Decentralized Urban Composting

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ABSTRACT

The NYC Compost Project Hosted by Big Reuse is a program funded by the New York City Department of Sanitation (DSNY), which features a community composting facility, located under the Queensboro Bridge in Long Island City, New York. The compost site uses a SG Mini™ System with GORE® Covers, which was developed by Sustainable Generation, and consists of a GORE® Cover placed over an aerated static pile. SCS Engineers (SCS) was hired to assist the NYC Compost Project Hosted by Big Reuse with the design and construction of their new site in 2017, which will increase the processing capacity to a maximum of 1,000 cubic yards of food scraps annually.

The NYC Compost Project works to rebuild New York City's soils by providing New Yorkers with the knowledge, skills, and opportunities they need to produce and use compost locally. The compost facility is part of a community-scale composting network. The finished compost is used in community gardens, street trees, and other public greening projects.

The following design and operations features are presented in this paper:

- New site design and layout
- Feedstock mixing
- Covered ASP system
- Turned windrows and screening
- Monitoring
- Working surfaces
- Grading and stormwater management
- Contact water management
- Electric utility service

PROJECT HISTORY

The NYC Compost Project Hosted by Big Reuse has been stewarding Western Queens and Northern Brooklyn since 2011. This program has worked to rebuild New York City's soils by managing and operating food scrap drop-off sites, processing collected material, and distributing finished compost through stewardship events and to neighborhood partners. Outreach and education play a primary role in all program areas, which fulfills the mission to provide New Yorkers with the knowledge, skills, and opportunities they need to produce and use compost locally. Over the last five years, the program has grown to host 14 food scrap drop-off sites, accept organic material from local partners (who manage food scrap drop-off sites) and from NYC Parks, and increase processing capacity to 1.3 million pounds in 2016

(see photos in Figure 1).

Food scraps are processed and turned into finished compost over a 4-5 month period. Appropriate and innovative small-scale composting technology has been incrementally and collectively developed to increase processing efficiency and address site constraints while keeping the site accessible and educational for the public.

The processing site is on NYC Parks Department land. The NYC Compost Project originally had informal permission to use an underutilized section of the NYC Parks compound in 2012 and, in 2016, signed a license agreement with NYC Parks to use and develop another section of the NYC Parks compound.

Figure 1. **Drop-off location; compost use; mixer at processing site**

REGULATIONS

The NYC Compost Project Hosted by Big Reuse operates a NYSDEC-registered facility.

A registered facility must be constructed and operated in compliance with the following conditions:

> (i) Material accepted does not remain on-site for more than 36 months;
>
> (ii) The process uses acceptable amendments or bulking agents and follows an acceptable method of composting that minimizes odor generation and results in a mature product;
>
> (iii) The facility is constructed to minimize any ponding on the composting area; and
>
> (iv) The facility is at least 200 feet from the nearest surface water body, potable water well, and residence or place of business.

Solid waste facilities in New York State are regulated under 6 NYCRR Part 360. Subpart 360-5, "COMPOSTING AND OTHER CLASS A ORGANIC WASTE PROCESSING FACILITIES", regulates the construction and operation of composting and other organic waste processing facilities for mixed solid waste, source-separated organic waste, biosolids, septage, yard waste and other solid waste. Some facilities may be exempted from Subpart 360-5 requirements, or be required only to "register" (similar to a general permit). Larger facilities are required to get an individual permit.

A summary of the types of compost facilities eligible for registration is provided in Table 1, as follows:

Table 1. Summary of Compost Facilities Eligible for Registrations

Process	Level of Materials Processed	Regulatory Oversight	Regulatory Citation
Composting	Yard waste: 3,000 to 10,000 cubic yards per year	Registration	360-5.3(b)(1)(i)
	Food scraps: Less than 1,000 cubic yards per year	Registration	360-5.3(b)(1)(ii)
	Food processing waste	Registration	360-5.3(b)(1)(iii)
	Animal mortalities or parts generated from a farm, slaughterhouse, butcher	Registration	360-5.3(b)(1)(iv)
	Dewatered solids from a registered anaerobic digester	Registration	360-5.3(b)(1)(v)

NYSDEC is currently in the process of revising Part 360-5 (including moving these rules to Part 361-3). The most significant changes from Part 360-5 to the currently proposed Part 361-3 would include an increase in the limits for food scrap composting facility registration from 1,000 cubic yards per year to 5,000 cubic yards or 4,000 wet tons per year (whichever is less). Facilities accepting ≤1,000 pounds or ≤1 cubic yard of source-separated organics per week would be exempt from all permitting and registration requirements. These changes were proposed primarily to facilitate community composting sites.

