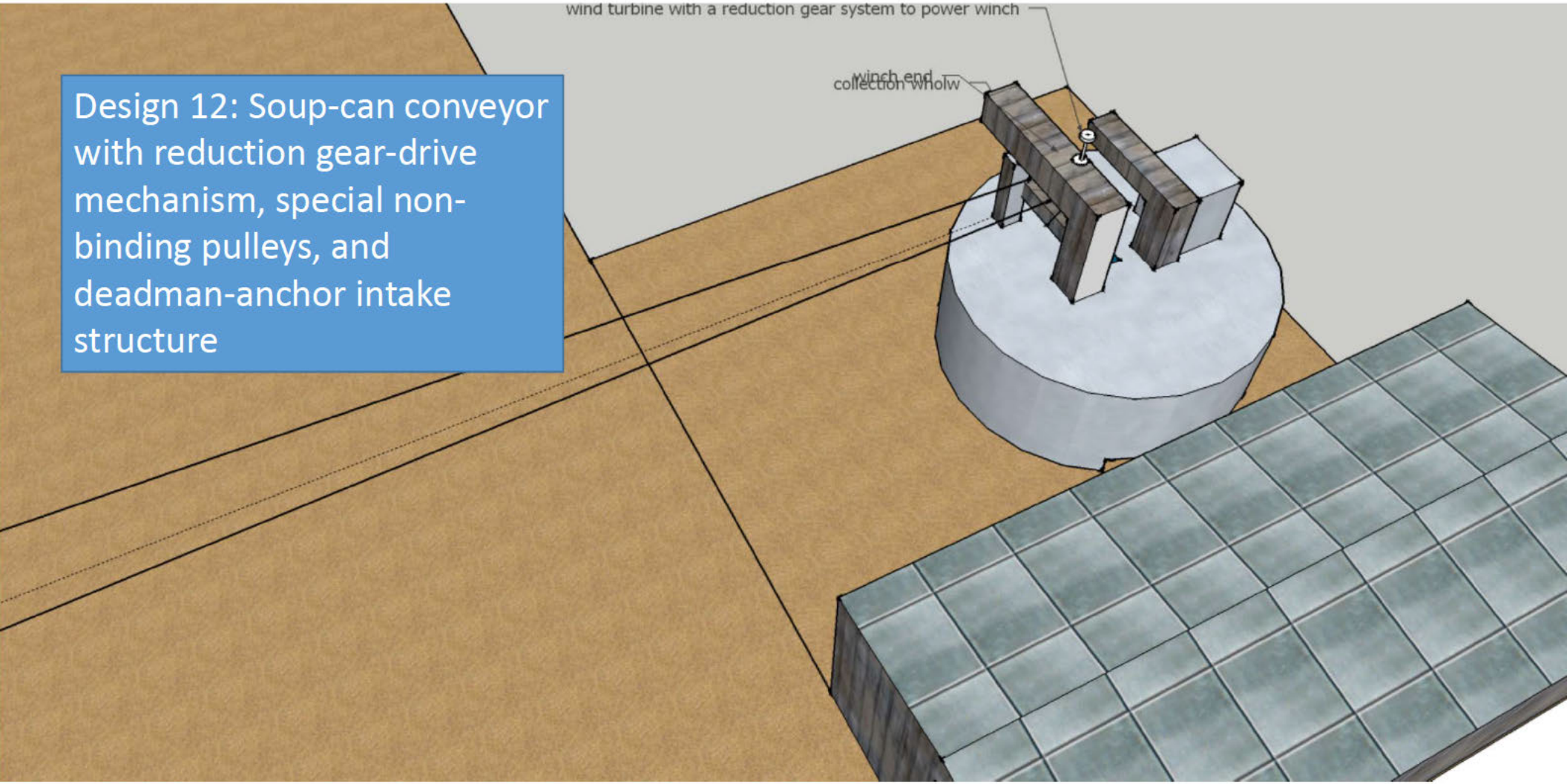
Another drawing illustrates the power source for the carrying system, which is a large "hamster wheel" big enough for a donkey to plod along and spin the shaft and two angled gears to pull the vines along. Thus delivering the water to the holding tank.

Yet another drawing shows the water filtration system. To the left of the tank itself is a spout leading to an old barrel that I found on the beach which holds many tightly packed reeds standing on end. The water slowly drains through the porous reed while the dirt and nasty stuff get caught in the reeds. The end product is filtered water, coming out the spout at the bottom of the barrel.
Finally, another drawing is an overview of the design.

Design 11: Island-donkey, circular treadmill-powered coconut conveyor system, with point-of-use reed-bed water filtration unit



Design 12: Soup-can conveyor with reduction gear-drive mechanism, special non-binding pulleys, and deadman-anchor intake structure



