

The Boston Rat Action Plan

Final Report: Part II¹

Prepared for the City of Boston
Office of the Mayor, Michelle WU
Dion Irish, Chief of Operations

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¹ This written report is meant to be accompanied by *The Boston Rat Action Plan Photo Report* (BRAP Part I) and will prove helpful to consult both reports concurrently as referenced within the appropriate sections of each. Too, Parts 1 and 2 are meant to complement each other in content; but to avoid a very long project report, not every area covered in Part 1 is discussed in Part 2 and vice versa.

Preface

Acknowledgement and appreciation is extended to the Office of Mayor Michelle Wu for the honor of serving the City of Boston on this important Boston Rats Action Plan (BRAP) project, and for The City's patience in allowing for flexibility in the final completion and submission.

Particular thanks to Chief of Operations, Dion Irish and Mr. Derek DaSilva, Special Projects Manager of Mayor Wu's Operations Cabinet. Also to the Boston Inspectional Services Division of Environmental Services: Commissioner Tania Del Rio, John Ulrich, Lisa Timberlake, and each of the inspectors and support teams.

Gratitude is further extended to each of the Boston City Departmental staff professionals listed below for their input and/or their direct field participation all of whom went above and beyond with their involvement, ideas, and time during this BRAP initial launch project.

From a consultant's perspective, this entire BRAP effort from beginning to end was a pleasure of work because of the professionalism of each and all within each Department.

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Boston Rat Action Plan Collaborating Departments

- Mayor's Office
- Operations Cabinet
- Boston City Council Members
- Superintendent of Basic City Services
- Boston Inspectional Services Department, Environmental Services
- Boston Water and Sewer
- Boston Public Works
- Boston Housing Authority
- Boston Public Schools
- Boston Parks and Recreation
- Boston Public Health Commission
- Boston Planning and Development Agency
- DoIT

Boston 2023-2024 Rat Action Plan

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Boston Rat Action Plan: Selected Neighborhoods and Infrastructures Assessed On-Site March 2024

1. Boston Commons and Public Gardens
2. North End Assessment and Area Pocket Parks
3. Boston Water and Sewer Collaboration: Sewer rat evaluations of North End Sewers and South Boston Reserve Channel
4. Boston Housing Authority Visits
 - a. Charlestown BHA
 - b. Cathedral BHA
 - c. Mary Ellen BHA
5. Allston Neighborhood Area Assessment on Trash Day
6. Ringer Park Rat Assessment
7. Department of Public Works tour with Gerard Gorman and assistants.
 - a. Several downtown neighborhoods and multiple alleys to assess residential trash practices and operations.
8. Back Bay Neighborhood and Alley Assessments: (start: Commonwealth / Exeter Street)
9. Roxbury Neighborhood /Park Walk Through
10. Haymarket Area Assessment
11. Downtown Public streets and alleys and James Michael Curley Park.
12. Cursory visit to Newmarket Square industrial park.

Overview / Summary Points³

1. Norway rat populations are well known to have been established since the mid 18th century in all the major port cities of the northeast United States. These include Portland, Boston, New York, Philadelphia, Baltimore and Washington DC. Each of these cities similarly reflect increases in their rat populations during the past decade as evidenced from complaint data, municipal public health sanitarians, and from surveys of well-established, quality private pest control companies that have been servicing these urban centers for more than 40 years.
2. Accordingly, rats were expected and found to be present within most--if not all-- of Boston's neighborhoods at levels ranging from low to severe as per the data inputs of a) 311 complaint data, b) ISD violations data; c) two-days of targeted field surveys with the Boston Rat Action Plan team and a consulting rodent scientist.
3. The broad abstract-level steps necessary for long-term sustainable success of the established 2024 Boston Rat Action Plan (BRAP) addressing Boston's on-going rat challenge are as follows:

(Each of these described steps are further expanded upon below and within the body of this Part II Final report, as well as within some portions of Part I BRAP Photo report).

3.1. Full mayoral support and stewardship of the established 2024 Boston Rat Action Plan. This endorsement and the commitments have been initiated via the 2024 Boston Rat Action Plan within Mayor's Michelle Wu's office as directed by Chief Dion Irish.

3.2. Maintaining a well-structured and organized BRAP purview department supported by the strong and committed collaborative efforts of an additional list of the most BRAP relevant Departments. (As per Final Report).

