

**Growing Greener  
Vermicomposting  
Project Report**  
8/09/04

**Overview**

Granville Township Sewer & Water is going to treat dewatered biosolids from aerobic digesters using large-scale vermiculture (earthworms). After the earthworms have digested the biosolids the end product is called vermicompost, an environmentally sound product, which can be commercially sold and used as a soil amendment for turf, and to replenish poor soils and many other commercial uses.

Granville Township Sewer & Water has been utilizing the local landfill to dispose of the biosolids, a waste of a natural resource that could be recycled and save future landfill capacity. The announcement of closure of our local landfill forced us into developing different means of handling biosolids generated from our facilities. After a program of in-depth research we decided on the innovative and ecologically sound technology of large-scale, process-controlled vermiculture. The facility, designed by Vermitech, a company with experience in this field, is intended to treat all of the Township's biosolids into the future.

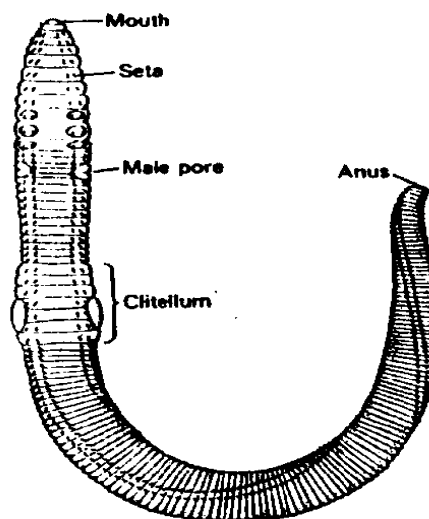
**How It Works**

Granville Township has constructed a facility at its Junction Sewage Treatment Plant to process 500 tons per year of sewage sludge, also referred to as biosolids. The facility will use vermiculture (earthworms) to transform the biosolids into a valuable and stable soil conditioner referred to as vermicompost.

**Background to Vermiculture**

Vermiculture is based on the use of hundreds of thousands of worms to process wastes such as biosolids. The worm-processed materials are referred to as castings or vermicompost.

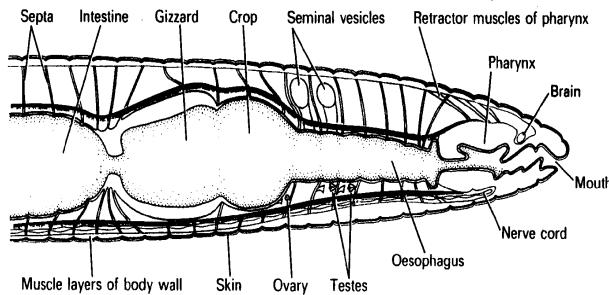
The worm's digestive system (Lee, 1985) consists of a buccal chamber, oesophagus, crop, gizzard and intestine. Earthworms rely on organic matter (such as biosolids), bacteria and fungi as a source of nutrition. Like birds, worms have a gizzard in which the food is ground to a fine consistency and then acted upon by a secretion of calcium carbonate. The food is next passed to the digestive tract for further processing by means of a variety of



enzymes, generated both by the worms and more importantly, by bacteria.

During the digestive process, a proportion of insoluble minerals are converted to a plant-available soluble form, Cellulose is partially broken down by bacteria and carbon is released to the atmosphere as carbon dioxide.

When the castings are ejected, they include bacteria and enzymes. Analysis of worm



castings (compared to the parent soil) reveals a major increase in bacterial count. Research has shown bacterial numbers contained in the ingested material increase whilst within the worm's gut. The number of these soil-benevolent bacteria in soils due to the presence of worms can exceed 5,000,000 per gram. The earthworms used in

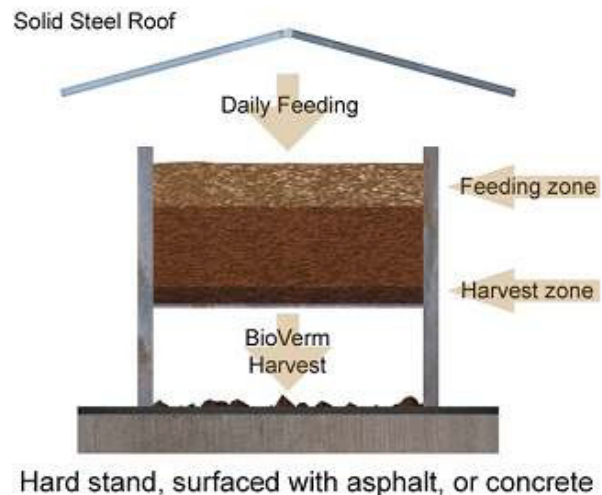
this process are of the family *Eisenia*.