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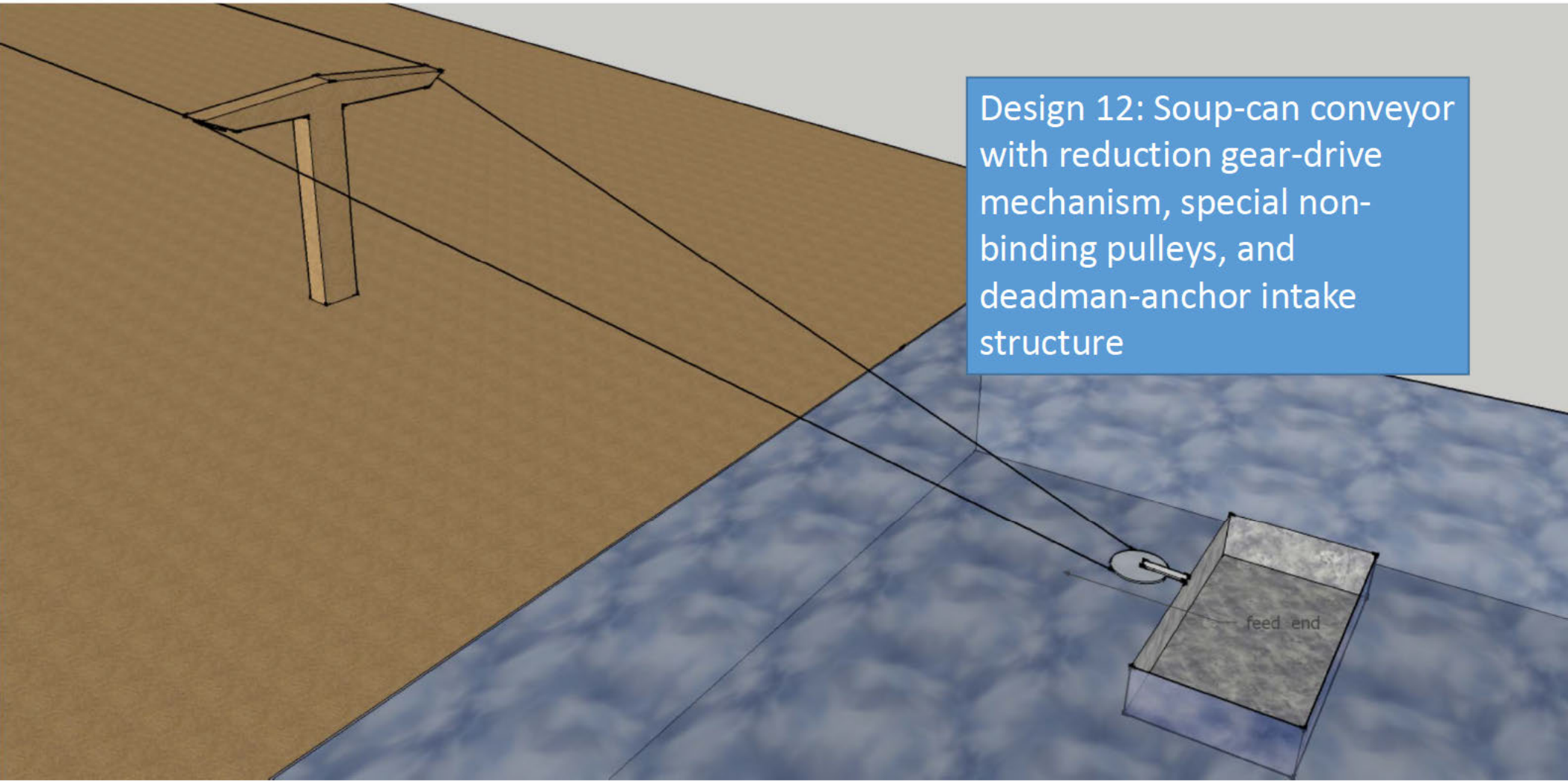
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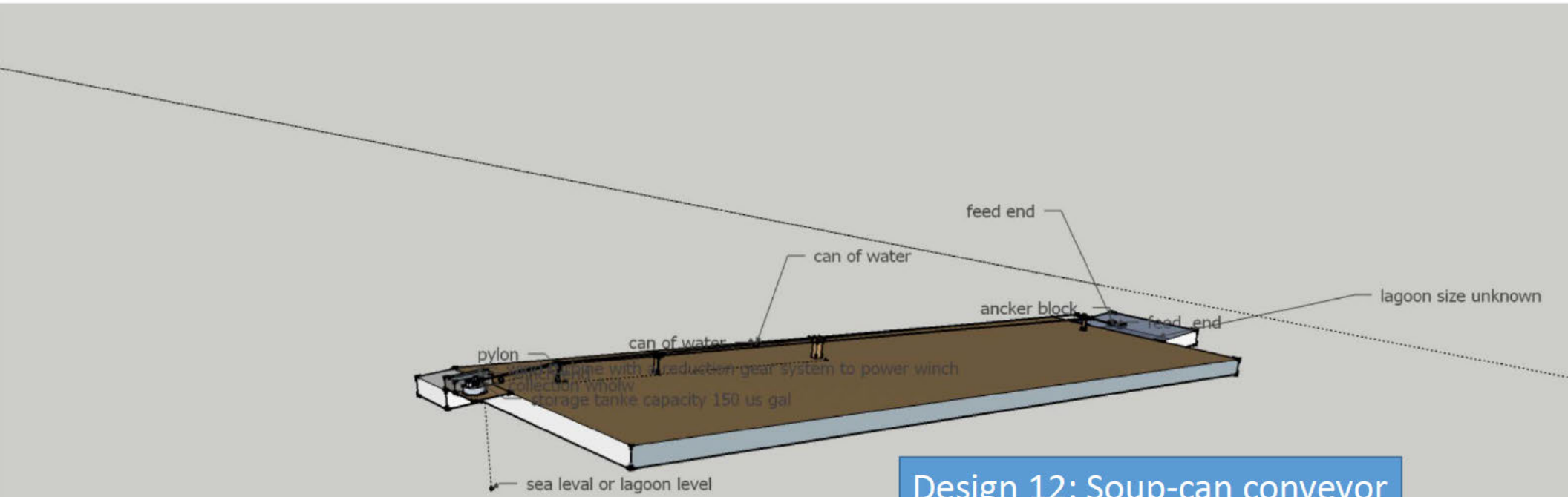
feed end

