

WSWMD's Compost Facility Expansion and the Mini MERP





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A Little History of Composting and Heat Capture...

Compost and Us



Composting and similar practices have been around as long as humans have practiced agriculture

- **Evidence from ancient Scots shows that crops were grown in heaps of manure. The crops grew better in these heaps so the the tradition carried on.**
- **Today's recipes for soil building can be complicated, but for the most part good crops can be grown using the same methods employed over 7,000 years ago!**
- **Every culture has their own preferred/available feedstocks. For example:**
 - **Coastal First Peoples used, and use today, a lot of fish**
 - **Irish peoples used a lot of salt hay**
 - **Every culture with livestock has used manures**

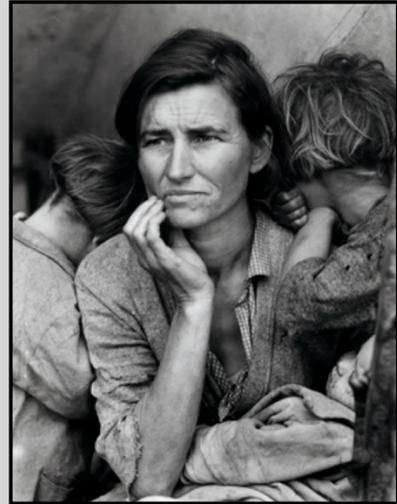
The ingredients representing carbon and nitrogen inputs might be different but the result is the same: healthy, enriched, absorbent soil



Compost Booms and Busts in the US

1900s to the 70s

Compost Pause: The Industrial Revolution brought with it vehicles reducing the need for oxen and horses... reducing the amount of available manure as well.

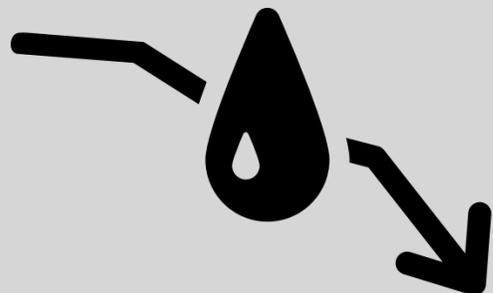


During the 1930's massive losses of topsoil became apparent in the US leading to rethinking how we use (or don't use) our organic wastes. In the same time period, information from India's Indore's region helped folks to utilize plant and animal wastes for agricultural fertility as well as water capture.



Victory gardens 1940's: Fertility at home made from the home led to flourishing gardens.

Haber-Bosch Nitrogen: Widely available synthetic fertilizers reduced the perceived need for compost yet again.



Desperation: The 1973 and 1979 oil crises led to innovation of heat capture from compost piles.

Not *Just* Healthy Soil

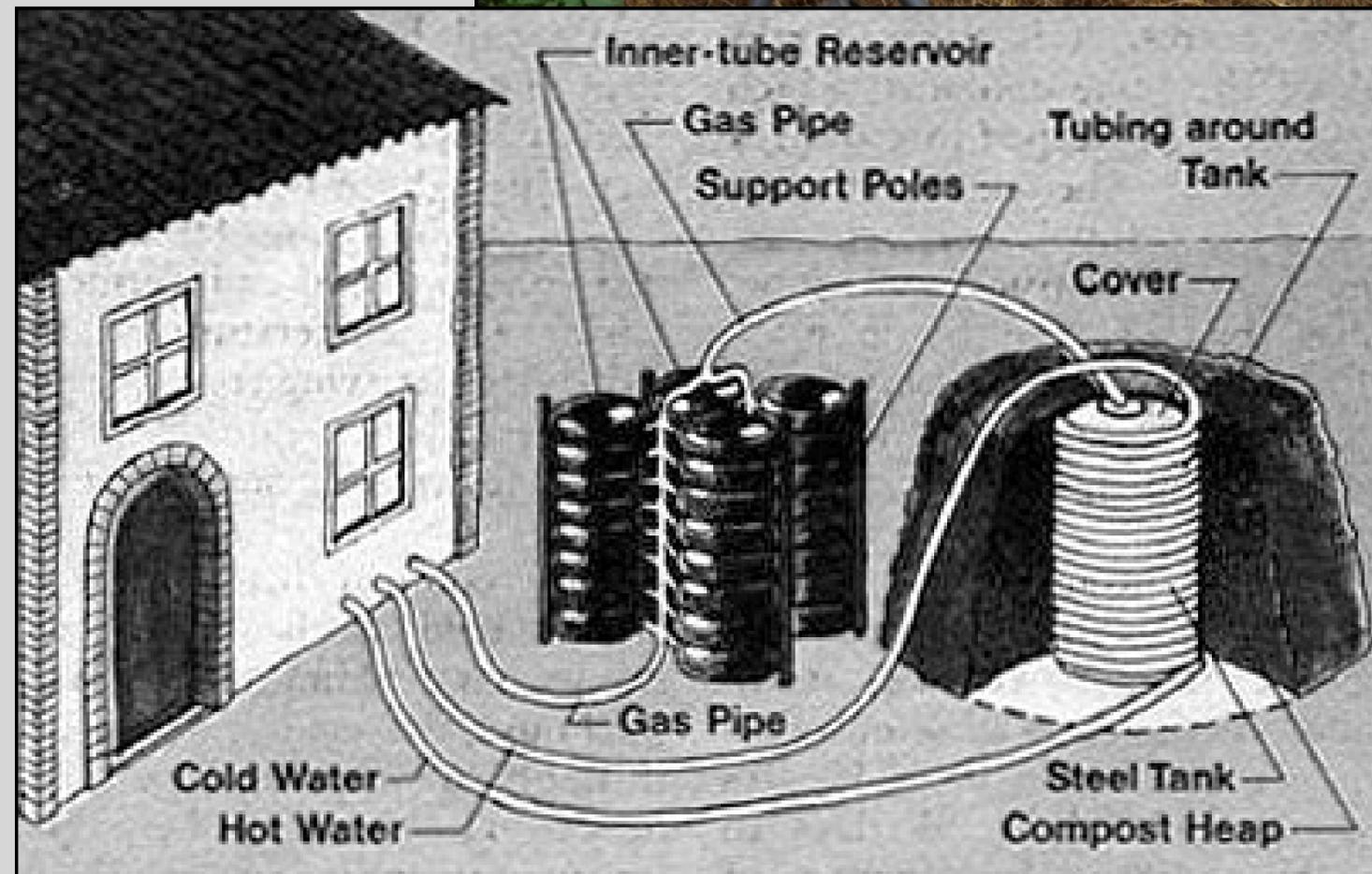
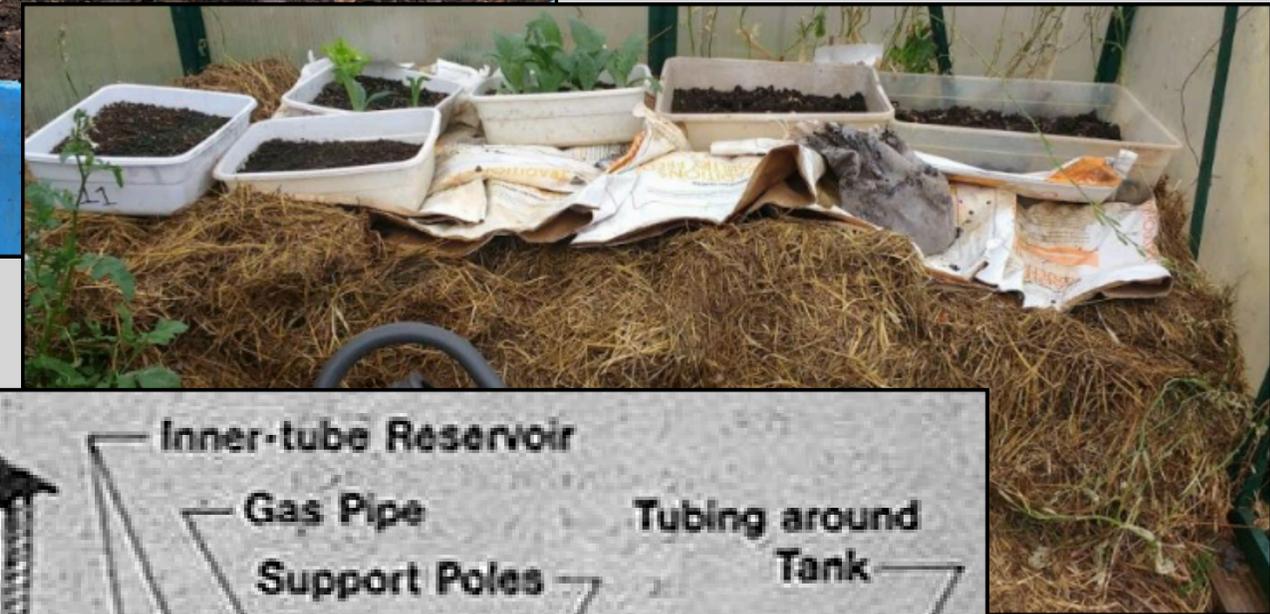
*In addition to bioavailable nutrients,
composting produces HEAT*

