Integrating Re-Use of Abandoned Properties for Healthy Food Options in Trenton, New Jersey

Prepared by Rutgers Center for Urban Environmental Sustainability (CUES)
for Isles, Inc.

CUES
Center for Urban Environmental Sustainability

RUTGERS
School of Environmental and Biological Sciences

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Table of Contents

The data presented in this report are current as of August 2014. There may have been additional data processing since then, which may in turn lead to different analyses than presented herein.

Introduction

The City of Trenton, New Jersey (NJ) conducted a city-wide environmental health assessment in 2009, in which Trenton residents identified abandoned properties as their highest-priority concern. The Trenton Neighborhood Restoration Campaign (TNRC), a group of regional stakeholders which Isles, Inc. chairs, has joined with the City of Trenton to develop cost effective and creative strategies to address Trenton's vacant/abandoned (problem) properties. Isles has also identified the potential and demand for more local healthy food options and wants to strategically approach an expansion of food production by leveraging the City's existing efforts to revitalize Trenton. A unique opportunity exists to convert Trenton's problem properties to community assets through comprehensive municipal planning and redevelopment efforts focused on improving local food options. Specifically, Isles seeks to integrate food system planning with comprehensive municipal planning by creating strategies to redevelop some of the vacant and abandoned ("problem") properties for food-related reuse.

A 1999 study estimated that 18% (900 acres or 1.4 square miles) of Trenton's land area was vacant. Isles estimated there are over 900 vacant lots and more than 2,500 abandoned buildings in the City of Trenton.

It is believed that these numbers are a conservative estimate because the data were generated from inconsistent and piecemeal field survey efforts. Redeveloping even a small number of the problem properties to include food-related production, distribution or processing uses would expand healthy food options in a city with low supermarket access (two supermarkets serving a city of 80,000 residents), improve blighted neighborhoods, and support economic development in a city that desperately needs an expansion of its existing tax base and new job opportunities.

In order to integrate these vacant/abandoned properties into an expansion of Trenton's food and social networks, accurate surveys of existing food options and problem properties are needed. Based on City of Trenton data, the location, ownership, and in the case of the vacant/abandoned properties, the suitability for food production, must be determined. The field survey confirmed the status of existing food options, as well as identified problem properties. The vacant/abandoned property survey also identified problem properties that are not currently captured in the City of Trenton databases. The project activities (Geospatial research, database development, mapping, and community surveys) support Isles' program goals through collection of the baseline data necessary to plan for increased food-related land uses and the potential to strategically improve the existing community gardening program. This research will inform development of a Food System Master Plan Element for incorporation in Trenton's required 2015 Master Plan update.

Left: Vacant property before rehabilitation
Above and below: After rehabilitation, the property became a community garden that served a local food pantry.
Opposite: Artwork installed in a community garden

Vacant Property Survey and Suitability Modeling

Trenton, like many cities across the U.S., has long worked to address issues relating to property abandonment as well as food systems; this project seeks to join what may be two sides of the same coin. Over the spring and summer of 2014, faculty and students from the Rutgers University Center for Urban Environmental Sustainability (CUES) and the Department of Landscape Architecture partnered with Isles, Inc. to assess vacant properties and food access in Trenton, New Jersey. The purpose of the field survey was to 'ground-truth' and verify existing databases known to be incomplete.

This project emerged from the recognition that a supply of vacant and abandoned properties in Trenton exists, as well as a need to improve access to fresh, healthy food. Vacant lots and abandoned buildings dot Trenton's landscape, and in recent years community gardens have flourished as a way to provide residents with fresh produce while at the same time building community bonds. Looking towards a way to integrate these projects into a larger framework to address vacant properties and food access, the Rutgers Center for Urban Environmental Sustainability and the Department of Landscape Architecture have partnered with Isles, Inc. to survey each parcel in the city, create a database of vacant properties, and assess how and where individual properties and neighborhoods might be targeted to improve food access. Thinking in terms of food systems, we envisioned the possibilities of refurbishing vacant buildings and lots into a variety of food-related uses. Vacant lots are candidates for community gardens and urban farms, while vacant buildings could be repurposed into food processing, distribution, and retailing.

From the outset, however, questions began to shape the project design. How many actually vacant/abandoned properties—buildings and lots—are there, and where are they located? Which properties are the most suitable for redevelopment? What do residents and local stakeholders think about these issues, and how would they address problem properties and availability of healthy food options? Through the partnership between Isles and CUES, we designed a multi-part project that included faculty and students from Rutgers, staff from Isles, as well as community volunteers and stakeholders from Trenton.

Beginning in the 2014 spring semester, students in the Advanced Geomatics course developed and tested models using geographic information systems (GIS) to aide in identifying suitable locations for redevelopment. Following development of four models, during summer 2014, student interns, supported by community volunteers, surveyed over 30,000 parcels in Trenton to create a complete and updated database of vacant/abandoned properties. Once this property survey was completed, student interns updated the GIS models using the field-verified property database and completed further analysis to understand where clusters of vacant properties are located in relation to demographic and zoning data. During the field survey process, Rutgers graduate students conducted interviews with Isles' community gardeners and focus groups with Trenton residents, community gardeners, and teachers.

The property research phase of this project produced an updated record of 98.7 % of the 31,574 parcels in Trenton, recorded in the ESRI Shapefile format. This resulted in a count of 3,850 vacant buildings (versus existing database estimate of 2,457). The survey also identified 1,376 unused vacant lots. Full explanation of these results and the models developed are discussed below.

Note: There are 413 parcels missing descriptions. The project team, led by Iana Dikidjieva at Isles, is aware of this missing data, and has corrected the database to reflect them. The analysis in this report is based on 31,161 parcels that were categorized during field data collection.

Project Design

Four key factors guided the project design and were related to issues that we identified in the available existing property data. Previous estimates and records indicated thousands of vacant properties, but there were limitations in knowledge needed to take action. First, existing tax rolls were out of date and it was not known how many properties were actually vacant, or whether their current status is still the same as that listed. Second, existing data did not specify whether a parcel was a building, lot, or an existing green space such as community garden or park. For this project, which aims to integrate land use with food systems, knowing these details is important. Existing uses, such as community gardens, should not be considered "vacant" because they are already addressing the food needs in the community. Potential uses can be found for truly vacant properties, but it is useful to know which parcels are vacant lots or have buildings. Lots, for example, can be used as additional community gardens or urban farms, while vacant buildings can be used as food processing, storage, distribution, and retailing, as well as a range of other options such as job training and education. Third, property records in Trenton use the parcel as the unit of analysis. As we set out to assess the current status of properties, our data entry was to occur at the parcel level. Since an individual building or lot can be made up of multiple parcels, additional analysis is important to combine parcels into relevant properties so that accurate counts of vacant parcels can be obtained. In other words, one vacant building could be sitting on multiple parcels, and so although data collection recorded each of those parcels as vacant, the analysis combining those parcels into one entity would more accurately reflect that it was just one vacant building instead of multiple buildings on multiple parcels. In sum, we needed to survey all parcels in Trenton and develop suitability models to assess the property inventory.

Property Survey: Summer 2014

We conducted field surveys of all parcels in Trenton during June and July, 2014. Field data collection was led by Isles staff member Iana Dikidjieva. The survey teams were made up of 15 interns from CUES, supported by Isles' ability to drew on volunteers from school and community groups. The survey teams used geographic information systems (GIS) technology with mobile phones to classify each of the city's parcels. The data were synced with a cloud-based GIS and downloaded into database files. These files are used in the analysis below, and are available for future Isles projects. The field-verified vacant property data were then plugged into the Rutgers suitability models, which are also explained below. An extension of this data collection phase was data processing and analysis; in cases where multiple parcels comprised a property, we combined those parcels into one entity in the database.

GIS Modeling: Spring and Summer 2014

This part of the project began during the spring 2014 semester and continued after the field vacant property survey was completed at the end of the summer. During the spring 2014 semester, Rutgers students in the Department of Landscape Architecture Advanced Geomatics class developed GIS models that identified potential locations for food-related redevelopment. Luke Drake, instructor of the Advanced Geomatics course at Rutgers University and co-principal investigator on this project, incorporated the project as a service-learning component of the course. While honing advanced geomatic

techniques and learning project management, four student groups developed their final models. The objective of the group work was to create models that identified suitable vacant properties for redevelopment through proximity to various geographic criteria, such as schools, parks, public transportation, and existing food businesses. Throughout the semester, students read case studies and reports about food access in cities across the U.S., as well as in Trenton, in order to become familiar with prevalent issues and strategies. Staff members from Isles, Julia Taylor and Iana Dikidjieva, along with Dr. Beth Ravit, the Co-Director of CUES, gave presentations to the class about Trenton and the work of Isles, providing helpful context to students by discussing how their course project would result in a 'real-world' product that would be useful to Isles and the City of Trenton.

The 12 students were divided into four groups. Isles provided data from the City of Trenton; students also used data obtained through the course and their own research. As advanced students—this was their third course in a GIS sequence—they were given significant freedom to select criteria and adjust their models to reflect criteria they deemed most relevant. This phase was included in the project in order to develop methods that Isles and Trenton stakeholders might use to assess the suitability of vacant properties for redevelopment using data that is up to date. Once field-verified data was obtained through the field survey, as described in the next paragraph, these models were re-run.

Methods and Data: Vacant Property Survey

In the initial planning stages of the project, the original goal was simply to verify the existing record of vacant properties—whether the status of each property listed as vacant in the database had changed or not. It soon became clear that for Isles' long-term goals a full survey of all City of Trenton parcels would be more helpful, and contribute more to future projects; a full Trenton property survey would also make up for any incompleteness in the existing property records.

Iana Dikidjieva, a team of 15 interns from CUES, and community volunteers surveyed over 30,000 parcels in Trenton during June and July 2014. The objective of this part of the project was to complete a full survey of all parcels in the city to determine whether each one is occupied or vacant/abandoned. The survey was organized with attention to three components: training interns in visual identification of property characteristics, setting up a multi-platform GIS for data collection, and planning daily and weekly fieldwork protocols.

Further classification of vacant parcels was undertaken to describe vacant properties using a series of pre-determined characteristics (see table 1). Interns began their training on June 3 at Rutgers, where Luke Drake and Dr. Ravit introduced the project and its key goals, as well as reporting procedures. On June 4, the interns completed a one-day training at Isles. Iana Dikidjieva gave a presentation to introduce the various types of properties that interns would encounter during their fieldwork and to explain fieldwork procedures. This presentation concluded with an orientation to

the smartphone data collection system. Afterwards, the entire team traversed the neighborhood around the Isles office; as a group, they discussed how certain properties would be recorded and got first-hand experience entering data into the smartphones.

Fieldwork protocols followed a team-oriented data collection routine that covered Trenton's neighborhoods on a week-by-week basis. Each week, a community partner (e.g. YMCA, Carver Center) served as the "field base" for the survey team working in that partner's neighborhood. Surveyors reported each morning to the field base, where they checked out their smartphones, which were pre-loaded with parcel maps of that neighborhood. They returned for lunch and at the end of the day turned their phones in to the interns designated as the 'GIS specialists'. While in the field, the interns worked in teams of two or three, and two or three teams collaboratively canvassed street by street to systematically cover a neighborhood until each parcel was recorded. With multiple people on one team, one person would be responsible for data entry, but the team would decide how to classify each parcel. Teams worked alongside each other to reduce the risk of duplicate data entry—for instance, two teams would walk down either side of a street in the same direction at the same time.

For each parcel, teams entered one of the classifications in Table 1. The first level of classification was to determine the type of parcel. For each parcel that was recorded as a vacant building, lot, parking, or park, garden or cemetery, a second level of classifications were entered (Table 2). Depending on the type of parcel surveyors answered additional questions about the parcel—for example, whether a building was under construction, if there was dumping present, or if a lot appeared to be maintained. These were predominately yes/no questions, except for cases where choices were given (e.g. type of surface). Full descriptions of the standards that surveyors used in identifying these characteristics are provided in Appendix 1, Field Guide for Volunteers.

Interns train with smartphone system and through fieldwork to accurately identify property characteristics

Multi-Platform GIS Data Collection

The goal in data collection was to build a GIS database of properties and to collect data using mobile devices that could automatically update that database. Advances in both GIS and smartphone technology in recent years provided an affordable way to design such a system, but technical expertise in GIS was still needed to complete the project.

The solution that Isles identified was a multi-platform GIS. This began with map and geodatabase construction in ArcGIS Desktop software. Parcel maps were then uploaded to the cloud-based ArcGIS Online platform (AGOL). This part of the system serves as the link between desktop software and smartphones used by the surveyors. AGOL communicates with mobile devices to share maps and data, sending that information to all of the survey team members through a Wi-Fi or cellular connection. The data was entered by surveyors using smartphones with the ArcGIS Collector app. Interns scrolled through a map of the city to find their location, and tapped on each parcel to follow the set of prompts explained above. After entering data, the phones stored updated maps locally until syncing with AGOL; data stored online was downloaded to desktop software for final analysis. This data flow is shown on page 10.

The process was started by creating a geodatabase in ArcGIS Desktop, where each file geodatabase feature class represented each parcel type, as shown in Table 1. The names and attributes were based on parcel types, and fields had set responses based on the geodatabase domains; the technical details of this GIS programming are described in Appendix 2, GIS Methodology. It was necessary to set up a geodatabase in this way in order to program the series of menus that surveyors saw on their smartphones. The ArcGIS Collector app displayed sequential menus for primary and secondary data input (Tables 1 and 2). In short, the database configuration created in GIS desktop software provided some automation in data input for surveyors. This way, interns were not required to have GIS knowledge but only had to be familiar with smartphone apps in general (i.e., how to tap, scroll, and enter text).

By the numbers

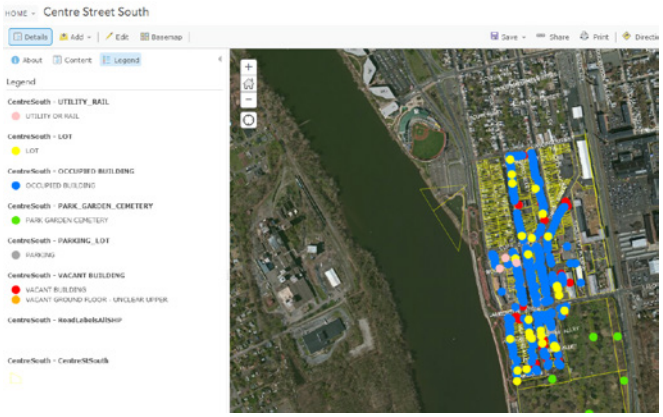
14 Student interns
9 Smartphones
7 weeks of data collection
31,161 parcels surveyed

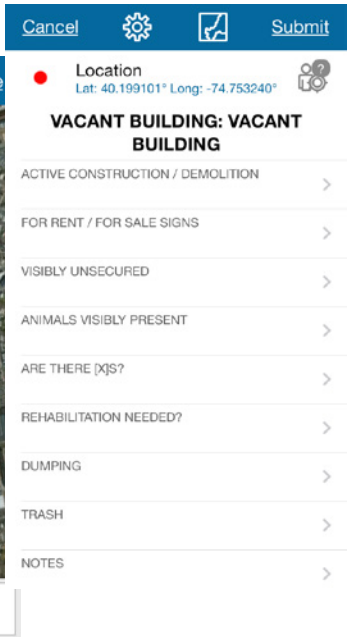
Table 1. Types of parcels

Table 1: Types of parcels
Parking lot
Park, garden, or cemetery
Occupied building
Lot
Utility

Table 2. Secondary data input for certain types of parcels; yes/no responses or multiple choice.			
Vacant Building/Vacant Lower, Unclear upper	**Lot**	**Parking**	**Park, Garden, or Cemetery**
Under construction	Earth or paved surface	Earth or paved surface	Dumping present
For rent or for sale	Dumping present	Dumping present	Trash accumulation
Entrance unsecured	Trash accumulation	Trash accumulation	Maintained
Fire dept. X present	Maintained		
Needs rehabilitation	Weeds present		
Dumping present			
Trash accumulation			

Top to bottom: Desktop GIS; Web GIS; Smartphone GIS and data collection





Survey teams were assigned neighborhoods for data collection, and neighborhood parcel maps were created in ArcGIS Desktop and loaded into AGOL and Collector as teams went through each neighborhood. This divided the city's parcels into manageable sections; the teams had a known goal each week, and the maps and data were small enough to be processed quickly in the GIS software. After uploading to AGOL, Isles staff and CUES interns configured maps to the display settings that interns would see on their phones in Collector. In Collector, for example, when a surveyor tapped on the map, a pop-up window would show information and allow data entry. This pop-up window was configured in AGOL so that background information such as streets and parcel attributes did not appear. Next, the geodatabase domains were set as the only editable layer; the default setting in AGOL is to allow editing of all layers. Since the surveyors only needed to enter data for the geodatabase and not for the parcels themselves, or the street data, this was a necessary step to prevent errors and data failure.

