

# The City According to Rats:

## A Survey of Rat Activity in East Somerville



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**For more information:** [somerillema.gov/rodentcontrol](http://somerillema.gov/rodentcontrol)



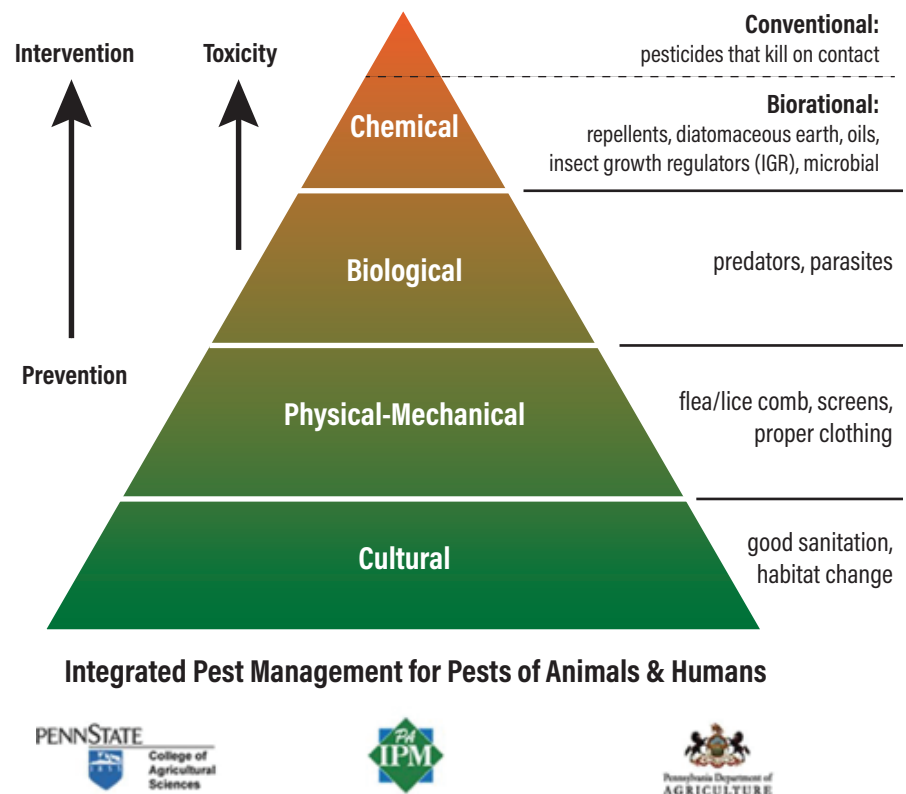
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## INTRODUCTION

While rats have been a part of human cities since they were first established,<sup>1</sup> in the last five years cities across the country have been receiving reports of rat activity at almost consistently increasing rates.<sup>2-5</sup> This trend can be seen in Somerville as well, with reports to the City's 311 Service Center about rat activity increasing from 523 in 2016, to 577 in 2017, to over 700 in 2018, and hotspots of reports found in new areas around the city that had not reported rat activity in the past. Rats are known to cause both economic and physical damage to aging city infrastructure,<sup>6,7</sup> and contribute to the stress and negative mental health effects of residents who regularly come into contact with them.<sup>8,9</sup> Thus, it is important for both cities and residents to take an active role in preventing, identifying, and decreasing rodent activity.



**Figure 1:** A graphic produced by the Penn State College of Agricultural Sciences showing the four main components of Integrated Pest Management (IPM) plans. The placement of cultural management at the base of the pyramid indicates that changing human behavior to make the habitat less attractive to pests must be a major focus of a successful IPM plan.

The most effective rodent control strategies utilize Integrated Pest Management (IPM), which involves the coordinated implementation of a variety of pest control techniques, emphasizing prevention and exclusion over traditional baiting and extermination methods (Fig. 1<sup>10</sup>). Reliance solely on baiting in reaction to reported rat activity has been shown to be an ineffective method of long-term rodent control,<sup>1,11</sup> especially as poison-resistant rodent populations have been identified in many areas across the globe.<sup>12,13</sup> However, management of the resources, specifically food, water, and harborage, that rats use to survive has been found to facilitate better long-term decreases in rodent populations,<sup>14</sup> and thus identification and elimination of these resources must be a central focus of any successful municipal IPM plan. Currently, rodent management in the City of Somerville focuses mainly on reactive baiting. Nearby catch basins are baited in response to resident reports of rodent activity, and the city has a program called the Residential Rodent Control Assistance Program, which is a free, one-time rodent inspection and baiting service available to owner-occupied properties upon request. Both of these programs are only implemented in response to reports of existing activity and they only treat individual properties or locations, instead of considering the surroundings as well. The information learned in this survey will help us understand how the broader environment is related to rodent activity, and thus develop initiatives to better manage this environment and the rodent populations living within it.

