University of Southern California

Los Angeles Drought Solution

Re-allocating Water Output & Industrial Usage of Treated Grey-Water

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Introduction

In response to the current California Drought, we have created a system in order to save the greywater that is from residential housing by making changes to the current system.

In our current system for wastewater treatment, first, the waste directly from the houses must be screened before entering the plants. This process is to remove any large objects that may be in the raw sewage such as bowling balls, motorcycle parts and goldfish. After the screening, the remaining sewage moves to mechanically mixed basins to remove sand-like material. After this point, the sewage goes to primary treatment. During primary treatment, the flow of the sewage is slowed so that the remaining heavier than water material sinks to the bottom of the tank. Also, materials that are lighter than water, such as grease and oil, float to the surface. Then, in giant tanks with rotating arms at both the bottom and the top of the tank, the solids and the bottom and the liquids at the top are separated from the water. These two pollutants are then moved to disectors to hold them. After preliminary treatment, the water is almost as clean as some of the rivers and lakes, but can still be cleaned more during secondary treatment. During the primary treatment, some of the dissolved organic matter is not removed. In the secondary treatment, those are removed through by microorganisms which consume the remaining organic matter. This organic matter is then converted into carbon dioxide, water and energy by the microorganisms. After being treated by the

microorganisms, the treated sewage goes to an additional set of settling tanks to remove extra solids. After this step, almost eighty-five percent of the suspended solids and BOD is removed from the original sewage. In some plants, however, the cleaned sewage continues to tertiary treatment. This treatment can remove up to ninety-five percent of the impurities from the sewage, which gives it almost drinking water quality. An example of tertiary treatment is a modification of the secodary treatment plant in order to remove more nitrogen and phosphorous. After the tertiary treatment(or secondary treatment in most), the cleaned sewages goes to disinfection, which is the final step of the cleaning process. But, since the disinfection is usual done with chlorine, environmental authority has become worried about the chlorine residue in the released water. Therefore, disinfection is often added into the plant, but not as frequently used as the other treatments.

Background For What We Should Change

Currently, our system's objective with water treatment is to clean the water to an acceptable quality for ocean life to live in (or what we consider to be 'acceptable'), and send it out into the great deep. But, by doing this, we are slowly getting rid of potentially useful water.

People in California only use 4% of the total freshwater used. We can't directly affect the other 96%, as it is used for agricultural and industrial purposes, but we plan to convince these industries to use treated water (from the 4% of water that we can control), rather than freshwater, and save the freshwater no longer being used. The goal

of this new idea is to do as much as we can to fix and improve upon how we use this precious 4%.

Of human-used freshwater (the 4% mentioned directly above), 17.5% is sewage from toilets. All of the water used for toilets is freshwater. It is universally believed that using freshwater for toilets makes no sense. Your secreted materials do not need special treatment with this pure, scarce resource.

We do not plan to change this, however. We agree that it is a complete waste to use freshwater for toilet water, but there are other areas where water is being wasted as well. Industrial water usage in many cases is very wasteful. Freshwater does not always need to be used in product production. Our plan revolves around treating water from household waste and sending it to industries. They would use this treated greywater in place of freshwater.

The reason behind our choice to send greywater to industries over sending it to be used in toilets is the cost. Regardless of if we use non-fresh water for toilets or industries, we will be saving the same amount of freshwater. But sending greywater to industries is much simpler- we would only need to build a small amount of piping to specific factories, rather than having to repipe *every single house* so that they are using greywater in the toilets. Also- the likelihood of convincing every family in a community to repipe their houses (whether the government would be paying for this or not) is a very tall task to take on. Industries would be more than happy to spend minimal amounts of money on pipeage to eventually save money (as greywater is far cheaper than freshwater).

Our Proposed Solution

Disclaimer: All of the following ideas would start in a small, new community, and eventually be implemented into bigger cities if successful.

Our proposal is to treat this water to the point where it is healthy for livestock consumption and/or industrial production usage. As of 2015, almost all of the water usage in these industries is freshwater, *but it doesn't need to be.* Industries and livestock companies would **want** to use greywater over freshwater too, because of the fact that greywater is cheaper than freshwater.

Today, industries are not interested in the greywater that is sent out to the ocean by Hyperion; if they were interested, they would be using it over freshwater due to the cheaper cost. The water is too low of a quality for them, however. This plan addresses this issue in the cheapest way possible that can convince these industries to use our treated greywater.