Early, passive heat capture was used to keep crops warm which speeds up germination

As time went on and ideas flourished, glass houses were employed to retain the heat generated from decomposing manure/greens which supports heat-loving crops

**Then we got really groovy with rudimentary piping which allowed for water heating
(Thanks Jean Pain!)**

In essence, the pipes are weaved through an active compost pile and water flowing through would heat up to allow the use of hot water near the active compost pile



Hot Compost

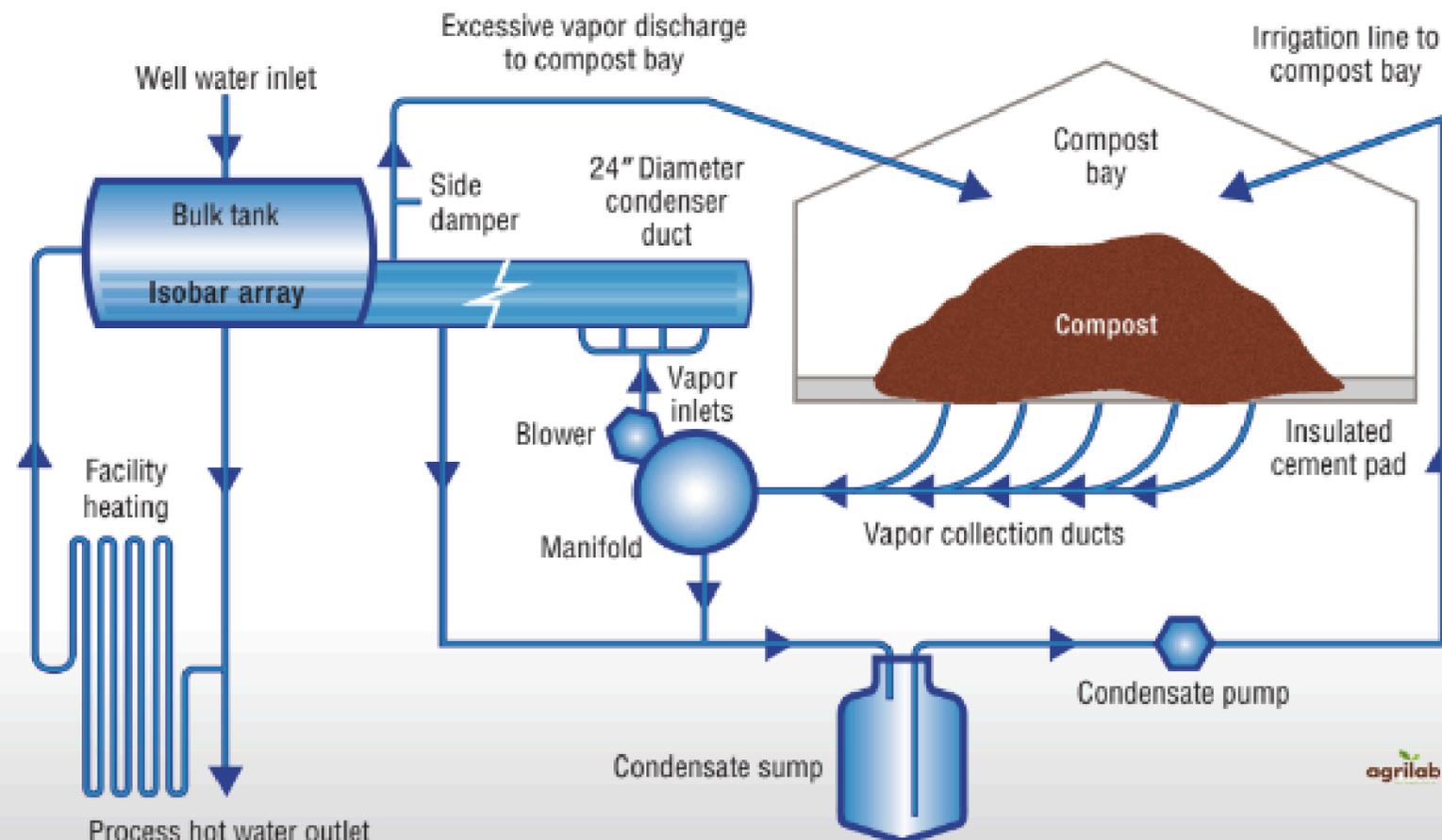
Piping water through a hot compost pile will capture thermal energy that can be used elsewhere (i.e. radiant heat).

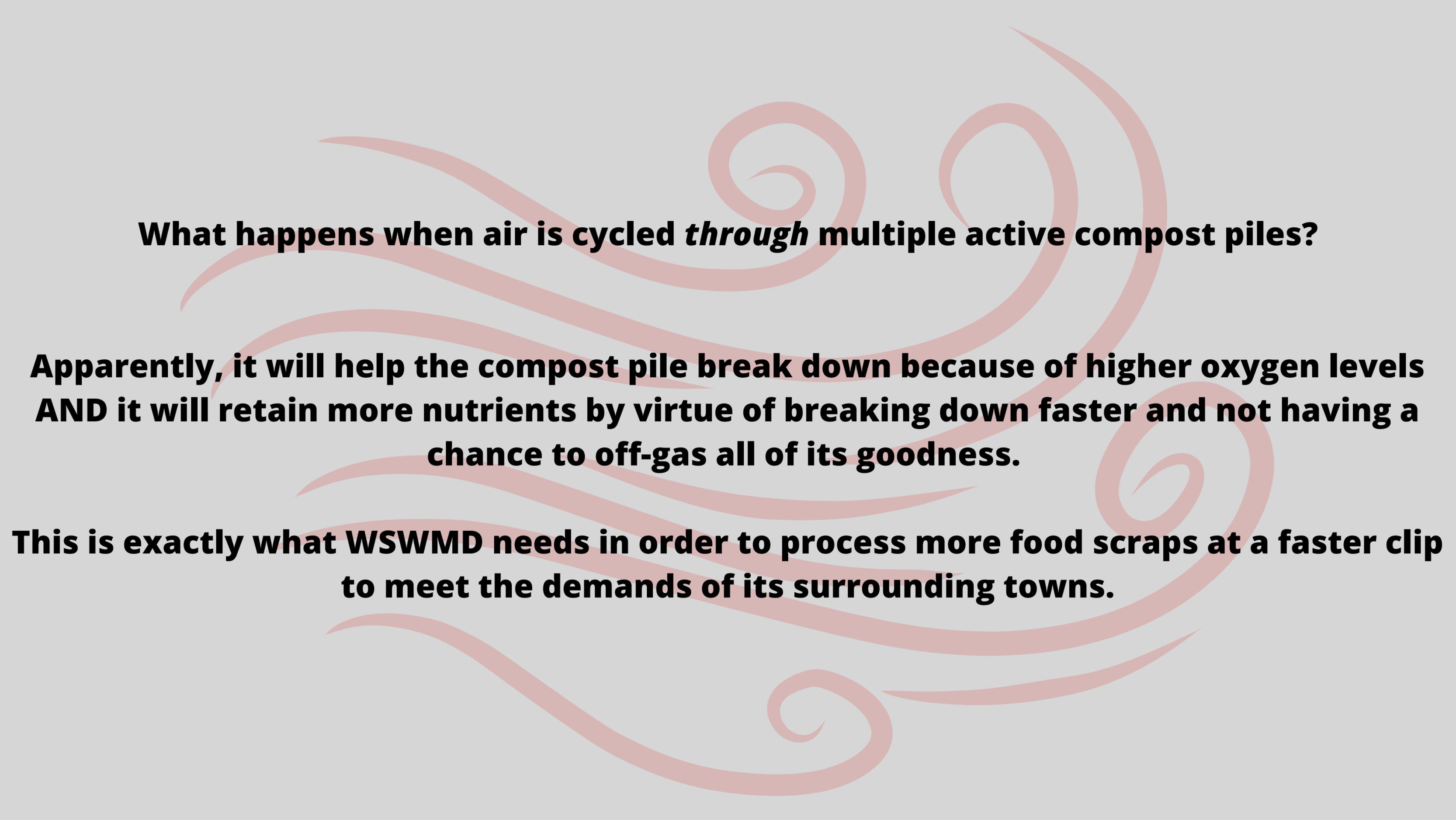
This can also be done with air.

Imagine:

- **Fresh air enters tube that travels through hot compost pile.**
- **Air heats up as it is forced through the pile.**
- **Tube of hot, clean air exits compost pile and travels to a destination of your choosing delivering warmth where you need it.**

FLOW DIAGRAM OF A CAHR SYSTEM





What happens when air is cycled *through* multiple active compost piles?