It is impossible to know where rodents are eating and living without knowing where they are, and currently the only way that the City can track and measure activity is through reports to 311. While this can give us a general sense of areas of relative higher or lower activity,<sup>15</sup> detailed trapping and monitoring methods are necessary to truly get a sense of where rats are located and the environmental factors that are associated with their activity. The purpose of this survey is to begin development of a quantitative method of monitoring rat activity within the city of Somerville and to investigate how the environment may attract or sustain rat populations. This initial survey, and others of its type, can be used to determine and address the patterns that contribute to rat activity across Somerville, leading to better long-term control of the rodent population.

## METHODS

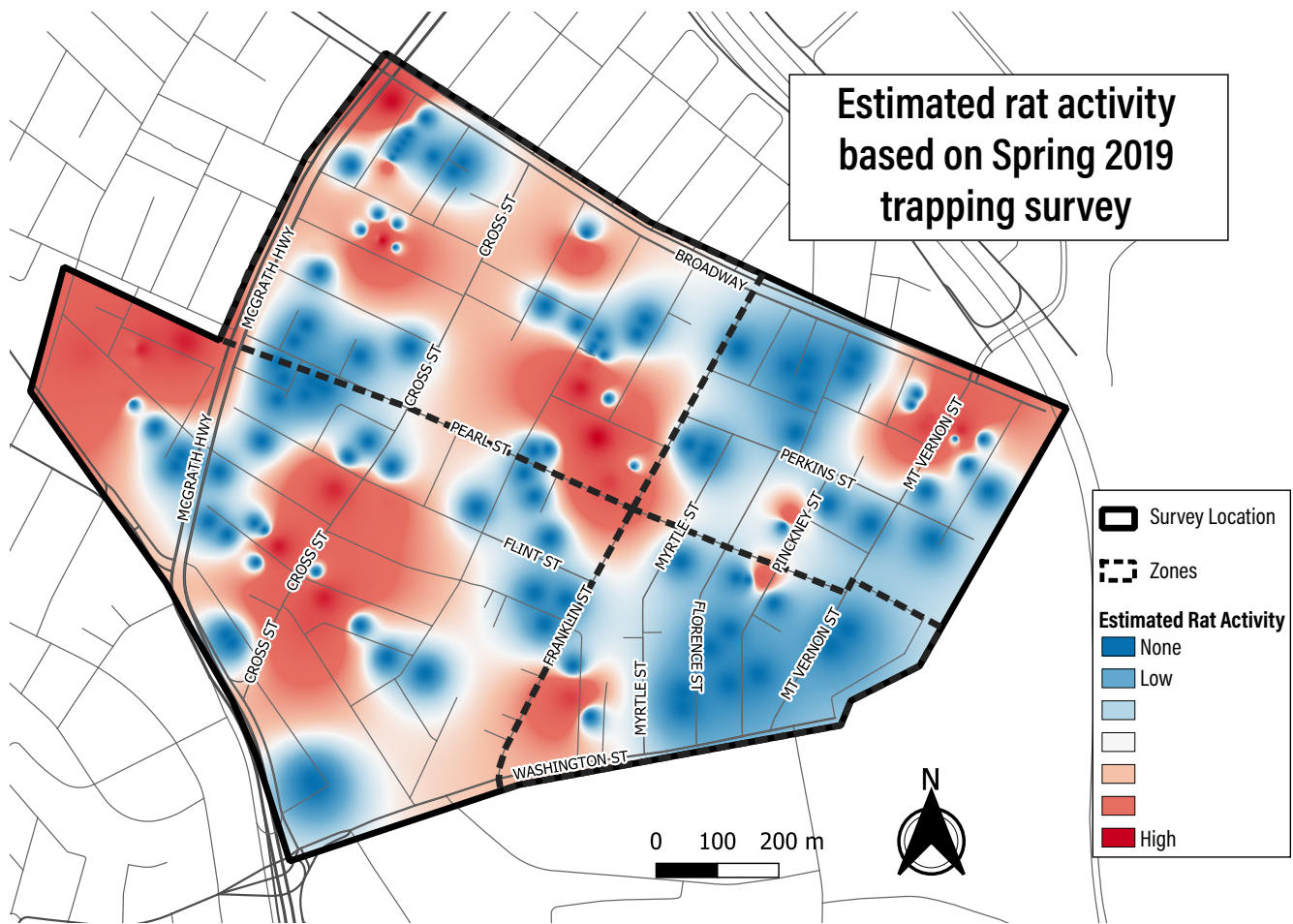
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### TRAPPING

