UMASS
Urban Homestead of the Future

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Introduction

By Danielle Alexander and Jack Cochran
Adjunct Faculty, Boston Architectural College

The University of Massachusetts - Amherst (UMass) is seeking to create an Urban Homestead of the Future at the site of the former UMass Suburban Experiment Station on Beaver Street in Waltham.

A part of the Center for Urban Sustainability, the Homestead is intended to serve as a showcase for how residents of Massachusetts and beyond might live in synergy with their environment. The Homestead seeks to provide food, renewable energy, and waste management for families in urban, suburban, and rural settings, combining new technologies and traditional know-how to achieve production and sufficiency goals.

The following document outlines initial research and a site proposal prepared by four students in the Gateway Initiative at the Boston Architectural College (BAC). The Gateway Initiative, which began in 2008, partners local non-profit organizations and neighborhood with BAC students on a variety of projects. In this case, the students have prepared a visioning document for the University to help raise funding for the project, working with Kathleen Carroll of UMass and Claire Kozower of Waltham Fields Community Farm.

After weeks of site research, historical research, and site design, they came up with the mission for the Homestead:

"Homesteading is a practice rooted in the belief that through addressing human-based needs, human-based actions can enrich the individual, societal, and ecological dimensions of the world. To remain relevant amidst the changing conditions of a densely populated modern world, the practice of homesteading must incorporate modern systems of communication and data collection to enhance established practices, inform output levels, enrich local ecosystems, and engage with a broader section of the public. The model homestead of the future is data driven, broadly accessible, efficient, inspirational, ecologically enriching, and adaptive."

The pages that follow determine the implications of this mission as it applies to our particular site, balancing research into basic human needs and how they can be sustained in Waltham, all the while engaging and informing the public as to how these systems and tools can be replicated in their own homes and neighborhoods.

Evolution of Homesteading

By Jamie Dondero

To develop a proposal for what the future of homesteading could be, it is necessary to first understand how the practice of homesteading has evolved over time. Homesteading, as a concept, is inherently mutable; it has historically been incorporated with a wide variety of intentions and ideals by different advocates for its practice. Despite such variety of expression, a common definition of homesteading can be distilled: homesteading is a practice rooted in the belief that through addressing human-based needs, human-based actions can enrich the individual, societal, and ecological dimensions of one's world.

The concept of homesteading first rose to popularity in the United States following the passage of the Homestead Act of 1862 by Abraham Lincoln, which provided 160 acres of land for $1.25 an acre to American families. This act was seen as a two part solution for the developing country; it helped to redistribute the growing populations of immigrants and lower class families across the largely undeveloped frontier land, while making the uninhabited lands agriculturally productive supporting further development and expansion. In this iteration of homesteading the land was seen as a right to the pioneer who was just in taming the land for his subsistence and well-being. The legacy of the Homestead Act is nuanced and contradictory; historians over the years have broadly disagreed on how to value its many impacts , however one positive result is that homesteading was introduced into popular culture.

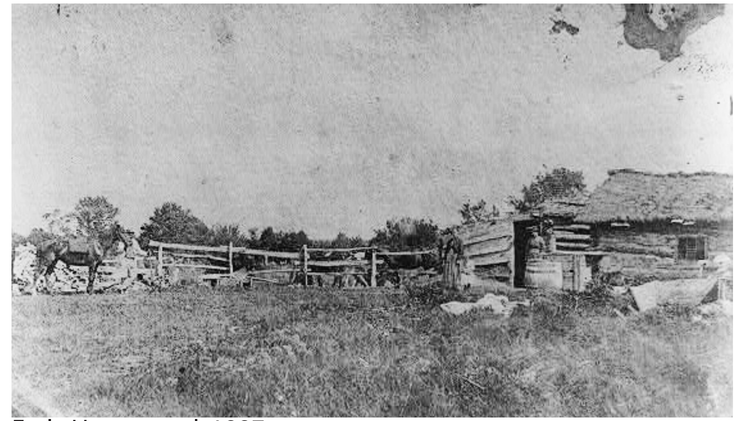
Concurrent with the spread of homesteading in the American West, a different kind of homesteading was developing in New England, one that was influenced by the nature-oriented spiritual beliefs of the American Transcendentalists, such as Henry David Thoreau. At the turn of the 20th century the social reformer Bolton Hall combined the economically productive goals of pioneer homesteading with the spiritual beliefs of Transcendentalist homesteading to create a new modern conception of homesteading. Hall's turn to homesteading was in-part a result of his anti-modernist beliefs, which placed the blame for rising inequality and poverty on America's growing industrial economy. Homesteading became a means to improve oneself spiritually and economically, and distance oneself from the evils of modern industrial society.

Following Bolton Hall's example, Ralph Borsodi became a champion of homesteading as a response to the dehumanizing conditions of modern cities. Borsodi advocated for the practice of homesteading by relating his own experiences homesteading in a New York City suburb. The anti-modernist message of Borsodi and other agrarians became especially compelling during the Great Depression, as the economic and social systems of an industrial nation, which they had repeatedly criticized, appeared to fail on a large scale. Many city-dwellers abandoned the city to homestead in outlying rural lands, seeking the refuge promised by advocates such as Borsodi. The national government also turned to homesteading as a potential solution for the disenfranchised city-dwellers of the Great Depression. Among others in the government, Franklin D. Roosevelt ascribed to the agrarian belief that moral and economic value could be gained through working the land. In 1932 the US Congress allocated twenty-five million dollars to the President to be distributed to establish and support subsistence homestead communities across the country, with the goal of improving the livelihood of poor and underemployed American families, who could supplement their costs of living through subsistence farming.

During the 1920s Scott Nearing, intellectual and economist, and his wife Helen, chose to leave the city to homestead in rural Vermont; their conception of homesteading was more idealistic than Borsodi. The Nearings wrote of their experiences in Living the Good Life, which would inspire a renewed interest in homesteading in the 1960s. Homesteading in the 1960s was also influenced by an increasing concern for ecological issues inspired by naturalist writers like Aldo Leopold and Rachel Carson, resulting in a practice that was pragmatically self-sufficient and ecologically sensitive.

At the turn of the 20th century, with an increasing concern for global climate change and the economic recession, homesteading was popularized again, but, as before, it had evolved to suit the changing needs and interests of modern Americans. Environmentally conscious Americans who live in cities, opting for the amenities and reduced environmental impact a city can offer, have adopted the practice of homesteading to fit their lifestyles. Dubbed urban homesteading, the latest iteration of homesteading carries over the pragmatic and ecologically sensitive ethics of past homesteading, while tailoring the practices to a smaller home and little or no backyard.

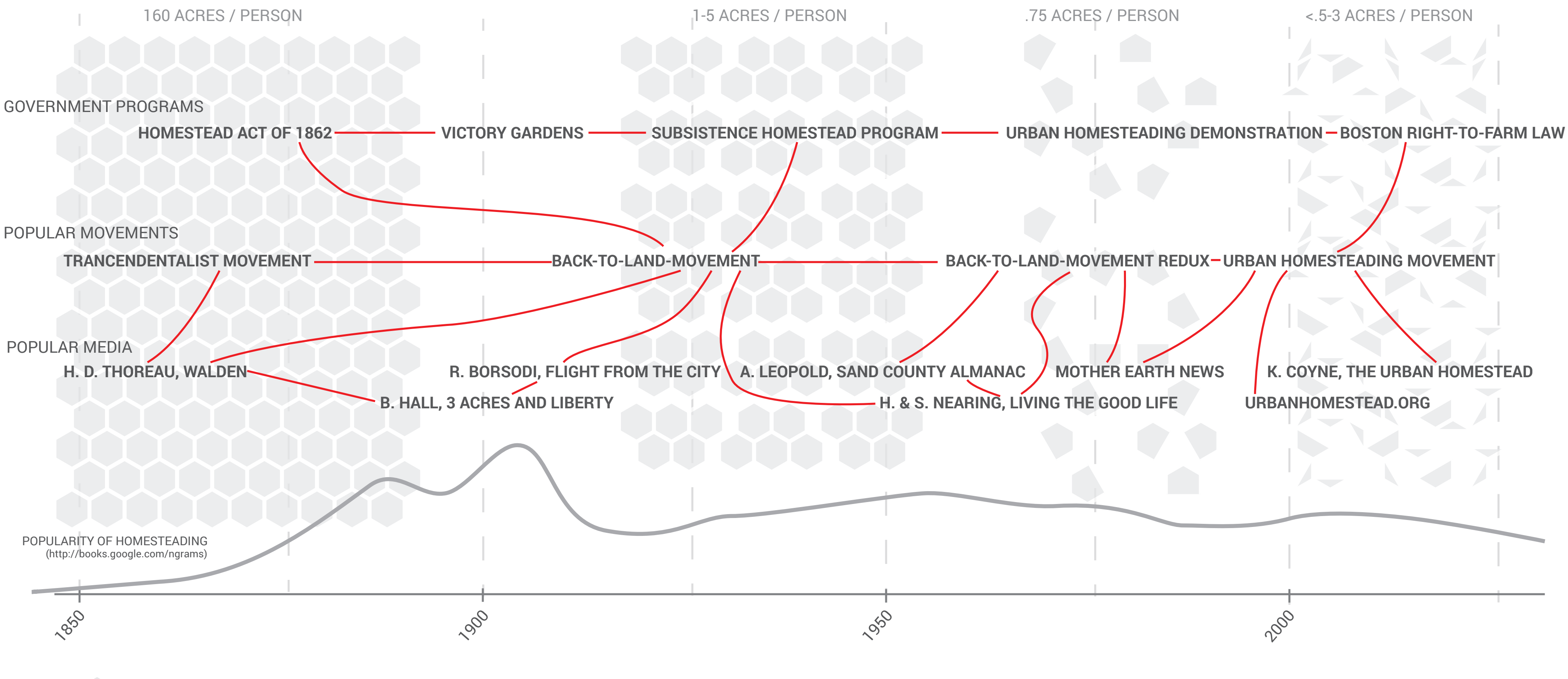
Moving forward into the 21st century, homesteading should be recognized as an established practice that presents a new paradigm for the operation of urban communities. The food, energy, and water needs of urban homesteaders can be met with a positive ecological impact through a combination of individual and communal measures.



Early Homestead, 1887
http://cdn.loc.gov/service/pnp/cph/3a10000/3a17000/3a17500/3a17554r.jpg

Subsistence Homestead, 1936
http://cdn.loc.gov/service/pnp/fsa/8b27000/8b27000/8b27038v.jpg

Urban Homestead, 2009
*http://upload.wikimedia.org/wikipedia/commons/3/3d/Claire_Gregorys_
Permaculture_garden.jpg*



160 ACRES / PERSON
1-5 ACRES / PERSON
.75 ACRES / PERSON
<.5-3 ACRES / PERSON
GOVERNMENT PROGRAMS
HOMESTEAD ACT OF 1862
VICTORY GARDENS
SUBSISTENCE HOMESTEAD PROGRAM
URBAN HOMESTEADING DEMONSTRATION
BOSTON RIGHT-TO-FARM LAW
POPULAR MOVEMENTS
TRANCENDENTALIST MOVEMENT
BACK-TO-LAND-MOVEMENT
BACK-TO-LAND-MOVEMENT REDUX
URBAN HOMESTEADING MOVEMENT
POPULAR MEDIA
H. D. THOREAU, WALDEN
B. HALL, 3 ACRES AND LIBERTY
R. BORSODI, FLIGHT FROM THE CITY
A. LEOPOLD, SAND COUNTY ALMANAC
H. & S. NEARING, LIVING THE GOOD LIFE
MOTHER EARTH NEWS
K. COYNE, THE URBAN HOMESTEAD
URBANHOMESTEAD.ORG
POPULARITY OF HOMESTEADING
(http://books.google.com/ngrams)
1850
1900
1950
2000

Site Tours and Education

By Patrick Grant

The University of Massachusetts Homestead of the Future Project was established as an educational venture, therefore our designs and proposals reflect The University's educational aspirations. This includes but is not limited to, sustainable agriculture methods, bio-remediation, homesteading at several scales, data collection, waste disposal and re-use, and energy systems. University of Massachusetts (UMASS), being a well-established and respected institution in the bay state, holds great potential for creating partnerships with other schools. By providing an opportunity for not only students attending UMASS, but to all people throughout the region, the knowledge of homesteading will extend even further.

Part of our goal is to attract the residents of Waltham community to the site. Therefore we propose features that are not primarily educational, but rather function as a way to draw people to the site. This includes the orchard, community supported agriculture (CSA), community gathering space, and the edible pathway. The idea of education simply for education's sake is appealing to many, but not for all. Therefore by providing this incentive we can reach more people. The community supported agriculture is critical for facilitating community engagement. The Waltham Community Farm has currently over one hundred people on the CSA waiting list, which demonstrates the scarcity of locally grown food as well as its high demand in Waltham. Along with the CSA, we propose an orchard be planted to add to the variety and quantity of agricultural production as well as simply being a fun attraction. In conjunction with the CSA and orchard, we propose a large scale aquaponic system to provide a local, sustainable fish source as yet another means to attract more people to the site.

We propose the principal educational elements be centrally located on a naturally raised plateau. This will include the data collection center, homesteading examples, energy and waste systems, and an aquaponic facility. The marsh walk and bike trail as well as the main pedestrian and vehicular access will guide visitors to the site's epicenter. This arrangement creates a central plaza, surrounded by the educational facilities with space for gathering. This will primarily be used as a pop up market space, further connecting the community with the site.

It is important that the places of interest not within this central area of the site be easy to access. The site, containing fly ash in the marsh, is hazardous and toxic. The bioremediation we propose will therefore be located in the marsh where the contamination is present. We propose an educational boardwalk within the marsh, offering an enjoyable trail with pleasant views of nature. This will display information along the trail about bioremediation as well as information regarding the naturally occurring flora, fauna, and handling of invasive species. Located between the welcome center and the start of the marsh walk, we propose the experimental agriculture areas that mimic the facilities across the street on The Waltham Community Farm. These facilities are no longer in operation on the sister site, but we propose they be restored on our site, as they are useful for educating and testing on agricultural systems and technologies. In order to be an example for the future of homesteading, we believe that developing and showcasing new technologies is fundamental for the University's educational aspirations.