3.3. The goal for Boston's urban rat management program is to, as best as possible and within the constraints of budgets and public cooperation, aim for *prevention*, rather than reaction. This is already stated in Boston's ISD mission statement.

3.4. A BRAP program strongly guided by data related to complaints, physical inspections, geo-mapping, population cluster models, and additional emerging technology from remote sensing as this technology continues to evolve.

3.5. A *Priority Action Neighborhood (PAN) IPM plan is needed* for the top 3-5 most afflicted neighborhoods to reduce currently established rat reservoirs/replenishment sources (i.e., historical hot spots) by employing enhanced IPM efforts, strong

³ These report summary points reflect a *culmination* of the consultant's complete BRAP involvement for the past 6-8 months. This involvement includes the multiple virtual meetings within the Mayor's Office of Operations, Inspectional Services Department, Individual Department meetings (e.g., Parks and Recreation, Public Works, BHA, Water and Sewers, etc.), reviews of provided data and pertinent background materials from each, multiple e-mail exchanges during 2023-present and a two-day onsite field assessment day involving the above Departments and the BRAP lead team. Each summary point is not meant to imply a full report section is associated with each point.

enforcement, targeted assessments, surveillance and enhanced monitoring using both ISD inspectors and sensor technology. (See Appendix B).

3.6. Employ specialized infrastructure-specific *Best Practices* for rat control for Parks, Sewers and Alleys and major construction zones. (See Section x of Final Report)

3.7. Maintaining a watchful eye on the use of current day rodenticides that are so very abundant throughout all greater Boston. These toxicants have been realized in the past several years to have very significant detrimental effects on city wildlife. This report presents alternatives baits and tools for controlling rats without presenting the same environmental threats. (See Appendix A: An IPM Toolbox for Controlling Rats in Boston in lieu of Employing Second Generation Anticoagulant Rodenticides (SGARS).

4. Controlling rats in modern day cities (regardless of the city) to achieve sustainable results is a complex and perplexing undertaking as to which steps should be prioritized. A list of Recommended Actions to be carried forth by the BRAP in a priority order begins this Final Report. Separate discussions of these steps follow in each section as well as additional discussion within included Appendices as listed.

5. Re: The organization and makeup of the Boston Rat Action Plan:

5.1. It seems apparent and earnestly agreed upon that the ISD/ES Department should remain the acting Chair of the BRAP ‘Working Group’ (or to whatever identity tag is given to such a group (committee, alliance, partnership, etc.).

5.2. Additionally, a BRAP sub-chair should be considered to assist in responsibilities and input from within the nine Key BRAP Departments listed below. The co-chair should be rotated on an annual basis among each of the Key BRAP departments to share in the work, and keep the input, and direction fresh.

5.3. The establishment of a separate Boston Rat Mitigation Department: It is the opinion of this consultant that based on the above point, a separate Rat Mitigation Department would be redundant based on *already existing* mission statement of the ISD/ES Department. Creating another rat mitigation department would result in valuable time being spent in reorganizing and staffing dynamics when the foundational elements are already in place at ISD/ES.

5.4. At previous BRAP meetings with City Council, discussion was raised as to the benefits of following New York City’s example of establishing a “Rat Czar” in addition to the BRAP working group and chairs or whether such a position would also be redundant to the efforts of ISD. However, because a Czar is a big-program *facilitator* (and not a subject matter expert (in rat control), there are pros and cons that should be considered. (See Appendix)

5.5. The BRAP Working Group (WG) should be comprised of the **most relevant city** Departments that meet regularly (e.g., bi-weekly) (and encouraged to do so from the Mayoral level) to address areas of concern and coordinate assignments for remediation

and as well as community involvement whenever possible. In this way quarterly *sustainable rat management goals can be measured and advanced*.

5.6. The Boston Departments and Affiliations most relevant for BRAP effectiveness include: (Additions and deletions per ISD and/or Operations Cabinet).