NEW SITE DESIGN AND LAYOUT

The new processing site layout (see Figure 2) occupies a 1/3-acre parcel and includes:

- Two *SG Mini™ Systems with GORE® Covers* designed by Sustainable Generation, approximately 20 feet by 50 feet, for Phase 1 of the process

Figure 2: Site Plan

- Turned windrows for Phase 2 and Phase 3
- Stockpile areas for feedstock and finished compost
- Equipment, including a skid-steer loader, mixer, screen, Toter® tipper, and food scrap containers
- Working surfaces
- Stormwater and contact water management features

FEEDSTOCK RECIPE AND MIXING

Food scraps are collected in 64-gallon Toter® carts on wheels and delivered to the processing site in a box truck, equipped with a lift gate. Wood chips and leaves, which are the primary bulking agents and carbon source, are delivered from the NYC Parks Department and help to absorb excess moisture and odors.

The mix recipe is 1 part wood chip: 1 part leaves: 2 parts food scraps, with some seasonal variability. This recipe achieves a starting carbon to nitrogen ratio of approximately 27:1, moisture content of 60-65%, and a bulk density of 800-1000 pounds per cubic yard. These conditions create the optimal mix for aerobic decomposition in this system.

Toter® carts are emptied into a vertical feed mixer, a self-propelled Jaylor A100, using a Toter® tipper. Wood chips and leaves are loaded into the mixer using a skid-steer loader. The two augurs in the mixer chop and blend the recipe. Site operators empty the mixer to create a pile that can be easily scooped up by a one-yard bucket attachment on the skid-steer loader.

COVERED ASP SYSTEM

The next step is to put the mixed feedstock onto a Phase 1 Aerated Static Pile, a *SG Mini™ System with GORE® Covers* (see Figure 3). This system includes an aeration trench connected to a "mobile unit". The mobile unit contains a blower and a computer that connects to oxygen and temperature probes. The temperature probe monitors temperatures in the pile to ensure temperatures are being reached that will reduce pathogens. In "Oxygen mode", the oxygen probe activates the blower based on oxygen levels inside the pile. The blower forces air through the pipe and the perforations, and into the pile. This provides the microorganisms with oxygen (aerated) without having to turn the pile (static).

The *SG Mini™ System with GORE® Covers*, utilizes forced aeration, coupled with a semi-permeable membrane cover, to achieve an encapsulated composting process. This system prevents pest issues, helps mitigate odors, holds in water vapor, collects contact water, and sheds stormwater, addressing many of the common issues of managing all scales of composting sites.

The GORE® Cover laminate prevents odorous gases from escaping the compost pile. A fine film of condensate on the inner side of cover develops during composting that traps these gaseous substances. These mostly dissolve in the water film and drip back into the pile, and continue to be broken down by the composting process. (Gore, 2007)

Contact water or leachate is collected under the compost pile by an in-ground trenching system, which is also used to deliver air to the composting process. The contact water is directed by drainage piping to a holding system for reuse.

The Phase 1 windrow will be built in about three weeks and will then remain on aeration for

another four weeks.