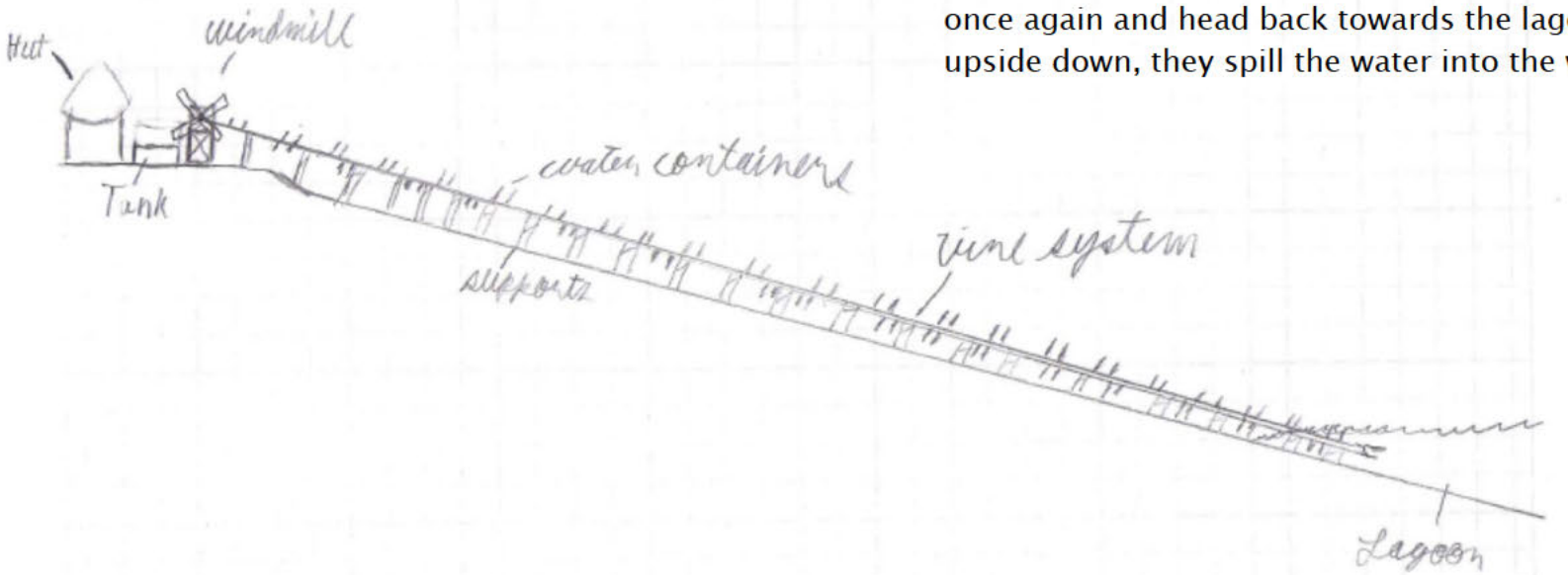


Design 12: Soup-can conveyor with reduction gear-drive mechanism, special non-binding pulleys, and deadman-anchor intake structure

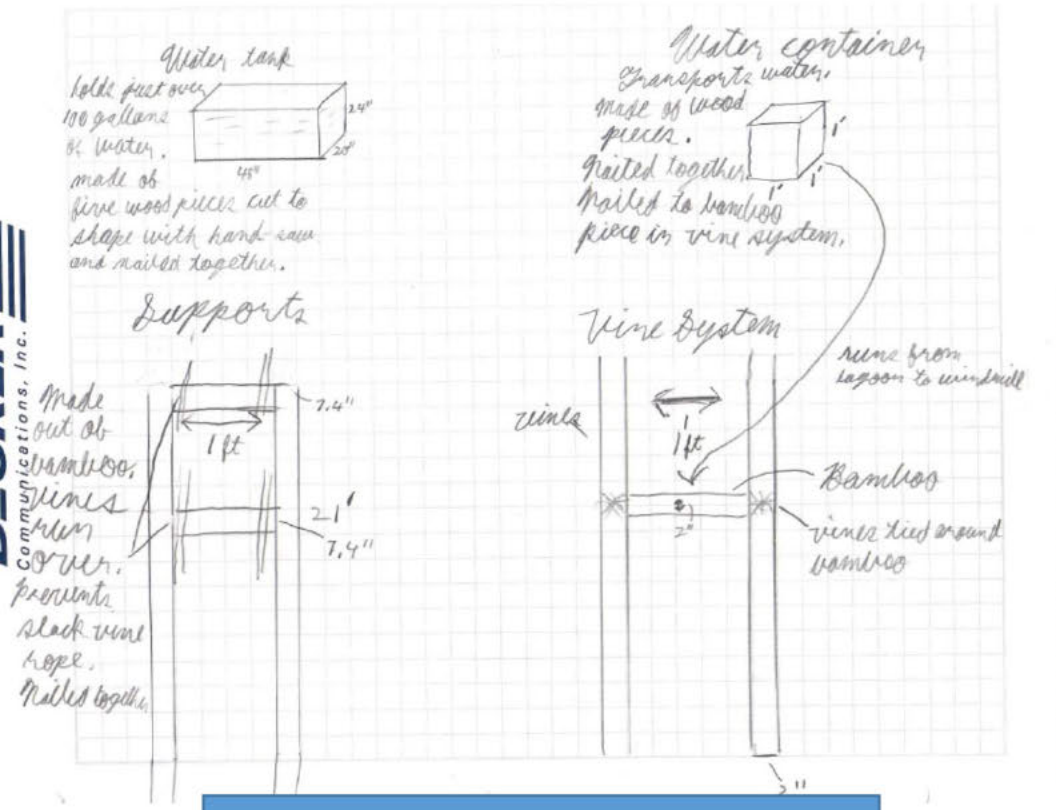
The design of this machine can work with any kind of power source to transport water to a higher elevation. A rope is wound around two sets of pulleys: one at the bottom of the hill (the source) and the other at the top (collection tank or receiving end). The top pulley is attached to a set reduction gear(s) that are operated by a power source solar with motor, wind, water wheel etc. Several soup cans are tied to the rope with string. There are several pylons that help support the rope, each with a pulley at an outward angle so the rope and string don't bind and jam in the pulley. This machine can be of any length, or any size. When the top pulley spins, it pules the rope with the cans of water from the bottom or source, to the top where the cans can dump their water at a collection tank or stream at top.

Design 12: Soup-can conveyor with reduction gear-drive mechanism, special non-binding pulleys, and deadman-anchor intake structure

Design 13: 300-ft wood box/bucket conveyor system driven by 4-blade, 21’ blade-length windmill unit with 3”x24” built-in bucket guides



When the windmill's fans spin, the pole on which the fans are mounted spin as well. When the pole spins, it causes the four smaller poles coming off it to spin as well. These poles lift the bamboo poles in the vine system up and over the windmill's spinning pole thus causing the whole vine system to move. The vine system acts like a conveyer belt and is supported by various supports along the way to prevent the vines from slacking. The water containers move upside down along the vine system until they reach the lagoon. Then, they flip right side up and move back towards the windmill. Once they reach the windmill, they are lifted up and over the spinning pole. Then they flip back upside down once again and head back towards the lagoon. As they flip back upside down, they spill the water into the water tank.