Office of the Mayor
Office of Operations
Inspectional Services, Environmental Services.
Department of Public Works
Boston Public Health Commission
Parks and Recreation
Water and Sewer Commission
Department of Public Services
Boston Housing Authority ((Strong cooperation of all refuse alcoves)
Schools* (e.g., Cooperation of school dumpsters refuse alcoves)
Analytics*
311
Business Improvement Districts (2): Downtown Boston BID and Boston Greenway BID⁴

Note: Occasional invites and input from local (and established) private pest management professionals that are members of the Massachusetts Pest Management Association (MPMA) are wholeheartedly encouraged.

6. Rarely are *multiple* rat complaints from the same area isolated vermin issues. Boston's Rat Action Plan has the greatest chance for sustainable outcomes when it tracks the scientific premise that city rat populations are an *environmental* barometer reading of the larger surrounding area, or block, park, alley and so on. (e.g., the rats of the Allston, or North End, Chinatown, etc.).
7. Because rats exist within cities as complex animal *populations* interfacing with the complexities of city infrastructures and building structures from very old to brand new, the BRAP must always be data-dependent and be data-driven. Whenever possible, this involves utilizing input from those sources listed in Item 9 (e.g., 311 and ISD inspection failure rates and densities) as well as any data associated with the ISD proactive rat surveys of the city's rat-vulnerable areas and infrastructures.
8. To Item 7 above, data analytics, modeling and AI can play important roles in achieving sustainable rat management in Boston.
9. The demographics of rat infestations are not a simple reflection of the number of 311 complaints. Multiple factors often drive a 311 tally for an area up and down.
10. As per the BRAP meeting with the Boston Public Health Commission (BPHC), rats currently do not pose a high public health threat to Bostonians. The BPHC program is very impressive in being acutely aware of the role of rats as potential threats year to year.

⁴ See Appendix C.

11. Major city construction projects and capital project improvements obviously are highly likely to affect older proximal infrastructures (e.g., existing subterranean old sewer lines, utility chases, abandoned infrastructure, etc.). If these systems ***are already rat infested***, construction events will certainly disperse rats into surrounding areas (like hitting a hornet's nest with a stick). However, construction events alone--regardless of the size of the construction project--***do not cause rat infestations to occur*** --if rats are not already established in the zone of construction.
12. As of 2024, new biological research on rats, their public health potential, and various technologies in smart-city rat surveillance have emerged over the past five or so years. It is important for Boston to continuously monitor these advances closely for applications to the BRAP. (See Appendix).
13. It is paramount that the BRAP continue to emphasize and focus upon (as per BRAP's already established mission statement) the scientific Integrated Pest Management (IPM) approach. Integrated pest management emphasizes (80%) addressing environmental root causes first (e.g., garbage management, building exclusion) and 20% addresses the safest use and most current employment of remedial extermination approaches (use of burrow asphyxiants, trapping, and low environmental-impact rodent baits as a last resort).
14. The No. 1 driver of rat populations in all cities is ***the food refuse dynamic*** (See Appendix). Boston is no exception to this elementary rodent pest management principle. A refuse inspection and management pilot are enthusiastically suggested for selected residential and commercial areas of Ward 3 (To be determined by ISD and perhaps DPW in collaboration).
15. To summary point No. 14, it is apparent that ***increased enforcement*** of refuse and the Boston various refuse 'receptacles' (ranging from sturdy and rat-resistant, to the 'accepted' use of flimsy plastic bags and the staging of the receptacles should be examined in greater detail—perhaps by a subcommittee comprised of ISD Inspection and DPW personnel familiar with this persistent urban conundrum.
16. Relative to Point 13 above and concluding from the two-day field BRAP survey of several different neighborhoods, many residential and commercial properties throughout did not appear to be aware of IPM or its importance because the predominant approach to rat control was the massive numbers of installments of exterior poison bait boxes.
17. Following an all-Boston City Department BRAP Launch, virtual interviews were then held throughout early 2024 with the essential BRAP-Partner Departments of: *Boston Public Health Commission, Dept. of Public Works, Boston Housing Authority, Boston Water and Sewers and Boston Parks and Recreation*. Each Department supplied to the consultant additional educational materials employed as public outreach (i.e., PSAs).
18. Each of these collaborative interviews coupled with a review of the supplied backgrounds and public outreach materials from each Department revealed excellence and dedication within each and the City of Boston. (Moreover, they proved exceptionally helpful to this overall BRAP Final Report). *Strong Kudos to the City of Boston are expressed.*

Section II

BRAP Action Steps for 2024-2025

Suggested Order of Priority

1. **Solidify the BRAP and the Departmental partnerships** of BRAP to assist the BRAP ISD Chair.
2. **Consider the benefits and negatives of hiring a BRAP Czar** (or Rat Czar) as discussed in the report.
3. **Target the Priority Action Neighborhoods (PANs)**⁵ as per the normalized 311 and inspectional data, ISD inspector input and the results of the BRAP in- field survey event of March 2024.