Apparently, it will help the compost pile break down because of higher oxygen levels AND it will retain more nutrients by virtue of breaking down faster and not having a chance to off-gas all of its goodness.

This is exactly what WSWMD needs in order to process more food scraps at a faster clip to meet the demands of its surrounding towns.

Mini MERP Grant

**In light of a much needed compost facility expansion,
WSWMD sought assistance to spread the word about our
specialized improvements.**

**With assistance from the BGS Energy Office within
the Vermont Agency of Administration,
WSWMD secured a Mini MERP grant.**





Municipal Energy Resilience Program

Grants are available for energy resilience building projects

Opportunities

- Free energy resilience audits and technical assistance
- Education and outreach assistance from your local Regional Planning Commission
- Grants and loans available



Funding

- Up to \$4,000 to build capacity for energy resilience work
- Up to \$500,000 for qualifying energy projects



Weatherize - Improve Energy Efficiency - Supplement or Replace Heating Systems with More Efficient Renewable Versions



Mini MERP

Awarded to WSWMD in order to help educate the public about our more efficient compost facility that recovers compost heat to accelerate the process.

The expansion isn't just a change in size of our compost manufacturing facility, it is also an improvement in our compost manufacturing technique.



Agrilab Technologies Inc.s Hot Skid 250
More on this later!

WSWMD Compost Operations Past and Present

Brattleboro Curbside Compost



YES COMPOST!

Non-Recyclable Paper & Cardboard

- Tissues
- Paper Towels
- Used Paper Napkins
- Food-Soiled Cardboard
- Food-Soiled Paper
- Cardboard Egg Cartons
- BPI Certified Compostable Products
- Unlined Sugar or Flour Bags

Other Compostables

- Pet Waste (no plastic bags), Pet Hair, Nail Clippings, Chopsticks

Food Scraps

- Bread/Rolls/Crackers
- Rice/Pasta/Beans
- Eggshells
- Cheese/Dairy
- Cooked or Raw Meat
- Cooked or Raw Fish
- Shellfish
- Fruits/Vegetables & Peelings
- Non-plastic Tea Bags
- Coffee Grounds & Filters
- Cooking Oils & Fats

DO NOT COMPOST

Milk/Juice/Ice Cream Cartons, Lint, Produce Stickers, Plastic Bags, Plastic Wrappers, Liquids, Aluminum Foil, Plastic Utensils, Trash, Metal, Glass, Styrofoam, "Biodegradable" Diapers



Composting by



Pick Up by

In 2012, Brattleboro began a residential food scrap pick up pilot and in 2013 went town-wide.

**As of 2024, all Brattleboro residents are offered curbside food scrap pick up:
~4,000 households
~600 tons/year**

Additionally, food scraps from Brattleboro businesses and surrounding towns are hauled to WSWMD to be composted on site and, when finished, sold and donated locally.



Alternative to Brattleboro's curbside program and local haulers bringing in organic matter, many folks from all over the district personally drop off their food scraps at our transfer station facility, adding a considerable amount to the volume of food scraps we compost.

WSWMD composts food scraps among other natural materials by creating “windrows” which achieve the volume and size for composting needed to break down a variety of materials into useable finished compost.





Composting in this manner happens year round and is passive, meaning we pile it, shift the piles with heavy machinery to increase oxygen, and nature (thank you, microbes) does the rest.

High carbon and nitrogen matter mixed together produces heat which in turn breaks down the materials into something useable.

In order for pathogens to breakdown, a pile temperature of 131 degrees Fahrenheit must be achieved.

WSWMD tests temperatures on a regular basis to ensure that this is happening.



After months of turning and temperature reading, the compost settles into a mature state. It is then screened in order to remove any materials that may not have broken down. This helps to remove inorganic materials known as contamination.





Finished and screened compost ready for use

**Large items including inorganic materials,
"tailings", are separated and not
incorporated into finished compost**

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95074
USA

TEL: 831-724-5422
FAX: 831-724-3188
www.controlabs.com

Account #: 4010030-1/1-12361
Group: Jan24A #16
Reporting Date: January 17, 2024

Windham Solid Waste Management District
327 Old Ferry Road
Battleboro, VT 5301
Attn: Bob Spencer

Date Received: 03 Jan. 24
Sample Identification: Compost #1 - Compost Package
Sample ID #: 4010030 - 1/1

Nutrients	Dry wt.	As Rcvd.	units	Stability Indicator:			
Total Nitrogen:	0.98	0.43	%	CO2 Evolution	Respirometry		
Ammonia (NH ₃ -N):	270	120	mg/kg	mg CO ₂ -C/g OM/day	2.6		
Nitrate (NO ₃ -N):	32	14	mg/kg	mg CO ₂ -C/g TS/day	1.0		
Org. Nitrogen (Org.-N):	0.95	0.42	%	Stability Rating	stable		
Phosphorus (as P ₂ O ₅):	0.44	0.20	%	Maturity Indicator: Cucumber Bioassay			
Phosphorus (P):	1900	850	mg/kg	Compost:Vermiculite (v:v)	1:2		
Potassium (as K ₂ O):	0.31	0.14	%	Emergence (%)	100		
Potassium (K):	2600	1100	mg/kg	Seedling Vigor (%)	100		
Calcium (Ca):	5.8	2.6	%	Description of Plants	healthy		
Magnesium (Mg):	0.44	0.19	%	Pathogens	Results	Units	Rating
Sulfate (SO ₄ -S):	55	24	mg/kg	Fecal Coliform	210	MPN/g	pass
Boron (Total B):	13	5.9	mg/kg	Salmonella	< 3	MPN/4g	pass
Moisture:	0	55.7	%	Date Tested: 03 Jan. 24			
Sodium (Na):	0.14	0.060	%	Physical Contaminants**	% by dry wt		
Chloride (Cl):	0.083	0.037	%	Total Plastic	< 0.1		
pH Value:	NA	8.45	unit	Film Plastic	< 0.1		
Bulk Density:	28	64	lb/cu ft	Glass	0.23		
Carbonates (CaCO ₃):	220	96	lb/ton	Metal	< 0.1		
Conductivity (EC5):	1.5	NA	mmhos/cm	Sharps	ND		
Organic Matter:	38.0	16.8	%	Total	< 0.5		
Organic Carbon:	18.0	8.1	%	Size Distribution			
Ash:	62.0	27.5	%	MM	% by weight		
C/N Ratio	19	19	ratio	> 50	0.0		
AgIndex	8	8	ratio	25 to 50	0.0		
Metals	Dry wt.	EPA Limit	units	16 to 25	0.0		
Aluminum (Al):	4700	-	mg/kg	9.5 to 16	0.9		
Arsenic (As):	2.4	41	mg/kg	6.3 to 9.5	8.6		
Cadmium (Cd):	< 1.0	39	mg/kg	4.0 to 6.3	12.4		
Chromium (Cr):	19	-	mg/kg	2.0 to 4.0	36.5		
Cobalt (Co):	4.1	-	mg/kg	< 2.0	41.6		
Copper (Cu):	22	1500	mg/kg				
Iron (Fe):	17000	-	mg/kg				
Lead (Pb):	28	300	mg/kg				
Manganese (Mn):	310	-	mg/kg				
Mercury (Hg):	< 1.0	17	mg/kg				
Molybdenum (Mo):	< 1.0	75	mg/kg				
Nickel (Ni):	11	420	mg/kg				
Selenium (Se):	< 1.0	100	mg/kg				
Zinc (Zn):	610	2800	mg/kg				

**Greater than 4mm in size (Sharps greater than 2mm)

Analyst: Assaf Sadeh



*Sample was received and handled in accordance with TMECC procedures.

When mature, compost is tested by a third party.

