Small Scale Living Machine Model

Living Machine At Islandwood, WA

Living Machine Full Scale Production

Species Observed in the DC Living Machine
These are very preliminary lists of the species observed so far.

Plants/Algae
1. hydrodyctyon (geodesic tube algae)
2. azolla (water fern algae)
3. duckweed
4. water pennywort
5. bladderwort (yellow flower)
6. frogbit/dogbit
7. water lettuce
8. water hyacinth
9. filamentous algae
10. algae spp.
11. arum arum
12. spikerush
13. wood nettle
14. rush sp. / sedge sp.
15. iris spp.
16. water willow (?)
17. low chordate leaved vine
18. millefoil
19. elodea

Fish
1. bluegill (6)
2. pumpkinseed (4)
3. gambusia (0)
4. goldfish (4)
5. plecostamus (0)
6. blue (?) catfish (0)
7. silver minnows / dace (sp. not yet identified) (14)

Snails
1. Physa spp. (2 spp.) -- small, brown fragile shells
2. Planorbis spp. (Ram's Horn)
3. Melanoides granifera -- black, conical, hard shell

Insects and Other Invertebrates

1. rust colored fleas/mites (springtails? [O. Collembola])
2. bluegray jumping aphids (also springtails?)
3. mosquito larvae
4. damselflies and larvae ([O. Odonata])
5. iridescent orange/green small flies (which may eat springtails; [O. Diptera])
6. wasps (several species -- black and pale yellow stripes; reddish brown and yellow stripes; plain black; iridescent blue-black; [O. Hymenoptera])
7. hornets (yellow and black stripes)
8. water beetles ([O. Coleoptera])
9. praying mantis
10. amphipods
11. cyclops

Birds
1. catbirds
2. sparrows
3. mockingbirds

Worms
1. water worm (bigger than nemotodes)
2. flat water worm (possibly a leech)
3. tube worms

Vertebrates
1. Will Hughes (sp. neighborus inquistivis, age 4)
2. Charlie Hughes (sp. neighborus inquistivis, age 2)

Living Machines

Theory:

The theory is that you can purify wastewater with living organisms rather than using traditional systems. Each step of the machine introduces new organisms that can digest or absorb particulates and contaminates rather than treat them with chemicals or using filtration systems.

Living Machine Using Freeway Offramp Unused Space

Dr. John Todd, Creator of Living Machines

Sources:
Hawken, P., H. L. Lovins, A. Lovins (1999). Natural Capitalism. Little, Brown and Co: New York.

Todd, N. & J. Todd (1984). Bioshelters, Ocean Arks, City Farming. Sierra Book Clubs: San Francisco.

Todd, N. & J. Todd (1993). From Eco-Cities to Living Machines. North Atlantic Books: Berkeley, CA.

http://web.mit.edu/12.000/www/m2008/teams/lastortugas/v_waste.html#livingmachine

Discover Magazine "Living Machines," Heros of the earthl; repairing the waters(movie).

www.clatsop.cc.or.us - Search Living Machine

www.enviroeducation.com

Overview

A living machine is a water treatment plant that uses living organisms instead of chemicals or machinery to purify water. Living machines get the majority of their power from the sun. A living machine (LM) contains many types of organisms including: invertebrates, vertebrates, higher plants. Most common animals are plankton, fish and mollusks like snails, these life forms are gathered from wild environments, or from living machines already at work.
Living Machines are made up of tanks that are connected together to form an engineered 'river'. The following six steps are in each living machine.

1. Anaerobic Reactor: The first step in the process, similar in appearance and operation to a septic tank (underground tank).
2. Anoxic Reactor: Low oxygen tank that encourages floc-forming and denitrifying organisms to remove a significant portion of the biomass.
3. Closed Aerobic Reactor: Used to reduce the dissolved wastewater and odorous gases and to stimulate nitrification.
4. Open Aerobic Reactors: Similar in function to a closed aerobic reactor, but instead of having a filter they have a layer of vegetation supported by racks.
5. Clarifier: A settling tank that allows remaining solids to separate from the treated wastewater, the solids are then pumped back to the closed aerobic reactor. The surface is often covered in duckweed to prevent algae from growing.
6. Ecological Fluidized Beds: An EFB consists of an inner and outer tank, the inner tank contains crushed rock or shaped plastic pieces that the wastewater is pumped through to encourage aerobic conditions. The second stage has a bubble diffuser at the bottom to prevent the rock medium from clogging, thus making it a fluidized bed rather than just a coarse filter.

At this point the wastewater is suitable for discharge to surface waters or a subsurface disposal system or reused as grey water for lawns and toilets.

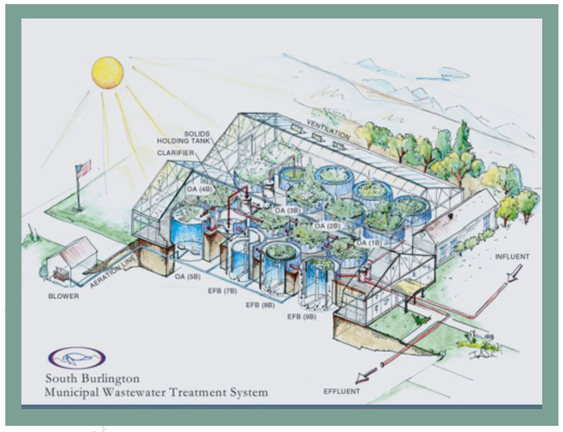

Diagram Section of a Living Machine

Cost

An independent study by the EPA concludes that water treatment by living machines is a lesser cost when system running at 40,000 - 60,000 gpd is used. Depending upon the size of the system savings range from $129,295.00 - $193,471.00. If the climate is warm enough a green house would not be required, thereby saving addition cost.

Good 'n Bad

The Living Machine is capable of treating various raw materials from industrial and municipal sources. Once through the machine the water can be used for agricultural purposes, toilet flushing, washing vehicles, and much more. Bio-solids and compostable plant material is the only waste produced by the living machine.
A disadvantage of the Living machine is its ability to remove influent phosphorous from solid wastes.

History

Designed By Dr. John Todd in the 70's as a way to deal with waste waters without such a heavy reliance on conventional means.

Created By:
Derek Lathrope
Randa Samms