From the consultant’s perspective, the 3-4 neighborhoods meeting the PAN profile include (in order):

- (1) **Ward 3** (includes the neighborhoods of: Downtown, Chinatown, North End, South End, and Haymarket).
 - (2) **Allston/Brighton**
 - (3) **Back Bay/Beacon Hill**
 - (4) **Dorchester** (mostly South Dorchester) and/or **Roxbury** (equal needs).
4. **A PAN Best Practices Guide (included in this report).**
 - a. Increased surveillance techniques and rat severity assessments
 - b. Best Practices for Rat IPM in:
 - Parks
 - Sewers
 - Public Market Sites (Haymarket)
 - Construction Sites
 - c. Alley Surveillance and management (Dumpsters, garbage profile, etc.)
 - d. Due to the sensitivity of the issue, a BRAP Schools Inspection Team should be scheduled to proactively inspect the schools in the PANs and/ or to schedule remedial IPM efforts on an ASAP basis.

⁵ Regardless of the overall listing of the highest complaints levels associated with 311 data, severe rat infestations can occur in any neighborhood and on any property at any time. A designated “Priority Response Team” (or whatever term ISD currently uses), must be on-hand at any time to address such rat-emergencies on an ASAP basis when they occur—both for weekdays and for weekends.

5. **Design and Initiate a Refuse Inspectional and Management Accountability Pilot** for residential and commercial areas within a few sections of Ward 3. As per Summary Points 14 and 15.

During the BRAP On-Site Field Assessments of March 2024 visited it was very apparent that food garbage in both residential and commercial spaces of the various areas of city visited was copious in all versions: mostly jettisoned plastic bags lying on sidewalks and curbs, improper dumpster practices, the copious use of cheap plastic garbage cans, and litter baskets permitting easy access to rats during the night.

It can't be over-emphasized that the Boston (any big city) garbage conundrum must be addressed to have any realistic impact on the future of Boston's city rat population.

Consider that New York City just recently (and is during) reforming its solid waste stream programs and already very positive results are being reported in local neighborhoods within the pilot.

SECTION III

KEY SUMMARY POINTS OF THE BRAP PHOTO REPORT

Referencing the BRAP Photo Report (Part 1) concurrently during the review of the written report will be helpful.

1. Rats were established in every area visited during the BRAP field assessment (although in the brief Newmarket visit, only conducive conditions to rats were noted and a thorough walk-through of the area would be warranted by ISD staff at some time soon).
2. Earthen burrows were the predominant evidence of active rats. Rat damage to sidewalks, walls, doors and garbage bags and receptacle cans were second.
3. All rat infestations were strongly associated with nearby food trash occurring either in dumpsters, residential flimsy plastic cans, or via simple plastic bags dropped randomly on the curb areas for pickup, which all could be easily reduced or eliminated with some modicum of basic attention to community sanitation or property-level pride.
4. Rat poison bait boxes (bait stations) were found to be overly abundant in locations and in numbers per location (to the point of nonsensical, and in some areas also not in adherence EPA pesticide label laws) in virtually all the neighborhoods visited during the BRAP field assessment. Boston property owners/renters seem to believe the rat poison bait boxes placed around property and area perimeters will compensate and/or substitute for good trash practices. (Sound science research, however, has shown this practice, without the elimination of the rat's food sources, essentially 100% ineffective.
5. The unique design of old alleys and how property owners use alleys for food trash and clutter staging, play directly into the success of city rats needing shadowy sheltered areas with nearby food sources.
6. Because the Norway rat of Boston is a burrowing mammal, it has a strong affinity towards parks of all sizes and any available earthen spaces (building perimeter landscaping, empty lots, back yards with trash and clutter, etc.).
7. Landscaping factor: shrubs that are evergreen all year and are allowed to grow downward to the floor to form cave-shapes provide ideal houses for rats as they burrow below and always remain hidden. Bushes in high rat neighborhoods should be vase-shaped either from original design of the bush, or by keeping a cave-shaping bush (e.g., Yew, Boxwoods) pruned up off the ground to allow for easy visual inspection.
8. As with all cities, the world over, the Norway rat is a denizen of the old (i.e., Brick) city sewer systems. Old Boston is an ideal harborage in this regard for rats.

