Closing the Food Cycle Loop: Part 1

The Liberty Hyde Bailey GREENhouse Project

Project Participants
Operations and Academics Working Together

Residential and Hospitality Services (RHS):

Diane Barker, Carla Iansiti, Robbia Pipper,

Student Organic Farm (SOF):

John Biernbaum, Laurie Thorp, Brendan Sinclair

Students: Kirk Green, Thom Mcalvey, Karri Tomich-Baylis, Charles Defever, John Dindia, Allison Stawara

Environmental Studies (RISE): Laurie Thorp and students

Landscape Services: Deb Kinney

University Office of Sustainability: Jennifer Battle

2012 Project Priorities and Funding

- More SOF produce for RHS (herbs, microgreens).
- Demonstrate entrepreneurial culinary herb production in a passive solar greenhouse.
- Provide freshman Environmental Studies students access to SOF and local food concepts.
- Increase Academics and Operations Partnerships.
- Experience how composting is used for nutrient cycling and to keep food waste out of landfills.
- Funded by a Sustainability Seed Grant award from the Office of Campus Sustainability for $50,374.

Time Line

- 1996: Research work with non-winter hardy culinary herb propagation and production.
- 2001: Winter harvest strategies of salad greens in PSGH that formed a part of the foundation for the Student Organic Farm.
- 2003: Emergence and discussion of Eco Dorm ideas – a place for students with common interests to learn beyond the classroom.
- 2005: Campus food waste evaluation and initial data collection.
- 2006: Start of the current phase of evolution of the campus food system.

Time Line

- 2009: Development of MOU with RHS, RISE and SOF; completed March 2010.
- 2010: Plans to manage campus food waste including anaerobic digester and worm composting.
- Fall 2011: Bailey Hall renovation; order PSGH; propagate herbs; prepare compost at SOF, Sustainability Seed Grant proposal.
- Spring 2012: Herb transplants in flats & pots at SOF.
- June-July 2012: PSGH construction and growing bed preparation.
- August 2012: Herb planting in PSGH and Green Roof installed.
- September 2012: Herb harvesting and sales begin. Landscape installation begins.

October, 2001 – Winter Salad Greens Research

30 different salad greens were planted at three times to develop planting recommendations for winter harvest of salad greens in Michigan from hoophouses or passive solar greenhouses (PSGH) which are unheated greenhouses with crops grown in the ground as if outside.

August, 2006 – 5th PSGH about to be built

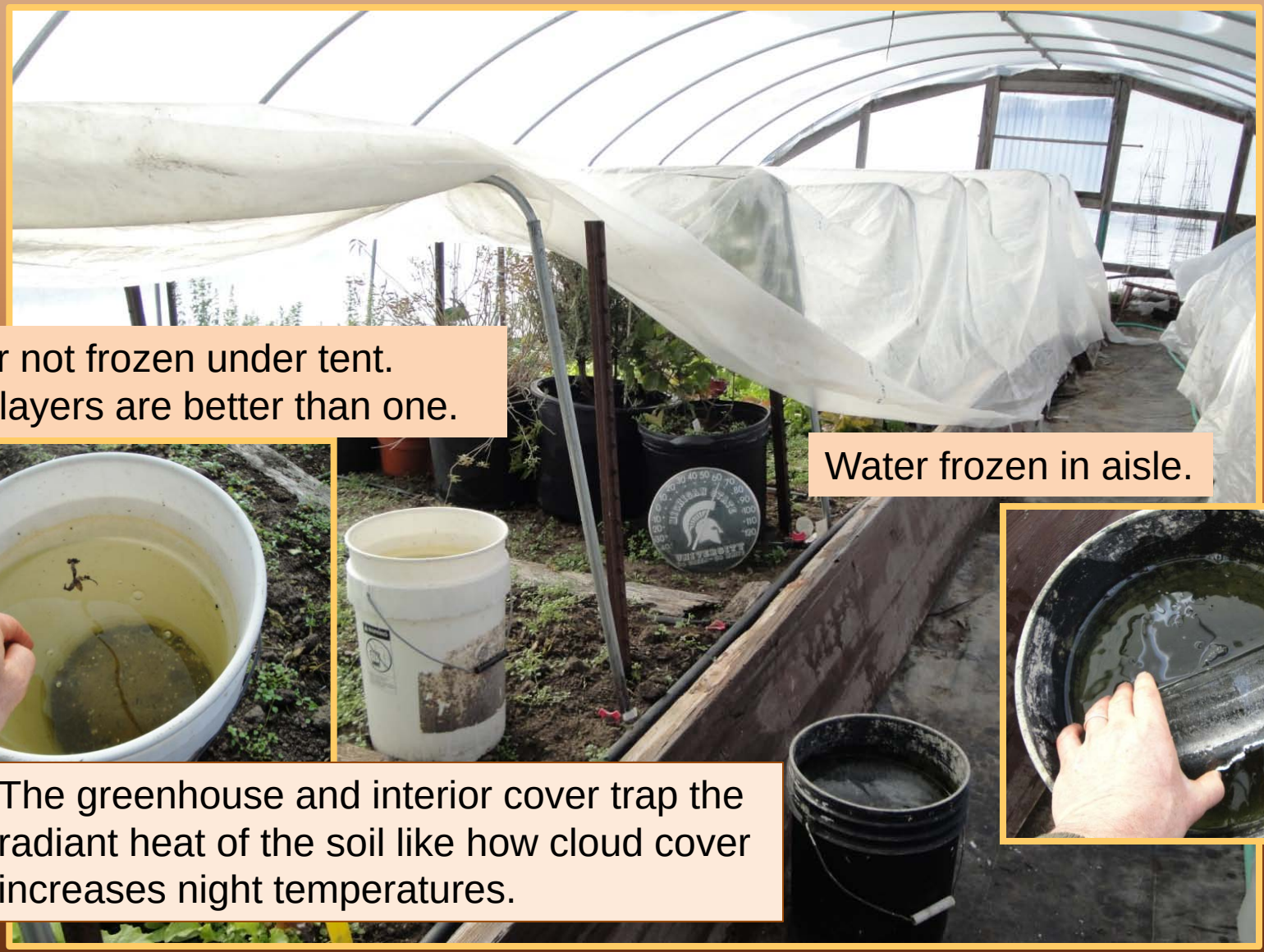
The PSGH winter harvest was successful and lead to the start of the year round community supported agriculture program at the Student Organic Farm. Hoophouses started popping out of the ground every two years.

Passive Solar Greenhouse PSGH) January 1, 2011

Outside temperatures can be near zero but solar greenhouse (no heater) warms to 50 to 70^{o}F.

Pear Tree Farm – Several Years of Overwintering Organic Herbs

Interior Tent Effect – Trap Radiant Heat

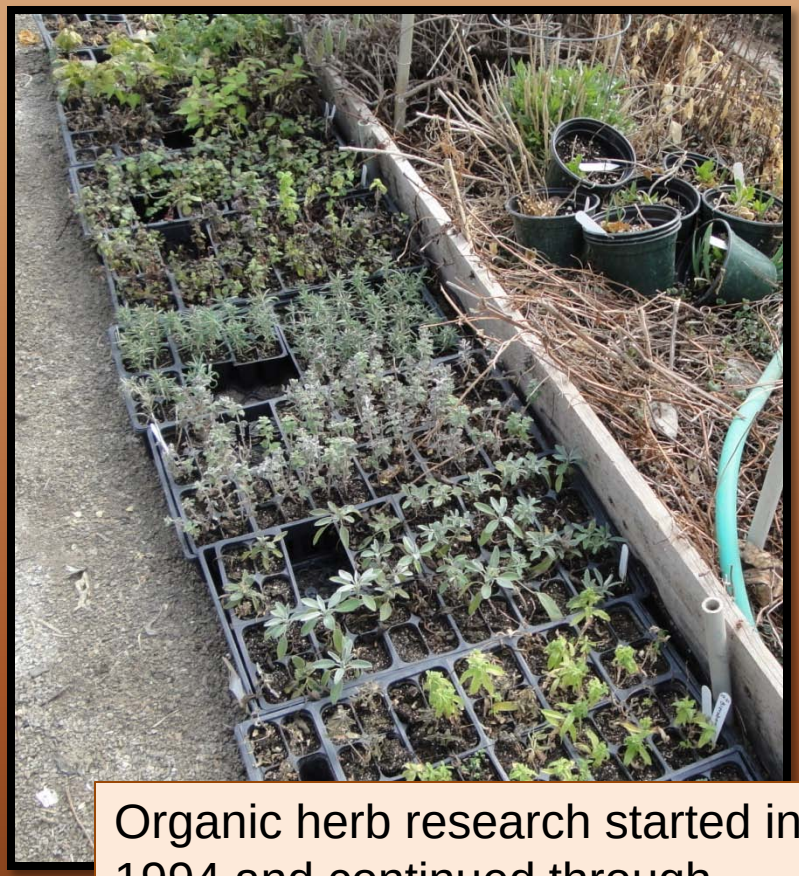


Water not frozen under tent.
Two layers are better than one.

Water frozen in aisle.

The greenhouse and interior cover trap the radiant heat of the soil like how cloud cover increases night temperatures.

Propagating and Overwintering Tender Perennial Herbs



Organic herb research started in 1994 and continued through 1998. At the time there was not an obvious market for the herbs.

