



ZERO WASTE REVOLUTION

2015-2016 School Year

MONTHLY REPORT • MARCH

Lanikai Teachers' Tour

On Wednesday afternoons when classes are dismissed early, School Director Mr. Ed Noh can call a meeting of his faculty and staff for any reason of his choosing – training, discussion, new policy announcements, etc.

Apprehensions that emerged regarding the use of mulch to restore the soil in the front schoolyard led to a request from teachers to learn more about our resource recovery program. Mr. Noh was kind enough to give up his time on Wednesday, March 9, to schedule a Teachers' Tour of the Zero Waste Revolution.

How is it possible, with the many tours we have conducted for other schools and organizations over the last year and a half, that we could have missed our very own teachers and staff? Maybe we presumed that they would absorb the details of this complex, comprehensive program through osmosis! Didn't happen.

While everyone got a quickie introduction when the program began and experience some aspect of resource recovery every day, piecemeal explanation has been inadequate. Teachers have been unable to answer parents' inquires (what exactly are those mounds around the garden?), or kids' questions (what is this bug?). Crazy rumors were circulating (the composting worms caused the kindergarten pinworm outbreak).

The Teachers' Tour was long overdue and proved to be the most important activity accomplished in March. By contract, teachers cannot be asked to stay past 2:50pm, so the actual March 9th one-hour walk-around was whirlwind style, supplemented by a carefully-crafted Tour Guide handed out following the tour. A great deal of thought was given to addressing the elements of the program most relevant to educators. *A Teachers' Guide to the Zero Waste Revolution* is attached to this report.



To paint the whole picture in one hour was a challenge! Full-on displays were assembled at each station to illustrate changes over time. Thirty members of faculty and staff attended the Teachers' Tour. The March 8th harvest from compost pile Blue is pictured above.

Both the tour and the Tour Guide were very well received. An optional bokashi workshop offered at the end was attended by four teachers who are now prepared to start bokashi fermentation at home.

The history of teachers in resource recovery

Who makes the decisions about waste management in schools? When the City Recycling Office offered a grant of \$500 per school per year for a resource recovery class from a group of contacted Recycling Teaching Partners (RTPs), it was clearly *teachers* who propelled the waste reduction movement. They could request hot composting from The Green House, vermicomposting from Waikiki Worm Company, or a 3R's Recycling program from Kokua Hawaii Foundation, among others. All of the RTPs had full schedules for the duration of the grant, 2005-2012 – see list below. We believed at the time that teachers would absorb the fascinating technologies we imparted and incorporate these systems to reduce waste on their campuses long after we collected our \$500 checks and walked away. What a conceit to think that the thrill of managing daily waste would supplant any of the other things teachers have to do!

Waikiki Worm Co. Vermicomposting Projects/Programs – 2005 thru August 2013

SCHOOLS		
Academy of the Pacific	Kamehameha Schools (Kapalama)	Royal Elementary
Aiea Elementary *	Kapalama Elementary	Sacred Hearts Academy
Aikahi Elementary	Kapiolani Community College *	Seagull Preschool - Kapolei
Aina Haina Elementary	Kapunahala Elementary	Soloman Elementary
Ala Wai Elementary	Kawananakoa Middle School	St. Andrews Priory
Aliiolani Elementary	KCAA Atherton Preschool	St. Anthony School
Alvah Scott Elementary *	KCAA Wai-Kahala Preschool	St. Johns Catholic Preschool
Anuenue Elementary	Keiki O Ka Aina Preschool	St. Patrick School
Assets School	Keoneula Elementary *	St. Theresa School
Blessed Marianne Cope Preschool	Kipapa Elementary	Star of the Sea ELC
Calvary by the Sea Preschool *	Kuhio Elementary *	Stevenson Middle School *
Castle High School	Lanikai Public Charter School	Sunset Beach Elementary
Central Union Preschool *	Le Jardin Academy **	Sunshine School
Dole Middle School	Le Jardin Preschool*	Trinity Christian School *
Ewa Elementary	Liholiho Elementary	Trinity Lutheran School
Ewa Makai Middle School *	Likelike Elementary	UH Manoa Childrens Center
Fern Elementary	Liliuokalani Elementary	University Lab School *
Hahaione Elementary	Linclon Elementary *	Voyager Charter School
Halau Ku Mana Charter School	Lunalilo Elementary *	Wahiawa Middle School
Halau Lokahi Charter School	Maemae Elementary *	Waialae Charter School
Hanahaualo School	Makaha Elementary	Waialua Elementary
Hawaii Baptist Academy *	Manana Elementary	Waialua High School *
Hawaii School for Deaf and Blind	Manoa Elementary *	Waianae Elementary
Helemano Elementary	Maryknoll High School	Waianae High School *
Hickam Elementary	Mokulele Elementary	Waianae Middle School
Hoaloa Kai Montessori School *	Mililani Iki Elementary	Waiakele Elementary
Hokulani Elementary *	Mililani Mauka Elementary	Waikiki Elementary **
Holy Nativity School *	Mililani Uka Elementary	Waimanu Elementary
Hongwanji Mission School *	Mililani Waena Elementary	Waipahu Elementary
Honolulu Waldorf School	Moanalua Elementary *	Waipahu High School *
Honowai Elementary	Moanalua High School	Webling Elementary *
Iolani School (lower) *	Moanalua Middle School	Wheeler Elementary
Iroquois Point Elementary	Montessori Community School *	Wheeler Intermediate
Island Pacific Academy	Nanakuli Elementary	Windward Community College *
Jefferson Elementary *	Niu Valley Middle School *	Windward Nazarene Academy
Kahala Elementary	Noelani Elementary	
Kahaluu Elementary	Nuuanu Elementary	OTHER
Kahili Kai Elementary	Olivet Baptist Preschool	Hawaii State Hospital *
Kailua Elementary	Olomana School	Hoa'aina O Makaha Farm *
Kailua Intermediate *	Our Lady of Good Counsel School	Kakaako Pet Hospital *
Kailua High School *	Our Redeemer Lutheran School	Lanikila Meals on Wheels kitchen *
Kaimuki High School	Palolo Elementary *	Mari's Gardens *
Kalani High School	Pauoa Elementary	UH Aquaculture Research Station *
Kamaaina Kids Preschool - Kalaeloa	Pearl City Elementary	WCCC Kailua *
Kamaaina Kids Preschool - Keolu	Pearl City Highlands Elementary	Waiau Correctional Center
Kamaile Academy	Pearl City High School **	YMCA Camp Erdman
Kamehameha Preschool - Kahaluu	Punahou School	
Kam. Preschool -Waimanalo	Queen Emma Preschool	* Pipeline Worm System
	Queen Kaahumanu Elementary	

A stunning record of failure... Not counting Lanikai, how many worm colonies on this list of 132 schools are flourishing today? **NONE.** The “teach the teachers” model crashed every time. It is not the fault of anyone – it is the nature of school and the limits of teachers’ time.

The original model presumed that *education* would lead to resource recovery, and for many years RTPs tried tweaking our presentations, improving our manuals, and offering teachers more and more support. This approach failed miserably in every single case, usually within two years.

Only when we realized that resource recovery was a *facilities* function (and a very specialized one at that, requiring staffing at least a part-time position), did the program take hold and show signs of producing long-term measurable results.

Teachers are *not* responsible for managing school waste – no matter how educationally interesting it is – anymore than they are responsible for waxing their classroom floors, If they offer active support (e.g. Mr. Sawyer) the program can deepen significantly, and if they are persuaded to kokua (minimize their classroom waste, remember Sort-It-Out Sam, lend their students to fulfill Zero Hero Service tasks, etc.), the Resource Recovery Specialist reaps the abundant benefits of community.

