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Clivus Composting Toilet Systems at Flag Staff Lake

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CLIVUS MULTRUM COMPOSTING TOILET SYSTEM

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EC278: *Joules to Dollars*
Colby College, 2015

Introduction

25% of water usage in American homes is due to flushing toilets. Older toilets can use 3.5 - 7 gallons per flush, while newer toilets use 1.6 gallons per flush. Further, conventional waste treatment systems negatively impact the environment by mixing large amounts of water with excreta and discharging excess nutrients and toxic household chemicals into bodies of water which often results in habitat destruction. Composting toilet systems are an alternative to traditional toilet systems that cut down significantly on water usage and energy costs associated with traditional systems. In the Clivus Multrum Composting Toilet (Figures 1 and 2) nutrients in excreta become available for sustainable reuse in agriculture and toxic substances are kept out of excreta. The simple and effective design of the Clivus system has allowed it to be used in homes, parks, and commercial buildings as a sole method of treating toilet waste. Increased installation and usage of Clivus Systems throughout the country could significantly cut down on water and energy usage associated with both public and private toilet systems and reduce the harmful ecological impacts of conventional waste treatment systems.

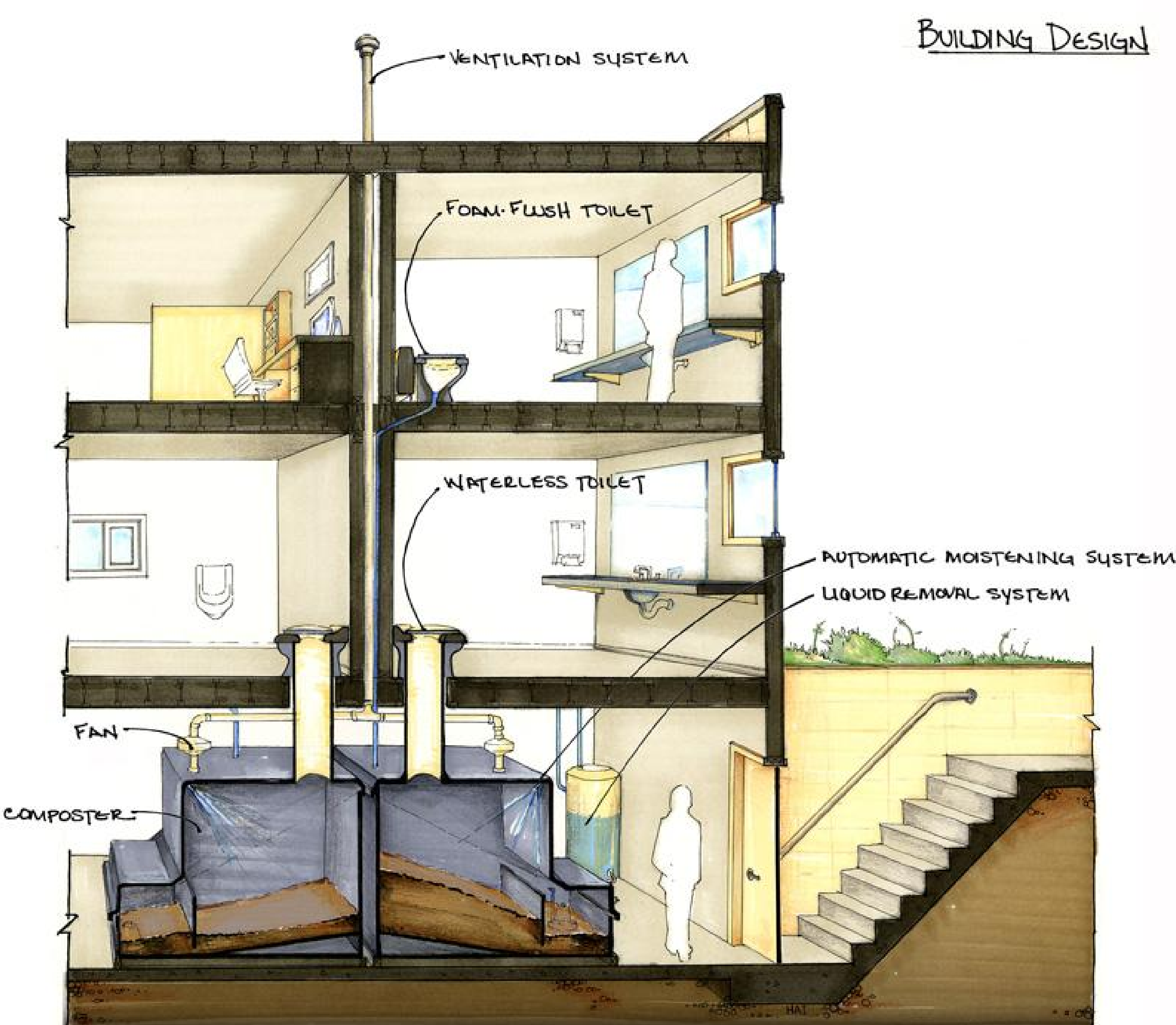


Figure 1. Schematic of a Clivus System installation plan for a building.

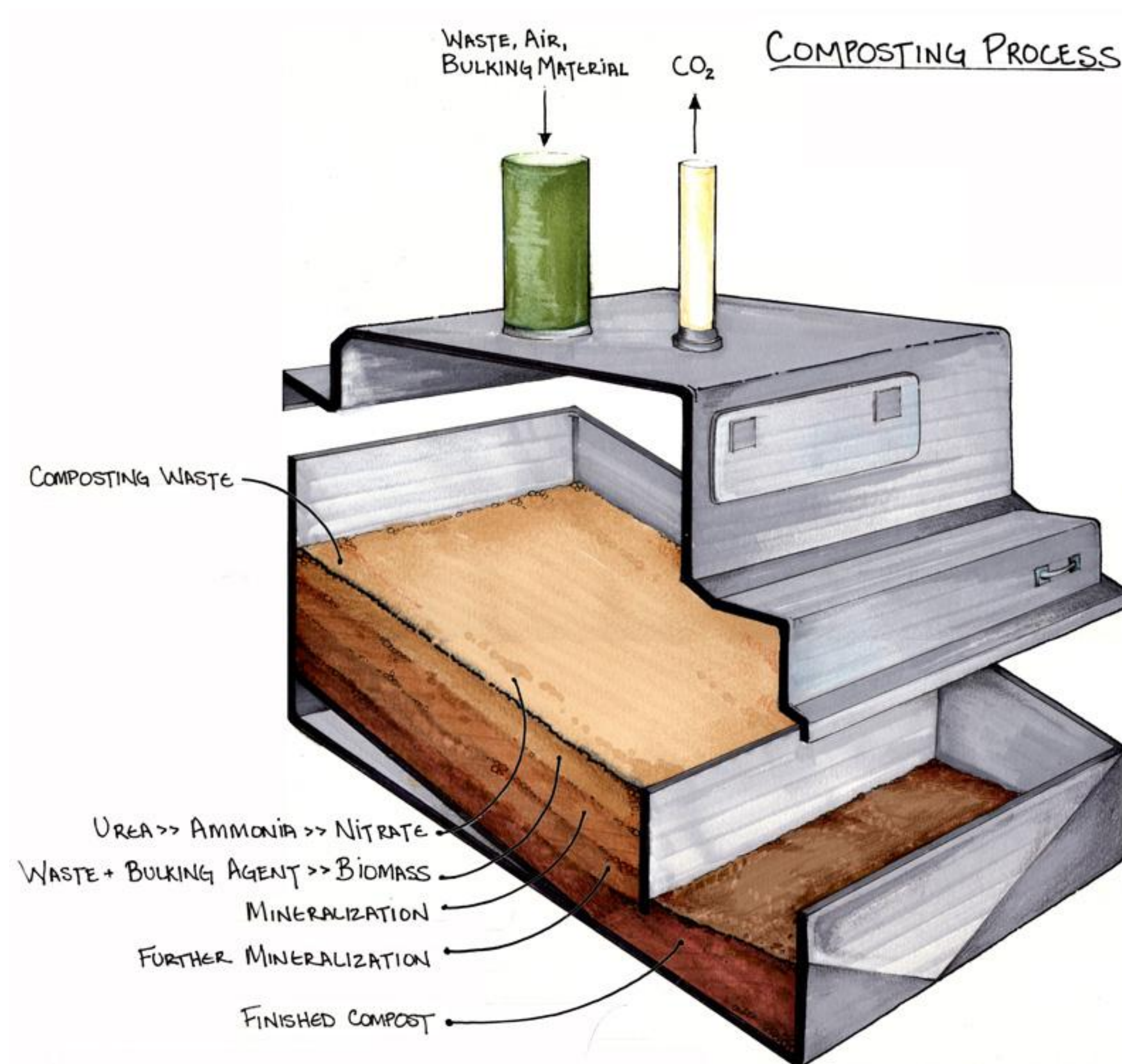


Figure 2. Composting chamber of Clivus System.