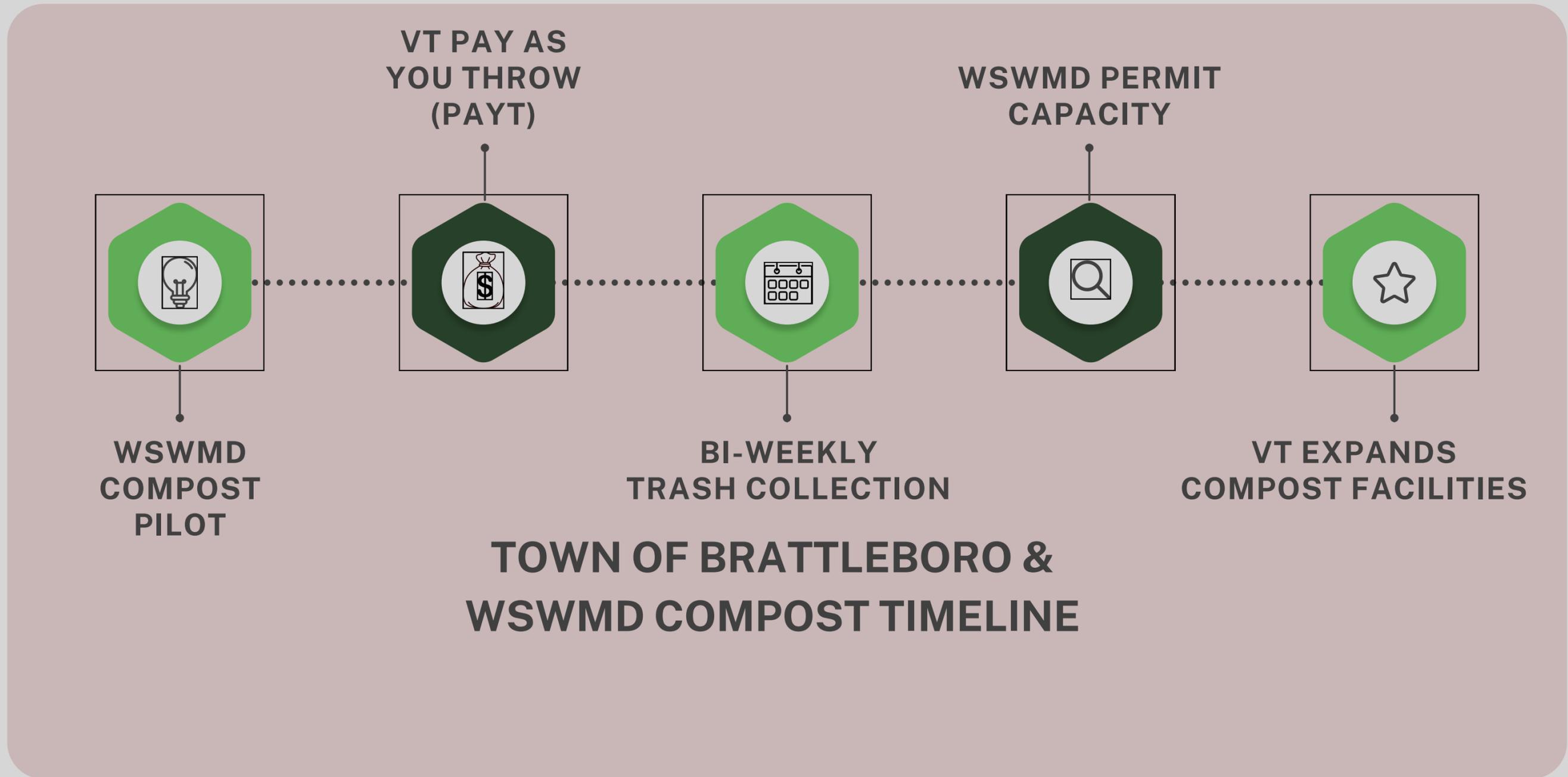
The annual quality test assures that compost:

1. Meets state standards for heavy metals and pathogens
2. Is mature so as not to "burn" plants
3. Has balanced nutrition for growing plants

These results are posted on our website.



Once testing confirms that finished compost is ready for use, WSWMD donates finished compost to local schools and sells the material to local distributors who use it operationally and sell to the public as well.



Over the years, WSWMD has received more and more food scraps as folks get smart with separating food scraps. However, this has resulted in WSWMD reaching capacity for its composting operations. The time to expand is now! WSWMD is expanding but not without including valuable system updates that will increase its efficiency.

**Compost Facility Expansion
with Agrilab Technologies Inc**

Proper Prior Planning Prevents Poor Performance



WSWMD is in great need of increasing the amount of food scraps they can handle. In order to do this, the site must be improved. WSWMD sought help from Agrilab Technologies Inc who has developed a system that promises to speed the process of composting and thereby save energy. The key to their system all has to do with oxygen. When high nitrogen (food scraps of all kinds) and high carbon (wood shavings, leaf litter, paper materials, etc.) materials are layered, they produce heat especially when “turned” thereby introducing more air to the process. By cycling air via compost aeration and heat recovery (CAHR) through piles of high nitrogen and high carbon materials, the need for turning is reduced and high quality, safe and mature compost will be created at a faster clip within the same physical area, meeting the demands of residents and businesses now participating in food scrap separation from landfill trash.



NEWTRIENT EVALUATION SUMMARY

CONSERVATION INNOVATION GRANT (CIG):

AgriLab Technologies Inc. Compost Aeration and Heat Recovery (CAHR) Technology

Dairy Manure Treatment Innovations – Enhancing Water Quality and Sustainability

TABLE 2: AS-IS COMPOST TEST PARAMETERS, FIRST AND LAST DAYS OF STUDY

AS-IS BASIS		TRAD		CAHR	
Test Parameter	Units	Initial value on 8/24/2021	Final value on 12/15/2021	Initial value on 8/24/2021	Final value on 11/19/2021
Moisture Content	%	64.73	70.53	64.22	63.85
Total N	%	0.50	0.77	0.52	0.92
Total <i>Kjeldahl</i> N	%	0.51	0.73	0.47	0.72
Nitrate + Nitrite N	%	below detection	0.04	0.05	0.20
Nitrate + Nitrite N	% of TN	N/A	5.19	9.62	21.74
Phosphorus	%	0.15	0.29	0.19	0.31
WEP	mg P/kg	312	256	387	304
				21.05	9.68
				0.45	0.83
		0.29 - 0.72		0.52 - 0.19 - 0.45	0.92 - 0.31 - 0.83
		94		16.74	16.04
		5		32.5	17.4
		66		2.74	2.97
pH	-	8.1	7.8	8.3	7.5

One example of a moisture and nutrient comparison between traditional commercial composting versus composting with a CAHR system.

TABLE 2: AS-IS COMPOST TEST PARAMETERS, FIRST AND LAST DAYS OF STUDY

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Phosphorus	%	0.15	0.29	0.19	0.31
WEP	mg P/kg	312	256	387	304
P as WEP	% of TP	21.16	10.34	21.05	9.68
Potassium	%	0.42	0.72	0.45	0.83
N-P-K	%	0.50 - 0.15 - 0.42	0.77 - 0.29 - 0.72	0.52 - 0.19 - 0.45	0.92 - 0.31 - 0.83
Total Organic C	%	15.97	11.94	16.74	16.04
C:N Ratio	-	31.2	15.5	32.5	17.4
N:P Ratio	-	3.33	2.66	2.74	2.97
pH	-	8.1	7.8	8.3	7.5

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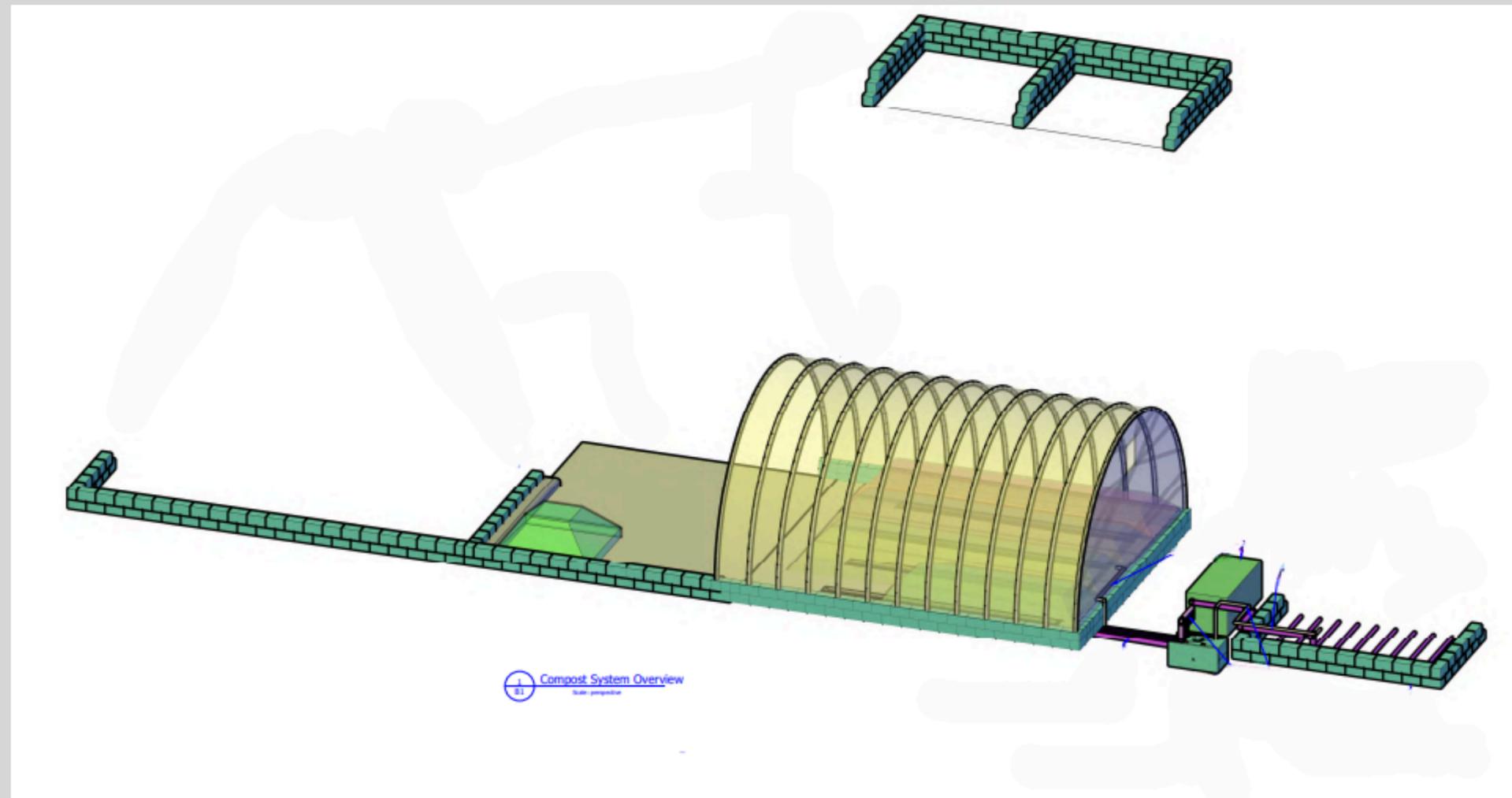
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		5.19	5.19	9.62	21.74
		0.29	0.29	0.19	0.31
		256	256	387	304
		10.34	10.34	21.05	9.68
		0.72	0.72	0.45	0.83
		0.29 - 0.72	0.29 - 0.72	0.52 - 0.19 - 0.45	0.92 - 0.31 - 0.83
		11.94	11.94	16.74	16.04
		15.5	15.5	32.5	17.4
		2.66	2.66	2.74	2.97
		7.8	7.8	8.3	7.5