With experience, we now more fully understand teachers’ priorities and time constraints. Our goal is to keep them well informed and engaged without demanding more than they can give.

GoFarm workshop

A tour and composting workshop was conducted on Saturday, March 26, for the current GoFarm class. GoFarm Hawaii is a program of UH with Windward, Leeward, Maui, and Kauai locations. They declare: “Our mission is to enhance Hawaii’s food security and economy by increasing the number of local agricultural producers by offering those with an interest in agriculture a combination of knowledge, experience, and support designed to assist them in becoming viable production growers, and accomplish this in a manner that encourages sustainability.”

We met the local GoFarm instructor, **Jay Bost**, when he placed an order for our surplus vermicast. He came to pick it up, returned for lunch and a quick visit and saw that Lanikai had the best to offer in composting education on the island.

It was fun to dive into deep technical detail with a group of people whose livelihoods may depend on



their success in duplicating our process. This comprehensive, professional-level tour lasted for nearly three hours. Many thanks to Mr. Sawyer and Ms. Espie for giving up their weekend time to help out.

Tagging along with the group was **Peter Bunn, CPAG***, an agronomist associated with the GoFarm program. His specialty is in soil and plant nutrition. He offered to test our garden soils, compost, and vermicast and provide a complete nutrient analysis and recommendations for improvements. While every living thing on our campus looks magnificent to our amateur eyes, Peter plucked a leaf off the mulberry tree that has been benefiting from leachate from the worm bins and pointed out “there’s a bit of zinc deficiency we can see here – not surprising since vermicast is often low in zinc. Easy to correct.” Wow! High-level professional help is on the way.

He was duly impressed by our operation (“you are doing everything exactly right”) and agreed to work with Mr. Sawyer in developing additional, more sophisticated science projects around our

* Certified Professional Agronomist, a certified crop advisor



The GoFarm workshop group. Jay Bost is in the middle with the hat and striped shirt. Peter Bunn is far right.

current program. We are so excited to have a burgeoning relationship with GoFarm – and a bridge to the vast resources of the University of Hawaii and the College of Tropical Agriculture.

Although there are still a number of important initiatives to implement (dishwasher, milk dispenser, hand blowers in the restrooms, water catchment/recycled water system, campaign to reduce packaging waste, etc.), most of the resource recovery component of the Zero Waste Revolution is settled and becoming routine. It is second nature, systemic, institutionalized.... soon to show up in our DNA!

Only a few years ago, a program like this was considered ridiculous and impossible, a dream. We made it happen at Lanikai, and now we can start to talk about diversifying to the next ridiculous impossible dream: *The Vision, Part 2*. .

Part 2 – Partnering with New Ag

Agriculture in Hawaii is changing. The glory days of sugar and pineapple plantations are long over; and the big industrial farms dependent on heavy inputs of chemical fertilizers, herbicides, and pesticides are collapsing under the weight of the environmental degradation they cause.

The push for food security means many supporting local producers on smaller farms using sustainable systems based on living soil – the very processes we are familiar with in our own gardens such as the use of cover crops, amending with bokashi and compost, fertilizing with vermicast, increasing moisture retention and microbial habitat with biochar and controlling pests and diseases with the application of vermicast tea.

The popularity of the GoFarm program attests to the power of this new concept. Young farmers – the next generation – are eager to become viable producers, and are leasing small parcels of State land – as small as 1/4 acre. With good inputs and good management, even small parcels can be very productive.

On Oahu, Ag land is limited, and much of it is contaminated and will take years or remediation.

Every public school on Oahu has a fairly large schoolyard. This is State land, and even though it has been largely nutrient depleted, it is free of contaminants. Over Spring Break, the broken down fence and dead trees at the edge of the back schoolyard was cleared and a bright new fence was installed. It doesn't take much imagination to picture a productive urban micro-farm and orchard parallel to the fence, for example.

Besides underutilized clean land, schools have another abundant resource critical to organic farmers – lunch waste, processed into rich soil amendments. School lunch waste comes every day, all over Oahu, massively and relentlessly. At Lanikai, we produce only 20% of the waste generated at similar-sized schools, and still we can only use a portion of the compost we create. At Palolo Elementary – more typical – where 20 tons of Federal Lunch Program food waste was collected and processed during the 2009-2010 school year, over 90 cubic yards of compost was created.

Our proposition is to partner school resource recovery production with on-site micro-farm operations. To complete the circle, as envisioned by the Farm to School Hui, fruits and vegetables produced on schoolyard farms find their way into the lunch menu. In our dream scenario, resource recovery and food production partner at every school (where feasible) on Oahu.

When we described this idea to Jay Bost, Peter Bunn and the GoFarm participants, eyes lit up. They immediately saw the benefits and appreciated the practicality. Later that day, Jay e-mailed Steven Chiang, Director of UH Manoa's Agribusiness Incubator Program. AIP “helps people who produce, use, or promote agriculture in Hawaii to start, grow, and improve their bottom line. AIP serves all islands with business planning, marketing, financial analysis, and other guidance

designed to launch businesses and products, lower costs, and increase sales.” So Steven knows a thing or two about small farms and working with the State.

If Steven said, “that’s crazy, could never happen,” we would certainly think twice about pursuing the idea but his initial response via e-mail was positive:

“I have nothing against it. If school and DOE allow it then sounds like an opportunity.

Some possible challenges:

- length of commitment from school to farmer for the use of the land
- possible lack of precedent and need for policies
- objection to commercial activity on public land (unless all food goes to school, for which there are other obstacles)
- ability to install storage and other facilities that the farmer needs”

There are undoubtedly other major issues concerning water, security, liability, etc., but there are likely knowledgeable people who can help us to identify the barriers and find ways to proceed.

Although the legislature avoids interfering with DOE policy, our State Representative, Chris Lee, has indicated his support for us and would know how to help legislatively. Although he had to cancel a visit scheduled in March, he will try to visit before the school year is out – we will have a list for him. In the meantime, we will research further and find out who else would be involved in making this happen.

If Lanikai is the model school for Zero Waste, we can take steps to complete the entire picture with a pilot on-site agriculture program in partnership with GoFarm.



Final batches of bokashi buried.

The final two of our four Bokashi Blasters was decanted and the contents buried at the tail end of the planter crescent.

Both Blasters were textbook-perfect, assurance that the seal was tight and anaerobic conditions were maintained throughout the fermentation process. One Blaster had been filled in October and the other in December.



The wait before planting is two weeks, during which time soil organisms will break down the pickled material into nutrient-rich amendment.

It has not yet been decided what to plant. Stay tuned.



Grants received

The Edible Schoolyard, whose representative Kyle Comforth visited last month, has awarded **two full scholarships to the 5-day Edible Schoolyard Academy** this summer in Berkeley, California, to Mr. Parker Sawyer and Ms. Espie Chapman. Kokua Hawaii Foundation kicked in additional funds to cover air travel.

They will undoubtedly have fun, meet many other eco-educators and learn a lot, but they also have a great deal to offer other participants, since Lanikai has the most extensive composting program in the nation.

Kokua Hawaii Foundation also awarded Lanikai School **\$1,000 for the purchase of a greenhouse**. Building one from scratch was considered but Costco had a nifty kit for a 8' x 12' unit that would be perfect, so the LSO made up the cost difference and the unit was ordered and delivered within days. It will be installed early in April. Mr. Sawyer has volunteered to start all the seedlings for the other AINA gardens in our new greenhouse.