We believe the idea of community togetherness is essential to homesteading. Rather than relying on a larger less sustainable system we should create micro systems of communal food production. This is the basis for the inclusion of the community engagement. By adding to the Waltham community farm's production, UMASS can provide the opportunity for more people to have locally sourced food. Keeping this in mind with our site design, we wanted the space to feel more like a community gathering space rather than a linear educational tour. Therefore we have given freedom to visitors moving through this interactive site, allowing them to connect with the educational aspects on their own terms, which we believe will create an environment that feels public and inviting.

The marsh boardwalk, engaging visitors through an educational nature walk

Metrics

By Patrick Grant

Homesteading is the act of providing for the needs of an individual, family, or community. Therefore, addressing our needs is vital in order to decide what homesteading methods be applied. This includes measuring the water and energy used domestically and for travel as well as quantifying the food required to survive. A complete homestead would also intend to fulfill needs such as cleaning supplies, clothing, and other household products. Presented with the task of creating a homestead of the future, we decided to research and analyze metrics as a basis for our proposals. Once we had collected an extensive amount of data, an understanding of the scalability of homesteading began to emerge.

Humans work more efficiently in cooperation, therefore an individual cannot sustain himself as well as a family unit can; and a family unit cannot sustain itself as well as a community can. We also took into consideration that a working individual or family if they are not farmers, are not typically dedicating the work hours required to sustain themselves. Therefore a lot of our data is trying to be realistic rather than optimal.

We decided then to use the metrics in conjunction with the realities of urban, suburban, rural, and communal living to create examples for the public to relate to. In order to do this we had establish the amount of residents in each that we determined should be 3,4, and 5 people respectively. We then gathered the data corresponding to their needs and allotted space.

A variety of systems then had to be analyzed in order to determine what was optimal for each scale. While the metrics of production played a factor, so too did size limitations of the examples. For example, it isn't plausible to propose geothermal inside the constraints of the urban condition with no access to a backyard. Another example would be that we wouldn't propose small vermicomposting on the rural site that can easily take advantage of a larger more efficient aerated composting heap. The metrics then were able to influence direct design decisions regarding what systems could function alongside each other to optimize the sites potential.

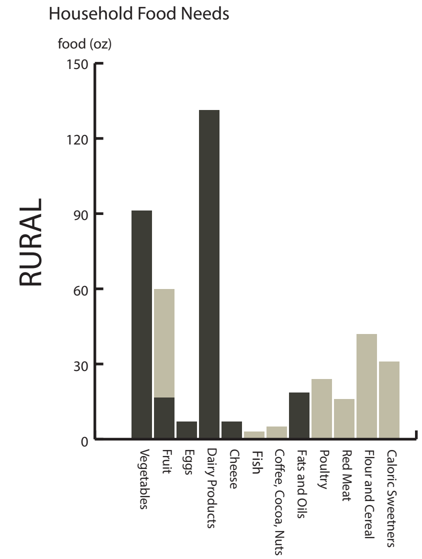
The goal for food production in regards to metrics is to meet as much of the dietary needs, defined by a 2014 food consumption report produced by the USDA, of a set amount of residents on-site as is possible at the different housing scales. Production encompasses a variety of agricultural practices and foods including seasonal vegetables and fruit, livestock, fish, and foragable plants.

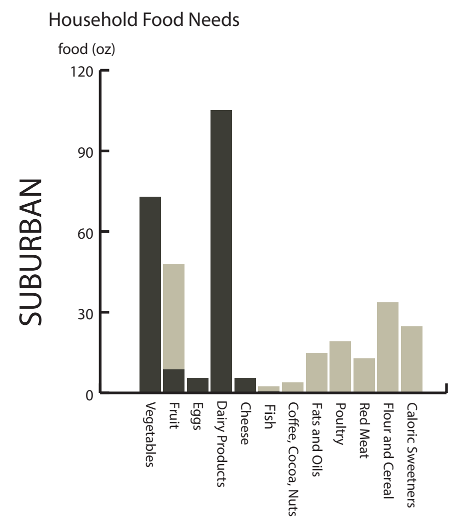
The smallest of the housing scales, the urban scale, is only capable of producing 5% of its food needs due to its small scale and lack of a backyard. This includes food produced through a small apartment-appropriate aquaponic system, which produces both fish and leafy greens, as well as vertical container grown seasonal vegetables. The rest of the urban scale's food needs are met at the communal scale, represented by the site as a whole, which provides a variety of seasonal vegetables and fruit, including apples and pears, goat and cow dairy products, and woodland and meadow forage, including berries and greens.

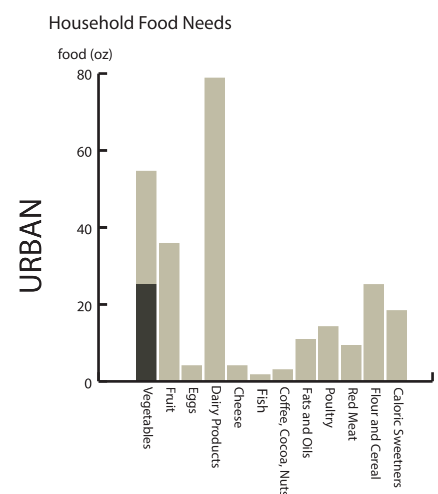
The mid-level scale, the suburban scale, is able to produce 62% of its food needs, utilizing its backyard with space-saving agricultural practices, like vertical gardening and aquaponics, and scale-appropriate livestock. The food produced at the suburban scale includes fish, through the aquaponic system, a wide variety of seasonal vegetables, apples, eggs, and goat-sourced dairy products.

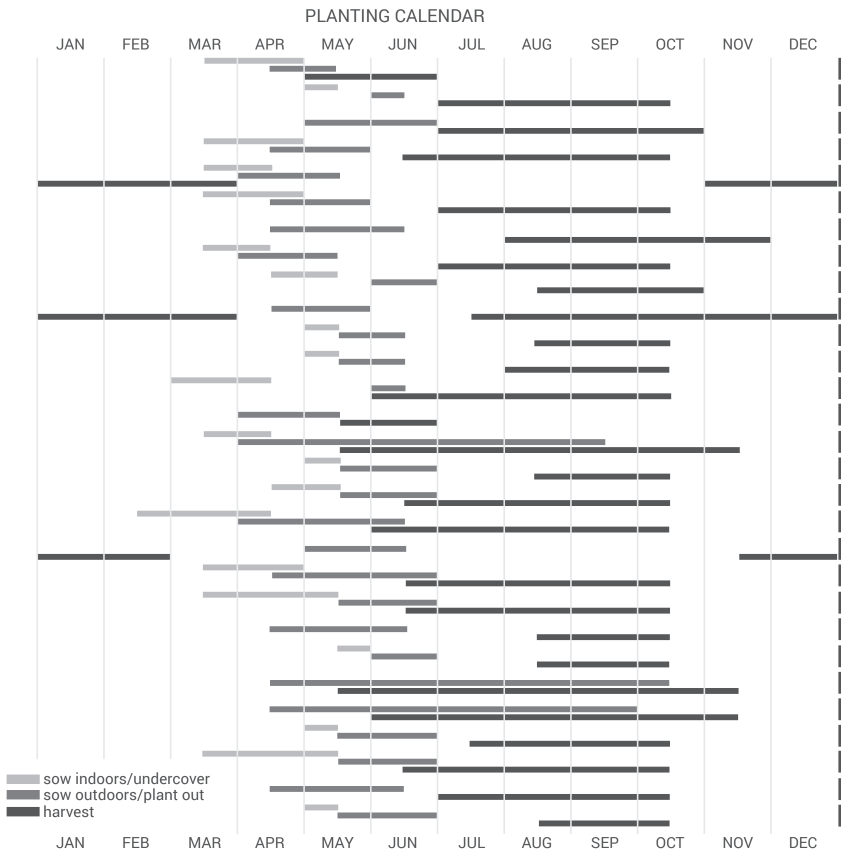
The largest of the housing scales, the rural scale, is able to produce 71% of its food needs, through a combination of traditional agricultural methods, high-density orchards, and larger-scale livestock. This food includes a variety of seasonal vegetables grown through extended seasons, fruit, eggs, and cow-sourced dairy products, including milk, cheese, and butter. Most of the food that can not be produced on site is either not native, like coffee or chocolate, or is not viable to grow at such a small scale, like cereals and grains. More food could be produced on-site, but the goal at the varied scales is to solely meet the food needs of the household.

Communities are becoming denser and populations tend to migrate to the cities, therefore it is exciting to have these urban examples in order to test new methods and collect more data for urban homesteading. The project goals dictate that we consider adaptability in order to exemplify forward thinking. Therefore we believe using these scales is effective since more data for urban homesteading. The project goals dictate that we consider adaptability in order to exemplify forward thinking. Therefore we believe using these scales is effective since they are so easily adaptable to replacing technology.

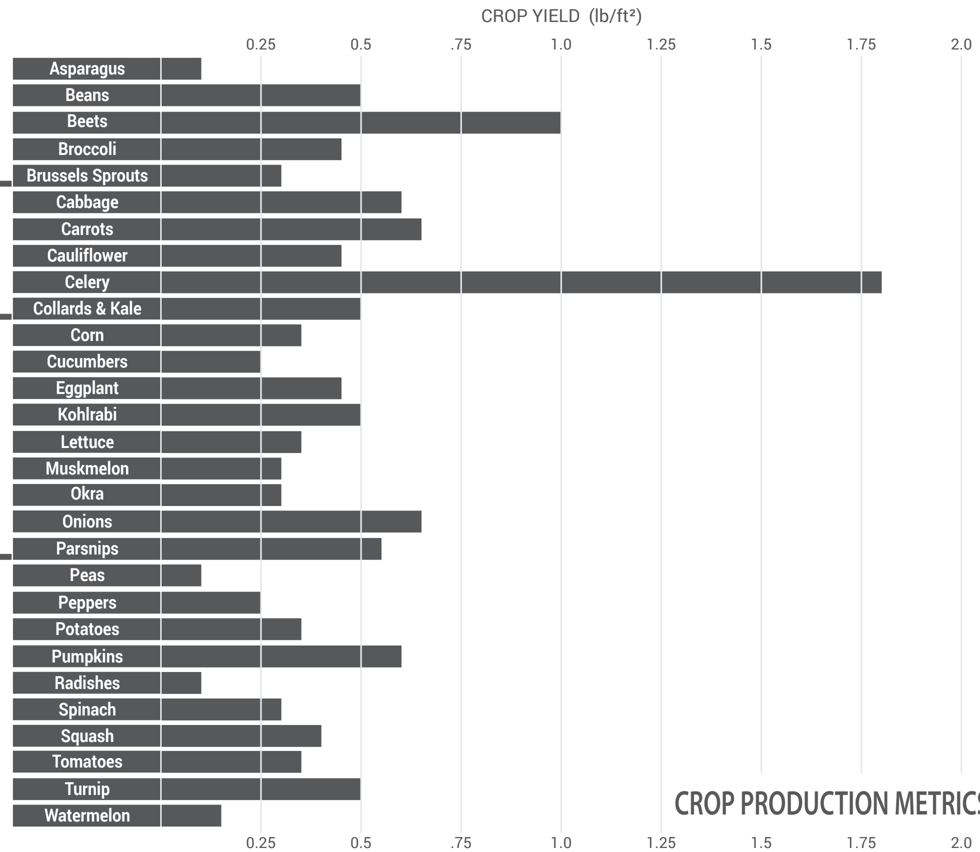




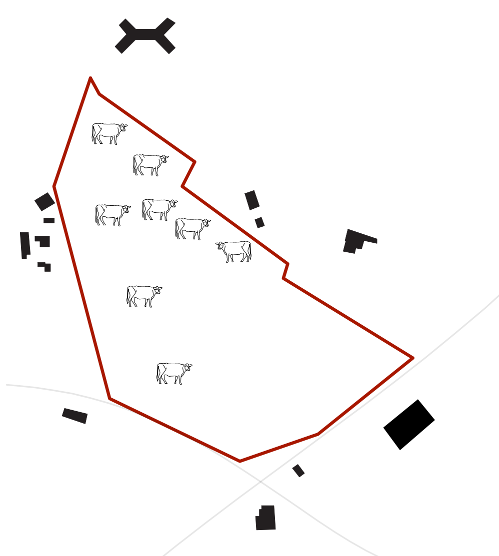




http://www.almanac.com/gardening/planting-dates/MA/Waltham 2/

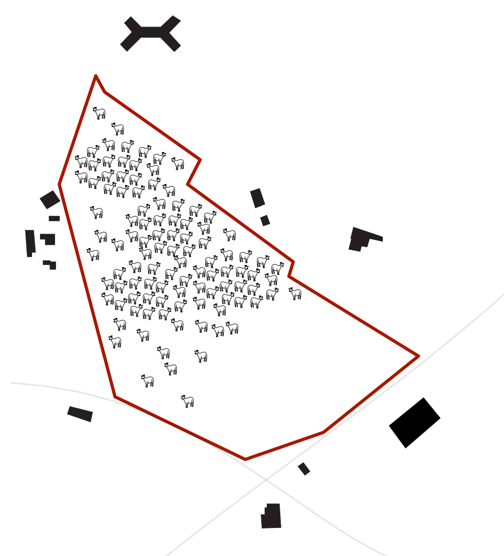


Nitzsche, Peter, Rabin, Jack, and Zinati, Gladis. "Yield Expectations for Mixed Stand Small-Scale Agriculture." *Monthly Briefing from Rutgers New Jersey Agricultural Experiment Station* 7, 1: (Sep 2012). https://njaes.rutgers.edu/pubs/urbanfringe/pdfs/urbanfringe-v07n01.pdf