Each smartphone was synchronized with the ArcGIS Online map; neighborhood maps were downloaded from the cloud to the phone. At the start of each day, phones were checked out to surveyors, who entered data for their assigned streets. At the end of the day, surveyors turned in their phones and the GIS team downloaded the data from the phones to AGOL. These data were then downloaded as shapefiles to ArcGIS Desktop.

Once the entire city's parcels had been mapped, the next step was to create one file that contained each parcel as rows and the parcel characteristics as columns. Since the geodatabase fields resulted in separate files during data collection (e.g., parcel type, trash, dumping, weeds, etc.), each of these attributes was spatially joined to the parcel layer. This process is explained in more detail in Appendix 2.

Reconciling Vacant Parcels and Vacant Buildings

Determining the accurate number of vacant buildings requires additional processing from our data model that is based on parcels. Extrapolating the number of vacant buildings from the parcel data is not straightforward for two reasons. First, parcel-level data is not the most accurate way to count vacant buildings because often one single unit structure, such as a warehouse or single-family home, can sit on multiple parcels. The vacant warehouse shown below, for example, is made of two separate parcels. Since data collection was parcel-based, we would overcount the number of vacant buildings simply by adding up the number of vacant parcels. To address this issue, further processing in ArcGIS Desktop was needed to merge certain parcel features together. To address this issue, the GIS interns combined contiguous parcels that were classified as vacant buildings if they were under the same "leadlot" owner. This process was not done for contiguous vacant lots with the same owner, because those parcels can be sold individually whereas the building parcels cannot.

Example of one property covering multiple parcels.

Second, multi-family housing such as duplexes and townhouses present challenges in counting vacant buildings because there are multiple residences within one structure. In those buildings, multiple parcels refer to separate units in one building. While some parcels may be vacant, others may be occupied. Although we can consider individual units to be vacant we cannot say that about the entire building, for example in the duplex shown below.

Multiple properties can take up one building.

Quality Control

Actions were taken throughout data collection and analysis to reduce errors and assure quality control. Interns went through training to identify parcel characteristics, and the first few days they worked closely with Isles staff to correctly record attributes. Once they became comfortable with identifying those characteristics, survey teams worked more independently from Isles staff but still worked in teams so that they could make collective decisions about a site's status. During data collection, surveyors were assigned a specific set of parcels, as described above, so that parcels would not be recorded more than once. If any duplicates were discovered during data processing, and if those entries had conflicting data, teams were dispatched to check those parcels again for final recording.

After data collection, the GIS interns recorded each day's work by labeling file names with dates and locations as they combined daily surveys together to form a master file of the entire city. During data analysis, we discovered some parcels had been incorrectly categorized. For instance, one parcel that is in a city park was classified as a vacant lot, and some of the community gardens in the Isles Garden Support Network were recorded as vacant lots instead of park/garden/cemetery. In order to get an approximate measure of the errors in data collection, we randomly selected 300 parcels that had been recorded as vacant lots in order to verify whether those parcels were vacant, or if they were buildings, parks, community gardens, or other land uses. Given time limitations to inspect each parcel in person, we instead compared them to images in Google Maps Street View (2013 images). Because this imagery is a year older than our survey, there could have been changes since the image was captured. Therefore, we did not check each attribute, only whether vacant lots appeared to be other land uses. Out of the 300 parcels that have been checked, 7% (21 parcels) may have been incorrectly recorded. However, since this check employed digital images that were a year old, we recommend that a parcel should be re-inspected in person before any decisions regarding repurposing are made.

Findings: Property Survey

Data Completion

The property survey updated records for 31,161 out of the 31,574 parcels in Trenton in the ESRI Shapefile format. This means that 31,161 parcels have been designated with one of the categories in Table 1. While these categories provide some basic analysis of the data, more complex understanding of vacant properties comes by examining the attributes listed in Table 2. For example, vacant lots can be given attributes of either "maintained" or "unmaintained," which means that some vacant lots are already currently in use as green space. Although each surveyor was trained to enter all data prompts that were provided (see methods above referring to Tables 1 and 2), not all of the attributes were entered. Table 3 presents the types of data and its levels of completeness.

Table 3: Data completion rates		
Total Parcels in Database	31,574	
Surveyed Parcels with "Parcel Type" designation (Table 1)	31,161	98.7% completion rate
Surveyed Parcels with land use clarification (see "Use and Occupancy," below)	30,790	97.5%
Surveyed Parcels with full designation of attributes (Tables 1 and 2)	29,307	92.8 %

Use and Occupancy

Since this project is rooted in a concern for improving the well-being of Trenton's residents by repurposing vacant properties into healthy food options, it is important to bear in mind the existing property uses. Therefore, we have made an effort to record existing land uses that serve residents' well-being. One way we have done this is by classifying community gardens in the same category as parks so that they are not seen as vacant and available for repurposing. Secondly, we aimed to be value-neutral in our judgment of vacant lots, simply by defining them as parcels without buildings or any of the other categories in Table 1 (e.g. community garden, utility, etc.).

"Vacant lot," however, is normally a loaded term, and for many individuals and organizations it means blight. In our survey we encountered parcels like these, but we also found parcels that, by definition, were vacant lots, but that were also well-maintained and obviously in use. These parcels are defined in this study as "maintained vacant lots," and serve as green and social space for residents and workers. Quite often, these parcels are used as yards for adjacent buildings, and so when viewed from the street do not appear to be vacant. As shown in the image below, the lawn on the right side of the image is actually a separate parcel, even though it is in practice used as part of the building on the left side and has the same owner. Therefore, we consider maintained vacant lots separately from unmaintained vacant lots in terms of recommending repurposing for healthy food options.

Land use clarification, then, is provided by a combination of the categories in Table 1, but completed with further specifying if vacant lots are maintained.

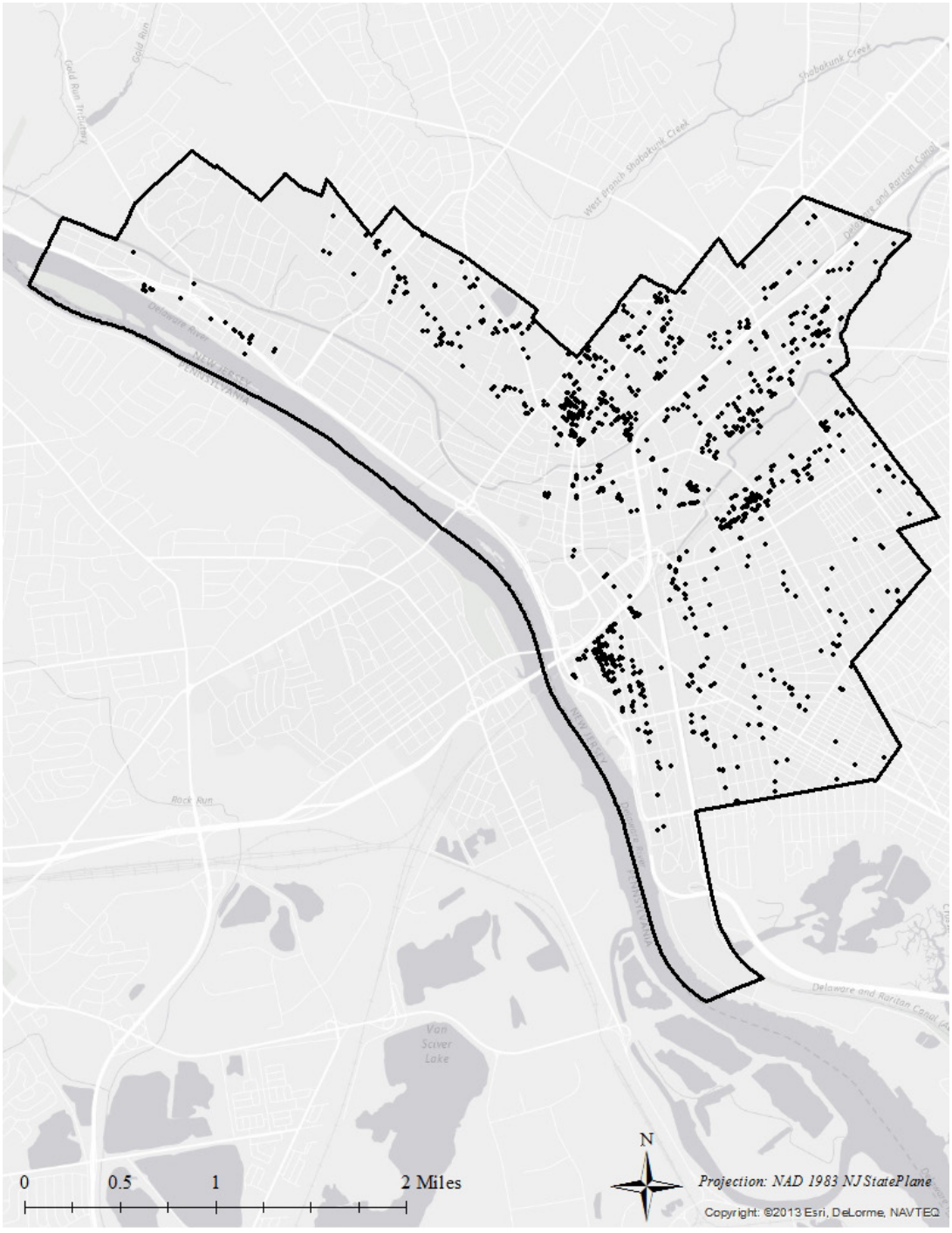
Considering occupied buildings, community gardens, parks, maintained vacant lots, and other existing uses in Table 1, the majority of Trenton's parcels are occupied or currently used for food production and green space. 82%, or 25,329, of the 31,161 parcels with land use clarification, in Trenton are currently in use. Map 1 on page 15 shows currently occupied parcels.

The lawn on the right side of the image is legally a "vacant lot" because it stands as a separate parcel with no structure.

Map 1: Occupied and vacant parcels in Trenton

Vacancy

Approximately 4.5% of the parcels in the City of Trenton (1,376) were recorded as unmaintained vacant lots (Map 2). The survey also identified 3,850 vacant buildings (Map 3). To tabulate the number of buildings, we had to combine a subset of the parcels together. Because multiple parcels may or may not contain individual buildings, additional analysis was done to combine multiple parcels into single units to accurately reflect the number of unoccupied buildings.

