

EARTHEN ARCHITECTURE

Community-Built Earthen Building/Bio-toilet
Dufferin Grove Park
2007



What is it?

A composting toilet (also known as a bio-toilet) is a container that composts human waste instead of flushing it. It uses no water, very little electricity and produces usable compost after a number of years' use. One unit will be installed west of the the playground and wading pool, enclosed and protected by a small earthen building.

Why do we need it?

Toilet facilities: Identified in a safety audit over a decade ago and confirmed by parents ever since is the need for nearby toilet facilities to serve small children using the playground.

Learning opportunities: The toilet would function as a site to learn about environmentally-friendly waste management alternatives. And like the cob wall, this project will invite neighbours and friends of the park to become directly involved in the construction, and to learn about natural building techniques.

Resource management: This building method takes materials out of the waste stream and uses them to create structures. Examples include clay subsoil, surplus straw from farming, and concrete chunks from ripped-up sidewalks.

Community-building: Building the cob courtyard in 2005 opened many people's eyes to the power of working together and of using their own labour to create something beautiful. Many are eager to have another opportunity and this project will allow them to do so.

Why a composting toilet?

Because of the structure of the plumbing in the south end of the park, the city deemed toilet plumbing hook-up to be too expensive to consider at this time. As an alternative to a flush toilet, the Phoenix composting toilet is a completely self-contained system that does not require sewer or plumbing hook-up.

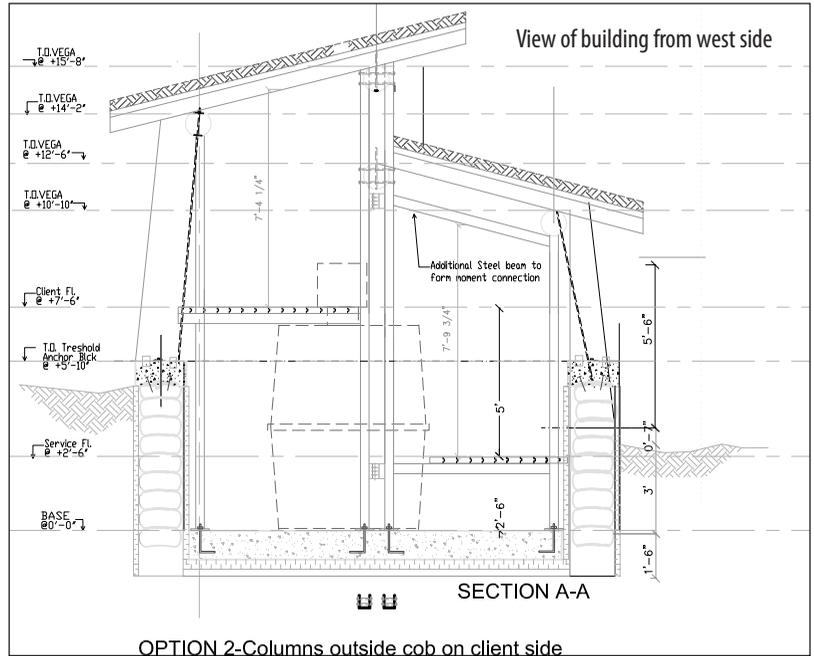
How does it work?

The system takes the form of a large bin with three sets of rotating tines inside it, and interior baffles to separate liquids from solids. Before its first use, the bin is filled two thirds full with wood

shavings, which act as a bulking agent and help the waste to compost properly. As the waste moves through the shavings, it is slowly digested, ending up as compost in the bottom of the bin. Often the first batch of compost is ready two years into the toilet's use.

Who authorized it?

The project is a partnership between Parks, Forestry & Recreation and park users. The city is providing resources and access to expertise, and park users are providing knowledge, fundraising and labour.



Does it smell?

As the material is integrated into the wood shavings, it loses its objectionable smell. The Phoenix composting toilet also has a robust fan inside the bin that draws air into the bin through the toilet seat and out through a venting stack. This aerates the pile to keep aerobic composting happening, as it is piles that are starved of oxygen that have an objectionable smell. It also results in slight negative pressure inside the washroom, keeping any smells from leaking into it.

How much use can it take?