it takes between 1.5-2 acres to feed one [cow] for one year

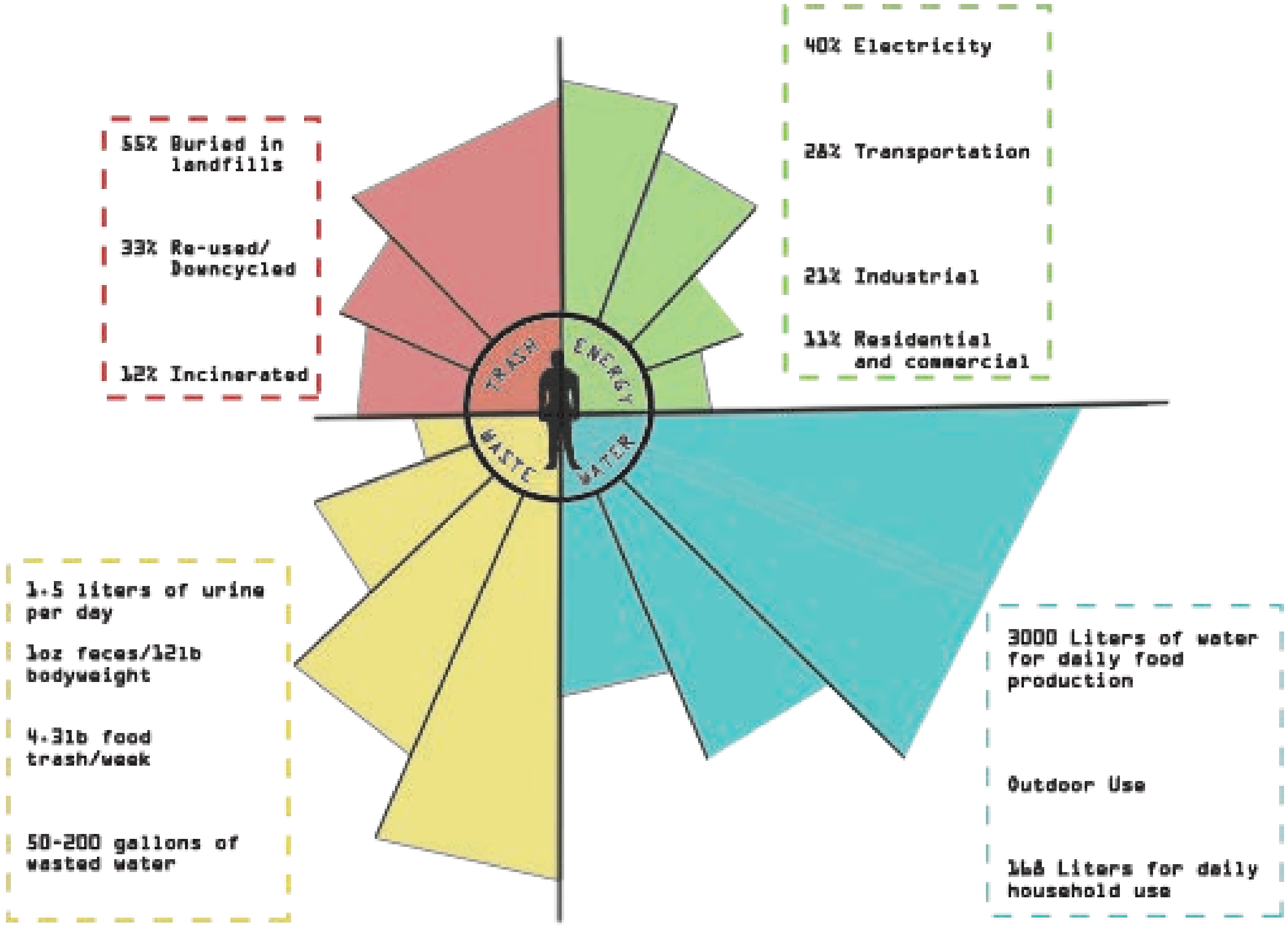
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1097070.pdf
http://www.agmrc.org/media/cms/feedingmanagement_096ddadac6bb2.pdf
http://www.wolframalpha.com/input/?i=how+much+does+a+goat+weigh



it takes .25 acre to feed one [goat] for one year

http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1097070.pdf
http://www.agmrc.org/media/cms/feedingmanagement_096ddadac6bb2.pdf
http://www.wolframalpha.com/input/?i=how+much+does+a+goat+weigh

AGRICULTURAL METRICS



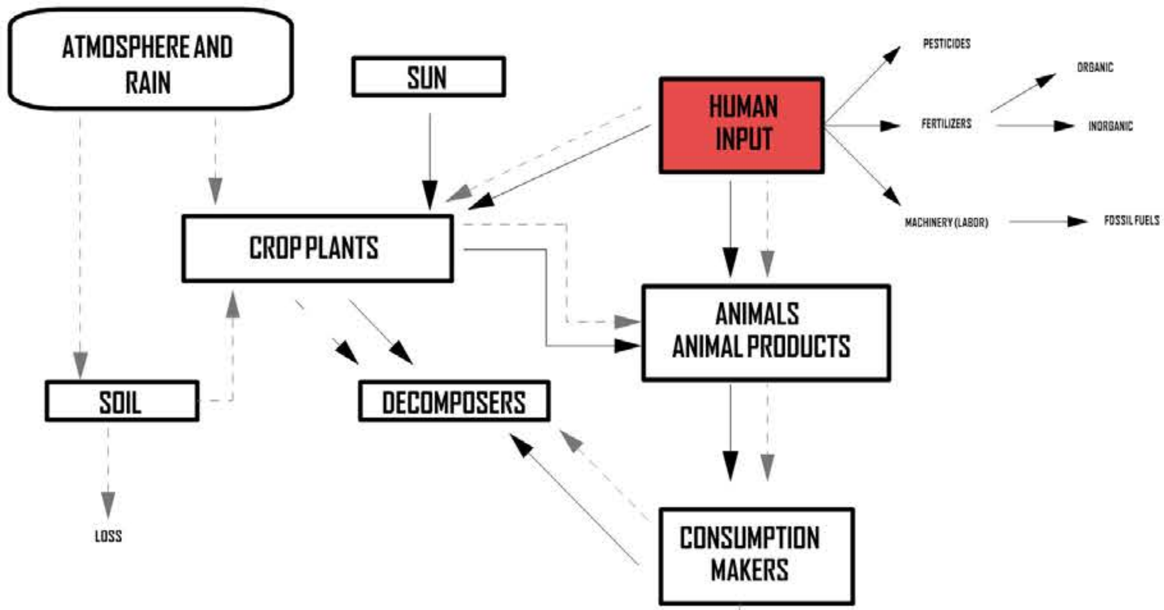
COMPOSTING	SYNGAS GASIFIER	BIOGAS DIGESTER	BIODIESEL TANK
BRANCHES GRASS/LEAVES HUMAN/ANIMAL WASTE ORGANIC FOOD SCRAPS	HOUSEHOLD WASTE INDUSTRIAL WASTE MEDICAL WASTE BIOMASS	HUMAN/ANIMAL WASTE	SODIUM HYDROXIDE FRY OIL
↓	↓	↓	↓
FERTILIZER	ETHANOL ELECTRICITY STEAM	ELECTRICITY HOT WATER	BIODIESEL

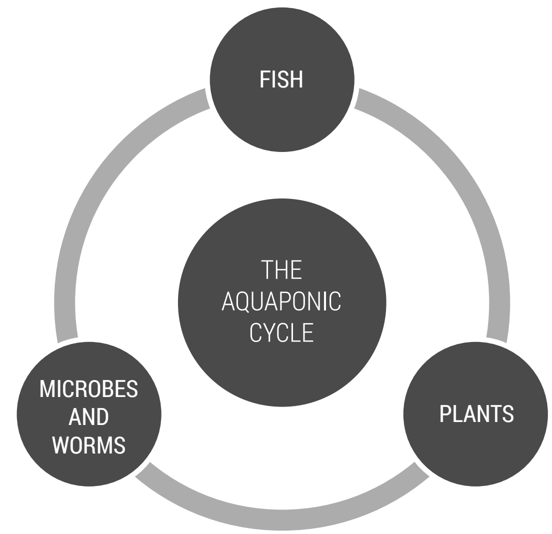
THE INPUTS AND OUTPUTS

IN THE TOP DIAGRAM WE ANALYZED THE MAJOR CONSUMPTION ELEMENTS OF HUMANS SUCH AS TRASH, ENERGY, WASTE, AND WATER.

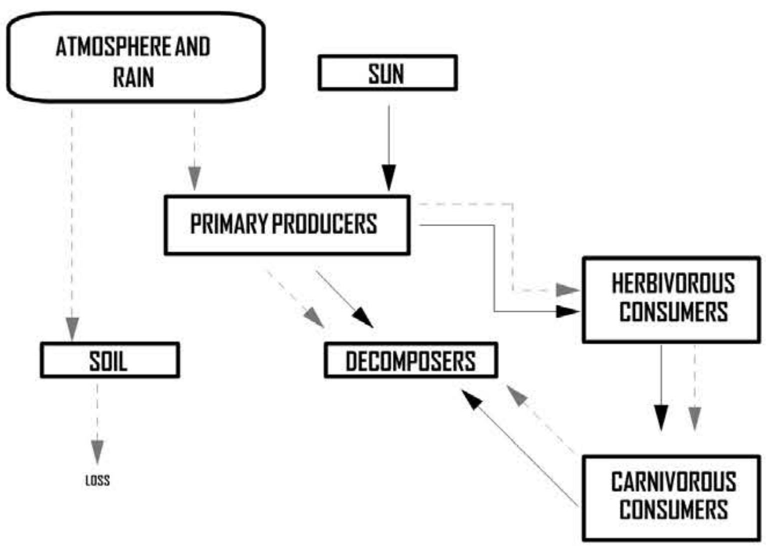
IN THE BOTTOM DIAGRAM WE SHOW WHAT SYSTEMS COULD BE USED TO TURN SOME OF THE PRODUCTS OF CONSUMPTION INTO RESOURCES FOR RECONSUMPTION

AGRO-ECOSYSTEM





NATURAL ECOSYSTEM



AGRICULTURAL SYSTEMS

When land is used for crop production, the pre-existing natural ecosystem is modified creating a human influenced agro-ecosystem. Unlike the natural ecosystem, the agro-ecosystem produces large amounts of waste that is not available for natural reuse, without processing. Aquaponics is an alternative means to food production with a closed system that maximizes output in a small footprint.

Site Research

By Renan Barreto

The North Parcel of the Waltham Experiment Station is made up of approximately 30 acres of land on the North side of Beaver Street. The Parcel shares its border with the Federal State School to its North, Girl Scouts of Massachusetts to the West, Beaver Street to the South, and Waverly Oaks Road to the East. The site is a part of the western greenway, a very large network of trails, green spaces, and forest.

A great portion of the site is made up of 16 acres of wetlands, as well as a meadow and succession forest vegetation that gradually slopes uphill to a group of abandoned structures that have suffered from excessive decay from over the years. Buildings include a farmhouse, three-car garage, two barns and a shed. After traversing the site on foot, we have assessed that the buildings are all uninhabitable. The barn which was previously stated to have possible re-purposing use has been nearly leveled by nature and there is no way to salvage it.

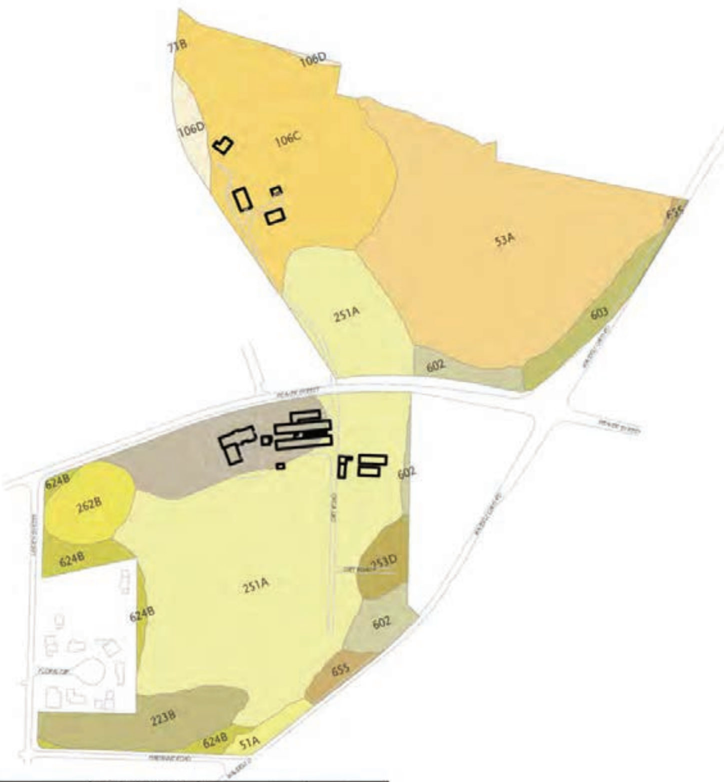
There is only approximately 6.6 acres of land suitable for agricultural production due to the sloping hills and soil varieties. The soil that is best for agriculture is haven silt loam which makes up section 251A in the soil diagram to the right. The forest has a variety of tree types, the most popular being oak, maple, golden rain, dawn redwood, and red oak. This can be seen most clearly in the diagram to the right.

In regards to the community around our site, it is full of opportunity. There are multiple schools, from elementary to collegiate levels. Most prominent being Bentley University to its left and the Fernald State School to its immediate right. These will be key in helping UMASS achieve its educational goals with help from these establishments. Partnerships with Schools will help bring students to the site, as well as help them with their food and waste programs.

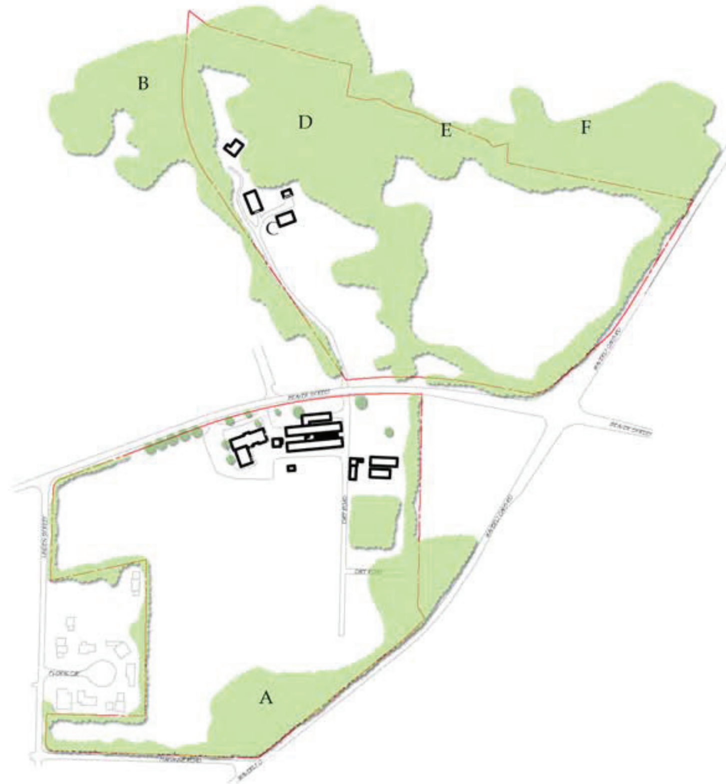
The site is more than 2 miles away from grocery stores, with no specialty fish markets or butcheries in the immediate area. There is also little agriculture land in the area, with Waltham community farm being the obvious exception.