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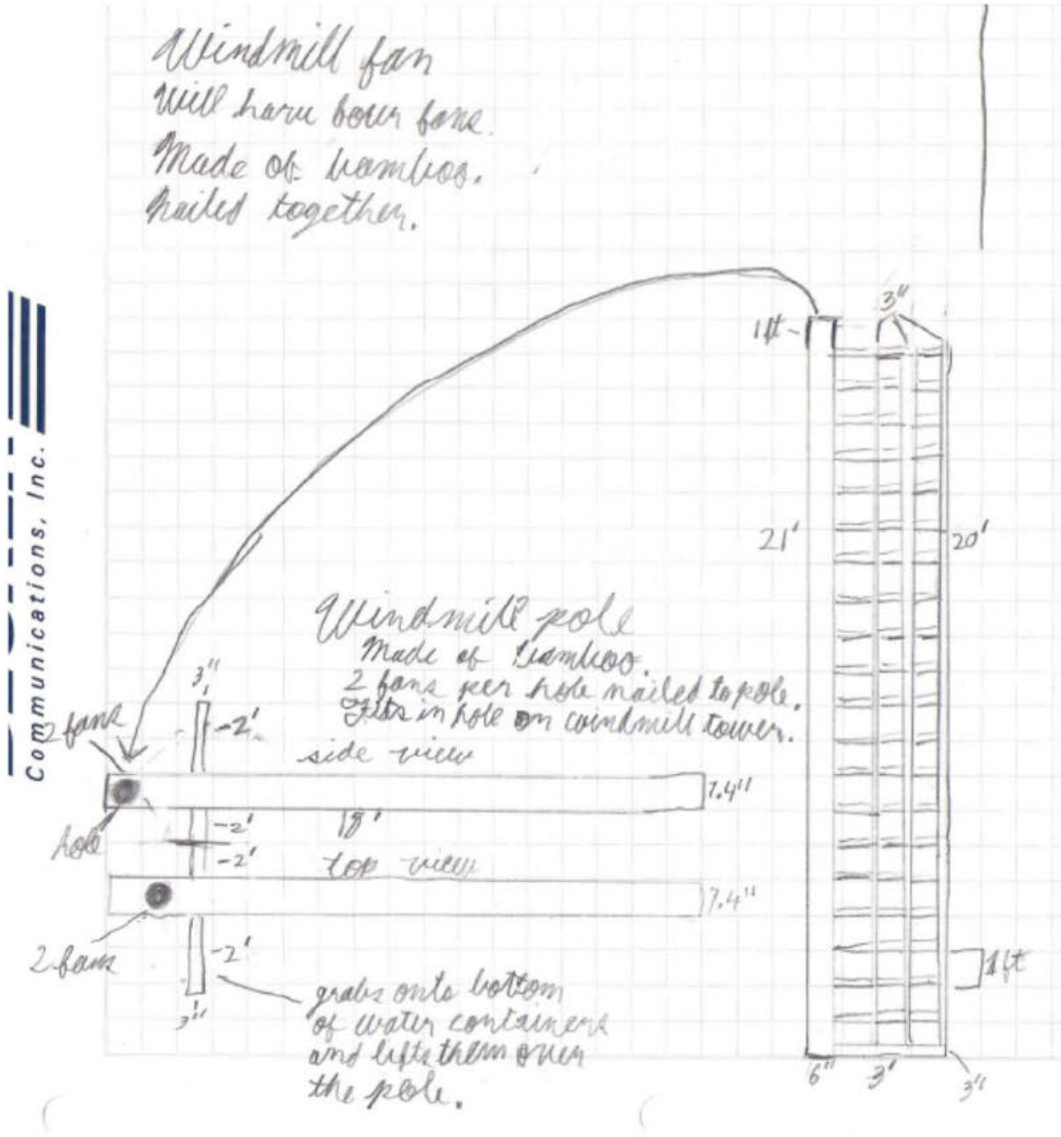
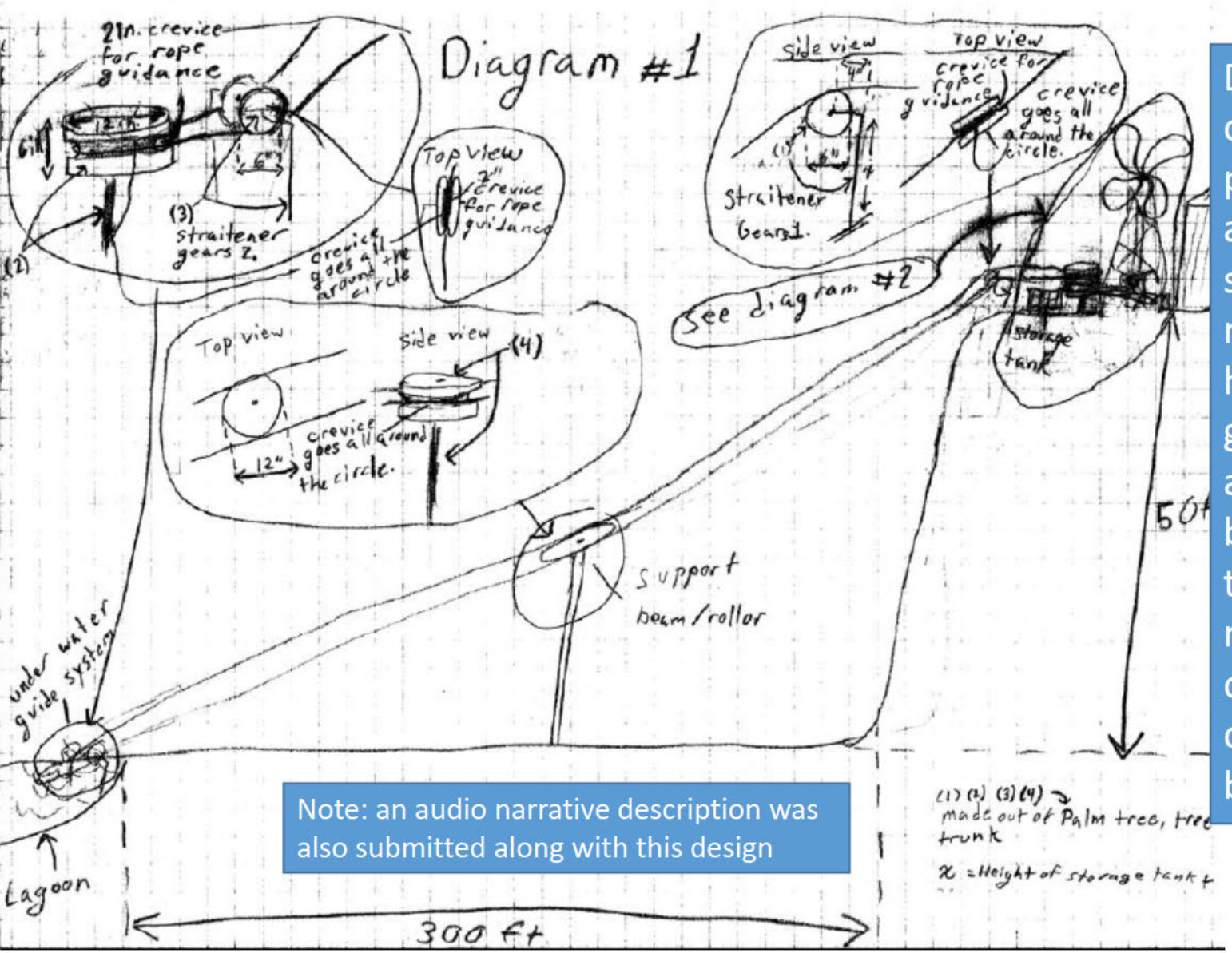
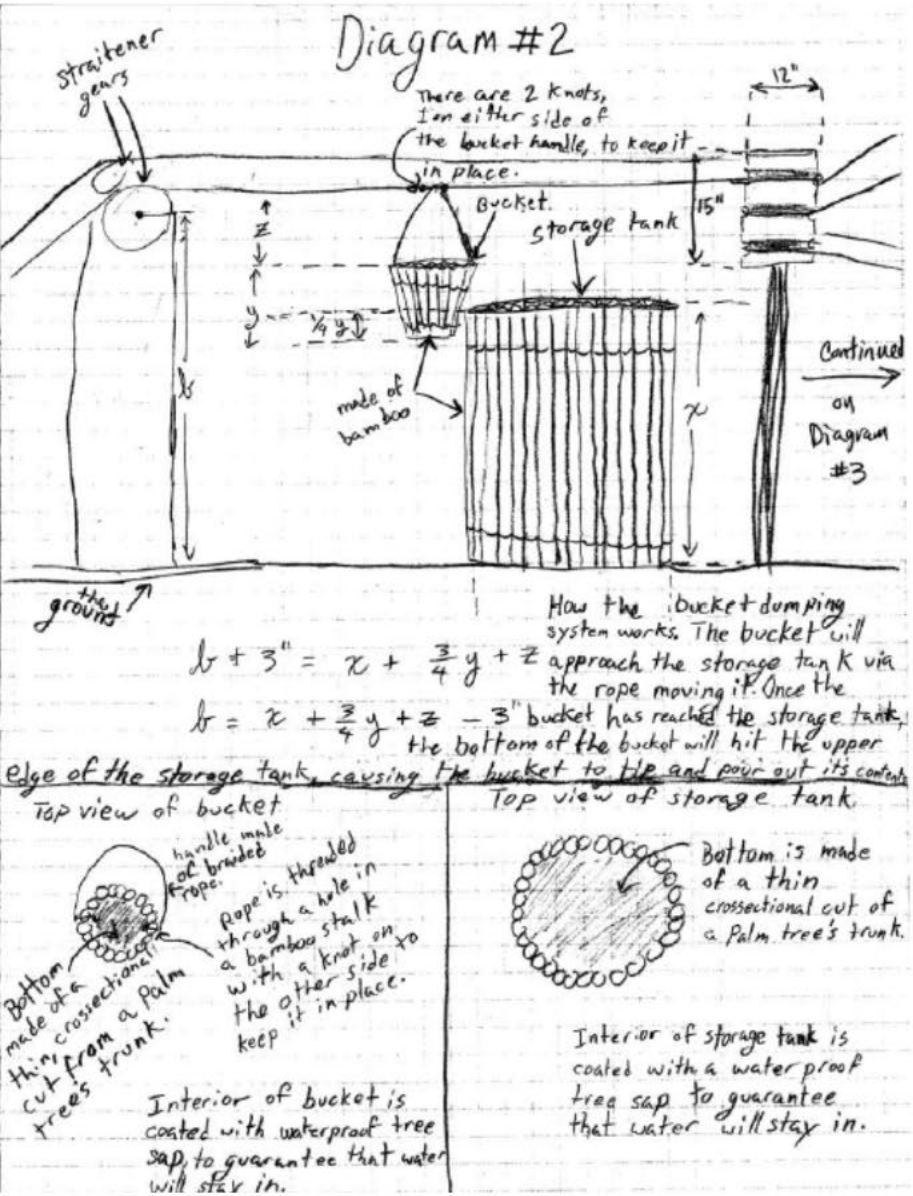




