COMPOSTING | KC

by

ANDREW ROSTEK

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture and Regional & Community Planning
College of Architecture, Planning and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2016

Approved by:
Major Professor
Jason Brody, Ph D

COMPOSTING | KC

COPYRIGHT

Masters Report submitted in partial fulfillment of the requirements for the degree of:
Master of Landscape Architecture (MLA)

Major Professor: Jason Brody, Ph.D.
Supervisory Committee: Vladimir Krstic and Blake Belenger

KANSAS STATE UNIVERSITY
College of Architecture, Planning, and Design
Department of Landscape Architecture & Regional and Community Planning

ABSTRACT

FUNCTIONALLY DEMONSTRATING RESIDENTIAL ORGANIC WASTE MANAGEMENT IN DOWNTOWN KANSAS CITY.

Kansas City is currently under achieving in its capacity of divert recyclable and compostable solid waste from city landfills. The city recycling system provides free access to single family residents, but it does not provide access to high density residential and commercial land uses commonly found Downtown. To solve this dilemma, KCDC has studied the current solid waste systems in the city, and developed its [re]considered proposal through a MARC Solid Waste Management District grant to improve Kansas City waste diversion. This is achieved through a system of links, clusters and nodes which will help to promote and facilitate greater recycling (KCDC 2015 Fall Studio 2015) Compost | KC seeks to answer if the organic nodes as proposed in can effectively compost residential organic waste in down town Kansas City.

As part of this system, the organic node at 12th and Holmes functionally demonstrates the potential feasibility and benefits of residential compost of organic solid waste. Through the site design, the proposed organic node creates an integrated system of residential organic waste collection, processing and utilization. Collected form a 15 minute radius, the waste is processed into a rich organic compost that is used in various ways to improve soil quality for stormwater management, carbon sequestration, and increased biomass production in and around the site. To compost the organic waste, the site contains a series of in-vessel composting drums, agitated compost piles connected to greenhouses, and an external maturing pile visibly demonstrating and educating the public composting benefits. Managed through a local non-profit organization, compost is used to grow a variety of produce and nursery stock sold to help fund the site management. Organic waste is brought to the site by organized collection with apartment complexes and free public drop-off points.

By incentivizing access, ease and appeal of composting in Kansas City for residences, the organic node at 12th and Holmes achieves the goals of both the site design and [re] considered proposals. By meeting those goals, the organic node helps to increase organic waste diversion and increase education and awareness about the benefits of composting in downtown Kansas City.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

I would like to extent thanks to my major professor, Jason Brody, and my committee members, Vlad Krstic and Blake Belenger. Without your support and guidance, this project would not have been possible.

Special thanks must also be given to the local professionals who gave their time to help critique the KCDC work throughout the year, but especially Lydia Gibson, Lisa McDaniel, Kevin Anderson, and Claire Zimmermann, who offered up time to meet with me on multiple occasions to guide my research and support me towards finishing this project. Their knowledge base was critical in creating a project that has real potential to change peoples' thoughts on composting and its place in the downtown community.

Design development of the proposal was a collaboration with the entire KCDC studio, but Joel Savage and Levi Caraway where two students in particular dedicated their efforts towards the final design outcome of the organic node concept. Throughout the final semester, both tirelessly worked to help complete the project, and I have come to consider both to be good friends. I wish them all the best in their future careers.

I must also thank my fellow landscape architecture students at KCDC, Amada Santoro, Libby Tudor and Lauren Heermann. The four of us pulled each other through a lot in this last year, and I will miss being able to talk with them and share our individual frustrations and joys.

Finally, I have to thank my family who have supported me in the past five years. I would not have been able to attend K-State without their support.

INTRODUCTION | 01

INTRODUCTION

PROJECT OVERVIEW

Organic waste is a major component of the overall waste management dilemma in Kansas City, and there are significant opportunities to improve current diversion rates of organic waste from the regions landfills. Currently, the only regulated organic waste in Kansas City is yard trimmings. All other organic waste management disposal decisions are voluntary and left up to the consumer. Paired with a significant lack of public education, organic waste diversion is unacceptably low. According solid waste breakdowns, at regional landfills, the current management strategy is leading to the significant majority of organic waste to end up in landfills. Where the United States averages 50% compostable waste in landfills, as much as sixty percent of Kansas City waste deposited at landfills is compostable (Cynthia Mitchell and Dennis Siders 2009).

Composting organic waste offers significant environmental and economic benefits that Kansas City could benefit from (US EPA 2016; Maynard 1999; Alexander 2015). By treating organic waste as an infrastructural and solid waste management issue, Kansas City can begin to leverage the latent potential of organic waste to create new value and jobs, improving the downtown public realm. Compost can be utilized in soil to act as a natural fertilizer, to reduce runoff and increase infiltration, to increase carbon sequestration, and to inhibit the growth of soil pathogens. All of these things reduce the stress on Kansas City's combined stormwater sewer system (Preston Sullivan 2002). Additionally compost can be applied towards the bioremediation of degraded soils in local brownfields (David Whiting et al. 2015; "Field Guide to Compost Use" 2001).

Kansas City must work to educate and engage its residents about composting and its benefits in the future. By using the organic node strategy proposed in the [re]considered proposal and developed in this report, Kansas City can begin to show residents the values of composting towards improving the public realm and work towards reaching appropriate diversion rates. Compost should not be a mystery in Kansas City. It should be an accepted and integrated practice benefiting all.

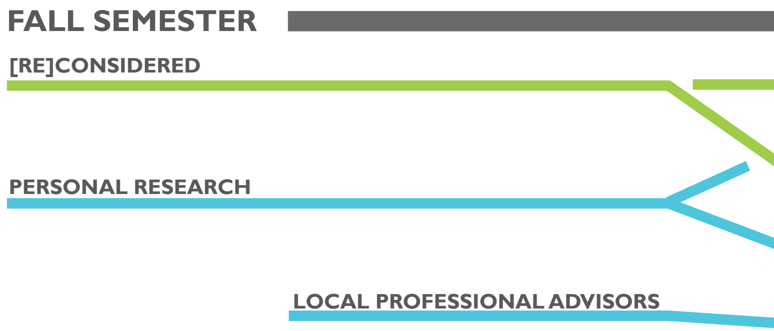
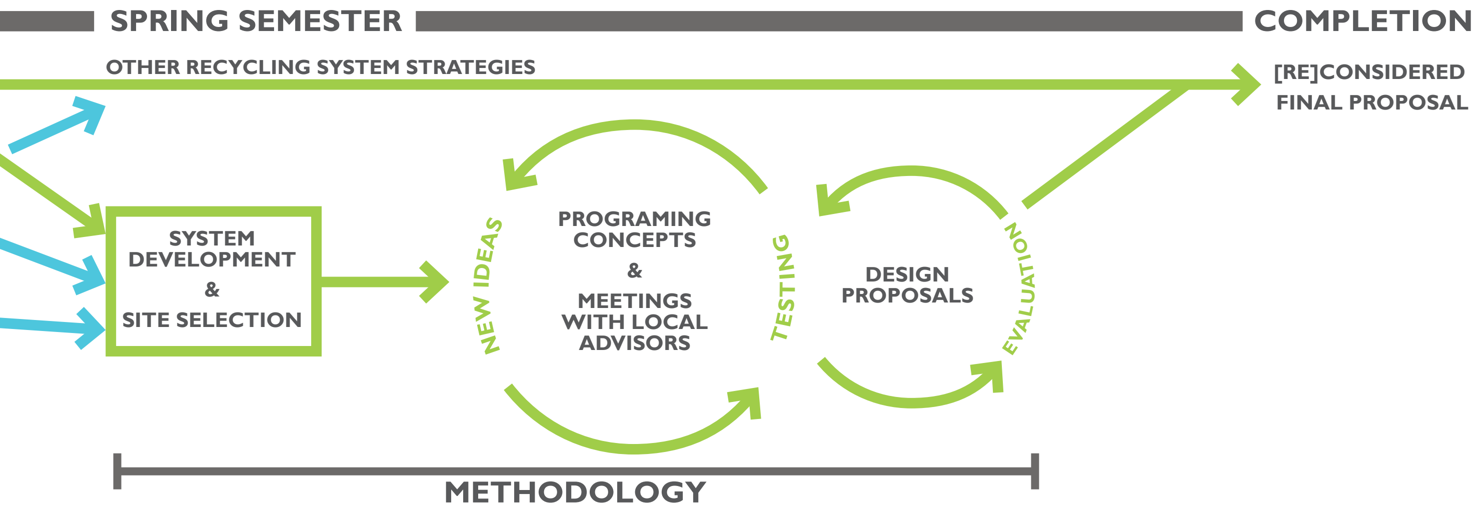


Figure 1.1 Vision, Mission and Goals | the proposal began as three parallel processes that intersected at the site selection and continued as a joint studio project (KCDC 2015)

PROJECT COORDINATION

This proposal is the work of multiple groups and advisors. Throughout the fall semester, the [re]considered proposal was developed to help create a design based system solution to help improve the solid waste management system in downtown Kansas City. Along side this work, an in line with the [re]considered proposal, I personally worked to expand my knowledge and understanding of composting and urban agriculture to help expose new strategies to improving the overall system by addressing organic solid waste. Realizing that I would not be able to learn enough about these complex systems in one semester, towards the end of the fall semester, I connected with a variety of local professionals who could help to provide guidance and critiques on the studio and research progress. Early in the spring, a final site was selected to show the application of our strategies to an actual site. The site selection represents the intersection of the three parallel processes. From that point, joint collaboration between the KCDC studio worked to see the design development and proposal to completion.



[RE]CONSIDERED PROPOSAL | 02

KCDC BACKGROUND

KCDC AND DOWNTOWN RECYCLING PROJECT

Located in downtown Kansas City, the Kansas City Design Center (KCDC) is a nonprofit program for students of architecture, landscape architecture, and planning at the University of Kansas and Kansas State University. Its mission is to "promote excellence in the design of Kansas City's built environment." This is done through educational programs in which "faculty and students form partnerships with local client groups and stakeholders to develop design concepts and implementation proposals addressing major architectural, urban design, and urban planning issues throughout metropolitan Kansas City (Kansas City Design Center 2015)." According the KCDC's website, collaborations with "community organizations, stakeholders and residents, local governments, and design professionals [have promoted] excellence in urban design and the built environment (Kansas City Design Center 2015)."

PROJECT GRANT PURPOSE

The Mid-America Regional Council Solid Waste Management District offered grant funding during the fall of 2015 to the KCDC in exchange for work that could improve the recycling program in the Greater Downtown Area of Kansas City. Work was done in collaboration with an advisory council and includes research and analysis, a programming and vision plan, site studies, and system component designs. This stakeholder group represented the voices of many people with invested interests in the project's outcomes.

The grant completed by the KCDC set out to address the need for a "comprehensive, appealing and convenient recycling system" which could be used as "an instrument of betterment of the quality of urban environment." Although the original grant proposal set forth requirements to guide the project scope, the wording was sometimes open to allow for flexible interpretations (Appendix I).

KC SOLID WASTE AND CLIMATE PLANS

In 2008, Kansas City and the region produced several key documents outlining solid waste management, regional landfill waste compositions and the city's future actions on climate change. This research lead to the creation of the Long-Term Solid Waste Management Strategic Plan, the 2008 Missouri Waste Composition Study, and the Climate Action Plan of Kansas City Missouri. These plans constitute a large amount of data on current levels of waste generated, public perceptions, and goals that the city has set in order to improve its environmental impact. These reports helped to formulate and guide many of the decisions made while creating the KCDC [re]considered proposal.

STUDIO PROJECT PURPOSE

The specific vision, mission, and goals that were created by students during the studio project drew from the original grant proposal, but were written to reflect the broader needs of the recycling system in downtown Kansas City (Figure 1.1). After main dilemmas were identified in the research and verified by the advisory committee, the studio moved to address the dilemmas with project proposals.

Beyond the original grant, the studio explored solutions within the public realm to integrate recycling and composting opportunities to improve quality of life and enhance the urban environment. The studio's investigation to improve downtown Kansas City's waste system took place over the course of two semesters. The first semester consisted of research and inventory of existing waste operations, policies, and infrastructure, leading to a comprehensive vision plan. Strategies were established and further developed into site design proposals in the second semester. These proposals were developed to create awareness, improve education about recycling, establish multi-family and commercial recycling infrastructure, and improve the aesthetics and convenience of recycling and composting in the public realm.

VISION

Our vision is to create a livable downtown Kansas City through a thriving material waste system known for efficient, data driven, innovative design.

MISSION

The mission is to build a positive public partnership by selectively investing in recycling and composting infrastructure downtown in order to improve participation and overall diversion rates, and contribute to a more convenient and amenity rich lifestyle in KC. This Proposed Framework will enhance public and private access, and waste system efficiency through the use of smart waste infrastructure, consisting of data-driven tools and innovative collection methods.

GOALS

- Generate awareness and city pride for recycling
- Create multi-family & commercial recycling infrastructure
- Improve recycling convenience through accessibility
- Measure and publicize city goal progress regularly
- Increase participation through public education
- Create design standards for the overall system

Figure 2.1 Vision, Mission and Goals | Top (KCDC 2015)

PROJECT DILEMMAS

Education
Individual unwillingness to take part in publicly provided recycling services may stem from a lack of education. According to a recent study, 22% of Kansas City residents do not recycle weekly although they do receive city-provided services to do so. Many do not recycle because of common misconceptions or they do not have convenient access (Kansas City Planning and Development 2015). For example, many do not understand the need to recycle or how and what to recycle (SCS Engineers 2008).

Expanded educational efforts may also increase people's willingness to compost. Education about proper composting processes could address common misconceptions that keep people from participating. Many people are often concerned about potential odors or pests associated with composting. If done correctly, the collection of organic food waste can be safe and clean, contrary to what many may think (SCS Engineers 2008).

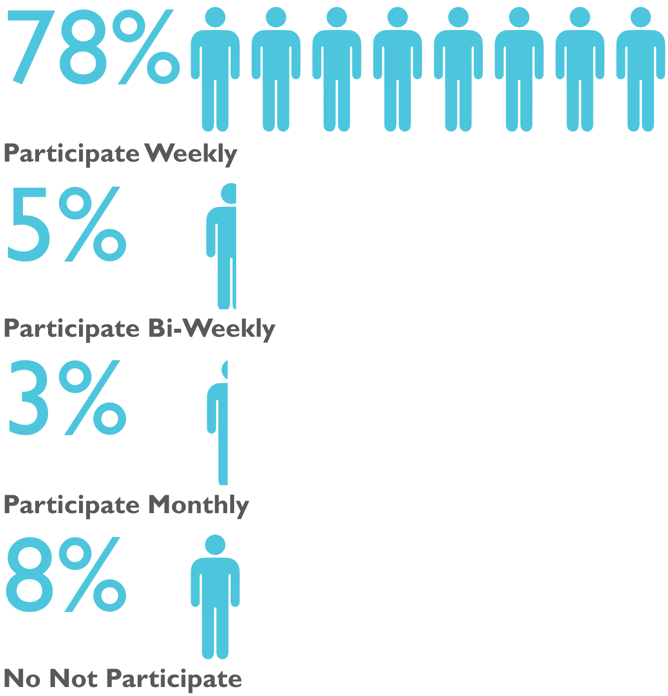
The strategies proposed by the studio offer possible ways to make recycling and composting more comprehensible. Education is an important element of the proposed open space and linkage strategies. Education about recycling and composting can take the form of not only outreach programs but also artwork, visual prompts, or various amenities in public space.

Efficiency
Inefficiencies found in the regional study relate to waste collection and transportation. For example, multiple haulers drive many of the same routes to collect along similar waste streams from neighboring properties. If more recyclable waste streams are further separated to collect individual recyclable or compostable materials, then additional trucks may be on the roads and driving similar routes. Instead, waste could be collected at centralized locations and shared by multiple land uses clustered in a dense area. Many business or residential complexes downtown currently own individual bins for trash and recyclables. If organic, glass, plastic, or paper are collected in single streams, countless more bins many fill alleys and service areas. Waste haulers may be required to make many more routes and stops if multiple buildings do not share central waste collection points. Service and function is an important element of the proposed privately shared collection points, which are explained in chapter three. Data collection may help efficiently predict the needs and trends of Kansas City's waste production, and integrated technology can make data collection easier. The city has already invested in GPS trackers, which have been documenting the routes of all city-funded haulers. Further technology investments in sensor equipment could notify haulers when bins are full to minimize collection routes. Possible technology and data collection scenarios are later addressed alongside proposed waste system improvements.

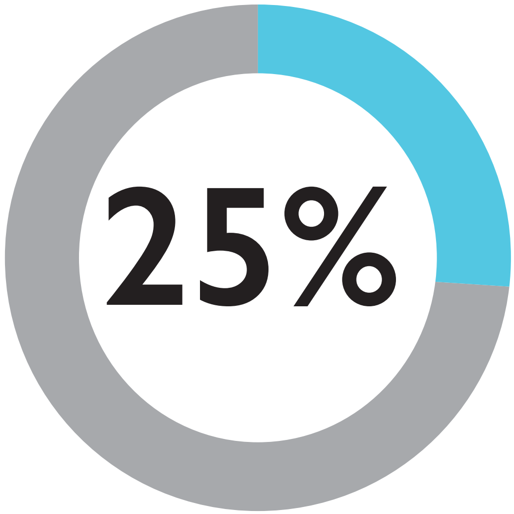
Accessibility
Although the city strives to provide trash and recycling opportunities to many residents, current collection services only reach 75% of Kansas City's population, who live in single-family housing. The remaining 25% of residents, or 116,000 people, do not receive such services (Kansas City Planning and Development 2015). This makes recycling inconvenient for many. Later proposals in this document explore outcomes if the current collection system expands to accommodate more people.

The city has considered an organics collection program, which has not yet been implemented. According to a previous study, the program would only serve residents living in single-family units (SCS Engineers 2008). Outcomes of a citywide organic waste program are later explored, with the intention that all residents are provided this service.

PEOPLE IN KANSAS CITY ARE WILLING TO RECYCLE WHEN SERVICES ARE AVAILABLE



CITY PROVIDED RECYCLING IS NOT AVAILABLE TO RESIDENTS IN MULTI-FAMILY HOUSING

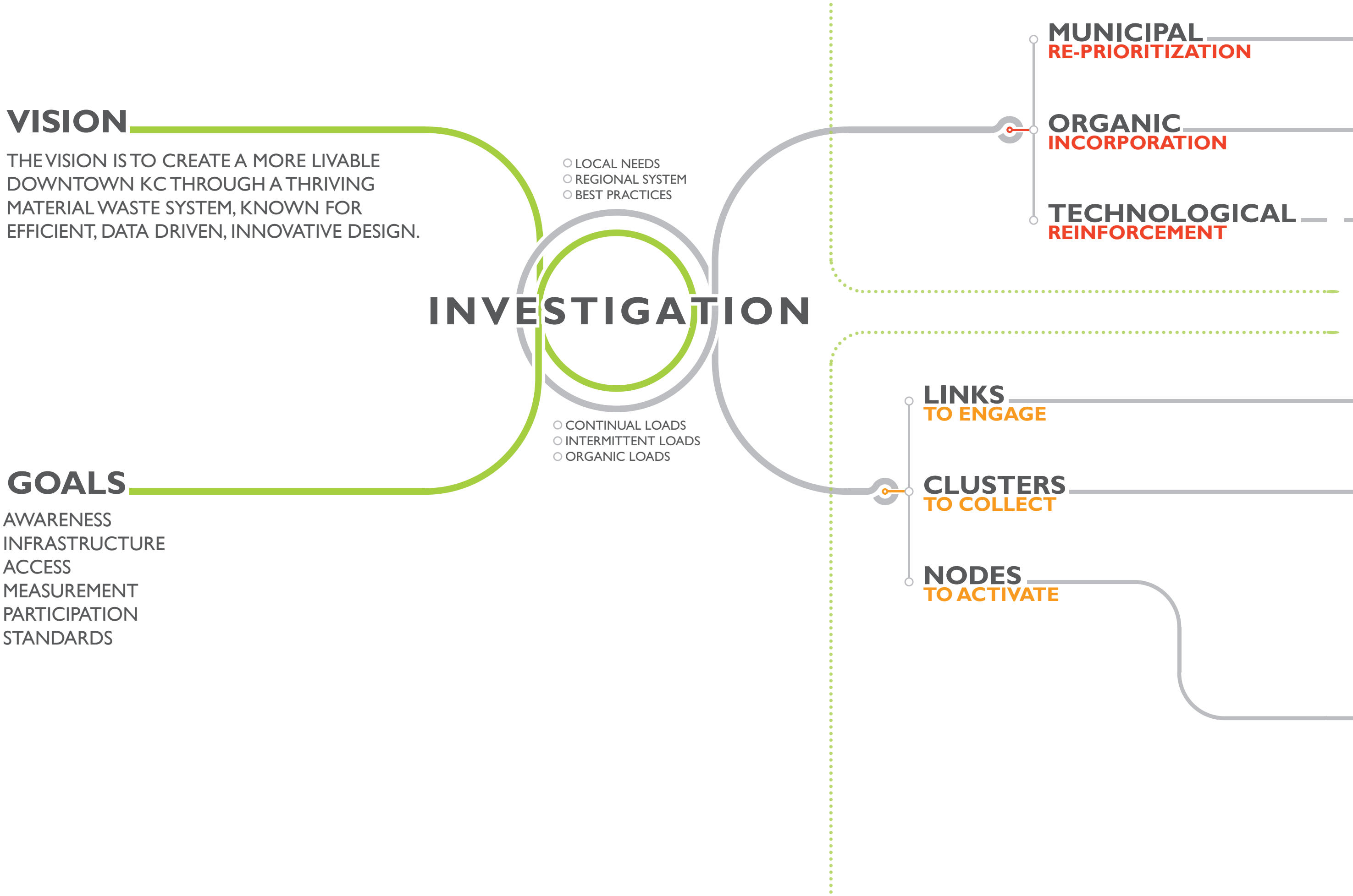


Kansas City residents who live in multi-family housing

Figure 2.2 KC Participation | Left (Kansas City Infrastructure and Transportation 2015, SCS Engineers 2008)
Figure 2.3 Vision, Mission and Goals |Right (KCDC 2015)

Large events intermittently contribute to a large portion of the City's waste, however many events do not offer attendees accessible places to recycle or compost. Bridging the Gap has outlined several ways to plan a sustainable event, but few policies require recycling to be provided (Bridging the Gap). More waste produced at these events could be collected and diverted from landfills if the city asked all public events to promote more sustainable waste practices.

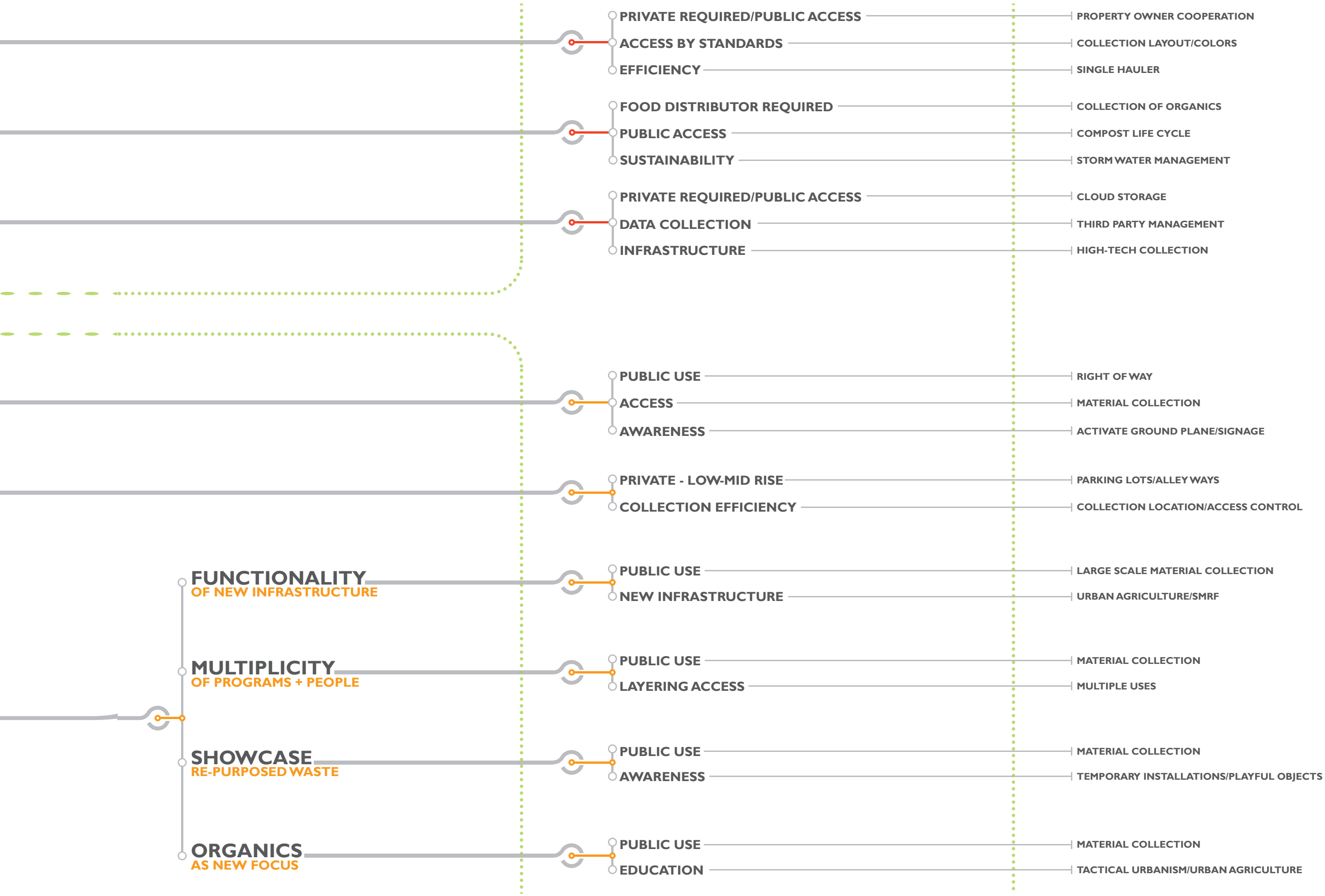
Well-designed public spaces can integrate recycling and composting, create healthier urban environments, and improve the quality of life for local residents (Hou 2010). However, the inventory of the Greater Downtown Area shows how access to recycling and composting is limited in public spaces. Recycling is rarely an option where trash bins are provided in the public right-of-way and parks, and organic food waste collection is never offered. The application of recycled materials also rarely exists. If a strategic plan for public space prioritizes sustainable waste practices and the application of sustainable materials, then recycling and composting behaviors may be encouraged.