Water is an important factor of the site, with the Charles river watershed running through heavily through the site. The steep topography in certain areas keeps most of the water in the marsh, but according to GIS data and first person account, there is flooding that happens on the south and south east portions of the site, spilling out onto the street.

There has been multiple invasive species to infiltrate the site. These occur in the forested areas, the meadow, as well as the marsh. Dealing with such a widespread infiltration will take a comprehensive strategy that will need to be reassessed every year to deal with new growth.

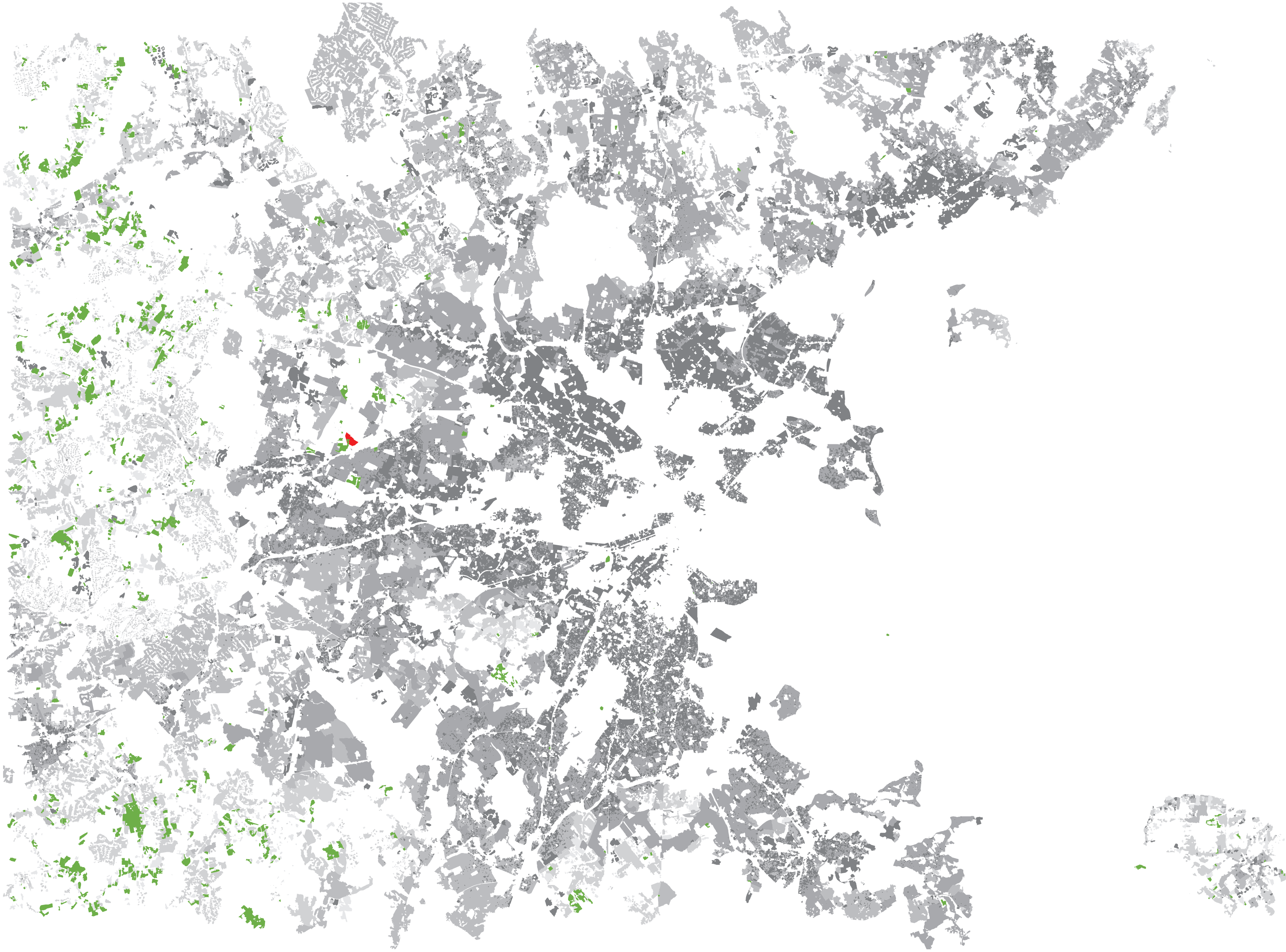


		Soil Description	Depth to Seasonal High Water Table	Drainage Class	Capability Class
	106C	Narragansett- Hollis	> 80 inches	well drained	*
	106D	Narragansett Hollis	> 80 inches	well drained	*
	223B	Scio; very fine sandy loam	1.5-2ft	moderate	II*
	251A	Haven Silt Loam	> 6 ft	moderate	I*
	251B	Haven Silt Loam	> 6 ft	moderate	II*
	253D	Hinckley loamy sand	> 6 ft	rapid	VII
	51A	Swansea Muck	0-1 ft.	moderate	V
	53A	Freetown Muck	0 - 3 ft. above surface	moderate	VII
	624B	Haven; urban land			
	71B	Ridgebury; fine sandy loam	0-1.5 ft	slow/ moderate	VIIs
	602	Urban land covered with impervious surface; on site investigations necessary excavated and filled land			N/A
	603	Urban Land; wet substratum excavated and filled land over alluvium/ marine deposits pilings typically required for building sites; soil tests recommended for gardens/ food production			N/A
	655	Udorthents; wet substratum soil properties vary greatly, can be suitable for building sites			N/A
	*	Represents prime farmland			



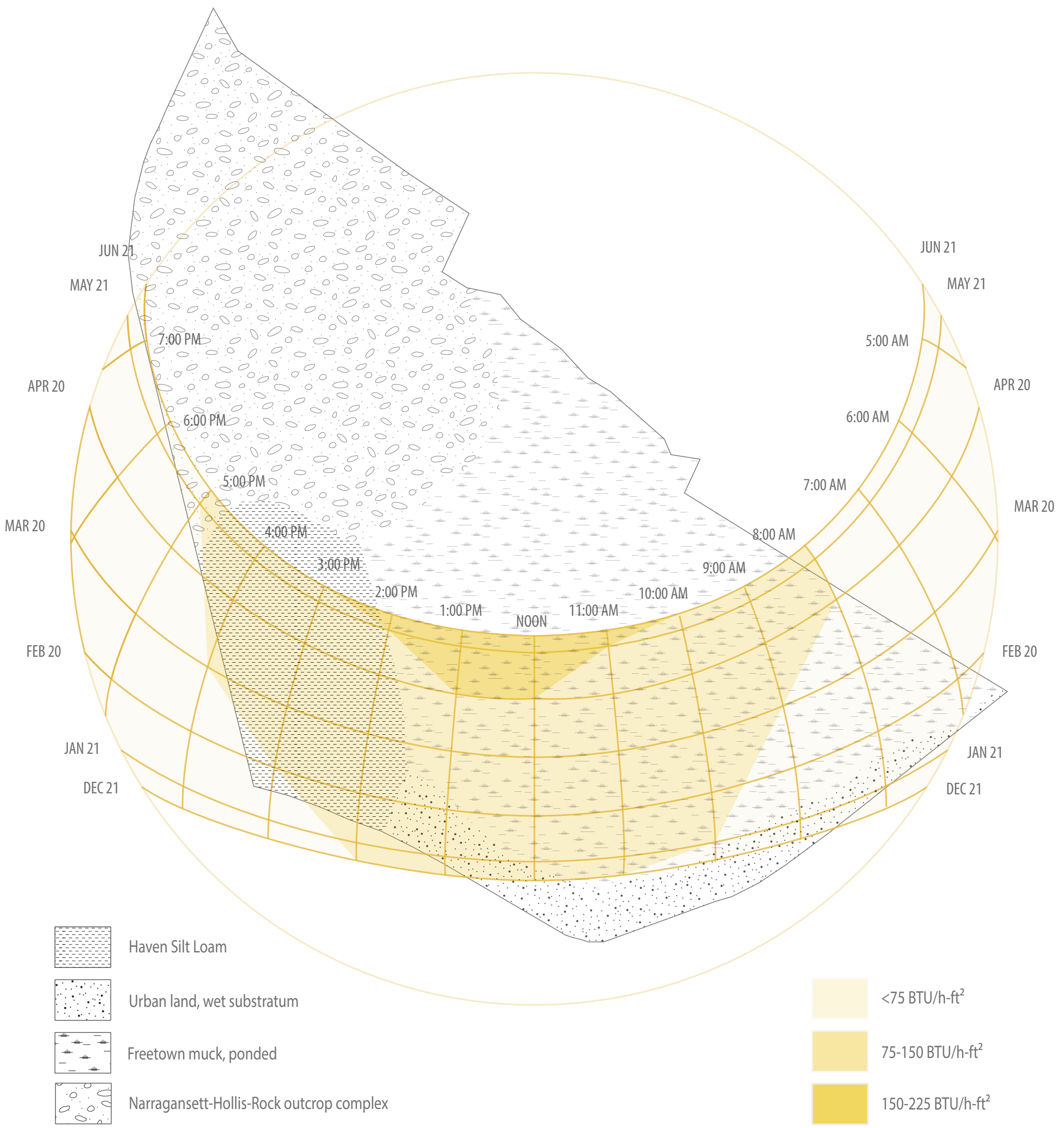
	Description	Size
A	Forest/ Woodland border; Mix of Hardwood and Deciduous Trees	range from ground cover and shrub material to 40'-50' high mature trees
B	Mix of mature Oak and Maple trees	Range; 30'-40' height
C	(2) *Gleditsia Tricanthos var. Inermis* Thornless Honey Locust	approximately 35'-40' high; 2.5'-3' D.B.H.
D	(2) *Koelreuteria paniculata* Golden Rain Tree	approximately 15'-20' high; 1.5' D.B.H.
E	(1) *Metasequioa Glyptostroboides* Dawn Redwood	approximately 50' high; 2' D.B.H.
F	(1) *Quercus Rubra* Red Oak	approximately 40' high; 1.5'- 2' D.B.H.

*Images taken from 2010 Waltham Report



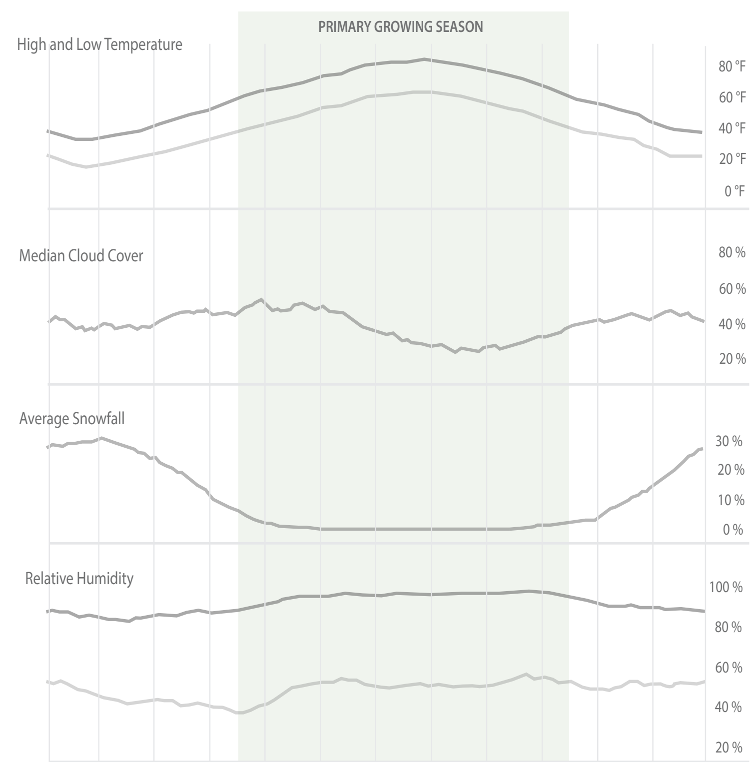
DISTRIBUTION OF FARMLAND RELATIVE TO POPULATION DENSITY
IN THE GREATER BOSTON AREA (SITE MARKED IN RED)

SITE CONDITIONS PERTAINING TO AGRICULTURAL USE



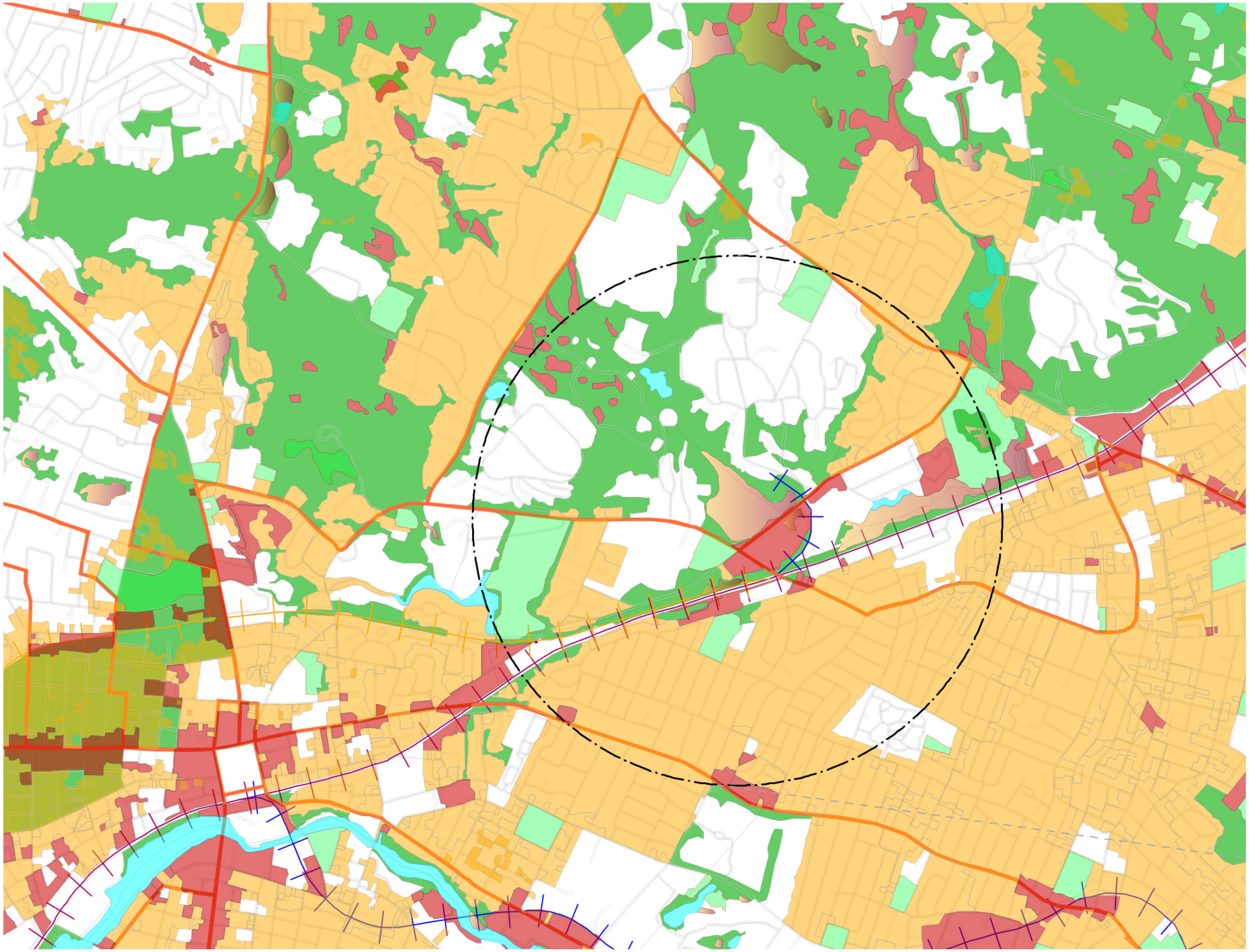
Average Hourly Global Horizontal Irradiance Per Month