The survey encompassed an area in Somerville of approximately 0.25 square miles bordered by McGrath Highway, Broadway, and Washington Street (Fig. 2). Major roads have been shown to be a barrier to movement of small rodents,<sup>16,17</sup> and thus the study was designed with these major roads as borders in order to encompass a continuous area of potential rodent habitat. East Somerville was chosen for this survey as it has

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**Figure 2:** This map shows the total survey area inside the black outline. The zones that were used to organize the traps by location are divided by the black dashed lines. Rat activity was estimated across the whole survey area from the activity measured at each trapping location using inverse distance weighting, with areas of higher activity shown in red and areas of lower activity shown in blue.

consistently had the highest number of reports of rodent activity since 2015, particularly in this area of Ward 1. The neighborhood to the west of McGrath Highway, which includes Gilman and Virginia Streets, was included because it has historically exhibited high rates of rat activity and would benefit from data gathering and assessment.

Using property ownership data from the 2019 Assessor’s Database, we mailed letters to all 545 owner-occupied properties in the survey area, approximately 50% of the total properties in the area, requesting permission to place rat traps in tamper-resistant boxes on their properties to measure rat activity. Owner-occupied properties were selected because the City needs explicit permission from the property owner to enter the property, and we anticipated a better response rate if the owner lived at the address. The letter explained the purpose of the survey, and included an access agreement granting City staff or their designees permission to go onto the property to perform the monitoring (Appendix A). We received signed permission from the owners of 134 out of 545 properties in the survey area to trap on their properties, for a response rate of 24.6% after only one mailing.

The City and its contractor, Catseye Pest Control, installed a total of 295 individual traps at these 134 properties, which remained in place for approximately three weeks. All the traps were set during the week of April 29th and removed on May 16th or 17th. The survey area was divided into four zones to aid in organization of trap locations (Fig. 2). The traps were checked every other day, on an alternating schedule by zone: Properties in Zones 1 and 3 were checked on one day, and Zones 2 and 4 the next day. During these checks, captured rats were counted and then disposed of by the contractor. All traps were initially baited with a combination of meat-scented spray and paste, and re-baited as needed using a combination of the spray and paste, lunch meat, and strong-smelling seeds known as Ground Hog “Kokaine,” all of which have strong scents to help lure rats into the traps.

## ANALYSIS

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Rat activity was measured using relative trap success. This measurement allows for activity on different properties to be directly compared, even if the surveyed properties didn't have the same number of traps or if the traps weren't deployed for the same length of time.<sup>18,19</sup> The equation is shown below:

$$\text{Relative trap success} = \frac{\text{number of rats trapped}}{\text{number of traps} \times \text{number of nights traps were set}} \times 100$$

We gathered environmental data for use in the analyses from a number of sources in the City, including the Health and Human Services Department, Inspectional Services Department, Assessing Department, the City Clerk's Office, Constituent Services/311 Service Center, and the City's public GIS database. These datasets included information such as location of dumpster permits, properties with trash violations, construction permits, and occupancy on properties included in the survey. A full list of the external datasets, separated by category, can be found in Appendix B.

The relationship between rat activity and external data was analyzed in two ways. The first method, which was used for most of the data, involved comparing relative trap success at properties within a 45-meter radius (approximately 150 feet) of the features in the dataset to overall relative trap success in the survey area. This size of radius was chosen because 45 meters has been shown to be the maximum average distance that rodents tend to travel in dense urban environments.<sup>6,17,20</sup> Thus, the rats that we found within this radius are the ones that are likely to be influenced by the nearby feature, such as a dumpster or active construction. Higher relative trap success within the 45-meter radius indicates a measurable pattern of higher rat activity around this variable than across the





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whole survey area, while lower relative trap success means that there was less rat activity around the variable. For the second method, which was used to analyze data from the Assessing Department including occupancy rates or the presence of a garage on the property, relative trap success was directly compared on the properties included in the survey. We compared relative trap success on properties with different numbers of units, or on properties with a garage or without a garage.