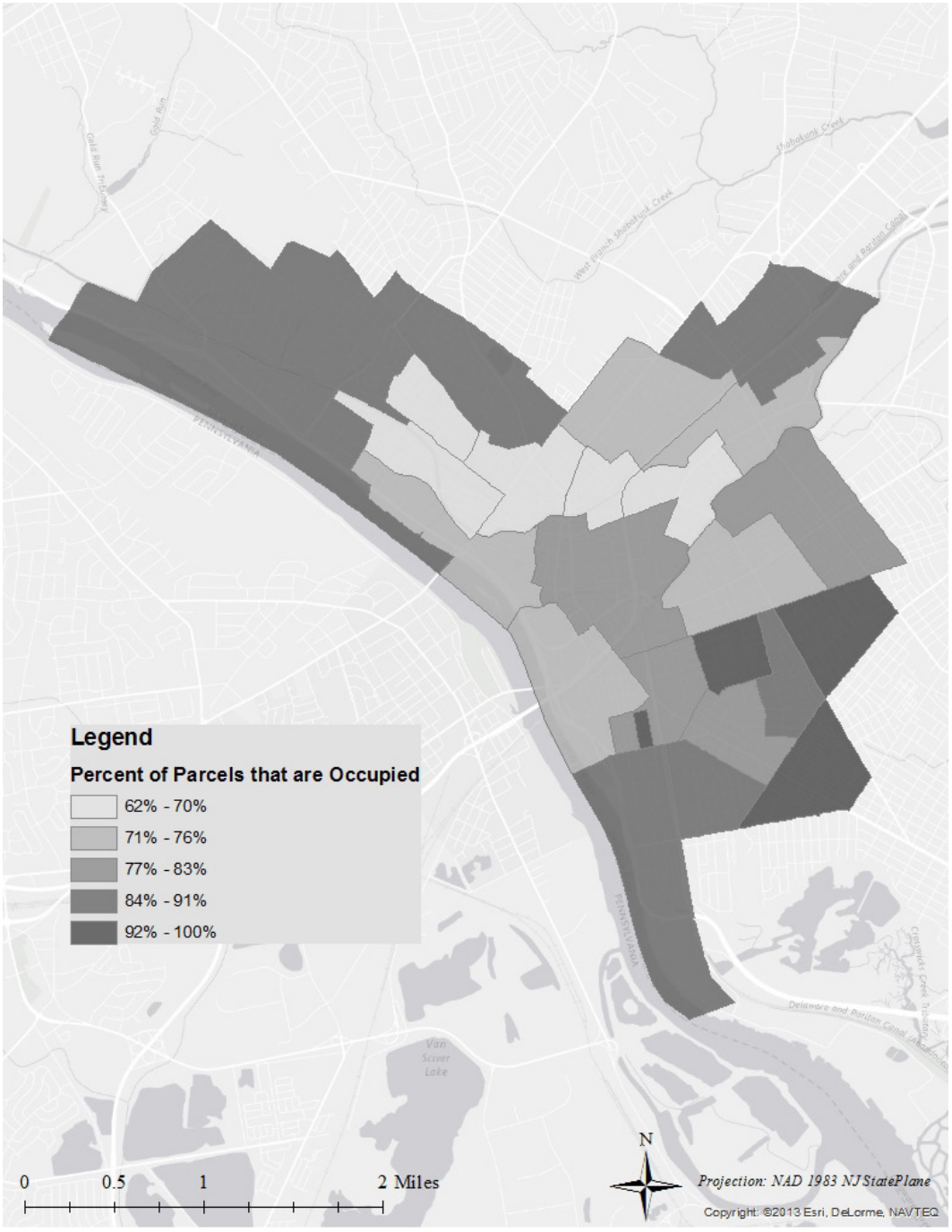


Map 2: Unmaintained vacant lots

Map 3: Vacant buildings

Percent of Occupied and Vacant Parcels by Census Tract

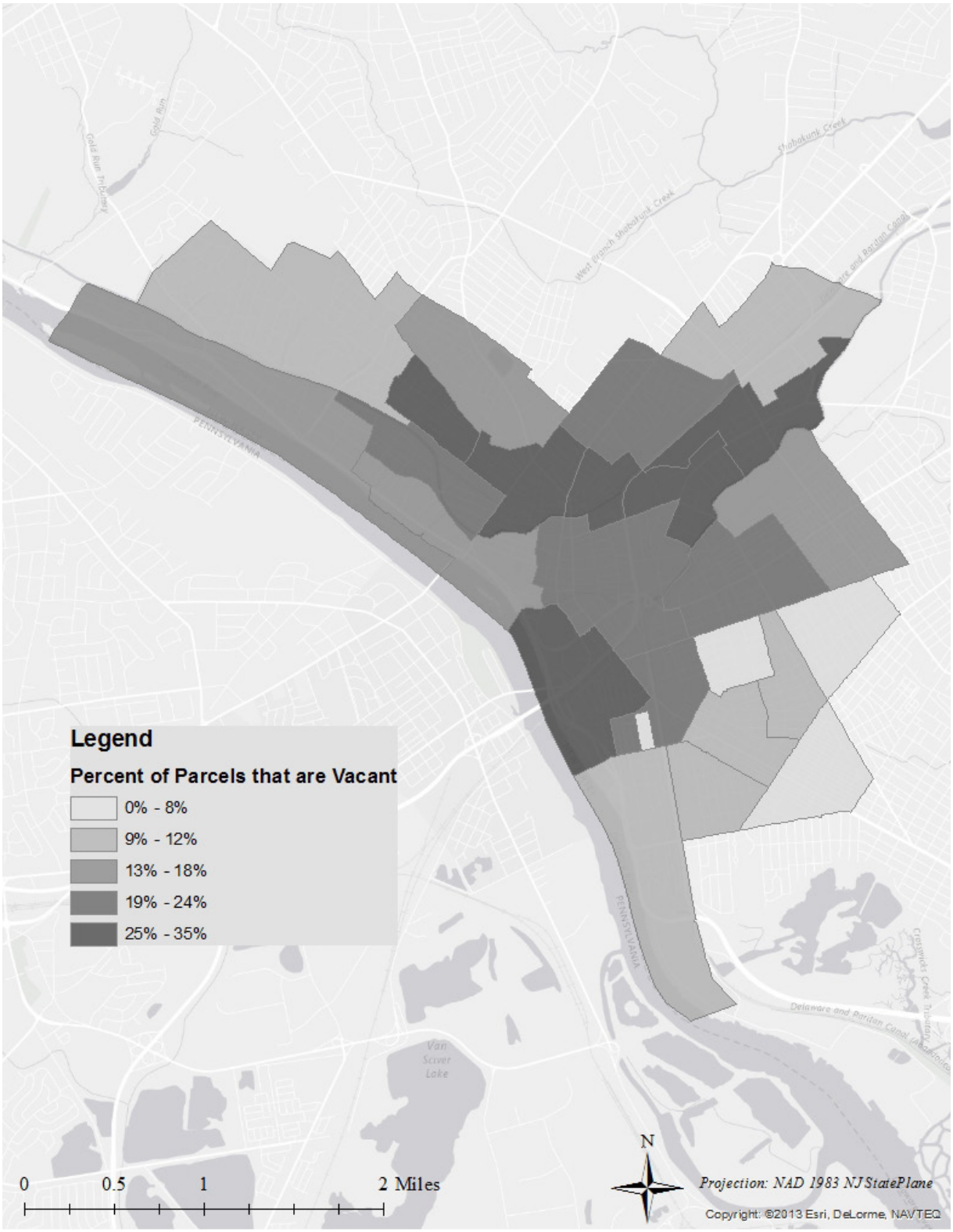
Although the above figures show the exact locations of occupied and vacant lots and buildings, it helps provide a deeper understanding by looking at the occupancy and vacancy rates across the city. This way, we are better able to gauge which areas have more or less concentrations of vacant properties. Map 4 shows the proportion of occupied parcels in each census tract in the City of Trenton. Occupancy is well-distributed across the city, and even in the census tracts with the lowest occupancy rates nearly two-thirds of the parcels are in use.



Map 4: Percent of parcels in each census tract that are occupied

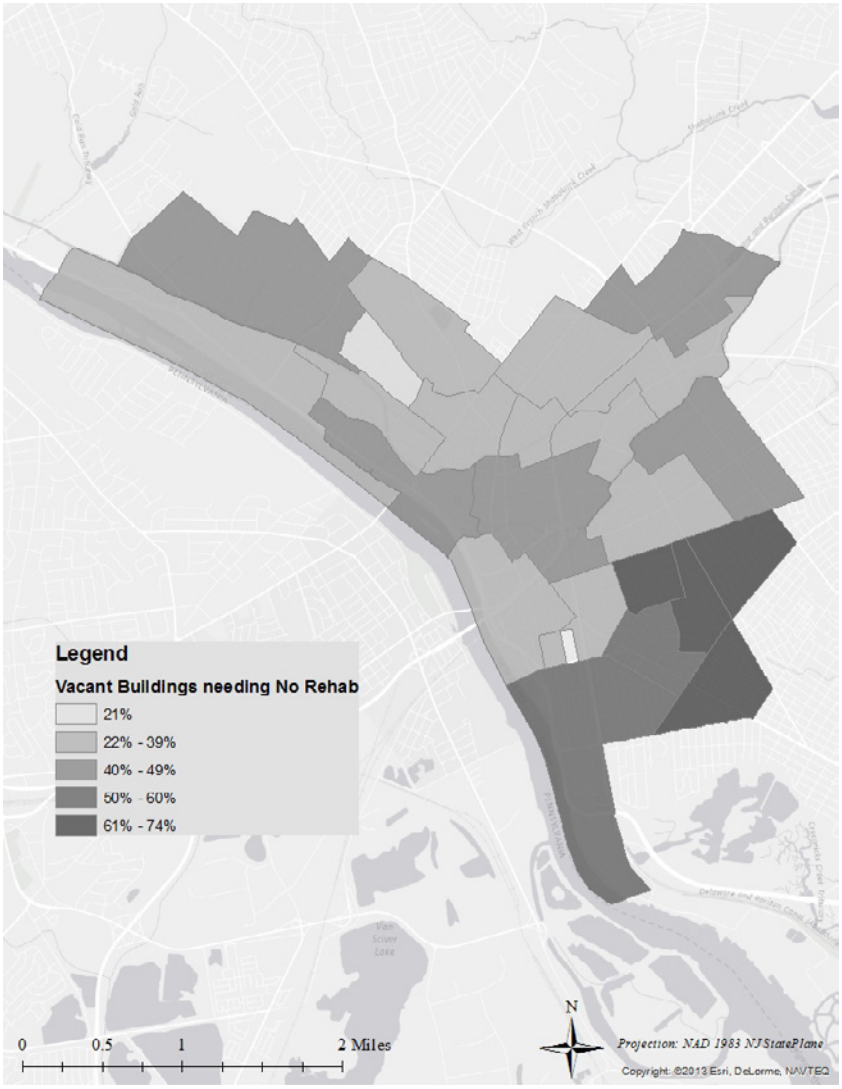
Map 5 (opposite): Percent of parcels in each census tract that are vacant

Vacancy rates in each census tract show the inverse of those data. Map 5 shows the percent of parcels in each census tract that are recorded as vacant buildings and unmaintained vacant lots.



Rehabilitation

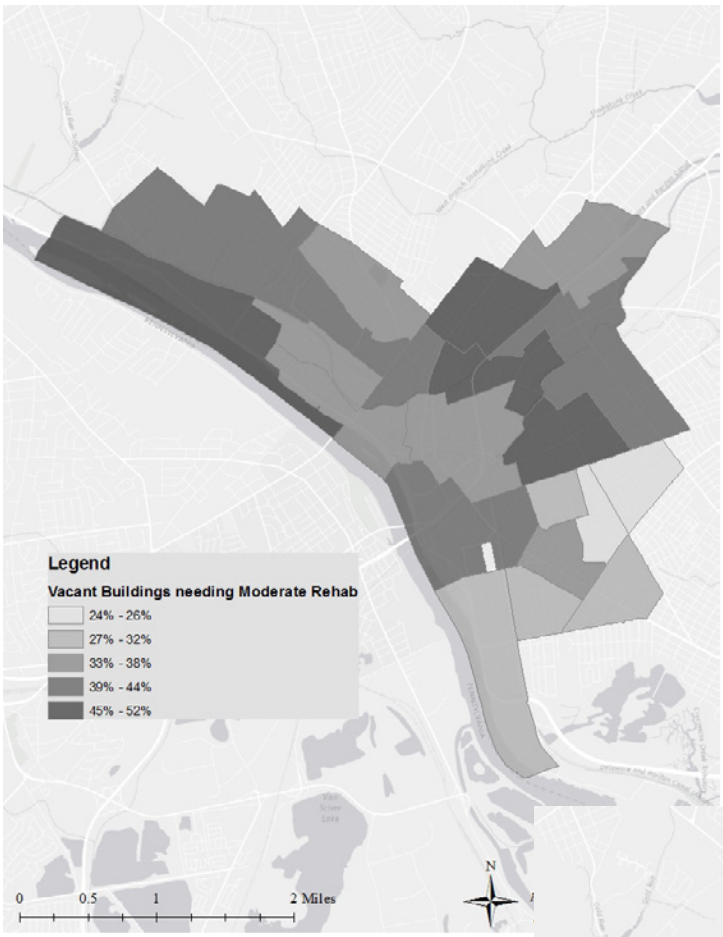
Survey teams recorded a number of attributes for vacant buildings (see Table 2), one of which was an observation of the structural condition of the building. Teams entered whether the vacant building needed no, moderate, or significant rehabilitation. Out of the 4,085 parcels marked "vacant building" or "vacant lower, unknown upper," there are 4,038 parcels with rehabilitation attributes (note: this is not the actual number of vacant buildings).



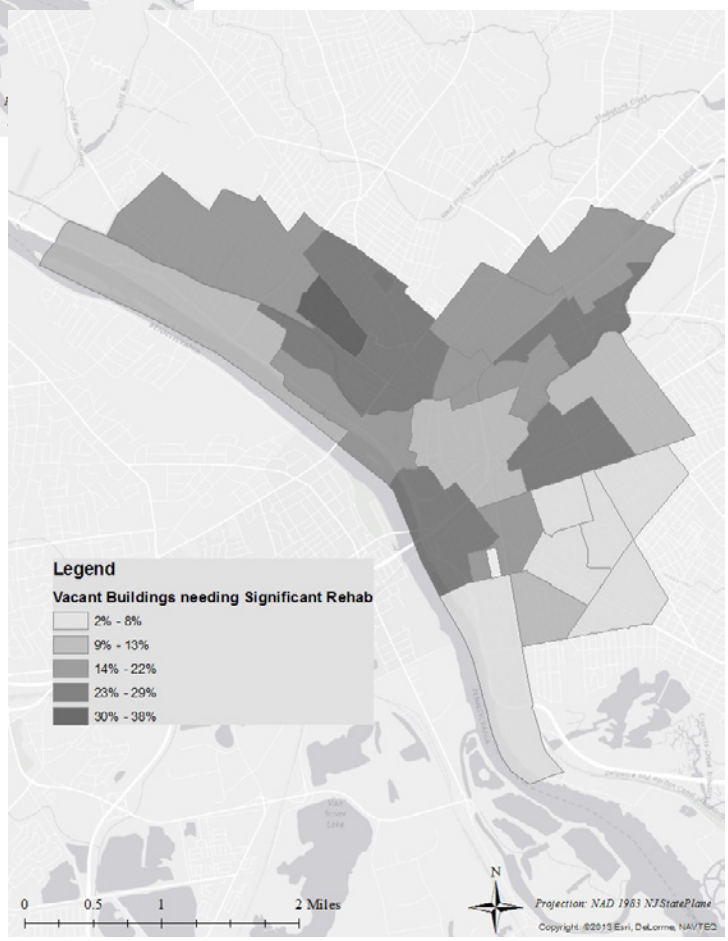
Map 6: Vacant buildings needing no rehabilitation

Most (81%) of these parcels reference buildings that need little or no rehabilitation—42% did not visually appear to require rehabilitation, and 39% appeared to be in need of moderate rehabilitation. 19% obviously needed significant rehabilitation.

The southeastern parts of Trenton have the highest concentrations of vacant buildings needing no rehabilitation, as shown in Map 6. Vacant buildings needing moderate or significant rehabilitation are distributed across the rest of the city, as shown in Maps 7 and 8.



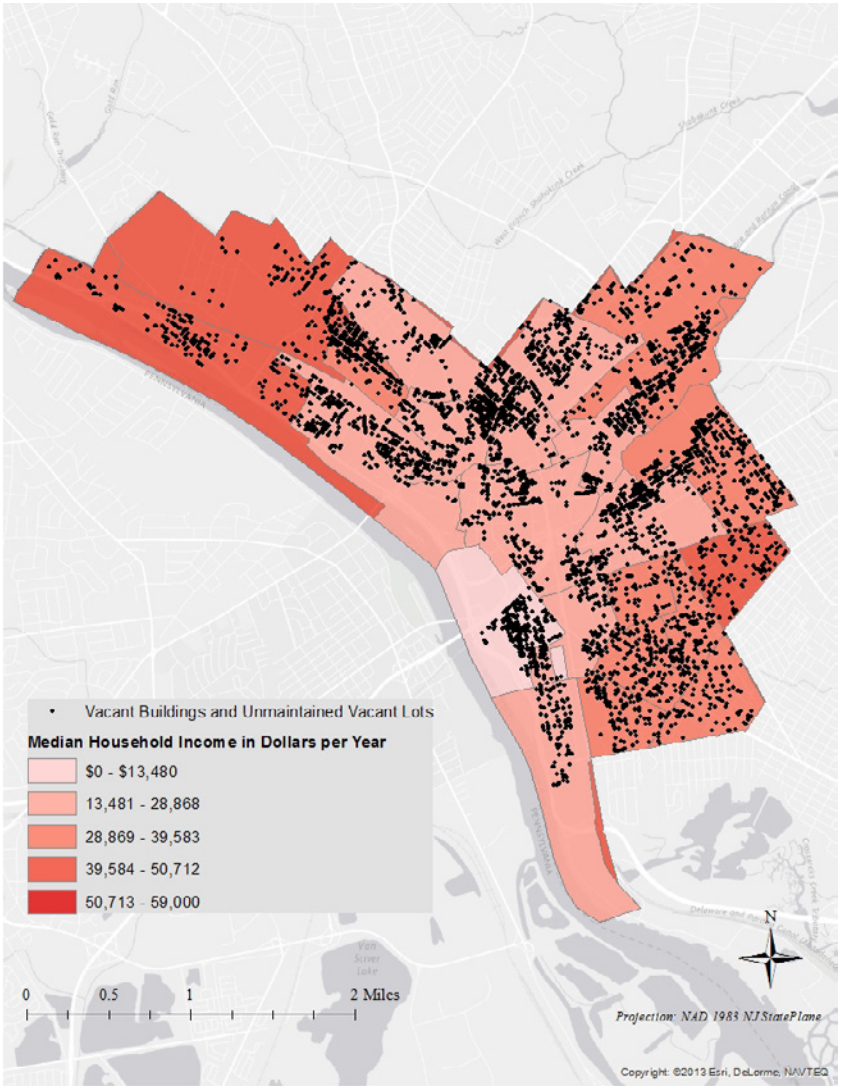
Map 7: Vacant buildings needing moderate rehabilitation



Map 7: Vacant buildings needing significant rehabilitation

Analysis: Property Survey

Vacant properties (both lots and buildings) can be compared with key census data, such as income and other community descriptors. Map 8 overlays median household income with vacant properties (lots and buildings). Vacancies are clustered in the Battle Monument to Stuyvesant/ Prospect area, although they are not the lowest income areas in the city, and share similar incomes with many other tracts. There are also concentrations of vacant buildings in Wilbur and Chambersburg, which have higher incomes. The highest Trenton incomes are in the Hiltonia and Cadwalader Park areas, which also have the lowest concentrations of vacant properties. The census tract containing Glen Afton and Parkside also have moderately high incomes, but these sections also have more vacant buildings than other higher-income areas.