Cycling air through active windrows of compost/CAHR:

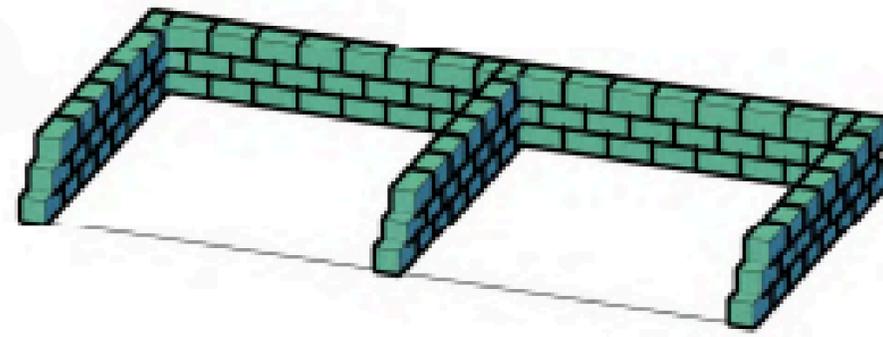
- Reduces time needed for composting and
- Increases amount of material composted on site
- Increases the amount of nutrients bound in the finished product
- Includes live data tracking helps to fine tune temperature, oxygen, and air flow rates

The Gist of WSWMD's Improvements:

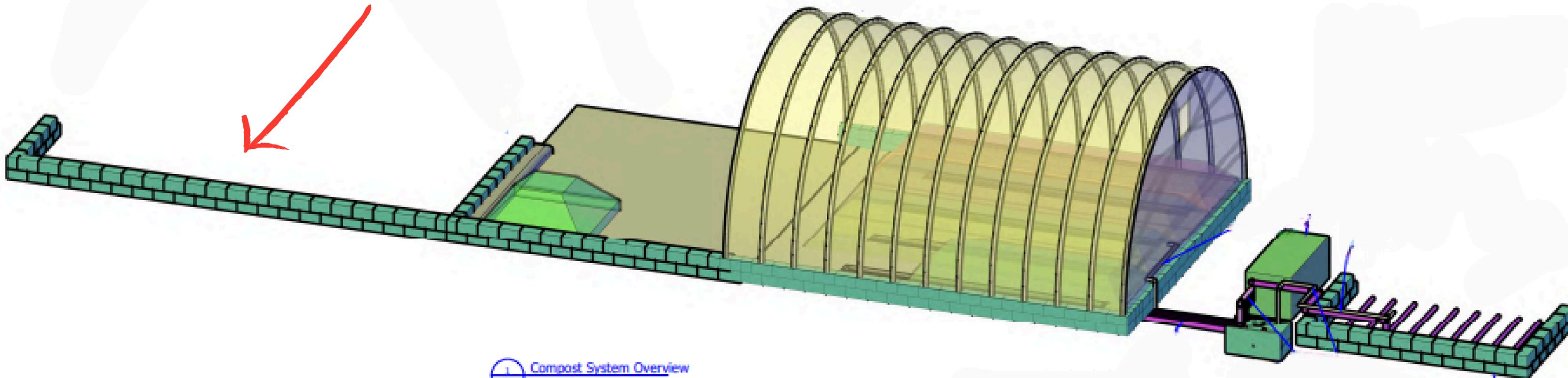
Compost Aeration System Upgrade



WSWMD's Compost Aeration System Upgrade

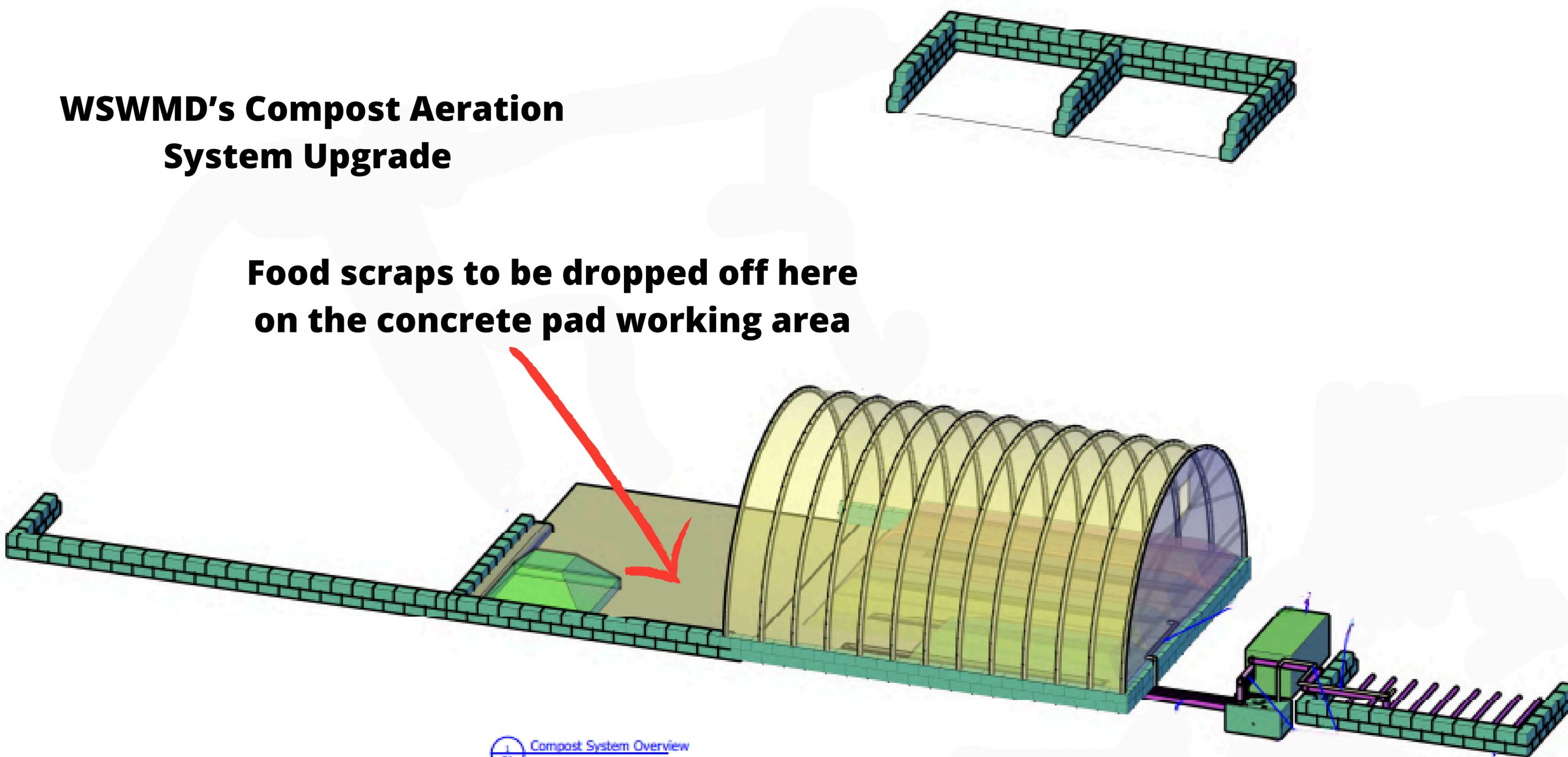


Drop off/storage area for high carbon to be mixed before forming into windrows within the fabric building