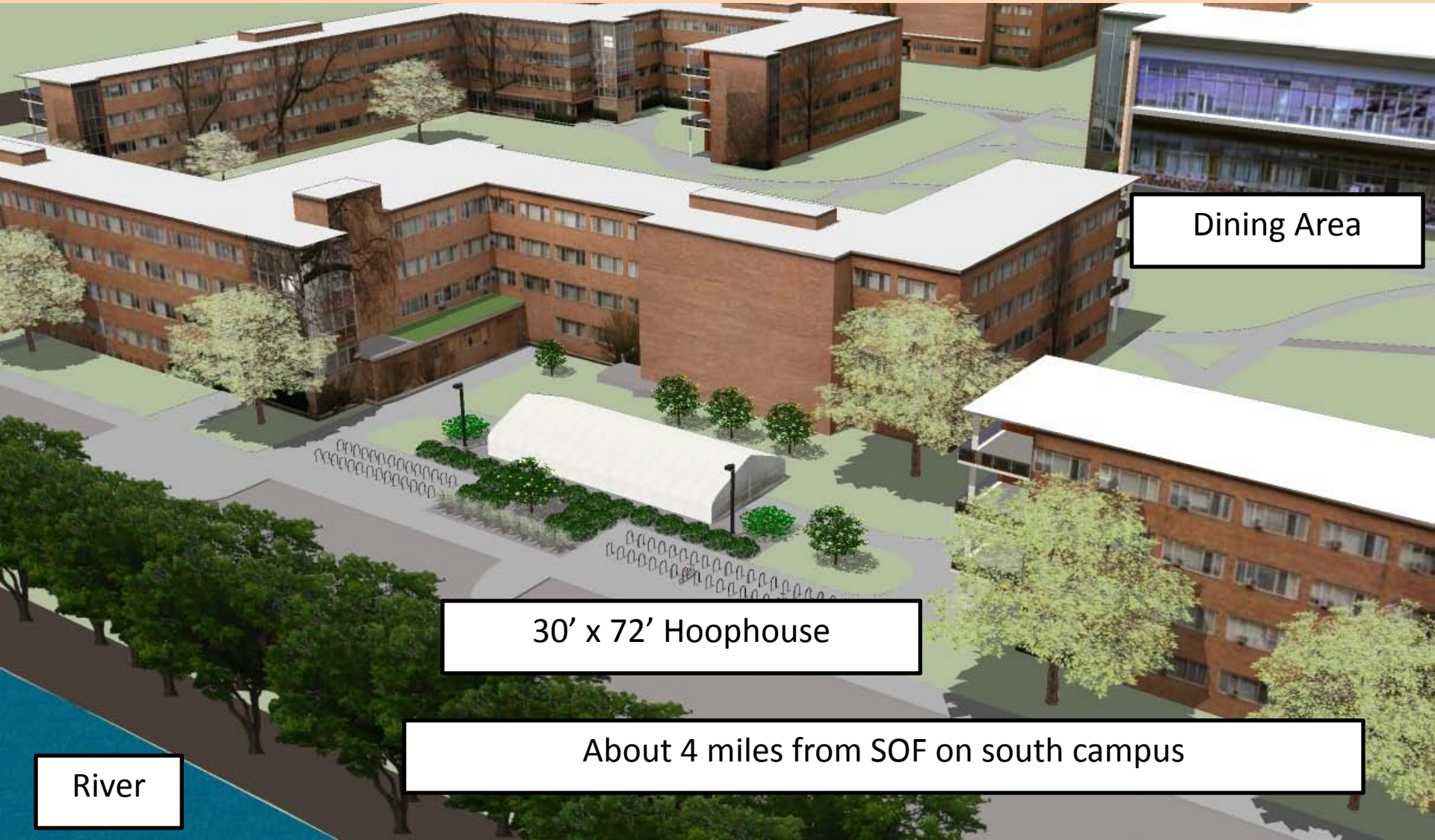
Lemon verbena and rosemary in large pots and wintered for over 5 years in Climate Zone 5 (minimums of -20^{o}F).

Rooted Herb Cuttings in flats, small pots and larger pots survived the winter.

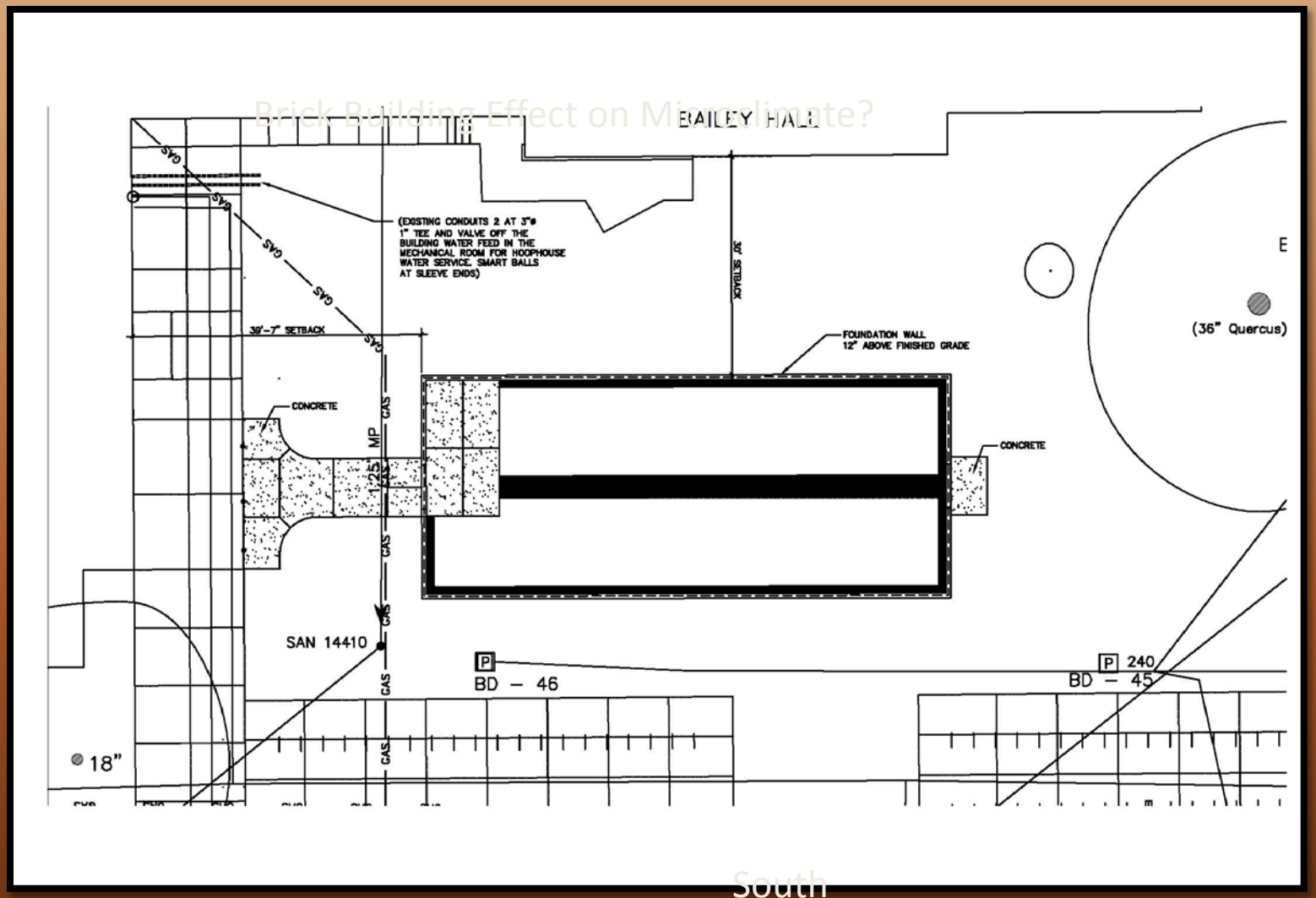
Rosemary, Lemon Verbena, Oregano, and Thyme growing in a ground bed like those proposed for Bailey GREENhouse.

MSU Hoophouse Herbs

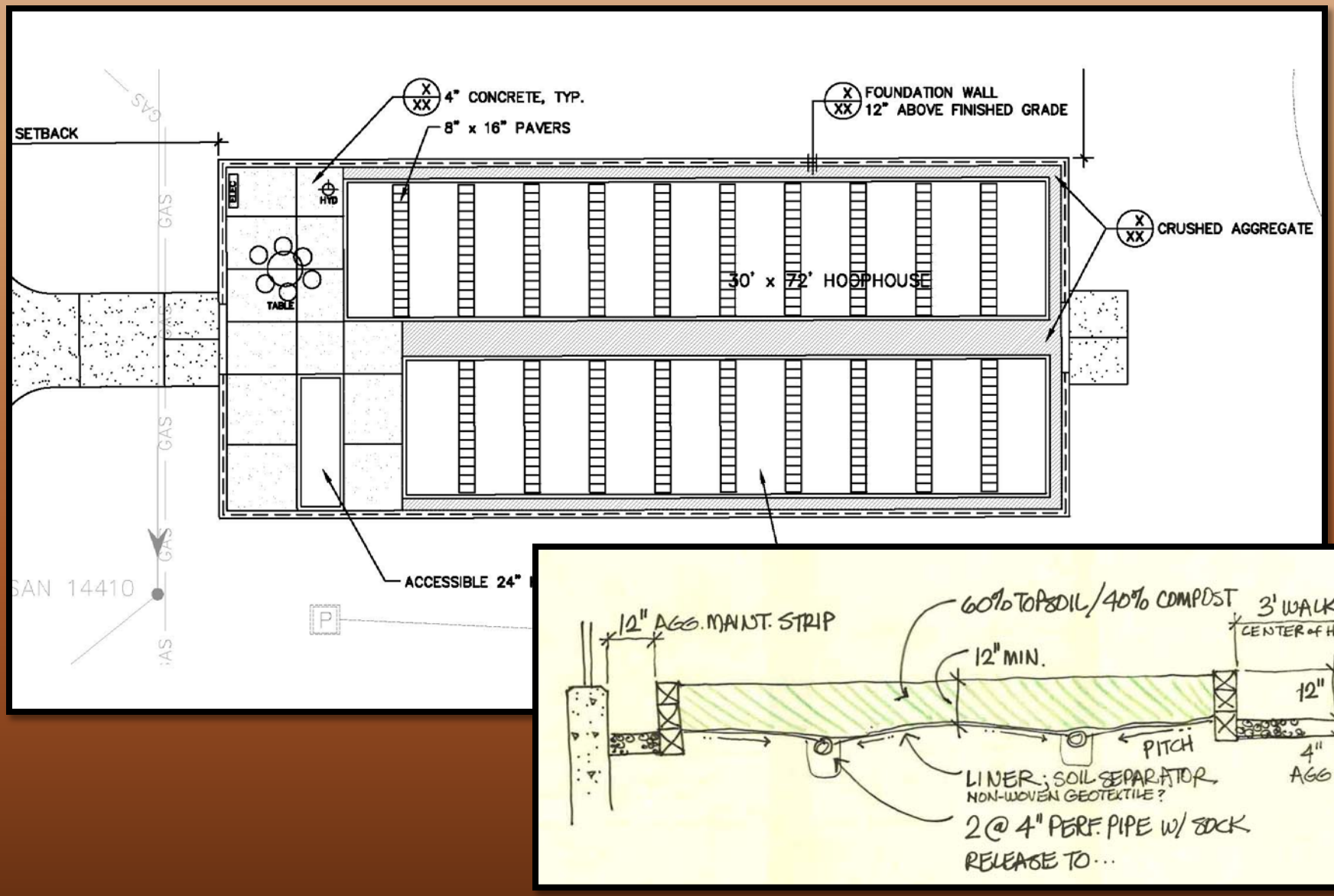
Project of Residential and Hospitality Services, Environmental Studies Program and Student Organic Farm