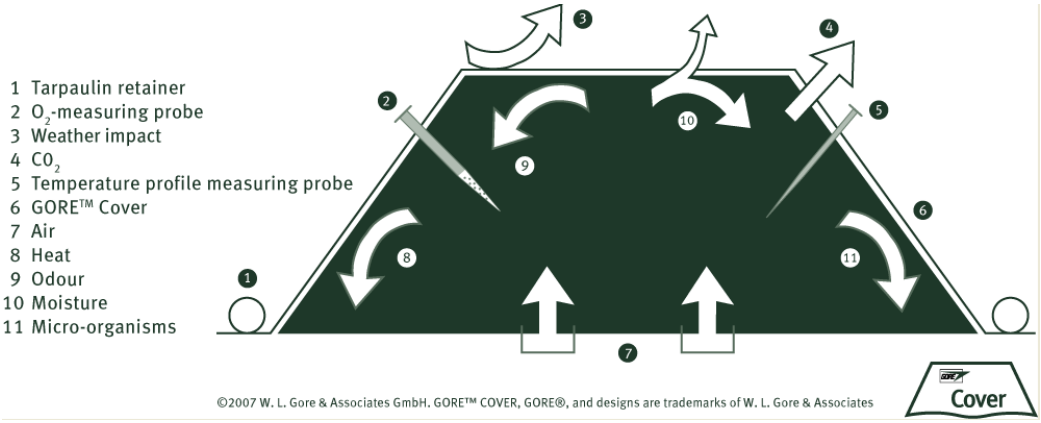

Figure 3. **G O R E® C o v e r S y s t e m**

TURNED WINDROWS AND SCREENING

After 7 weeks, phase 1 is taken off aeration and moved to an uncovered phase 2 location using a skid steer. After phase 1, food scraps are no longer recognizable. Phase 2 is managed by aerating the edges with a forklift attachment for three weeks and then turning the entire pile into a phase 2b location during the fourth week. Turning the windrows ensures that material on the outer edges is incorporated into the middle during processing. Phase 2b is then turned into phase 3 where it is minimally managed with forklift aeration for three weeks and then screened (see photos in Figure 4). Temperatures above 131 F continue to be reached throughout phase 2 and 3. Screened material is still fairly active and is stored in a curing pile for another 2-3 weeks before it is distributed to partners and community groups.

Figure 4. **Screening process and final bagged product**

MONITORING

Compost project staff are on site on a daily basis to perform operations and monitor the site and compost (see Figure 5). Batches are tracked for temperature and follow state and federal regulations to meet the Process to Further Reduce Pathogens (PFRP). Before distributing, the maturity of the compost is evaluated using a Solvita test. Two batches per year are tested using the US Composting Council's Seal of Testing Assurance Program, a program designed to standardized compost testing for compost producers and users.

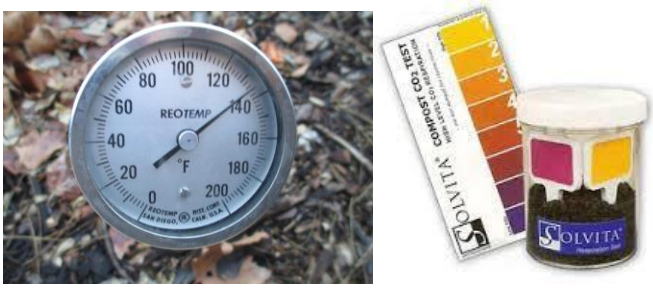

Figure 5. **Temperature probe, Solvita Maturity Test**

WORKING SURFACES

SCS designed the working surfaces for all areas, including:

- Receiving and mixing
- Concrete for the active composting area for SG Mini™ System with GORE® Covers
- Turned and curing windrows
- Finished compost storage area
- Carbon storage area
- Incoming roadway, including Con Edison access area

GRADING and STORMWATER MANAGEMENT

SCS subcontracted with a New York-licensed surveyor to survey the new site. SCS then designed site grading and improvements for proper drainage and stormwater management. Stormwater control features were designed to prevent run-on to the facility site and to control the runoff volume.

Since the site is largely under the Queensboro Bridge, there will be limited direct stormwater run-off. Downspouts from the bridge discharge near two of the bridge support structures and will be managed by the NYC Compost Project Hosted by Big Reuse. The design directs the north downspout run-off to the south downspout, then to the south of the site (see Figure 2). A rain garden will be installed to manage the combined run-off in late 2017.

CONTACT WATER MANAGEMENT

Water/leachate that drains from the covered heaps is directed to leachate containment on the east side of the site. The contact water is used on site to wet the incoming leaves and wood chips.

All other contact water related to Phase 2 and Phase 3, as well as the stockpiles, will be managed as stormwater and will drain to the rain garden.