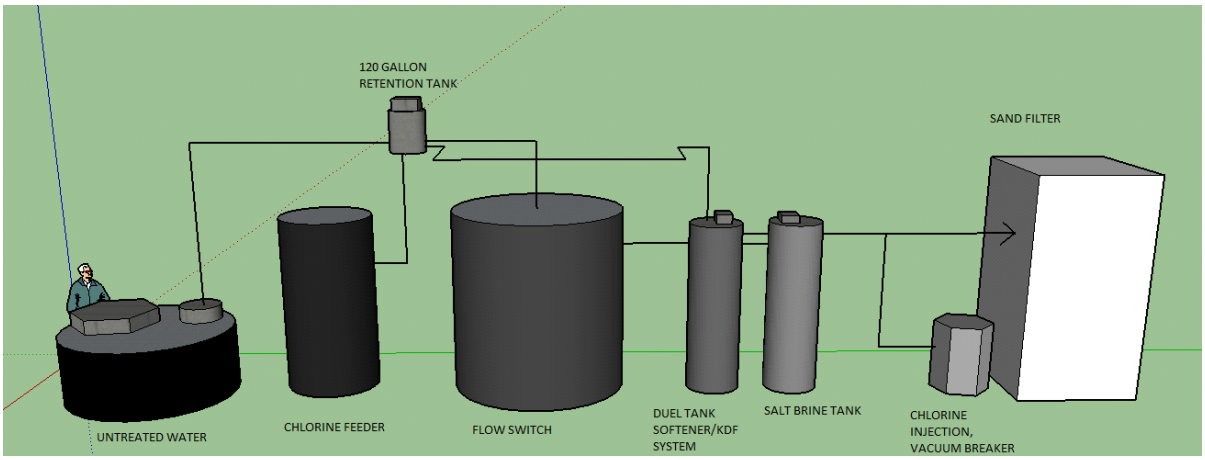
Learning by example is always an effective way to progress and understand what we have done wrong. Another water-treatment plant in Durham, California cleans their sewage intake to the point where nearby industries are willing to use their water in place of freshwater. One important, finalizing step that the Region of Durham plant does is called sand-filtering. Sand filtering is fantastic at removing the smaller clumps of metal in greywater- specifically after larger solids have been removed in previous steps. Sand filters are also especially proficient when it comes to making the visual quality of the

water better (it makes the water clearer). This would be a major improvement when it comes to getting industries interested in using greywater.

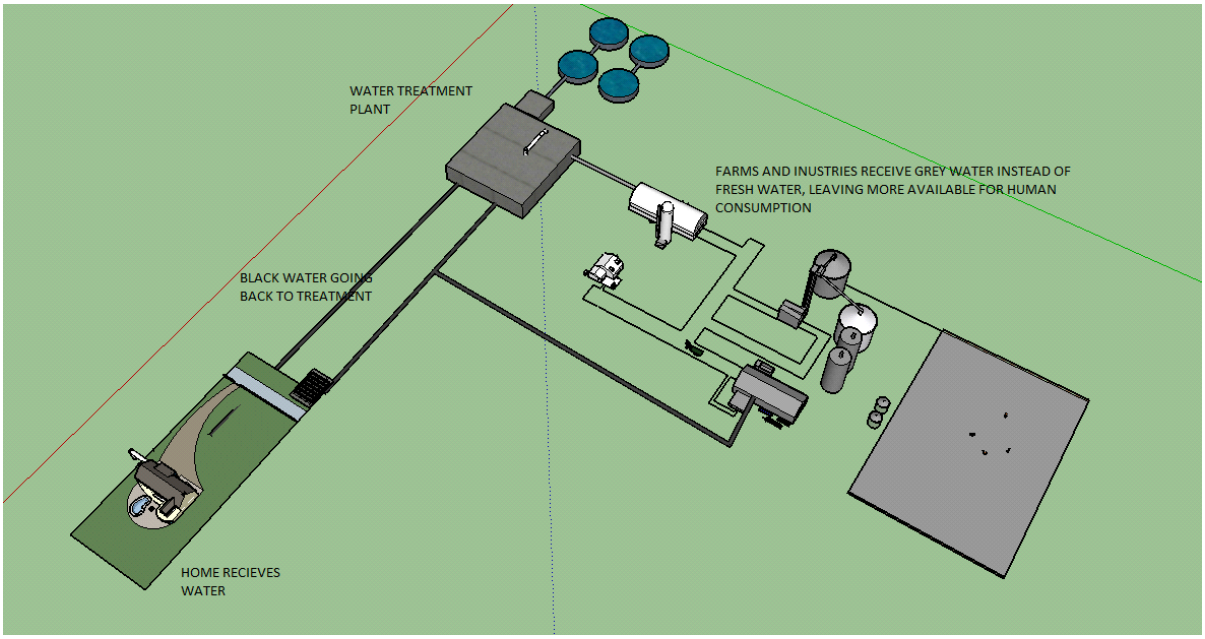
According to a CDC article on smaller, household filters, it costs .068 cents per liter of water filtered. But this would be *even cheaper* if applied to a big scale project like Hyperion's water treatment, as these household filters are filtering out bigger metals as well (whereas Hyperion already filters big solids out). This would reduce the cost of maintaining sand filters drastically from .068 cents, as they won't have to be replaced nearly as often.

The cost of one liter of water in the US is currently .040 cents, which is actually lower than the cost to filter greywater. **BUT** it is under double the cost to filter it, therefore we could charge companies somewhere along the lines of .030 cents per liter. Industries
interested would be saving 25% on their water costs. Hyperion would be saving a meager .002 cents per gallon, which is still significant because saving any money at all would be an added bonus to this project.

"When will that 4% of California-wide water usage come back into play?" you may ask. Well, that 4% would be stored and saved in reservoirs. We would be the same amount of water that households use, allowing industries to save 25% on water costs, and making a small profit for Hyperion. Not a single party loses.



Treatment Process



Plant layout

Works Cited

"Cost of Water." *Cost of Water*. N.p., n.d. Web. 10 July 2015.

"Hyperion Treatment Plant Sludge-Out, United States of America." *Hyperion Treatment Plant Sludge-Out*. N.p., n.d. Web. 10 July 2015.

"Sand Filters." *Sand Filters*. N.p., n.d. Web. 10 July 2015.

"Sewage Treatment Process." *Region of Durham*. N.p., n.d. Web. 10 July 2015.

"Slow Sand Filtration." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 02 May 2014. Web. 10 July 2015.

"Wastewater Treatment Process." *Wastewater Treatment Process*. N.p., n.d. Web. 10 July 2015.