Landscape Layout
30’ x 72’ Passive Solar Greenhouse



Bed Layout: 26 beds – 40” x 11’ (40 sq ft)



MSU Herb Purchases in 2009

Herb	units	Unit Cost	Total $	oz Unit Size	Total lbs	Yield/ sq ft	sq ft needed	$/sqft
Basil	300	$7.10	$2,130	8	150		need to determine	
chive	168	$4.95	$831	4	42			
dill	80	$7.13	$570	8	40			
mint	32	$5.50	$176	8	16			
mint	12	$13.50	$162	16	12			
oregano	60	$5.65	$339	4	15			
parsley	288	$9.64	$2,770	16	288			
rosemary	96	$5.50	$528	8	48			
tarragon	80	$5.00	$400	4	20			
thyme	24	$5.65	$135	4	6			
sage	32	$3.25	$104	8	16			
Totals:			$8,153		653	lbs		

Average $12.50 per pound; Basil and Parsley total more than 50%

Culinary Herb Crop Plan / Percents

Seasonal Crops	%	Perennial Crops	%
Basil*		Rosemary*	
Parsley*		Oregano*	
Cilantro		Chives	
Edible flowers		Tarragon	
Dill		Sage	
Microgreens?		Thyme*	
Pea sprouts?		Spearmint	
		Peppermint	
		Lavender*	
		Savory? Majoram?	

*Reported use at 5 to 6 lbs per week

A plan was developed for how many herbs to plant based on prior purchasing practices.

Propagation of Culinary Herbs

Independent Study Project by Horticulture Student during Fall 2011

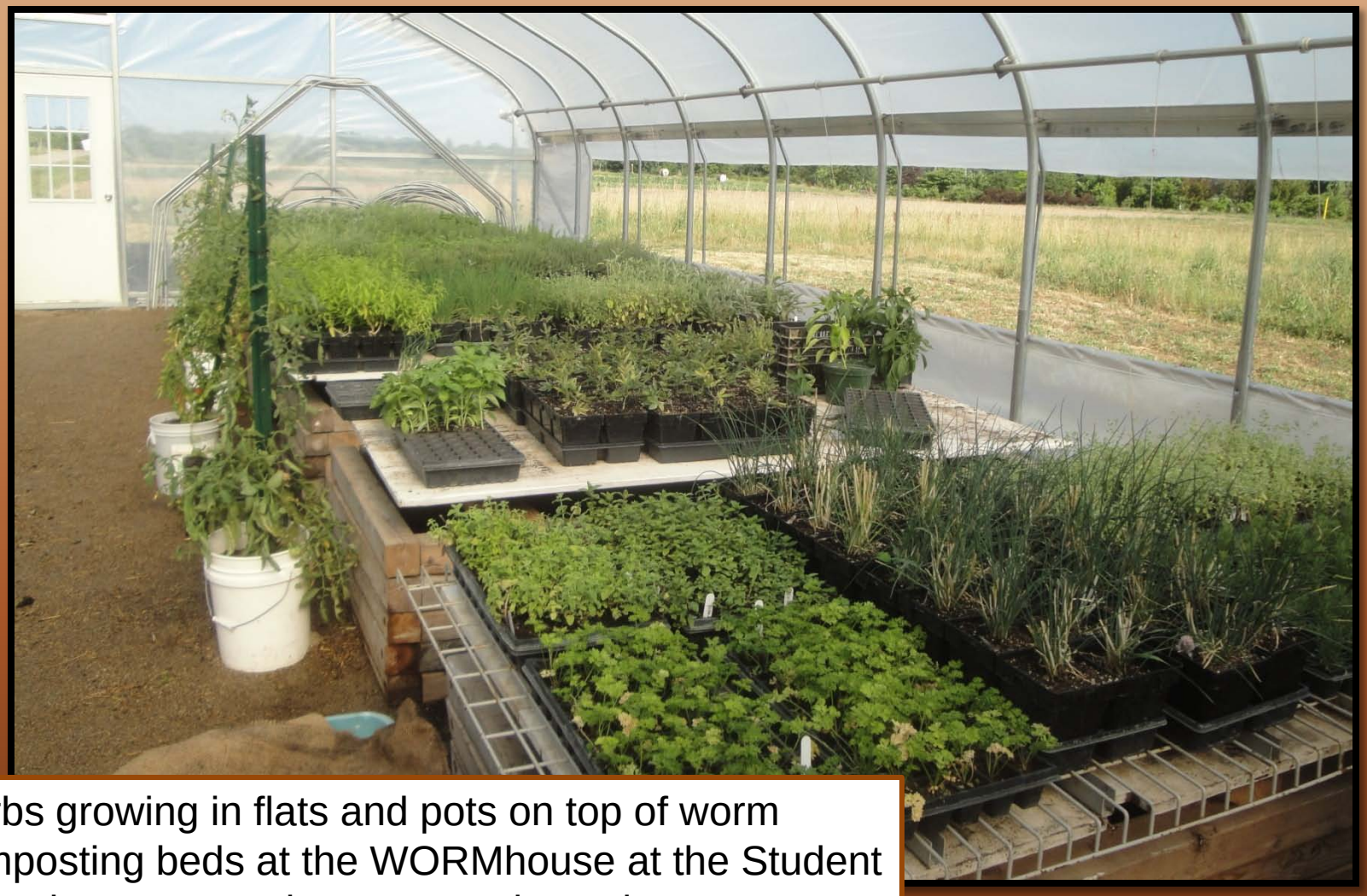
All cuttings were obtained at no cost and from organic management from Pear Tree Farm.

Propagation of Herb Cuttings

Rosemary, Oregano, Sage, Thyme, Tarragon, Peppermint, Spearmint

Mist propagation accomplished at the Plant and Soil Sciences Teaching Greenhouses. Shoots kept moist initiated new roots and new plants.

June 26, 2012 Herbs ready for Planting



Herbs growing in flats and pots on top of worm composting beds at the WORMhouse at the Student Organic Farm. Herbs were ready to plant.

Sage, Oregano, Rosemary, Thyme, Chives, Mints

Organic herbs grown in compost and with worm compost as fertilizer. Initial harvesting and sampling by chefs occurred at this point in time.

Preparing the “Soil” by Composting

Composting allows immediate organic certification which would not be possible with the 60% top soil and 40% compost blend initially planned.