Map 8: Locations of vacant properties and income by census tract

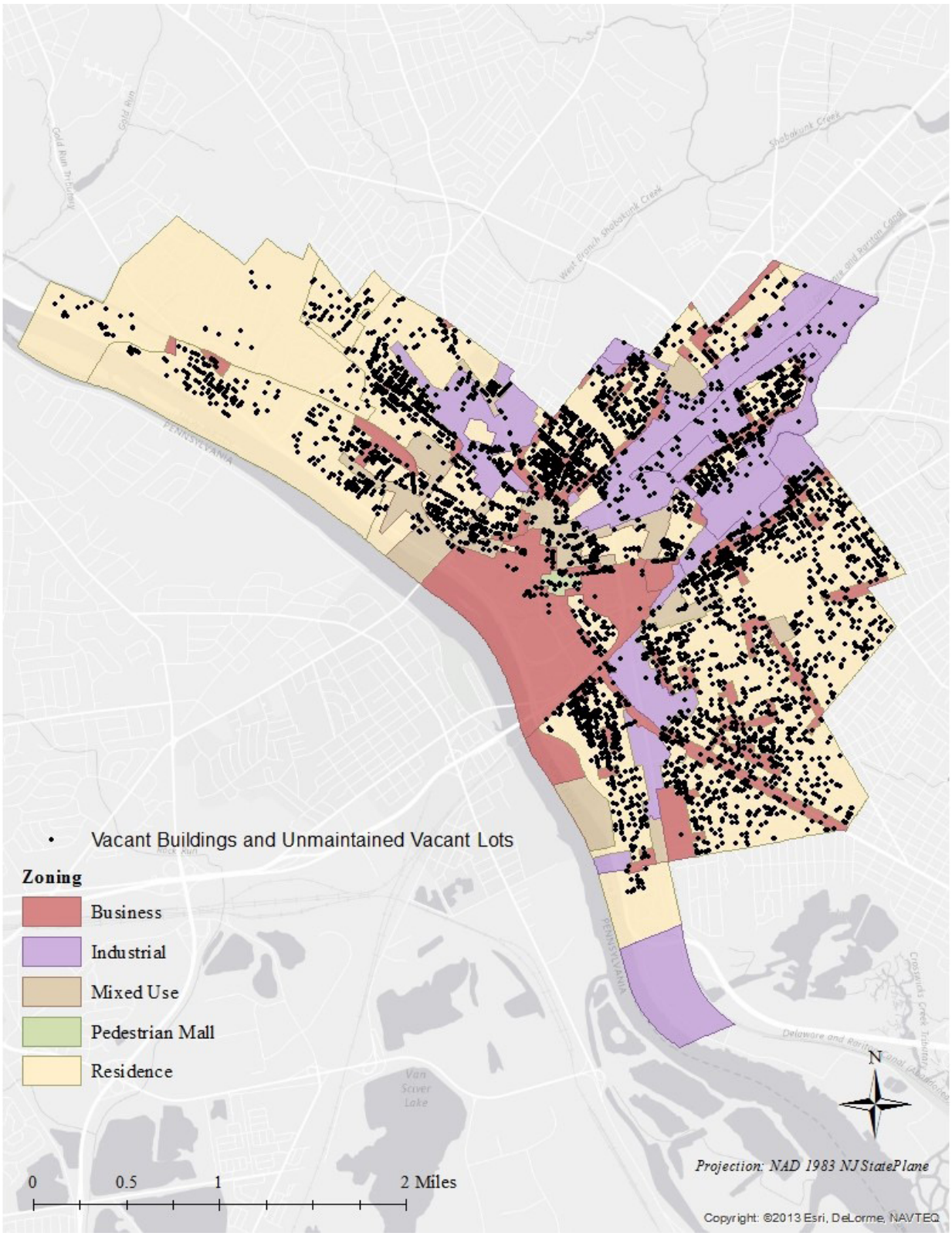
Redevelopment objectives can be shaped by zoning, and so it is important to note how many vacant properties are in each zoning classification. Using the zoning shapefile and categories provided by the City of Trenton, we identified the numbers of vacant lots and buildings in each zone, shown in Table 3.

The majority of vacant properties are in residential areas—62% of the vacant lots and 75% of the vacant buildings. Thus, the greatest opportunities for repurposing are in the residential areas. Since community gardens are well-suited for residential areas such gardens may be an attractive option for using available vacant lots. In terms of re-purposing vacant buildings for business development, such as food processing, distributing, and retailing, however, these opportunities are narrowed slightly by the lower supply of vacant properties in business, industrial, and mixed-use areas. Still, there are over 1,400 vacant lots and buildings in these three zones that could be used as commercial farms or food-related businesses. See Map 9 on page 24 for a zoning map with an overlay of vacant properties.

Many of the vacant properties are in residential zones. If prioritizing food-related businesses in business and industrial zones, they may be far away from people in residential areas. However, there are some parts of the city where business and residential are intermixed such as Stuyvesant/ Prospect. Vacant properties that are business and industrial zones, and are also in close proximity to residential areas, may offer great benefits in terms of developing food-related businesses. These sites would be close to potential employees and consumers.

Table 3. Vacant Properties by City of Trenton Zoning Category

Zone	Unmaintained Vacant Lots	Vacant Buildings	Total
Business	238	580	818
Industrial	205	196	401
Mixed Use	51	177	228
Pedestrian Mall	0	17	17
Residence	815	2,880	3,695
Total	*1,309*	*3,850*	*5,159*



Map 9: Locations of vacant properties and planning zones

Methods and Data: GIS Modeling

A database of occupied and vacant properties will be a great resource for Isles and the City of Trenton, but given the number of potential sites a deeper analysis can help identify areas to target for repurposing. Since the overall project goal is to integrate vacant properties with food systems, the next step is to understand of how the neighborhood contexts may influence how vacant properties may be best reused. To this end, GIS analysis can help identify suitable properties based on their spatial relationships to food system factors, such as access to transportation and existing food outlets. To demonstrate the power of GIS analysis, we created GIS models that compare the locations of vacant properties to various sets of criteria in order to identify specific properties and neighborhoods to potentially target food system efforts.

We strongly emphasize that the models presented in this report are first and foremost illustrations of how modeling works—they are not necessarily concrete recommendations of sites to repurpose. To be most effective, this type of modeling requires intimate knowledge of the issues affecting food access in Trenton. The CUES research team worked from best practices in the literature related to urban food security, and we recognized the themes of transportation, safety, and soil contamination, among others, in the criteria we used to identify suitable sites. The model output however, is a guide rather than prescriptive, and Isles and partners in the City of Trenton should carefully select criteria that they understand will best reflect the needs of Trenton's residents. The analysis below should be seen as an example of GIS modeling and a lesson that careful deliberation in selecting model criteria is needed. As we show, three models resulted in three very different outputs.

This part of the project began in the Rutgers University Department of Landscape Architecture Spring 2014 Advanced Geomatics course, where students devoted their group projects to developing suitability models for redeveloping vacant properties into food-related uses. Suitability analysis is a method in geographic information systems (GIS) which uses the locations of certain criteria to identify the most suitable locations for an object of interest. In this case, the objective was to identify the most suitable vacant properties for food-related redevelopment. Through a series of readings on urban planning and food systems, as well as guest presentations by Isles staff, students learned about some ways that cities are addressing these issues, such as community gardens, urban farms, and small business incubation; they also learned about the spatial contexts such as childhood obesity, access to public transportation, and the existing food landscape. Their assignment started from the following question: out of all the vacant properties in Trenton, which ones are most suitable for integration into the food system? Through class discussions we raised certain points that students then considered as criteria—should proposed sites be near schools to encourage healthy eating for children? Should they be near or far away from existing food businesses? What distances should be considered? When considering multiple criteria, do they all have equal importance or are some more important than others?

Students used the ModelBuilder feature in ArcGIS software to address these questions. Criteria were selected that would reduce the number of vacant properties to those that could best address the needs of the city, based on the selected criteria. Each group drew on data about social, natural, and built environments to use as criteria in their models. Using City

of Trenton data provided by Isles, along with data procured through the course, the four student groups developed four different models. Three of the four groups focused more on social factors such as proximity to schools and public transportation, and the fourth group focused on environmental data. Model outputs provide different scenarios that illustrate how different criteria selection and weighting produce different model results.

From the outset, however, the students worked to deliver not just the final outputs but also their actual models so that Isles staff can edit and revise the models for future use. Thus, the deliverables are four sets of model outputs and also the models themselves. These are stored in the form of ModelBuilder scripts for use in ArcGIS Desktop software. In the future, criteria can be added, deleted, or modified based on the working knowledge of Isles staff about the needs of Trenton. In sum, while the model outputs discussed here provide some insights into which neighborhoods might be best targeted, they were made with the assumption that Isles staff can further revise the models given their knowledge of the city and/or changing future conditions.

These models were run during the course using the existing database of vacant properties. After the field property survey was completed (see next section), the models were rerun with updated data. The model outputs discussed here reflect the field verified data describing the current state of vacant properties in Trenton. In addition, our interns edited the models in order to improve efficiency and correct any errors that occurred during the coursework portion of the project.

Scene from Gandhi Garden, built by SAGE Coalition with assistance from Isles, Inc.

Analysis: GIS Modeling

In addition to creating maps illustrating the results of the field survey, we also reran the original class models using the field-verified data.

Model 1: Social and Transportation

The first model included the following criteria: proximity to public transit stops and parking lots, population density, redevelopment areas, and proximity to community gathering points such as schools, and parks. The model used a suitability score that combines these criteria, which are individually weighted to reflect the importance given to each factor. This equation is shown at the bottom of the page.

The rationale for this model:

A weight factor of 4 was given to proximity to transit stops since Isles feels strongly about transportation to healthy food being an issue – because resident ownership of automobiles is quite low, and public transportation may be influencing the shopping choices of Trenton residents. A weight factor of 3 was given to redevelopment areas and areas with a higher population density because of the potential for ease of project completion within a redevelopment area and a potentially large customer base. Existing healthy food businesses were included in an effort to build clusters of healthy food options. Food businesses were given a weight factor of 2 because we did not feel it was as important as population density or redevelopment areas but more important than the remaining criteria.

Schools, parks, and parking lots were given a weight of 1 because it is not known how many individuals travel to schools to drop off or pick up children. Children may walk home or take a bus so providing healthy food options at these locations would not prove to be any more advantageous than other locations. If residents are going to parks they may not want to have to walk further throughout the city to buy healthy food or interrupt their leisure activities by running errands. Parking lots received no weighted value either due to street parking throughout the city and the fact that Isles believes transportation to healthy food options is a large obstacle.

Model 1 identified 1,319 vacant properties that are most suitable for food-related redevelopment, as shown on page 28.

Suitability score (Model 1)=
(4*Transit score)+(3*Redevelopment areas score)
+(3*Population density score)+(2*Food business score)
+(Proximity to schools score)+(Proximity to parks score)
+(Proximity to parking lots score)

Potential Locations of Healthy Food Options - Model #1

Model 2: Access + Safety

This model used several social criteria, which focused on access to the sites and on the safety of the areas in which sites are located. These criteria are crime, population density, distance to schools and bus stops, and existing grocery stores. The assumptions in choosing these criteria are as follows:

Population: Proposed sites would potentially be more successful in a densely populated areas versus sparsely populated areas. It was assumed that when higher numbers of people are present, there will be a higher probability that the proposed sites will be visible, maintained and protected by the majority of the community members.

Crime: In order to find the safe zones in a community, areas with high crime were detected and eliminated as possible locations for a suitable sites. An area with low crime is important in order for the residents to feel safe and comfortable while visiting a sites. Also, with lower crime areas there may be less theft and crops are not as likely to be stolen as opposed to areas with high crime rates.

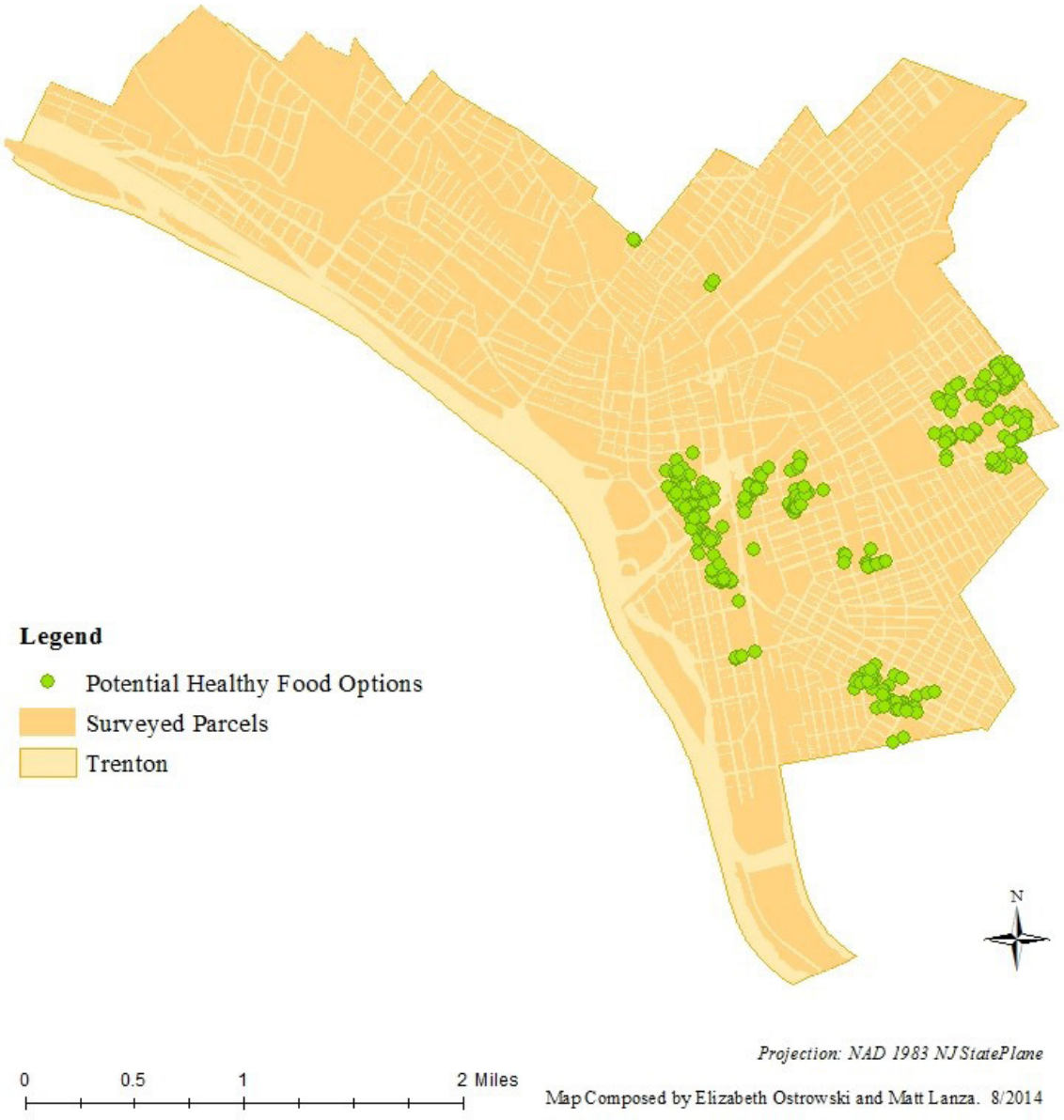
Schools: Healthy food option within close proximity to schools might be beneficial. For instance, having fresh food near schools could help introduce students and their families to the benefits of community gardens. Local Trenton after-school activities or community service programs might involve students with maintaining community gardens, for example, giving them hands-on experience and exposing them to agricultural science concepts. It was assumed that students in lower grade levels are too young to help maintain community gardens, and so the grade levels chosen as criteria in the model were middle and high schools.