In the summer, this facility is rated at approximately 100 uses per day. The manufacturer allows increases to this number for seasonal operations and for daytime usage operations (day time usage involves mostly liquids as opposed to solids). An automatic counter will be installed on the door so that staff can keep track of how much use the toilet is getting. If they have concerns about overuse, they will simply close and lock the facility until the toilet has had a chance to rest.

Are there any other emissions?

Since a vast majority of the input is liquid, most of what goes in ends up evaporating. The remainder of the liquid is pumped back over the bulking material to keep it moist and actively

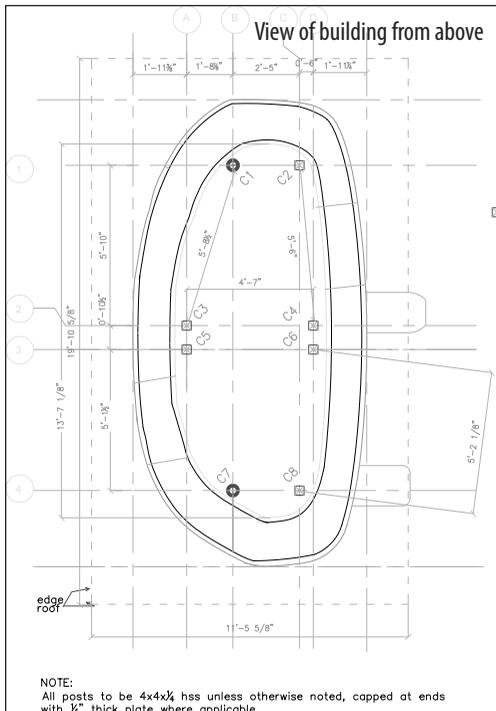
composting. In the case of excess liquid, the system is set up to output to an engineer-designed leaching bed. This is an ornamental garden with a tube running under the soil to where the leachate is pumped out. There it disburse high above the water table and the nutrients from it are allowed to back into the soil.

The Canadian Standards Association (CSA) has approved the Phoenix toilet. The Phoenix Facility Application Guide states that the leachate “generally has a low coliform indicator concentration ([cfu] (<200 org/100 ml), low BOD [biochemical oxygen demand], (<50mg/liter) and low TSS [total soluble solids] (<100 mg/liter) compared to septic tank effluent, so a short (10-foot; 3-meter) leach line is all that is necessary.”

The Phoenix leachate consistently tests at less than 10 cfu/100 ml; usually negative, which means undetectable. As a comparison, monitored swimming areas are required to not exceed 200 cfu (coliform forming units) per 100 ml of sample over a long period and 400 over 24 hours. Septic tank sampling would probably yield about 6,000,000 cfu/100 ml.

Who will maintain it?

To keep the toilet composting properly, the toilet needs weekly and monthly maintenance, which park staff will attend to. Keeping the room clean will be a joint effort between users and staff. Any misuse of the facility may result in its temporary closing to maintain its safety.



What would it look like?

This oval cob building will have plastered walls, stairs for access and a green roof. The foundation is of rammed earth (earthbags). Windows will be large enough to let in light and air, but small enough to prevent the passage of people. The walls will feature sculptures in bas-relief. As with the cob wall, participants will help to make day-to-day decisions on certain aspects of the design as they are working, and will therefore contribute to the eventual appearance of the building.

Where can I find out more?

- www.compostingtoilet.com/index.htm > Public Facilities Application Guide
- www.cobinthepark.ca
- <http://www.cityfarmer.org/comptoilet64.html>
- http://en.wikipedia.org/wiki/Composting_toilet

Responses to concerns raised regarding the earthen building/ bio-toilet facility in Dufferin Grove Park

Standards

Toilet: This toilet facility – the Phoenix 201 PF (Public Facilities) – is installed in several national and provincial parks in Ontario, as well as a number of YMCA camps. It is CSA approved, and is a well-accepted alternative to standard sewage or septic options where there is concern is about minimizing environmental impact and encouraging environmental stewardship.

Building: Engineers and an architect have been working with the project leader and Parks, Forestry & Recreation officials to procure a building permit for the installation.

Hand-washing: Although hand-washing facilities at the cob wall are located within the distance required by Public Health, those working on the project are looking into possibilities for portable hand-washing stations that might be suitable for installation inside the client room of the facility.

Size Impact

The building has been designed to minimize its visual impact on the park, and to blend in as completely as possible.