Summer 2011, Feedstocks from South Campus Compost Facility

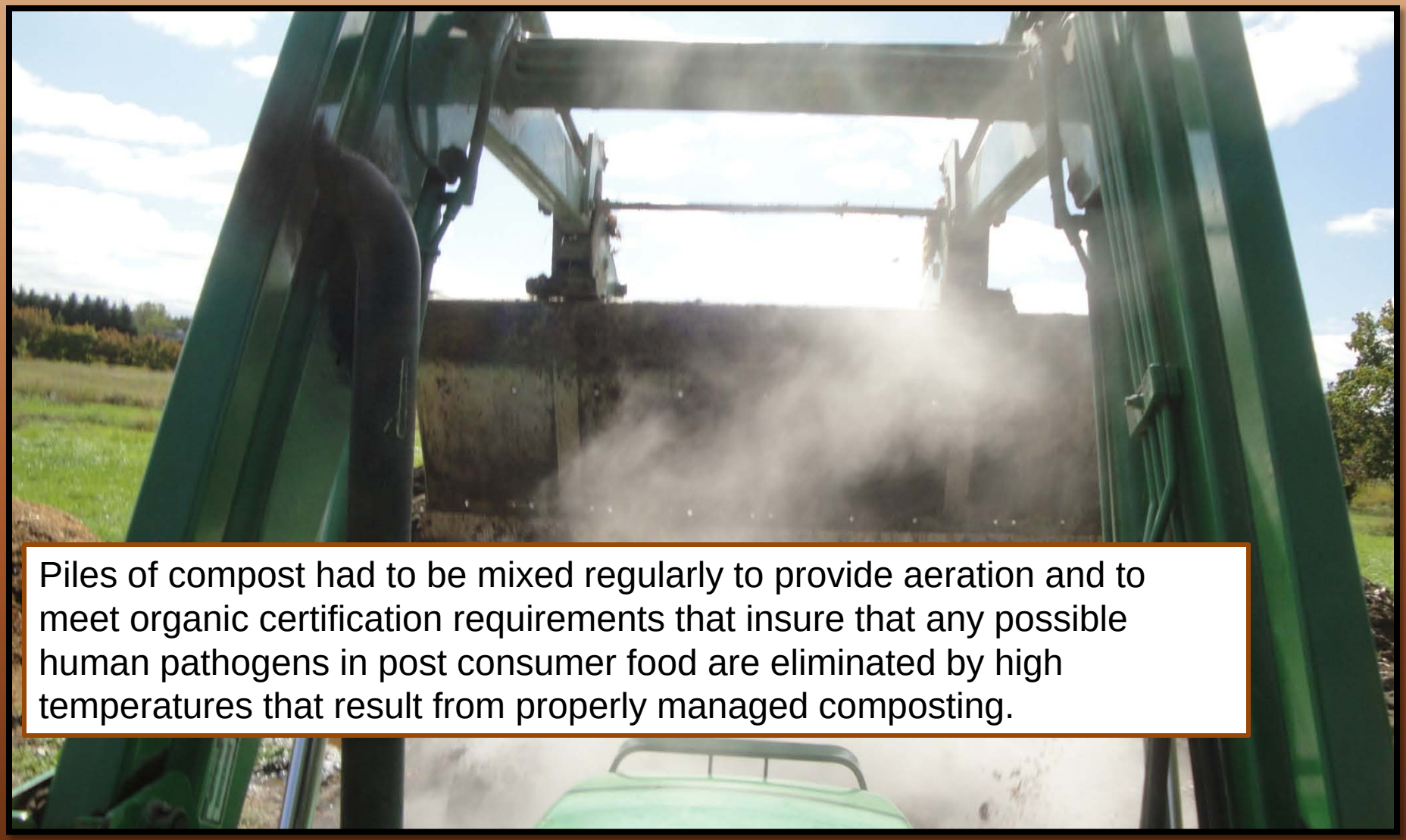
Preparation for Pulped Food Residue

Mixing in Pulped Food Residue

About 3 to 5 cubic yards per delivery.
Delivery Tuesday and Friday.
Cubic yard more than 1000 pounds.
Increase from 600 lbs/wk in spring to over 6000 lbs/wk

Mixing feedstocks and pulped food residue

Turning Hot Compost – Over 150ºF



Piles of compost had to be mixed regularly to provide aeration and to meet organic certification requirements that insure that any possible human pathogens in post consumer food are eliminated by high temperatures that result from properly managed composting.

“Finished” Brody Pulper Compost

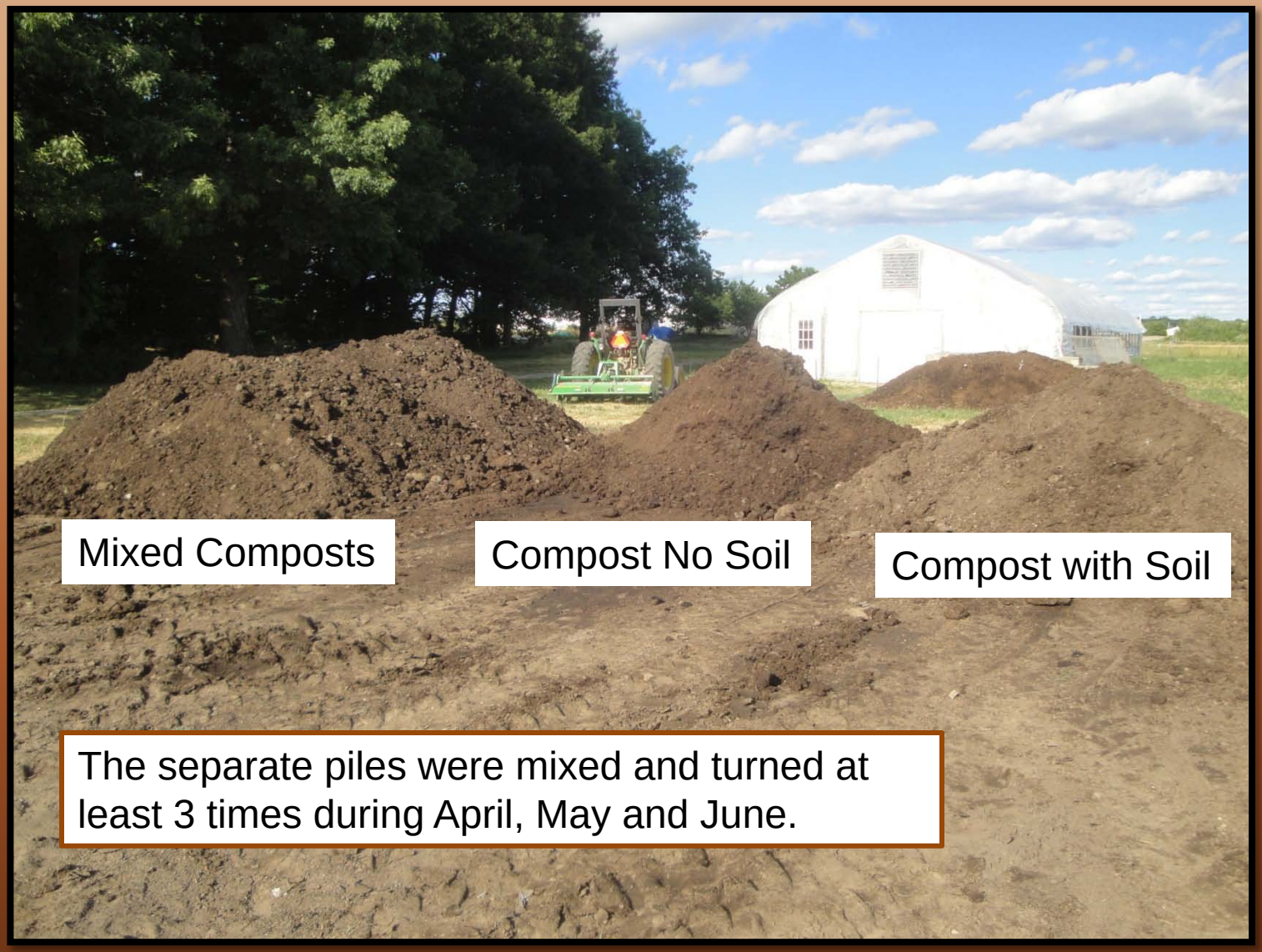
November 2011 – after hot composting. Three windrows this size of compost with no soil were produced.

March 4, Compost Prior to Mixing

Protected with covers over the winter.

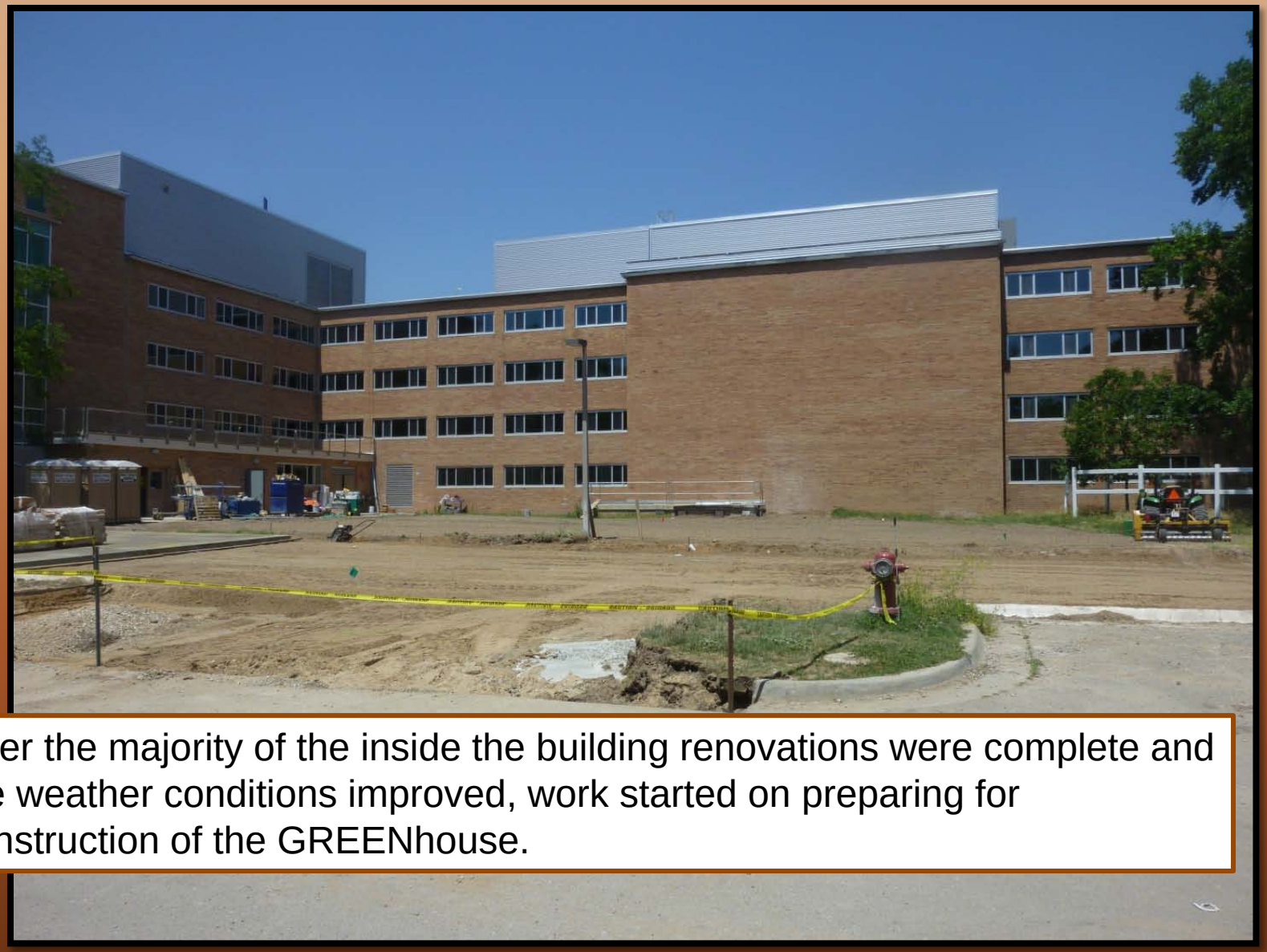
The piles maintained warm but not hot temperatures over the winter and were protected to prevent leaching of minerals and nutrients from the compost. As conditions dried the piles were turned more so the compost could mature. Eventually samples were analyzed and used to grow test crops of basil in small containers.