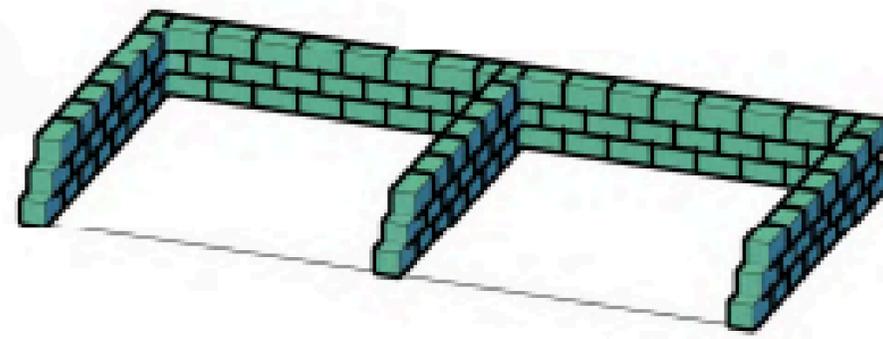


WSWMD's Compost Aeration System Upgrade

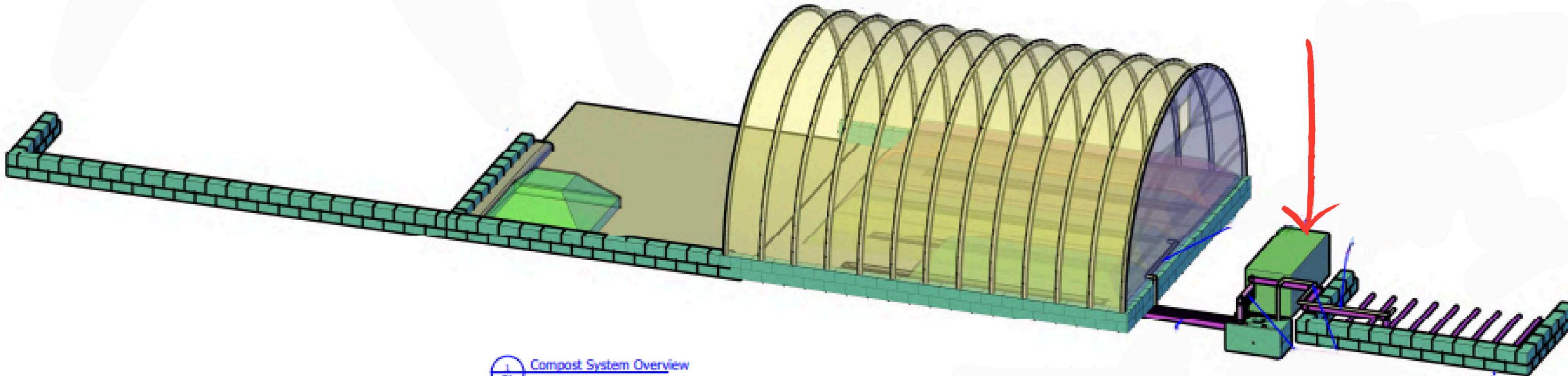
**Food scraps to be dropped off here
on the concrete pad working area**



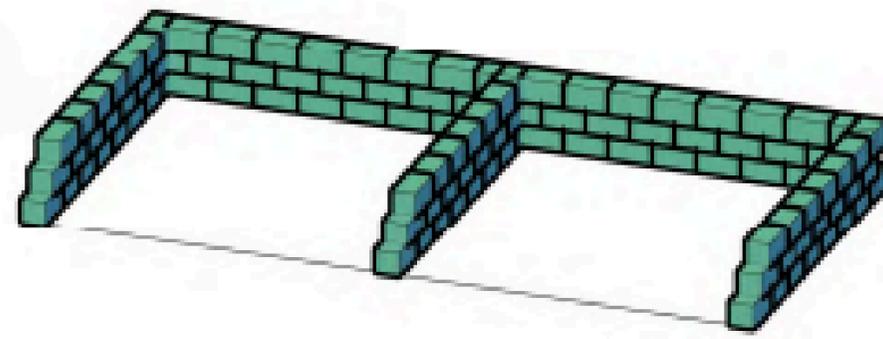
WSWMD's Compost Aeration System Upgrade



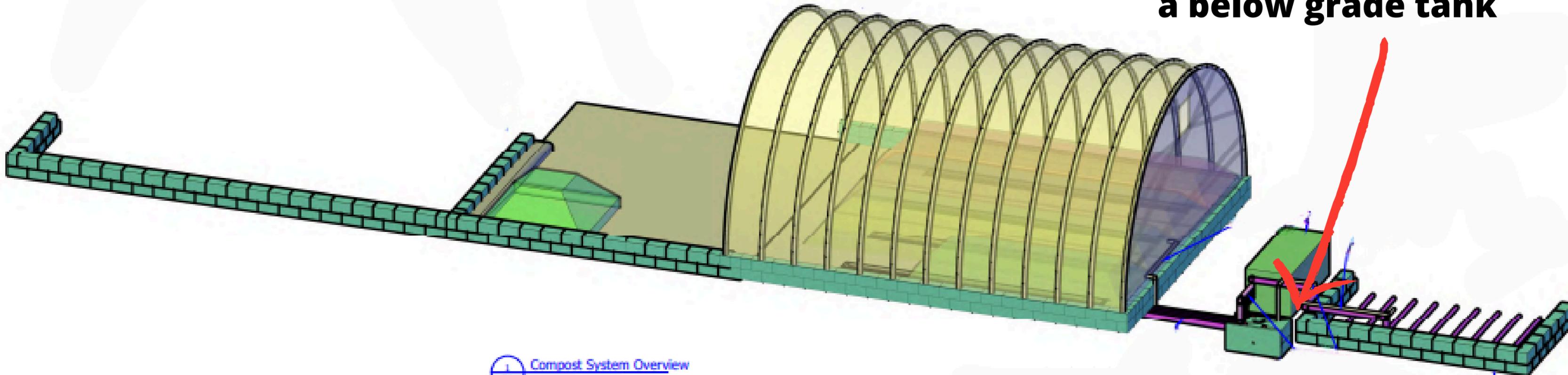
**Hot Box 250
forced air system:
pulls and pushes air, keeps
records of temperature, oxygen,
air flow rate**



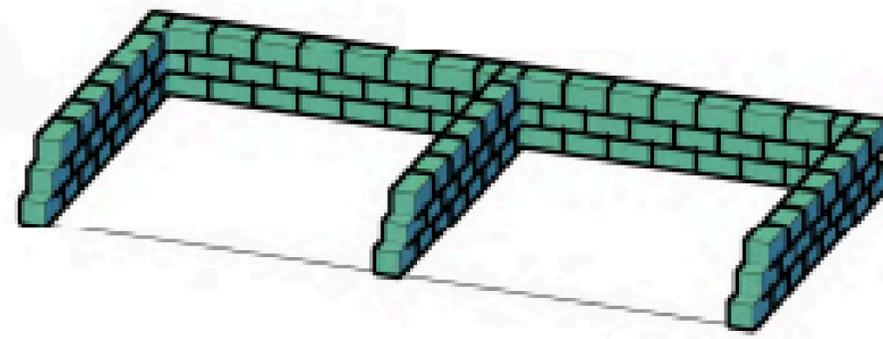
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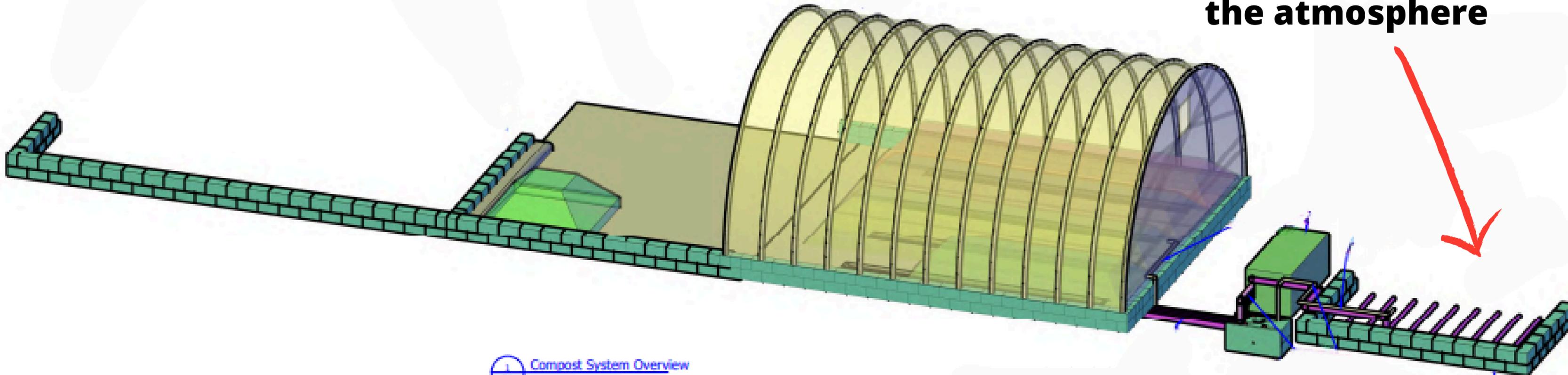
Sump pump collects and retains condensate from exiting vapor and stores in a below grade tank