### The Vermitech System

Vermitech is an Australian company that utilises a continuous flow system comprising:

**Beds:** The core of the technology is an open top, steel vessel or bed in which the worms are housed. The beds in the Granville facility are 32 yds (29 m) long.

**Mixing and feeding equipment:** A controlled blend of waste is fed to the surface of the bed on a regular basis. The worms consume the waste in and around the top region producing vermicompost. Preparing the waste to make it worm accessible has required the development of mix formulae, mixing systems and mechanisms for spreading the material onto the surface of the bed. The vermicompost is removed from the base of the bed, using specialist equipment developed by Vermitech. Harvested material is dried, screened and dispatched following a quality assured testing process.



**Worms stay within the bed:** The worm's stay at the top of the bed until they die, although a small percentage is lost during harvesting operations. In industrial systems, life expectancy can be up to 2 years, at which time they are removed from the base of the bed and simply become part of the vermicompost.

**Worms maintain the eco-system balance:** Much like wastewater activated sludge, the earthworm system retains a population balanced to the incoming food. The population

will increase up to the point of food and space constraints. The process is extremely flexible and robust, but consistent productivity of the system relies on process control and ensuring that feedrates are matched to process and environmental parameters.

### **Quality Control**

The Quality System is based on the principles of HACCP (Hazard Analysis Critical Control Point) program in accordance with the internationally recognized Codex Alimentarius Method of the World Health Organization. HACCP is a management system that is designed to:

- identify potential hazards,
- nominate preventive measures to stop them from occurring,
- monitor these areas and
- formalize action plans if a hazard is identified (in combination with plans to prevent re-occurrence).

HACCP programs are standard practice for the Food Manufacturing Industry and offer benefits for Biosolids management systems: HACCP is:

- a preventative system which moves from reactive quality control to pro-active quality assurance
- Targets resources at the most critical parts of a process
- Defines process parameters closely and assigns responsibility for monitoring

### **End Product**

Vermicompost is rich in nutrients and soil friendly bacteria and has been found to significantly increase crop yields in agriculture. Using vermiculture for the treatment of biosolids represents a shift from the traditional approach of the disposal of biosolids to a fully sustainable solution that treats biosolids as a resource.

The process, which involves a number of steps and incorporates earthworms (*Eisenia foetida*), commonly known as (Tiger Worms), stabilizes the biosolids and reduces pathogens. The biosolids are pressed into a mixer where a small quantity of wood chips are added to act as a structural agent providing air pockets in the biosolids. The worms then go to work consuming the biosolids or the promoting beneficial bacteria. After the worms do their thing the vermicompost is dried, screened and stored until tested for compliance with the facility permit.

Vermitech's several years of experience with the technology overseas has shown that it produces end product meeting the standards of Class A pathogen and vector attraction reduction. Granville also expects that the material, due to its pollutant levels, will also satisfy criteria for Exceptional Quality biosolids. The Township plans to sell the high quality vermicompost to local users for value and use the funds to offset the costs of construction and operation.

The Federal Environmental Protection Agency and The State Department of Environmental Protection are currently assessing the facility and the process. In the meantime the Township is permitted to provide the Mifflin County Landfill with all the end product material as a soil amendment until such time as Federal & State approval is obtained.

### **Reported Advantages Over Conventional Technology**

Being a natural process, vermiculture offers many environmental benefits, producing virtually no dust, leachate or odor. Since the process does not involve heat or mechanical agitation, energy use is also kept to a minimum. Research has shown that the system also produces significantly lower greenhouse gas emissions than conventional landfill.

The end-product vermicompost is full of beneficial microbes and fungi, and provides proven benefits to soil health and crop yields and helps to reduce plant disease.

The Township plans to explore avenues for utilizing the vermicompost in the local agricultural market and so helps to reduce the amount of chemical fertilizers applied to local soils.

The process itself is cost competitive with other options available to the Township. Any sales of end product will provide additional benefit to offset the cost of treatment

Teaming up with the assistance of Vermitech, Granville Township is confident that the Vermicomposting operation (due to come on line in mid-2004) will provide financial stability for the future, while providing an alternative solution in resolving environmental issues utilizing biosolids.

### **Technology Verification and Usage**

At present Vermitech and Granville Township are performing tests on the process and preparing documents for submission to DEP & EPA for review and approval. A third party laboratory, Hoosier Microbiological Laboratory, a Nelap Accredited Laboratory located in Muncie Indiana, is performing most of the testing.

### **Sources of Additional Information**

Vermitech, a world leader in large-scale vermiculture, is providing the technology and equipment for the facility. Vermitech is based in Australia and in addition to delivering vermiculture equipment to Granville Township; Vermitech has six years of experience in the operation of vermiculture facilities and marketing vermicompost in Australia.

To contact Vermitech just email Shaun Ankers at: [shaun.ankers@vermitech.com](mailto:shaun.ankers@vermitech.com)

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