June 25, Mixing Piles



The separate piles were mixed and turned at least 3 times during April, May and June.

June 10 – Bailey Site Preparation



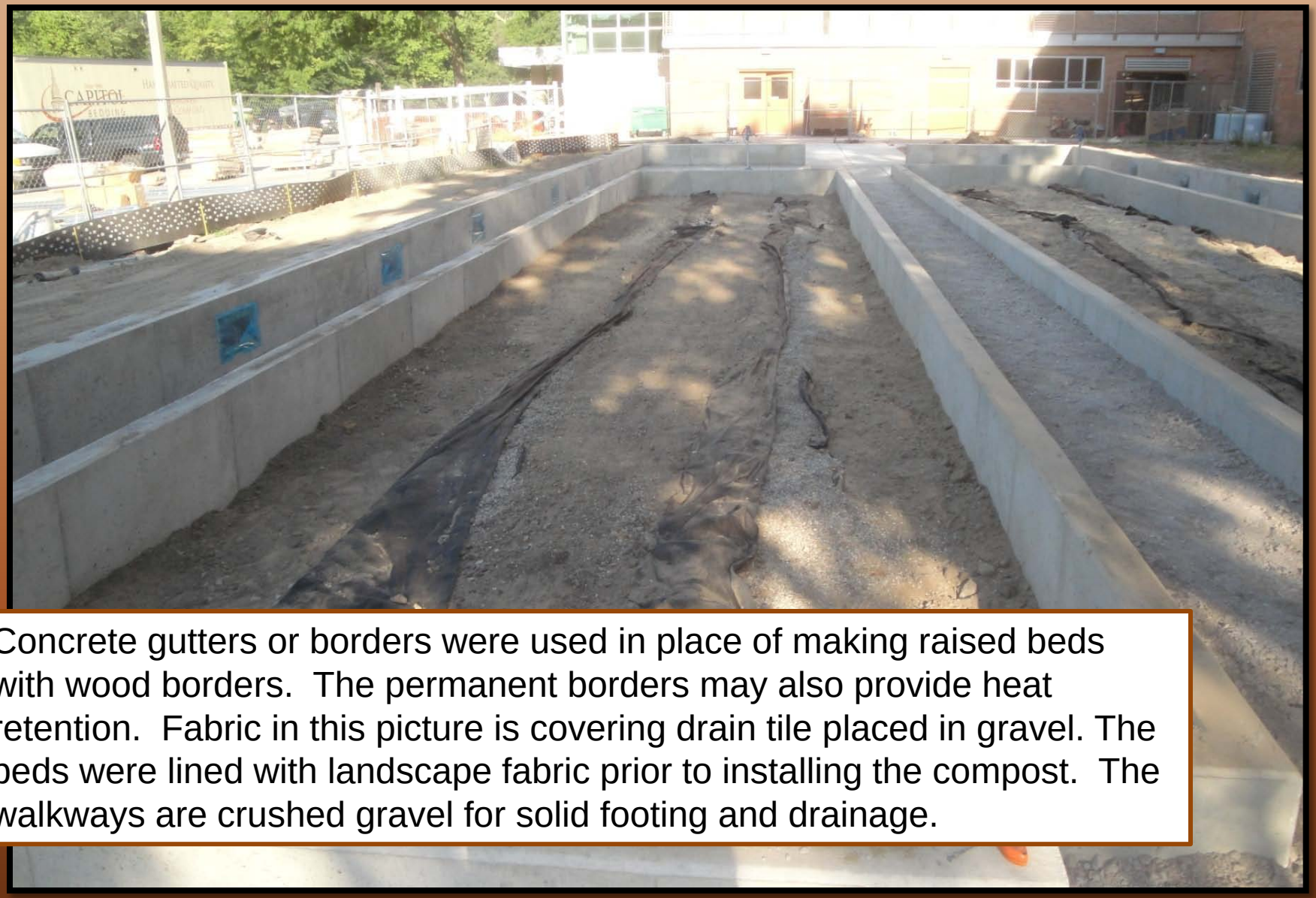
After the majority of the inside the building renovations were complete and the weather conditions improved, work started on preparing for construction of the GREENhouse.

June 21 - GREENhouse Foundation

The poured cement foundation with vents was required because the site is on a 100 year flood plain

July 9th Empty Beds with Drainage

Ready for Composted Soil



Concrete gutters or borders were used in place of making raised beds with wood borders. The permanent borders may also provide heat retention. Fabric in this picture is covering drain tile placed in gravel. The beds were lined with landscape fabric prior to installing the compost. The walkways are crushed gravel for solid footing and drainage.

Loading Mixed Compost at SOF

July 9, About 10:00 AM

July 2012 – compost is mature and ready to move to campus . Screening the compost would have improved uniformity but the necessary equipment was not available.

Delivery at Bailey Hall

3 truck loads moved, about 45 cubic yards

Filling the Beds

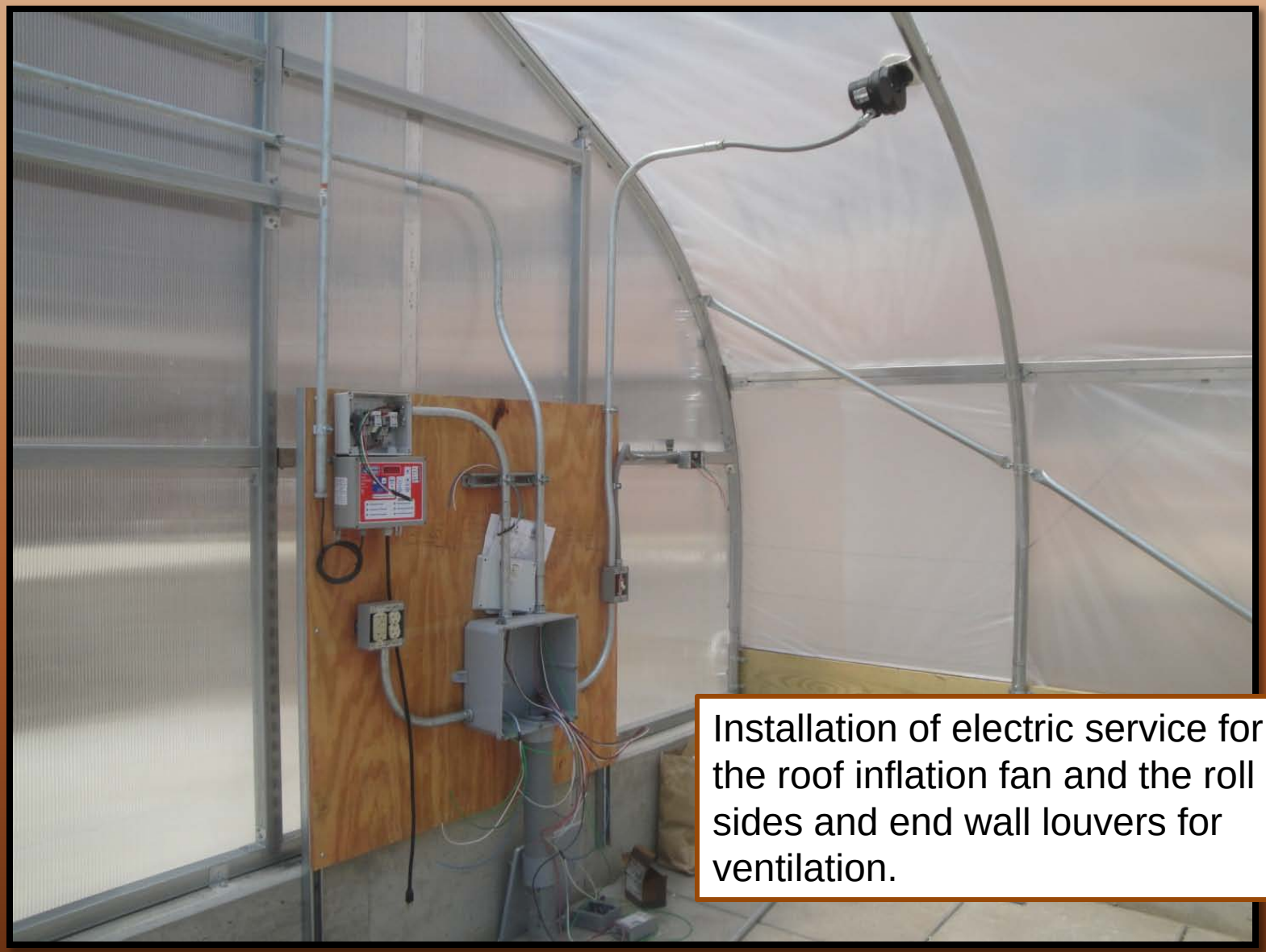
Beds Filled

July 9 – Start of Frame Construction

Commercial Contractors built the greenhouse frame and covered the structure with plastic film.