9. The Newmarket Square neighborhood is scheduled for a major capital renovation for 2030? If so, the time to be thinking toward a thorough assessment of this area's rat population (surface and subsurface) **is soon**. If another 5-6 years passes without attention to this area's rat population (if a substantial one exists?), the rats are likely to increase and cause significant and expensive management plans come 2030.
10. Sadly, rats and homeless encampments are strongly aligned. A pro-active consideration for the Office of Operations and ISD moving forth for areas such as Mass-Cass Area and spilling further East toward Frontage Road.
11. It is important to note that in addition to rats being a potential public health pest and generally lowering the quality of life for all once they become established on properties and in neighborhoods, rats are also significant economic impacts to a city's infrastructure. As the photos clearly show in this BRAP report, rats do significant damage to sidewalks, roads, drainage systems and sewer, and to supportive slabs and retaining walls of all types.
12. The repairs to the above infrastructures are typically very expensive. But these monies will be financially short-lived gains if the rats that caused the need for repairs are not permanently eliminated from that area *from sustainable IPM efforts* versus short-term baiting repeated ad nauseum. Rat colonies over time constantly re-infest their previous generation's favorites harborages of parks, sewers, basements, alleys and so on.

End.

Section IV

Analytic Assessment of the Boston 311 and Inspectional Services Department Violations Data

Analytic Assessment of the Boston 311 and Inspectional Services Department Violations Data

Background of 311 data

As every municipality statistician knows, 311 complaints to a City's Office of Operations are often fraught with biases. And this is acutely true of complaints associated with *rat issues* because rats cross over into multiples of annoyance levels of citizens ranging from mild to very severe. A rat 311 complaint for example, may or may not mean rats are present, or that rats were even seen, or have ever been seen prior to the 311 call. Conversely, a low level or even a complete lack of complaints from an area, block, or property doesn't guarantee that rats are absent from those entities.

The factors that bias *311 rat complaints specifically* include the following:

- 1) **Season:** City rats are predictably more apparent during the warm weather months because of longer day lengths, more outdoor dining via picnics, park food litter, bar-b-ques, and so on. Additionally, there are more offspring from rats during the warm weather months than in winter.
- 2) **Property types:** For example, rental properties tend to have more rat issues than properties that are owned (i.e., vested ownership). People who are transient in their relationship to a property, have no financial motivation to worry about rats on the property and are apt of complain less, or may even be fearful of complaining about drawing attention to their rental status, or other status. Vested property owners certainly wish to maintain the value of a property for future resale, and as such would be inclined to complain more to the city to request services (or to complain of an untidy next-door neighbor that they believe will draw rats to their shared area).
- 3) **Personal tolerance:** Some people have a very low tolerance of rats. Some even have an acute fear of them. Studies have shown it is common for rats in one's personal space can cause people to fret, worry, lose sleep, and remain annoyed over even just one rat sighting for days on end.
- 4) **Vocal Community Anti-rat groups:** These can be very organized and, within the group, submit *multiple and repeating complaints* representing the same neighborhood or park, street, etc., or until they, as taxpayers feel, significant attention has been paid by the city to correct the problem.
- 5) **Socio-economic levels:** Affluent property owners often have a very low tolerance for seeing rats because rats, in general, tend to be associated with squalor and decrepit conditions, signifying an area of a lower quality of life. Less affluent and disadvantaged populations may have backgrounds that facilitated a greater familiarity with seeing rats in their immediate living environments and thus may not be inclined to complain upon witnessing rats on a regular basis.
- 6) **Age of a neighborhood.** Older areas of cities (unless they have undergone massive gentrification) generally suffer more rat infestations and invasions because rats re-infest historical rat areas such as sewers, old building foundations, parks, and so on. This historical association is very common and can continue for centuries. Residents that invest and enjoy these neighborhoods (especially following re-sale of classic properties) tend to be very annoyed with having to share their historical district with rats. They will

demand the city to maintain the character of an area and prevent rats from damaging the old sidewalks, facades, tree squares, etc.