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	1	4	6	5	1	0	0	0	0
6:00 AM	0	0	2	11	20	30	28	14	6	1	0	0
7:00 AM	0	4	20	41	50	67	73	52	30	13	5	0
8:00 AM	9	23	59	78	87	109	121	95	70	47	27	10
9:00 AM	38	56	94	114	119	145	162	139	111	81	62	40
10:00 AM	66	85	120	136	146	181	196	171	140	104	90	68
11:00 AM	81	108	140	150	169	200	211	184	160	121	113	88
12:00 Noon	85	120	146	164	177	209	216	191	159	124	120	94
1:00 PM	86	123	141	162	179	210	221	190	155	121	109	87
2:00PM	76	106	134	141	162	187	214	171	151	104	89	72
3:00 PM	56	83	114	119	131	160	190	143	123	82	61	51
4:00 PM	33	59	92	89	112	131	146	109	89	45	26	22
5:00 PM	8	27	51	57	75	92	101	68	47	16	2	1
6:00 PM	0	2	14	25	38	53	56	32	12	1	0	0
7:00 PM	0	0	1	3	11	20	19	6	0	0	0	0
8:00 PM	0	0	0	0	0	1	1	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:00 MID	0	0	0	0	0	0	0	0	0	0	0	0

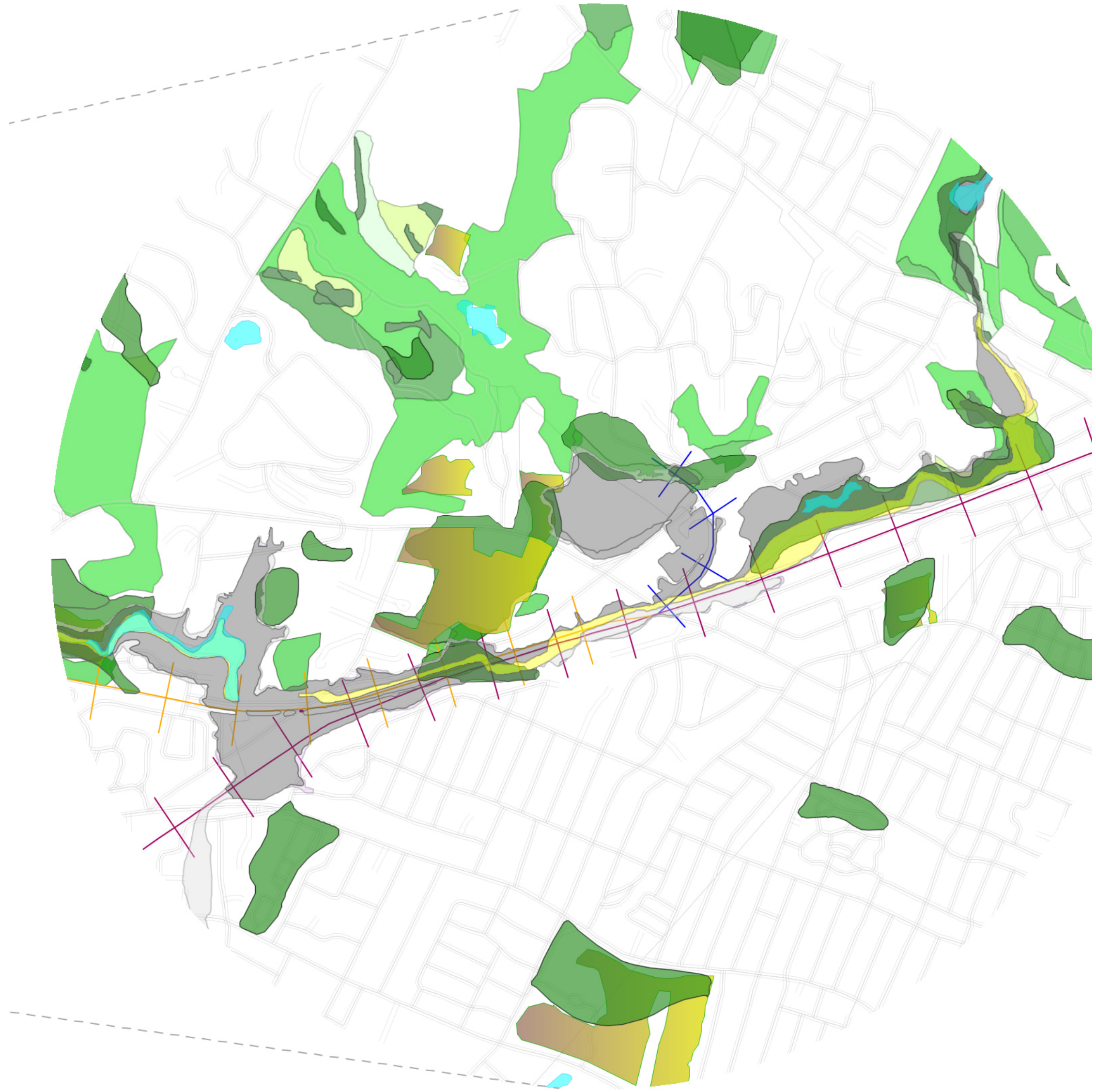



Bentley University
Site
SCALE = 1":18,056'
KEY
Educational Facilities
Small Business
Technology Company
Public Land
Note: No Markets within 2.3 miles of Site


SCALE = 1":18,056'
KEY
Impervious Surface
Regulatory Floodway
1% Chance of flooding
.2% Chance of Flooding
Activity & Use Limitations
Fly Ash



Residential Recreational Forests Commercial Wetlands Water



Prime Forest Land | Prime Crop Land | State Important Forest land | Existant crop land | 1% Annual chance of Flooding with BFE | Regulatory Floodway | Water

Remediation

By Jamie Dondero

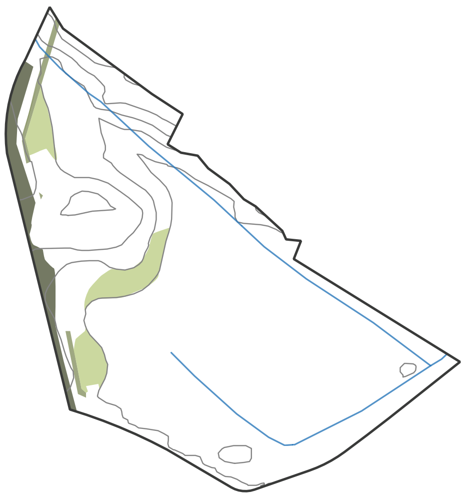
The urban homestead of the future tempers its measures through an informed sensitivity to the ecological well-being of the site and region. This begins with efforts to remediate any anthropogenic issues on the site that inhibit the healthy operations of the site's ecosystems. The UMASS Urban Homestead will foster a sense stewardship in visitors through on site examples explained in their micro- and macro- ecological context, including the remediation of hazardous waste, the removal of invasive species and the replanting of native species.

A pre-existing ecological issue on the UMASS Homestead site is the presence of fly ash, a coal byproduct with high concentrations of heavy-metals, once thought to be a potentially beneficial soil additive for farming, in the site's wetland. The fly ash is incredibly detrimental to the wetland, into which its heavy metals leach, as well as the region; the wetland is located within the Charles River Watershed. As part of the plan for the Urban Homestead of the Future, the wetland will be remediated, with the fly ash being capped and bioremediating plants used to absorb excess heavy metals. The remediation process will used as an educational opportunity for visitors through the installation of a boardwalk by the capped fly ash and a series of monitors throughout the marsh that communicate the presence of heavy metals and other pollutants with colored lights.

The site is also heavily infested by invasive species that out-compete native species, greatly reducing the biodiversity of the site ecosystem and compromising native animal habitat. The invasive plants will be removed through successive measures and replaced with hardy native species. Edible native plants safe for consumption by either people or animals are the preference when selecting native species for the site.

The Urban Homestead of the Future will be an educational model that instructs visitors in practices of homesteading that have the potential to enrich visitors' homes, communities, and broader ecological communities in which they're situated.

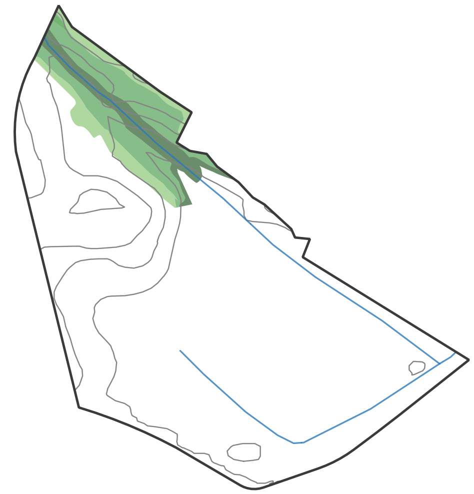
ECOLOGICAL STRATEGY



Upland

Dry | Wet

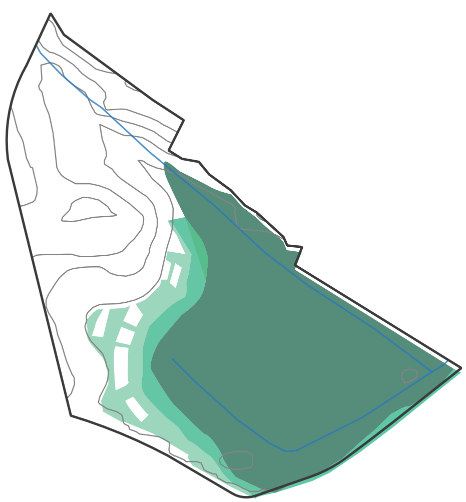
indian grass common milkweed beebalm	lowbush blueberry black raspberry common strawberry	white pine striped maple helianthus



Woodland

Dry | Wet

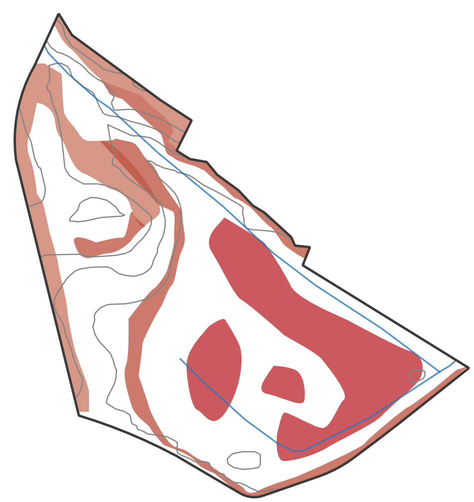
sugar maple virginia creeper wintergreen	northern red oak american witch-hazel trailing arbutus	red maple serviceberry ostrich fern



Lowland

Dry | Wet

indian grass swamp milkweed rudbeckia	river birch common elderberry staghorn sumac	rough bentgrass bog goldenrod broadleaf cattail