PROJECT VISION FRAMEWORK

The project vision framework was developed after substantial research and reflection had been done on recycling and composting in Kansas City. The framework was meant to guide the remainder of the research and design phases. The system strategies explain the later design strategies, which includes links, clusters, and nodes.

Figure 2.4 Vision Framework Plan | (KCDC 2015)


PRIVATE REQUIRED/PUBLIC ACCESS
ACCESS BY STANDARDS
EFFICIENCY
PROPERTY OWNER COOPERATION
COLLECTION LAYOUT/COLORS
SINGLE HAULER
FOOD DISTRIBUTOR REQUIRED
PUBLIC ACCESS
SUSTAINABILITY
COLLECTION OF ORGANICS
COMPOST LIFE CYCLE
STORM WATER MANAGEMENT
PRIVATE REQUIRED/PUBLIC ACCESS
DATA COLLECTION
INFRASTRUCTURE
CLOUD STORAGE
THIRD PARTY MANAGEMENT
HIGH-TECH COLLECTION
PUBLIC USE
ACCESS
AWARENESS
RIGHT OF WAY
MATERIAL COLLECTION
ACTIVATE GROUND PLANE/SIGNAGE
PRIVATE - LOW-MID RISE
COLLECTION EFFICIENCY
PARKING LOTS/ALLEY WAYS
COLLECTION LOCATION/ACCESS CONTROL
FUNCTIONALITY
OF NEW INFRASTRUCTURE
PUBLIC USE
NEW INFRASTRUCTURE
LARGE SCALE MATERIAL COLLECTION
URBAN AGRICULTURE/SMRF
MULTIPLICITY
OF PROGRAMS + PEOPLE
PUBLIC USE
LAYERING ACCESS
MATERIAL COLLECTION
MULTIPLE USES
SHOWCASE
RE-PURPOSED WASTE
PUBLIC USE
AWARENESS
MATERIAL COLLECTION
TEMPORARY INSTALLATIONS/PLAYFUL OBJECTS
ORGANICS
AS NEW FOCUS
PUBLIC USE
EDUCATION
MATERIAL COLLECTION
TACTICAL URBANISM/URBAN AGRICULTURE

MANY PERSPECTIVES

KEY COLLABORATORS WITH DIFFERENT ROLES

Many people were involved in this downtown recycling project. Although primarily conducted by the students at the KCDC, it would not have been possible without the guidance from several people and organizations. With grant writing and funding support from the Mid-America Regional Council (MARC), the KCDC progressed with help from an advisory committee, professional preview group, and the everyday residents, workers, and users of public space in Downtown Kansas Cty. Many people have a stake in this downtown project, and an attempt was made to consider the needs and opinions of all.

Each person or entity involved in the guidance of the project development played a slightly different but important role in the outcomes. Where some offered technical knowledge about the factors of waste management downtown, others provided broader thoughts about what the project could offer the entire metropolitan area or region. While some were more concerned with the feasibility and logistics, others were more interested in how the project could be shared with local leaders and the larger community to inspire change.

ADVISORY COMMITTEE

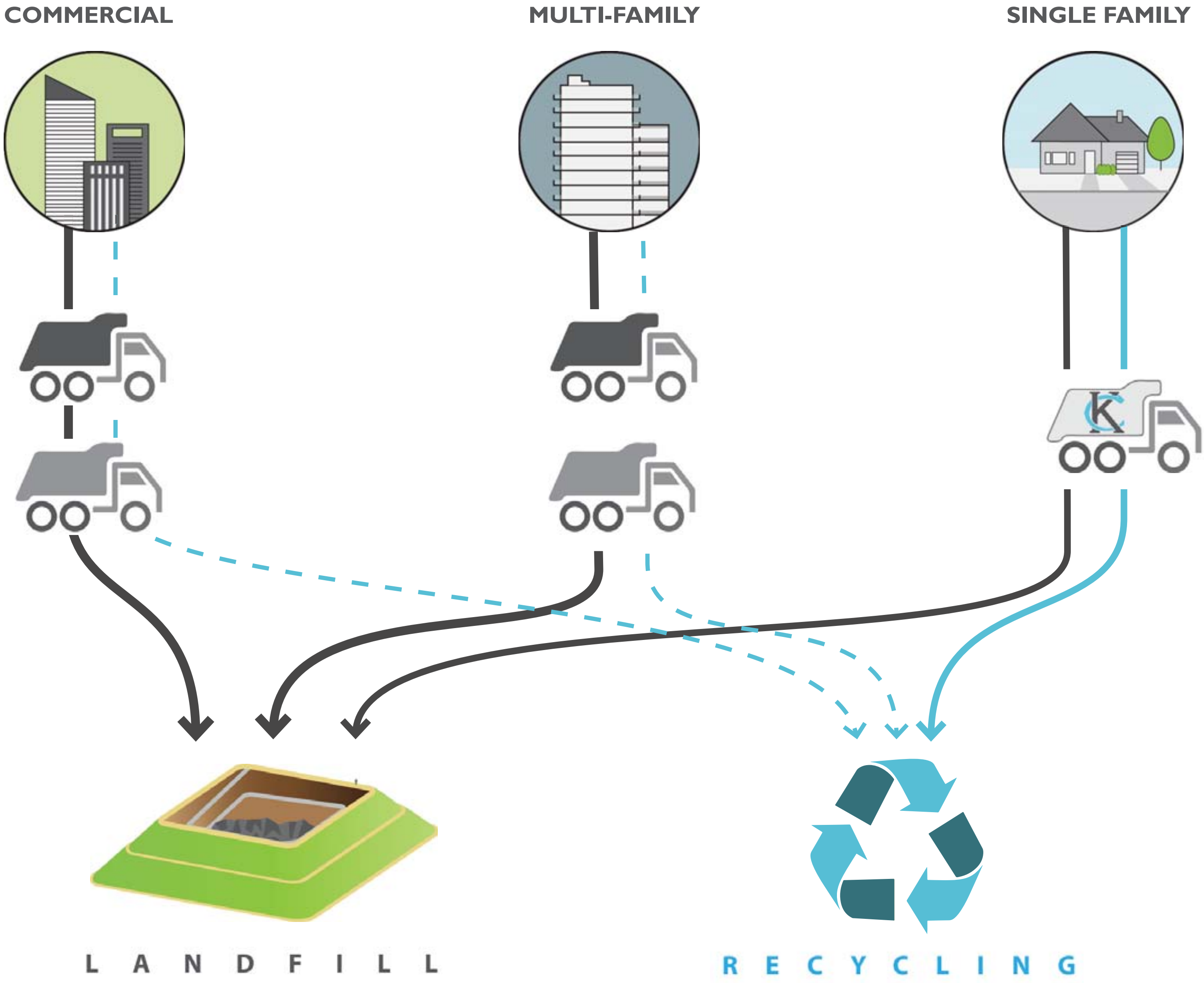
The advisory committee included eleven members and was invited to review the project and provide critical feedback and guidance on the studio's research and design. These reviews occurred at two meetings and an open house event during the fall and again during the spring semester. The committee offered expert advice on sustainable design and planning and practical waste management techniques. They collectively represented various stakeholder opinions within the community.

Several design professionals reviewed the studio work at two occasions in October and December of 2015. During the spring semester, the professional reviews and advisory committee meetings were merged, as both groups represented stakeholder concerns, whether from an expert waste management perspective, local neighborhood perspective, or an urban design perspective.

Although some members on this list were not always available to meet and a few were invited midway through the project, this group is collectively represented by the following people and organizations:

John Blessing, Deffenbaugh Industries
Jim Callier, EPA Representative
Dominique Davison, Principle Architect, DRAW Architecture + Urban Design LLC
Cassandra Ford, Business Recycling Program Manager, Bridging the Gap
Lydia Gibson, Independent Planner and Recycling Consultant
Scott Harris, Downtown Neighborhood Association
Tom Jacobs, Environmental Program Director, MARC
Nadja Karpilow, Solid Waste District Environmental Planner, MARC
Marleen Leonce, City of Kansas City, MO - Solid Waste Division
Lisa McDaniel, Solid Waste Program Manager, MARC
Kristin Riott, Executive Director, Bridging the Gap
Professional Review Group

Figure 2.5 Waste Flows in KC | Single-family housing has access to both trash and recycling services through the city.; however multi-family housing and commercial businesses negotiating with multiple haulers for trash (KCDC 2015).


COMMERCIAL
MULTI-FAMILY
SINGLE FAMILY
LANDFILL
RECYCLING

RECYCLING PROJECT STRATEGIES OVERVIEW

LINKS STRATEGY

Links are about engaging the people, bicyclists, and vehicles that are moving through public spaces in highly visible and creative ways. The design elements here make use of ground-plane, signage, and street furniture to make the City's identity and instill pride. They make noticeable statements about recycling in Kansas City and what it can do for the environment and local industries.

Clusters to Collect

Clusters are about efficiently collecting trash, recyclables, and organic waste in the private realm. Businesses and apartments grouped within close proximity to one another can take advantage of the cluster's design elements to free more space in tight areas, leverage bargaining power with waste companies, and make a proud statement about their willingness to participate in sustainable practices.

Nodes to Activate

Nodes are about activating an open space to bring new activity and awareness to a specific issue. Two types of node strategies have been chosen from the original four types proposed in the first semester of the studio project. The showcase node uses art to enhance its surrounding public space and bring people's attention to the topic of recycling. The organic node is a place where the community's organic waste can be collected and broken down into compost that can be used to benefit Kansas City.

Figure 2.6 [re]considered system map | To improve recycling rates and diversion, we have proposed a system of different links clusters and nodes to create more connection in greater downtown area (KCDC 2015).


I-670
I-70
MAIN STREET
GRAND BLVD
HIGHWAY 71
N
Cluster
Compost Node
Showcase Node
Link
Functional Node
Multiplicity Node

NODES STRATEGY

Nodes are sites that activate the public realm and create key destinations along the links through a variety of purposes such as the collection, removal, and re-purposing of waste through recycling. Based on current conditions, various objectives have been identified for the system framework. Two primary objectives for the recycling system is better functionality and public engagement. To meet these objectives, four types of node strategies were developed; the Organic Nodes which focuses on the collection of organic waste and use of compost, Showcase Nodes which displays re-purposed recyclable materials, Functional Nodes establishes new recycling infrastructure, and Multiplicity Nodes reactivates sites through the layering programs.

The Organic Node

The organic nodes challenge the issues of composting in an urban area. Since organic waste is a large contributor to the overall waste stream, the organic node has been designated to demonstrate the composting process in an urban environment to change current views and behavior on the matter. The demonstration aspect includes collection of organic waste, processing, and potential use of it. This will promote greater awareness for composting organic waste in the city. Overall the sites will work to functional demonstrate that organic waste is an infrastructural dilemma that composting can solve in ways that engage the public.

The Showcase Node

The showcase nodes are activated through the collaboration of local artist to create artful and interactive displays in high areas of activity. On these sites, artist will be challenged to utilize locally sourced recycled material to create art which will bring awareness and promote greater discussion of the recycling system to inform the public why recycling is important. The selected Main and Truman Road site consist of a light frame structure that will house rotating art instillations that will show the city what their recycled materials can transform into. The base of the structure will provide social spaces for people to gather and pathways to experience the instillations up close.

The Functional Node

The functional nodes focus on establishing new recycling and composting infrastructure within the public realm. The purpose is to provide an efficient collection system that educates and makes the recycling process visible to the public. By establishing a visible recycling system that is displayed in a positive way at the City Market location, which is a well-known city destination, it will show and encourage people to participate in the recycling system. By collaborating with the local businesses at the City Market to create new recycling and composting infrastructure will help raise the city's diversion rate while bringing the recycling process into the public realm.

The Multiplicity Node

The multiplicity nodes are focused on reactivating underutilized sites that create more programmatic features for the public to use and activate the space. These sites will integrate the collection of recyclable waste into the public's everyday routine to add to the diversion rates. The multiplicity node will fulfill the potential of underutilized sites by layering multiple and integrating functions to re-activate, and better promote a more livable downtown Kansas City through recycling. The 17th and Main site will provide interactive public glass recycling to engage and draw the public up above the existing parking lot into a space that will entertain, educate, and inspire people to recycle.

Figure 2.7 Nodes Strategy Map | The node proposal uses four types of nodes spread throughout the city to address recycling in underutilized spaces within the city (KCDC 2015).


Multiplicity Nodes
Showcase Nodes
Function Nodes
Organic
N
0'
1200'
3rd St and Main
Functional Node
rd St & Wyandotte
Multiplicity Node
10th St and Main
Showcase Node
12th and Holmes
Organic Node
12th and Forest
Functional Node
2th & Wyandotte
Multiplicity Node
Truman and
Main Showcase
16th &Wyandotte
Showcase Node
14th St and Main
Multiplicity Node
20th and Main
Showcase Node
Pershing and Main
Multiplicity Node
7th St & Gillham
Node

CLUSTERS STRATEGY

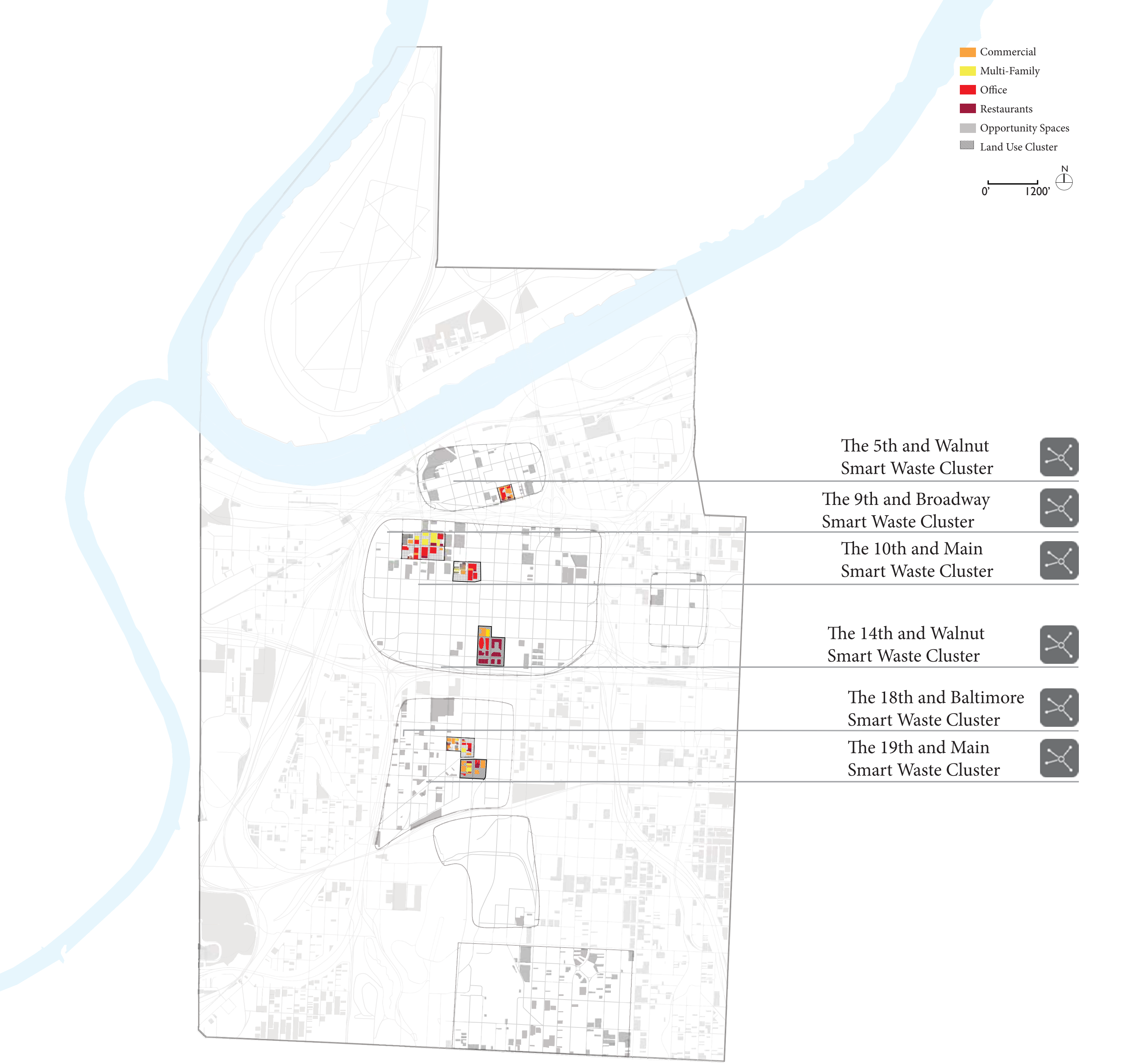
Clusters are about efficiently collecting trash, recyclables, and organic waste in the private realm. One cluster was selected to explore the businesses and apartments waste strategies more in depth. A design proposal demonstrates the advantages of the cluster's design elements to free more space in tight areas, leverage bargaining power with waste companies, and make a proud statement about their willingness to participate in sustainable practices.

Broadway Cluster

The Broadway Cluster is located at 7th and Broadway Boulevard in the northwestern portion of the downtown core. The Cluster contains a various amount of land uses and a medium to high building density coupled with a low operational space. The low activity area is strategically organized through the scale of the recycling and waste operations of the site.

The concept was driven by the lack of space for on site, large scale waste collection. The intent was to conceal most of the waste by burying it within the ground. Different colored are used to mark which material belongs in each bin to make it easier for users. Weight sensors are located at the bottom of each collection bin to report and monitor the measurements of waste loads. This allow the haulers to have a more convenient waste collection. By clustering the bins in a central location for all buildings and using weight sensors, allows for a more efficient collection method.

Figure 2.8 Clusters Strategy Map | The clusters proposal identified a number of potential location where businesses may work to collaboratively handle waste collection to increase efficiency and lower costs (KCDC 2015).



Commercial
Multi-Family
Office
Restaurants
Opportunity Spaces
Land Use Cluster
N
0'
1200'
The 5th and Walnut Smart Waste Cluster
The 9th and Broadway Smart Waste Cluster
The 10th and Main Smart Waste Cluster
The 14th and Walnut Smart Waste Cluster
The 18th and Baltimore Smart Waste Cluster
The 19th and Main Smart Waste Cluster

LINKS STRATEGY

Links are not only about connecting the areas of activity around town, but they are about engaging people in the public right of ways to increase awareness and access to recycling. In addition to general standardization of street furniture into zones to one or both sides of a pedestrian movement zone and placed at regular intervals, five types of interventions were identified. Each type of intervention is derived from a series of urban spatial conditions, and are meant to concentrate different types of public amenities with a focus on waste collection and engaging a public in motion.

Slowing
Slowing interventions occur where the pedestrian right of way expands on one side of the road in an area of fairly wide overall right of way. These often occur along surface parking lots between destinations. These elements are aligned with a path of travel, offering comfortable space to slow pace and read signs, sit, park a bike, wait for public transportation, and enjoy being outdoors. These elements collect benches, bins, bike racks, planters, street lights, as well as bus stops and street car stops into a cohesive "ribbon" of recycled materials framing these otherwise separate objects. The ground plain uses paint and/or texture to define a zone to one or both sides of the pedestrian walking path, with occasional spillover into the pedestrian zone.

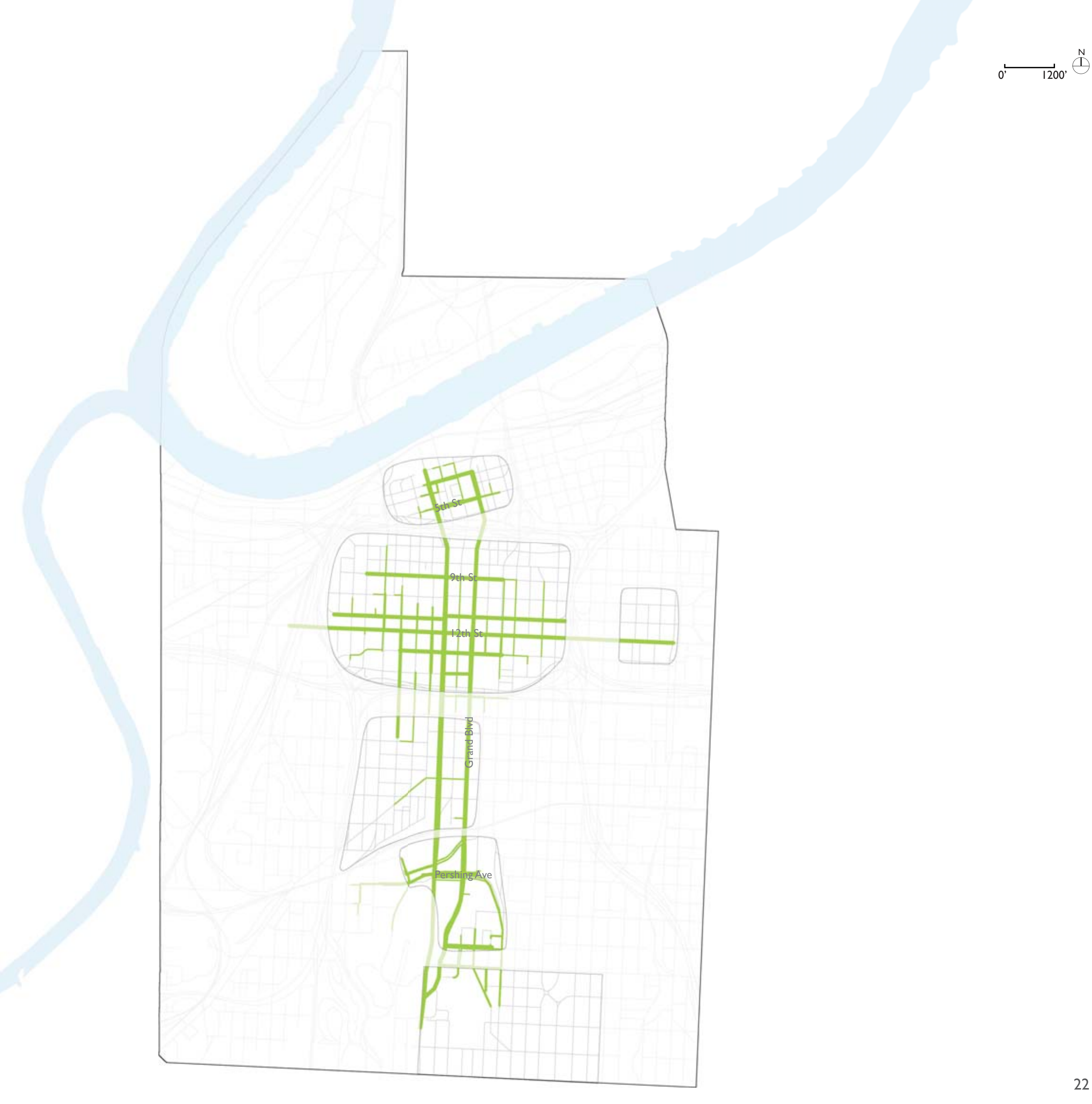
Interrupting
Interrupting interventions are typically are placed in areas of sudden setback along blocks with a narrow right of way. The intervention designs intentionally disrupt the path of pedestrians with kinetic objects meant to engage the public through interactive features. These objects can include large scale play equipment that also transforms waste through crushing, grinding, compacting, or sorting actions derived from the energy provided by the participating pedestrians. The ground plain uses paint and/or texture perpendicular the pedestrian travel to visually interrupt movement.

Connecting
Connecting interventions are defined by areas of wide right of way and no buildings on either side of the road. This design type creates a connection between pedestrian areas separated by roadways, bike paths, rail lines, and other obstacles, visually and physically connecting (where possible) these pathways through message and demonstration focused objects, signs, and pathway changes. These interventions should each focus on priority materials for each local area, such as compost in areas with high event and residential traffic or office paper in areas with high commercial traffic.