Transportation: It was assumed that healthy food option within close proximity to bus stops would provide easier access. If food sources are not within a walkable distance, it is less likely that people will want to go to them. It was assumed that trains are primarily a means of commuter transportation for people going into or out of Trenton for a specific destination and so these routes were not included in the analysis. The primary means of transportation within Trenton was assumed to be buses, and so locations of bus stops was a significant criteria considered for the suitability analysis of this model.

Healthy food store locations: In contrast to Model 1, Model 2 prioritized areas that were farther away from existing healthy food options in order to distribute them more evenly across the city. To determine areas within Trenton that are not in close proximity to healthy food options, the addresses of food stores that sell healthy food (supermarkets/grocery stores) were obtained. These addresses were then geocoded and a kernel density analysis performed, followed by a reclassification. The reclassification inverted the values of the surface density so that areas with stores that sell healthy food received a lower score. Conversely, the higher ranked areas are lacking in stores that sell healthy food options.

Results of Model 2 are shown on page 30.

Potential Locations for Healthy Food Options - Model #2



Model 3: Environmental factors for community gardens

The third model employed criteria based on environmental data to identify potential community garden sites. This particular model focused on environmental, rather than social, data, looking for sites that are free of soil and water contamination. Criteria also included using the aspect and slope of abandoned lots, lot cover and soil type, population density, and pollution data. This model identified vacant lots that are not in industrial zones or near brownfields, are flat or slightly sloped to provide good drainage, and have a southward facing aspect to capture the most sunlight during the growing season.

Model 4: Cautionary lesson in criteria selection

The fourth model output resulted in only three vacant properties deemed suitable for community gardening. We believe this low output resulted because the criteria selected were too numerous and too restrictive. We include this output as a caution to anyone relying on decisions based on models. While this model's output itself is not useful for planning, it provides a lesson about the importance of careful criteria selection. Site selection criteria that are too stringent will reduce the number of potential sites. This model was rerun with field-verified data, and both the original and revised model outputs are shown in Appendix 3 to illustrate this issue.

Summary

GIS provides a powerful tool to quickly analyze large amounts of geographic data and to understand how the spatial relationships of various criteria can affect an object of interest. In this project, three models drew on various sets of criteria and produced differing outputs in terms of neighborhoods to target for repurposing vacant properties. Of particular interest are the first two models, which used similar datasets that were processed differently, producing two different outputs. Model 1 centers more on central Trenton, while Model 2 suggests the eastern section of the city would be most suitable for community gardens. Model 3, which looked specifically at vacant lots, found the northern section of Trenton to be most suitable for community gardens. We provide these multiple outputs in order to stress the importance of criteria selection and data processing. Only with the combination of intimate knowledge of the factors that really matter, along with access to accurate data, are suitability models useful. In this case, our results are best interpreted as templates for further inspection, modification, and analysis.

Community Gardener Survey and Focus Groups

Concurrently with the vacant property survey, the Rutgers Center for Urban Environmental Sustainability (CUES) and Isles also collected data on community gardening in Trenton and residents' and teachers' perspectives on food access. Questionnaires were directed to community gardeners, who were asked about their key experiences in their garden sites, perspectives on food access in Trenton, demographics, and the relationship with the Isles Garden Support Network.

Methods and response rate

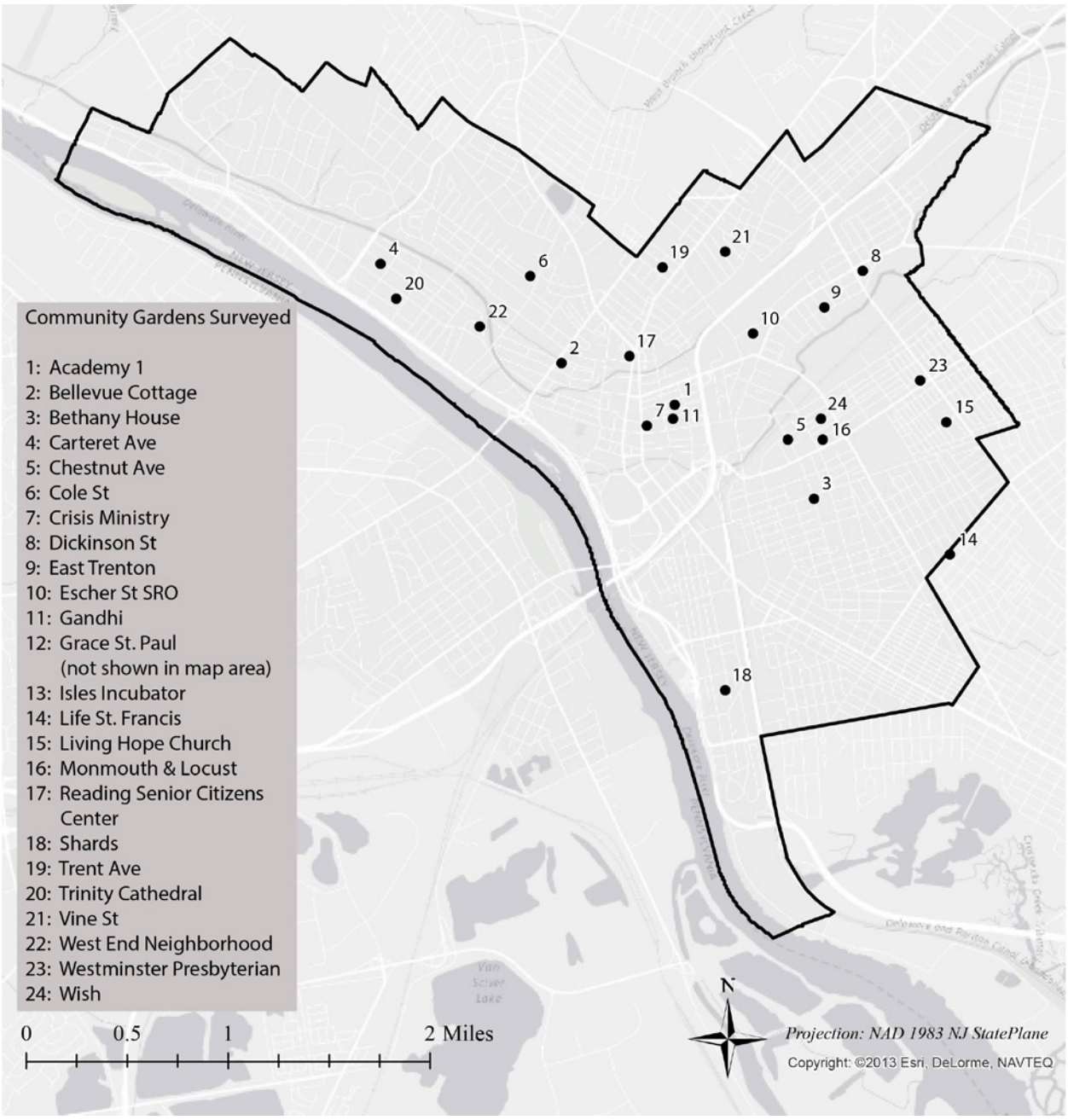
We held two focus groups over the summer of 2014 to collect information from a broader set of people; in addition to community gardeners, non-gardening residents, teachers, and residents working in various capacities with non-profit organizations and government to improve food access in Trenton. We discussed the relationship between vacant properties and food access. There were 13 participants in the focus groups and 49 community gardener questionnaires were completed. These questionnaires represented 25 community gardens across Trenton (see map in Figure 1). An initial gardener event, hosted by Isles, introduced the project to garden leaders who then completed surveys of their own. After that, we collected surveys in-person, over the phone, and via a web survey. 42 of the surveys were completed in-person or over the phone by the research team, while the remainder were completed by gardeners using a web survey. Although the total number of community gardeners in Trenton is unknown, Isles has a list of 99 gardeners with contact information that we used. Out of the 99 people on the list, seven were not reachable due to incorrect telephone numbers and 11 people were no longer community gardeners. This reduced our sample frame to 81 people, and we collected surveys from 35 of these gardeners. From this list only, we reached a 43% response rate; however, additional gardeners were surveyed through in-person and web methods.

Community gardener profile

On average, respondents joined a community garden in Trenton in 2008; they range from having just started this year to having been active since the early 1990s. The average age of respondents was 52, ranging from 21 to 82 (median age was 53). Minors were not asked to participate. A range of income classes and race/ethnicity is represented in the survey (see section on demographics, below). Most respondents, however, were born in the U.S. and identify as African-American or White.

Getting to the garden: Location is important

The ease with which people can get to their community garden is likely to play at big part in how frequently they go there and the garden's overall productivity and social atmosphere. Gardening must be integrated into people's normal routines to be successful and enjoyable. With this in mind, it is important to understand community gardens in the context of how people get to them. In our survey, community gardeners use a variety of ways to get to their garden: 53% walk, 57% use a car, and 38% use other means such as public transit or bicycling (Table 1). 18% of gardeners use more than one form of transportation, meaning that on some days they walk while on other days they take a car or bus. Most (82%), however, use only one method. Overall, it is easy for gardeners to get to their gardens—74% reported having no problems getting to the garden site (Table 4). Given the number of ways they do so, however, gardening is woven into their daily routines in many ways.


Community Gardens Surveyed
1: Academy 1
2: Bellevue Cottage
3: Bethany House
4: Carteret Ave
5: Chestnut Ave
6: Cole St
7: Crisis Ministry
8: Dickinson St
9: East Trenton
10: Escher St SRO
11: Gandhi
12: Grace St. Paul
(not shown in map area)
13: Isles Incubator
14: Life St. Francis
15: Living Hope Church
16: Monmouth & Locust
17: Reading Senior Citizens
Center
18: Shards
19: Trent Ave
20: Trinity Cathedral
21: Vine St
22: West End Neighborhood
23: Westminster Presbyterian
24: Wish
0
0.5
1
2 Miles
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Projection: NAD 1983 NJ StatePlane
Copyright: ©2013 Esri, DeLorme, NAVTEQ

Getting to community gardens is likely to be a function of neighborhood walkability and availability of private and public transportation options. Further research is needed to better understand where gardeners want the garden to be relative to the other aspects of their lives—close to home, work, or other places that are part of their routes in and around Trenton. Community gardens do not necessarily need to be within close walking distance of people's home, but they certainly do need to be located in places that gardeners can easily incorporate them into their daily or weekly spatial routines. Site selection thus depends in large part on the specific target population. Although GIS modeling and identifying areas of need by mapping existing food access points can be a starting point in planning new community garden sites, the end users' actual use of space is a fundamental consideration in site location.

Respondents tend to visit their gardens frequently—on average, they make trips to the garden about 5 days per week. This suggests that gardeners in our survey find garden locations easy to get to and that they have integrated their gardening into their normal routines. It does not tell us, however, about any people that have stopped gardening because they could not easily get to the site on a regular basis. Taken together, these findings stress the need to better understand the complex ways in which community gardens may or may not fit easily into residents' lives—in other words, just because a garden is in a location deemed to be "in need" does not mean people will use it.

Outputs and Outcomes: Where does the food go, and what else happens through gardening?

Community gardeners distribute the food they grow in a variety of ways (Table 2). Although one might assume that community gardeners are there to grow food for their own household,

Table 4: How do you get to the community garden? (select all that apply)

Answer		Response	%
Walk		26	53%
Car		28	57%
Bus		5	10%
Train		4	8%
Bicycle		6	12%
Other		4	8%

Table 5: How do you use the food from your community garden? (select all that

Answer		Response	%
Take it home for eating		36	75%
Share it with other people		41	85%
Donate it to church, food bank, etc.		15	31%
Sell or trade it		1	2%
Other		5	10%

only 75% reported that they take the food home. Most people who do take food home also distribute it elsewhere as well—85% of respondents share the food with other people. 31% donate their food to a church or food bank. 12% use other means of distribution such as selling, cooking demonstrations, or community lunches. Furthermore, only 4% responded that they only take their food home; that is, nearly all community gardeners distribute food beyond their own household.

Although food production is an important part of community gardening, there are many other facets to these activities. Exercise, recreation, and neighborhood improvement, for example, are as important to our survey respondents as food itself (Table 3). While the majority of community gardeners surveyed do not see their garden as an income source, many do see it as a way to save money, and as such gardens play a role in household budgets—and by extension, local economies.

Gardeners generally found most of these aspects important, but three in particular stand out as the most agreed-upon responses. Fresh food and neighborhood improvement had the biggest differential between "very important" and "not important" (Figure 2). In other words, gardeners overwhelmingly see fresh food and neighborhood improvement as key outcomes of community gardening.

Table 6: How important to you are the following aspects of community gardening?