State Science Fair

None of our State Science Fair finalists placed, but everyone had a wonderful time and learned many new things! It was very inspirational and an excellent experience for our science students. We are proud of their achievements and commend them on the hard work they committed to their projects.

Hawaii Public Radio goes Zero

Hawaii Public Radio's Spring Pledge Drive will be a Zero Waste Event courtesy of Lanikai School. More details in the April Report.....

Food waste reduction Webinar planned

Ms. Mindy was contacted by **Laurie Solomon** of the U.S. Environmental Protection Agency's Office of Resource Conservation and Recovery and asked to present in a national Webinar scheduled for June 15th. Laurie's e-mail stated that the goal of the Webinar is "for participants in the Educational Institution sector to learn from you and from each other about how to successfully achieve wasted food reductions, as well as identifying obstacles and learning useful strategies on how to overcome obstacles."

The other presenters are all from Keene State College (New Hampshire): the Campus Sustainable Material Management Specialist, Dining Services General Director, and Nutritionist.

Keene State College was a first place winner of the Food Reduction Challenge in the College/University category. Pearl City High School (project prior to Lanikai) was the winner of the K-12 Schools category for the 2013-2014 school year.

Not only can Hawaii schools compete successfully on a national level, but we are now recognized nationally as experts in the field!

Sunflower Patch update

Started from seeds, the Steve and Marilyn Katzman Perpetual Sunflower Patch has burst forth from our rich soil in just a few weeks. Stay tuned.



Garden bounty takes your breath away...

Lettuce, kale, carrots, radishes, several varieties of eggplants, green beans, bell peppers, chili peppers, gooseberries, bok choy, basil, tomatoes, sweet potatoes, kalo, corn, squash, snow peas, papaya, banana.... absolutely every growing thing in the Lanikai School gardens is off-the-charts robust and productive.

Mr. Sawyer is trying to keep up with weighing the harvest from each crop and keeping data that will be reported at the end of May.



Bottom line for March

This report covers the period from February 29 through March 31, 2016. Due to Spring Break in the middle of the month, there were only 15 school days during this period.

During this interim **1,284 pounds** of food waste was collected and processed via vermicomposting and hot composting technologies. The school year total to date is **11,087 pounds** of food waste recovered, representing a 100% landfill diversion rate.

- 100% of all HI-5 cans and bottles were collected and redeemed
- 90% of all paper and cardboard waste was collected and processed.
- 100% of all green waste was recovered.

What's left? Still going into rubbish bins is minimal kitchen/custodial aluminum and plastic waste, milk cartons, paper towels, all paper and cardboard with lamination, tape, or other plastic coating, rigid plastic containers such as Lunchables, yogurt and other snack containers, plastic Ziplock bags, mylar drink pouches and snack bags. Programs can be devised to address many of these items, but interest has waned for the time being.

We will take a fresh look at new waste issues when school starts up again in August. Spring is for other endeavors.....

A Teachers' Guide
to the
**ZERO WASTE
REVOLUTION**



Lanikai School Teachers' Tour • March 9, 2016



Zero Waste is a philosophy that encourages the redesign of resource life cycles so that all products are reused. No trash is sent to landfills and incinerators. The processes recommended are similar to the way that resources are reused in nature.

The internationally recognized definition of ZERO WASTE adopted by the Zero Waste International Alliance is:

“Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use.

Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.

Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.”

Beyond reduce, reuse, and recycle...

To establish **ZERO WASTE** as a unifying principle at Lanikai School, *everyone* participates daily. We go far beyond the Three R's by collecting all organic resources (formerly called “waste”) to process on campus.

Every student at Lanikai is a **Zero Hero** every day they sort and separate their lunch leftovers and use Sort-It-Out Sam properly to dispose of snack waste. In addition, each year every student performs a grade level **Zero Hero Service Activity** that contributes to the school community Resource Recovery operation.

Teachers, you rank sky high as Zero Heroes because you graciously tweak your classrooms and schedules to accommodate new procedures, assign and supervise recycling activities when asked, and patiently put up with changes that are often confusing and inconvenient.

Zero Waste is a team effort with everyone on the field. We all win with a cleaner, greener and more economical campus, thoughtful and informed students who develop lifetime habits of good stewardship, and a strong culture of *malama 'aina* to address Hawaii's future.



Even the 2nd grade guinea pigs contribute! Cedar shavings and nitrogen-rich droppings are added weekly to the compost mulch.

Tour Stop #1

Lunch Separation Station

The core of our Zero Waste program is capturing the daily food waste at lunchtime. No matter how lovingly parents prepare home lunches and our caterer serves up fresh and delicious meals, kids throw away literally tons of food. It is shocking and a shame, but we have a different perspective because when you practice food waste recovery, garbage is transformed to valuable resource.



Sixth graders are responsible for staffing the Separation Station as their Zero Hero Service Activity under supervision of Mr. Sawyer. Lunch monitors serve on teams of three for one week. They set up, manage the tables at both lunch shifts, break down, clean up, weigh waste and log data, dispose of the rubbish, and wash buckets. They also retrieve food, milk, trays and other items from the LC and replace full buckets with clean empty ones.

In addition to recovering 100% of leftover food over the last year, we have reduced other lunch waste by replacing disposable trays, bowls, cups, and forks with washable, re-useable items. This has taken some adjustment and generated more work, but the results justify the effort. We used to fill five 32-gallon rubbish cans at every meal – now we fill only two 13-gallon corn-polymer biodegradable bags. Nine hundred plastic rubbish can liners per year have been eliminated.

How low can we go? Discussions are underway to replace milk cartons with a refrigerated milk dispenser and washable cups. Students are planning a campaign for Waste-Free Wednesdays to encourage home lunch students to work with their parents to design a lunch with ZERO plastic and mylar packaging. We can do this!

The **BOTTOM LINE** on food waste

In one school year, Lanikai PCS generates

14,433 pounds

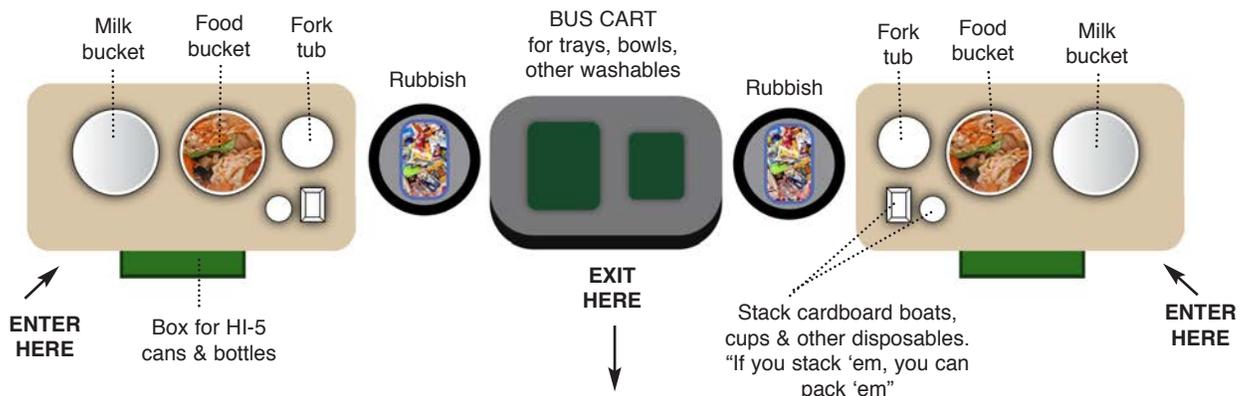
(7.22 tons)
of food waste.