Maintaining
Maintaining interventions define a bridge between building facades with similar setbacks. Design characteristics: walls, signs, planters, and edge defining elements which maintain a defined sidewalk edge and can screen open or recessed space beyond. These elements should orient pedestrian motion to the sidewalk and away from movement into the recessed space, aligning with adjacent building fronts and other defining urban features in order to create a clearer view of the interface between public space and private zones.

Guiding interventions claim additional space for public occupancy in the right of way where the built edge of the right of way recedes. Similar to Maintaining, these elements consist of walls, benches, planters, and edge-defining elements. The primary difference is that Guiding elements shift away from typical sidewalk setback to claim additional land for public use. These defined edges can be aligned with adjacent building setbacks to create a staggered urban edge.

Figure 2.9 Links Strategy Map | The links proposal addresses recycling and awareness in the public right-of-way, where limited access in not currently accessible (KCDC 2015).


0'
1200'
N
5th St
9th St
12th St
Grand Blvd
Pershing Ave

PROPOSAL BACKGROUND | 03

URBAN AGRICULTURE IN THE URBAN ENVIRONMENT

History

Urban agriculture is a long-standing practice across multiple cultures and generations. Although agriculture dates back to the dawn of civilization, the modern structure for community gardens—called allotments in Europe— date back as early as16th century in England and other parts of Europe. Allotments were small parcels of land set aside within towns to help provide adequate food for poor villagers and in later periods, for factory workers who had moved to cities during the Industrial Revolution (Savill 2009; Senate Department for Urban Development and the Environment 2015; Conan 1999). At the turn of the 20th century, Ebenezer Howard become one of the first recognized proponents of integrating agrarian practices as a major focus of the design of the urban environment with treatise Garden Cities of To-Morrow, in 1902 ("Field Guide to Compost Use" 2001). Throughout the middle of the 20th century, urban agriculture became a part of the war effort, and Americans on the home front were encouraged to join the fight through planting Victory Gardens. In both Europe and the Americas, war time gardens became critical parts of urban life, and in many cases, they became the primary source of food (Conan 1999; Senate Department for Urban Development and the Environment 2015; Victory Gardens 2015).

Figure 3.1 "Dig on for Victory" | poster from WWII produced in England to promote victory gardens for the war effort(Peter Fraser 1939)
Figure 3.2 Green House 1 | top right, Cultivate KC has become one of the largest urban agrciiutlure groups in the city since recent ordience changes (Cultivate Kansas City 2016)
Figure 3.3 Green House 2 | bottom right (Cultivate Kansas City 2002)

Modern

In modern times, urban agriculture has come back into the publics' attention as a way to solve growing food deserts in urban environments and as a way to help connect people to more locally grown sustainable food sources. Additionally, the practice has been expanded and applied as a way to help improve blighted communities by programing vacant lots (McMillan 2010; admin 2015; "Urban Farming Invigorates Detroit Neighborhood" 2015). These efforts are not new ideas, but the application of old concepts that have proven over history to be a successful way to answer difficult food related challenges; however, many projects do not express a need or the potential to incorporate composting into the site, even though the two concepts have high parallelism.

Kansas City

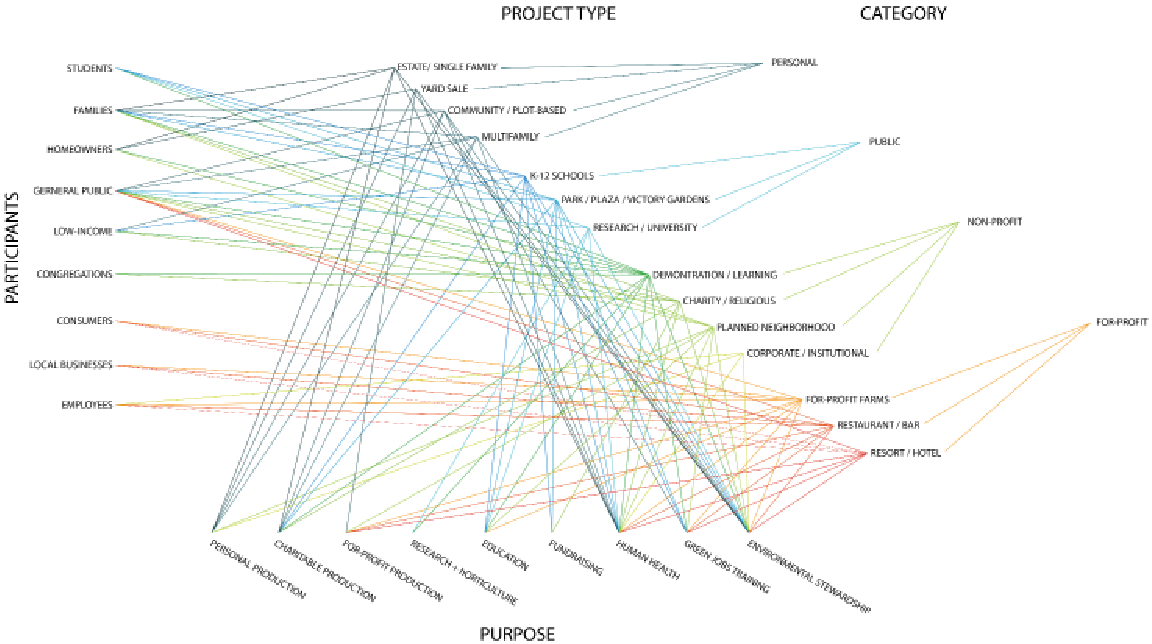
Urban agriculture has seen a boom in growth in Kansas City over recent years since the passing of Ordinance No. 100299, which relaxed laws prohibiting the sale or distribution of food grown on community/ home gardens. A continuing openness to urban agriculture is also reflected in the recent passing of Ordnance 150603 which specifically outlines new regulations for Home Gardens, Community Gardens and Community Supported Agriculture passed on July 15, 2015 (Kansas City 2015). Out of these political shifts, many non-profit organizations supporting urban agriculture throughout the city , and developers are even utilizing the practice, acting as a land bank, to hold land until the market is ready for further development . Even with the huge growth of urban agriculture in Kansas City, many of the urban agriculture sites in Kansas City are or feel like private entities from the public realm. Because of their designs, most of the organizations and urban agriculture sites in Kansas City are not understood or considered by the general public in Kansas City.

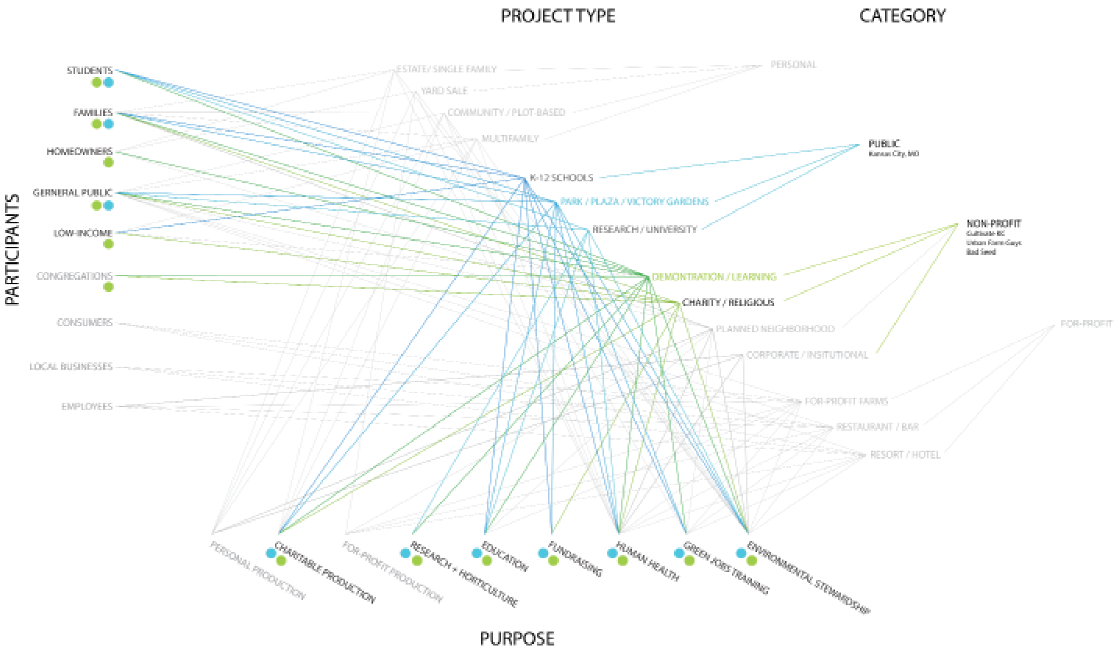
TYPES OF URBAN AGRICULTURE

Urban agriculture covers an ever increasing range of food production within the urban environment. This range can cover both the scale and/ or purpose of the agricultural production. Over recent years, there has been as increase in the hybridization of urban agriculture typologies (April Phillips 2013). This has help to create a diverse range of project typologies beyond the traditional four: Institutional Farms, Institutional Gardens, Commercial Farms, and Community Gardens (Jerome Chou et al. 2016). The diagram below is a modified copy from Designing Urban Agriculture. In this soup of hybrid urban agriculture typologies, the division of urban agriculture typologies falls more towards the general characteristic of who is using or operating the site. Within this operational classification, multiple subcategories service a range of participants and purposes (April Phillips 2013). This diagram was used to help develop and choose what the appropriate typology of urban agriculture should be for the organic node site selected; however, any number of the typologies listed in the graphic could be used for the other organic nodes within the downtown are depending on the specifics of the selected site.

Figure 3.4 Hybrid Typologies | of Urban Agriculture; over time, the traditional types of urban agriculture have blended into a range of new typologies that span multiple participants & purposes (April Phillips 2013).

Figure 3.5 Achievable Types | through this framework of project typologies it is possible to narrow down the types urban agriculture applicable to the organic node proposal (Rostek 2016).


PROJECT TYPE
CATEGORY
PARTICIPANTS
STUDENTS
FAMILIES
HOMEOWNERS
GERNERAL PUBLIC
LOW-INCOME
CONGREGATIONS
CONSUMERS
LOCAL BUSINESSES
EMPLOYEES
ESTATE/ SINGLE FAMILY
YARD SALE
COMMUNITY / PLOT-BASED
MULTIFAMILY
K-12 SCHOOLS
PARK / PLAZA / VICTORY GARDENS
RESEARCH / UNIVERSITY
DEMONTRATION / LEARNING
CHARITY / RELIGIOUS
PLANNED NEIGHBORHOOD
CORPORATE / INSITUTIONAL
FOR-PROFIT FARMS
RESTAURANT / BAR
RESORT / HOTEL
PERSONAL
PUBLIC
NON-PROFIT
FOR-PROFIT
PERSONAL PRODUCTION
CHARITABLE PRODUCTION
FOR-PROFIT PRODUCTION
RESEARCH + HORTICULTURE
EDUCATION
FUNDRAISING
HUMAN HEALTH
GREEN JOBS TRAINING
ENVIRONMENTAL STEWARDSHIP
PURPOSE


PROJECT TYPE
CATEGORY
PARTICIPANTS
STUDENTS
FAMILIES
HOMEOWNERS
GERNERAL PUBLIC
LOW-INCOME
CONGREGATIONS
CONSUMERS
LOCAL BUSINESSES
EMPLOYEES
ESTATE/ SINGLE FAMILY
YARD SALE
COMMUNITY / PLOT-BASED
MULTIFAMILY
K-12 SCHOOLS
PARK / PLAZA / VICTORY GARDENS
RESEARCH / UNIVERSITY
DEMONTRATION / LEARNING
CHARITY / RELIGIOUS
PLANNED NEIGHBORHOOD
CORPORATE / INSITUTIONAL
FOR-PROFIT FARMS
RESTAURANT / BAR
RESORT / HOTEL
PERSONAL
PUBLIC
Kansas City, MO
NON-PROFIT
Cultivate KC
Urban Farm Guys
Bad Seed
FOR-PROFIT
PERSONAL PRODUCTION
CHARITABLE PRODUCTION
FOR-PROFIT PRODUCTION
RESEARCH + HORTICULTURE
EDUCATION
FUNDRAISING
HUMAN HEALTH
GREEN JOBS TRAINING
ENVIRONMENTAL STEWARDSHIP
PURPOSE

COMPOSTING ORGANIC WASTE

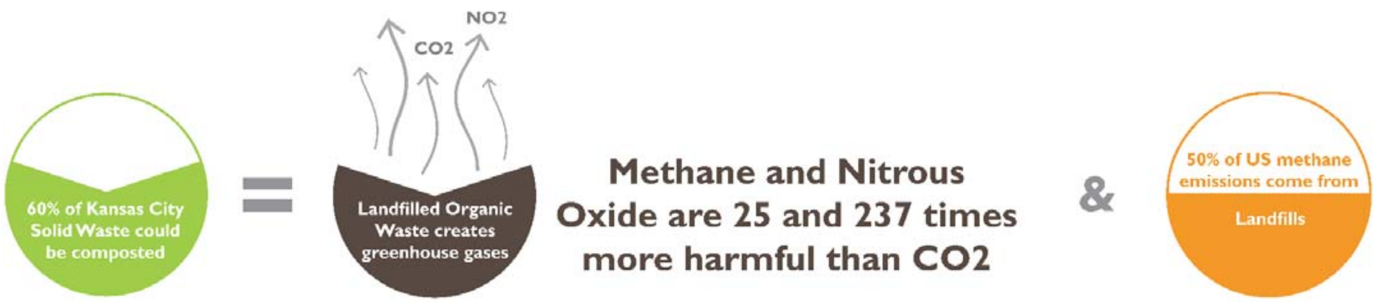
What is Compost?

Compost is the natural decomposition process of organic materials. In this process, organic material is broken down through physical and biological processes, creating an end product that can improve soil and releases nutrients into a usable form for plants. When recreated artificially by humans, this process, this process has great potential to solve the problems associated with the handling and treating of organic waste within the traditional solid waste management system ("Field Guide to Compost Use" 2001). In the process of composting, almost any organic material can be used; however, some materials can attract pest or will not completely decompose except on larger scales. These materials include fatty meats and bones ("Field Guide to Compost Use" 2001; Lydia Gibson 2015). Traditionally, materials to be composted are grouped into two separate categories: green waste and brown waste. Green waste typically is used to describe food waste and green colored yard waste. Brown waste is used to describe brown colored yard waste. When making compost it is crucial to have an appropriate mix of these two waste types to avoid maul orders and to produce the best quality compost. The range of this mixture falls between 1:1 and 2:3 green waste to brown waste depending on climate and waste composition.

National Picture

In the United States, as much as 50% of the solid waste sent to landfills could be composted ("Municipal Solid Waste in The United States: 1999 Facts and Figures" 2001). This is significant because the transportation of heavy wet waste leads to increased tipping and fuel costs for haulers, and the decay of organic waste leads to the production of methane and nitrous-oxide in landfills. Diverting organic waste away from landfill provides the opportunity to decrease this release of greenhouse gases while producing a viable asset that can be used to benefit a number of other infrastructural and social systems or sold as an agricultural commodity. In the United State, studies conclude that the average family throws away up-to a quarter of the food it purchases annually. Families throw away an average $1500 in produce each year. According to a study be the USDA, 0.8 lbs of organic waste is created per person per day (Rabbitt 2016). This waste of food puts an enormous strain on the economy and environment; especially since wasted food is likely to end up in landfills and does not have any further life cycles.

Figure 3.6 Compostable Materials | are a significant part of the Kansas City waste produce, and its contribution to greenhouse gas emissions. (KCDC 2016)



TYPES OF COMPOSTING

Anaerobic
Anaerobic digestion is a composting process that decomposes organic matter in the absence of oxygen. This is the same process that organic waste undergoes in landfills, releasing large amounts of biogas. Although the biogas does contain greenhouse gases, as it is captured in the decomposition process, it can be burned to create energy on site. Anaerobic digestion does have some significant disadvantages beyond the release of the methane containing biogas. Devoid of oxygen, the decomposition process produces noxious orders, and the compost may contain organic acids that may kill some plant roots (Henley and Barker 2011; Oregon State University, n.d.).

Aerobic
Aerobic, or pile composting, is the most common form of organic waste decomposition. In the processing, natural processes are accelerated as mechanical and biological decomposition of the organic material occurs though turning and microbial activity. This process is somewhat labor intensive requiring either active turning of the pile or forced air flow to ensure the decomposition occurs in the presence of oxygen. Startup cost a very low compared to other composting methods, and the final compost product does not contain organic acids. With proper management aerobic digestion does not produce significant odors or biogas emissions. Overall, the process is the most easily scaled composting method and has the least startup cost, but the processing period can take longer to achieve a final product. Aerated static pile methods are generally best at reducing the time it can take to process organic waste using the aerobic process (Oregon State University, n.d.).

Vermicomposting

Vermicomposting is a method of composting organic waste using earth worms to create worm castings. This process is general considered to produce a better end compost material, but it is more labor intensive and requires more room. The increased labor is a result of extra maintenance to keep the compost pile within conditions suitable to health worms. Additionally, it is important to separate the worms from the final product to be used to create new compost. Overall, the process requires more attention and startup when compared to other composting methods (Glenn Munroe, n.d.).

Figure 3.7 Anaerobic Digestion | ("Anaerobic Composting | Composter Connection" 2016)
Figure 3.8 Windrows | agitated compost piles (Craig Coker 2012)
Figure 3.9 Small Scale Worm Composing | (Toby Hudson 2009)

INFRASTRUCTURE + RECYCLING AND COMPOST

Today's modern urban environments require the integration and coordination of multiple systems to create a healthy, vibrant livable public realm. In Kansas City, this integration of systems spans multiple city departments, regional planning districts and privately contracted businesses (See Diagram Below). Unfortunately, many of these civic partners do not coordinate their actions costing the city and tax payers a significant amount of money and lost productivity. The following sections look at specific aspects of composting which our proposed node will look to implement. It is hoped that they would become coordinating points around which Kansas City leadership, residents and businesses can begin to build a better functioning, integrated urban system.

Urban Infrastructure Webs

The urban infrastructure web is a network of the systems involved in the daily function of urban environments. This web spans four broad categories: natural resources, utilities, land-use, and transportation (April Phillips 2013) (See Diagram Below). Within this web, efficiency is gained by increasing the number of connections that each node has with its neighboring related functions (April Phillips 2013). In an ideal scenario, all of the system nodes within this web would have multiple connections with their related neighboring nodes. I have modified this diagram slightly, elevating the public realm up as a fifth function of the Urban Infrastructure Web that occurs at the intersection of multiple other infrastructure functions. This is because open space serves as a critical facilitator of the other functions in urban environments, and without effective open spaces, cities cannot function effectively.

In Kansas City, this urban infrastructure web operate across multiple private businesses and local and regional governances; however, like many other cities, these functions work independent of each other in order to protect their funding streams. Without the necessary interconnections found in strong urban infrastructure webs, Kansas City's urban infrastructure management fails to facilitate the healthy vibrant standard of living it seeks. Furthermore, because open space is found at the intersection of the other infrastructure functions. The failure to coordinate land-use, natural resources, utilities, and transportation directly leads to the degradation and failure of public space in Kansas City.

Adding Recycling and Compost to the Web

Adding recycling and composting through urban agriculture to this web can become a way that Kansas City can begin to increase the connectivity of urban infrastructure systems. The grant asked the studio to look solely at recycling in downtown Kansas City for multifamily and commercial land used. Through our fall research, the development of [re]considered amended the given project objectives to include composting organic waste. Through urban agriculture, the [re]considered proposal has the potential to improve interconnectivity and therefore the efficiency of Kansas City's urban infrastructure web. This increased efficiency and connectivity will improve Kansas City;s public realm, helping [re]considered meet its outlined mission for a more livable downtown (KCDC 2015 et al. 2015). From an economic perspective, a more efficient urban infrastructure web could save the city a vast amount of money annually.

As the focus of this report, compost specifically can act as one of any number of connecting agents in Kansas City's infrastructure web. Compost has the potential to significantly reduce the stress on Kansas City's aging combined stormwater-sewer system. It can help reduced the city's environmental impact, and help reduce growing food inequality. Additionally, the connections through compost and urban agriculture provide opportunities for residents to engage more closely with the city management of urban infrastructure, promoting greater engagement in local government.

GRANT CONNECTIONS

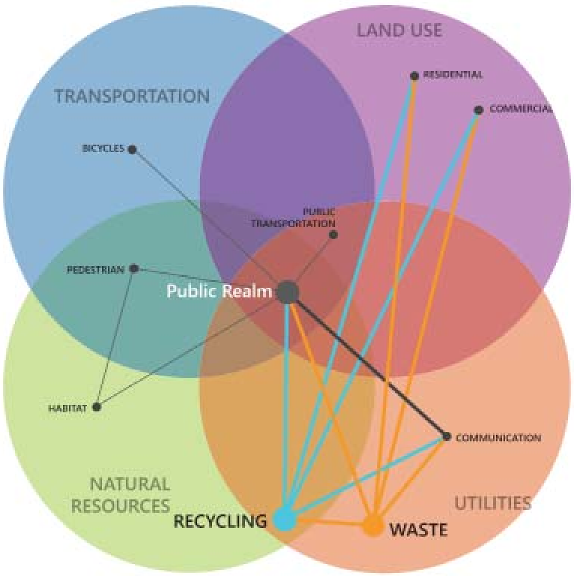


Figure 3.10 Grant Connections | Kansas City has few connections between its current infrastructure systems, The grant sought to create new connections within the solid waste and recycling systems (Rostek 2016).

[RE]CONSIDERED CONNECTIONS

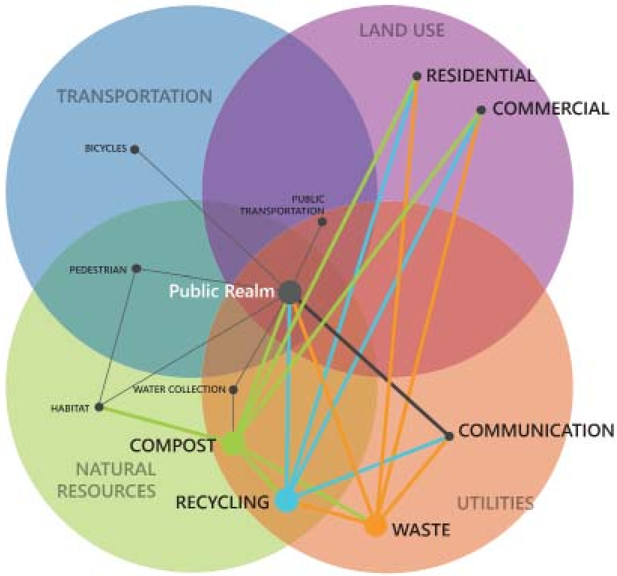


Figure 3.11 [re]considered proposal | added organic waste composting to create more infrastructure connections within Kansas City's solid waste management system (Rostek 2016).

MAJOR COMPOSTING BENEFITS

Infiltration
Kansas City currently is working to implement the EPA mandated Overflow Control Program estimated to cost 2.48 billion dollars over 25 years, starting in 2008 (Kansas City, Missouri Water Services Department 2012). This project is the largest single infrastructure improvement in the city's history; however, much of the improvements proposed in Overflow Control Program is focused on managing stormwater through outdated, hard infrastructure methods. Though the city has budgeted for some soft infrastructural improvements in its efforts to meet the EPA's mandates towards reducing the number of Combined Sewer Overflows throughout the year, significant savings and downscaling of hard infrastructure could be achieved by using locally sourced compost within the right-of-way to reduce peak discharge volumes through the current stormwater infrastructure.

Compost's physical properties make it an idea soil amendment to achieve greater runoff and infiltration. The addition of compost to soils can increase the available water content by 16,500 gallons per 1% of organic matter per hectare (Preston Sullivan 2002; Jerry Hatfield and Thomas John Sauer 2001). Additionally, this increase of organic material helps water infiltrate further down into the soil adding to its resilience against drought. Overall, mixing compost into urban soils is an inexpensive, environmentally responsible and practical approach to increase water storage capacity. Using this information, [re]considered proposal found that within the downtown area, Kansas City has 708 acres of pervious right-of-way. Adding even one percent compostable material over the top twelve inches of soil would be able to capture 11.5 million gallons of water from a 1.5" rain event. Capturing 15% of all the rainwater to fall on the downtown area, incorporating compost would significantly reduce the load on existing infrastructure.