Mapping and analyses were performed using QGIS,<sup>21</sup> a free and open source Geographic Information System (GIS) that allows for mapping and manipulation of spatial data. Further analyses were performed utilizing spreadsheet software (Microsoft Excel 2010).

## RESULTS

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### TRAPPING RESULTS

A total of 90 rats were caught at 31 of the 134 properties, indicating that there is patchy distribution of the population throughout this area, which is typical for urban rats,<sup>22,23</sup> and indicates that there is something that draws them to certain blocks over others. We noticed a degree of clustering of activity in some areas in connected or nearby properties (Fig. 2).

### ANALYSIS BY ENVIRONMENTAL CATEGORY

#### FOOD

Three environmental features in the food category had a higher relative trap success within 45m, all of which were trash storage locations: dumpster permits, city trash receptacles, and trash violation tickets. When trash tickets were separately analyzed by number of offenses, only properties that had two or more offenses had higher relative trap success within a 45m radius (Table 1a).

#### HARBORAGE

None of the three features in the harborage category had a measurably different relative trap success within 45m when compared to the whole survey area (Table 1b).

#### CONSTRUCTION

Of the two types of construction data analyzed in this survey, building permits issued by ISD and construction in roadways, rat activity was found to be higher around only one: building permits issued by ISD. We found no difference in relative trap success around areas of active roadwork in the city, which included gas line replacements and water main upgrades occurring during trapping on Pearl, Washington, and Gilman Streets, among other nearby projects. While there was no difference in rat activity around all ISD permits issued since the beginning

Table 1: Relative trap success calculations for environmental data			
Category	Data	Relative trap success within 45m	Properties within 45m
	Entire survey area	1.917	134
<b>a. Food</b>	Dumpster permits	5.271*	14
	Food service licenses	2.333	10
	City trash receptacles	7.110*	9
	Trash violation tickets – All	2.232	96
	Commercial trash violations	0.880	19
	Residential trash violations - All	2.400*	88
	1 offense	2.218	81
	2 offense	3.176*	27
	3 or more offenses	2.584*	20
<b>b. Harborage</b>	All catch basins	1.881	108
	Overgrowth violation tickets	1.639	17
	<i>Has garage on property</i>	1.346	16
<b>c. Construction</b>	ISD-issued building permits – All	1.597	74
	January	1.759	37
	February	1.531	28
	March	2.824*	28
	April	0.628	22
	Construction in roadways	1.393	38
<b>d. Baiting</b>	Residential Baiting 2018	2.278	24
	Residential Baiting 2019	1.952	19
	Nearest two catch basins to a rat 311 call	2.188	56
<b>e. Human density</b>	<i>Occupancy per parcel:</i>		
	1 unit	1.631	56
	2 units	2.712*	52
	3 or more units	0.641	26
<b>f. Misc.</b>	Dog licenses	1.364	74
	311 calls reporting rats	2.150	60

**Table 1:** The relative trap success calculations for the environmental data. For data listed in italics, relative trap success was calculated directly on the properties included in the survey. All other data was analyzed with the 45 meter radius method. Also included is the number of properties included in these calculations. Columns marked with an asterisk (\*) were found to be significantly different from overall relative trap success, despite the different number of properties, using a rarefaction analysis.

of 2019, a difference was found when the permits were separated by month. Permits issued in March had a higher relative trap success than the rest of the survey area and the other months in which permits were issued (Table 1c).

### **BAITING**

The nearest two catch basins to a rat 311 report were used to map which specific catch basins were likely baited as a response to that report. Neither this baiting, nor that which was done through the Residential Rodent Control Assistance Program, was found to have significant difference in relative trap success in the 45m radius (Table 1d).

### **HUMAN DENSITY**

Relative trap success was slightly higher on parcels with two units than in the whole survey area. No significant difference was found on parcels with 1 unit, or three or more units (Table 1e).