Daily average food waste including lunch and snacks equals 76 pounds.

Two gallons of milk is discarded every day to equal 364 gallons annually.

Eating lunch in your classroom or other location? Please get a bucket for food waste and bus back food & washables to the caf ...

MAHALO!



Tour Stop #2 • The definitive guide to Sort-It-Out Sam

It's relatively easy to collect food waste at lunch at a centralized time and place. Back in the dinosaur era of the 1950's and 60's when Ms. Mindy was in school, no food consumption was allowed outside the cafeteria and eating between meals was considered unhealthy. Ah, those were the good ol' days of waste management.

The predominant snacking culture of today means food waste is generated all day long in every corner of the campus. Tracking it down for recovery poses a real challenge.

Sort-It-Out Sam made his debut in April of 2015, and after nearly a year of operation following a somewhat rocky start, we have seen significant systemic change.

Sam's greatest impact is to make the recycling of food, paper and HI-5 cans and bottles the personal responsibility of every single teacher, staff member and student. At least twice a day you are asked to think "I generated this waste and I have to deal with it properly." No longer does **someone** come to pick up the recess snack or pizza party leftovers chucked into a rubbish can. No longer do teachers hoard big heavy boxes of paper and cans in classrooms for **someone** to take away. There is no someone any more. It's every one of us, every day.

Because Sam recycles small batches frequently, students can accomplish after school Sort-It-Out Samurai duties in about three minutes, tops. Compliance is pretty good, but teachers, we have considerable room for improvement. Yes, it's hectic at the end of the day, but please remember that Sam is waiting for *your* Samurai. If we each do our part, Sort-It-Out Sam really works.

Sam is a work in progress steadily evolving as recycling technology improves. Right now he takes a variety of snack litter and trash packaging in his belly, but Sam is longing to fulfill his destiny as a 100% Recycling Guy. Mylar is the shiny silver packaging used for chips, granola bars, juice, etc. – it comprises our biggest volume of non-biodegradable waste. On the mainland there is a special program for school mylar recycling. When that program is extended to Hawaii, Sam's belly will be for "Clean Mylar Only" and we'll collect and recycle this material, too.



Sort-It-Out Sam is the hardest part of Lanikai's Resource Recovery initiative and takes the most time, thought, maintenance, energy and cooperation to sustain. No other school in Hawaii has ever attempted a satellite Separation Station for recyclables. Is it worth it? Check out the data below and see what you think.

The **BOTTOM LINE** on Sort-It-Out Sam

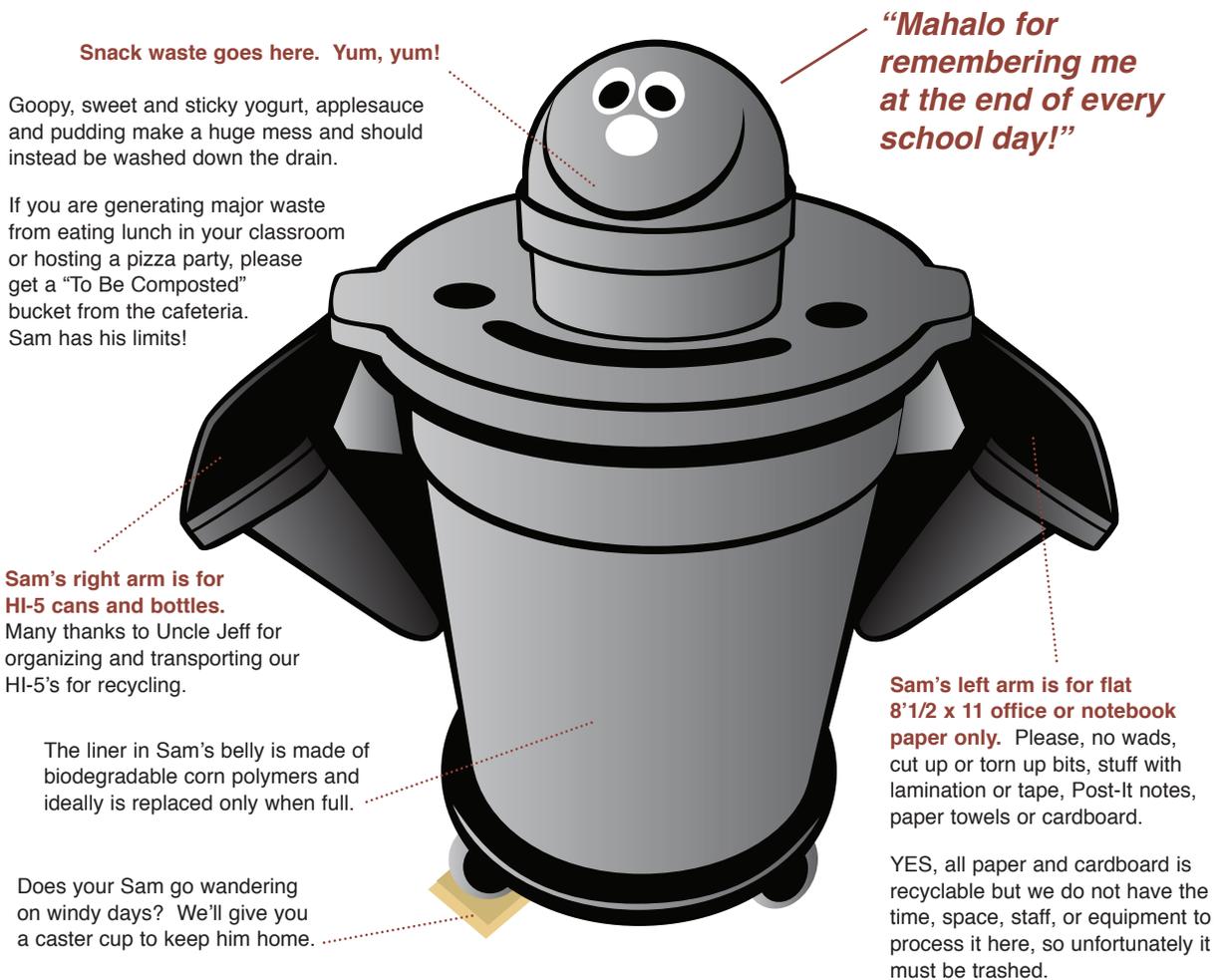
Twelve Sams replaced eleven 32-gallon rubbish cans that landfilled 2,024 plastic liners per year. The Sams use only 120 biodegradable corn-polymer liners per year.

Every day Sam collects an average of:

- 10 pounds of snack waste
- 2 inches of paper
- 15 HI-5 cans & bottles

In one school year, that adds up to

- 1,840 pounds of snack waste
- A stack of paper over 30 feet tall
- 2,760 cans & bottles



Snack waste goes here. Yum, yum!

Goopy, sweet and sticky yogurt, applesauce and pudding make a huge mess and should instead be washed down the drain.

If you are generating major waste from eating lunch in your classroom or hosting a pizza party, please get a "To Be Composted" bucket from the cafeteria. Sam has his limits!

"Mahalo for remembering me at the end of every school day!"

Sam's right arm is for HI-5 cans and bottles.

Many thanks to Uncle Jeff for organizing and transporting our HI-5's for recycling.

The liner in Sam's belly is made of biodegradable corn polymers and ideally is replaced only when full.

Does your Sam go wandering on windy days? We'll give you a caster cup to keep him home.

Sam's left arm is for flat 8 1/2 x 11 office or notebook paper only.