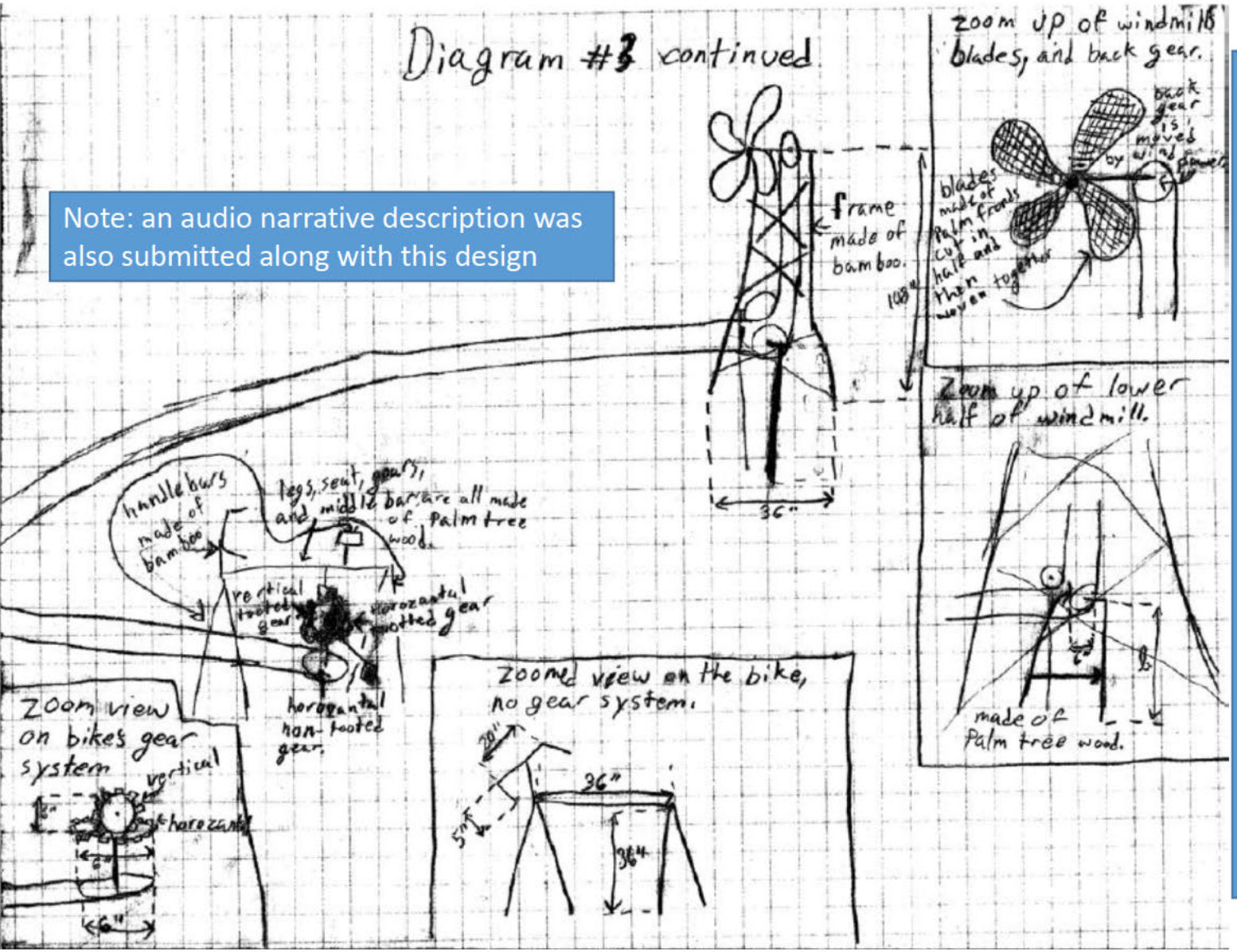
Note: an audio narrative description was also submitted along with this design