### **MISCELLANEOUS**

This category contains two factors whose relationship to rat activity doesn't fit in any other categories: dog licenses, and reports to the City's 311 Service Center. The presence of a dog could potentially scare rats away from a survey site, and available dog food and water might attract them, thus we examined data for pet dogs licensed with the City. Rat reports to the City's 311 line were also included in this category because we wanted to measure whether reports of rat activity correlated to the rat activity that we measured. Relative trap success was not found to be measurably different in a 45m radius of either factor (Table 1f).

## **SUMMARY OF RESULTS**

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Of the six environmental categories that were analyzed for this project, food, human density, construction, and baiting were found to have the most notable relationships to rat activity. Higher activity was consistently measured around three different datasets in the food category (Table 1a), which was expected as access to a food source has been shown to be one of the most important factors that draws rats to an area.<sup>23,24</sup> While rats need a combination of resources to survive, specifically food and harborage, our results support the theory that harborage on its own won't attract rats to the area. We didn't measure significantly higher activity around two potential sources of harborage, catch basins or properties that received overgrowth violations from the city, but we did measure higher activity around three possible food sources: dumpsters, city trash receptacles, and residential trash. Rats thrive in a neighborhood first because of the combination of food that draws them to a location, and then an available place to burrow which establishes them.



Specifically, higher relative trap success was found around sites where trash is consistently stored, such as dumpsters and city trash receptacles, and not just where food is served or prepared, such as retail food establishments. These findings suggest that available food from unsecured trash is an important factor that contributes to rodent activity in Somerville. This theory is supported by a deeper analysis of residential trash violations. Higher relative trap success was only found around residential properties with two or more trash violations, suggesting that consistent improper residential trash storage does contribute to rat activity, while one-time violations do not. However, most of the properties that were part of this survey were not near many retail food establishments or city trash receptacles, and the 2015 city trash receptacle map does not fully correlate with the current locations of the barrels. Therefore, the impacts of these factors deserve further investigation.

**Properties with more units may have more resources to manage the amount of waste produced, while parcels with just two units do not. The effect of occupancy in Somerville is a question that deserves further investigation.**

### **FOOD/TRASH STORAGE Recommendations:**

- Provide increased education when dumpster permits are issued about how to effectively use and maintain a dumpster to prevent rodent activity
- Update the database of city trash receptacles, including information about condition and rodent damage, to facilitate assessment of rodent feeding activity from these barrels
- Inform tenants when their property receives a trash violation, in case owners and absent landlords do not, to ensure notices sent to owners and landlords are shared with their residents
- Update information about trash and recycling ordinances and regulations mailed to residents and shared via social media to include details about how to properly protect food waste from rats

Relative trap success was expected to be higher on properties with more units because more people means more available resources, such as food waste, for rats. This pattern was found on parcels with two units. Surprisingly, properties with 3 or more units had a much lower relative trap success than the survey area. We mainly trapped on properties with one or two units because they are more abundant in the survey area, and thus the lower relative trap success on properties with more than two units might be due to the difference in sample size. It may also be because properties with more units may have more resources to manage the amount of waste produced, while parcels with two units do not. The effect of occupancy in Somerville is a question that deserves further investigation, especially because higher density of people living in an area has been consistently shown to be associated with higher rat activity in other urban settings.<sup>22,25</sup>

There has been very little research done on the relationship between rodent activity and construction, and the connection is not yet well understood. The current consensus is that construction may displace rats that are living on a construction site, but that it will have no impact if there are no rats present before work takes place. Rodent displacement is also only expected while the work is occurring, and then activity should return to base levels once disturbance at the site ends. We were able to map public roadways that had work actively occurring within the survey area during the trapping dates, and didn't find any change in relative trap success around these locations, suggesting that this type of work doesn't have a significant impact on rodent activity. It is more difficult to determine specific dates of active construction at addresses that received building permits from ISD, because contractors can start work any time within 6 months of permit issuance. The spike in relative trap success around ISD building permits issued in March may be due to the fact that these permits represent places where work was actively taking place in the city during trapping in late April through mid-May because there was enough time since the permit was issued for work to have begun. The fact that relative trap success was at the base level for older permits, issued in January and February, also lends support to the theory that higher rat activity only occurs during active construction activity, and that this activity doesn't stay elevated after the work is completed.