- 7) **Incomplete statistical treatment:** “Raw data complaints” (i.e., not normalized with important geographic variables, population demographics, etc.) affiliated with a particular Ward are often of little value. The simplest example is the case of Boston’s rats being so well distributed throughout most (but not all) of Boston’s wards. A larger ward in area and population might predictably reflect more “straight complaints” than a ward that is smaller in size and people density. Or consider Wards further separated from highly dense areas; fewer citizens, less refuse, fewer eateries, fewer sewers and parks: i.e., fewer essential rat resources; less rat population spread.

Minimal Normalizing of Boston’s 311 Rat Data

Based on the above then, 311 complaint data **must be statistically normalized** to make any sense among 22 of Boston’s wards, which vary dramatically in size, population size and density, longevity of the established rat colonies, geographical profile, location, number and density of food serving establishments, parks, apartment buildings, and other multiple factors.

However, short of undertaking and employing *sophisticated modeling (currently a possible MIT project)* that attempts to measure all the various variables, the most practical method of normalizing the 311 tool is to at least account for population demographics and density (population per sq. mi).

The following methods were employed to statistically normalize the Boston 311 data sets, and subsequently then analyze the data (See Table 1):

1. The Inspectional Services Department of Environmental Services provided upon request the grand totals of all Rodent Activity Reports (RARs) according to each neighborhood (and each Ward) from February of 2021 until April of 2024.
2. The citizen population and population density of each Boston neighborhood/Ward was obtained from www.statisticalatlas.com (accessed May 2024)
3. The number of 311 complaints for each of the neighborhoods was then divided into the citizen population numbers of that neighborhood to achieve a value of: “one out every xx person in the neighborhood saw or complained about rats”.
4. Upon conducting this normalization, the neighborhoods with the highest normalized 311 complaints were separated out from the rest for comparisons to further focus down on the top eight neighborhoods as presented in Table 1. (It is important to note that every Ward of Boston filed a 311-rat complaint, a couple (Null and Mattapan were very low indicating either very few actual rats, or possibly (but not likely) no rats at all.

Table 1. Normalized (adjusted) rat population demographics based upon **2023** complaint data *per* citizen population and ranking of density of *eight neighborhoods posing Boston’s highest rat infestations*. (Mattapan listed for comparison of lowest).

Neighborhoods/Wards are listed from high to lowest number of original 311 complaints for the year 2023 and ranked per normalization.

Neighborhoods (Pop) ⁶ /Density (P) (D) Col. 1	2023 Rat Complaints Rec’d to 311 ⁷ (Adj. Pop Ratio) Col. 2	Ranking of Complaints received per Pop. High to Low Col. 3	Ranking of population Density High to Lowest Col. 4
(Ward 3) Downtown, Chinatown, North End, South End, Haymarket P 50K/ D:6k, 52K, 42K, 32K.	1217 Adj. 1/41 (i.e., there was one complaint per every 41 people of W3)	1	1
N/S Dorchester P 89K /D15K	911 Adj. 1/ 98	4	3
Allston/ Brighton P 29K/ D14K	569 Adj. 1 / 51	2	4
Roxbury P52 K / D15K	463 Adj. 1 /112	6	3
South Boston P33K/D11K	327 Adj. 1 / 101	5	5
East Boston P 41K/D 9k	300 Adj. 1 / 137	7	7
Back Bay + B Hill P32k/D26K/48	416 Adj. 1 / 77	3	2
Jamaica Plain P 41K/D10K	228 Adj. 1 / 179	8	6
Mattapan (for comparison: lowest of 23 neighborhoods) P34K D 13K	77 Adj. 1 / 441	23	(5)

⁶ Population size and density estimates of a Boston neighborhood vary according to the reference source. However, the differences are not enough to affect the goal of identifying Boston’s Priority Action Neighborhoods (PAN). The figures listed here are all from the same source making the estimates all relative regardless as to how “clean” the data may be to the current date. What’s more, for the purposes of Boston Rat Management, the relative estimates and rankings here in combination with the BRAP On-site Assessments, during the Spring of 2024 are sufficient to clearly identify the “Priority Action Neighborhoods within Boston as of the summer of 2024.
Population Data Source: Statistical Atlas @2024. (www.statisticalatlas.com)