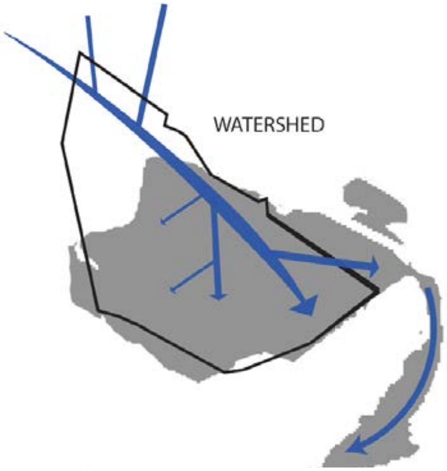


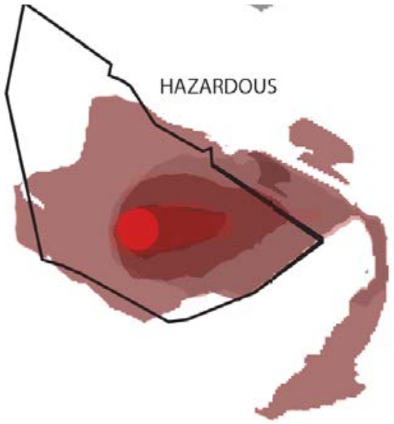
Invasives

to be removed through succesive measures
and replaced by native species

Dry | Wet

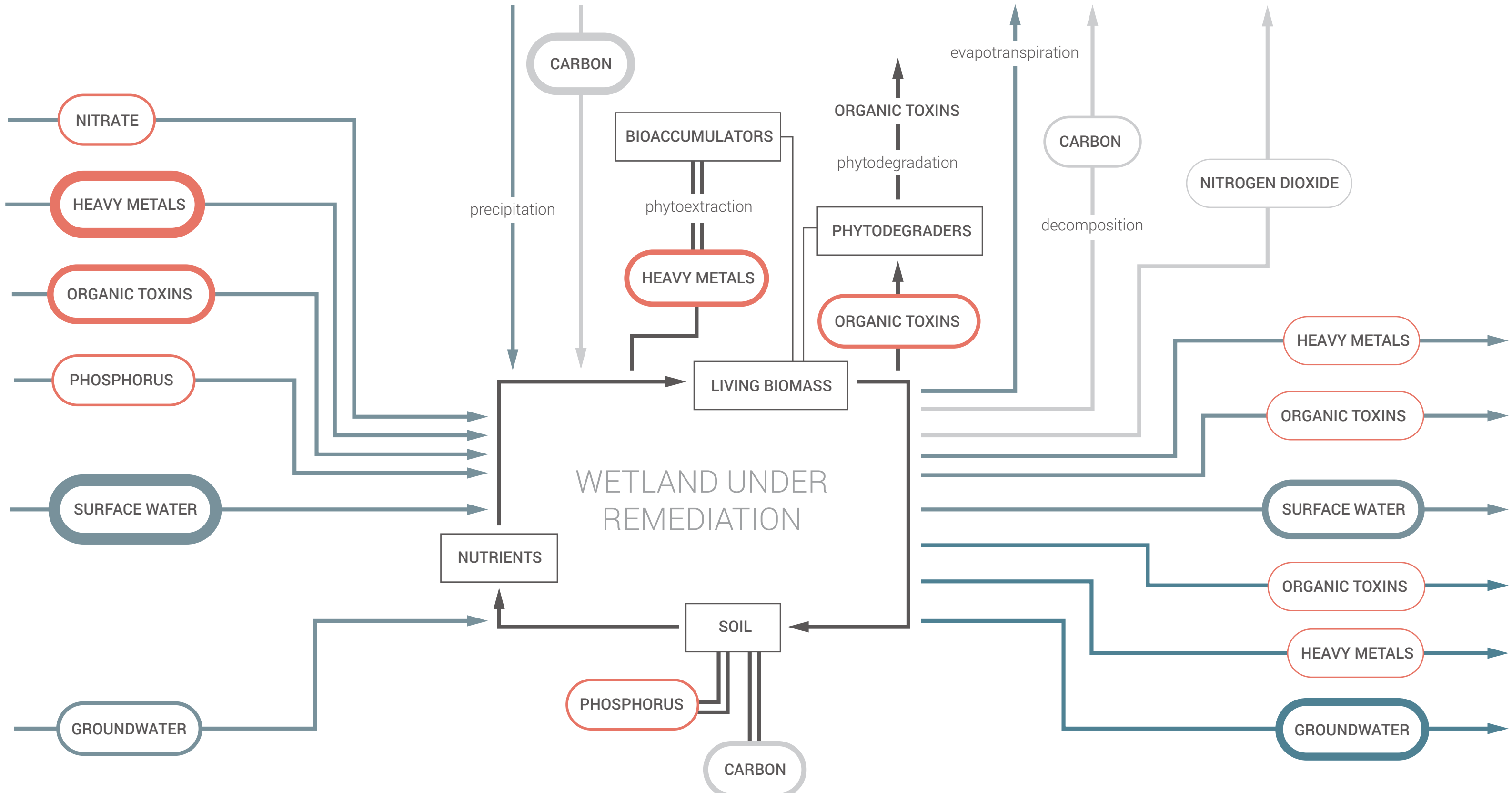
norway maple glossy buckthorn	bittersweet black swallow wort	phragmites



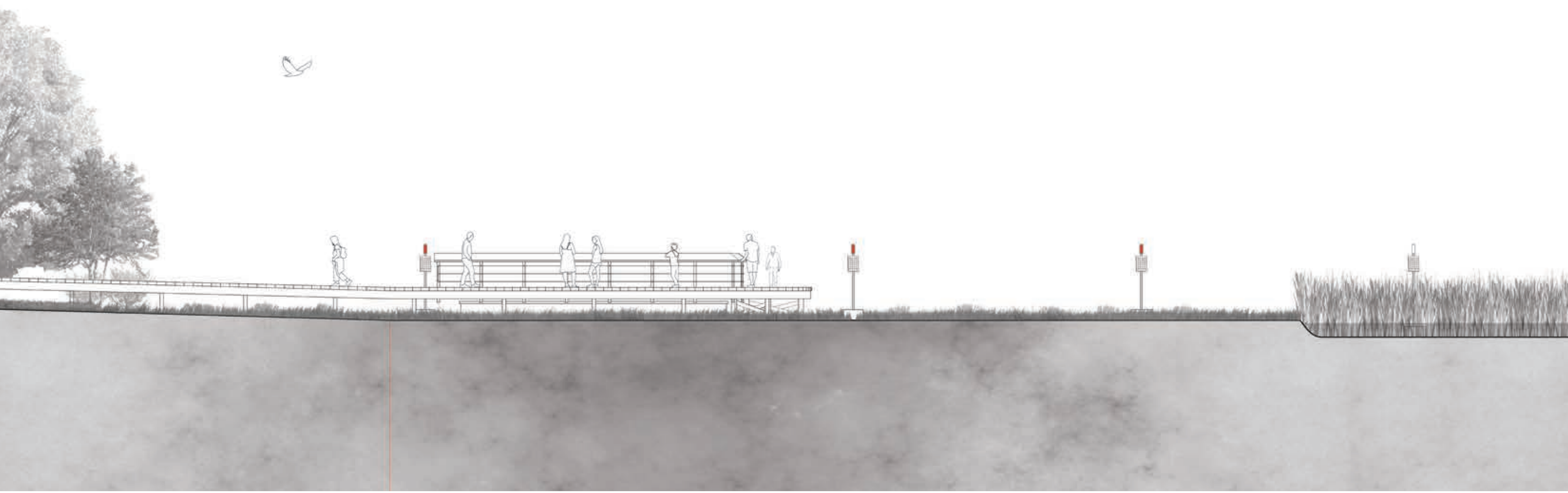


PROJEC TION OF IM PACT FROM THE FLY ASH POLLUTED WETLAND

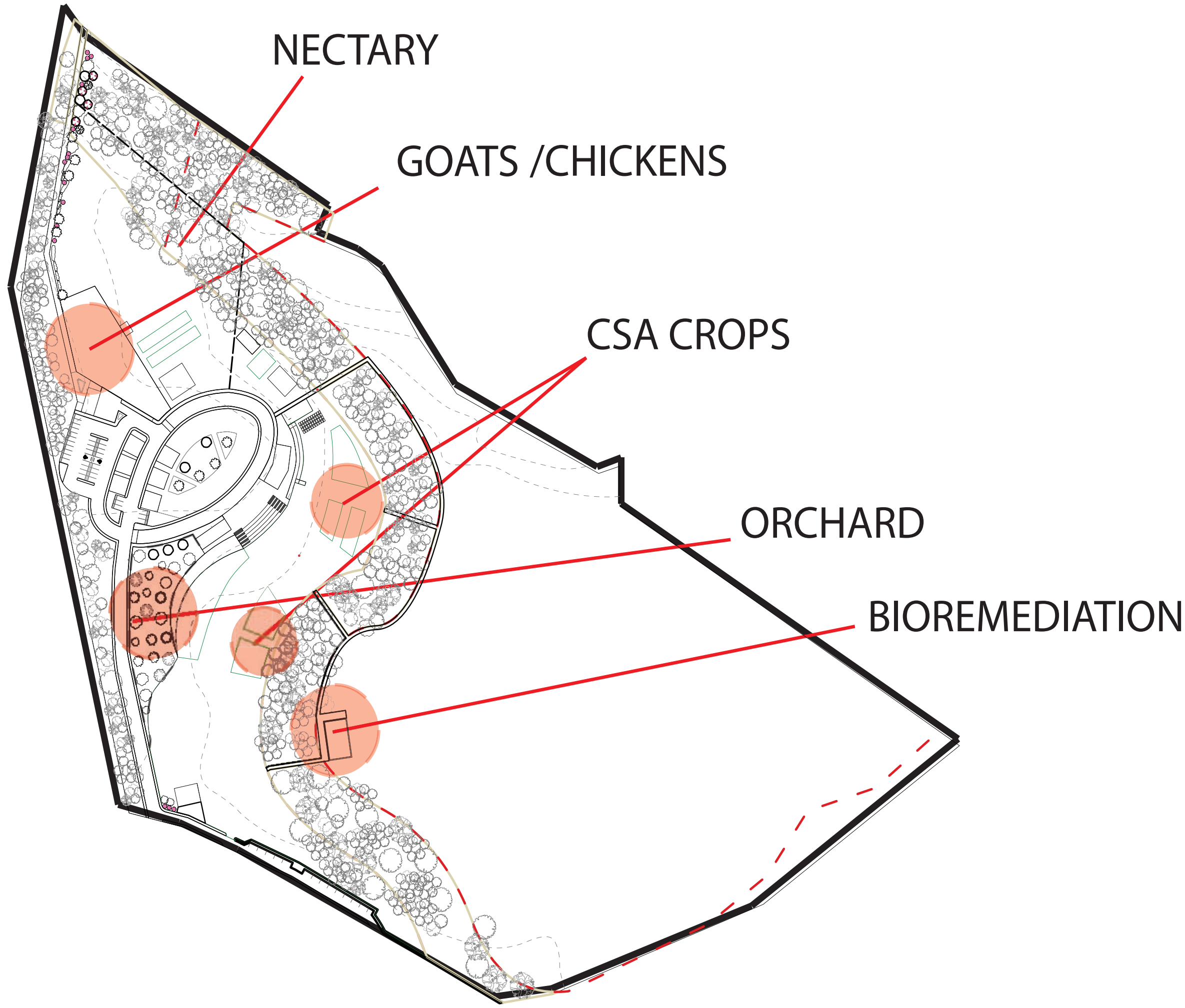
THE DIAGRAM TO THE LEFT SHOWS THE SITE'S WATERSHED O N A LARGER SCAL E. WE WANT TO REITER ATE THE IMPORT ANCE OF REMEDI ATING THE FLY ASH CONT AMIN ATION ON OUR SITE BY SHOWING THE COURSE THROUGH THE HEART OF BOSTON THAT THE TOXIC CHEMICALS WOULD TRAVEL.



CARBON
NITRATE
HEAVY METALS
ORGANIC TOXINS
PHOSPHORUS
SURFACE WATER
GROUNDWATER
precipitation
BIOACCUMULATORS
phytoextraction
HEAVY METALS
ORGANIC TOXINS
phytodegradation
PHYTODEGRADERS
ORGANIC TOXINS
evapotranspiration
CARBON
decomposition
NITROGEN DIOXIDE
LIVING BIOMASS
WETLAND UNDER REMEDIATION
NUTRIENTS
SOIL
PHOSPHORUS
CARBON
HEAVY METALS
ORGANIC TOXINS
SURFACE WATER
ORGANIC TOXINS
HEAVY METALS
GROUNDWATER



ECOLOGY



General Ecology Strategy on Site

Technology and Energy

By: Renan Barreto

Reducing fossil fuel dependence is the challenge of our generation. Numerous studies have indicated that the technological ability to economically and significantly reduce our emissions and unease the current dependency on natural resources has been abundant, and made available for the application in particular. Here is where the practice of using renewable resources for energy production comes into play. This notion falls within the principles of sustainable Agriculture, as the Midwest Sustainable Agriculture Working Group describes as a creative system of practices that are economically viable, locally managed, ecologically sound and socially responsible.

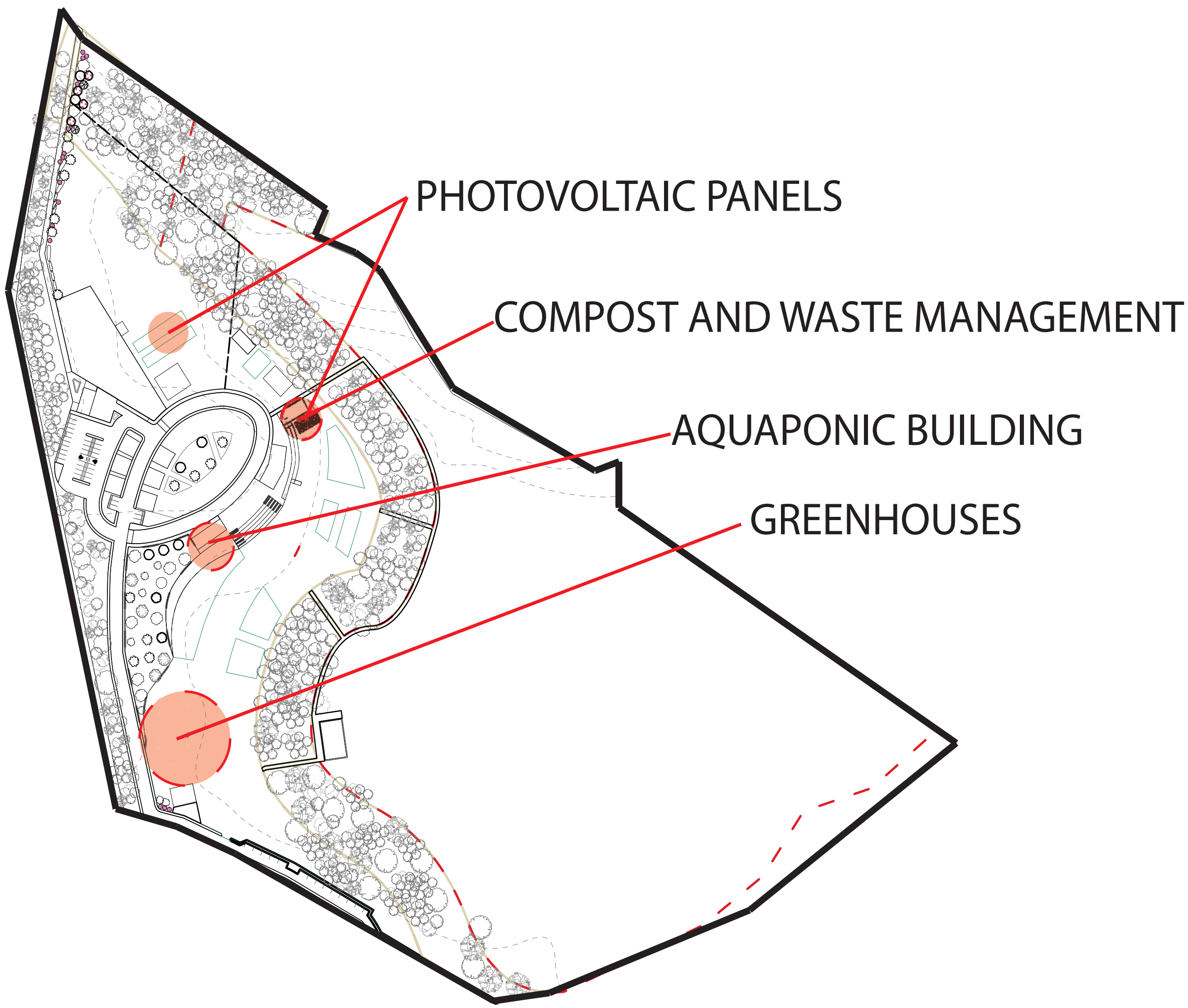
Various methods of renewable energy production could be practiced in rural land. When considering renewables our Waltham farm, a comprehensive study of it's future energy needs were conducted, assuring that the principle that all energy developments, including renewable energy, should go through individual site and environmental review to insure that ecological impacts are minimized. As part of the analysis, a wide range of strategies had been considered. Ultimately resulting in making use of Biomass, Wind, and Solar, which could essentially be harvested forever. These resources have the potential to exceed the farm's energy demand, not only making the site self sufficient but also, creating the opportunity to generate an income by selling the fuel as a "cash crop".