Question	Not important	Somewhat important	Very important	*Somewhat or Very Important*
Fresh food	8%	6%	85%	*92%*
Social interaction	13%	27%	60%	*88%*
Exercise or recreation	6%	31%	63%	*94%*
Cultural activities	13%	38%	49%	*87%*
Neighborhood improvement	10%	10%	79%	*90%*
Income generation	75%	21%	4%	*25%*
Saving money on food expenses	27%	20%	53%	*73%*
Other	0%	0%	12%	*12%*

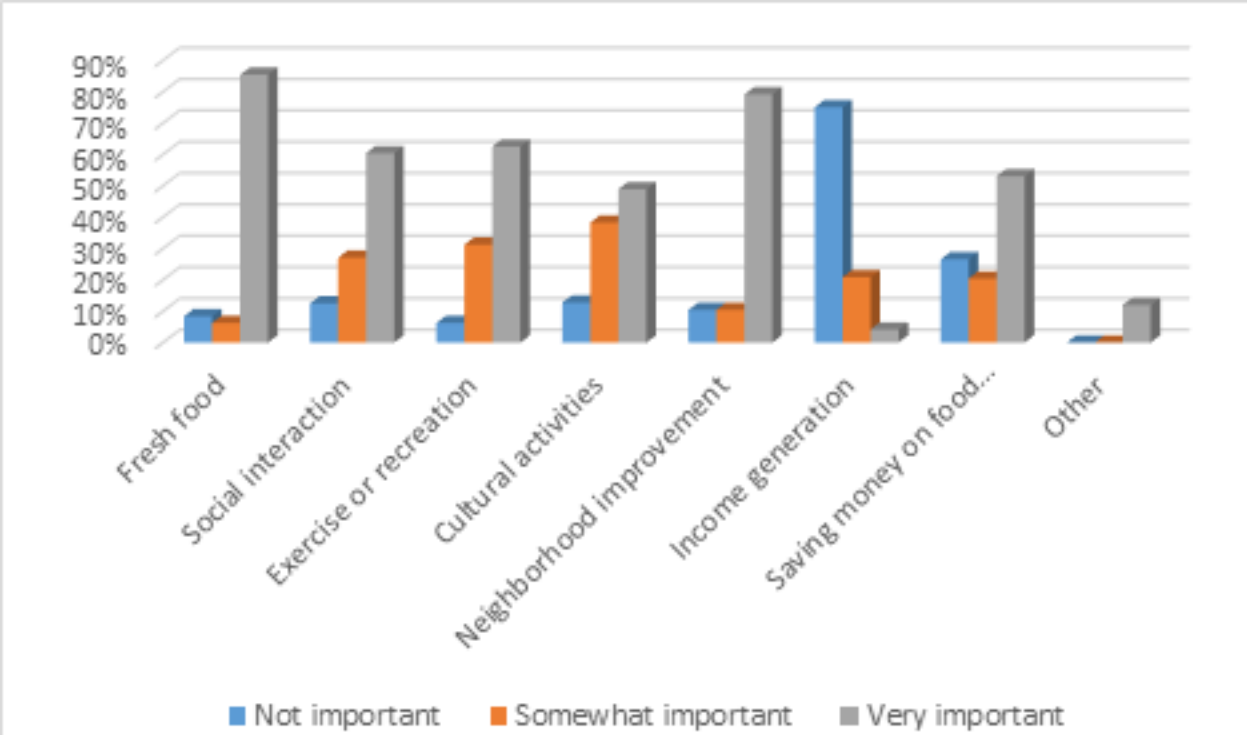


Chart 1: How important to you are the following aspects of community gardening?

Challenges

Working in community gardens is rewarding but does not come without its challenges. We asked respondents how much a given set of challenges affects their ability to garden. Weeds and pests were at the top of the list, affecting half of the gardeners either somewhat or a lot. 30% faced challenges having access to materials (soil, tools, etc.) either somewhat or a lot. The third highest rated challenge? Time commitment (26%). Weeds, pests, and time commitment also ranked highest among minor inconveniences—those ranked "a little" challenging to respondents. These results strongly suggest that gardening takes a lot of work, although avid gardeners see it as a labor of love. The policy implications are that while community gardens certainly provide a range of benefits, they are not a cure-all; since it takes a lot of work, residents should not all be expected to willingly participate. In other words, community gardens are an integral part of neighborhood life for many people but they are not easily introduced without proper buy-in and interest on the part of residents. It should be noted, however, that many respondents report no challenges, as clearly shown in Table 4.

Table 7: How much do the following challenges affect your ability to garden?

Question	None	A little	Somewhat	A Lot	Either "somewhat" or "a lot"
Weeds and pests	19%	32%	36%	13%	*49%*
Access to materials (soil, tools, etc.)	57%	13%	15%	15%	*30%*
Time commitment	40%	34%	17%	9%	*26%*
Water	64%	13%	13%	11%	*23%*
Crime or safety	61%	17%	15%	7%	*22%*
Theft	62%	19%	11%	9%	*19%*
Working with other members of the garden	72%	9%	19%	0%	*19%*
Getting to the garden	74%	11%	13%	2%	*15%*
Health condition(s)	68%	19%	13%	0%	*13%*
Other	0%	22%	11%	11%	*22%*

Fresh produce in Trenton: Community gardens and shopping

We asked respondents to indicate how much of their households' fresh fruits and vegetables come from their community garden (none, some, most, or all). Community gardens are indeed a source of fresh produce—85% of the respondents eat food they have grown in the garden (Table 5). Gardeners tend to fall between those who use the garden as a substantial source of fresh produce and those who supplement their household food budgets with the garden. These numbers are divided almost evenly, with 41% getting either most or all of their fresh produce from the garden and 45% using the garden for some of their produce. Only 15% stated that they got no food from the garden, but at least one respondent indicated this is because it was the first year and there had been no time to harvest yet.

We asked people about the amount and quality of the food they get from their community gardening and from shopping. Overall, people are highly satisfied with their gardens, but the shopping options are not entirely seen as negative. We explore these results in more detail after explaining the demographic characteristics of the sample.

Table 8: How much of your fresh fruits and vegetables come from your community garden?

Answer		Response	%
None		7	15%
Some		21	45%
Most		15	32%
All		4	9%
Total		47	100%

By the numbers

77% of survey respondents get some or most of their fresh produce from a community garden

Community Garden Satisfaction

Table 9: Are you satisfied with the amount of fresh produce you can get from your community garden?

Answer		%
Yes		81%
Maybe / I don't know		6%
No		13%
Total		100%

Table 10: Are you satisfied with the quality of fresh produce you can get from your community garden?

Answer		%
Yes		50%
Maybe / I don't know		15%
No		35%
Total		100%

Shopping Satisfaction

Table 11: Are you satisfied with the amount of fresh produce you can get from shopping in Trenton?

Answer		%
Yes		40%
Maybe / I don't know		20%
No		40%
Total		100%

Table 12: Are you satisfied with the quality of fresh produce you can get from shopping in Trenton?

Answer		%
Yes		72%
Maybe / I don't know		6%
No		21%
Total		100%

Demographics

In terms of income, Trenton has a median household income of $36,727 (Source: U.S. Census, 2008-2012 American Community Survey 5-Year Estimates). Respondents reported their household income for 2013 as follows:

Table 13: Household income

Answer		Response	%
Less than $10,000		4	11%
$10,000 - 14,999		2	6%
$15,000 - 19,999		3	8%
$20,000 - 29,999		5	14%
$30,000 - 39,999		5	14%
$40,000 - 49,999		3	8%
$50,000 - 74,999		8	22%
$75,000 or more		6	17%
Total		36	100%

Table 14: Race and ethnicity

Answer		Response	%
American Indian or Alaska Native		1	2%
Asian American		2	5%
Black or African American		22	50%
Hispanic or Latino		5	11%
Native Hawaiian or Other Pacific Islander		0	0%
White		16	36%
Multiracial		2	5%
Other		3	7%

Community gardening and food access across income classes

The survey results are insightful on their own, but they also raise additional questions about how community gardening and food access are experienced by people of different income levels. While people are overwhelmingly happy about the amount and quality of fresh food from their community gardens, the opinions about food shopping are not as enthusiastic. Half of the respondents are satisfied with the amount of fresh food available through shopping in Trenton, and 40% are satisfied with the quality of that food. This is surprising given the constant news about Trenton's status as a "food desert"—we expected satisfaction levels to be much lower. Given the diversity in income levels shown above we then examined whether these shopping opinions are related to income.

We simplified the household income classes to only three categories—less than $20,000 per year, from $20,000 to $50,000, and more than $50,000—to get a rough estimate of whether the responses are driven by low, middle, or higher income households. Respondents with the lowest household incomes are the ***most satisfied with the amount*** of fresh food they can get by shopping in Trenton (Figure 5). In contrast, however, the lowest-earning households are the ***most dissatisfied with the quality*** of that food (Figure 6). This suggests that fresh produce is easily accessible by the families who are least able to travel outside the city to other supermarkets; however, that produce is not of acceptable quality. Furthermore, around half of higher income households are dissatisfied with the selection of fresh produce in Trenton. Although affordability is often a key issue in healthy food access, even those families who are not as constrained by price are likely not able to meet their needs within the city.[1]

1 Walker, Renee E., Christopher R. Keane, and Jessica G. Burke. 2010. "Disparities and access to healthy food in the United States: A review of food deserts literature." *Health & Place* no. 16 (5):876-884.

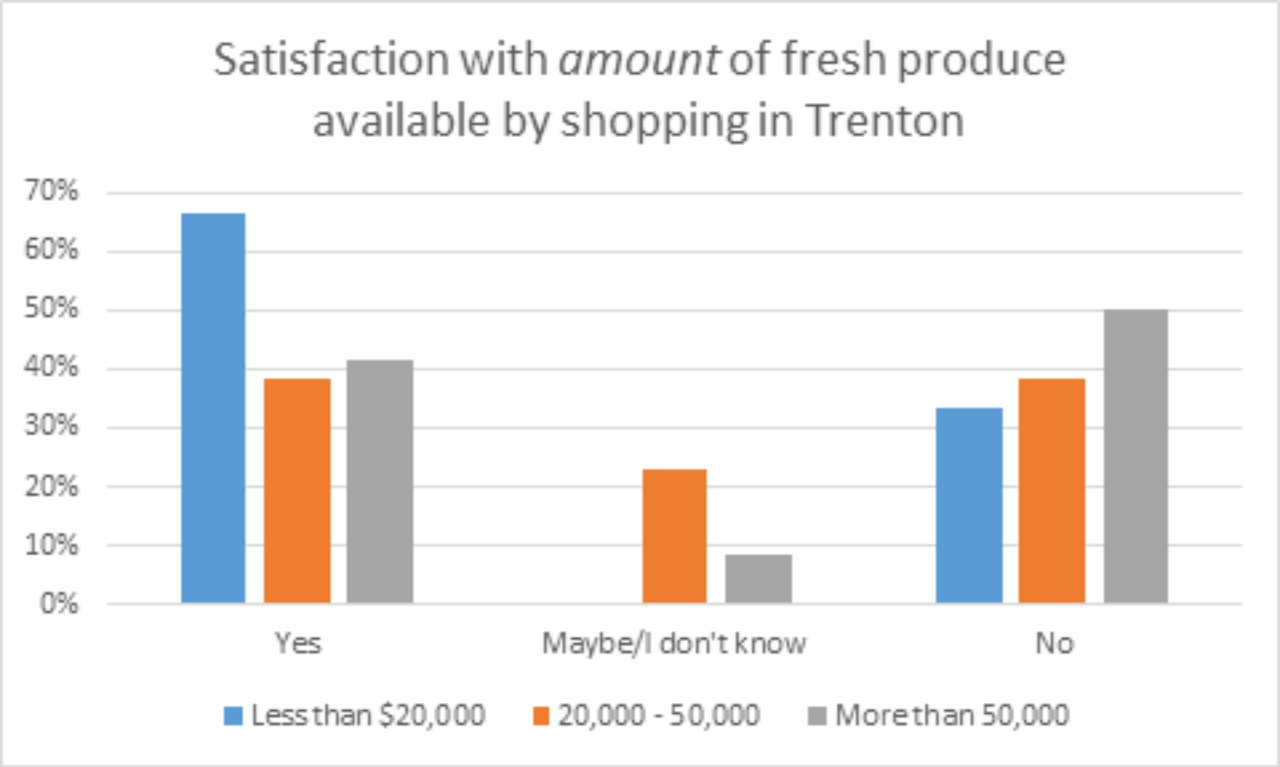


Chart 3

Chart 3

Transportation is also a factor in food access, which we first discussed in the earlier section on getting to the community garden. Although community gardeners in this survey may find it easy to get to their gardens, they see food shopping as a difficult exercise; this message was conveyed in the focus groups. In our two focus groups, it became apparent that transportation regarding food access more broadly is a widely recognized issue. For families without cars, this can be particularly difficult. Focus group participants pointed out that although food was generally easy to find, healthy and fresh food was less so. Residents face dilemmas when considering transportation to the places where quality food is available. For example, a resident of Villa Park pointed out that while a corner store might be walkable from home, the Food Bazar might be difficult to access even though it is a great source for good quality healthy food. This sentiment was echoed around the room, with others pointing out that "it's hard to get to places," and "if you're a family of four, you're not getting a lot of groceries on the bus." This last comment reflects how many families without cars try to shop by taking the bus, but find it difficult to carry a week's worth of groceries on to the bus. Furthermore, another participant, from the Franklin Park area, said that existing bus routes do not go very close to Food Bazaar or other stores with high quality food.

Food access: Joining the need for affordable, healthy food with demand for high quality, pleasant experiences

These findings point to the pressing need to rethink healthy food access to include factors of quality and taste. In Trenton, there is not necessarily a lack of fresh food—there is more likely a lack of good quality fresh food that residents want to eat at prices they can afford. Affordability is well-discussed in the community food security literature, and focus group participants raised this point as well. Affordability and nutrition are not the only two factors that might contribute to better food security, however. Participants contributed more to the food access discussion by making clear their interest in high quality food and a pleasant shopping experience. Indeed, one participant summarized this viewpoint by stating a desire to see an affordable version of Whole Foods in Trenton. Given the survey results that stressed the dissatisfaction with the quality of that fresh food, it is clear that food access is more than calorie counts and nutrition requirements. A resident of the Cadwalader Place area explained that the existence of grocery stores and supermarkets is not enough: "We did have a grocery store but it didn't do well – it was only open 2-3 years. It smelled bad – things that weren't fresh (both the product and the people working there)."

In addition, teachers in our focus group argued that the prepared food offered to children needs to be desirable—and it often is not. As some of the teachers explained, the apples at school lunches are, by definition, a healthy snack. Students were not interested in eating them, however, because they were often overripe, bruised, or not tasty. One focus group participant said that when she had cut apples into slices, they were more attractive to the children. The point here is that attractive preparation and presentation of healthy food is also a key lesson. In sum, families in

Trenton want the same kind of food access and shopping experience as would any suburban family.

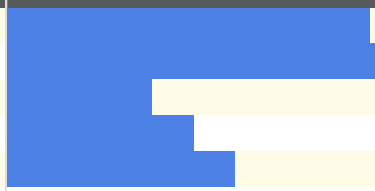
Building food access with existing assets

Although much of the literature on food security in low-income cities focuses on bringing in supermarkets from the outside, our focus groups participants argued that there are ways to develop local assets that can increase healthy food access. A key point they raised is the need to educate residents on entrepreneurship and business management so that they can start the food businesses that are needed in the city. As one participant noted: "people are starving for the opportunity to do something," but simply do not have the skills to start or know where to turn for help. Another participant suggested micro financing as an avenue to support business start-ups. A second key point to emerge concerned the process to obtain a vacant property from the city. Low-income residents that might be interested in starting a food business could also benefit from inexpensive vacant properties. Although outside developers and higher-income residents might be familiar with the process—or have the time and education to learn it—lower-income residents might simply be unaware of how to do it or find the bureaucracy intimidating. These two points, education in business management and how to obtain vacant properties, are aspects that focus group participants felt that Isles is well-suited to address in their work. Comments such as these show just how wide-ranging the options are to address food access; together with the comments above, they show how residents' perspectives are crucial pieces for building food access programs.