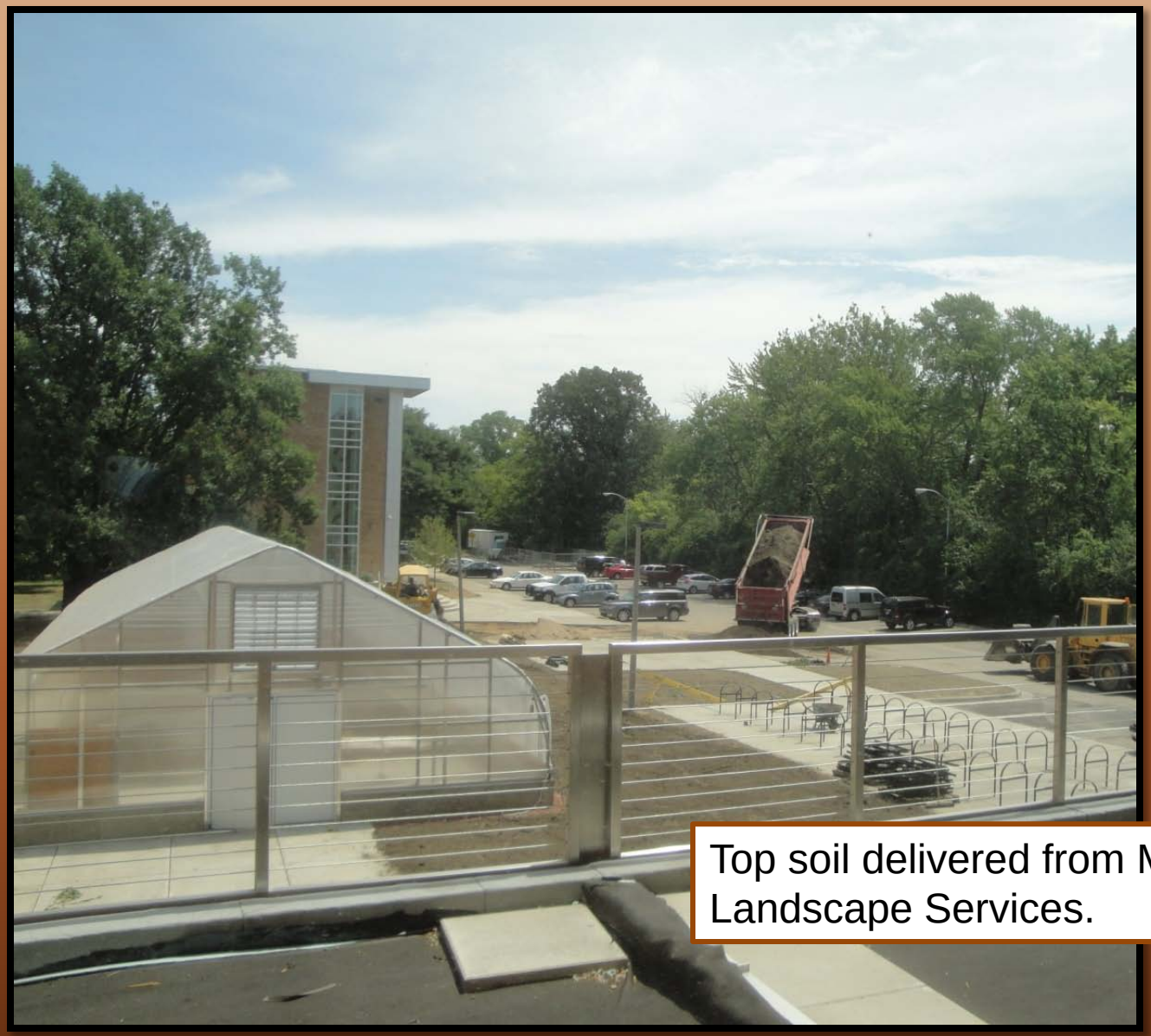
July 13 – Frame and Plastic Completed

July 25 – Electric and Wiring



Installation of electric service for the roof inflation fan and the roll up sides and end wall louvers for ventilation.

July 25 – Top Soil for Gardens and Turf



Top soil delivered from MSU Landscape Services.

Site Preparation – Replacement of Topsoil

Construction residue was excavated and six plus inches of top soil installed. Soil was from MSU Landscape Services.

August 7 - Green Roof Installation

Plant materials for the Green Roof were delivered on Aug 7 and installed over the next week. Sedum will eventually be partially replaced with vegetables.

August 1Installing Bed Walkways

After leveling and compacting the compost, concrete blocks (8”x16”x4”) were placed to form the between bed walkways. Blocks cost ~$1 each.

August 8th Planting

Beds were prepared and spacing marked to simplify the planting of the well rooted plants waiting for more space and compost.

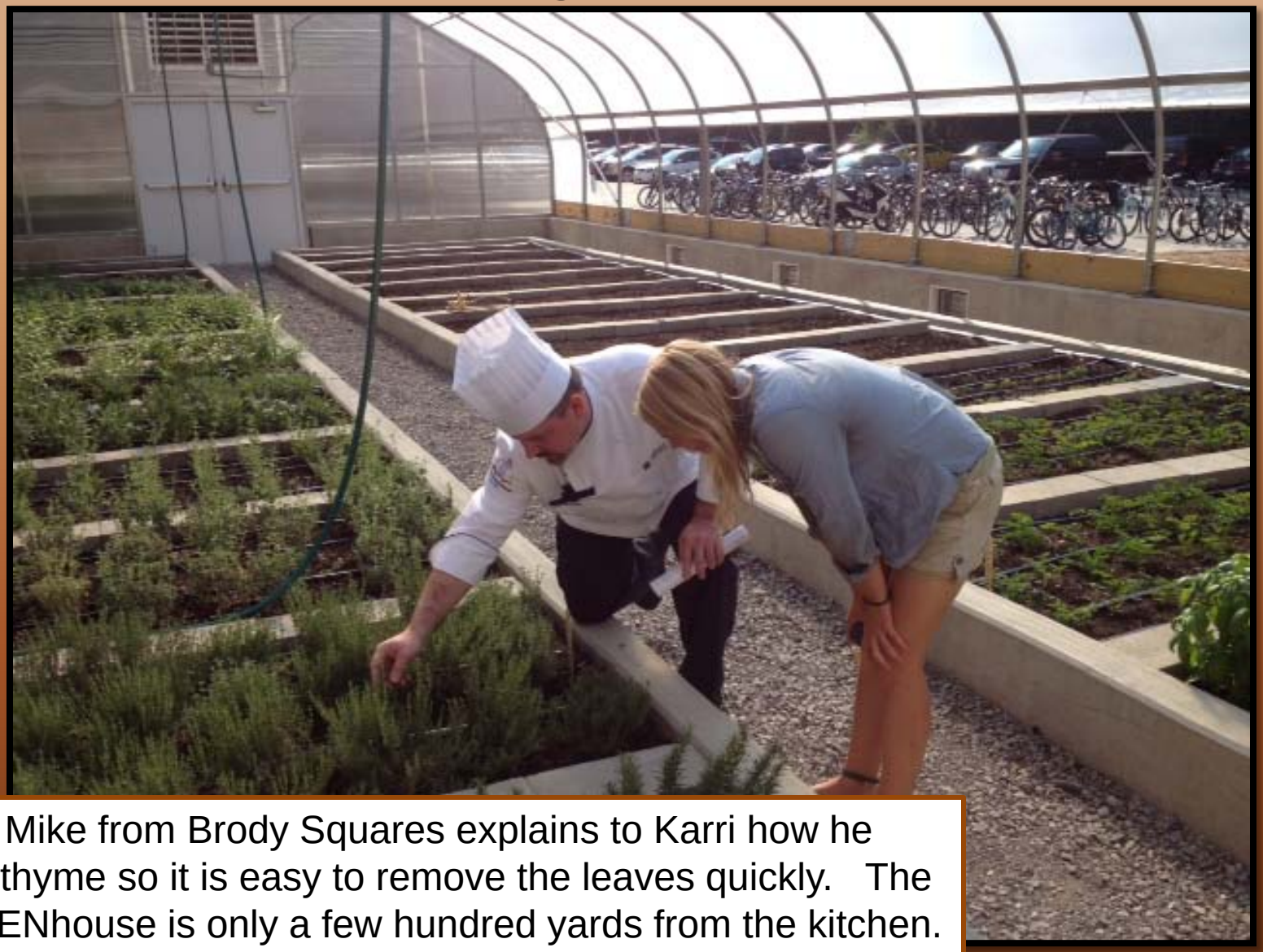
August 8 - Planting

Larger pots were planted in holes made with a post hole digger. Left side beds were planted in about 4 hours with 5 to 6 people working.

September 17 – Ready for Harvest

Overhead irrigation hose in place. Crops grew rapidly and were quickly ready for harvest.

Chefs get Involved



Chef Mike from Brody Squares explains to Karri how he likes thyme so it is easy to remove the leaves quickly. The GREENhouse is only a few hundred yards from the kitchen.

September Herb Harvests

Freshly cut herbs were collected in bowls or five gallon buckets, weighed, and placed in food grade, unsealed plastic bags. Herbs were walked to Brody Square or Kellogg Center

Three honey bee colonies were placed on the green roof in early September by the Entomology Department.

Honey bees are known to be successful producing honey in urban environments like Chicago and Detroit and help with pollination.

October 4 – Interior Covers in Place

Electrical metal tubing (EMT) was used to make frames to support the frost fabric interior covers used to trap the soil radiant heat.

October 30 Grand Opening & Dedication

The dedication of the GREENhouse was highlighted by a vine cutting by Dean of CANR Fred Poston, RISE Student Karri Tomich-Baylis, RISE Director Laurie Thorp, RHS Vice President Venie Gore, and SOF Coordinator John Biernbaum.