Application

The Clivus system is flexible and can be used for many different purposes. It is suitable for household usage (eg. Flagstaff Lake Hut) as well as commercial structures (eg. offices, retail and manufacturing buildings). The system can also be chosen for outdoor areas since it is designed to handle large crowds and shock loading far better than traditional water borne system due to the reduction in sheer total volume (eg. public highways, parks). Clivus also has a broad range of experience with permitting and regulatory issues, which often arise in locations where the technologies are unfamiliar, so the system can be installed very remote locations. The systems also work extremely well at seasonal only facilities with little start up and shutdown maintenance. Clivus has been implemented in many locations, e.g: The Bronx Zoo (NY), Telluride Ski Resort (CO), University of Georgia (GA), Kansas City Structural Steel (MO), YS Estate (Jamaica), etc...



Figure 3: Clivus at Hershey Links Golf Course, PA

Discussion

TECHNOLOGY (Figures 1 and 2)

Blackwater:

Aerobic decomposition breaks down both urine and feces into stable compounds within the composting unit which is made of polyethylene. The compost chamber slopes in order to separate urine from feces and gravity moves urine to the lowest point (anaerobic), where its unstable compounds, urea and ammonia, are broken down by bacteria into nitrite and nitrate. The resulting liquid end product is generated at about one gallon per every 20 uses and can be used safely and effectively as fertilizer.

Alternatively, feces remain in the aerobic environment which includes bacteria, fungi, insects, and red worms (added manually) that break down the matter, reducing the volume by over 90% and resulting in a compost material effective for topsoil.

The chamber remains below 100°F, and CO₂ gases and water vapor are pulled through the system's vent stack by a continuously operating fan. Pathogens die due to the non-aqueous environment and competition for nutrient resources as well as predation by other organisms in the environment.

Greywater:

Wastewater from washers, showers, sinks, and dishwashers decomposes much faster than blackwater and achieves chemical stability faster, but requires treatment within 1 - 2 days of production, thus cannot be stored in holding tanks. Therefore, the Clivus system releases greywater into the aerobic layer of the soil to fully stabilize the liquid by the same processes as those to decompose the urine.

ENVIRONMENTAL ADVANTAGES

1. **Reduce water usage** from conventional toilet systems that use water when flushing toilets, through plumbing systems, and during waste treatment.
2. **Reuse nutrients from excreta** which become available for agricultural use, which in turn reduces fossil fuels, a major ingredient in the production of chemical fertilizer.
3. **Reduce usage of toxic chemicals** including toxic household chemicals dumped into toilets which ruins excreta for reuse as well as the thousands of chemicals from conventional manufacturing processes.

Conclusion

Clivus systems should be used on a larger scale since it is a great method to protect and conserve water and soil. Conventional on-site waste treatment systems misuse water and create pollution. Composting systems reduce water used for flushing by over 97%, compared with 1.6 gallons per flush toilets. They turn waste into stable dry and liquid end-products useful as fertilizer. Greywater systems reuse wash water on site for plant irrigation. Thus, in new construction the combination of composting and greywater systems eliminates the need for expensive, invasive, and polluting infrastructure. By increased awareness and publicity regarding the advantages of a composting toilet system, new legislature that incentivizes (via rebates and tax credits) individuals and businesses to install composting system, and by increased advocacy and recognition of the importance of alternative energy systems as a whole, composting toilet systems could make an increased environmental impact in the US.

Resources:

1. ConserveH2O.org. "Toilets." <http://www.conserveh2o.org/toilet-water-use>
2. ClivusMultrum.Inc. "Science and Technology." <http://www.clivusmultrum.com/science-technology.php>