Design 14: 300-ft bucket conveyor system, with 2 power options: windmill and stationary bicycle; special grooved support rollers for vertical & horizontal control, triple-grooved main drive roller, algebraically-derived bucket design height & tank height, bicycle uses right-angle gear reduction drive unit, tree sap-derived coating on buckets and sto tank.



Design 14: 300-ft bucket conveyor system, with 2 power options: windmill and stationary bicycle; special grooved support rollers for vertical & horizontal control, triple-grooved main drive roller, algebraically-derived bucket design height & tank height, bicycle uses right-angle gear reduction drive unit, tree sap-derived coating on buckets and sto tank.

Note: an audio narrative description was also submitted along with this design



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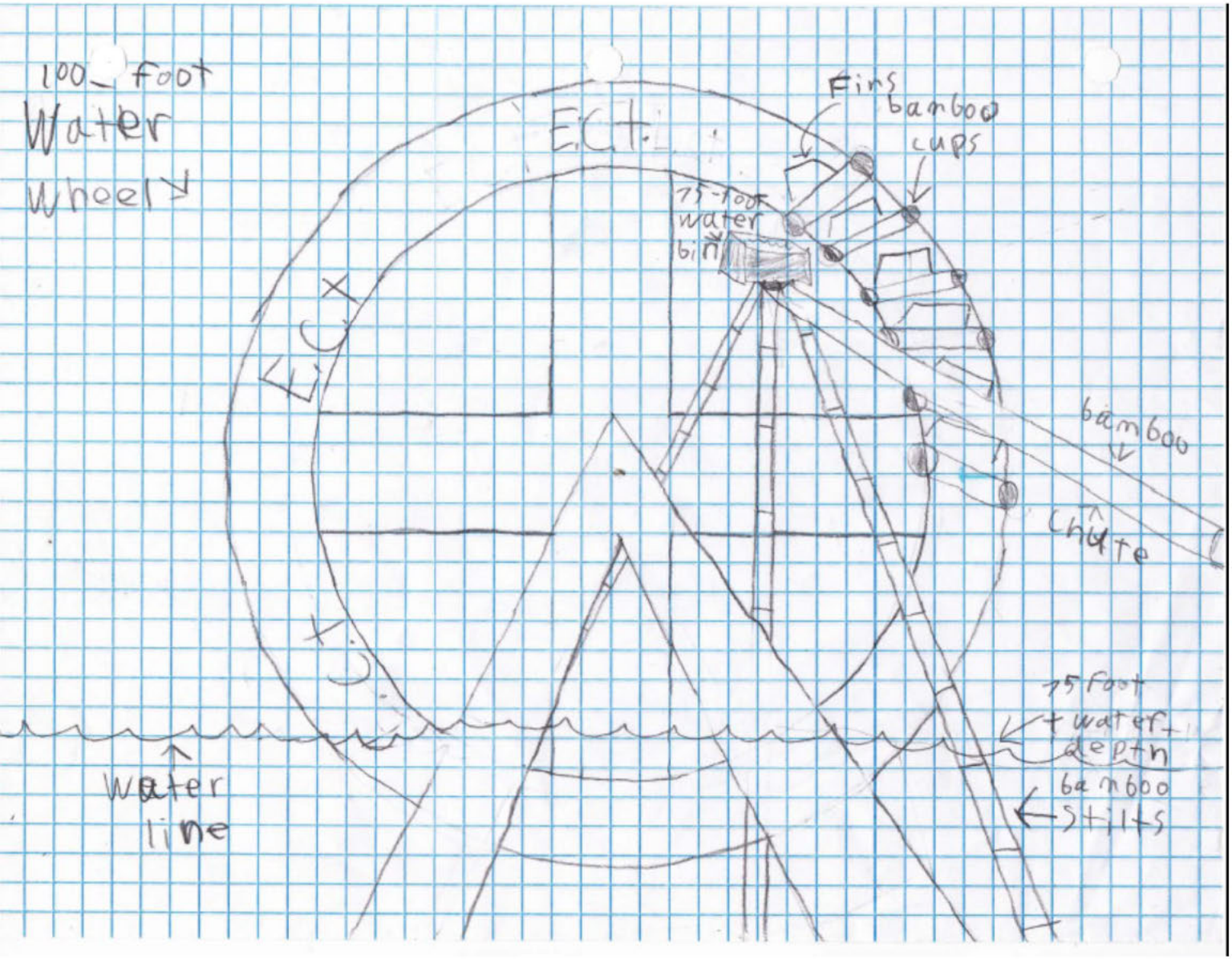
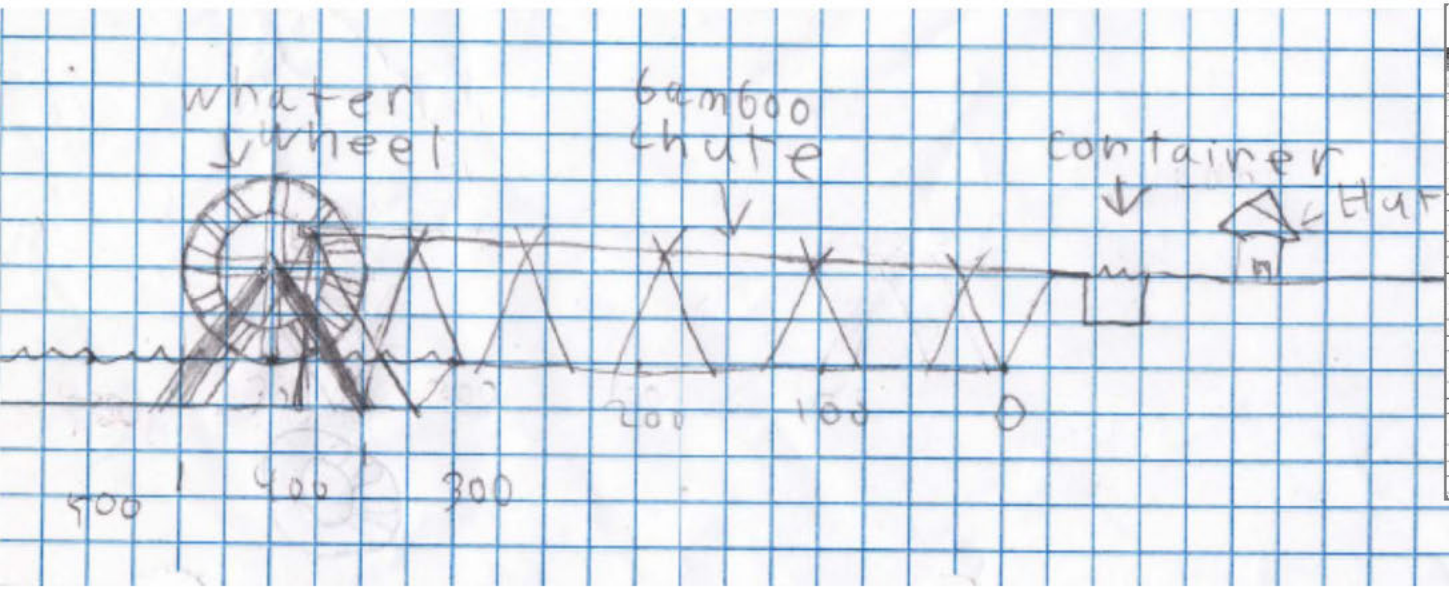
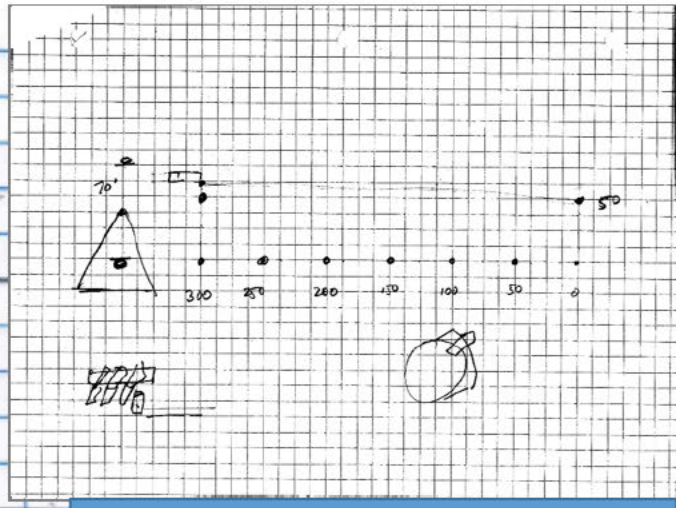