Herb Harvest and Sales

September through December 17

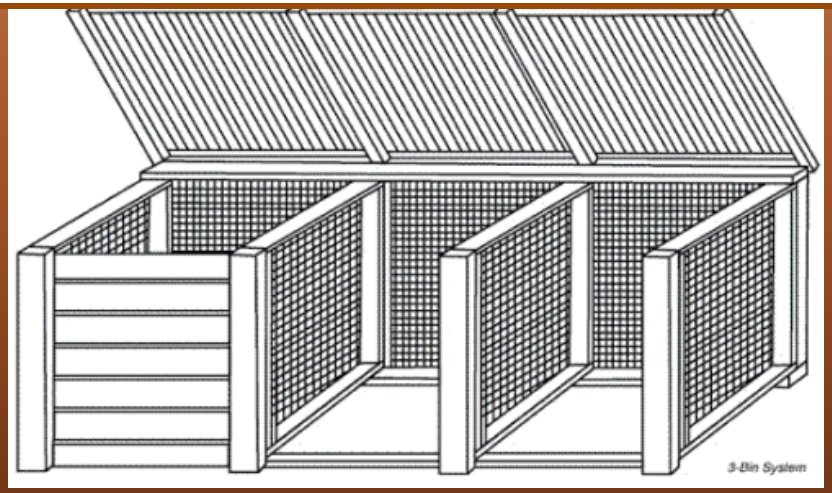
Crop	Pounds	% of total	$/pound	Total Sales	% of total
Basil	34.65	16.6	$16	$554.40	18.1
Chives	5.89	2.8	$16	$94.24	3.1
Cilantro	46.82	22.4	$12	$561.84	18.3
Dill	2.02	1.0	$20	$40.40	1.3
Lemon Verbena	4.41	2.1	$24	$105.84	3.5
Microgreen	3	1.4	$48	$142.08	4.6
Oregano	6.21	3.0	$20	$124.20	4.1
Parsley	74.06	35.5	$12	$888.72	29.0
Pea Shoots	1.48	0.7	$48	$71.04	2.3
Peppermint	0.29	0.1	$16	$4.64	0.2
Rosemary	8.74	4.2	$20	$174.80	5.7
Salad Mix	10.92	5.2	$8	$87.36	2.9
Spearmint	1.35	0.6	$16	$21.60	0.7
Sunflower Shoots	0.56	0.3	$48	$26.88	0.9
Thyme	8.27	4.0	$20	$165.40	5.4
TOTAL	**208.63**	**100.0**		**$3,063.44**	**100.0**

Basil, cilantro and parsley accounted for two-thirds of sales based on dollar value and 70% by weight. This was consistent with prior purchasing trends. Additional herbs not sold but needing to be harvested were harvested for drying.

NSC 192 Compost Method Proposals

Students reviewed and considered a wide variety of composting methods for the site.

Seventy first semester students in the Environmental Studies specialization were presented information about composting and then asked to explore available information and recommend composting methods to teach and demonstrate at the site.



RISE Students Cooking With Herbs

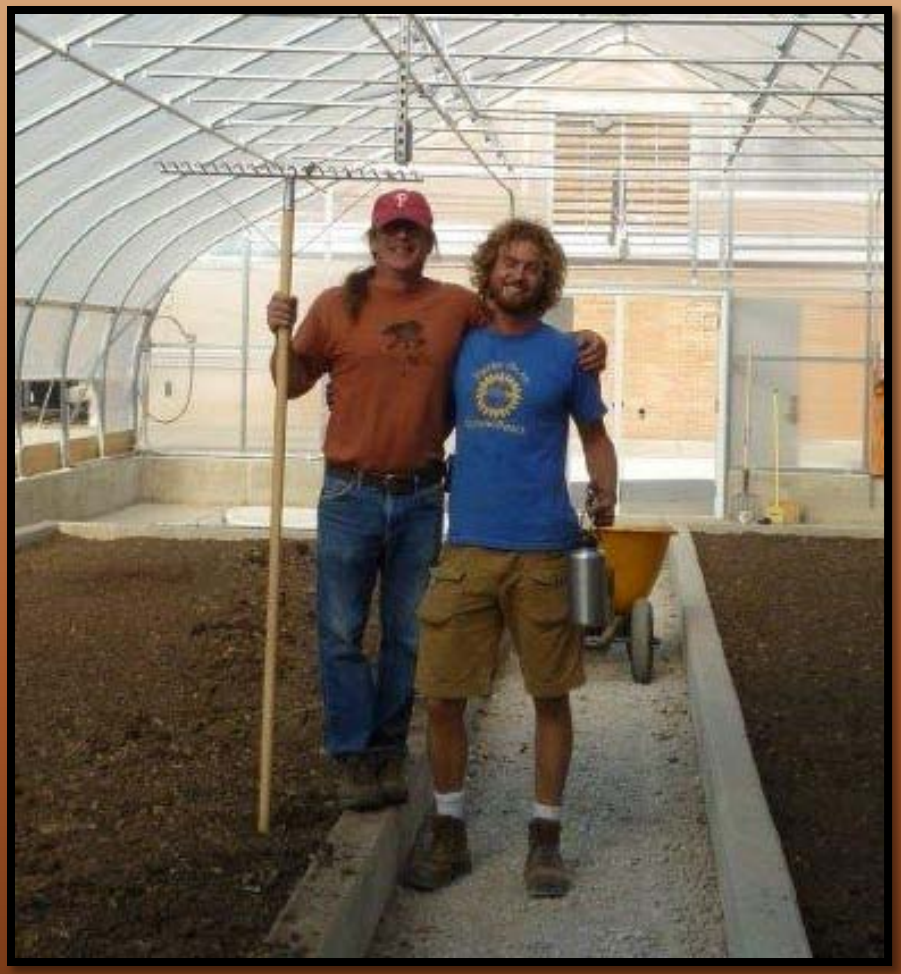
The realization of a long time goal to have students cooking together.

Basil in pesto, cilantro in salsa and parsley in tabouli with pita bread made for a healthy herb experience.

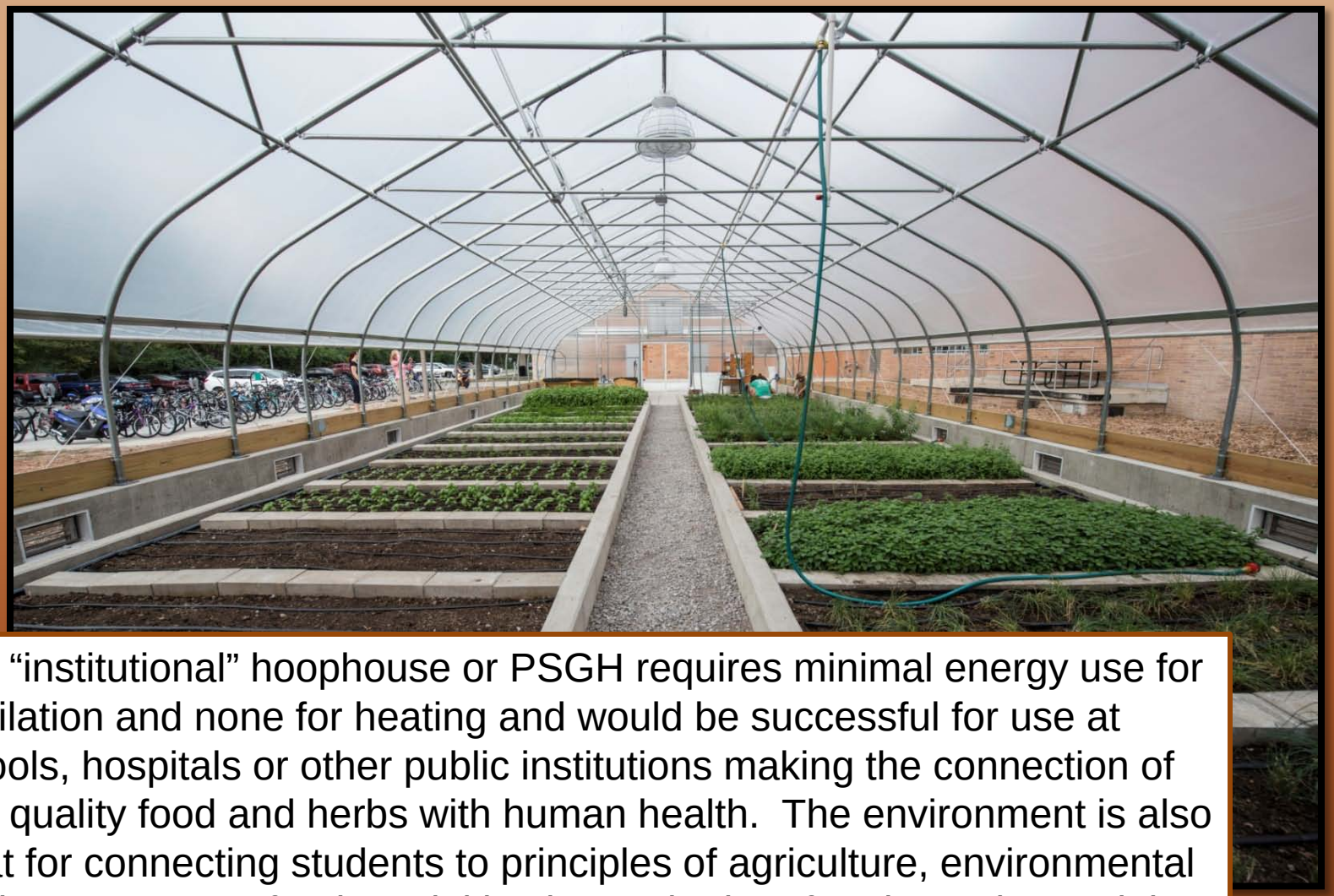
Students Constructed and Planted an Herb Spiral as a first step in Landscape Development

Composted soil like what was used to fill the GREENhouse and stones from the farm were used to develop a unique bed for herbs and vegetables. Some of the vegetables were harvested for a pot-luck dinner.