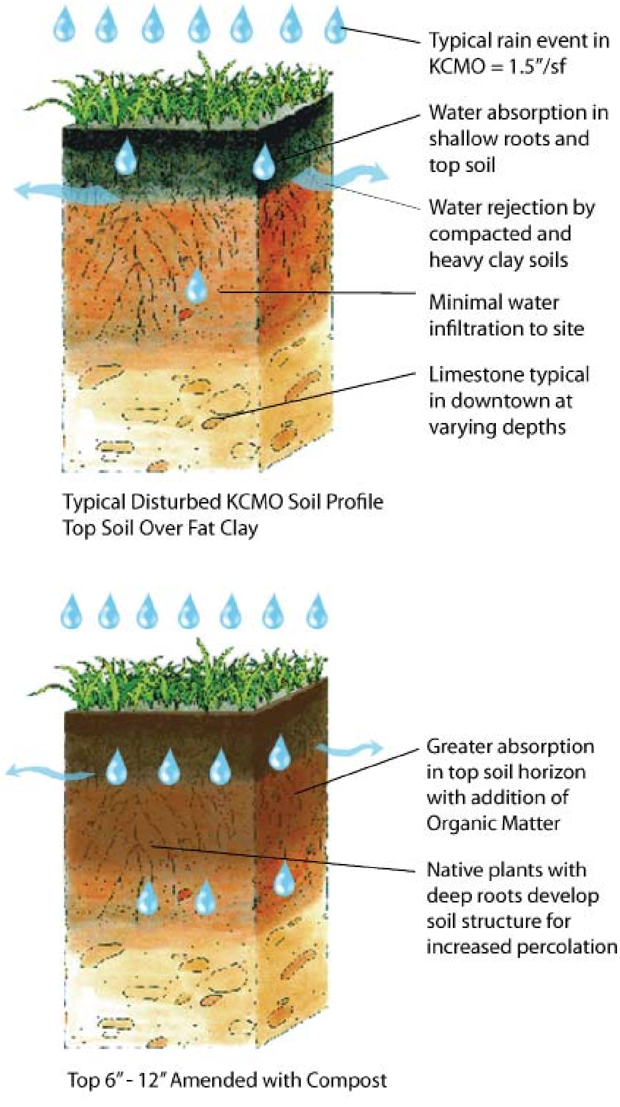


Figure 3.12 Soil Performance | [re]considered study of improved infiltration through the addition of compost to solids (KCDC 2015).

Figure 3.13 Water Capture | compost can have a great effect on Kansas City stormwaster infrastructure, helping to reduce the need for large hard infrastructure improvements (KCDC 2016)

Organic waste management
Organic waste in landfills is a major issue within the solid waste management system relating to shortened landfill lifespans and the industry's contribution to climate change. In the United States figures conservatively place the percentage of compostable material sent to landfills every year around 50% and 60% in the Kansas City region ("Municipal Solid Waste in The United States: 1999 Facts and Figures" 2001; Lydia Gibson 2015; Cynthia Mitchell and Dennis Siders 2009). Once in the landfill, the anaerobic decomposition of organic waste contribute to the accumulation of landfill gas, a mixture of volatile organic compounds This mixture is approximately 40-60% methane with the rest mostly carbon dioxide; however, 1% of the mixture is a combination of non-methane organic compounds, generally known as NMOCs (EPA 1991). Additionally, if the organic waste is fatty foods and meat, the decomposition increased the volume of nitrous oxide produced in the landfill (Sánchez et al. 2015). Based on reports produced by the EPA, the landfill produced methane accounts for 18% of total volume of methane released in the United States annually. Methane is a massively damaging greenhouse gas considered to be between 28 to 36 times more harmful than carbon dioxide (US EPA 2016; US EPA and Leif Hockstad 2015). NMOC impact on climate change has not been studied, but studies link them to the production of dioxins, which according to the World Health Organization "are highly toxic and can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer" (WHO Media centre 2014; Mike Ewall 2016).

Although landfills are currently required to control and burn the release of landfill gas by the EPA, and some companies are using energy recovery systems to produce electricity from burning the gas, a better alternative would be to reduce the volume of gas being released in the first place (Mike Ewall 2016). By composting the organic waste instead of sending it to landfills, there is an opportunity to avoid the anaerobic decomposition of the organic waste. Processed aerobically, organic waste produces far less greenhouse gases, and it creates a marketable product to be sold to any number of outlets (Sánchez et al. 2015). Missouri Organic is the largest business in the Kansas City region, and annually they currently divert 32 million pounds of organic waste from regional landfills and produce 54 million pounds of compost at their industrial scale composting facilities across Kansas City ("About" 2015). This product is then sold to landscaping companies, homeowners, and farms. If the Kansas City was able to generate greater awareness and public engagement with organic waste management. It is likely the city could begin to leverage and grow these current efforts to compost organic waste before it ends up in landfills.

Soil amendments
Compost is a natural fertilizer which can be used in the bioremediation of soils. Added as a soil amendment, compost improves the soil structure, porosity, density. It increases the amount of micro and macronutrients and water availability in soils. It stabilizes pH; and it could potentially control or suppress soil-borne pathogens while promoting beneficial microorganisms ("Field Guide to Compost Use" 2001). Used instead of inorganic, industrially produced inorganic fertilizers, compost can be a more cost effective, and it does not place the same strain on the environment as the industrial production of fertilizers (Maynard 1999; Adrian Card et al. 2016). In a study looking at tomato yields in Connecticut with comparative amount of compost, 10-10-10 fertilizer and/ or no soil amendment, it was found that leaf compost can Additionally, the use of compost as a fertilizer has does not carry the same risks in regards to over fertilization as inorganic fertilizers, with can lead to blossom-end rot (BEM).

Carbon Sequestration
Composted organic waste to be used in urban infrastructure and urban agriculture as one method of increasing carbon sequestration in the environment. Based on studies of urban and rural soils, it was found that urban soils tended to have lower carbon reserves due to development and compaction over time; however, this provides an opportunity to rapidly increase the carbon reserves in urban soils. Because composted organic matter contains significant amounts of carbon, it is a great candidate for increasing urban soil carbon reserves. In Carbon Sequestration Potential in Urban Soils,

the authors tested the effects of compost on urban soils Tacoma, WA, and found that the application of compost in these soil was an effective way to increase carbon reserves in soil. U to 81% of the carbon added through compost remained in the soil 3-18 years after its application (Brown, Miltner, and Cogger 2012).

Food Security and Urban Agriculture
Simply put, improved local access to food decreases food security. In Missouri, 16.8% of people in the state were considered to have low food security (Rabbitt 2016). In Jackson County, this number jumps up to 18.4% (Gundersen et al. 2015). This is well above the national average. Additionally, food insecurity is highest amongst minority populations and single mothers with children (Rabbitt 2016). Urban Agriculture can become one of a number of tools that Kanas City can employ to help reduce the food insecurity of its residents. Additional, this practice can begin to layer benefits as urban agriculture, as proven, should look to incorporate organic waste practices. By addressing food security with urban agriculture, Kansas City can also garner the additional benefits of compost.

Figure 3.14 Growing Plants | compost can has the potential to improve soil quality in numerous ways (KCDC 2016)

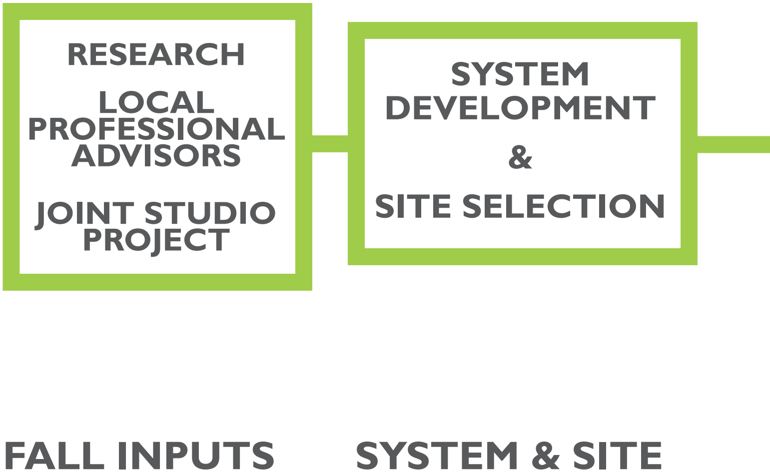
METHODOLOGY | 04

Can Kansas City use vacant sites to compost downtown residential organic waste towards reaching 40% residential organic waste diversion?

Can these sites incentivize continual participation, foster education and engage the general public?

The Organic Node strategy proposed in [re]considered seeks to utilize vacant and underutilized sites for the management and processing organic waste into compost within the urban environment. This open definition allows for flexibility between sites that are more focused on the production of or education about composting in the urban realm.

This project has taken one of the organic nodes for the [re]considered proposal, and seeks to create a design that can compost the organic waste produced by residents in the downtown surrounding the site. Through the site development, the project demonstrates the viability and benefits of composted organic waste to improve integrated urban infrastructure functions. The success or failure of the project development will test the question if Kansas City can use organic nodes to compost downtown residential organic waste in an effort to reach 40% residential organic waste diversion, and does this strategy work within the vision, incentivizing continual participation, educating about compost and engaging the general public?



DEFINING SUCCESS

For this project to be successful, the final design must meet and prove the viability of various goals and programing objectives outlined in the [re]considered proposal. Primarily, the final project design must be functional. It must be able to capture a minimum of 40% of the residential organic waste from its outlined collection area. Secondly, the project design must have incentives that start and keep residents participating in the composting process. The design should make composting a norm of everyday life. Lastly the project design must work to create awareness and facilitate composting education to fulfill the vision, mission and goals of the [re]considered proposal.

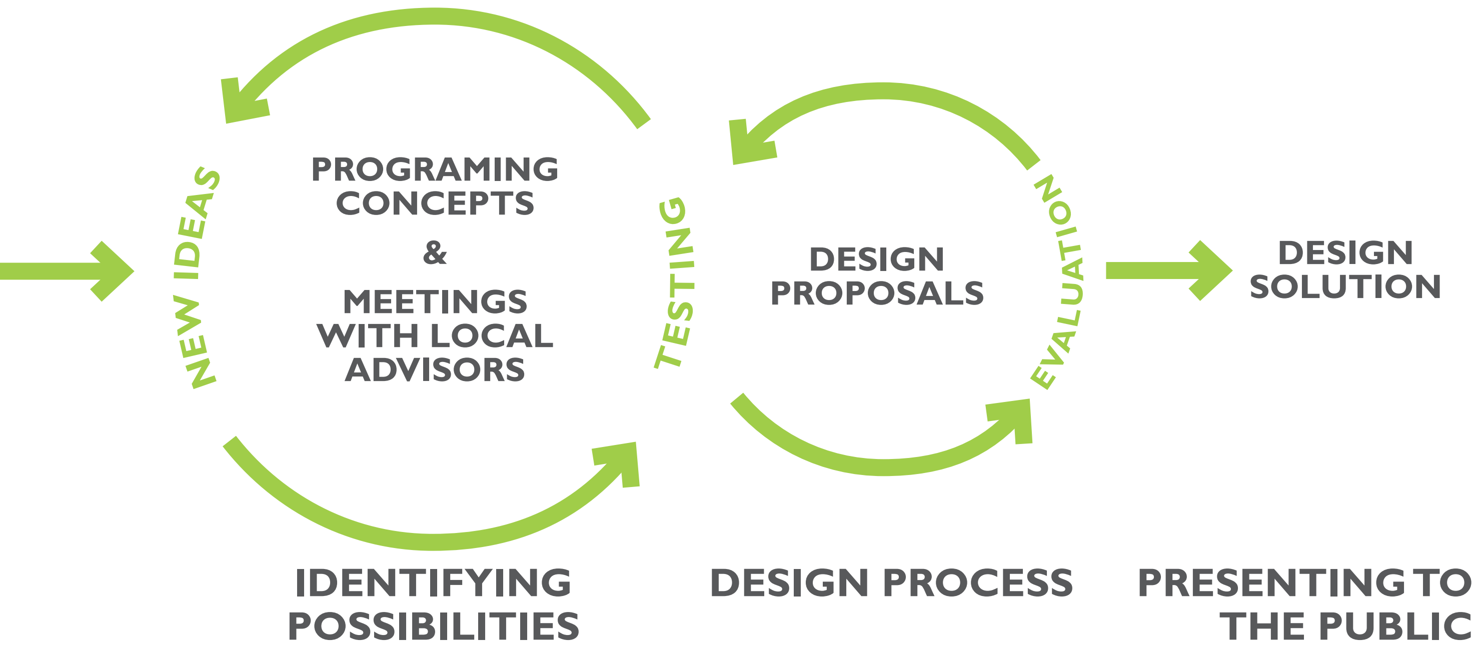
Figure 4.1 Target Rate | left, Target organic waste diversion used to scale site designs (KCDC 2016)

Figure 4.2 Methodology | Process Diagram (Rostek 2016)

PROJECT METHODOLOGY

Fall Inputs

The project builds off the framework from [re]consdiered proposal developed over the fall by KCDC. This framework and proposal established the strategy, goals and potential sites from which this project will work within. Because of the complexity of composting organic waste and urban agriculture, this project relied on both in-depth research into composting & urban agriculture and guidance from an organized team of local experts from the Kansas City region familiar with composting, urban agriculture and solid waste management. I worked over the fall semester to develop a strong strong analytical and researched based background within the topics of urban agriculture, composting and urban infrastructure systems. This background included reviewing literature from key authors in the fields of urban agriculture: Andres Duany and April Phillips. There knowledge was used



to help frame the potential impact, design scale, ownership and management strategies that should be used in the final project design. To better understand composting, significant research was completed into scientific journal articles about composting. Supporting the scientific literature, information from the EPA, US Composting Council and BioCycle where used. These resources provided the complete picture of composting necessary to develop the project justification and design.

Local Professional Advisors
Because of my limited knowledge about composting coming into this academic year, I established a professional committee of local experts over the winter break to help guide my research and later to give feedback on the project development. I selected professionals who's expertise directly relate to composting and/ or urban agriculture. This group consisted of Lydia Gibson, Lisa McDaniel, Kevin Anderson, and Claire Zimmermann. Their combined expertize represent consultants, business owners, regional planners, and non-profit groups who work with compost or urban agriculture in Kansas City currently. Throughout the spring semester, this professional committee was asked to meet with myself and the organic node project team to review the progression of the research and project. Discussion from these meetings was used to seek out the necessary research and help push the design development of the project.

In addition to the design feedback, the professional advisory group was able to provide key insights into the local recycling process and solid waste management system. These figures included important detail such as compost values, recycling and compost rates, local needs, and city policy resources. The professionals input and focus ensured the viability of the final project, and helped in the development of a realistic system strategy and site design for improving Kansas City's organic solid waste diversion rates.

Using the fall inputs, a portion of the larger KCDC studio worked collaboratively to produce a design for the organic node, This team included Joel Savage, Levi Caraway and myself. As a team, the three of us were responsible for site selection, programing, site analysis and design development. Through design development, further meetings with the local professional advisors where held to continue to test the project development and viability, as well as to provide new ideas that had not been considered in for the design.

The process started with the creation of a system framework that would be applicable to the entire organic node strategy. This allowed the team to understand the necessary components of the organic waste management within the strategy. Along side the development of the system framework, sites where evaluated for their ability to best display what the potential impact and benefits on compost would be in Kansas City. The team decided to use the site at 12th and Holmes to develop because of its lack of development, city ownership and location within the downtown.

After the framework was developed and site selected, the process of developing site programs and design proposals continued through an iterative process of incorporating new ideas, testing how they could work and creating a design proposal back into testing until the right balance and types of programing for the site was achieved. Once a final design proposal was settled upon, further refinement was achieved through digital and physical modeling, site grading studies and detailing.

The final project design was then incorporated back into the umbrella [re]considered design proposals developed by the rest of the KCDC studio during the spring systems.

PROJECT DEVELOPMENT | 05

12TH AND HOLMES

The development of the 12th and Holmes organic node must be flexible enough to be applied to the larger system proposal developed in the [re]considered proposal, but in order for the site to function effectively, it must also be site specific enough to meet the object of 40% diversion of organic waste from its specified reach. To makes sure the project development achieved both goals, an initial organic waste flow process map was developed to illustrate where waste is coming from, how it gets to the site, processing stages, and what the potential applications for organic waste are. This flow map was then applied to the site using site specific details found through thorough site analysis, This application of site specific details did not provide a final design solution, but established what where the minimum and maximum values for processing area needed in the final design solution. Lastly, a site design was developed to incorporate the necessary processing areas in a design that fulfilled the established definition of an organic node.

SITE HISTORY

Based on the EPA report on the site history and brownfield cleanup, there are no to very limited concerns about hazards to human health that could occur from composting or producing food on the site. The 12th and Holmes site has primarily being used for industrial manufacturing and commercial land uses. The most recent development on the site was a parking garage which was in use from 1994 to 2003. The site remediation notably include the removal of underground storage tanks, asbestos, and elevated soil petroleum hydrocarbons. No further action letters have been issued for continued site cleanup, and a certificate of completion has been issued (Appendix AA) (Long-Term Stewardship Unit 2010).

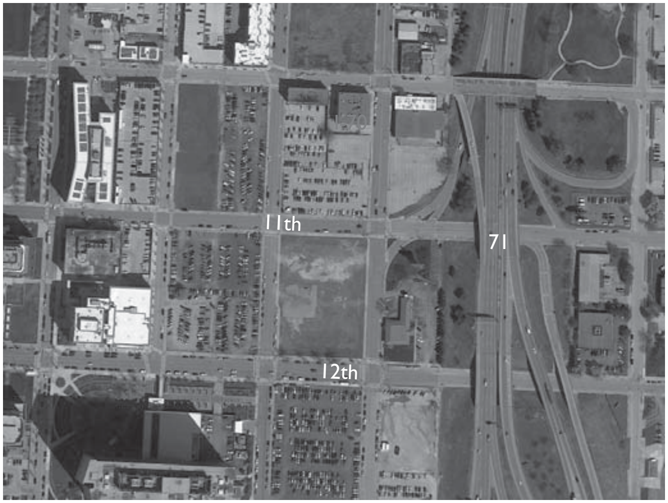


Figure 5.1 Site Location | on the less developed east side of downtown (Google 2016).

Figure 5.2-4 Site Photos | clockwise, site images looking south on Holmes, southwest from 11 and Charlotte, and north from site center (KCDC 2016)

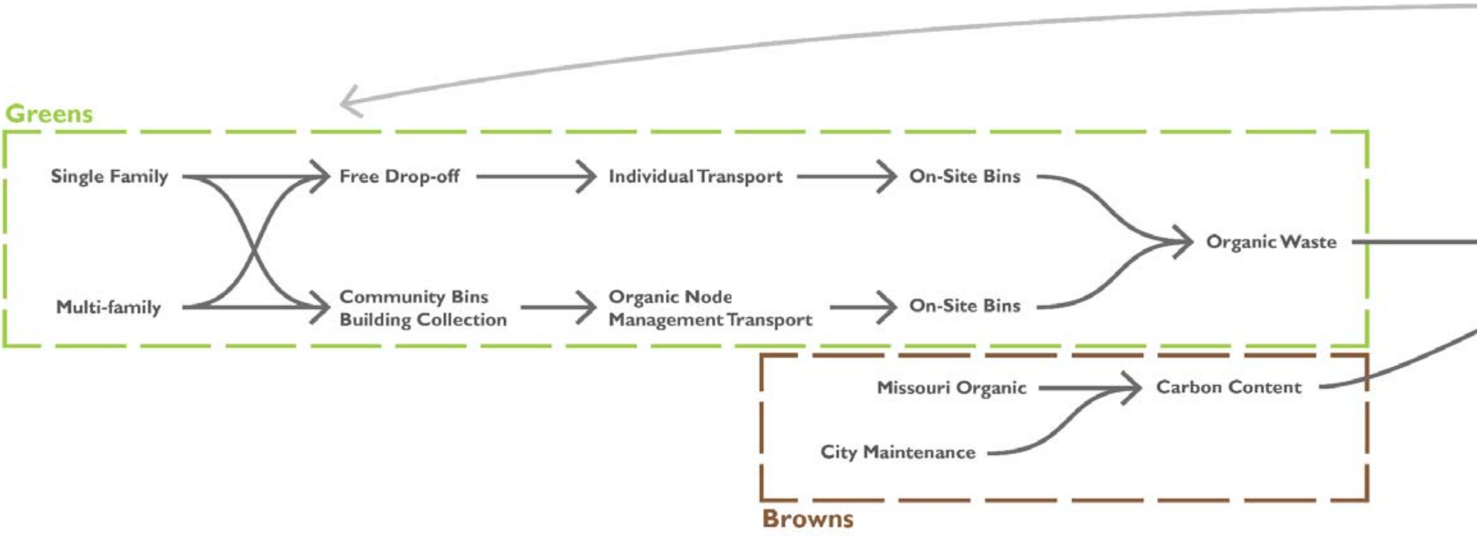
Property conditions

Size:	2.14 acres
Ownership:	City of Kansas City
Zoning:	Urban Redevelopment
Adjacent Businesses:	United States of America

Environmental conditions

Aspect:	Southeast
Contamination:	Remediated in 2009
Wind:	S 22%, SW 3%, N 12%
Sun Exposure:	Full

SYSTEM DEVELOPMENT



ESTABLISHING FRAMEWORK FLOWS

The [re[considered proposal establishing organic nodes as the strategy to attack residential composting in downtown Kansas City. In order for the 12th and Holmes project to fulfill the goals and objectives of the organic node strategy, it's functions must work within a larger system framework that is applicable to any other organic node site within the downtown area.

The first part of creating this system framework is to understand the potential sources of organic waste, both browns and greens, and how it will be transported to the site. Secondly, what type or types of composting will be recommended for the organic node strategy. Lastly, the framework must show there are potential applications of the compost across the entire system proposal.

WASTE SOURCES AND TYPES

The organic waste will come entirely from residents in Kansas City; however, not all residential waste can be considered equally. Within Kansas City, for the organic node strategy, residential buildings can best be classified into two categories: multifamily and single family (where multifamily represents residences with building managed waste collection). This categorization distinguishes collection that can be hauled efficiently in larger scales versus organic waste drop-off depending on individuals to compost their waste.

Additionally, this classification can be used to infer the amount of brown organic waste that will be produced in each category. In mostly single family areas, there will likely be a reasonable balance of organic waste to facility composting throughout the year. In areas represented by mostly multifamily collection, it is likely that outside sources for organic waste are used to provide enough browns to facilitate composting. The suggested framework identifies city maintenance and Missouri Organic as the best sources for this material due to cost and being local to Kansas City.

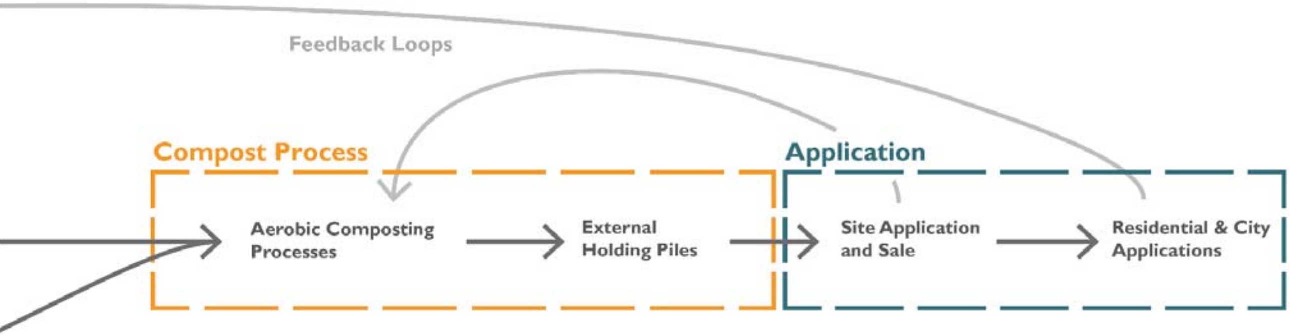


Figure 5.5 Unscaled Organic Node Waste Flows | (KCDC 2016).

GREEN WASTE (HIGH IN NITROGEN)

Vegetable Scrapes
Coffee Grounds
Grass Clippings

High moisture content, but will lead too odor if composted alone.

BROWN WASTE (HIGH IN CARBON)

Leaves
Straw
Saw Dust
Animal Bedding

Slow decaying dry material, but can tie up too much nitrogen if composted alone.

Figure 5.6 Compost | consist of two types of waste, brown and green waste. Usually brown one to one and a half parts brown waste is needed for each part of green waste (Oregon State University, n.d.).

PROCESSING AND APPLICATION

Aerobic composting is best process to recommend at a system level because of its scalability and accessibility to people unfamiliar to composting. The process can be as simple as a pile of leaves of scaled as large as a in-vessel commercial scaled processor. Other methods will require more attentive maintenance or higher startup costs.

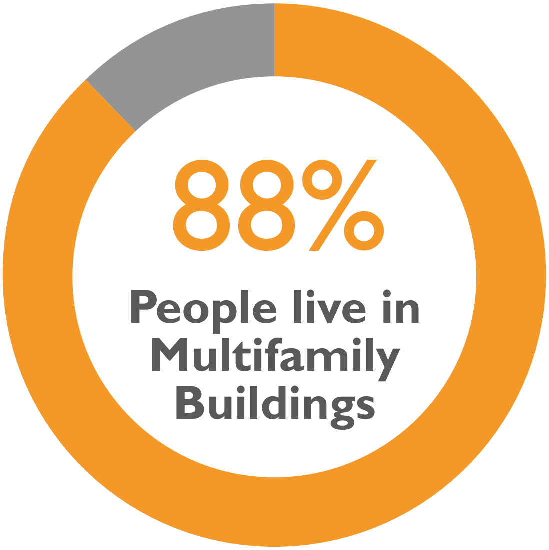
The application of compost in Kansas City could vary greatly depending on the location of the node, but urban agriculture is likely to be the most common application use. Other applications as documented in the research would include use as a soil amendment to improve soil structure and infiltration capacity or as a natural fertilizer. Again, the density surrounding the nodes will determine the possible applications and impact scales, but all nodes would contribute to increasing the organic waste diverted and would improve the soil health across the city.