Please, no wads, cut up or torn up bits, stuff with lamination or tape, Post-It notes, paper towels or cardboard.

YES, all paper and cardboard is recyclable but we do not have the time, space, staff, or equipment to process it here, so unfortunately it must be trashed.

Sam says, "I'm NOT a rubbish can, I'm a Recycling Guy! There's ambiguity when it comes to Sam's belly because currently all packaging is landfill rubbish. All clean snack packages – mylar bags, Ziplock bags, raisin boxes – are OK for now. Sam stands ready to assist with litter control.

What we really want to avoid is any packaging with **food residue** on it. Please **DO NOT** put into Sam's belly goopy containers of yogurt, pudding, applesauce, peanut butter, hummus, Nutella, cheese dip, unfinished milk or juice drinks, or paper cupcake cups with sticky cupcake crumbs. All will draw ants and flies.

These nuisance items are better off in the regular rubbish bins where they will be vanquished overnight by the custodian.

Please **DO NOT** put any lunch disposables – boats, cups, milk cartons, or paper trays – in Sam's belly. Use the regular rubbish can. Same goes for party cups, bowls, and plates.

The slots for disposal into Sam's belly are small for a reason. If you are crushing and forcing items into the pukas or lifting Sam's lid to dispose of something, it probably should not be going into Sam. Use the regular rubbish.

Sam's core job is to collect the three major recyclables – food, cans/bottles, and school paper. Anything but the lightest of clean rubbish gives him a real tummy ache.

Sam aims to maximize and celebrate recycling over trashing, but you still need two or three small rubbish bins in your room. Ask if you want more.

Tour Stop #3 • Decomposition 101

All organic material – anything that was once alive – will decompose eventually, breaking down into component atoms of carbon, nitrogen, oxygen, hydrogen, etc. Most of the heavy lifting of decomposition is done by mighty microscopic bacteria and fungi, able to break molecular bonds, assisted by legions of organisms you can see (invertebrates) who shred, scrape, grind, chew, chomp, rip, munch, spit, burrow, crawl, and poop.

Hawaii's warm climate offers a year 'round ideal environment for quick and efficient decomposition. Any schoolyard on Oahu can easily absorb the all the organic waste generated on site. This is our unique advantage!

Composting is defined as *controlled decomposition*, the natural breakdown process of organic residues. Composting transforms raw organic waste materials into biologically stable, humic substances that make excellent soil amendments.

Decomposition will happen on its own without our help, but when we *control* the environment by adopting specific composting technologies we can pick the ingredients, time frame, characteristics and quality of the finished product.

At Lanikai, we use **vermicomposting**, a.k.a. worm composting, and thermal, a.k.a. **hot composting**. Both of these are aerobic composting methods that include a carbon source (tree mulch, cardboard, paper), a nitrogen source (food), and an environment with plenty of moisture and air.

We provide the set up and give the **FBI – fungi, bacteria, and invertebrates** – time do the job they have been doing on the planet for hundreds of millions of years. At this station you will meet some of the more charismatic compost critters your students may inquire about including millipedes, isopods, earwigs, beetles, compost mites and compost snails. All are safe to handle.



Holding hands and singing Kumbaya, diverse and extensive decomposer communities sustain life on earth.

The FBI Song

(Fungus, Bacteria, Invertebrates)

Banana Slug String Band
from the CD *Singing in My Garden*

The FBI, whenever something dies,
The FBI is there on the scene
The FBI is working over time
The FBI, to pick those bones clean
Fungus (Fungus!)
Bacteria (Bacteria!)
Invertebrates (Invertebrates!)
The FBI
Fungus (Fungus!)
Bacteria (Bacteria!)
Invertebrates (Invertebrates!)
The FBI

There's **FUNGUS** all among us
And it's breaking things down
Returning nutrients
Into the fertile ground
Millions of mycellium
Underground that's why
When you hold a handful of earth
You hold the FBI
(chorus)

There's billions of **BACTERIA**
In that soil over there
Microscopic life is in all water,
land and air
You ought to know they are there
'Though they're too small for your eye,
They are the secret agents
Of the FBI
(chorus)

Insects, bugs, slugs and worms
Are working night and day
The **INVERTEBRATE** crew
Are special agents of decay
To remove whatever's rotten
They will hop, crawl, hide, and fly
Enforcing nature's laws
They're the FBI
(chorus)

Lie down very still in the duff
And learn their ways
Peek into your worm bin (compost pile)
You will surely be amazed!
Go creeping through the forest
Learn to see and be a spy
In search of evidence
Of the FBI
(chorus)

Tour Stop #4 • Our wonderful wormies

Worm composting is a good fit for schools. The worm bin is an enclosed container, there is no odor, a superb, nutrient-rich fertilizer – vermicast – is produced, and most kids absolutely love the squirmy guys.

The two epigeic (surface-dwelling) species we use are not indigenous to Hawaii but are long-established here. They likely came in with the Polynesians and their pigs. They are closely associated with animal agriculture because their natural diet is pig, chicken, horse, goat, rabbit, and other manures. To a worm, however, one variety of decaying organic matter is the same as any other, so lucky for us they switch readily to food waste.



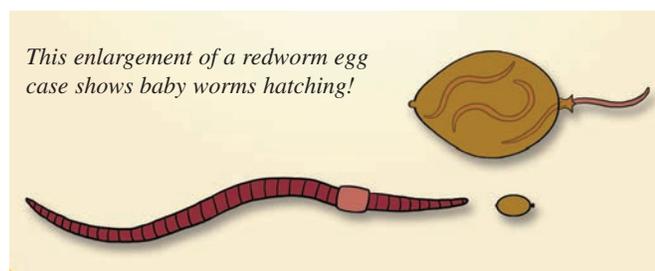
Eisenia fetida or redworm (top) and *Perionyx excavatus*, Indian blueworm

The vermicomposting industry was initiated on the mainland, Canada and Europe many decades ago, but it is relatively new to Hawaii where worms are in limited supply and expensive (retail price \$160/pound). The Department of Agriculture strictly enforces the law against importing worms into the state. With an proper DOA inspection sticker, worms can be shipped legally interisland.

Vermicomposting is a cool, wet process where temperatures rarely reach over 90 degrees and the moisture content ranges from 40 to 60 percent. Although the worm bed is teeming with important bacteria, fungi, and invertebrate populations, a worm bin is specifically managed to maximize worm comfort and productivity.

Composting worms are able to consume their weight a day in decaying organic matter and will reproduce prodigiously in good conditions. All worms are hermaphroditic and all can produce eggs. A composting worm can begat millions of babies over his/her lifetime, which commonly spans several years.

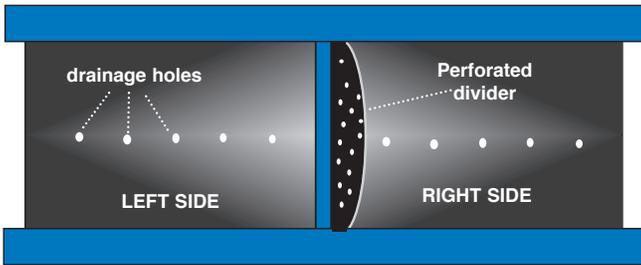
Lanikai School worms are fed from the supply of fruit, vegetable and grain prep waste generated by our lunch provider, One Love Cafe. Because Shannon uses mostly whole foods, the wormies feast on abundant banana peels, melon and pineapple rinds, apple and pear cores, potato, beet, and carrot peelings, salad trimmings, as well as leftover rice, bread beans, and noodles.



This enlargement of a redworm egg case shows baby worms hatching!