Great Thanks to Laurie Thorp and Brendan Sinclair

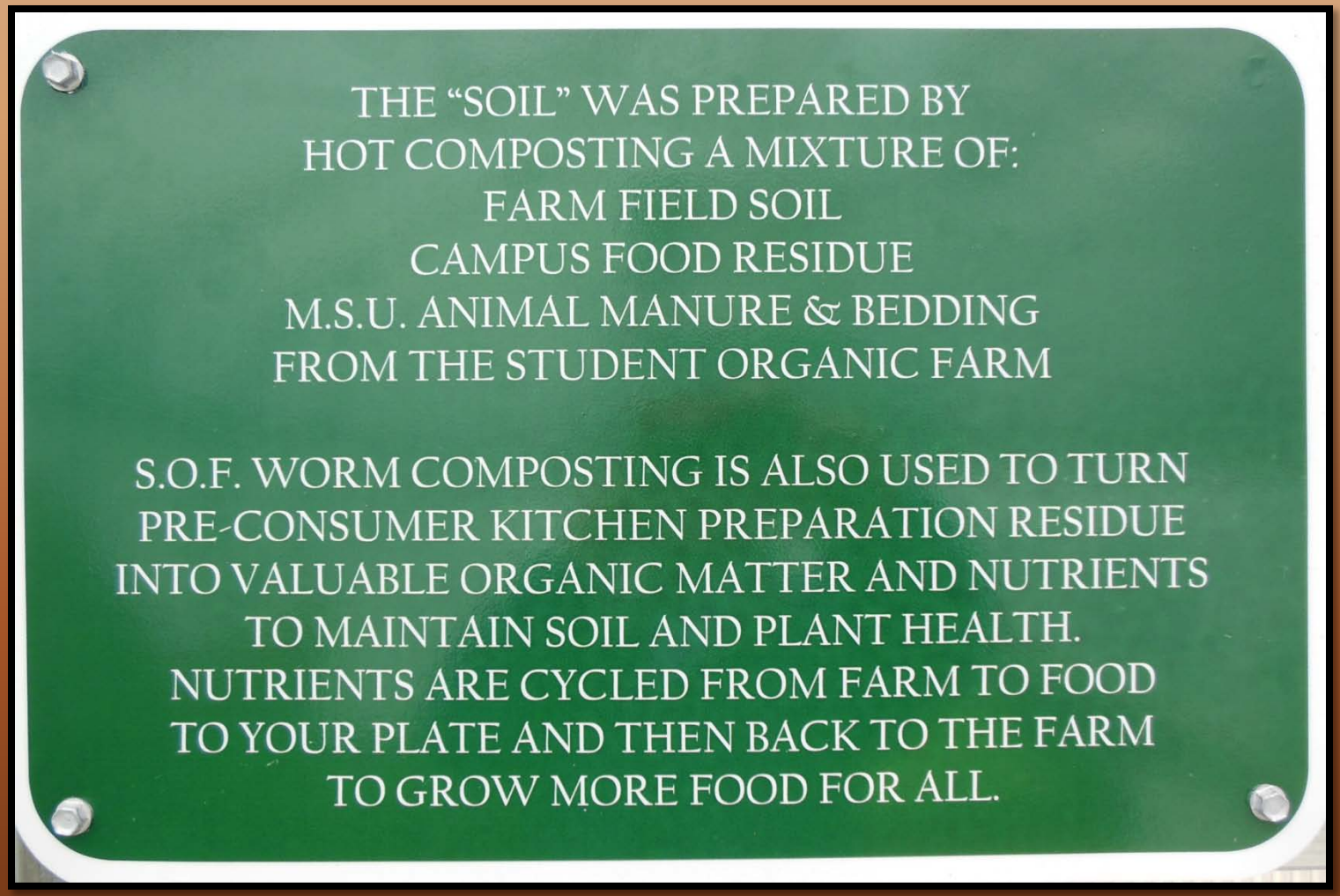


A Clean and Green Environment



This “institutional” hoophouse or PSGH requires minimal energy use for ventilation and none for heating and would be successful for use at schools, hospitals or other public institutions making the connection of high quality food and herbs with human health. The environment is also great for connecting students to principles of agriculture, environmental studies, access to food, social justice and urban farming. The work is personally rewarding.

Signage in the GREENhouse



The Bailey GREEN Team

The work is all about the students and these are the first in what will be a long tradition of Environmental Studies students making a difference on a campus of over 40,000 students.

More thanks to those that made the project possible.

- Dr. Fred Poston, Vice President for Finance and Operations
- Venie Gore, Vice President for Residential and Hospitality Services
- Jennifer Battle, Director of Office of Campus Sustainability
- Diane Barker, Carla Iansiti, Robbia Pipper, Chef Dave at Brody, Chef Mike at Kellogg

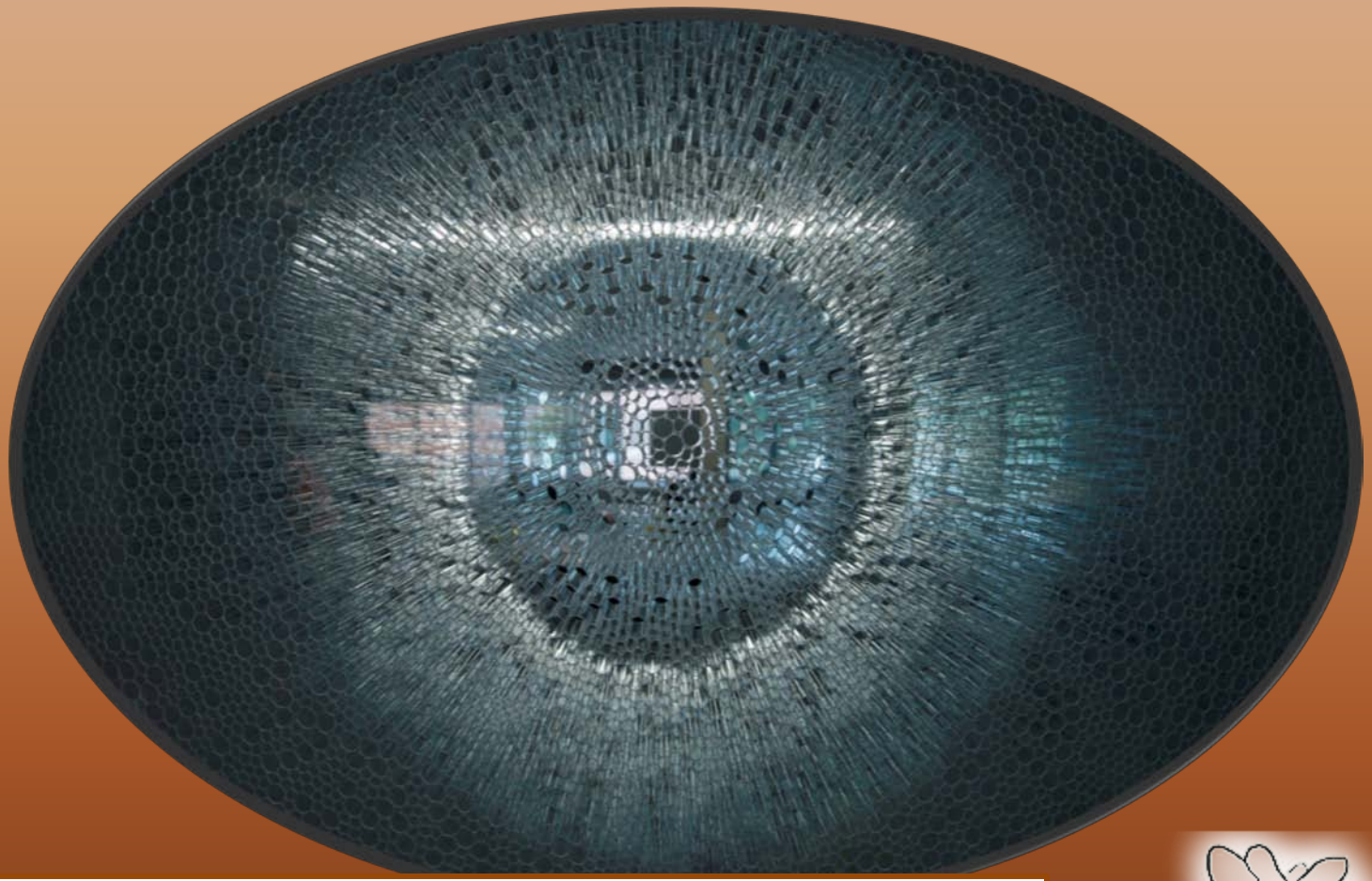
Summary

- A passive solar greenhouse was planned and constructed literally just out the front door of the L.H. Bailey Residence Hall and not far from the Brody Square dining facility and Kellogg Conference Center.
- Food residue from Brody Square was composted to prepare the soil for growing herbs in the GREENhouse to demonstrate the food cycle loop, nutrient cycling and to allow immediate organic certification.
- Students with prior farming and gardening experience at the SOF were selected to form the GREEN Team to begin the process of student management of the project and a Student Advisory Team was formed.
- Funding from the Office of Campus Sustainability provided funding for a full time staff position to support the project development and launch as well as food residue vermicomposting at the SOF.

Summary

- Over $3000 of fresh culinary herbs and greens were sold in the first four months of harvest and GREENhouse occupancy.
- Students were engaged in a variety of efforts such as compost system design, construction and planting of a spiral herb garden, and evening cooking with fresh herbs. Several new projects are being planned including vermicomposting, green roof gardening, and solar heating options.
- University operations staff participated in academic and student events that strengthened and expanded learning and relationships.
- The model developed is reproducible for campuses across the US.

The Future is Bright with Much More to Come



And thanks to Liberty Hyde Bailey, a Michigan native and man of many talents who is often referred to as the father of academic horticulture. We are proud to have the project bare his name and follow in his tradition.

STUDENT ORGANIC FARM

A Local Food Cycle

The path to prosperity, peace, parity and partnership
is the passionate perennial progression from
planting,
producing,
protecting,
processing,
preserving,
purchasing,
preparing,
partaking
and passing pooh to
renew the soil and begin anew.

Promote positive personal, public and planetary perspectives and programs with your food practices and purchasing power.

John Biernbaum

A Vision and A Task

A vision without a task is a dream.
A task without a vision is drudgery.
A vision and a task
Are the hope of the world.

Integral Agriculture

Farmers, friends and families
using facts and feelings to
physically, faithfully and fearlessly
farm
front yards, forests and fields
for food, feed, fodder, fiber, fuel, flowers,
fertility, fun, freedom, fairness

and the future.

John Biernbaum

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