⁷ Complaint data provided by ISD from 2021 until April 2024. For the purposes of the Rat Action Plan, emphasizing the full year data of 2023 for all areas suffices to identify neighborhood-specific targeting of High Rat Infestations as the complaints did not varying significantly over the 3.5 years (except for the post-covid rat resurgence effect of 2022),

Recommendations Re: Inspectional Services Department’s (ISD) Operational Processes and Procedures (OPP) for addressing in-field complaints, requests for assistance, and issuance of violations relating to rat infestations and property conditions that are conducive to rats. ⁸

As stated within Boston’s Environmental Services Division’s OPP manual there are five basic principles of ES/ISD:

1. Education
2. Improving Sanitation Practices
3. Proactive and Prevention Rat Management
4. Rapid Response
5. Enforcement

From an outside urban rodent control consultant’s point of view, these principles impressively cover the essentials of a city’s service and stewardship to the citizens. The breadth of Boston’s reach in this regard is indeed impressive.

Additionally, after spending two days on-site of various neighborhoods and observing ISD “inspections-in-action”, the take-away was noting a very dedicated, experienced, and rodent-knowledgeable team. The ISD inspectors knew the most salient points of the rodent science associated with active rodent signs, a property’s/area’s rat-conducive conditions dynamics, and what constitutes a follow up visit to encourage residential or commercial property owners to prevent rats or, if rats are present, to work through the 5-step principles as listed above.

Upon analyzing the 311-complaint data coupled with the ISD violations data for the past 39 months, the grand mean of complaints and violations for the 22 neighborhoods (per month over 39 months) is 390 complaints per month. The average number of violations issued per month is 46 violations, resulting in violation per complaint ratio of 0.12.

Of course, this ratio/relationship could never be 1:1—especially as per the five principles of Boston’s Environmental Services Department. Nevertheless, 46 violations issued per 390 complaints is noticeably lopsided ---especially when this ratio is in context to the State of Massachusetts’s State Sanitary Code, (Chapter II) 105 CMR 410.00 (the minimum standards of fitness for human habitation).

Upon anyone performing a casual walk about in those top four neighborhoods as listed in Table 1, it becomes clear that it is not difficult to note multiple violations of SC 105 CMR 410.00.

Among Sections from 550A through to 602 A.

Just reviewing with perhaps are the most important rat infestation -relevant Sections 600A and 600B state:

600 A: Garbage or mixed garbage and rubbish shall be stored in watertight receptacles with tight-fitting covers. Said receptacles and covers shall be made of metal or other durable rodent proof material.

⁸ The comments within are a compilation of a review of ISD’s Operation and Procedures manual, meetings and email exchanges with the ISD team and observations made of the ISD inspections performed with several ISD inspectors during the two full days of on-site field surveys across several different Boston neighborhoods.

600 B: Plastic bags shall be used to store garbage or mixed garbage or rubbish only if used as liner in watertight receptacles with tight-fitting covers as required in Regulation 410.600A410.

As can be seen in Figures 10-26 of this BRAP Report (Part 1), violations to SC 105 CMR 410.00. Sections 600A and 600B are numerous.

The ISD's approach to issuing violations to Boston citizens as provided by the ISD is as follows:

- 1) ISD' approach is "compliance through assistance".
- 2) Our goal is to guide the constituent to compliance with education and sometimes other resources.
- 3) Enforcement happens when ISD does not get cooperation.
- 4) ISD is hesitant to issue a violation to a constituent who is asking for help.
- 5) Code Enforcement will issue fines for trash violations and address most of the trash violations and trash complaints (as per CMR 410/600A and 600B).
- 6) **However, enforcement can be rendered quite challenging as per The City of Boston needing access permission to step onto property owner's spaces.**

Section V.

Best Practices for Controlling Rats at Boston Housing Authority Complexes

BRAP Best Practices A.