Isles Garden Support Network

The development of local assets return us to community gardening, which is something that Isles prioritizes through its Garden Support Network (IGSN). We asked survey respondents to list which IGSN services they had used in the past year. The most frequent services include seed and plant donations, and education through workshops and technical assistance.

Table 15: Sevices received from Isles Garden Suppport Network

Answer		Response	%
Seeds		35	76%
Plants		36	78%
Tilling		14	30%
Water access		18	39%
Tools		22	48%
Volunteer support		21	46%
Attended workshop		29	63%
Conflict Resolution		3	7%
Technical support/advice		29	63%
Help with leasing city-owned land		5	11%
Other		9	20%
None		4	9%

Other
Email Blast Newsletter. Good communication
Mowed the lawns
Part of 1st incubator garden with Isles this year
Built raised beds
Built raised planting boxes and perennial beds and rain garden
Outreach to other senior centers
Leading their voice to policy dicussions.
Fertilizer

Conclusions: Surveying residents and vacant properties to improve healthy food options

The two surveys in this study show that there are existing activities such as community gardens that engage local food systems and also that there are potentially ample opportunities to reuse vacant properties in Trenton for further expansion of similar efforts. Vacant lots and buildings are located across the city, but are concentrated in certain areas, particularly north of downtown from Battle Monument to Stuyvesant/Prospect. When it comes to income levels, vacant lots are clustered in the lowest income-earning census tract. Concentrations of vacant buildings, however, are found in areas of relatively moderate income levels. This could provide the basis for opportunities to situate redevelopment in areas with existing potential for business investment and incubation. Most of these properties are in residential zones, however. These areas can be targeted for community garden development given the support of residents in those neighborhoods. Nonetheless, there is plenty of opportunity for redeveloping lots and buildings in business, industrial, and mixed-use zones.

Our GIS models, given the criteria selected, suggest that the most suitable sites are not necessarily in the areas with the highest densities of vacant properties. By analyzing which properties are most suitable for redevelopment, our models suggest a range of possibilities given the broad supply of vacant lots and buildings. The three models focus on different criteria for selecting potential healthy food sites, resulting in model outputs that suggest different sections of Trenton could be considered for problem property reuses. Careful deliberation about criteria is needed, however, because changes in which factors are chosen and how they are weighted will change the model outputs.

However, the questionnaires and focus groups demonstrate the importance of engaging residents in the planning process to increase healthy food options. Community gardens play a major role in food production in Trenton, but people experience them in different ways. Food itself is a major output; for some people it is a primary source of fresh food while for others it is a supplement. Regarding food systems planning, the results below stress the importance of understanding the context of residents' lives in relation to location decisions on where to start food projects. Consumers must be able to reach these places easily, and they must also be able to easily integrate trips to the community garden, supermarket, or other location into their daily routines. Furthermore, residents' feedback suggests that healthy food options need to be considered among broader quality-of-life factors. Not only is healthy food needed in the city, but it also should be affordable and tasty, presented attractively and through a pleasant shopping experience.

Based on the data, there are some short and long term recommendations that may help bring together the supply of vacant properties and demand for healthy food options. The findings in this report suggest that there are different degrees of occupancy and vacancy. While one could simply gauge the number of vacant lots by the lack of buildings, in practice this would not reflect how residents might be using those lots as existing food production, green, and social spaces. We thus urge decisions that take into account the full range of attributes for a given parcel, along with additional site visits to confirm existing uses and how residents may already be using a given parcel. Since this project is rooted

in a concern for community engagement, it would be counterproductive to take away space that residents are already using, but might be considered "vacant" because of the lack of buildings.

As such, in the near term we recommend focusing what we have identified as unmaintained vacant lots as potential land for repurposing. Likewise, vacant buildings that need no rehabilitation hold promise for a first pass at developing food-related processing, distribution, and retailing. Regarding the GIS modeling that we demonstrated in this project, short term work can focus on using these more attribute-rich vacancy data to identify suitable sites. In our work for this interim report, we simply used all vacant properties as the input data, without regard to building condition or if vacant lots were maintained or unmaintained. More accurate outputs that reflect the richness of the datasets will come from models that use subsets drawing on the attributes in Table 2.

Additionally, one-third of the survey respondents were not satisfied with the quality of the food from their community garden. This could be an opportunity for Isles, the City of Trenton, and other partners to continue or expand current educational workshops.

Over the long term, we recommend including healthy food access and green space in the City of Trenton Master Plan. Although community gardens are often targeted as uses for vacant lots, they often retain "vacant" status even after they become vital links in the neighborhood fabric. In this study, we classified community gardens in a category separate from vacant lots because our aim was to increase healthy food options. Since community gardens are sites of food production, they should not be considered as "vacant", a term that immediately conveys the availability for site re-use.

Long term planning can also consider the spatial planning of food businesses in relation to residential areas. The unmaintained vacant lots and vacant buildings that we identified in business, industrial, and mixed-use zones present opportunities to develop food businesses. However, these businesses would serve the community much better if they were located close to potential customers and employees. By targeting business development such as urban farms and value-added food processing adjacent to residential areas, people would be better positioned to access the goods produced at those sites. Moreover, in terms of job creation, close proximity would allow people to more easily get to and from work. Lastly, this study suggests that vacant properties may also offer the opportunity to bring in fresh produce from outside of Trenton. If there are vacant lots or buildings in good condition, there is the potential to create one or more temporary farmers' markets. Such "mobile markets" have been used with success in other New Jersey cities such as New Brunswick. In addition to these sites that are used on a weekly basis, one or more permanent farmers' markets may suit a residential area's demographics.

Appendix 1: Field Guide for Volunteers

(compiled by Iana Dikidjieva, Isles)

Observation Guide

Parking Lots

What counts as a parking lot?

- Parking lots are the ones actually being used as parking lots, even if they are informal.
- Lots that were parking lots at some point but are now fenced off and/or disused are not parking lots.

Condition information

1. Surface

This question helps identify informal (and possibly illegal) parking lots.

- Earth: Select "Earth" only if the lot has no paving, rubble, gravel, etc.
- Paved or rubble: All other surfaces.

2. Is there dumping?

This question aims to identify parks (primarily) and gardens that are being neglected to the point where additional criminal activity (dumping) is taking place, and where cleanup will involve equipment and/or a dumpster.

Yes Select "Yes" if there are large items like mattresses, tires, furniture, cars or car parts, etc. deposited on the lot.

No Select "No" if the lot is clean, or if the only garbage is "tossables" – paper, candy wrappers, bottles, etc., even if there is a lot of such garbage.

3. Is there an accumulation of trash?

This question aims to identify gardens whose owners may be found in violation of city codes on health, safety, etc., and parks where additional maintenance may be needed.

Yes Select "Yes" if a lot of tossables (paper, packaging, bottles, cans, etc.) have accumulated beyond what might have blown in there in a single day.

No Select "No" if there is minimal or no trash, or if the only trash is large items that fall into the category of "Dumping" above.

Parks and Gardens

What counts as a park or garden?

- City or state parks are generally marked with a sign (you may have to look hard for the sign).
- Gardens are lots actively in use as gardens – with plantings, some order to the vegetation,

etc. If a lot appears to have been a garden at some point, but has not been planted this season, enter a lot observation (below).

Condition information

1. Is there dumping?

This question aims to identify parks (primarily) and gardens that are being neglected to the point where additional criminal activity (dumping) is taking place, and where cleanup will involve equipment and/or a dumpster.

Yes Select "Yes" if there are large items like mattresses, tires, furniture, cars or car parts, etc. deposited on the lot.

No Select "No" if the lot is clean, or if the only garbage is "tossables" – paper, candy wrappers, bottles, etc., even if there is a lot of such garbage.

2. Is there an accumulation of trash?

This question aims to identify gardens whose owners may be found in violation of city codes on health, safety, etc., and parks where additional maintenance may be needed.

Yes Select "Yes" if a lot of tossables (paper, packaging, bottles, cans, etc.) have accumulated beyond what might have blown in there in a single day.

No Select "No" if there is minimal or no trash, or if the only trash is large items that fall into the category of "Dumping" above.

Lots

What counts as a lot?

- A parcel that doesn't have a structure on it at all (front yards are not lots)

Note: The lot next to a house may be a separate lot. Check the map. If it is a separate parcel, do a lot observation for it.

- A parcel where the only structure is a shed, a guard-post, etc. – something you can't live or work in.
- Vacant parking lots
- Lots where a building has been demolished
- Lots that are not gardens or parks (see above)

Ambiguous things:

- An active demolition (where the bulldozer is present) is a building, not a lot.
- Coach houses are buildings. If the main house has been demolished, but the coach house is standing and appears to be vacant, do a building observation instead.
- Sometimes a gap between buildings can look like part of the street. Check the map. In most cases, this will have been a demolished building – do a lot observation for it.
- The canal banks do not need lot observations.

Condition information

1. Surface

This question helps us identify whether a lot can easily be converted to a garden.

- Earth: Select "Earth" only if the lot has no paving, rubble, gravel, etc.
- Paved or rubble: All other surfaces. This includes lots that were clearly parking lots,

2. Is the lot maintained?

This question aims to distinguish lots that someone appears to be taking care of from those that are actively abandoned.

- Yes Select "Yes" if the lot appears to be getting regular attention:
  There are minimal or no weeds;
  The grass appears to be maintained;
  There is little or no trash;

- No Select "No" if the lot:
  Is overgrown with weeds or wild plants;
  Has a lot of garbage on it, or large garbage (mattresses, tires, etc.);
  Appears to have been a garden at some point but has not been maintained this season.

3. Is the lot overgrown with weeds (2½ feet)?

This question aims to identify lots whose owners may be found in violation of the City's ordinance on lot maintenance and fined.

- Yes: Select "Yes" if the vegetation is higher than 2½ feet – including unkempt bushes, weed-trees, etc. – or if there is a lot of smaller brush growth all over the lot.

- No Select "No" if the weeds are lower than 2½ feet and if the vegetation overall is minimal.

4. Is there dumping?

This question aims to identify lots with accumulations of large items, where cleanup will involve heavy equipment and/or a dumpster, and where an additional criminal activity (dumping) is taking place.

Yes Select "Yes" if there are large items like mattresses, tires, furniture, cars or car parts, etc. deposited on the lot.

No Select "No" if the lot is clean, or if the only garbage is "tossables" – paper, candy wrappers, bottles, etc., even if there is a lot of such garbage.

5. Is there an accumulation of trash?

This question also aims to identify lots whose owners may be found in violation of city codes on health, safety, etc.

Yes Select "Yes" if a lot of tossables (paper, packaging, bottles, cans, etc.) have accumulated beyond what might have blown in there in a single day.

No Select "No" if there is minimal or no trash, or if the only trash is large items that fall into the category of "Dumping" above.

Vacant Storefront / Unclear Upper Floors
Many buildings in Trenton consist of a storefront and a floor or two of apartments overhead. When the storefront is vacant, it can be very hard to tell if the whole building is also vacant, or if someone is still living upstairs.

Make a "Vacant Storefront – Unclear Upper Floors" observation where you have no clear information about the upstairs. The rest of the condition observations are identical to those for vacant buildings (below).

Vacant Buildings

How to tell if a building is vacant:
It can get confusing in the field. Some buildings look occupied but aren't. Some buildings look vacant but aren't. There is no exact science to this, and you will probably get some things wrong. This is okay.

As a general rule, err on the side of vacancy. If the building could be vacant, and you have no clear information to suggest it isn't, enter a vacant building observation for it.

Condition information

1. Is there active construction or demolition?
If a building is being built or rehabilitated, it is vacant by definition. Relatedly, if a building is in the process of being demolished, it will soon be a lot rather than a building.

Select "Yes" if the work crew, bulldozer, contractor, etc. is there at the time you are there, or if you get direct verbal confirmation from a neighbor that the construction is active.

- If it looks like the building is still under construction, but nobody is actually working on it and you receive no information to the contrary, the construction may have halted – and that is just a vacant building.
- Similarly, if a building is just collapsing, or if demolition seems to have stopped halfway, that is a vacant building in very bad shape.

2. Signs
This gives us additional information that someone may still be interested in the building (by trying to sell or rent it), or that additional activity has recently taken place:

- Rent/sale: this includes informal signs and any all-purpose signs from realty companies.
- Weatherized: this is a clear indicator that the building is vacant, but that it has received some active attention to make its pipes etc. safe during the winter.

- Construction permit: this is an indicator that someone may have been trying to fix the building up.
- Stop work order: this is evidence of illegal construction and an indicator that the building as a whole is at additional risk of abandonment due to additional fines, legal issues, etc.
- Eviction: Note this if there is an actual sign, not simply physical evidence of a recent eviction.

3. Is the building visibly unsecured?

A vacant building that is not secured is a particular hazard: people may be using it as a base for illegal activities; people may be living in it at serious risk to their lives; it may have been taken over by animals that pose health issues; and it will be more prone to fires that risk spreading.

Yes Select "Yes" if:
Any of the doors and/or windows on the ground floor or basement are:
Open or broken
Not boarded up
A wall or portion of the house has collapsed such that one can get into it.
You see ropes, ladders, cables etc. extending from an open upper-floor window.

No Select "No" if the windows (and, where relevant, the doors) are boarded up well.

4. Is there a visible presence of vermin?

This is another indicator that the property is outright abandoned. Select Yes if you actually do see vermin (typically rabies-carrying mammals) on the property, or if there is a very strong odor of animals. Most of the time you'll select No. This is for those times when you see the critters in person.

6. Is there dumping or an accumulation of trash or debris?

This question aims to identify some of the additional codes where the owner might be found in violation.

Yes Select "Yes" if:
- There are large items like mattresses, tires, furniture, cars or car parts, etc. deposited on the lot.
- There is a lot of trash. A few bits of litter or a couple of bottles are not a lot of trash. We're trying to identify lots that are being treated as the community garbage can.
- Hazardous trash is easily visible. This includes gas cans, drug paraphernalia, weapons, and similar.

No Select "No" if there is minimal or no litter.

7. Does the building need rehabilitation?

Most vacant buildings do have something wrong with them, and will need some degree of rehabilitation. (And many occupied buildings need rehabilitation as well.) This question refers only to what you can see from the street, however.

- Yes, significant: Select "Yes – Significant" if you can see portions of the building missing, the roof collapsing, large cracks in the bricks, holes in the foundation, etc. – the kind of damage that suggests demolition.

- No: Select "No" if the building does not look like it needs much work at all.

- Yes, moderate: Select "Yes – Moderate" for situations in between – if there are issues with porches or other exterior parts of the structure, you can see water damage on the ceilings, etc.

8. Are there hazardous property markers [Xs] on the building?

The Fire Department marks some buildings with full or partial Xs as a warning to firefighters that the building is unsafe. Where these appear, they are a strong indicator of buildings that may be a priority for demolition.

- A full X indicates that the roof or floors have collapsed: firefighters should not enter the building.
- A half X (in either direction) indicates that the building is unsafe – they may go in but must be very careful.

Appendix 2: GIS Methodology

(by Elizabeth Ostrowski and Daniel Rico)

Geodatabase

A geodatabase was created with each file geodatabase feature class representing a different parcel type. The feature classes were in simple point format. The names and attributes were based on parcel types and fields had set responses based on the geodatabase domains.