Solar- The amount energy that is emitted from the sun through daylight is immense. The energy that is currently stored in our planet's reserve of coal, oil, and natural gas is equivalent to only 20 days of sunshine. For our Waltham farm, we're harvesting sunlight with the use of photovoltaic cells in solar panels to convert solar rays to usable electricity. By strategically positioning our facilities throughout the site, we've established an opportunity for each facility to meet its own electrical demand by incorporating the use PV panels on rooftops, with the largest rooftop array grouping as many as 30 panels, with the potential of harvesting as much as 7,650 watts. The Urban homestead examples derives electricity from the solar farm - A ground based array that is composed of 40 PV panels, capable of fueling 10,200 Watts to the farm's reserves.

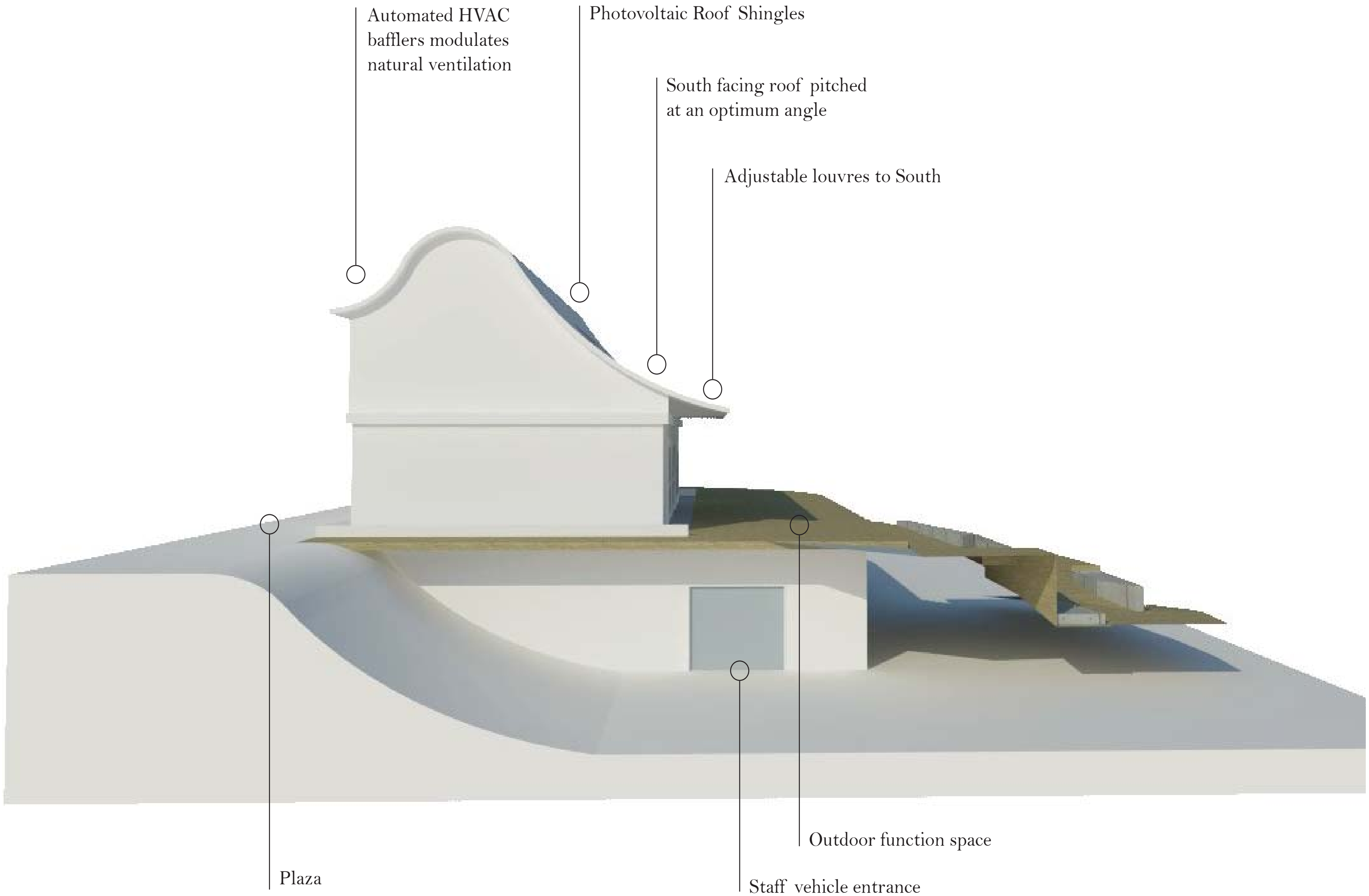
Wind - Wind power isn't exactly new technology in agriculture. For centuries, wind mills have been utilized to convert wind power to mechanical energy for a wide range of agricultural applications. As an extension to achieving self sufficiency with our electrical demand, we're proposing the application of two examples of wind turbines. Which would be installed parallel to the streetscape to generate electricity in absence of sunlight.

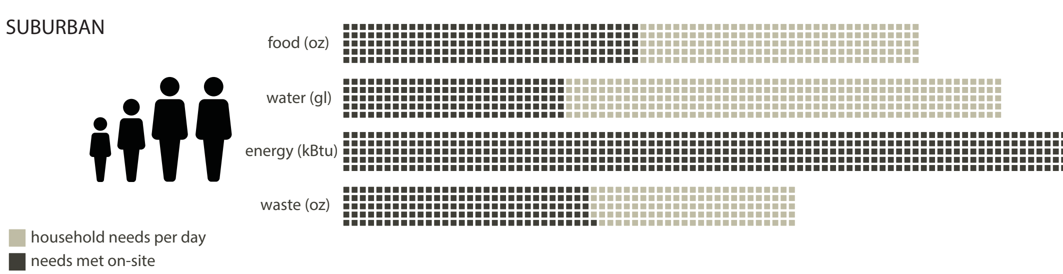
Biomass- Typically Biomass energy is produced from plants and organic wastes. Crops could also be grown in different scales to be used as energy crop, such as corn and native prairie grasses. For our farm in particular, we've sought to introduce the site's dry waste to our anaerobic digesters

TECHNOLOGY

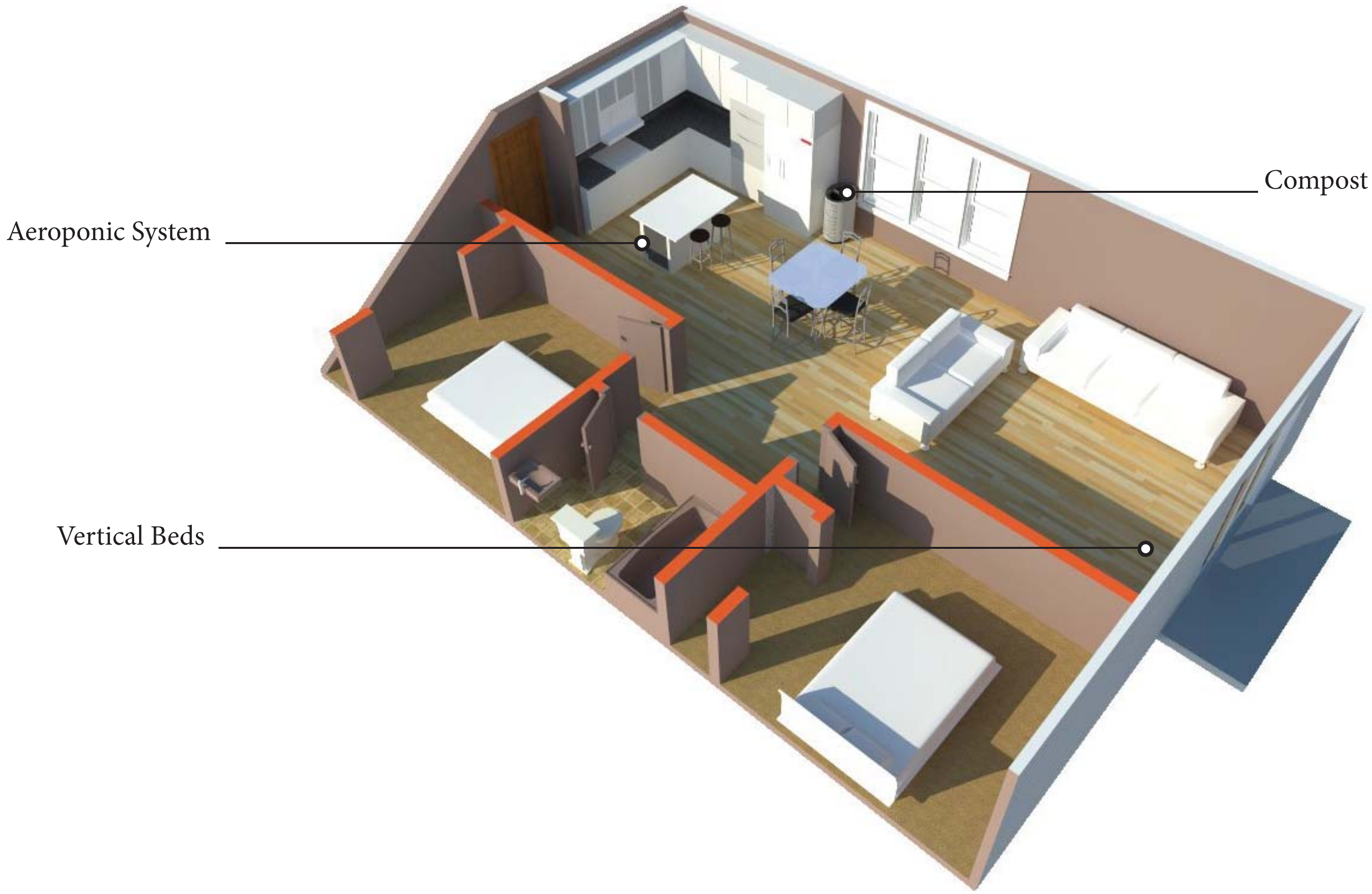

PHOTOVOLTAIC PANELS
COMPOST AND WASTE MANAGEMENT
AQUAPONIC BUILDING
GREENHOUSES

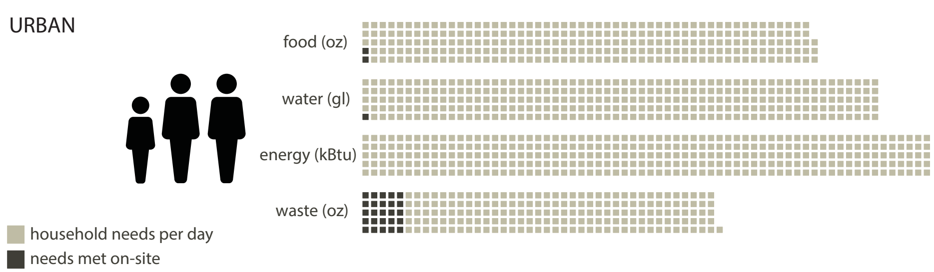
Sustainable Strategies



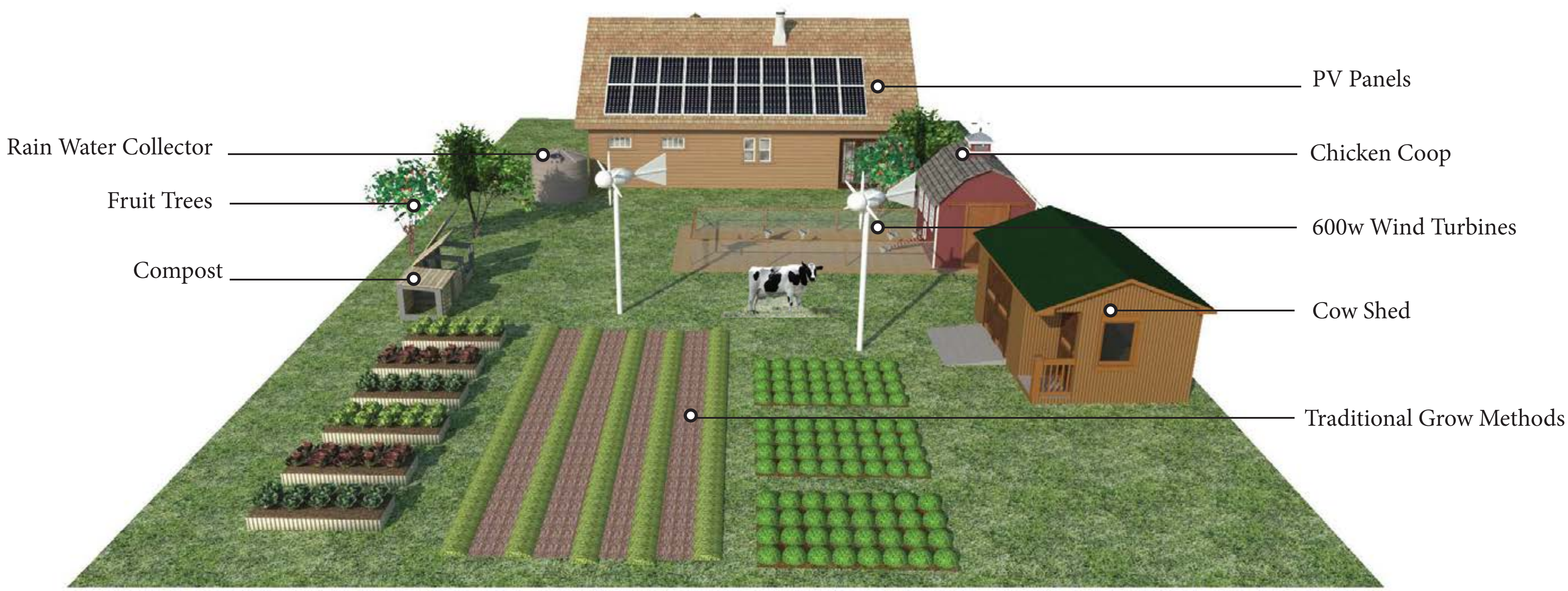


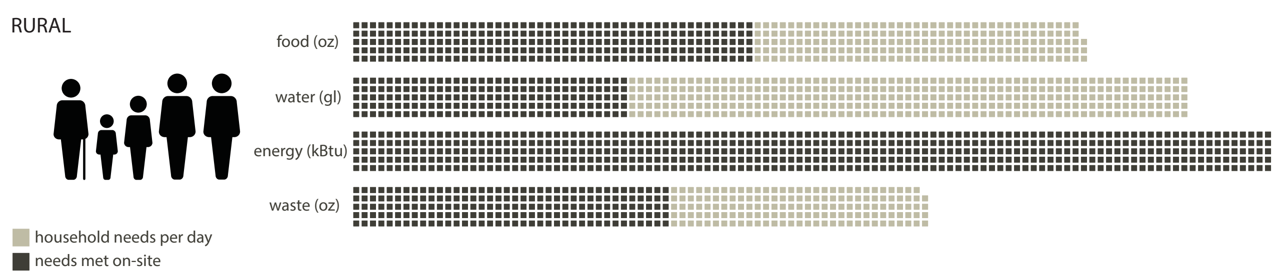
SUBURBAN SCALE


Compost
Aeroponic System
Vertical Beds


URBAN
food (oz)
water (gl)
energy (kBtu)
waste (oz)
household needs per day
needs met on-site