- The walls are curved, so the building takes up less space than a rectilinear building of comparable dimensions
- It is nestled in amongst trees, instead of out on the open green space
- The colour of its plaster will help it to blend in with the surrounding trees
- A clerestory roof (two distinct roof sections joined by windows) will minimize overall height
- A green roof will further integrate the structure into the park's greenery

Jurisdiction

Parks, Forestry and Recreation is working in tandem with park users to create this facility. Park users and friends are providing materials, the toilet system and labour to build the facility. PFR is providing materials such as it has available, (sand, clay, gravel), and is involved in permissions and facilitation. PFR will maintain the facility, while park users will maintain the building.

Evaluation

Effectiveness: Staff and park users will keep a close eye on the unit's effectiveness. Safeguards in place include:

- Slow, measured implementation: Can include opening the unit for short periods to start, to ensure that the unit is used below recommended capacity
- Ability to lock the unit down in case of misuse
- Monitoring use: Taking door counter readings will allow staff to monitor number of uses. If uses approach capacity on any particular day, the facility will be closed for the rest of the day.
- Watching for foreign objects: A door in the mechanical room gives access to the top of the compost medium, so that any foreign objects can be removed and disposed of. Standard equipment for this job includes a special rake, so that staff never touches the toilet bin's contents. This check is done before the pile is turned.
- Paying attention to potential odors: Any questionable emissions will mean closure of the facility to look into the problem.

Compost: A unit used year-round will likely have compost ready in about two years. It is possible that a seasonal-use facility such as this might take several more years than that to produce its first compost. Tests have shown that compost produced from this type of unit is safe for use on gardens, and indeed that is the intention of the unit's designers. Here however, compost from the facility would be destined for use on flower gardens only.

Day-time use: A toilet that is used only during daylight hours has, as a rule, fewer solid deposits than one available 24 hours a day. This actually increases the daily use threshold, although use will be kept under the published recommendations.

Additional units: The proposal of one unit is the culmination of several years of goodwill offered to the park from several parties, including anonymous donors. It is unlikely for this confluence of goodwill to occur again, so there is little expectation that another unit would be installed here, even if need proved to be great. The "several new cob structures" mentioned in the proposal refers to benches built on existing asphalt bench pads, many of which are missing their benches through age and/or use, and for which there are rarely funds in the Parks budget for replacement.

Unheated composting unit: Since this is a seasonal, warm weather facility, no heating is required. The toilet is closed through the winter.

Leachate: The manner of dealing with leachate is the same as is common in Ontario's many national and provincial parks where this facility is installed.

From the Phoenix installation guide literature:

After filtering through the compost pile, liquid receives secondary treatment in the well-aerated, stable, peat moss medium beneath the bottom baffle. The stability and tremendous surface area of peat provides

an excellent filtering medium for treating liquid. The amount of liquid discharged from the Phoenix depends upon the amount of use it receives, and the temperature and relative humidity of the ventilation air. Approximately 20 liters (five gallons) of liquid is added to the Phoenix for every 100 uses. Incoming ventilation air circulating above the secondary liquid treatment medium can evaporate some of this liquid. The remaining liquid draining from the tank should be directed to a leaching field.

This line will run into an engineer-designed leachate bed located immediately beside the structure. The line will be made of PVC weeping tile surrounded by filter cloth. It will be pumped there by a condensate pump which has a small reservoir and float switch and will pump the liquid up to the leach line. A garden will keep people from walking near the leach line, although the line will be buried and no evidence of it or its contents will appear above ground. The soil and plants will integrate the minerals; the liquid will evaporate and be used for plant growth.

At a maximum five gallons per 100 uses, it is exceedingly unlikely that this tiny amount of leachate would migrate laterally from the leachate bed, across the park, over the concrete collar and into the pool. Undoubtedly, there is already bacteria of many kinds already in the pool, but that comes from the pool's users, and a chlorination schedule is already in place to deal with it.

Currently, there is likely five gallons of liquid effluent per day being added to the trees around the southern playground by young children who cannot make the trek to the north washrooms without wetting themselves. A washroom close by would offer the chance to evaporate most of it safely, and give primary and secondary treatment to the rest of the leachate before dispersal.

Compost toilet installation at St. Lawrence Islands National Park, Ontario

Turning tines inside composting unit





Compost toilet installation at St. Lawrence Islands National Park, Ontario