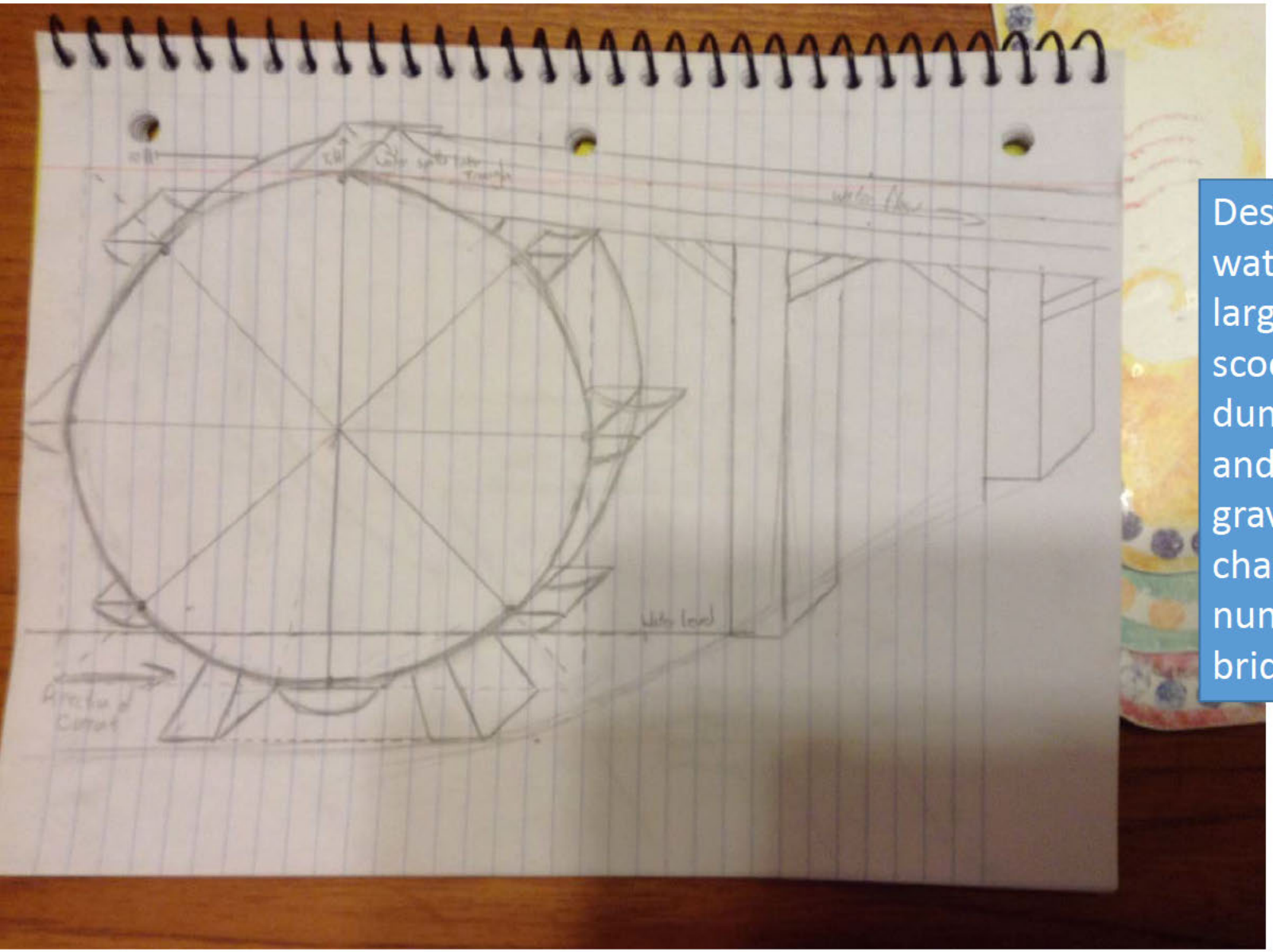
Design 15: Colossal 100-ft water wheel with submerged support structure, bamboo collection cups - and 2nd-stage, 75-ft high, gravity-fed trestle/trough leading to potable water storage tank.



