EVERFLOW: Oceanic Cascades below the Horizon

*"The cure for anything is salt water: sweat, tears, or the sea."*

 *-Isak Dinesen*

 It is estimated that 97% of the Earth’s water is saline- only a mere 3% is freshwater. The distribution of this potable water is becoming increasingly disproportionate with changing climates. There is no wondering why the desalination of seawater and purification of storm water have become so popular. Current technologies can certainly address the shortage of drinking water- we`ve estimated that we could produce up to 60 million gallons of fresh water a day given the sheer size of the site. However, creating a mesmerizing abundance does not ultimately solve the problem of the drought; it allows us to cope with it.

 The pier site for the competition not only has the saline sea water but also three storm drains that pour out into open waters. This storm water is a source of water pollution with contaminants from urban runoff, pesticides, sediments, oil, and trash. Additionally, incompletely treated sewage was being dumped into the bay up until 1985. According to reports, swimmers and surfers contracted rashes and respiratory or gastrointestinal illnesses. There were also dead areas in the bay where marine life could not flourish due to the lack of oxygen. Fish had fin rot and local dolphins even had tumors. Although many efforts have been implemented to improve the quality of storm water and the ocean it flows into, people still can get sick swimming in runoff contaminated water after rainy days.

 The vast ocean, which was once thought of as an unusable resource, will soon be turned fresh in vast quantities. However by sufficiently coping with the shortage of water, we will forget where the water comes from or how it becomes contaminated and by whom. Our understanding of water will be reduced to “saline and dirty” VS. “fresh and clean”.

 We have realized from our preliminary research that producing energy would not be an efficient and advantageous function on the site. Given the climatic conditions and the professionals we talked with, the team decided to focus on the challenge of providing clean water.

 Our project will demonstrate the vast range of uses for different concentrations of water- that the seawater we so commonly view as unusable can be a crucial resource, even without having to desalinate or filter it. Rather than a mechanical intensive technology we have resorted to a permaculture of diverse species of algae and halophytes (salt-plants) that is anticipated to be as effective and more environmentally conscious. Our team was also passionate about the idea of renewability, rather than sustainability, where the recharge of resources over human time frames approximately equals withdrawals and discharges from both anthropogenic and natural processes. Excessive withdrawal of sea water may deplete, create subsidence, or affect the quality and quantity of adjacent water bodies.

 Current desalination and filtration plants face many difficult challenges. First and most important is the collection of water. For a typical desalination plant water intake is mechanically pumped from the seabed- a process which is estimated to kill billions of juvenile-stage fish and invertebrates. Large volumes of ocean water containing organisms are subject to impingement and entrainment. Impingement is the pinning or trapping of organisms against the screens or filters of the intake pipe. Entrainment is when organisms are drawn into the piping. Additionally, modern filtration methods are so effective in removing contaminants that it requires an extra process where minerals inherent in water have to be manually added back in as demineralized water can cause harmful nutritional deficiencies. Furthermore, resorting to mechanical technologies also produces an equal amount of brine as fresh water. This byproduct, essentially concentrated sea water, cannot simply be dumped back into the ocean as it will disrupt the balance of salinity and put unexpected pressures on the ecosystem.

 **The Project**

 To deal with the idiosyncrasies of machinery, our project is conceived as a submerged void within the site that will naturally gather the water flowing in with rising tides or the height of the waves. This way, we would be taking surface water which is expected to have significantly less marine life. It will also allow the collection of any floating debris or trash for cleanup once inside the cascades.

 Inside, will be a field of terraced pools of varying sizes and depths. As ocean water enters the site, the pools will sequentially overflow and fill up. Shallower and wider pools will tend to contain more halophytes for desalination. This is to increase the surface area for halophytic desalination process. The use of halophytes also addresses the problem of brine production by having the plants store it within themselves. At exceeding levels of salinity the plants that are grown can be harvested as edible crops and new ones can be replanted. We have calculated that the project would generate up to 2 million gallons of potable water per year with 5 million gallons of grey water per year for various uses.

 Because algae prefer to bloom submerged in seawater the deeper pools will tend to contain more algae for purification purposes. Algae is commonly used in water treatment plants as a passive filtration system. The project does not generate energy directly. But to keep algal blooms in check it can be collected to generate ingredients for other industrial products or biofuel which can be used to support the local transportation system. The project also generates up to 1,000 kW of biofuel from algal biomass for fueling Santa Monica’s public electrical buses.

 We do not stress a direct one way process in desalinating and purifying the water. The water flow, and consequently the amount of usable water being produced, is dependent on the day’s forecast. Extreme weather conditions can even flood the entire site without significantly harming the plants and visually displaying the natural fluctuations of the sea. Consequently, the ability for the project to completely submerge itself will also serve as a breakwater to protect the pier. Ultimately, at the end of the process will be large pools of fresh water that can be connected back into the city grid. Water in mid-process can also be redirected via the network of pipes and injected deep underground as seawater injection barriers. Underground aquifers are being intruded by sea water due to reduced amounts of water resulting from excessive pumping for drinking purposes. In short, emptying aquifers are not sufficient in displacing sea water that is migrating inland. The aquifers can be recharged by injecting reclaimed water.

 By no means do we see our proposal as a revolutionary solution. It isn’t an idea that will fight climate change any better than hydropower or wind power. But when there is an overabundance of resources that are deemed unusable, it begs us to reimagine and reconsider the possibilities behind them; in this case, even polluted salt water can be a resource. If we rely on an efficient but inflexible process of water desalination and purification, we risk limiting our views and capabilities of such water.