SITE IMPACT AREA

POPULATION & WASTE CAPTURE

Downtown Area Residents

Using census block data we are able to calculate the number of people living in the downtown area surrounding the organic node location. In total, 12,094 people live in the area, 5,538 of which live in the downtown core. While the [re] considered proposal found that 25% of people in Kansas City live in multifamily dwellings, this number is skewed compared to the higher density in downtown. In the capture are, there is one single family house for every multifamily unit. Relatively, 88% percent of people are living in multifamily buildings ("Downtown Housing Report" 2014).



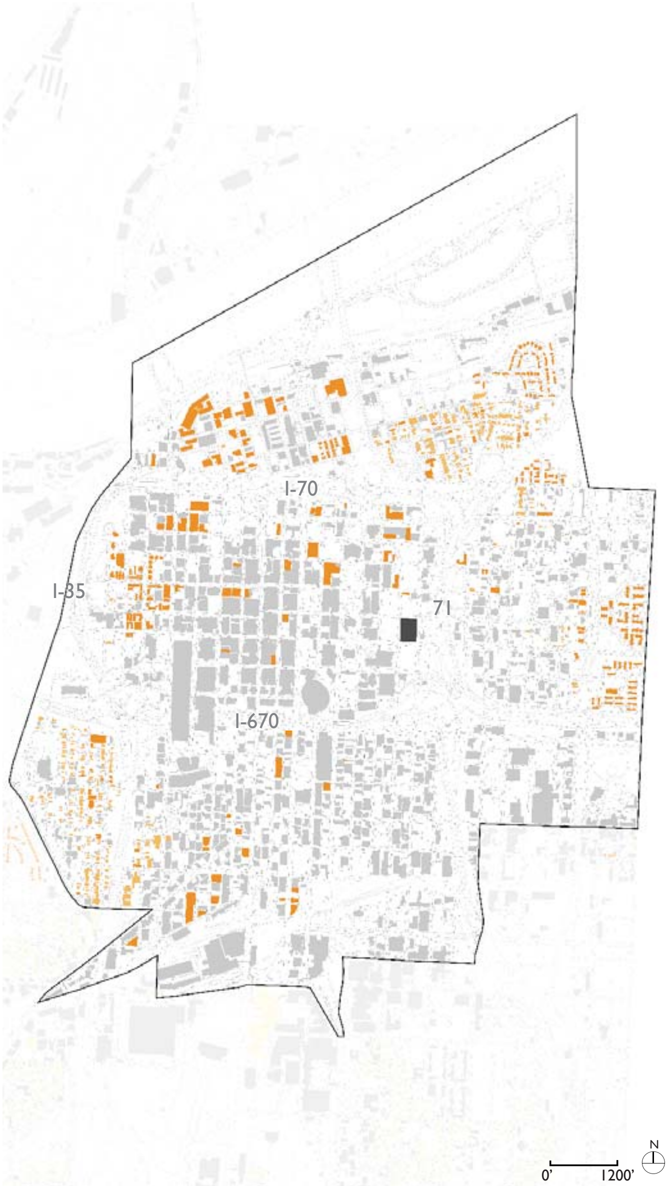


Figure 5.7 Multifamily | percentage based on the Downtown Council Housing Report

Figure 5.8 Location of Residential Buildings | (Dark = Multifamily) (KCDC 2016)

MATERIAL VOLUMES

Green Waste

To calculate the potential green waste that will be produced by residents, the project used an average waste per person per day calculation of .639lbs provided by Lisa McDaniel. This calculation came out of a 2014 review of regional waste which provided a per person weight of solid waste per day. From this total number, construction and non-compostable waste was removed and a factor of compostable waste applied (Lisa McDaniel 2016). The project applied this number to the total number of residents within the capture area, predicting a total weight of 3091.2lbs per day of green waste.

Brown Waste

Brown waste is added in accordance to the composting process, varying from a 1:1 to 2:3 ratio of green to brown waste. An average of the two ratios was used to estimate the amount of brown waste the site would need. From this, it was calculated the site will process 4250.4lbs of brown waste per day.

Total Waste Volume

In total the site is estimated will process 7341.7lbs of compost per day. This weight of compost is approximately 9.79 C.Y. of compost per day. Through the composting process, there is general a 20% reduction in volume between input organic waste and final compost product. The market value of compost produced on the site is $88,453 per year (based on a $30.95/C.Y. market rate provided from Kevin Anderson from Missouri Organic).

WASTE PROCESSING

The type of waste processing within the organic node strategy should be evaluated to take into consideration the volume and type of organic waste being processed as well as the management of the site. In most cases some form of aerobic composting is likely to be the most accessible and cost effective method, but on larger scales when composting will include industrial and commercial organic waste, anaerobic digestion maybe a consideration. Vermicomposting would only be recommended in situations where there is significant control and oversite through the composting process. Such situations are likely to be found where only a few individuals are actively adding to and managing the compost pile (Jean Bonhotal, Mary Schwarz, and Gary Feinland 2011; Henley and Barker 2011; Glenn Munroe, n.d.).

APPLICATION POTENTIAL

As analyzed in the background, the compost can be applied and sold to help improve Kanas City's urban realm and infrastructure in a variety of ways. For the development of the 12th and Holmes organic node, compost application will be applied towards improving stormwater management, and as a structural soil amendment and natural fertilizer for urban agriculture.

Through coordination with local stakeholders and the KCDC advisory committee, allowed the discovery that Kansas City is in significant need of new street trees to replace those lost throughout the year. Because of its location and scale the program of the 12th and Holmes organic node is well positioned to meet this need.

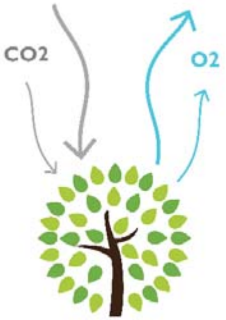
KANSAS CITY STREET TREES

In discussion with local stakeholders and in particular, KCDC advisory board member, Kirstin Riott, it was discovered that Kansas City is currently unable to replace the trees that it is losing annually. Based on information provided by Ms Riott, Kansas City currently loses approximately 3,000 trees each year not including those lost due to emerald ash bore. Currently the city is able to replace approximately 1,000 trees each year at an average cost of $570 per tree. The city is currently working with local partners to reduce the cost to replace trees to $480 per tree, but instillation cost for some urban street trees can rise to $1,500 per tree. Overall, the annual value lost and money spent on new trees totals conservatively $2.28 million; however, this estimate heavily undervalues the loss of existing street trees (Kristin Riott 2016). It is important that Kansas City finds ways to reduce the deficit of trees lost annually across the city because of the significant importance of street trees within the urban realm. Not only do street trees capture carbon dioxide and release oxygen, they can help reduce urban heat island effects lowering the energy needed to cool buildings. Additionally, trees make the urban environment more pedestrian friendly and increase neighboring property values. Lastly, trees help to increase stormwater retention and infiltration, through root uptake, transpiration, and canopy capture (Dr. James R. Fazi, n.d.).

Figure 5.9 Trees | are an important environmental and economic part of the downtown public realm in Kansas City. Additionally, they can have a massive impact towards improving urban infrastructure systems. (KCDC 2016)

KC LOSES 3,000 TREES ANNUALLY | ONLY 1,000 ARE REPLACED

Representing a loss of $2.28 million



Trees capture 48 pounds of carbon dioxide annually

Street trees return $1.37 to $3.09 per every $1.00 invested.

SITE SYSTEM MODEL

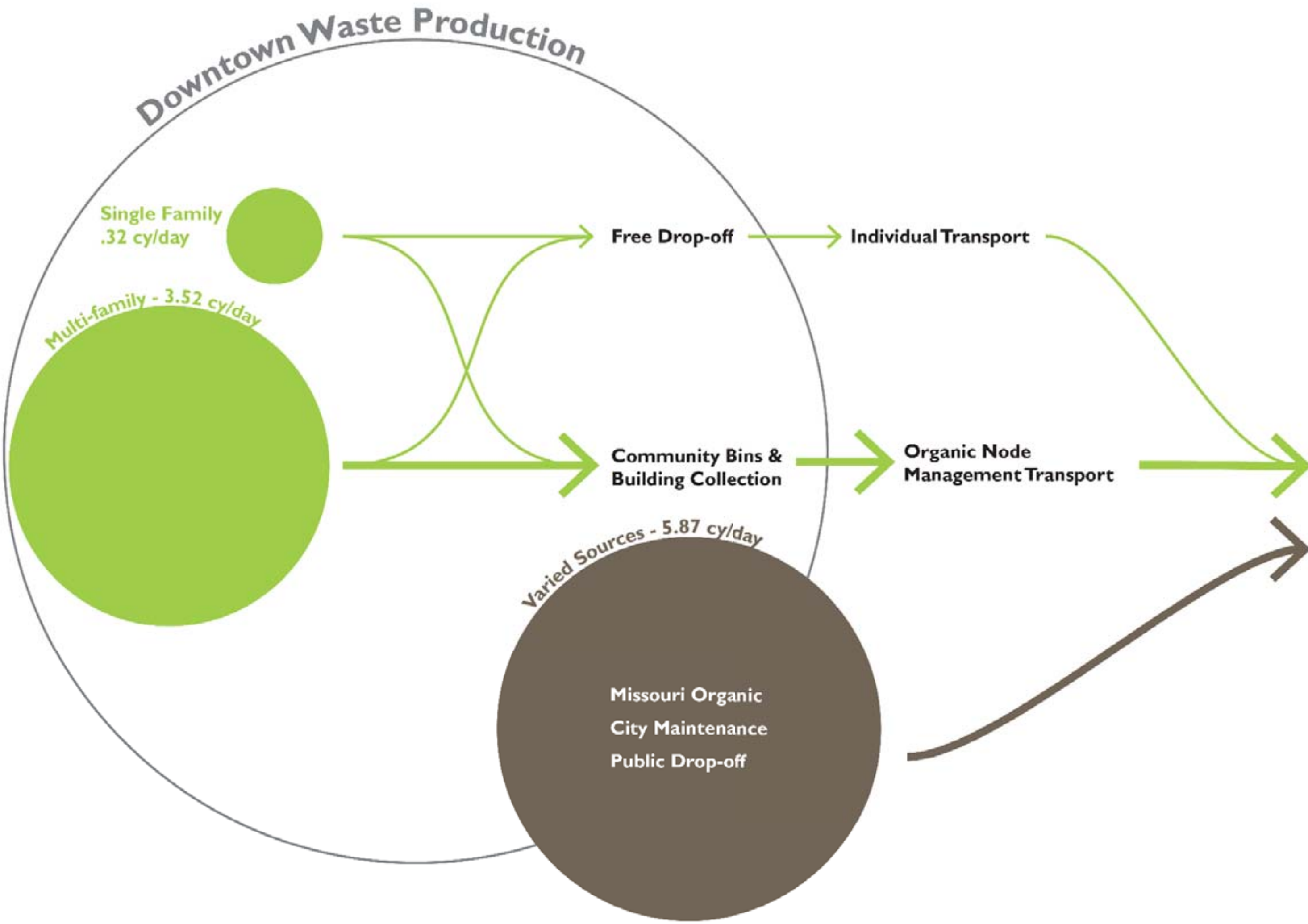
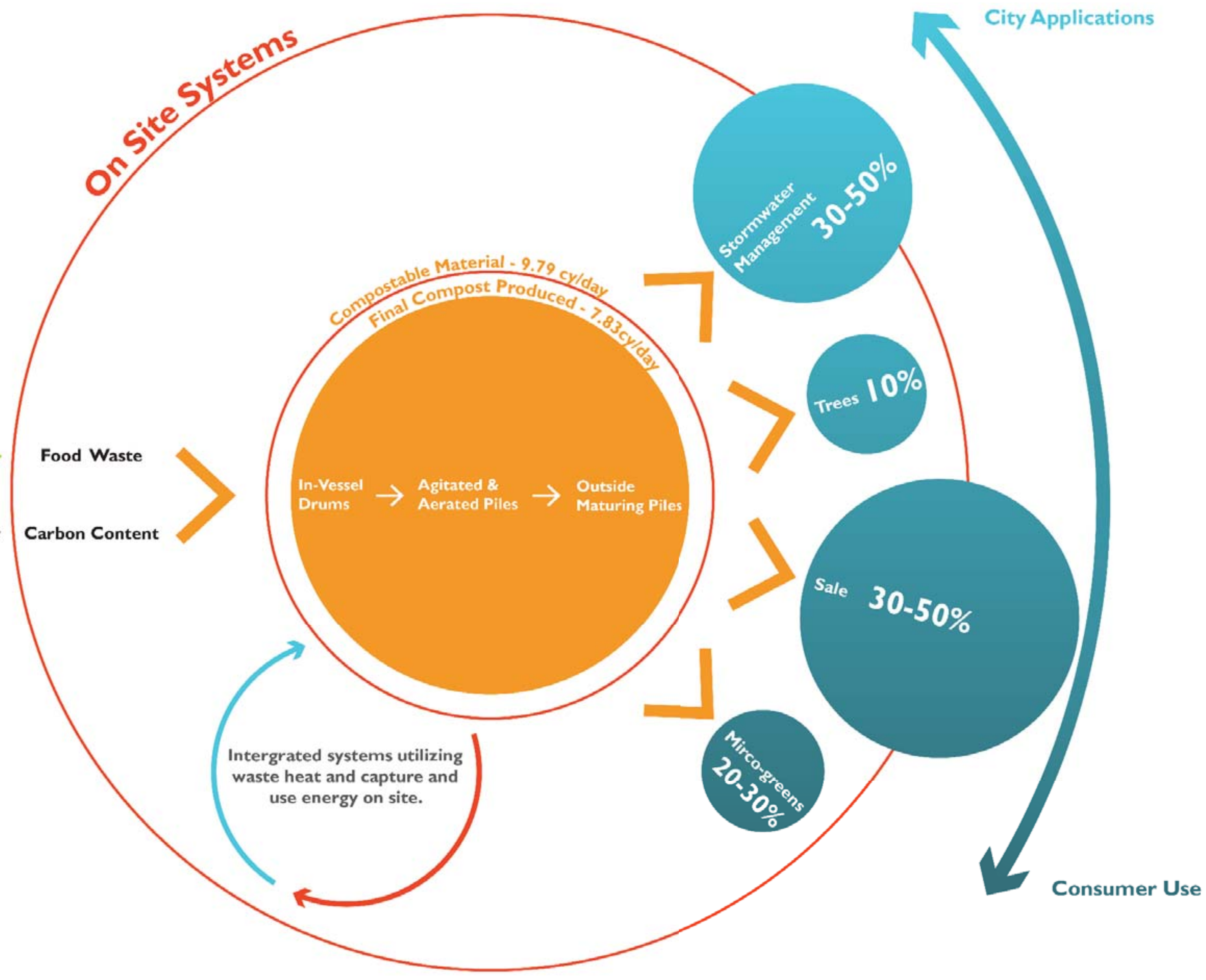
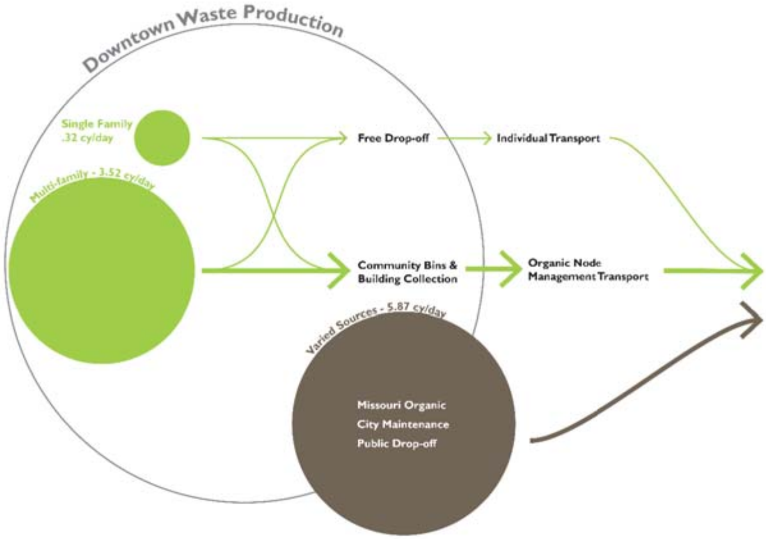


Figure 5.10 Scaled Waste System | model to the 12th and Holmes organic node site (KCDC 2016).


On Site Systems
City Applications
Compostable Material - 9.79 cy/day
Final Compost Produced - 7.83cy/day
Stormwater Management 30-50%
Trees 10%
Food Waste
Carbon Content
In-Vessel Drums
Agitated & Aerated Piles
Outside Maturing Piles
Sale 30-50%
Mirco-greens 20-30%
Intergrated systems utilizing waste heat and capture and use energy on site.
Consumer Use

COLLECTION

The structural differences in waste management between single family and multifamily units require different methods of collection and transportation of organic waste to organic nodes. The green component of the compost will come entirely from residences, but depending on the size and scale of the node, brown organic waste may need to be sourced from other municipal and private sources.



GREENS

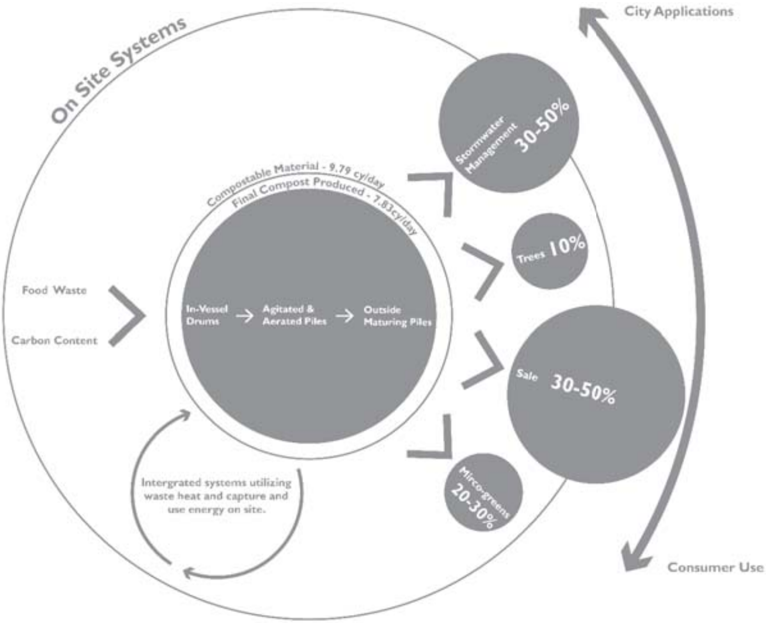
Due to the low density of single family housing downtown, greens collection will require residents to bring waste to the site; however, the higher density and structured management of waste collection in multifamily provides an opportunity for greater coordination and more efficient collection of organic waste. In conversation with Justin Morrison, a local apartment manager, during a KCDC Open House on March 24, it was discovered that many apartment managers downtown would likely be supportive of coordinating the collection of organic waste within their building as a way to attract environmentally conscience tenants and to reduce building waste disposal costs. According to Justin, many new building are no longer incorporating trash shoots into the design of the floor plat as it is cheaper to have someone collect the waste from residents by hand. The hand collection within buildings would help to control and sort the waste generated. For older buildings, it is recommended that an organic waste collection container be placed on each floor near the trash shoot, and collected by building staff.

COMPOST BAGS

To make composting easier, compostable bags will be used. This eliminates the need to un-bag waste brought to the site. These bags would be given to residents and will be given free heavily discounted for building managers. The rate charged to building managers would be used to offset the cost of collection. To control contamination, these bags would be bar coded to identify where the waste came from, and emails would be set out to help educate participants on how they can improve their compost collection. Additionally, the codes associated with bags could be tried to separate rewards programs, which could include giving participates discounts on compost or plants from the nursery.

BROWNS

Due to the high percentage of people who live in apartment buildings, it is unlikely that the site would receive enough brown organic waste from residents or multifamily building management alone. To solve this issue, Kansas City municiple brown organic waste would be processed on site. As a backup plan, brown organics could be purchased from Missouri Organic as a temporary measure to keep the composting process running.



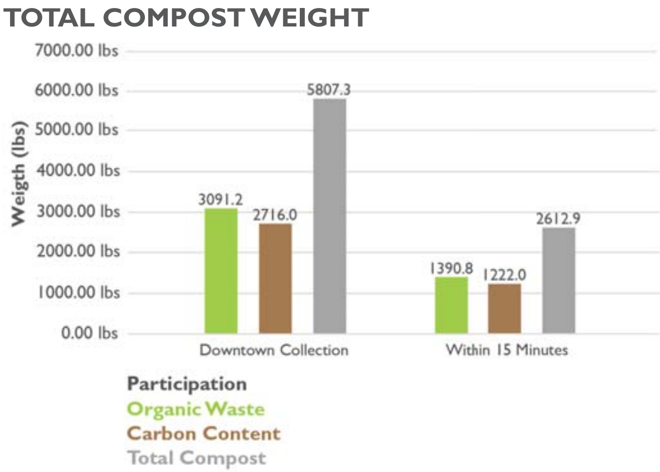
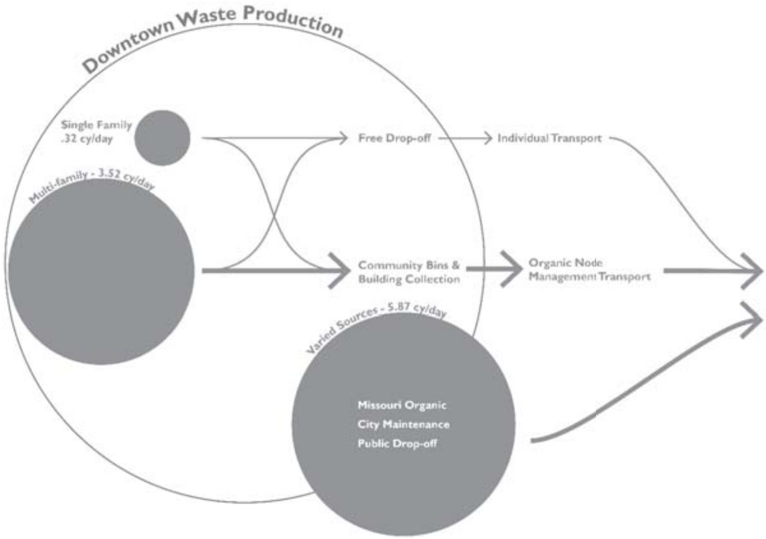


Figure 5.11 Collection | organic green and browns are sourced from residents and other city partners (KCDC 2016).

Figure 5.12 Calculation | of the weight of organic waste coming into the site based on the population and figured from advisors (KCDC 2016).

PROCESSING



Because of the lack of greenhouse gas emissions and limited startup cost compared to other composting methods, the site will utilize aerobic composting to decompose the organic waste brought to the site. This processing will occur in two stages to take advantage of different processing methods.

IN-VESSEL COMPOSTING

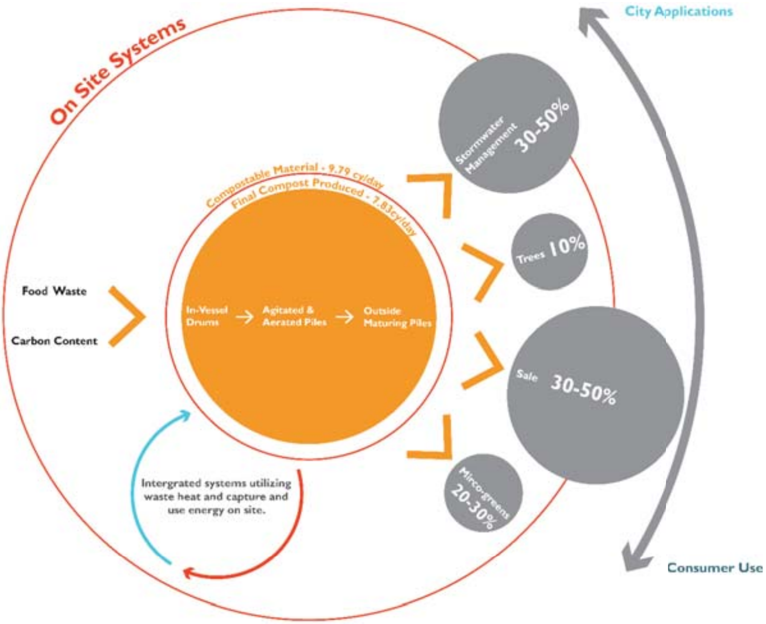
First the organic waste will be processed in an in-vessel composting unit to take advantage of its ability to mechanically break down the organic waste. In-vessel composting can occur in a variety of shapes and sizes, but general they are cylindrical containers which rotate organic material. Depending on manufacture, this container can have continuous feed, forced air flow, and moisture control systems. The agitation of the process maintains the heat necessary to maintain decomposition in addition to mechanically breaking down the organic waste. These features will increase the range of materials that can be process, reducing management labor towards sorting out contaminants like meats and fatty foods; however, disposal of meat, dairy and/ or bones will not be encouraged. Too much of these organic wastes in the compost system will lead to longer processing times and increased incidents of noxious odors (Jean Bonhotal, Mary Schwarz, and Gary Feinland 2011; Robert L. Spencer 2007).

AERATED STATIC PILE

The second stage of the composting process will involve the use of aerated static piles. This method involves compost being placed on top of a bed of porous material, wood chips, containing one or more perforated pipes used to force or draw air through the compost pile. The forced air flow maintains active decomposition in the presence of oxygen. In some cases, the pile can be covered with an insulating layer (compost, bulking agent, or permeable membrane) to retain heat, reduce moisture loss, prevent egg laying flies, and to filter out odors (Oregon State University, n.d.). On site, the heat from this process will be captured to help maintain a year-long growing cycle within the greenhouses on site.