URBAN SCALE


PV Panels
Rain Water Collector
Chicken Coop
Fruit Trees
600w Wind Turbines
Compost
Cow Shed
Traditional Grow Methods


RURAL
food (oz)
water (gl)
energy (kBtu)
waste (oz)
household needs per day
needs met on-site

RURAL SCALE

2600 Gallon Tilapia Tank
502 Sq. Ft. Grow Bed.

Fish density of 1lb of fish per 2.5 gallons of water.

For each 60-100 grams of fish food added per day, you can support 1 sq. meter of plants.

Site Development

By Carlos Guzman

The site plan was conceived upon understanding the physical boundaries of the site as well as its topography. Given the irregular shape and size of the wetland as well as its obliged buffer, it was imperative that the different systems (roads, circulation, building locations, etc.) be inscribed within this outline. Topography lines were also followed to arrive at the organic form of the open plaza and the distribution of land for the different homesteading scales. By following these pre-existing conditions we set the foundation for a proposal that has minimum impact on the site, the wetland and the rest of the environment.

With the understanding of the site's topography, we began to see the natural behavior of water through the site and into the wetland (see water flow diagram). Water is the most important element for agriculture and homesteading it is both a source of nourishment and a vehicle for environmental pollution. This knowledge was the basis for the decision of the cropland and animal farming locations.

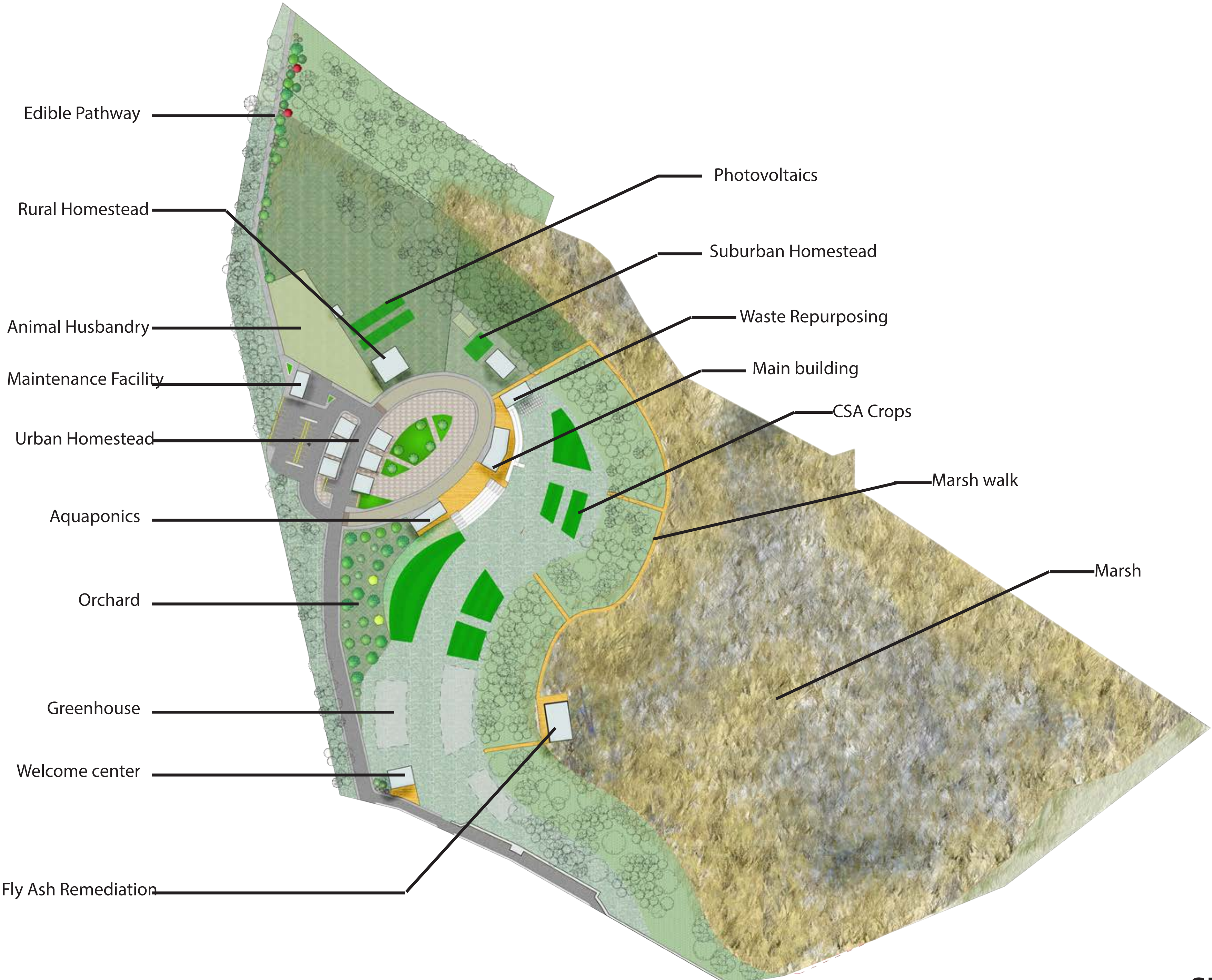
Upon entering the site, one walks north uphill to a plateau from where the whole land is made visible. As the height difference between the street and this plateau is of at least 30ft, this topographic condition represented both a challenge and an opportunity for the design of the project. By adjusting the buildings to this condition of the land, we reduce the scale of the buildings by having a basement level that can be potentially developed, especially in the case of the buildings that are closest to the cropland. In these particular cases, the basement level can be used as space for farm equipment. This condition can be seen in the longitudinal section of the site. as food preparation and storage space for farm equipment. This condition can be seen in the longitudinal section of the site.

The different scales for the homesteads where based on different metrics. For the urban scale, its dimension was based on the average apartment size in the Boston area and with the intent of accommodating a family of 3. In the case of the suburban and rural scales, their proposed built area and lot size was met following the average dimensions of similar houses in the Waltham area. Their occupants would be families of 4 and 5 respectively. The urban homesteads would be perfect stages to showcase experimental agricultural systems like vertical farming, aquaponics, among others. However, unlike the suburban and rural scales, all of its food and energy demands are not met directly within its infrastructure or its lot.

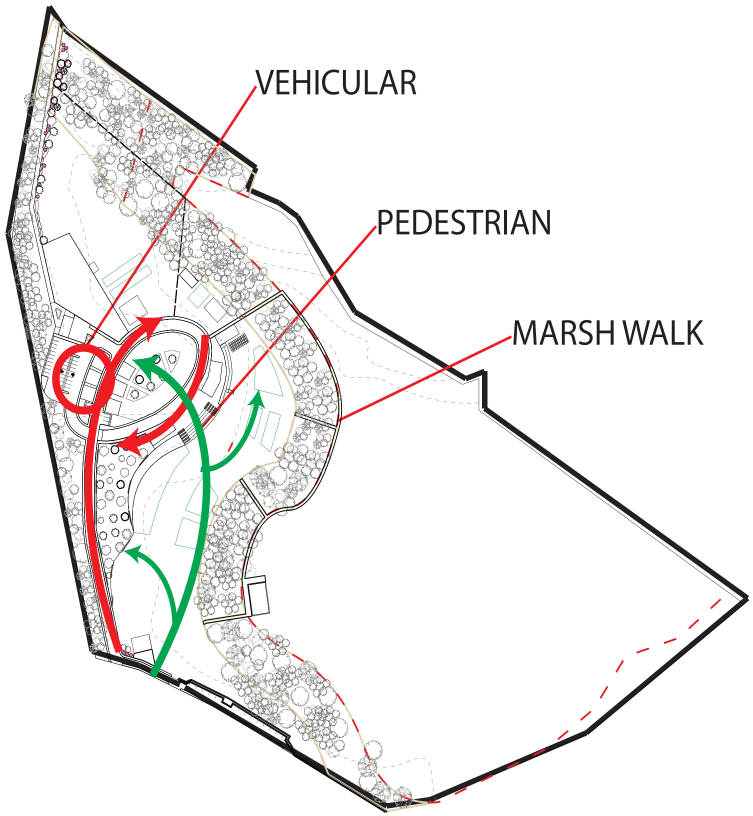
The most important aspect of homesteading is choice. Each person chooses its own way on how to participate on this culture. This reality is translated to how the site is meant to be experienced. As can be seen in the Site Plan there are many ways on how the site can be accessed by the public. A pedestrian can enter the site through the Welcome pavilion, passing through the experimental spaces and can choose to make its way to the plaza either through the orchard, the marsh walk and the fly ash remediation area or up the stairs of the open terrace on which a pop-up market will be available some months of the year. A person arriving by car can access the site through the main road pass the smaller homesteads and use the parking lot adjacent to them. This parking lot communicates directly with the bike trail that leads to the northern end of the site. So the parking lot accommodates cars and bicycles.

From this point the road changes material as it makes its way around the plaza, the reason for this is because this portion of the road is meant to be used more by pedestrians than cars. The only vehicles allowed past this point are emergency vehicles, buses, trucks and other special circumstances.

To conclude, the main strategies for the proposed Site Plan were the site's irregular shape, the wetland buffer and its topography. By following these guidelines we are proposing a flexible Site Plan that is based upon natural conditions of the land instead of imposing new ones that are out of context. Such framework is the basis for an environmentally and economically sound proposal that has the potential to reach the public on many levels.

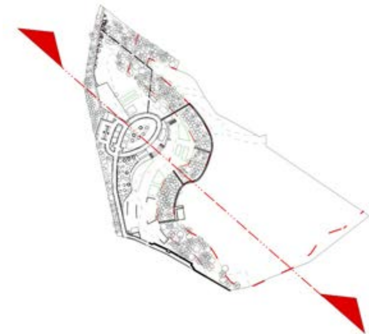

Edible Pathway
Rural Homestead
Animal Husbandry
Maintenance Facility
Urban Homestead
Aquaponics
Orchard
Greenhouse
Welcome center
Fly Ash Remediation
Photovoltaics
Suburban Homestead
Waste Repurposing
Main building
CSA Crops
Marsh walk
Marsh

SITE PLAN

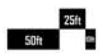


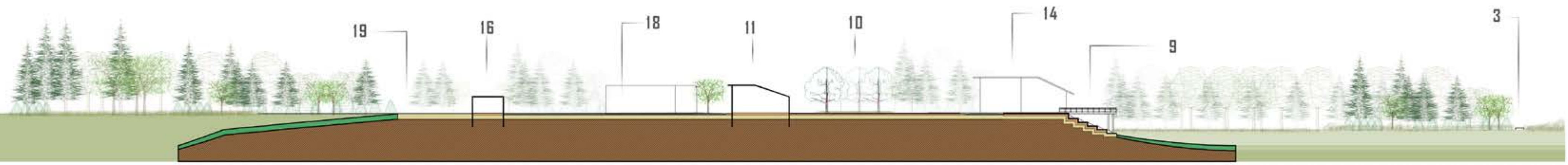
Circulation On-Site

Water Movement On-Site



Longitudinal section





Section zoom

1. Main road and entrance
2. Welcome Pavillion
3. Marshwalk
4. Experimental crop area
5. Flyash Remediation
6. Temporary parking
7. Sloped Orchard
8. Cropland
9. Open terrace
10. Open plaza
11. Urban condition
12. Rural condition
13. Suburban condition
14. Community Building
15. Aquaponic Facility
16. Mantenaince building
17. Field Composting
18. Parking lot
19. Bike trail

Conclusion

By Carlos Guzman

This project and the research described in this book mark an important precedent not just for the vision of the future of Homesteading, but for how communities interact with food and natural resources. When the average North American sits down to eat, each ingredient has typically travelled at least 1,500 miles. Most of them are unaware of this. Even worse, most of them don't even understand where the food in the grocery stores comes from. They remain distanced and ignorant of this vast and complex system of inputs and outputs, while existing only as consumers. The time has come for this knowledge to become mainstream and part of the cultural zeitgeist. The project presented in this book is but a single cell in what can become a network of interconnected homesteading communities dedicated to sharing the knowledge with the public on how to live life in a more balanced manner.

The UMASS Homestead of the Future will begin a conversation in the Waltham and Greater Boston area about food, community and the environment by informing and educating people on topics that were previously never taught or discussed in such a visual and experiential manner. In doing so, people's lives are empowered with a sense of purpose and the possibility of participation opens up. Although it is unlikely that everyone will feel the need to get involved, that's fine. Education is a form of revolution in its own way.

However, there's still much more research that needs to be done. A lot of what is discussed here is heavily dependent on technology. Some of this technology is still in its experimental phase and therefore it will take time to become fully accessible for the basic consumer. Once it does it will completely change the way people interact with the environment and with one another.

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