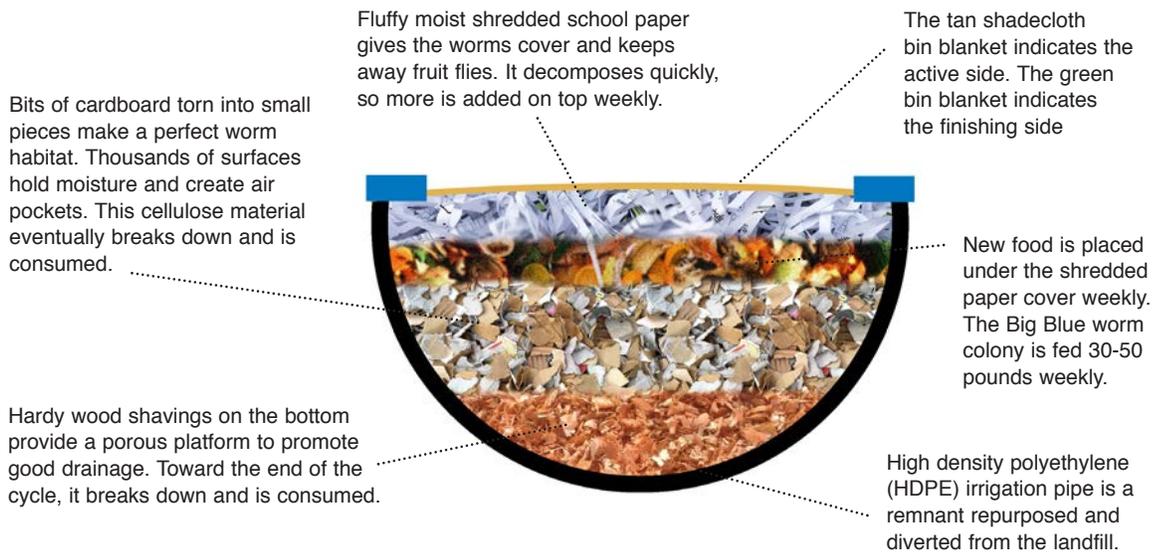


Redworm egg capsules lodged in a decomposing banana stem.



Lanikai’s vermicomposting operation consists of two colonies, a Pipeline Half Pipe named **Big Blue** – next to the fish – and the **Mulberry Gang**, five Pipeline PODs just outside the cafeteria. All of these bins are *lateral-flow systems*. The worms move laterally, from side to side.

Cross section of a Pipeline lateral-flow worm system



The bin is divided in half by a perforated divider. Feeding is done on one side at a time. The left side is bed, fed, and watered for six months, then feeding on the left stops. The right side is bedded and fed. The worms migrate to the right side to find the new source of food. Within six more months, they have long consumed every morsel on left side and vacated – they are all on the right.



At this point, the material in the left side is fully finished vermicast, a full year in production. It is scooped out – harvested – and replaced with fresh bedding. Feeding now switches to the left, the worms begin to migrate left and the cycle begins again.



This box bin worm colony, freshly harvested by 6th graders, grew from four ounces to just over two pounds in one six-month cycle. Vermicomposting is a 3rd grade AINA project.



Pizza boxes, postal boxes, custodial supply boxes and other campus cardboard is continually collected, cut into pieces and soaked in water to soften. Kindergarten and first graders help tear this material into bits which is used to make worm bin bedding, a welcome fresh habitat for the worms to live in after vermicast has been harvested.



Worms have no teeth or grinding mouthparts. They are dependent on other members of the FBI to soften their food to goo. A high moisture content hastens this process, so keeping the worm bin wet is of critical importance. Luckily, 2nd graders excel at Worm Watering, a daily classroom Zero Hero Service Activity they perform with great care and skillful hose-handling technique.

Second graders also help to harvest Big Blue every August and February. Students pick through batches of vermicast searching for stray worms and egg capsules to rescue. The clean vermicast from Big Blue is used in our own gardens.

The AINA program uses **box bins** for its worm composting lessons. Box bins are hand-harvested after six months of operation, an activity students truly enjoy. Both worms and vermicast are harvested. Worms are manually separated from the vermicast using a “mound and pick” technique that relies on applied knowledge of photophobia (aversion to light).

Although they are terrific for classroom learning, box bins are not appropriate for large scale waste management programs.

Box bins and manufactured bins such as the Worm HangOut, Worm Cafe, Can-O-Worms, etc., are popular for residential use. If you are interested in starting a worm colony at home, contact Leslie Foster<kokuaworms@gmail.com>. Website: www.kokuaworms.com. Phone: 256-6717.

The BOTTOM LINE on vermicomposting

**Approximately 50 pounds
(80,000) worms at Lanikai
School process**

- **30% of total food waste**
- **90% of total cardboard & paper waste.**

**In one school year our
worms consume**

- **4,307 pounds of fruit,
veggie, and grain waste.**

**In one school year our
worms produce**

- **1,100 pounds of
vermicast.**

**Retail value of vermicast
@ \$3/pound is \$3,300.**

Tour Stop #5 • Thermal compost is HOT

Worms are wonderful, but they can't do it all. The majority of food waste generated at Lanikai is post-consumer waste, consisting of plate scrapings, home lunch leftovers, and Sort-It-Out Sam snack waste.

Because this material contains meat and dairy products, salty crackers and sugary snacks, thermal – or hot – composting is the best choice. Worms happily consume these items but they cause a stink in the worm bin so we hot compost instead.

Hot compost can handle anything and everything! With a pitchfork, water source, and a supply of mulch courtesy of the local tree trimmers, Lanikai's hot composting operation processes 61% of our total food waste. Blanketed with burlap coffee bags and colorful painted bricks, the compost crescent is truly an Earth Art installation, alive and ever-changing.

At this station Mr. Sawyer and Ms. Mindy will demonstrate the layering procedure, the “feeding” of the compost pile. We hot compost twice a week, usually after school. After several failed attempts to involve

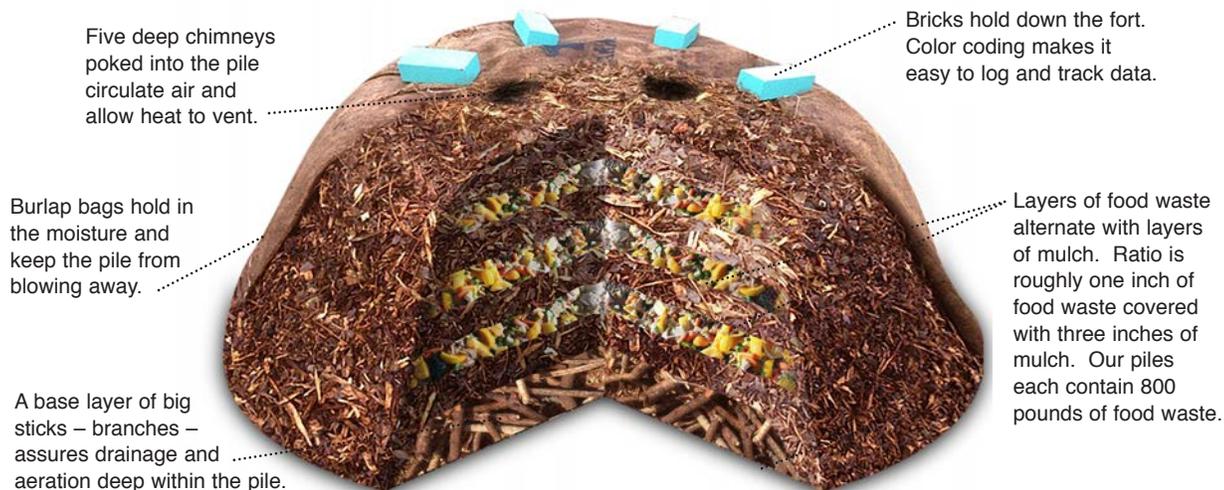
students, we determined that this step was for motivated adults only. Kids help us by schlepping mulch over from the mulch pile.