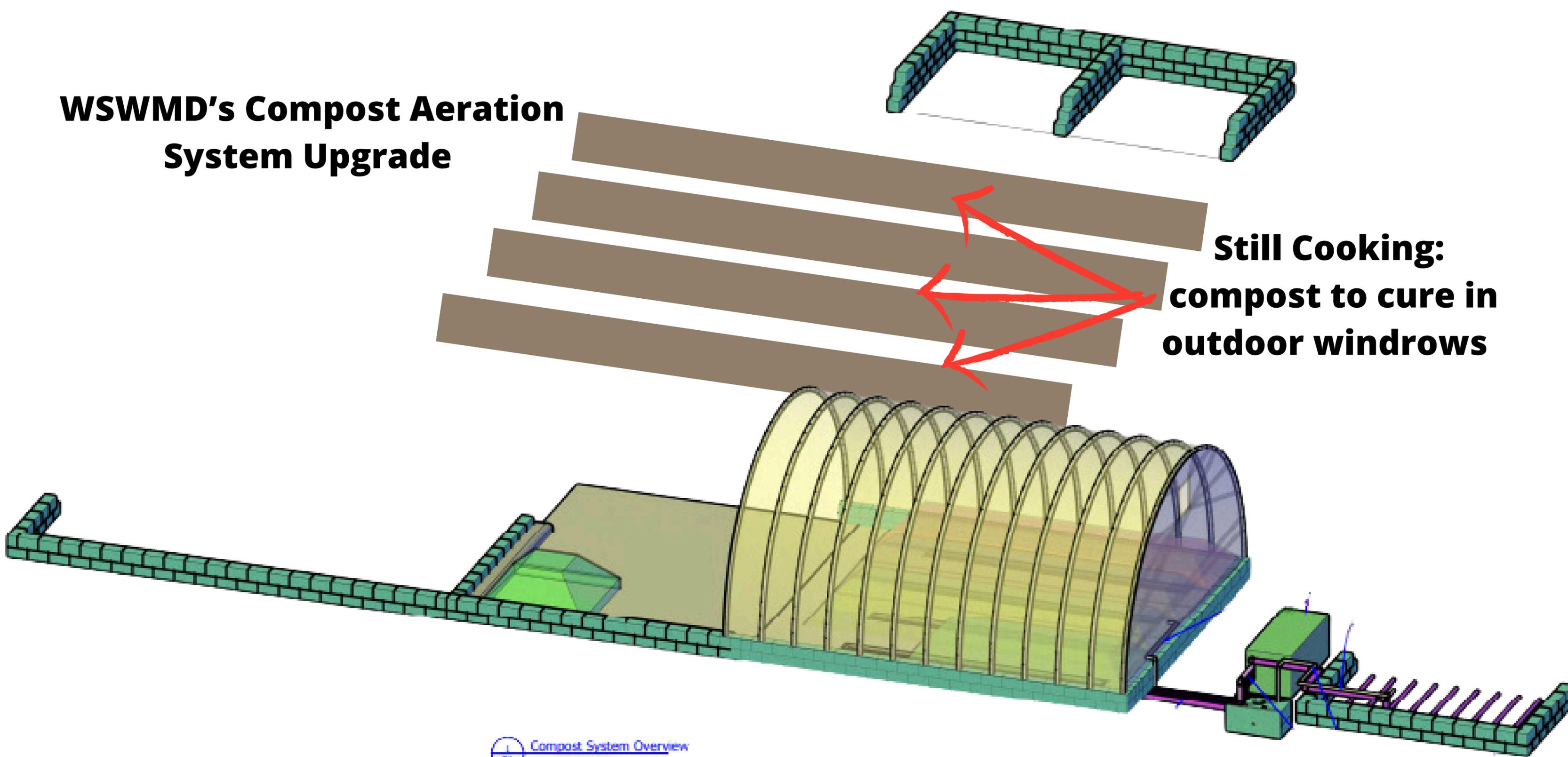
WSWMD's Compost Aeration System Upgrade



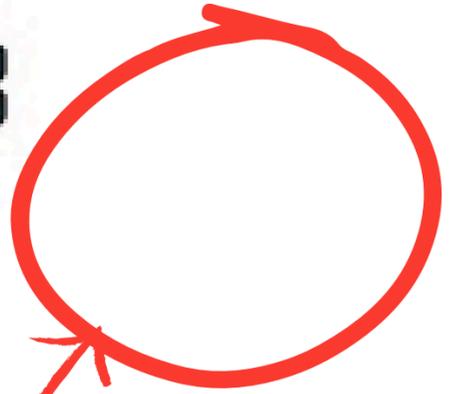
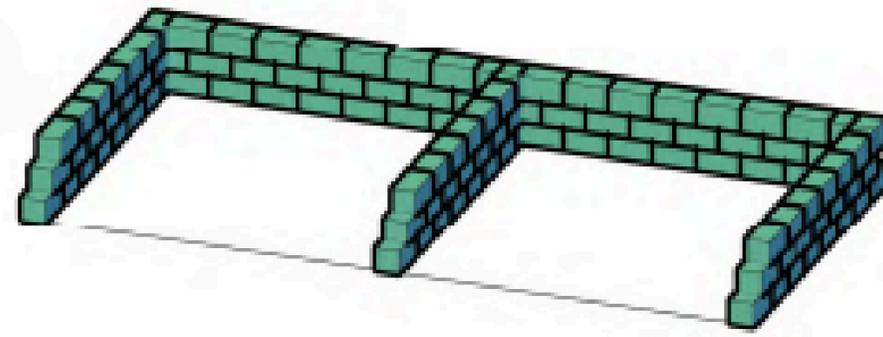
Remaining air flows through a biofilter which will reduce odors and gases released in the atmosphere



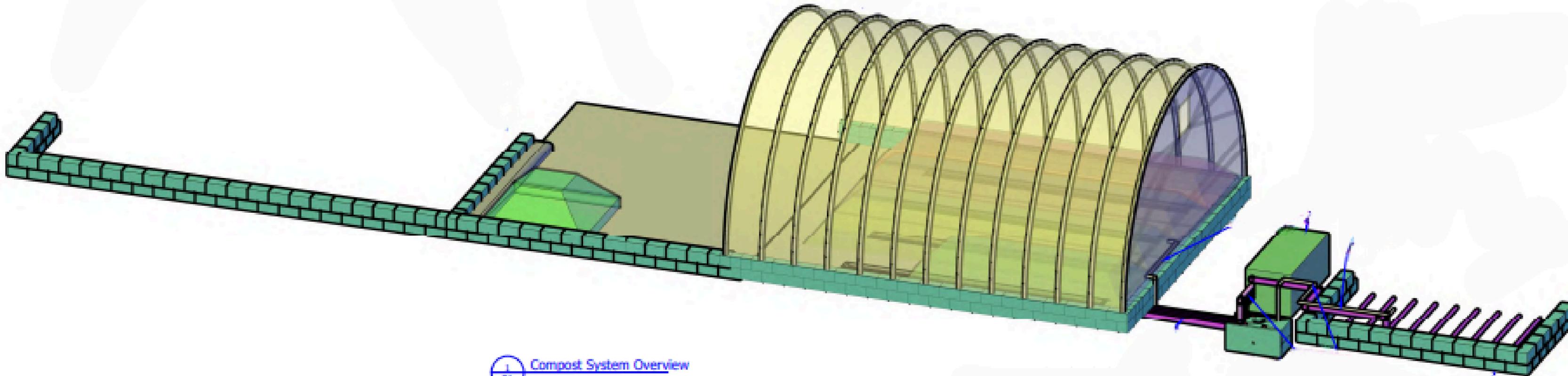
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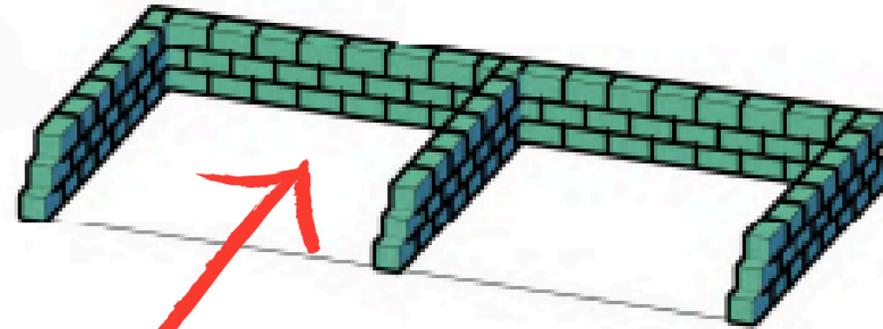
WSWMD's Compost Aeration System Upgrade