#### **CONSTRUCTION Recommendations:**

- Finalize new requirements mandating that a wider variety of building permits include provisions for rodent inspection and management
- Further investigation into how construction affects rodent activity over time

Relative trap success was not significantly different around places where the city had recently baited, either on residential properties or in catch basins. These results suggest that the current baiting methods are not significantly impacting rats at the population level, and are only affecting individual rats or pockets of activity. We caught rats directly adjacent to or in the vicinity of many properties that participated in the residential baiting program, and there was one area of activity near the intersection of Cross Street, Auburn Avenue, and Fountain Avenue that hadn't received any assistance from the program in 2018 or 2019. In order to make the residential program more effective at decreasing rodent activity on a larger scale, as many properties as possible should be treated on one block when the program is implemented, and promotion of the program and its services should be continuous and accessible in multiple languages and formats.

## BAITING PROGRAM Recommendations:

- Increase participation in the residential baiting program through new outreach campaigns, with a focus on baiting many properties in the same area
- Discuss alternative or additional actions that can be done in response to rodent 311 reports, besides catch basin baiting

## NEXT STEPS

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The following is an overview of the suggestions for next steps that should be taken based on the findings from this pilot study:

- Perform additional studies in other locations throughout the City, revising data collection methods based on this pilot, and specifically designed to answer questions such as:
  - *What is the relationship between rat activity and a combination of trash and overgrowth violations?*
  - *What is the effect of owner occupancy and number of residential units on rodent activity?*
  - *What is the effect of proximity to restaurants and food service establishments on rodent activity?*
- Is there a relationship between active construction and rodent activity?
- How do different wards and different areas within the wards compare in terms of rodent activity?
- Increase educational efforts directed at tenants, not only property owners, and for properties with multiple trash violations or with dumpsters on-site
- Finalize new rodent abatement requirements for construction permits
- Increase participation in the residential baiting program via outreach campaigns and other communications efforts



## ACKNOWLEDGEMENTS

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Special thanks to all who had a hand in making this project a reality including: the 134 property owners who allowed us to trap in their yards; Doug Kress, Director of Health and Human Services, for his leadership, guidance, and assistance with management of logistics and study design; Paul Dube and Rich Merullo from Catseye Pest Control, who placed and checked all 295 traps for the duration of the study; HHS staff who helped fold 550 letters and access agreements that were sent to property owners; Eileen McGettigan and Frank Wright from the Law department, who drafted and signed the agreements; Keith Johnson, who assisted with mapping analysis and data preparation; Donna Pickett, Andrea Como, Joseph Hamel, Chris Roche, John Long, Andrea Revilla, Andrea Torres, and Kathy Teixeira-Henkle, who assisted in city data collection; City Councilors Stephanie Hirsch and Matthew McLaughlin, who supported and promoted the program; Barbara LaPiana-Doran and Veronica Gee, who helped gather and organize the access agreements; Denise Taylor and Jaclyn Rossetti, who assisted with communication to residents; and Kate Hartke, who provided a final review and edit of this report. This trapping survey was truly a multi-department effort, and would not have been successful without all of the partners listed above.

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**CITY OF SOMERVILLE, MASSACHUSETTS**  
**HEALTH & HUMAN SERVICES DEPARTMENT**



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April 10, 2019

Dear Somerville Property Owner,

As the temperature begins to warm and spring is just around the corner, many residents are getting excited about being able to spend more time outside. We also know that this is a time of the year when rat activity may become more noticeable. We are excited to introduce a new staff member, Georgianna Silveira, who, as our first Environmental Health Coordinator, will dedicate her work to addressing this issue.

The more information we have about rodent activity in the city, the better we can address it. Thanks to many of you who call 311 to report rodent sightings, we have an excellent sense of where rats are being spotted across the city (so please keep calling). To start gathering more detailed data on where rodents are living and their movements, the City of Somerville is preparing to perform a rat population survey in your area. This study will help us understand Somerville's rats better and design more effective control strategies. To ensure a successful survey, we are asking for your help.

We are requesting that property owners allow a city employee, along with a licensed pest control technician from Catseye Pest Control, to set rat traps on the exterior of your property. These traps will help us measure rat activity and track differences across this area. Once these traps are set, staff will return to check them every weekday over the course of three weeks, which adds up to a total of 15 visits. The program is tentatively scheduled to begin on April 29th, and end on May 17th. We understand that this is short notice. However, we know that spring is a good time to sample rat numbers, so we want to start this project as soon as possible.