Perhaps because students miss this part, there is confusion about hot composting. How can food and bits of ground-up tree branches turn into soil? It's easy to see how the worms eat food and poop out vermicast, but what's going on in those piles?

The answer is **HEAT**. When you layer carbon materials – mulch – and a nitrogen source – food – in the presence of moisture and oxygen, a group of thermophilic (“heat-loving”) bacteria are activated. These microscopic organisms secrete enzymes that break the molecular bonds holding together the organic materials. *That energy is released as heat.* Within a couple of days, the pile reaches temperatures of 140 to 160 degrees. It's literally an oven in there!

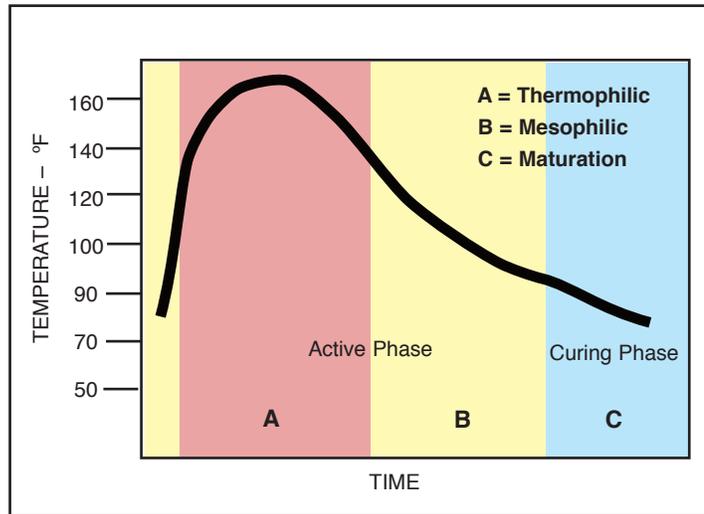
And just like in an oven, materials cook down. The food goes to mush, the tougher woody bits weaken and soften. We continue to layer food and mulch for a month more or less, during which time the pile will maintain high temperatures – this is called the **thermophilic**

Cross section of a static aerated hot compost pile



phase. The extended high heat not only breaks down the materials but also kills any pathogens. When we reach 800 pounds of food waste in each pile, it's pau. From that day we add on six months and that becomes the harvesting date.

You can track the progress on each of the hot compost piles on the white board posted just opposite the library doors.



Temperature changes in an average hot compost pile

As the pile cools down during the **mesophilic phase**, more and more members of the decomposer community – the infamous FBI – arrive on the scene to partake of this bonanza of nourishment. Some interesting molds and mushrooms appear, penetrating deeply into the pile with delicate root-like mycelium that secrete acids to hasten breakdown. Multitudes of joint-legged creepy crawlies feast away, using some of the food energy and nutrients for their own sustenance and reproduction, then excrete what's left.

All these juicy bugs draw predators such as centipedes and the rare and beautiful Hawaiian blind snake, whose muscular burrowing around in search of a meal aerates, stirs, and mixes..

The compost pile during its active phase radiates and vibrates with vitality. The end result of this intense and complex thermal, chemical, metabolic, and mechanical activity is a rich, dark, crumbly substance called “compost.” Compost contains essential life nutrients packaged in a form that can be absorbed by plants. (Yeah, compost is basically bug poop.)

GALLERY

Top Ten Cool Hot Compost Critters

(not to scale)



Isopod



Millipede



Surinam Roach



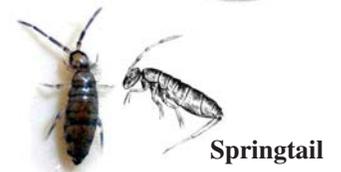
Earwig



Beetles



Beetle Grub



Springtail



Black Soldier Fly Larvae



Centipede

For observation only.
Do not handle.



Hawaiian Blind Snake

We are very proud that all of the plant nutrients needed to grow beautiful gardens at Lanikai PCS are created right on campus by all of us working in partnership with nature.

We have successfully closed the circle and achieved recycling of the highest order – Zero Waste! Since we began collecting and processing our food waste a year ago, we have purchased no outside soil, compost, or fertilizer. Our artisanal chemical-free organic amendments are of far better quality than any other product available on Oahu. The quantity we produce is plenty for our own gardens with surplus to share with the community.

By regarding waste as a resource, we have built value and environmental enhancement where formerly there was only expense and degradation.



The luckiest kids on campus are the 4th graders, whose Zero Hero Service Activity is to harvest the hot compost piles. It's a lot of fun!

The thermophilic bacteria have had their day and all the industrious mesophilic creatures worked the pile over and over. When all the FBI food is processed down to plant nutrients the bugs lose interest – they bail to find fresher fare elsewhere. The pile cools off during the phase called maturation or curing. That's when the 4th graders come in to do their part.

Working in teams of six, shovelers and screeners dismantle the finished compost pile and sort out any unfinished chunks, filling boxes with clean compost to be stored under the trailers until they are needed.

There are always some stragglers among the invertebrate crew – not enough to overwhelm but plenty to give students a chance to interact with a few millipedes, isopods, etc. Encounters with huge centipedes (treated with due caution) and Hawaiian blind snakes have created big thrills at every harvest session.

Hot composting is a clear winner, start to finish.

The BOTTOM LINE on hot compost

**In one school year we process
in ten hot compost piles:**

- **8,659 pounds (4.33 tons)
of lunch and snack waste
that equal...**
- **61% of total food waste.**

**Harvest yields approximately
20 cubic yards of compost.**

**Retail value of our premium
compost @ \$15/cubic foot is
\$2,700.**

We use 50% and sell the rest.

Tour Stop #6 • Green waste composting station

Green waste consists of leaves, branches, prunings, garden clippings, etc., plentiful and unrelenting on a large landscaped campus. It has been standard DOE custodial procedure for as long as anyone can remember to bag up green waste in 32-gallon plastic rubbish can liners and toss it in the dumpster for disposal.

Because green waste is voluminous, dumpsters fill up fast. Full dumpsters must be emptied (\$\$\$) and the contents trucked across the island to the landfill or H-Power and processed at great cost, an egregious waste of taxpayer dollars. To transport, burn or bury easily biodegradable green waste – and all that toxic plastic it's packed in – is just plain crazy.

Old habits die hard, but we have finally elicited the kokua of our custodians to allow us to keep the resource on campus. Large items like branches and big palm fronds are now piled at the back end of the mulch pile where they will be periodically shredded.

All other green waste is deposited in front of the Green Waste Station, where it is layered with retired burlap bags or placed in commercial tumblers where with minimal effort it very quickly breaks down to a medium grade compost. Although composting by this method does not reach the high temperatures of the hot compost piles, materials are well pulverized by the FBI.

Fears about spreading invasive species, weed seeds, plant diseases, mold and pest infestations have been thoroughly researched and are completely unfounded.

The compost resulting from this operation is not rich enough for our gardens but will be adequate for lawns. It will be broadcast on grassy areas to add organic matter to the soil, increasing water retention capabilities.

So far this year we have been successfully keeping up with the volume of green waste. We have not collected data on this operation as yet.