SPATIAL REQUIREMENTS

To calculate the volume of compost that would be on site during processing, the total waste volume was used to create a spread sheet. The spread sheet accounted for daily input and estimated processing periods for each stage of the composting process (appendix AA). Using the calculations from the spread sheet, the site is estimated to need a minimum capacity of 118 C.Y. for stage one, 412 C.Y. for stage two, and 350 C.Y. for stage three. To achieve the capacity for stage one, the design will incorporate 5 HotRot in-vessel composting units, each being 6 in diameter and 36’ in length and holding a 25 C.Y. of compost, totaling 125 C.Y.



VOLUME OF COMPOSTS AT EACH STAGE

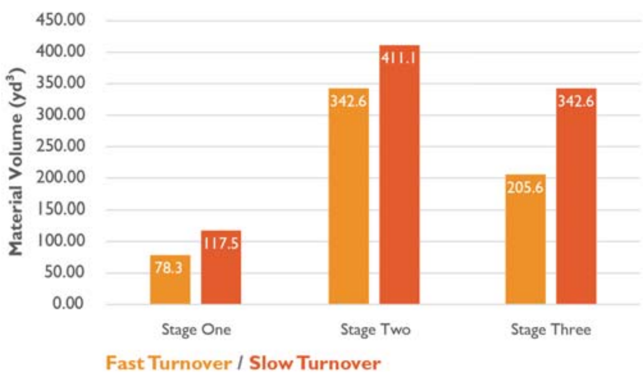


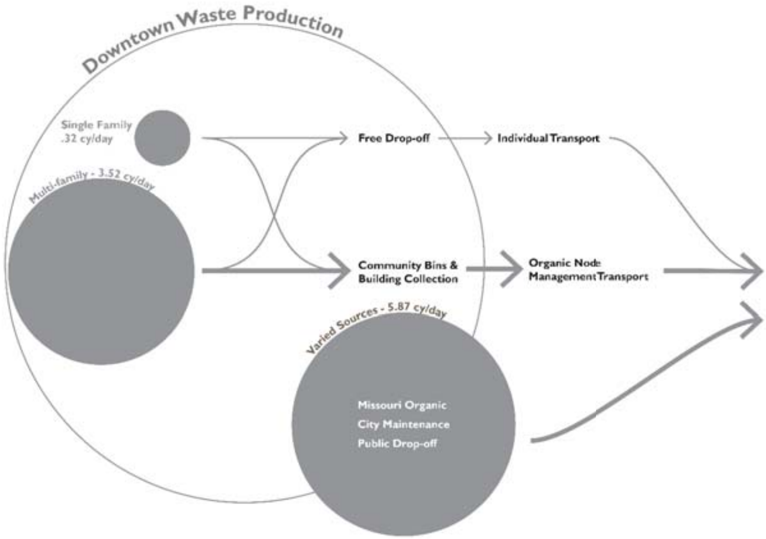
Figure 5.14 Processing | organic waste is processed on site, some volume is lost through the three stages of composting (KCDC 2016).
Figure 5.15 Maximum Volumes | of material in each stage of the composting process (KCDC 2016).

These units have continuous feed capability and function under negative pressure. The airflow through the unit is counter to material flow and is filtered through a biofilter to remove odors (Robert L. Spencer 2007). Because of the objective to capture heat from the composting process to maintain a year-long growing season within the greenhouses, the second stages will be divided into five equally spaced piles within 5 greenhouses sections on site. The greenhouse will be a continuous structure to maintain a constant temperature across the entire greenhouse-compost system. These aerated piles will be 80' x 10' and up-to 6' tall, with a total volume of 450 C.Y. The final compost will be stored on site in a compost collection and pickup area with a maximum compost capacity of 450 C.Y.

APPLICATION AND SALE
The on-site application of compost for the 12th and Holmes organic node will primarily focus on the production of street trees for Kansas City. Other applications of the compost will be towards stormwater management and the growth of microgreens to be sold to the general public. Additional compost created on the site will be sold to the general public at market rates for personal use.

The breakdown of final compost based on the design is as follows: tree growing and transplanting will use 10% of the compost, microgreen production will use 20% of the compost, and the rest will be used by the city for stormwater management amendments or sold to the general public depending on current needs. The allocation is based on priority of site management and volume needed. Tree growing was considered to be the highest priority on site although it uses limited amounts of compost because of its economic function within the site and benefit to the city.

PUBLIC INCENTIVES AND EDUCATION
The main incentive towards the composting of organic waste is based on free disposal for residents and multifamily buildings. The total cost deferred for the waste collected on site totals $30,809. Additionally, first time visitors will be given a free bag of the microgreens grown on site. Active participants would be given proportional discounts on on-site microgreens and tree saplings.



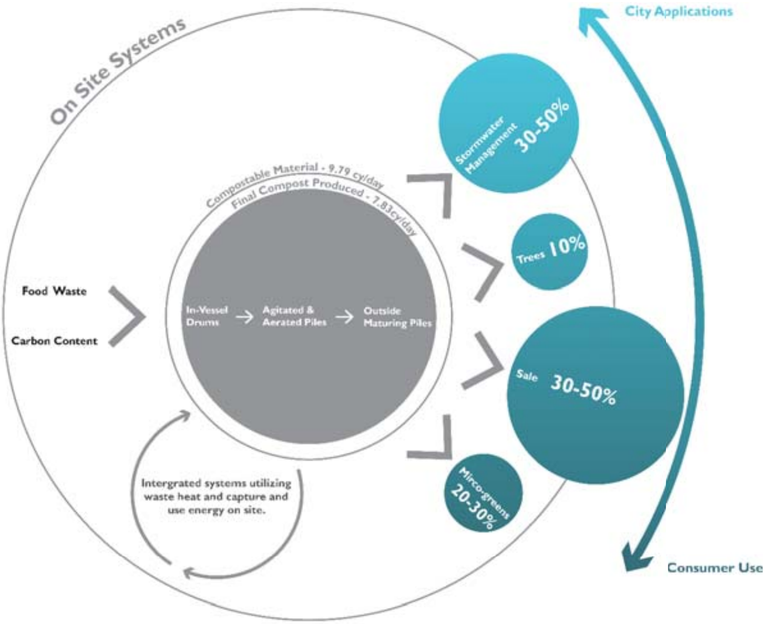


Figure 5.15 Sales | compost can be sold in a variety of different markets. The volume of compost for the trees and microgreens will remain steady through proper site management (KCDC 2016).

SITE ANALYSIS

SLOPE AND HYDROLOGY

The site slope is very workable within the goals and objectives of the site. The average aspect of the site is towards the southeast at a 4.6% slope. The most significant slope occurs along Charlotte St at 5.3%. This is the only place within the site that would exceed the maximum slope for ramps under ADA regulations without handrails, but no of the site exceed the maximum allowable slope of 8.33%. Overall the grading will allow for some flexibility towards creating small areas of land art through the use of site grading.

In addition to accessibility benefits, this moderate slope is favorable from a hydrological perspective since no area will have significant pooling or erosion from storms. Although the site location is high up within its local watershed, it does drain 28 acres of land to the northwest extending up to the federal court house. The cumulative volume of water to capture from a 1.5 in rain event is 760,000 gallons, a little more than one Olympic size swimming pool. Though this is not significant in the context the total volume of water to fall on downtown Kansas City, the site's ability to intercept pollutants would have a very significant impact on a much larger extent of Kansas City's drainage network.

The site is just under 2.2 acres and will capture approximately 90,000 gallons in a 1.5 in rain storm. The aim of the site design is to capture and infiltrate all the water to fall on the site through roof run-off capture, use of pervious surfaces, and infiltration bioswales.

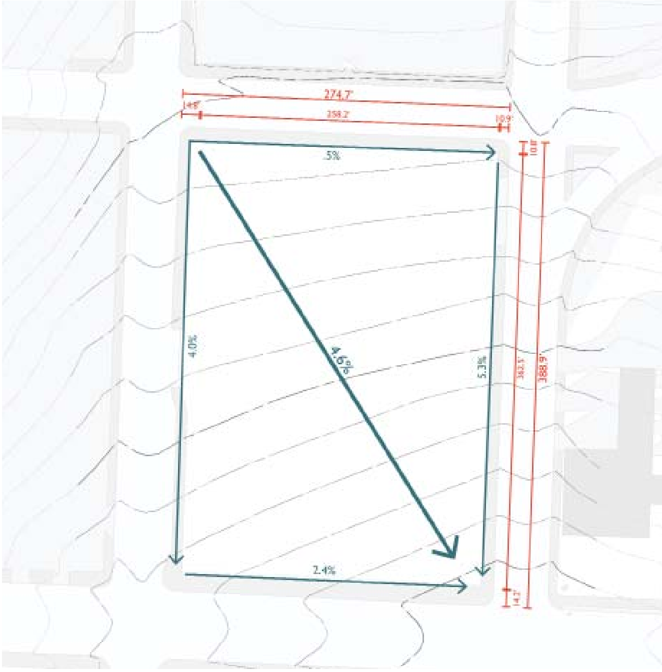
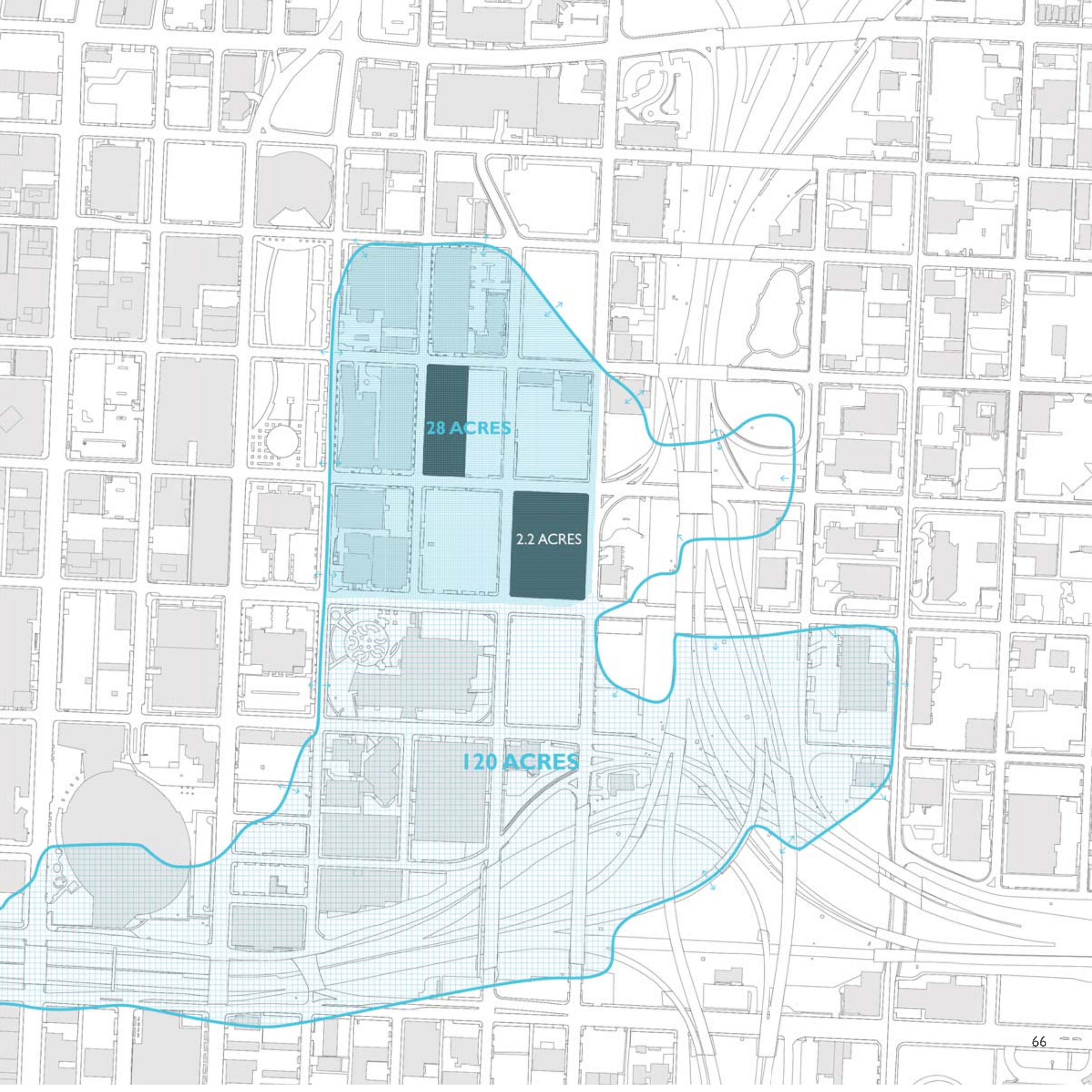


Figure 5.16 Site Dimensions | top, and slope gradients (KCDC 2016).
Figure 5.17 Hydrology | right, the site is at the top of a small local watershed meaning potential pollution capture is more significant than total retention volumes (KCDC 2016).


28 ACRES
2.2 ACRES
120 ACRES

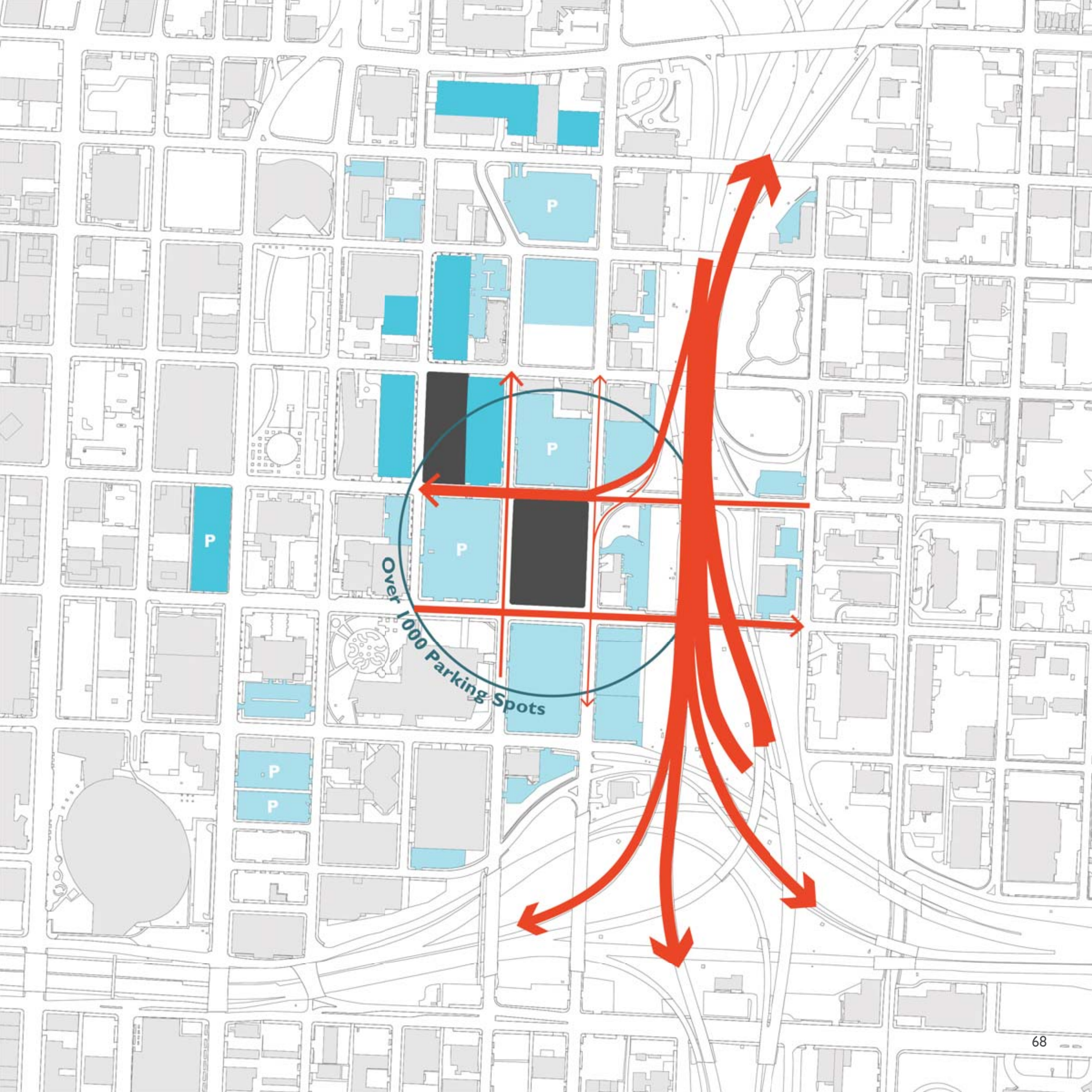
CIRCULATION

The site is surrounded by a combination of highways, oversized arterial streets and large roads. Highway 71 is elevated adjacent to the site. Though this does bring a lot of traffic, the elevation reduces noise pollution. 11th street to the north, has high volumes of traffic in the morning as commuters exit 71 and feed into downtown. To a smaller degree, 12th street operates counter to 11th and feeds commuters out of the downtown in the evening. Holmes and Charlotte are important north-south connections east of downtown connecting to the Hospital Hill neighborhood, but both low traffic compared to their physical size. The roads surrounding the site facilitate multiple transit options, and have street parking on multiple sides surrounding the site.

Parking

Kansas City is an automobile centric city, and any design would need to consider this in the final design outcome. The site is surrounded by many actively used parking lots. In total, the site is surrounded by 1066 public and private parking spaces which are full on a daily basis (588 Federal Bldg, 288 W, 160 NW, 310 N). Though it is likely that those parking lots will eventually be developed into future office and residential developments according to recent comprehensive plans, the current parking reduces the need for extensive on-site parking and grantees a consistent weekly audience. Additionally, the site is surrounded completely by on street parking providing additional options to cater to commuters to the site.

Figure 5.18 Circulation | the site is bordered by parking on the west and US-71 to the east. The office and public parking are usually full and 71, elevated near past the site, provides a consistent audience. 11th and 12th street are primary access points in and out of downtown, so public engagement is best placed on the less busy Holmes and Charlotte St.(KCDC 2016).


P
P
P
P
P
P
Over 1000 Parking Spots

Transit
The site has immediate access to a variety of transit options, and future plans for the development of Kansas City's public transit system will further expand what is currently available. Located between 11th and 12th Streets, the site is bounded my KC Max bus routes. These routes will become more important in the future forming the backbone of East-West public transportation through the city. Additionally, the city has proposed two alternative locations for a new bus terminal on the east side of the city. Both locations are adjacent to the selected site, but the alternative along Holmes (red) would encroach on the property. Having review both alternatives, the studio has used the second alternative location (orange) for the new bus terminal located southeast of the site along the eastern edge of Charlotte. This location does not encroach on the property and is coordinated with the bike infrastructure.

Bike
Kansas City is working to develop a better network of bike infrastructure to promote greater ridership in across the city. Recently the city has seen the introduction of bike shares within as part of a partnership between Kansas City B-Cycle and Blue Cross Blue Shield. In addition, the city is currently expanding the number of bike friendly routes. Unfortunately, many of the new routes are "Sharrow" type roads, but Charlotte does have painted bike lanes, and future proposals for12th Street include protected bike lanes. Given Kansas City's push to improve bike infrastructure, the placement of bike share on the site or accent bus terminal re-enforces the decision to maintain Charlotte as a pedestrian scaled street for greater public engagement.

Figure 5.19 Transit Options | the site is well serviced by both bike and transit infrastructure, (KCDC 2016).

Wind

Winds normally blow toward the South, Southwest and North in Kansas City ("Average Weather For Kansas City, Missouri, USA - WeatherSpark" 2016). Additionally, the site is heavily exposed to wind due to a lack of building mass or trees surrounding it. Proper management of the composting process should mitigate much of the smell that causes concern when producing compost, never the less, wind is a consideration that must be addressed as residences are located within half a mile of the site in the directions of these common wind patterns.

To address the nearby issues of smell coming from compost, building vents will be located on the tops of the buildings. Orientating the buildings north and south will allow the most commons wind directions to vent the smell up and away from the public.

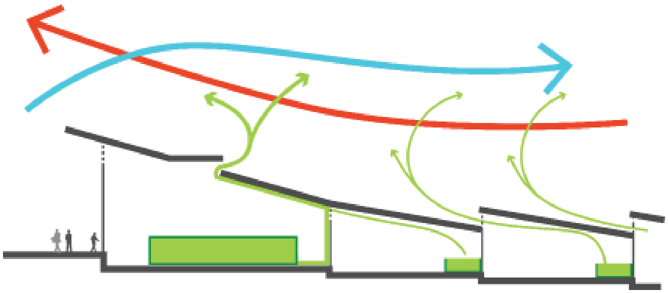
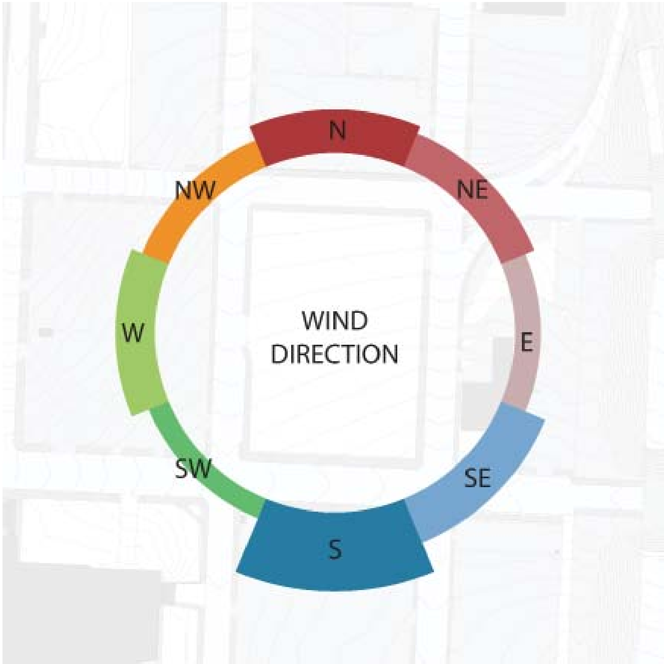


Figure 5.20 Air Flow | negative pressure pulls compost gases out and away from the site (KCDC 2016).



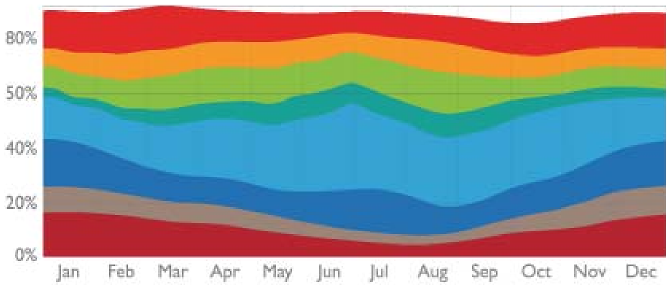


Figure 5.21 Direction and Percents | in summer, when odor is the biggest concern, wind is to the south where limited residential buildings are located (KCDC 2016). The graph represents the percent likely-hood that wind will come from a direction during a given month (KCDC 2016).

Viewsheds

The lack of development around this location create a huge viewshed from which the site can be seen. Most notably, the site is highly visible from the elevated section of Highway 71 which runs parallel the downtown to the east of the site. The site is also visible from the few residential towers to the north and from important civic and corporate institutions such as: City Hall, KCPD Headquarters, JE Dunn, the County Courthouse, US Federal Building and the US Department of Transportation. To take advantage of these views from 71, the building should be sited on the west side of the site, opening up the tree production to the highway. Because the views from the west of the site are elevated, the height of the buildings on site will need to be considered for how they frame views into the site.