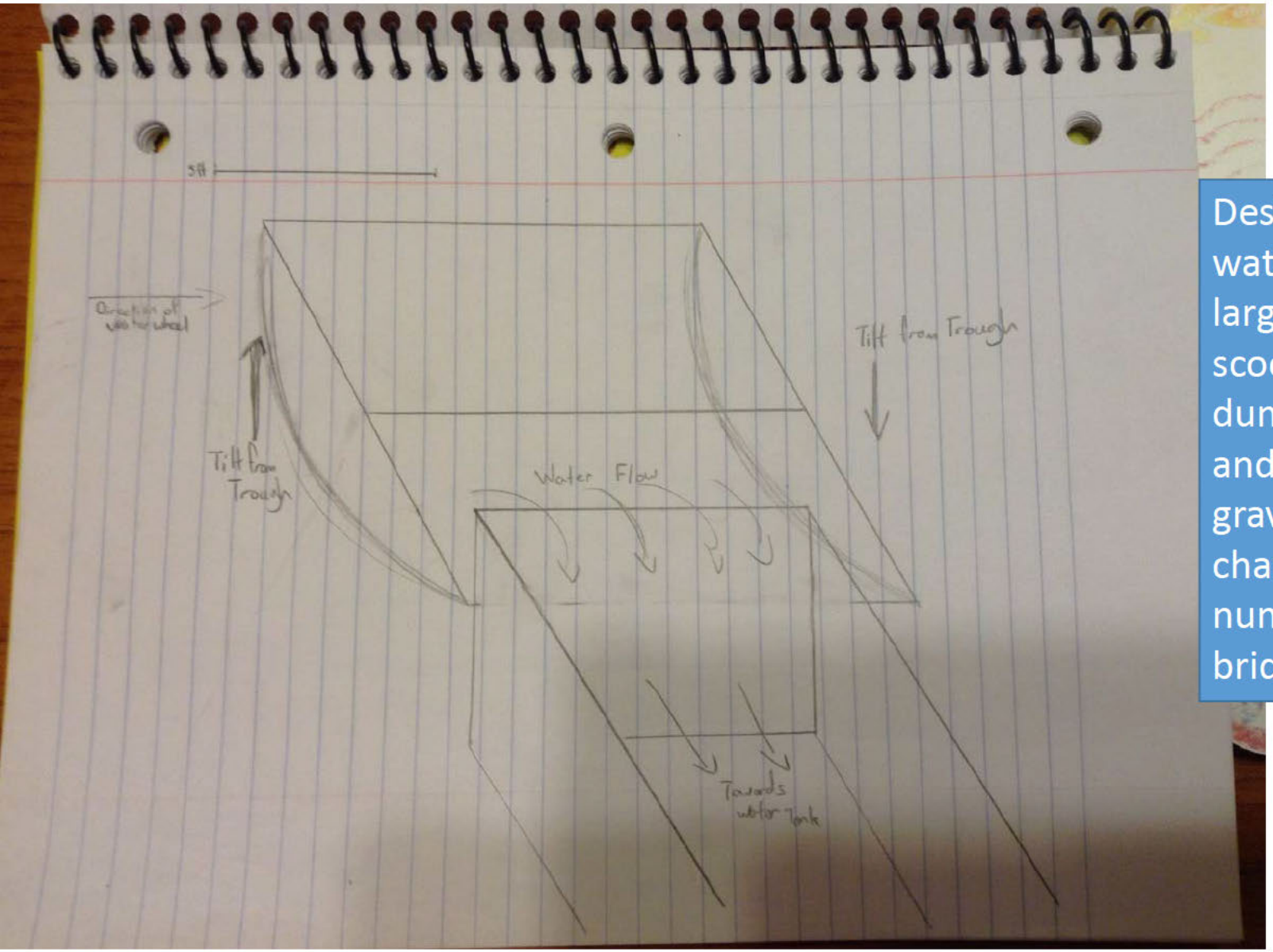


I will collect the water with a 100-foot bamboo water wheel. The water wheel will be made of bamboo poles slightly bent and lashed together (bending not visible in drawing). It will be equipped with fins bamboo fins to help the wheel rotate and bamboo cups to collect water. Each cup will be tilted towards the center of the wheel. When each cup reaches close to the highest point of the wheel, the water dumps into a bucket held up by a tripod of bamboo suspended 75 feet above the ground. Then the water will go out a hole in the bucket facing away from the wheel and will be conveyed down a shoot from the bucket to the 50-foot hillside (a 25-foot drop). The chute will be made of bamboo poles cut lengthwise and nailed together so that the bamboo makes an open chute that leads strait into the container by my hut.

Design 15: Colossal 100-ft water wheel with submerged support structure, bamboo collection cups - and 2nd-stage, 75-ft high, gravity-fed trestle/trough leading to potable water storage tank.



Design 16: Mammoth water wheel using (8) large pivot-mounted scoops, automated dump-tilt mechanism, and 300-ft long gravity-fed water channel supported on numerous braced bridge-type piers.



Design 16: Mammoth water wheel using (8) large pivot-mounted scoops, automated dump-tilt mechanism, and 300-ft long gravity-fed water channel supported on numerous braced bridge-type piers.

The End