Tour Stop #7 • Marvelous Mulch: restoring healthy soil

The most ambitious project of Lanikai's Zero Waste Revolution is the restoration of the front schoolyard. The soil is totally depleted and compacted as hard as cement – even in the rainy months it can barely support grass in the center section. The wide perimeter was bare dirt, dusty in dry weather, mud flats in rain.

When tree trimmers are in the area, they are more than happy to drop off to us their truckloads of mulch at no charge. Mulch is simply tree branches comprised of wood and leaves, chipped and shredded into bits.

To mulch an area, we first spread out all the cardboard waste that's been generated (actually not all – some goes to make worm bin bedding). Instead of filling dumpsters, cardboard boxes

are flattened and become the basement of the mulch layer. There are hundreds of science fair display boards buried under there, too! Then mulch is spread 8 to 10 inches deep on top.

The FBI move in to do their work and within six months we have an inch of rich soil. This procedure will be repeated four times. We have completed two layers so far. The estimated addition of organic materials to our schoolyard over the duration of the project will be **24 tons**.

In two or three years when we have a deep enough bed of soil, the yard will be re-seeded with a hardy, resilient green grass. With standard maintenance and regular applications of compost tea, our new lush verdant schoolyard will be good for generations to come.

Tour Stop #8 • Tea Time

Compost and vermicompost in granular form are perfect for amending soil when preparing beds for planting or starting seedlings. Once plants are established and growing, they benefit from applications of an aqueous extract called **compost tea**.

The liquid tea will contain all the compost's soluble nutrients as well as many important microorganisms that contribute growth-enhancing enzymes, hormones, and other organic compounds that help plants to resist pests and diseases.



Compost tea is made from seeping several cups of high quality compost and/or vermicast in ten gallons of water for 24 hours in a brewer. We used some grant money to purchase a commercial tea brewer which is headquartered in the Teachers' Lounge.

This particular brewer makes an *aerated tea* by forcing tiny bubbles through the water during the brewing process with a (noisy) air pump. Aeration is important because all the beneficial microorganisms we want swimming in our tea are oxygen breathers. When the oxygen in the water gets depleted they start to die off, so compost tea is best when used fresh. It's good for 24 hours and can be extended a day or so uncorked in the refrigerator.



Our 3rd graders have been brewing up batches of tea as their Zero Hero Service Activity. They make a mix of mostly vermicast with a few handfuls of mature hot compost thrown in.

Compost tea is used as a foliar spray to coat the surfaces of leaves and stems to inhibit white fly, mealy bug and aphids. Tea is an excellent alternative to toxic chemical pesticides, perfect for school campuses, safe for children and pets.

Mostly compost tea is applied as a wash to deliver nutrients and beneficial microbes deep into the soil. We have plenty of kid-sized watering cans that can be filled with tea to water our garden beds.

Compost tea has many enthusiastic advocates. The Four Seasons Resort at Hualalei on the Big Island abandoned chemical soil management 14 years ago and switched to using compost tea. All the golf courses in the Bay Area in San Francisco have eliminated pollutants by switching to tea.

Harvard University restored their lawn in 2009 and maintains it successfully with compost tea despite heavy use and New England winters. Google "The Grass is Greener at Harvard" to find a fascinating article that appeared in the *New York Times*.

This story was the inspiration for our schoolyard grass restoration project! Tea is terrific on turf.



Free Tea!

Do you have a garden or potted plants? Please pick up a complimentary gallon of compost tea following the tour, first come first serve while supplies last. We will brew a second batch later this week for those who missed out on the first batch. Water your plants at full strength or dilute up to seven times to stretch it out.

Many mahalos to Ms. Kristi and her art students for designing and producing the beautiful Lanikai School branded product labels for the various Zero Waste goods we offer to the community.

Tour Stop #9 • Bokashi fermentation – do try this at home

Bokashi is an ancient Japanese method for recycling food waste to create rich soil. Unlike hot composting and vermicomposting, bokashi is not a decomposition process at all – it is a preservation process you are already familiar with: fermentation or pickling. The decomposing part does not come into play until the finished material is buried in the soil.

The fermentation process involves a consortium of bacteria and yeasts working in anaerobic conditions, that is, in a sealed container. Food waste is packed in with a microbial “starter.”

On our campus we have four Bokashi Blasters that each can pickle 150 pounds of food waste mixed with 18-20 pounds of starter within a month’s time. Whether you decant your batch in a month or a year, it doesn’t matter. The preserved food waste looks exactly the same as the day you put it in, although it has been structurally and chemically altered. To soil organisms it has been weakened, practically predigested.

When the bokashi is finished, dig a trench or pit in any soil.



Break up and mix the material with the dirt, then cover completely with soil at least four inches deep. Wait two weeks while soil critters break down the bokashi to rich nutrient granules that plants respond to vigorously. (The plot with the amazing kalo in the garden has 250 pounds of bokashi buried in it).



Bokashi starter is made from wheat chaff, molasses, water, and a convenient commercial inoculate called EM-1. Fifth graders enjoy mixing it up, packing it into containers to ferment, decanting, drying, and packing it up again. We store the one pound containers for our



own use as well as sell them to people practicing bokashi fermentation at home.

Worm composting is a serious commitment to managing livestock and hot composting takes up quite a lot of space, but a tightly-sealed little bokashi bucket can be kept under the sink in the kitchen with minimal impact. We highly recommend bokashi fermentation for those who want to achieve food waste diversion at home.

A workshop on home bokashi will be offered after this tour, and in the future periodically by request. Bokashi buckets (\$70) and containers of starter (\$5) are available.

The BOTTOM LINE on bokashi

Last year we processed 937 pounds of food waste with bokashi – about 9% of the total.

Where do we go from here?

Thank you for taking today's tour, and for your continued patience as we pioneer Zero Waste at Lanikai School. Your kokua is much appreciated! Your comments are welcome.

We have achieved a lot. We are currently recovering 100% food waste, 100% HI-5 cans and bottles, 95% green waste, and 95% paper and cardboard waste. We are getting national attention and are up for an EPA award! How can we reduce waste even further to get closer to ZERO?

Here's a partial wish list (cost no object):

- Install a water catchment system; use recycled water for garden and composting
- Switch to a refrigerated milk dispenser to minimize milk and milk carton waste
- Switch to hand blowers in the restrooms to minimize paper towel waste
- Review and revise current policies regarding snacks and parties
 - adopt the Healthy Snack or other alternate program
 - disallow sweet and gooey treats brought in by parents
- Work with home lunch kids and parents to reduce plastic and other packaging;
 - Campaign for and promote re-useable lunch kits
 - Waste-Free Wednesdays
- Other ideas welcome!

What can you do to help every day?

Eliminate waste when possible, vigilantly police your classroom rubbish separation, and be especially kind to Mr. Sort-It-Out Sam. Don't forget your daily Samurai.

Whenever you have the opportunity – whether you're planning a meeting, party, or major event where waste may be generated – take a moment to think “how can I minimize waste impact here?” You have the use of re-useable, washable classroom party sets – use them! Ask for tables, buckets, supplies and any other support you need from Mindy or Espie.

Please don't hesitate to contact Mindy with any questions or concerns you personally have or issues that parents bring up. E-mail is best: mindy@waikikiworm.net

Lanikai School's Zero Waste Revolution is a program of Oahu Resource Conservation and Development Council, funded by a generous gift from Steve and Marilyn Katzman.

Project management is provided by Mindy Jaffe, owner, Waikiki Worm Company.

Monthly Reports are posted online at www.waikikiworm.com