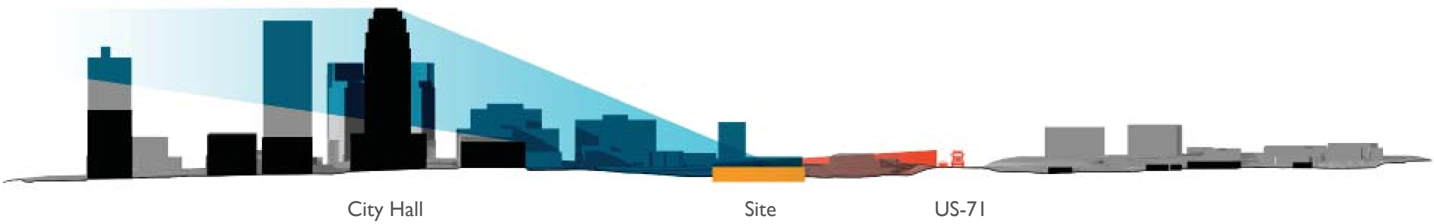
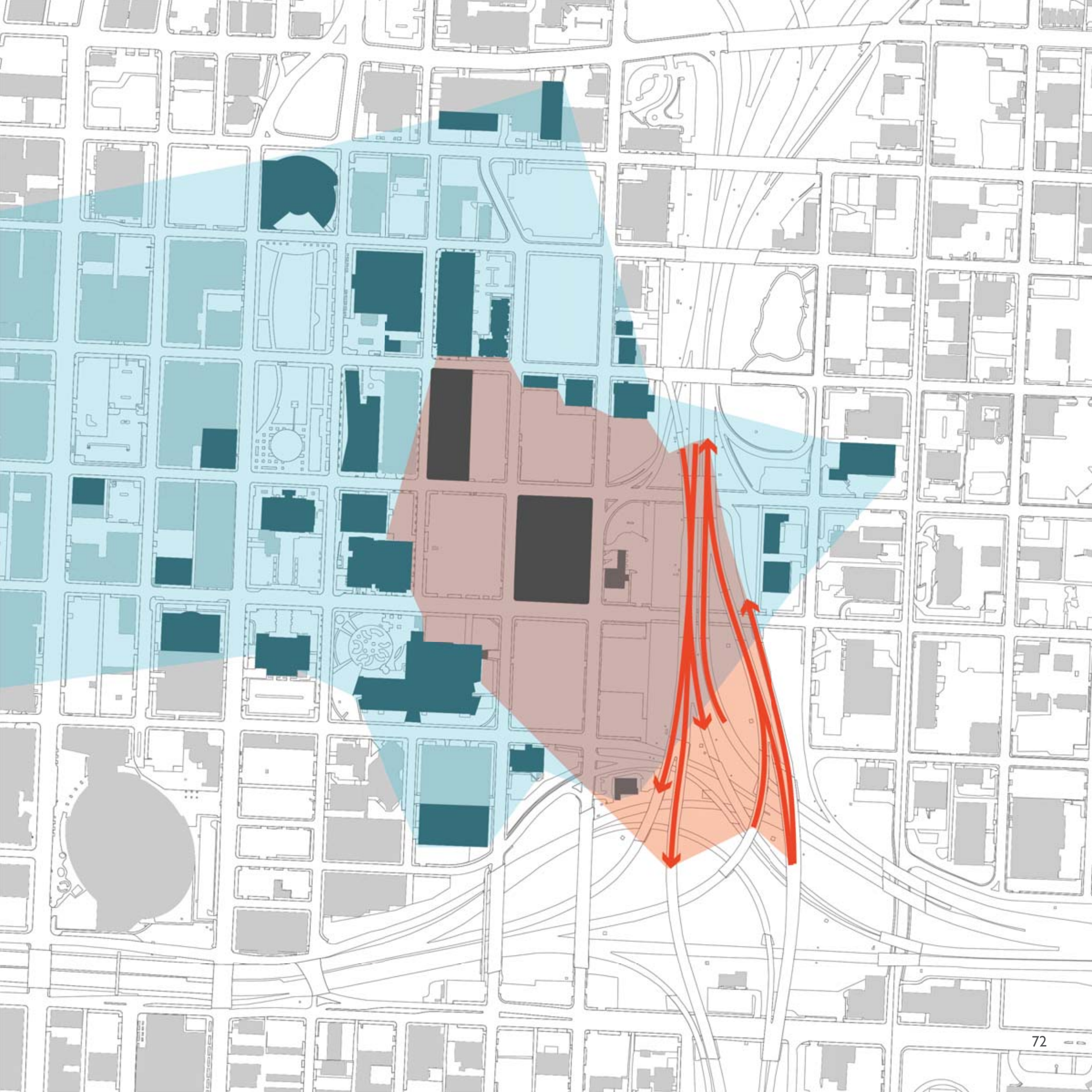


Figure 5.22 Section Views | in blue, the site is visible from taller buildings in the downtown, and in red, the site is visible from US-71(KCDC 2016).
Figure 5.23 Area Views | in plan, the viewshed of the site covers most of the eastern downtown loop (KCDC 2016).



Sun and Shadow Studies

The defining development adjacent to the site is the US Federal Building located southwest of the site. This building does cast significant shadows across the site during the winter months during the afternoon, but otherwise, the impact of surrounding development in minimal. This high amount of sun exposure promotes the use of solar photo-voltaic panels and clear PV glass on the roofs of the site structures. The energy captured by the solar energy capture would be able to power the composting equipment.

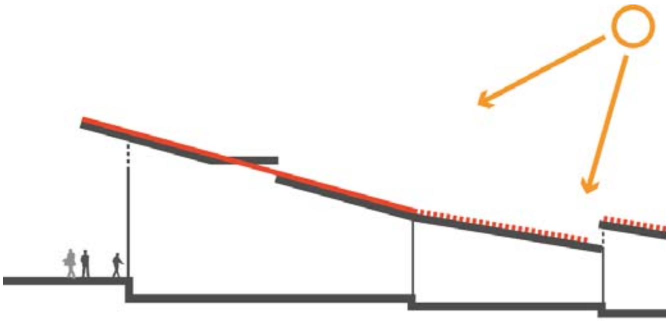


Figure 5.24 Pitched Roofs | are tilted up towards the south to capture solar energy to run site equipment (KCDC 2016).

Figure 5.25 Shade Map | hourly shadows in Dec, Mar, and July (purple, pink, and orange) the site is rarely in shadow for prolong periods (KCDC 2016).

Capturing Residents and Visitors

Although many of the residents' waste will be captured through building collection through site managed trucks, some residents will need to bring their waste to the site. Additionally, it is important to understand how other visitors will access the site. Due to the orientation of the one-way streets and highway on & off ramps, 11th street is the primary access point into town for many residents, and 12th street is the primary exit east out of downtown. Because of these conditions, the drop-off and point of sale should be located along these streets for the ease of access and high visibility from vehicles.

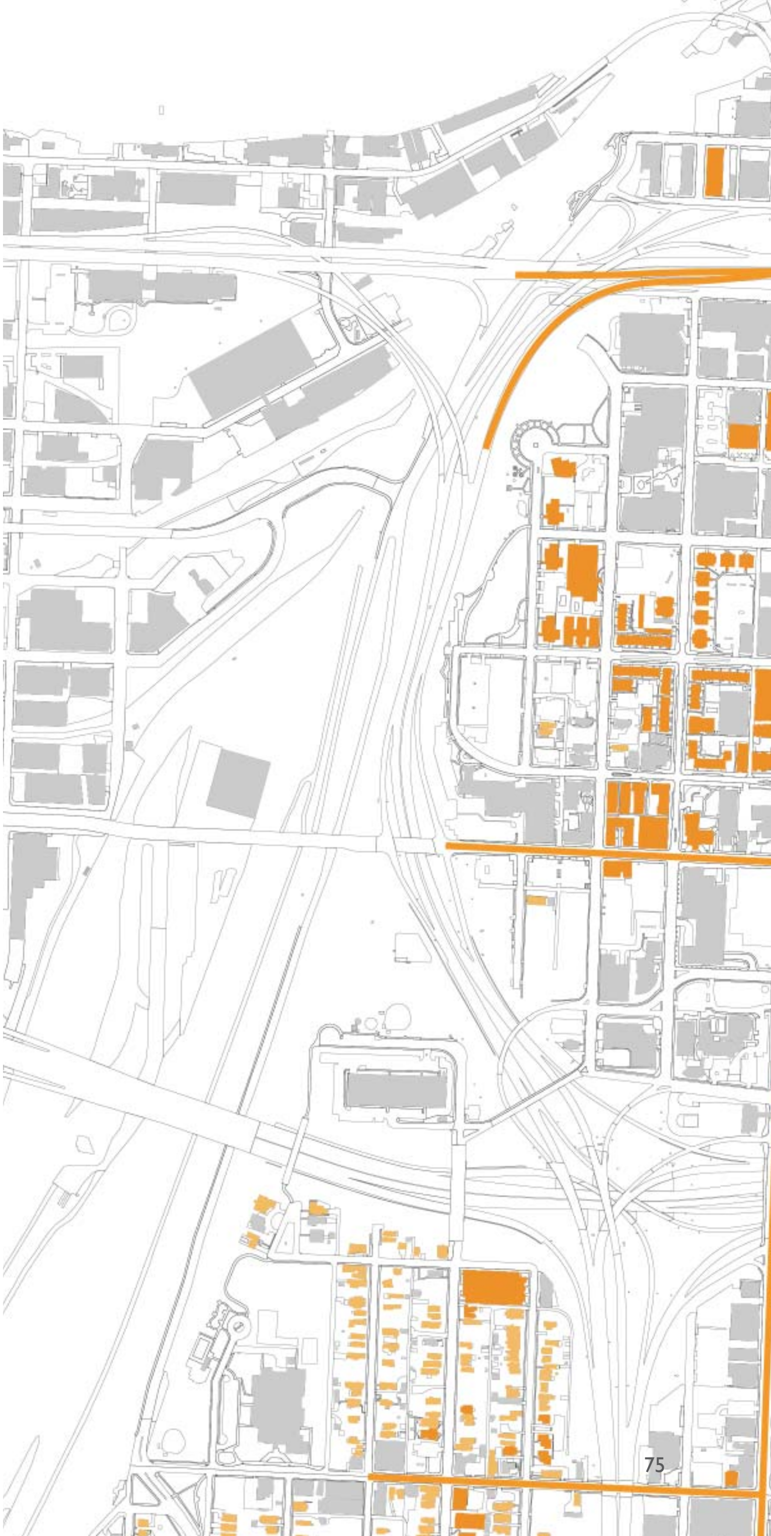


Figure 5.26 Residential Access | primary access points for people visiting the site and dropping off organic waste are on 11 and 12th streets. Vehicle access should be on these arterial streets while service and education are placed on Holmes and Charlotte (KCDC 2016).

Connecting with Educational Institutions
The site is surrounded by quite a few educational institutions downtown and is readily accessible to UMKC's dental program and Volker campus. Homes and Charlotte are beat streets to foster this public, educational aspect of the site design due to less vehicle traffic and more pedestrian friendly street scales.

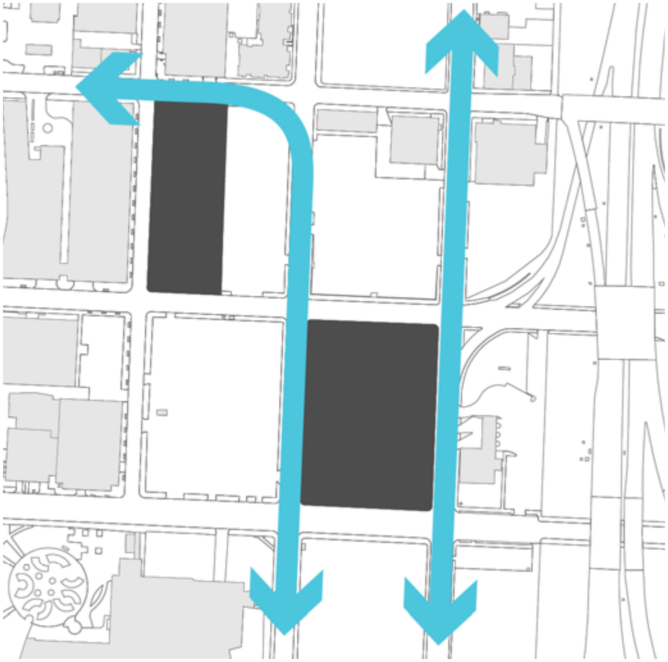
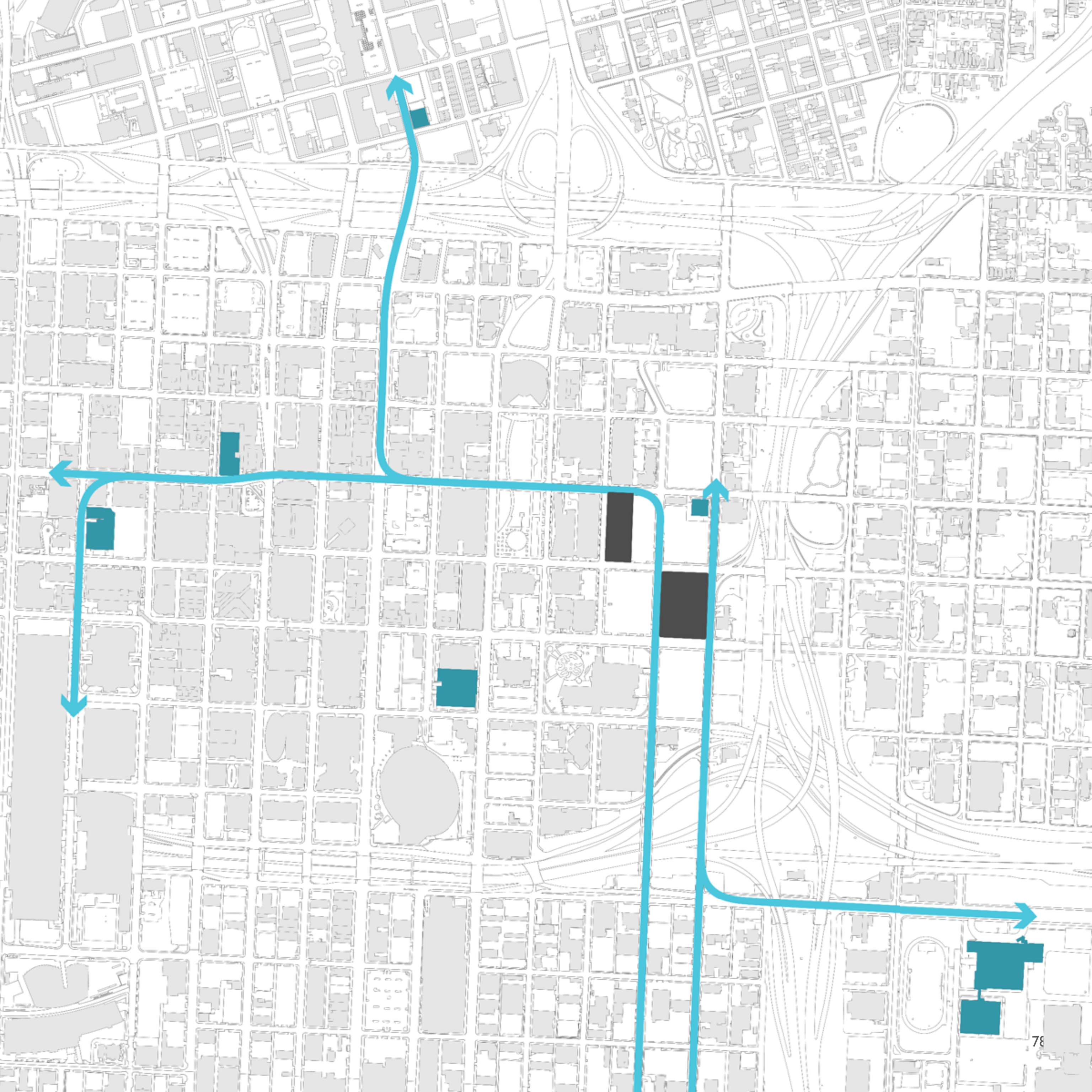


Figure 5.27 Site Fronts | Charlotte and Holmes provide the greatest chance to educate and engage the public (KCDC 2016).
Figure 5.27 City Education | the smaller connector streets are have the greatest connection to the immediate schools and educational institutions downtown (KCDC 2016).



DESIGN PROPOSAL | 06

DESIGN PROPOSAL

The proposed design for the organic node at 12th and Holmes is designed to facilitate the efficient collection and processing of single and multifamily residence within the surround downtown area. The building mass has been kept to the west side of the site to facilitate view into the site from Highway 71 and to accommodate the needed stormwater bioswales. The buildings on site will be designed to keep down site costs in response to likely future development on the site, and it will utilizes recycled and low cost materials where possible. The composting process will begin at the north of the site and follow the site topography as it is processed to the south of the site. The center of the site is dedicated to exterior planting and street tree development, while the Charlotte St edge is used to collect and infiltrate stormwater. Adjacent to the drop-off building at the north end of the site, larger street trees frame a public amphitheater space overlooks the entire site.

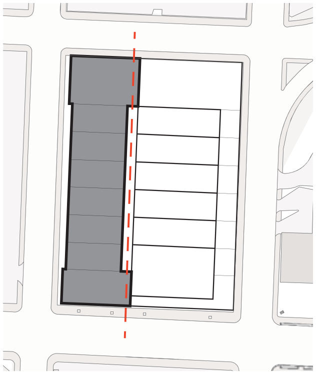
Figure 6.1 Site Plan | (KCDC 2016).
Figure 6.2 Aerial View | looking to the north east, the site framed against the Kansas City skyline (KCDC 2016).

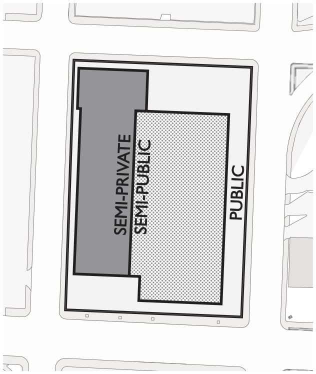
SITE PLAN

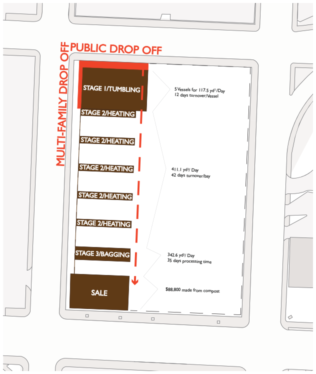
The primary site is located on the vacant parcel surround by 11th, Charlotte, 12th and Holmes St. On this block the composting and public engagement functions are handled. To provide enough trees for the city, and additional half block owned by the city to the northwest bounded by Cherry, 10th and 11th streets will be used to provide the majority of city street trees (750 or more trees). Combined these locations will provide enough composting potential to handle 40% of the residential organic waste from downtown with some additional room for expansion.

By developing a currently underutilized site, this organic node is helping to bring activity to the east side of the downtown loop. Overtime, this activity should help spur the development of the surrounding parking lots. Located prominently alone two of the downtown's most important arterial streets, the site development will be bring much needed attention to composting and urban street tree issues.

Lastly, by focusing on the eastern edge of downtown, this organic node will help to bridge the divide created by the vacant lots and US-71 between downtown and northeast Kansas City.







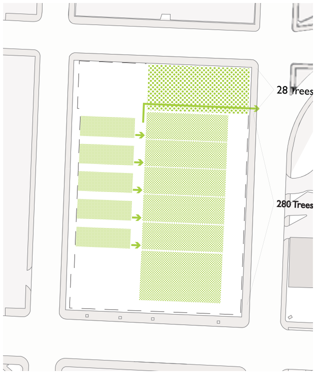


Figure 6.3 Building Mass | top left, kept to the western edge to respond to stormwater and viewshed analysis (KCDC 2016).
Figure 6.4 Access | top right, the site is a mixture of public and private spaces to facilitate composting and engage downtown KC (KCDC 2016).
Figure 6.5 Drop-Off and Shop | bottom left, are along arterial streets to respond to residential capture analysis (KCDC 2016).
Figure 6.6 Agriculture | bottom right, the majority of the site is used compost created on site for street tree and micro-green production (KCDC 2016).

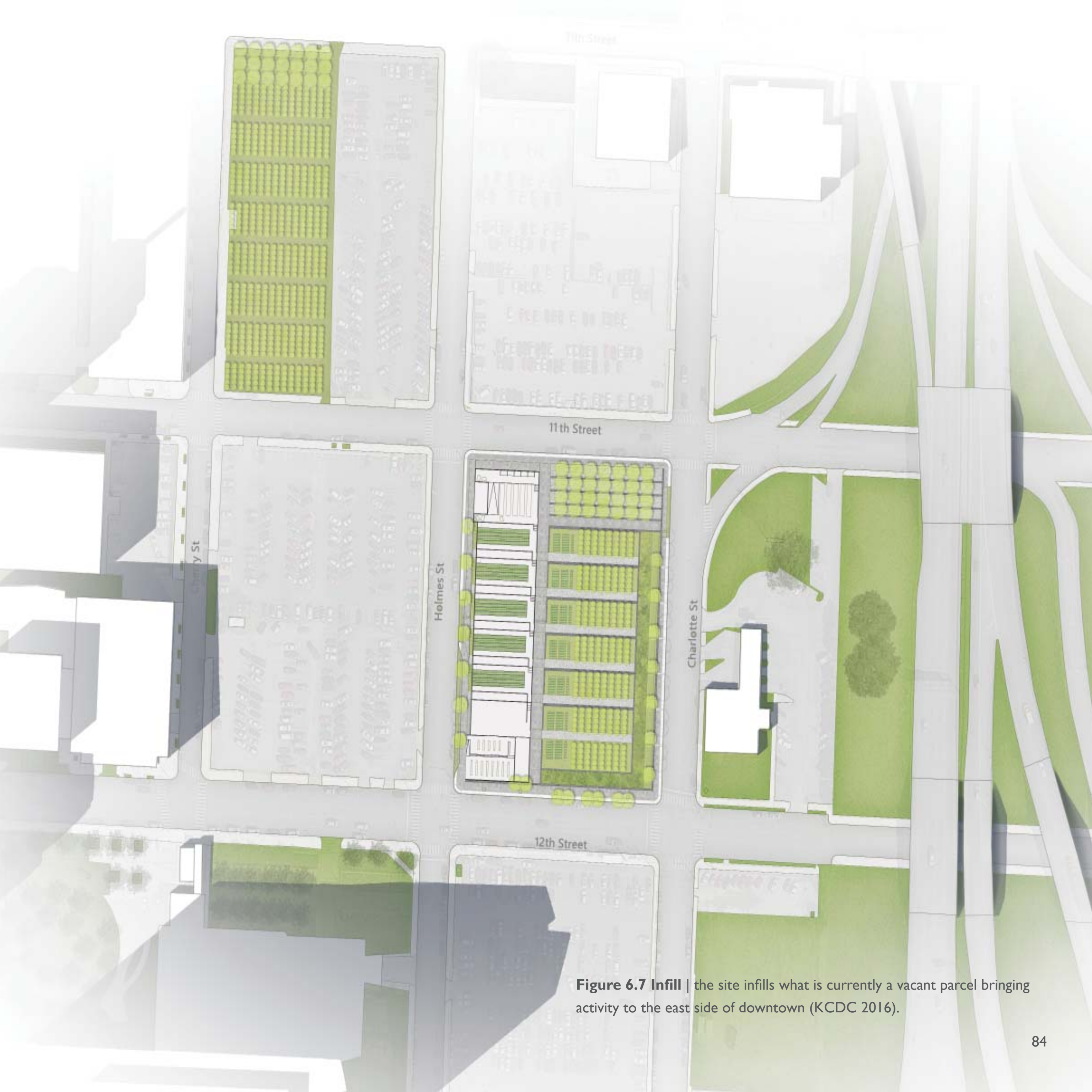


Figure 6.7 Infill | the site infills what is currently a vacant parcel bringing activity to the east side of downtown (KCDC 2016).

BUILDING FUNCTIONS

Building Siting and Structure
The building have been placed along the western edge of the site to limit their impact on the site stormwater management strategy and to facilitate views into the site. The structures will be mostly transparent using glass or clear corrugated polycarbonate panels. The rest of the material pallet will include cast-in-place concrete, recycled wood, and gabions filled with clean concrete construction waste. The Holmes street frontage facing downtown creates and urban edge in an area lacking any current street character.

Collection Building (Yellow)
The collection will happen in two places within the collection building at the corner of 11th and Holmes. Along 11th St, temporary on-street parking will allow residents to come to the site to drop off their organic waste, and a covered service are will facilitate larger multifamily organic waste collection along Holmes St. The transparent structure and up-lifted roof allow and invite visitors to see the 5 large in-vessel composting units in action. The south facing roof of the building will have solar panels to produce energy offset the electricity needed to run the composters and other site functions.

Figure 6.8 Program Section | west from Holmes, compost is processed with the slope from the top of 11th street down to 12th street (KCDC 2016).

Connected Greenhouses (Orange)

The greenhouse structure will contain both the second composting stage and greenhouse plantings in one long continuous space. This will allow the building to capture and use the heat produced by the compost to maintain a stable growing environment for the plants. Again transparent materials will allow the general public to view the composting process and how it directly relates to growing plants. Within the structure there are five 10' x 80' composting piles and five 18' x 70' panting pods. The planting areas will consist of a stacked system of removable trays. The bottom two trays will be used to grown micro greens which in the early growth stages do not need light to germinate. The top tray will be used to grown tree saplings before they are transferred to develop on the exterior site. In total the five buildings can produce more than 2000 saplings and turn over the micro-green trays every 2 months.

Compost Maturing Pile (Red)

The compost is held at the bottom of the greenhouses providing immediate access to city officials and residents shopping in the Sales Center.

Compost Sales Center (Blue)

The final structure capping the southern 12th street edge will be where the compost and plant sales will take place. Between the greenhouses and the building, an exterior service space will hold finished compost. The compost will be available for individuals to bag or to load onto a truck for both personal and municipal uses. Inside the building, composting information, books and other gardening tools will be available for sale, and the building will be the starting location for site tours. Lastly, the building will have a small service shed for tools and a small maintenance vehicle.

THE VESSELS | FACILITATING COLLECTION

The glassy exterior exposes the in-vessel composting units to the public while the roof line lifts to open the building up to the 11th street frontage. 15minute street parking alone side the site allows people to quickly and easier deposit organic waste at the facility. On Holmes, a large bay allows site managed vehicles to drop-off waste collected from multifamily buildings.