Our findings will, of course, remain confidential, and will not be used to penalize you or any of your tenants based on the conditions found on or near your property. The traps do not involve the use of poisons or any other toxic substances, and are tamper-resistant to help ensure that they only catch the target species: rats. The only thing we require from you is permission to go onto your property to place and check these traps.

If you agree to participate in the program, you will also be offered access to the city's Residential Rodent Control Assistance Program. This program provides weekly rodent inspection and baiting services at no cost to you until we see rat activity decrease. Please note that you will be eligible for the program regardless of whether or not your property meets the program's regular requirements. More importantly, you will be contributing to a better understanding of how to decrease the rat population in Somerville.

50 EVERGREEN AVENUE  SOMERVILLE, MA 02145

**ACCESS AGREEMENT**

This ACCESS AGREEMENT ("Agreement") is entered into on this \_\_\_\_ day of April, 2019 by and between the CITY OF SOMERVILLE, acting by and through the City of Somerville Health and Human Services Department ("City") and \_\_\_\_\_ (name), of \_\_\_\_\_ (address), Somerville MA \_\_\_\_\_ (zip) ("Owner"), regarding \_\_\_\_\_ (address), SOMERVILLE, MA \_\_\_\_\_ (zip) ("Property").

1. By signing below, Owner gives permission for the City, its employees and agents, and its contractor Catseye Pest Control, its employees and agents ("Catseye"), to come onto the Property for the purpose of rat population monitoring (the "Work") from April 29, 2019 to May 17, 2019, as described in the attached communication dated April 10, 2019. Owner gives specific permission for City and Catseye employees to do the following on the Property:
  - a. Placement of tamper-resistant rat traps;
  - b. Checking of the traps each weekday, Monday-Friday, to remove trapped animals;
  - c. Removal of the traps at the end of the monitoring period.
2. The above activities will occur between 8:00 a.m. and 5:00 p.m. There will be no access to Owner's property in the evening, overnight, or on weekends and holidays unless specifically requested by Owner.
3. Upon request of Owner, the City will provide a copy of the results of the monitoring program.
4. The Owner shall inform each tenant or licensee of any portion of the Property of the Work and when it will be performed. The Owner shall also provide the City with the name, address, and telephone number of each tenant or licensee such that the City or its agents may contact the tenant or licensee to notify them of the Work.
5. All activities specified herein shall be at no cost to the Owner and shall be performed to interfere as little as possible with the use and enjoyment of the Property by the Owner and any affected tenants or licensees. To effectuate this intent, the City shall conduct all activities as expeditiously as possible.

**CITY OF SOMERVILLE:**

By: \_\_\_\_\_

Joseph A. Curtatone

Its: Mayor

Approved as to Form:

\_\_\_\_\_  
Francis X. Wright, City Solicitor

**OWNER:**

\_\_\_\_\_  
Name

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
E-mail address

\_\_\_\_\_  
Date

**Appendix B:** The full list of environmental data that were included in the analysis, including the municipal department from which the data was obtained and the dates that the data encompasses.

Category	Data	Source	Date of data used
<b>Food</b>	Dumpster permits	Inspectional Services Department (ISD)	All active licenses as of May 2019
	Food service licenses	ISD	All active licenses as of May 2019
	City trash receptacles	Public GIS data	Last updated September 2015
	Trash violation tickets	ISD	All tickets issued from January – June 2019
<b>Harborage</b>	All catch basins	Public GIS data	Last updated June 2019
	Overgrowth violation tickets	ISD	All tickets issued from January – June 2019
	Has garage on property	2019 Assessor’s Database	2019
<b>Construction</b>	ISD-issued building permits	Public GIS data	All permits issued from January – April 2019
	Construction in roadways	Engineering	All work done the week of April 29, 2019
<b>Baiting</b>	Residential Baiting Program Participants 2018-2019	ISD	January 2018 – June 2019
	Nearest two catch basins to a rat 311 call	Public GIS data	Catch basin locations updated June 2019. Based on 311 calls from January – May 2019
<b>Human density</b>	Occupancy per parcel	2019 Assessor’s Database	2019
<b>Misc.</b>	Dog licenses	City Clerk’s Office	All active licenses as of May, 2019
	311 calls reporting rats	Constituent Services	All rat 311 calls from January – May 2019