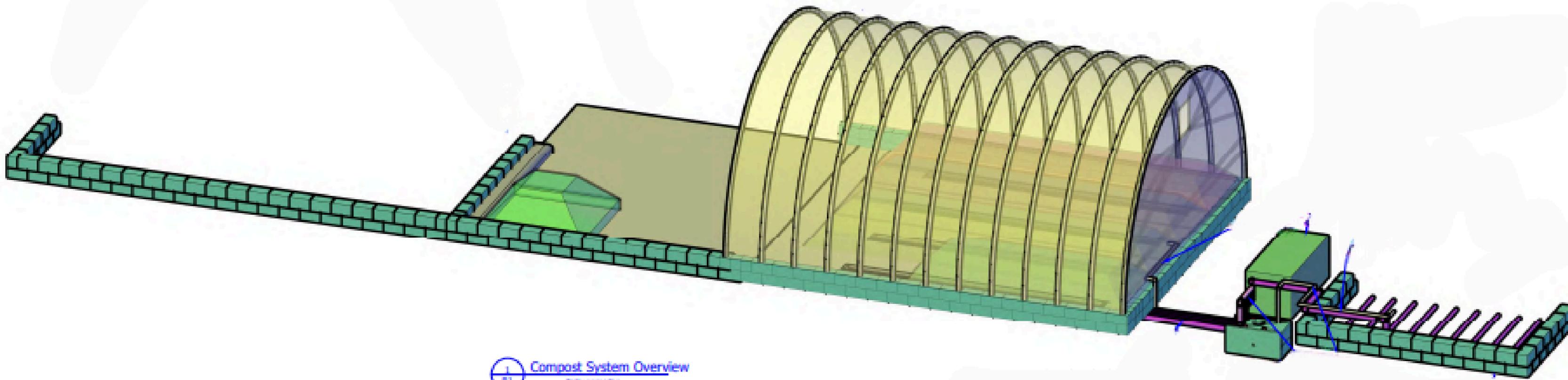
Compost screener to be located here



WSWMD's Compost Aeration System Upgrade



Finished compost holding area





Agrilab Technologies Inc. Hot Skid 250 and Hot Box 250 are aeration equipment units that will be adjacent to the covered active composting area.

- **Cycles aeration through 4 compost windrows**
- **Recirculates hot air into adjacent piles**
- **Attached to a sump pump that stores condensate from the steamy air, saving water for later uses on site**

Piping underneath active compost piles forces air through the windrow and speeds up the process of composting. It also reduces the need to “turn” (move with a bucket loader which increases oxygen) the compost.

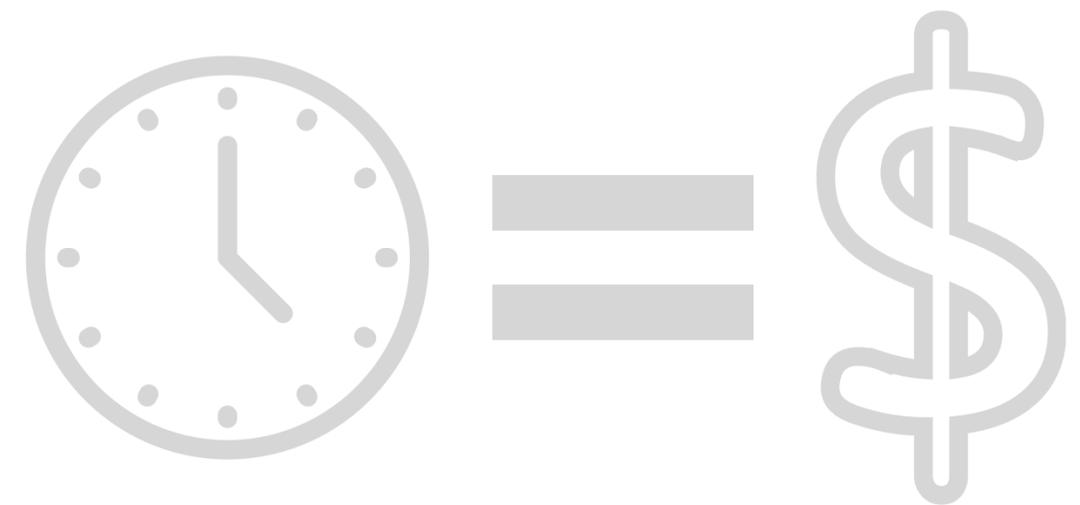


Below, a “biofilter” helps reduce fowl odors before the air that has been forced through several compost piles re-enters the atmosphere.





Because cycling air through windrows of compost speeds up the composting process and helps it to retain valuable nutrients, it also saves the facility money that in the past would be needed for compost management, notably the turning process is reduced.





The Compost Facility Expansion, featuring Agrilab Technologies Inc.

CAHR System will:

- Increase the WSWMD's capacity for incoming food scraps, which is in high demand, within the original square footage thereby meeting the state mandated food scrap ban from landfills**
- Speed up the time it takes to create quality compost**
- Reduce the amount of field work needed to create finished compost**
- Recycle water within the system, eliminating the need for outside sources of water**
- Improve moisture control, allowing WSWMD to remove contaminants with ease and distribute the product more efficiently**
- Increase process control at every step of the way enabling WSWMD to reduce odor potential**
- Create more nutrient rich finished compost that can be used locally for gardening and stormwater management**
- Preserve our local community's best way to handle organic waste thereby reducing the amount of waste sent to landfill**

No, we still won't want your fruit stickers!



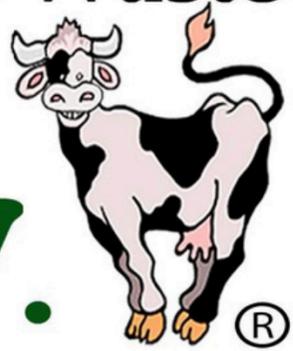
Improving composting efficiency does not mean that the composting process will breakdown inorganic materials like plastics, rather it improves the system in which WSWMD composts its original feedstocks.



Composting Organic Waste



Project C.O.W.



Windham Solid Waste Management District

YES Compost!

Food Scraps

Bread/Rolls/Crackers
Rice/Pasta/Beans
Egg Shells
Cheese/Dairy Products
Cooked or Raw Meats, Fish,
Shellfish (Including Bones)
Fruits & Vegetables (**NO** Fruit
Stickers/Rubber Bands)
Coffee Grounds/Tea Leaves
Cooking Oils and Fats

Non Food Items

Used Napkins & Paper Towels
Damp/Wet, Non-Glossy Paper
Pizza Boxes & Soiled Cardboard
BPI Certified Compostable Products
Cardboard Egg Cartons
Sugar & Flour Bags (Without Plastic)
Coffee Filters
Tea Bags
Pet Waste/Kitty Litter

DO NOT Compost!

Plastic Bags, Plastic Wrappers, Plastic Utensils, Milk/Juice/Broth
Cartons, Aluminum Foil, Trash, Metal, Glass



**We accept many materials for
composting at the WSWMD facility.**

**For more information visit:
www.windhamsolidwaste.org**

**Or give us a call at:
802 257 0272**

Links to More Information

To Learn More About This Project:

- **[Brattleboro Reformer Article about Expansion](#)**
- **[Short Video about Expansion](#)**
- **[2023 VORS Presentation on Expansion](#)**
- **[Newtrient Evaluation Summary of Agrilab's CAHR Technology](#)**
- **[Brattleboro, VT's Curbside Compost Program](#)**
- **[WSWMD's Compost Landing Page](#)**
- **[WSWMD's Act 250 Notice of Application](#)**
- **[2022 Food Scrap Drop Off at WSWMD Video](#)**

WSWMD



Keep an eye out for future workshops, demonstrations, videos, and other educational materials about the WSWMD compost improvements.

Thank You for Your Interest!



Thank
you!