Domains

Domains were set as follows:
Domain names were set for each of the parcel types with the code of: LOT, OCC_BLDG, PARK_GARD, UTIL AND PRKING, with their description indicating the full name of this classification, i.e. OCC_BLDG description is Occupied Building.

The domain TYPE_VAC indicated vacant building, and features two coded values: VAC_BLDG (Vacant Building) and VAC_LOWER (Vacant Ground Floor -Unclear Upper).

The domain PARC_TYPE includes the coded values for each of the parcel types, identical to the domains of the parcel types with the addition of the coded values for TYPE_VAC. The coded values as such are LOT (LOT), OCC_BLDG (OCCUPIED BUILDING), PARK_GARD (PARK GARDEN CEMETARY), UTIL (UTILITY OR AIL), PRKNG (PARKING), VAC_BLDG (VACANT BUILDING) and VAC_LOWER (VACANT GROUND FLOOR -UNCLEAR UPPER).

The domain REHAB featured the coded values of NO (NO), YES_SIG (YES - SIGNIFICANT) and YES_MOD (YES -MODERATE). This domain indicates whether a vacant building needs rehabilitation and to what extent.

The domain RENT_SALE indicates whether a building features for sale or for rent signs. The coded values are RENT (FOR RENT), SALE (FOR SALE), BOTH (BOTH (OR GEN REALTOR)) and NONE (NONE). This is where rent indicates a “for rent” sign on the property, sale is “for sale” sign and both indicates both sign types are present.

The domain SURFACE is indicated for the LOT parcel type, where coded values indicate the cover type for the lot: EARTH (EARTH ONLY) and PAVED (PAVING, RUBBLE, ANY OTHER SURFACE).

The domain WEEDS indicated presence of weeds on a lot where coded values NO (NO) and YES (YES > 2.5 FEET) refer to the presence and rough size of the weeds.

The Domain XS refers to the presence of spray paint X’s on the building face of vacant structures. Generally, full X indicates that a building is not safe to enter, even during fire, and a half X

indicates to enter with caution. This mark refers to the structural integrity of the building and risk of collapse upon entry. The coded values are FULL (FULL [X]), HALF (HALF [/] or [\]) and NONE (NONE).

YES_NO domain indicates for when fields can be answered only with Yes or No responses, the coded values being YES (YES) and NO (NO).

Feature Classes

The feature classes in the geodatabase are saved as followed. All are simple point type.

Feature Class	Alias
VAC_BLDG	VACANT BUILDING
PARKING	PARKING_LOT
PARK_GARD_CEM	PARK_GARDEN_CEMETERY
OCC_BLDG	OCCUPIED BUILDING
LOT	LOT
INFRA	UTILITY_RAIL

The domains where attached to the feature class in ArcCatalog under properties. Under the subtype tabs, the desired domains are added. The domain set up for each of these feature classes are as follows:

VAC_BLDG

Field Name	Domains
CONSTRUCTION	YES_NO
RENT_SALE	RENT_SALE
UNSECURED	YES_NO
XS	YES_NO
REHAB	REHAB
DUMPING	YES_NO
TRASH	YES_NO
PARC_TYPE	PARC_TYPE
NOTES	

LOT

Field Name	Domains
SURFACE	SURFACE
DUMPING	YES_NO
TRASH	YES_NO
MAINTAINED	YES_NO
WEEDS	WEEDS
PARC_TYPE	PARC_TYPE
NOTES	

PARKING

Field Name	Domains
SURFACE	SURFACE
DUMPING	YES_NO
TRASH	YES_NO
PARC_TYPE	PARC_TYPE
NOTES	

PARK_GARD_CEM

Field Name	Domains
DUMPING	YES_NO
TRASH	YES_NO
MAINTAINED	YES_NO
PARC_TYPE	PARC_TYPE
NOTES	

OCC_BLDG

Field Name	Domains
PARC_TYPE	PARC_TYPE
NOTES	

INFRA

Field Name	Domains
PARC_TYPE	PARC_TYPE
NOTES	

Setting Up

Clips

The basefile for creating this project is a city wide trenton parcel shapefile. This file was downloaded from Trenton's FTP site, adapted by the city to update distinct attributes about the properties and ownership information. The attributes that are the most important for this project are the PIN which indicates in the string of numbers the 4 digit municipality code, the 5 digit block code and lot code in the format of mmmm_bbbbb_ll and the leadlot, which indiciates property ownership.

Clips were created from a Trenton parcel shapefile by selecting desired features and exporting from the main file. Each clip consists of less than a thousand parcels, due to processing restrictions by ArcGIS online for feature quantities larger than one thousand. Clips were based loosely around neighborhoods and proximity to each daily field base, with each clip being roughly one day's work.

Map

After the clips have been created from the masterfile, the map has to be formatted for upload on ArcGIS online. The desired clip is added to the ArcMap document. For best visibility, the clip layer was set with no color and a solar yellow .4 outline width.

Under the clip shapefile's properties, the display was altered to show the field 'ADDRESS' by default. A road shapefile of trenton is added, consisting labels of all roads. The display color is adjusted to white with no border.

The 6 features from the geodatabase are added to the map. The symbology was set to categories, unique value type. The value field was PARC_TYPE, and all values excluding the one relevant to the feature class were removed. The exception to this is VACANT BUILDING, where symbology maintained both VACANT BUILDING and VACANT GROUND FLOOR -UNCLEAR UPPER.

The geodatabase point features were displayed as a circle of size 18. The color set up is as follows:

Feature:	**Color:**
VAC_BLDG	Mars Red
VAC_LOWER	Electron Gold
PRKNG	Gray 30%
PARK_GARD	Quetzel Green
OCC_BLDG	Lapis Lazuli
LOT	Solar Yellow
UTIL	Rose Quartz

Feature: Color:

ArcGIS Online

Sharing the Feature Service from ArcMap:

Once all the domains and layers are completed, the next step is sharing the service into the ArcGIS Online account. Before starting the rest of this process, it is important to first sign into the appropriate AGOL account in ArcMap. This option can be found under the file tab in ArcGIS for Desktop and selecting share, and then selecting to share as a service.

In the subsequent pop-up, select "publish a service" and choose a connection based on your appropriate AGOL account. In the subsequent window, the following tabs need to be configured: Capabilities, Item Description and Sharing.

For Capabilities, check off "Feature Access" and uncheck "Tiled Mapping." Under "Feature Access" subtab, select all the operations allowed (Create, Delete, Query, Sync, and Update). Under the "Item Description" tab, AGOL requires users to provide a summary and tag before allowing the service to be published.Under sharing, select all parties and accounts whom the data should be made available to. In this project this indicated the survey team account and the main map account. When all tabs are appropriately formatted, select publish and proceed to AGOL.

Steps starting from the upload of the service from ArcMap:

After sharing the service from the ArcMap software, the service appears as features on ArcGIS Online (AGOL). View the feature details and enable syncing and exporting in different formats. Once the feature shows up in the ArcGIS Online menu, add that service to a new map with full editing control. To apply this setting there is a drop-down menu that appears when cllicking on the downward facing triangle on the feature service. The first step to set up the map was setting the basemap, in our study the AGOL Imagery basemap was used. The Map then needs to be saved appropriately before proceeding.

For each features, the pop ups now need to be configured. ArcGIS Online has a feature where pop-ups are shown when someone clicks a feature in the map. These pop-ups can be configured from the settings menu. In the pop-ups configuration menu, the user can define what exactly is shown in the feature's information.

The popups were adjusted to make for easy data gathering for the surveying teams. The Pop-up Title was adjust to correct for formatting errors. Generally, this involved AGOL adding the display attribute as a tag on to the title, which merely needed to be erased. This was done for all of the parcel features. Roads and the basemap clips were set to "disable editing". The popups for the clips and any redos were additionally configured to only show the attribute fields of PIN, ADDRESS and OWNNAME. PIN was added for quick understanding on the backend in the case the phones ran into problems on collector. ADDRESS states the address of the property so collectors can confirm they are collecting on the right polygon, and OWNNAME gives ownership data, which occasionally proved useful when accessing lots or buildings owned by the city or a larger organization.

Before the maps could be uploaded on collector, they need to be shared so that they can be downloaded. The boxes for the the main account and survey group need to be checked off. Under "My Content" the item details of the map need to be edited so that Offline mode is enabled.

ESRI Collector Methods:

Before each survey, a GIS Administrator (Analysts?) needed to prepare the handheld Droid device for collection purposes.The Esri Collector Application was opened on the phones, logged into the survey account, and the appropriate map was selected from the content list and downloaded. A new basemap was created for each map clip, due to the collection process being performed in offline mode. This was done by selecting a zoom level just past the clip, and zooming in the entire way for scale selection. Batteries were ensured to be greater than 75% full, and a record was made recording the phone ID and associated team utilized it. Phones were labeled by number on the back of the device prior to the start of the project. Surveyors are kept in teams of 2-3, where one person handles public relations as needed with informative pamphlets and the remainder collect data. All surveyors wear a bright orange vest indicating the organizations name. This is both for general protection, so that the public can see that they are official, and so that other teams can quickly identify surveyors.

Once this step was done, the field teams depart and take down information on every single lot. Because of the set up in ArcGIS for desktop, the immediate information when the surveyors click on an individual parcel is the address. Using that and the associated street labels, they are are to ensure that the parcel they collect data on is correct.The process in taking down the information was as follows:

1. Press and hold finger on the parcel for which data is to be collected.
2. In the pop up menu, tap on the collect here tab
3. Select the appropriate parcel type that best descripes the parcel. These options are: Lot, Occupied, Vacant Building, Vacant Lower Level, Park/Garden/Cemetery, Utility/Rail.

Subsequently, a number of questions pop up about the various landscape factors composing the parcel. Questions for lots and vacant buildings are included as an example below.

- If the parcel is a lot, then the questions that have to be answered are:
    - What is the surface?
    - Is there dumping?
    - Is there trash?
    - Are there weeds (more than 2.5 feet)?
    - Is the lot maintained?

- If the parcel is a vacant building, then the questions that have to be answered are:
    - Is there active construction/demolition?
    - Are there for rent/for sale signs?
    - Is the building visibly unsecured?
    - Are animals visibly present?
    - Are there firefighter [X]'s?
    - Is there rehabilitation needed? (Moderate or Significant)
    - Is there dumping?
    - Is there trash?

4. Once all the parcels are completed for the data collected, the handhelds are synced. This is performed by selecting "sync all points" off of the main menu from Collector. The AGOL map will now reflect all collected points. The map can be downloaded and redos are created as

necessary.

Downloading the data into ArcMap

After the data is collected, the map needs to be opened in ArcGIS for Desktop. The drop down menu in AGOL for the maps had an option to open in ArcGIS for Desktop.The entire map will the load into ArcMap.The point features were then merged into a single point file of all feature classes. The output attribute table for this merge included all the associated question fields and the answers for each feature class.

After the initial merge was made, a spatial join was produced using the original clips and the merged points. Spatial joins are when two attributes tables from different layers are combined based on spatial location or a specific attribute field, while maintaining the features of a designated target layer. Spatial joins were completed with the parcel clips as the target features, and the merged point as the join features. This was performed on the field 'PIN.' Missing parcels were identified as any parcels without an associated 'PARC_TYPE' and exported for redos.

Redos
Redos for missed parcels were extracted from the completed spatial join by parcels that had PARC_TYPE = ' ' and applied to another map. The extracted redo shape file was set to a transparency of 50% with solar yellow fill color and mars red outline width of 1.0. Depending on the parcel size, the original parcels were set underneath with the same format in as in set up. If doing an entire neighborhood redo, the clips were uploaded onto ArcGIS online as individual features and added to the redo map separately.

Creating the Masterfile

The Trenton-wide parcel file is the base element for creating the masterfile of all the gathered property data. Several fields must be added to this initial file before proceeding, which match with the attribute fields related to the collection questions. These fields are as follows:

PARC_TYPE	Indicates parcel type (occupied, vacant, lot, etc.)
TRASH	Indicates whether or not there is trash
DUMPING	Indicates whether or not there is dumping
WEEDS	Indicates whether or not there are weeds
SURFACE	Indicates cover type for lots
CONSTRUCTI	Indicates whether or not there is construction
RENT_SALE	Indicates presence of signage for rent, sale, both or neither
ANIMALS	Whether animals such as rats, raccoons or cats are present
XS	X's spray painted onto vacant buildings by the fire department.
MAINTAINED	Indicates whether or not the property is maintained
UNSECURED	Indicates if the building is secured or not
REHAB	Whether the building needs rehabilitation and to what degree

All added fields are string type.

The spatial joins of the clips are joined by the PIN field to the trenton-wide parcel file. The joined table is then selected by only the features occurring on the clips. This is to prevent accidental override of previous entries. An easy way to do this is selecting by "PARC_TYPE" IS NOT NULL in the 'select by attributes' window.

The fields in the masterfile are then recalculated using field calculator to match the fields in the clips. Once all the parcel data is consistent in the masterfile to match the clip, the join is removed and the masterfile shapefile is exported. Each update of the masterfile is saved in the format of MasterParcels_mmddyy to minimize risk of data loss.

Producing the end data:

Parcel level data is not the most accurate for estimating counts of vacant buildings and lots. The leadlot field refers to ownership data, and therefore is more accurate in terms of distinguishing separate properties. Thus, the data must first be processed before determining this information.

Vacant Buildings:

Vacant buildings are extracted from the masterparcel file by selecting all vacant buildings and vacant lower attributes and exporting them. Additional attribute fields are added to the extracted vacant buildings shapefile. Each field is a replicate of the various "question fields" created when the data was gathered, with a tag of _VALUE at the end. For instance, XS_VALUE. These fields are short integer type.

These fields are calculated based on ranking in their string type counterparts. YES/NO records are calculated as 1/0. Ranked situations, such as construction, are given values from 0 to 2, with 2 being the most severe.

To determine the number of vacancies on the property level, the extracted vacants are dissolved on the leadlot field. Statistics fields are run on all the "_VALUE" fields, using the the

statistic type "MAX." The output is a shapefile of all vacant properties, with an attribute table consisting of the "worst case" for each field if the leadlot consisted of multiple parcels.

Vacant Lots:

Vacant lots are defined as any lot that is stand alone or on a leadlot property with multiple parcels in which none of the others parcels are occupied. Lots are examined on the parcel level, as each parcel in this case is a discrete property, allowing for different development and distribution routes.

Vacant lots were extracted in a multistep process. The masterparcels was dissolved on the leadlot field, and the masterparcels file was then spatially joined to this output. Occupied buildings were selected and extracted out on the property level, producing a shapefile that contains not only occupied buildings but any other parcel types contained within properties that have occupied buildings.

The occupied building extract is then dissolved on MUN (municipality). This is to reduce processing issues in the subsequent steps from handling over 30,000 parcels in ArcMap, by erasing with a single feature rather than thousands of small ones. The masterparcels file is then erased by the occupied dissolve. Lots are extracted from the output, and fit the defined criteria of "vacant lots" defined above.

Points:

Using the "features to points" tool, centroid points were created for all master files, vacant lots, vacant buildings and vacant buildings needing severe rehabilitation. A merge was made between the points of the vacant buildings and vacant lots for overall vacant analysis purposes.

Appendix 3: Example of model that provides too few results due to overly-selective criteria