DESIGN CONSTRAINTS AND PREVENTING COMMON ISSUES

The primary constraint of the composting site is proximity to neighbors. The site technology, infrastructure, and systems are designed to address common issues associated with compost processing sites. The proximity to a dense residential neighborhood allows little tolerance for these issues and site operators strive to maintain a clean, attractive, odor and pest free site to avoid perceived or real nuisances to neighbors. As a small-scale community composting site

focused on processing local organics to educate and benefit the surrounding neighborhood, we are less subject to some of the perceptions and issues that larger scale facilities must combat.

Common issues associated with compost sites include the following:

- Pests
- Odor or the perception of odor
- Contact water impacts

Using the Gore cover, processing and aerating during weekday work hours when few people are at home, adjusting the recipe to reduce leachate, and designing the site so the most finished phase is closest to residential neighbors are practices used to reach these goals. As previously explained, the *SG Mini™ System with GORE® Covers* mitigates odors and prevents pest issues by encapsulating all fresh food scraps.

Contact water and stormwater, as mentioned above, are managed by leachate containment and grading that directs water to ornamental gardens on site.

Another constraint that is addressed by the design is limited area. The new site has increased work surfaces which simplifies the tasks of managing incoming browns and greens, outgoing finished compost, space for trucks and equipment to maneuver, and Toter storage. Adding an additional ASP system with a bunker allows for higher volume piles using the same footprint. These two factors increase throughput capacity while maintaining space for public education, tours, and workflow.

According to a report on community composting from the Institute for Local Self-Reliance, "Despite the many compelling drivers to support community-based composting, a number of obstacles to widespread implementation of decentralized systems exist, including:

- increasing consolidation and vertical integration of the organics recovery industry;
- lack of training programs and best practice toolkits for small-scale composting;
- difficulty in finding adequate land for composting operations;
- securing the proper mix of ingredients for optimal composting conditions;
- having trained staff adequately maintain the composting system;
- regulations that impeded community-based operations; and,
- lack of equipment designed for small-scale operators.

Local and state government policies are needed to overcome lack of a decentralized and diverse infrastructure, and other obstacles to diverting organic materials from disposal through locally-based systems."

ELECTRIC UTILITY SERVICE

Electrical service was provided to power the blowers that are part of the GORE® cover system.

PERMISSIONS

Figure 3 is used by permission from W.L. Gore & Associates.

APPROVALS

Approval has been obtained from SCS, DSNY, and Big Reuse to submit this paper.

CONCLUSIONS

According to the report, "Growing Local Fertility: A Guide to Community Composting", "Currently there is a lack of infrastructure to process food scraps. What is needed is a highly decentralized and diverse organics recovery infrastructure that prioritizes food rescue, backyard composting, small-scale locally-based community composting, and urban and rural on-farm composting before the development of centralized regional facilities. Communities embracing such an infrastructure will be more resilient and will better reap the economic and environmental benefits that organics recovery has to offer."

The composting site developed and managed by the NYC Compost Project Hosted by Big Reuse is consistent with this recommendation. It is a decentralized, urban composting system that is sustainable and viable for urban settings and helps to advance the technology and equipment needed for sites of this scale. Similar processing sites could be sited and operated across New York City. Organics comprise 31% of New York City's waste stream, and a significant portion can be composted locally and returned to the environment to support green spaces. Decentralized community compost operations are part of the solution to recycling food scraps and diverting this material from landfills. Medium-sized community composting sites can exist in dense urban settings because they are neighborhood assets, as education centers, green spaces, and compost sources for community greening projects. With well-designed systems and appropriately-scaled equipment, they can be managed so that no odor or pest issues are created. These sites reduce carting distances and serve as an impetus for changing local land management practices by making high quality compost abundantly available.

REFERENCES

W. L. Gore & Associates, 2007.

Growing Local Fertility: A Guide to Community Composting, Institute for Local Self-Reliance and Highfields Center for Composting, Brenda Platt, July 2014.

New York State Department of Environmental Conservation (NYSDEC) regulations, 6 NYCRR Part 360-5: Composting and Other Class A Organic Waste Processing Facilities.