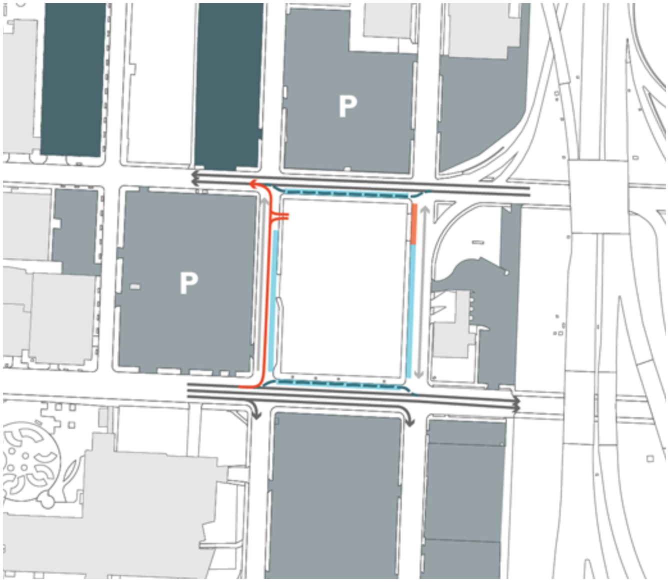
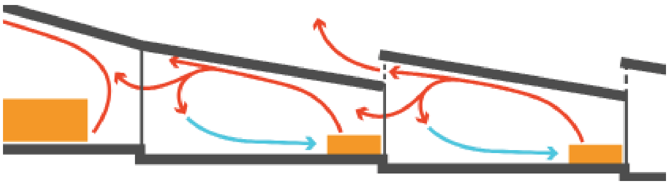


Figure 6.9 Travel Direction | the locations of the drop-off and facilitate efficient traffic flow by residents, dark blue, and workers collection multifamily organics, red. Street parking in light blue provides temporary site parking for visitors.(KCDC 2016).

Figure 6.10 The Vessels | building has residential drop-off on 11th and multifamily collection on Holmes (KCDC 2016).

THE GREENHOUSES | FROM DEATH TO LIFE

The glassy exterior exposes the site processes throughout the year. The heat generated from the composting process keeps plants growing and turns the long greenhouses into a warm winter attraction.



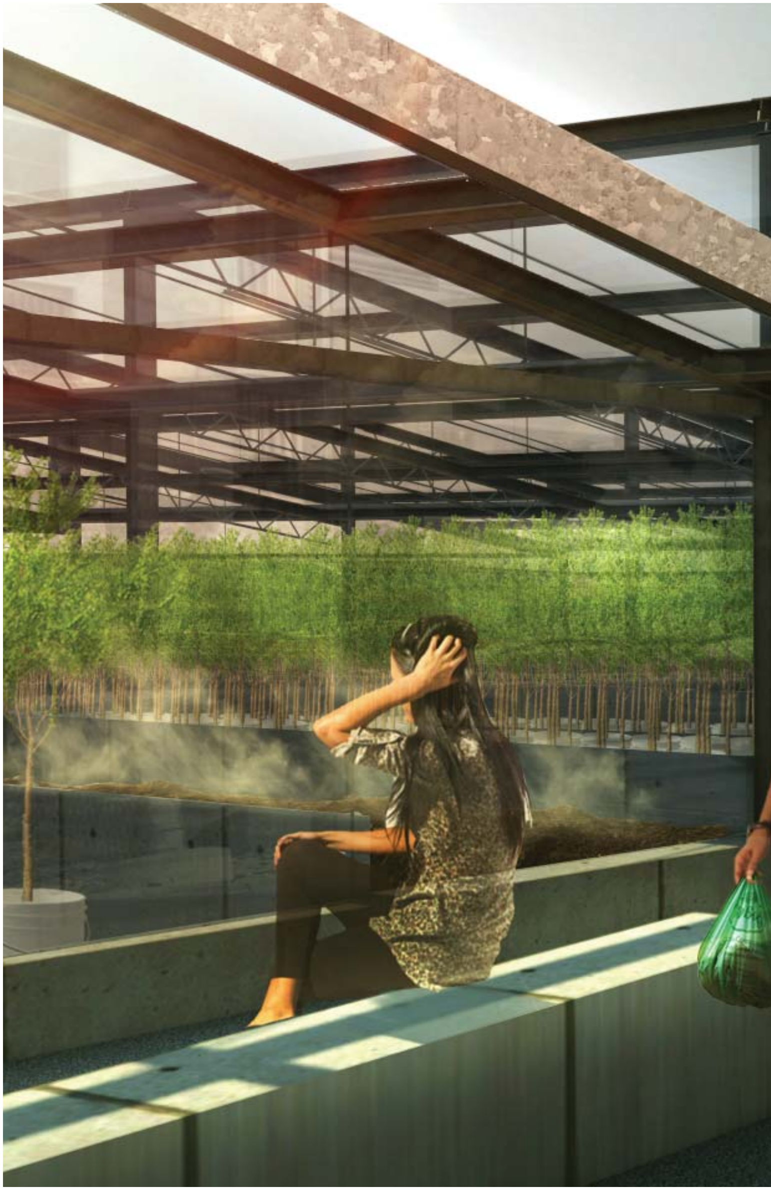


Figure 6.11 Heat Capture | the greenhouse structure captures heat from the compost piles to maintain a yearlong growing season (KCDC 2016).

Figure 6.12 The Greenhouses | the new structure frames a new urban edge along Holmes street that engages people to learn and engage in the composting process(KCDC 2016).

TREE NURSERY | PRODUCING A BETTER KC

The tree nursery will occur in two locations within down town. A quarter of the trees will be grown on site, and the rest will be grown on the open space to the northwest behind JE Dunn. On the main site, 28 greater than two inch caliper tees will be grown in 95 gallon wood boxes, 280 two inch caliper trees will be grown in ground in 20 gallon plastic containers, and in the green houses up to 1,450 saplings per pod can be grown in 5 gallon plastic containers as needed. On the adjacent site, 21 large trees and 672 two inch caliper trees will be produced. The trees will be rotated on site as necessary spending no more than two years in the greenhouse and in ground plastic containers. It is hoped that the site would be able to have an annual output of close to 1,000 trees, halving the current tree replacement deficit faced by the city.

TREE TYPES

Due to the pressing need for trees and the limited available space on which to grown them downtown, the tree palette for the site consists of trees that have rapid growth but are suitable for street planting. The list does not contain ash because no emerald ash bore resistant ash trees have been identified. Additionally, it is recommended that the city to limit the number of acer species to be planted to avoid developing a monoculture prone to future disease or pests.

Tree List

American Sycamore (Platanus occidentalis)	6 ft	20-25 ft
Tulip Poplar (Liriodendron tulipifera)	6 ft	15-20 ft
'Heritage' River Birch (Betula nigra)	3-4 ft	15-20 ft
Dawn Redwood (Metasequoia)	3-4 ft	15-20 ft
Ginko (Ginko biloba)	3 ft	10-15 ft
Red Maple (Acer rubium)	3-5 ft	15-20 ft
Weeping Willow (Salix × sepulcralis)	4-8 ft	15-30 ft
'Red Rocket' Crape Myrtle (Lagerstroemia)	3 ft	10-15 ft

Figure 6.13 The Nursery | inside the site, the public is welcome to enjoy the nursery as a new working public space (KCDC 2016)

THE SHOP

Creating a home for people to come and learn about composting and the site's purpose, the shop will be the first location for visitors to the site. The building will contain the maintenance equipment for the site, and store. The store will have DIY composting equipment and guides for single family residents, free compostable bags for people to drop-off their waste, and per-prepared bags of compost for people to take home. Additionally, the shop will be where residents come to purchase compost, micro-greens and saplings in larger quantities. The shop caps the composting process on site both physically and functionally, framing the 12th street corner.

Figure 6.14 The Shop | people purchasing composting and micro-greens after touring the site (KCDC 2016).

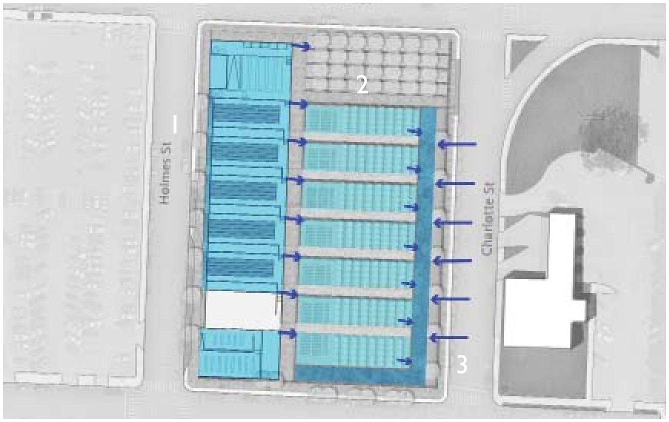
THE RAILS | TEACHING FUTURE COMPOSTERS

Using the site topography, the Rails is a small amphitheater space created under a grove of larger trees grown for use in the city. Located on the corner of 11th and Charlotte, the space uses re purposed rail road tracks to move the trees tying into Kansas City's railroad heritage. The location of this educational component is meant to tie into the connections found in the educational analysis and the presence of bike infrastructure on Charlotte St.

Figure 6.15 The Rails | children on a school field trip learn about composting in their city, and how it is making a better future for them (KCDC 2016).

BIOSWALE GARDEN | BUTTERFLY HOME

The east edge along Charlotte St will have an extended stormwater bioswale to infiltrate the water from onsite and the adjacent streets, while the Collection building and greenhouse will capture roof runoff for site agricultural uses. Within these bioswales, native plantings that encourage monarch butterfly migration. The soil in the bioswales will incorporate compost amendments to improve water infiltration and retention. The combination of compost application and use of native plants would demonstrate to the public alternative strategies for water management and landscape planting.



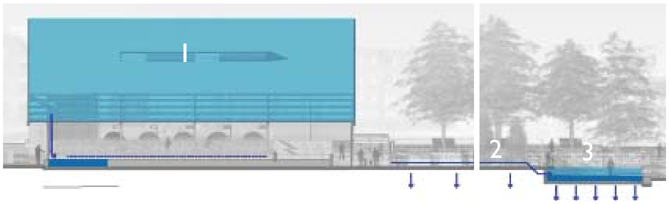


Figure 6.16 Water Capture | buildings (1) collect water to be used for irrigation (2) while the site is mostly permeable to collect and infiltrate rain water. The bioswale capture from the site and street (3) (KCDC 2016).

Figure 6.17 The Bioswale | small cantilevers align with seating over the bioswale creating connections into the site and with nature (KCDC 2016).

CONCLUSIONS | 07

PROJECT GOALS

Is the site able to achieve 40% diversion?

Working within the site constraints, the project demonstrates the viability of the organic node at 12th and Holmes to divert 40% of the organic waste from residents in the downtown area. Additionally, the site design demonstrates that the application of compost can have significant economic, environmental and economic benefits for Kansas City; however, it must be recognized that residential organic waste is only part of the recycling picture in Kansas City. Additionally, initial participation is not likely to immediately reach 40% diversion. The segmented design of the site allows for the growth of capacity with resident participation.

Does the design engage and incentivize participation?

Overall, the design mostly focuses on economic incentives to promote resident engagement. Additionally, the sale of microgreens will encourage resident's downtown to come and purchase locally grown food; however, the lack of surrounding activity or development around the site will likely make site engagement more difficult.

APPLICATION TO THE OTHER SITES

Adjusting to Fit Site Needs

Though the development of the site, programing shifted from urban agriculture towards primarily street tree production. Additionally, site development allowed the project to expand the collection scope to include more of the downtown area than was initially expected. These two major changes may have differed from the initial project background research, but the changes demonstrates the organic node's flexibility to adjust to site conditions and needs. This flexibility helps to strengthen the overall system proposal outlined in the [re]considered, and the organic system's applicability to a variety of sites within the downtown area. Going forward the major consideration for future sites will be how residential housing density effects site participation. With the 12th and Holmes site, most of the residents live in multifamily buildings which significantly simplify site material collection. As the proposal is applied elsewhere, future sites will have to scale appropriately, so residents are not discouraged from participating due to the travel distance to the organic node sites.

REFLECTIONS

Working with Other Professions

To create a successful design this project required the collaboration with many professionals who are not within the design profession. This collaboration is significantly different that what one normally experiences it college, but it is hugely rewarding to see how working together each group can help to push a design much further than they would have been able to separately. To get the most out of the collaboration however, it was important to keep an open mind to suggestions even through they might completely change the expected design outcomes. In particular, I spent a significant amount of time in the fall working to develop an understanding of urban agriculture and temporary urbanism. Through the development of the project with local professionals, it was realized that the project would be better able to serve the city and engage the community by replacing much of the food based urban agriculture with tree production for the city. Moving from the preconceived idea that I had developed over the previous semester proved to be very difficult, but it the end, the final design solution is significantly more valuable as a design for Kansas City. Going forward this experience has made me much better prepared to enter the workforce where I will always be working with other professionals, land owners, and other stakeholders who each have their personal takes on the project. From my experience of being able to clear out my preconceptions on this project, I know that I will have a better time of being able to help work with these people to over come their preconceptions to help create better design that serve all parties.

Collaboration with Architects

Although KCDC did have five landscape architects represented in Kansas City during this project, most of the people we worked with through the development of the project where architects. Throughout the year, it was important to develop an ability to think and deconstruct problems from and architectural perspective. In many cases the difference in perspective was down to different ways of wording and describing the problem, but on occasion, thinking about a problem from an architectural perspective helped to shed light on new alternatives to solve problems. Even though I would not say that I have been move adopt a formalism philosophy to design, the experience has helped me to appreciated an apply other ways of thinking about design.

LITERATURE REVIEW

Andres Duany, and DPZ. 2011. Garden Cities. 2nd ed. The Prince's Foundation.

Andres Duany is a prolific author within the realm of urban agriculture and community gardening. In Garden Cities, Duany discusses the history of urban agriculture and the various types of urban agriculture typologies. Though the book looks at urban agriculture from a much higher, planning scale, the book provided key insights into how urban agriculture can be integrated into the urban environment.

April Phillips. 2013. Designing Urban Agriculture: A Complete Guide to the Planning, Design, Construction, Maintenance and Management of Edible Landscapes. Wiley.

April Phillis, RLA, FASLA, is the founder and principal of April Phillips Design located in San Francisco, specializing in urban ecology. Designing Urban agriculture is a comprehensive guide to designing and implementing urban agriculture across multiple a wide variety of situational conditions. The book includes histories of urban agriculture and its development and a framework through which to view the modern evolution and functions of urban agriculture installations. The book also contains detailed information for strategies for the design, community integration, management and construction of urban agriculture.

Brown, Sally, Eric Miltner, and Craig Cogger. 2012. "Carbon Sequestration Potential in Urban Soils." In Carbon Sequestration in Urban Ecosystems, edited by Rattan Lal and Bruce Augustin, 173–96. Springer Netherlands.

This source is from the section of a larger book about carbon sequestration in the urban ecosystems. The chapter discusses the effects of urbanization on soils,and how management of these soils can be used to sequester carbon. Importantly, this chapter discusses the ability to use composted food waste as well as other organic solids in urban soils for carbon sequestration.

Griffin, Mary, Jeffery Sobal, and Thomas A. Lyson. 2009. "An Analysis of a Community Food Waste Stream." Agriculture and Human Values 26 (1-2): 67–81.

This article was funded by the National Solid Waste Management Association, USDA and EPA to develop an understanding of the food waste stream in industrialized countries and its impact on the environment. This included detailed analysis of where organic food waste is generated, how it is disposed of, and suggestions and implications for the effects of food waste, recycling and consumer habits could effect decisions towards reducing food waste.

Maynard, Abigail A. 1999. "Reducing Fertilizer Costs with Leaf Compost." BioCycle 40 (4): 54–55.

Maynard through the Connecticut Agricultural Experiment Station looked to determine the ability of compost to improve soil quality. The experiment uses control groups, compost only, fertilizer only and both comport and fertilizer to determine the effectiveness of compost. From the resulting tests, it was found that compost can replace traditional fertilizers, but that a mixture of compost and fertilizer would produce the best result.

McKenzie-Mohr, Doug. 2011. Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing. Third Edition edition. New Society Publishers.

McKenzie-Mohr's book has been one of the primary resources for the [re]considered proposal, and it helped to frame the thinking and strategies for site, audience, design, and incentive development for the organic node on 12th and Holmes. Through the book, McKenzie explains how to help foster sustainable behavior in communities. He argues that changes can be achieved through purchasing habits, but that changes must be made through economic and community based engagement as education alone has little to no effect on behavior. The book concludes with way on turning good intention into action, building community support and how to speed the adoption of new sustainable behaviors.

Preston Sullivan. 2002. "Drought Resistant Soil." IP1698. Appropriate Technology Transfer for Rural Areas.

This is the primary source used for the calculation and justification of the stormwater benefits of compost for Kansas City. Preston Sullivan calculates that compost amended soils can hold 16,500 gallons of water/ hectare. The source recommends the use of compost to improve soil water retention primarily from the view point of minimizing the impact of drought, but for our purposes, this information is applied to address the need to reduce the runoff from stormwater.

Sánchez, Antoni, Adriana Artola, Xavier Font, Teresa Gea, Raquel Barrena, David Gabriel, Miguel Ángel Sánchez-Monedero, Asunción Roig, María Luz Cayuela, and Claudio Mondini. 2015. "Greenhouse Gas Emissions from Organic Waste Composting." Environmental Chemistry Letters 13 (3): 223–38.

The article is co-authored by a long list of experts in the field, and very specifically reviews the impact of composting on the environment from the formation of greenhouse gases. The article compares the effects of different processing methods, how the resulting greenhouse gases can be mitigated through simple biofilters, and final providing a life-cycle analysis of the processes across composting systems. Lastly, the article provides a list of best practices to minimize greenhouse gas emissions while composting. These conclusions where taken into consideration for the final system design and site design development.

APPENDIX A: WORKS CITED

About." 2015. Missouri Organic Recycling. http://www.missouriorganic.com/about/.

admin. 2015. "Keep Growing Detroit." Accessed December 17. http://detroitagriculture.net/.

Adrian Card, David Whiting, Carl Wilson, Dan Goldhamer, and Mary Small. 2016. "Organic Fertilizers." CMG Garden Notes, Yard and Genden Publications, , no. 234 (January). http://www.ext.colostate.edu/mg/Gardennotes/246.html#location.

April Phillips. 2013. Designing Urban Agriculture: A Complete Guide to the Planning, Design, Construction, Maintenance and Management of Edible Landscapes. Wiley.

"Average Weather For Kansas City, Missouri, USA - WeatherSpark." 2016. Accessed February 26. https://weatherspark.com/averages/30893/Kansas-City-Missouri-United-States.

Brown, Sally, Eric Miltner, and Craig Cogger. 2012. "Carbon Sequestration Potential in Urban Soils." In Carbon Sequestration in Urban Ecosystems, edited by Rattan Lal and Bruce Augustin, 173–96. Springer Netherlands. http://link.springer.com.er.lib.k-state.edu/chapter/10.1007/978-94-007-2366-5_9.

Conan, Michel. 1999. "Perspectives on Garden Histories." In Vernacular Gardens to a Social Anthropology of Gardening. Vol. 21. Dumbarton Oaks Colloquium on the History of Landscape Architecture. Dumbarton Oaks. http://www.doaks.org/resources/publications/doaks-online-publications/perspectives/perspec09.pdf/view.

Cynthia Mitchell, and Dennis Siders. 2009. "The 2008 Missouri Waste Composition Study." 031609. Missouri Department of Natural Resources. http://dnr.mo.gov/env/swmp/docs/wcs2008.pdf.

"Downtown Housing Report." 2014. Downtown Council.

Dr. James R. Fazi. n.d. "How Trees Can Retain Stormwater Runoff." Tree City USA Bulletin.

EPA. 1991. "Air Emissions from Municipal Solid Waste Landfills-Background Information for Proposed Standards and Guidelines." EPA-450/3-90-011a. Emission Standards Division. http://www3.epa.gov/ttn/atw/landfill/laurv1.pdf.

"Field Guide to Compost Use." 2001. Power Point.

Glenn Munroe. n.d. "Manual of On-Farm Vermicomposting and Vermiculture." Organic Agriculture Centre of Canada. http://oacc.info/DOCs/Vermiculture_FarmersManual_gm.pdf.

Gundersen, C, A Satoh, A Dewery, M Kato, and E Englhard. 2015. "Food Insecurity and Child Food Insecurity in America." Feeding America.

Henley, Lord, and Gregory Barker. 2011. "Anaerobic Digestion Strategy and Action Plan." PB 135 41. Department for Environment, Food and Rural Affairs. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69400/anaerobic-digestion-strat-action-plan.pdf.

Jean Bonhotal, Mary Schwarz, and Gary Feinland. 2011. "In-Vessel Composting Options for Medium-Scale Food Waste Generators." BioCycle. http://cwmi.css.cornell.edu/invesselcomposting.pdf.

Jerome Chou, Nevin Cohen, Agnieszka Gasparska, Ian Marvy, Rupal Sanghvi, and Rob Stephenson. 2016. "About the Project." Www.fiveboroughfarm.org. Accessed February 25.

https://www.google.com/maps/d/viewer?mid=z0bibiu_07Xs.kDynevzis9tA&hl=en.

Jerry Hatfield, and Thomas John Sauer. 2001. "Managing Soils to Achieve Greater Water Use Efficiency: A Review." ResearchGate Agronomy Journal 93 (March-April 2001): 11.

Kansas City. 2015. "Ordinance No. 150603."

Kansas City, Missouri Water Services Department. 2012. "Over Flow Control Program." 81001. City of Kanas City. https://www.kcwaterservices.org/wp-content/uploads/2013/04/Overflow_Control_Plan_Apri302012_FINAL.pdf.

KCDC 2015, Amanada Santoro, Andrew Rostek, Halima Shehu, Jeremy Knoll, Joel Savage, Jazmin Perez-Flores, et al. 2015. [re]considered. Edited by Vladimir Krstic, Jason Brody, and Sarah Kraly. KCDC.

Kristin Riott. 2016. "Street Trees," March 28.

Lisa McDaniel. 2016. "Compost Calculation Spread Sheet," March 28.

Long-Term Stewardship Unit. 2010. "East Village: Greyhound Bus Terminal (Former)." Missouri Department of Natural Resources.

Lydia Gibson. 2015.

Maynard, Abigail A. 1999. "Reducing Fertilizer Costs with Leaf Compost." BioCycle 40 (4): 54–55.

McMillan, Tracie. 2010. "5 Urban Farms Reshaping the Food World in New Orleans." The Atlantic, November 12. http://www.theatlantic.com/health/archive/2010/11/5-urban-farms-reshaping-the-food-world-in-new-orleans/66473/.

Mike Ewall. 2016. "Landfill Gas-to-Energy: Toxic and Bad for the Climate... Not Green or Renewable." Energy Justice Network. Accessed February 19. http://www.energyjustice.net/lfg/.

"Municipal Solid Waste in The United States: 1999 Facts and Figures." 2001. EPA530-R-01-014. Solid Waste and Emergency Response. EPA.

Oregon State University. n.d. "Green and Browns: Aerobic and Anarobic Composting." http://extension.oregonstate.edu/lincoln/sites/default/files/documents/aerobic_and_anaerobic_composting_-greens_and_browns.pdf.

Preston Sullivan. 2002. "Drought Resistant Soil." IP1698. Appropriate Technology Transfer for Rural Areas. https://attra.ncat.org/attra-pub/summaries/summary.php?pub=118.

Rabbitt, Alisha Coleman-Jensen Christian Gregory, Matthew. 2016. "USDA Economic Research Service - Key Statistics & Graphics." Food Security in the US. Accessed February 25. http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics.aspx.

Robert L. Spencer. 2007. "What's New – In-Vessel Composting « « BioCycle BioCycle." BioCycle 48 (5): 21.

Sánchez, Antoni, Adriana Artola, Xavier Font, Teresa Gea, Raquel Barrena, David Gabriel, Miguel Ángel Sánchez-Monedero, Asunción Roig, María Luz Cayuela, and Claudio Mondini. 2015. "Greenhouse Gas Emissions from Organic Waste Composting." Environmental Chemistry Letters 13 (3): 223–38. doi:10.1007/s10311-015-0507-5.

Savill, By Richard. 2009. "England's Oldest Allotments

Celebrate 200 Years." March 10. http://www.telegraph.co.uk/gardening/4967971/Englands-oldest-allotments-celebrate-200-years.html.

Senate Department for Urban Development and the Environment. 2015. "The History of Berlin's Urban Green Space Allotment Gardens." Accessed December 17. http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen/geschichte/en/kleingaerten/index.shtml.

"Urban Farming Invigorates Detroit Neighborhood." 2015. Detroit Free Press. Accessed December 17. http://archive.freep.com/article/20130520/NEWS01/305200021/urban-gardening-detroit.

US EPA, Climate Change Division. 2016. "Methane Emissions." Overviews & Factsheets,. Methane Emissions. Accessed February 11. http://www3.epa.gov/climatechange/ghgemissions/gases/ch4.html.

US EPA, Climate Change Division, and Leif Hockstad. 2015. "U.S. Greenhouse Gas Inventory Report." Reports & Assessments, EPA 430 - R - 15 - 004. http://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html.

Victory Gardens. 2015. Accessed December 17. http://archive.org/details/victory_garden.

WHO Media centre. 2014. "WHO | Dioxins and Their Effects on Human Health." WHO. June. http://www.who.int/mediacentre/factsheets/fs225/en/.

APPENDIX B: LIST OF FIGURES

CONCLUSIONS | 07