Controlling Rats at Boston Housing Authority Complexes⁹

Introduction

Controlling rats around large multi-family housing complexes can be challenging for several reasons:

- 1) MFH complexes typically have abundant amounts of yard space surrounding the buildings.
- 2) There are many tenants...all with different behaviors relative to refuse practices,
- 3) MFH properties typically utilize refuse alcoves containing dumpsters which some tenants may or may not carefully use,
- 4) Many tenants will store their bar-b-ques directly outside the apartments all year long. During the warm weather months, nothing will draw rats to building perimeters faster than the odors of fresh bar-b-que smoke and molecules. Obviously, most people (of all levels) do not typically scrub down and clean their used bar-b-que stoves immediately after use.
- 5) Copious amounts of food odors are generated out from several hundreds of apartment windows on a 24/7/365 basis and these billions of food molecules get carried into the surrounding outside area creating a very strong pull to any local rats in the nearby blocks on all sides of the campus.
- 6) Large apartment complexes in general must be acutely careful of any rat control programs to prevent accidental occurrences from any baiting program or trapping program to the tenants, (especially inquisitive children playing on the grounds).

The following recommended best practices are the result of an on-site assessment visit to three BHA properties, Charlestown, Cathedral, and Mary Ellen Houses in collaboration with Boston ISD, the Mayor's Office of Operations and BHA staff on 7 March 2024:

Recommendations:

1. Sanitation must be paramount on all building perimeters

Among the dozens of independent apartments facing any one side of a BHA building, it only requires one tenant in an entire apartment inconsiderately throwing trash out the window creating the conditions for rats to begin burrowing along that apartment building's foundation walls.

⁹ Also refer to the additional discussion in the BRAP Photo Report; Figures 39-49.

Realistically, there is little BHA staff can do to constantly counteract these individual behaviors (which is not restricted to BHA but is a common dynamic in apartment buildings the world over from the affluent to the poor).

The key effort should be for an early evening BHA staff member to attempt to at least remove from offending windows the food trash before nightfall, and/or to at least remove the trash as often as possible during any given week. If such trash is allowed to remain and accumulate, so too will the severity of the pest issues that follow (rats, mice, cockroaches, flies, wild animals, etc.). The longer the lag, the longer and more difficult this chore becomes for staff.

2. Daily Clean up of Refuse Alcoves

All BHA refuse alcoves should contain a strongly regimented schedule of daily clean up as close to the very end of the workday as possible (or just prior to quiet times during the evening would be ideal as this time is the rat's preferred feeding times).

Although the frontal areas of the BHA campuses were found to be orderly and clean, the March 2024 on-site visit of the BRAP team witnessed that each of the BHA property exterior rat infestations (some very severe) were linked directly to each development's refuse staging alcoves (Refer to Figures 41-45).

3. Public Service Announcements and Educational Materials:

With the onset of colder temperatures and the end to the bar-b-que season (for most), Boston ISD and BHA should issue public service announcements/ pamphlets, fact sheets, door hangers, etc., to inform tenants of the importance of exterior cooking appliances and their role in attracting rats directly to their doors.

The educational message should emphasize that the best practice for rat prevention is for all outdoor cooking appliances and materials to be 100% cleaned before the off season, and ideally following each use during the warmer months.

The worst mistake with outdoor cooking appliances is for tenants to encase any uncleaned outdoor cooking appliances within protective covers, as this combination will provide rats and other pests with both food and an excellent cave in which to pass the winter.

End.

Section VI.

Best Practices for Controlling Rats in Boston Parks and Other Green Spaces Using Integrated Pest Management (IPM) Programs¹⁰

¹⁰ Also refer to the additional discussion in the BRAP Photo Report. Figures 52-61.

BRAP Best Practices B.

Controlling Rats in Boston Parks and Other Green Spaces Using Integrated Pest Management (IPM) Programs

Introduction

Rats are disturbing and annoying pests in and around city parks. Their presence often frightens people and can reduce the overall enjoyment of city residents visiting their city's park. This is especially true for park visitors with children and/or dog pets.

In general, the world over, most people perceive the presence of rats in a neighborhood as a sign of urban decay and deterioration, so this can result in residents avoiding a park altogether and being deprived of the many benefits parks provide for the citizens.

Rats also damage historic statues, undermine sidewalks, retaining walls, and damage subsurface irrigation lines used for watering and fountains. Finally, rat burrows in and around garden beds and tree bases are unsightly and ecologically unhealthy.

Healthy urban parks are usually inhabited and/or frequented by valued urban wildlife (hawks, owls, squirrels, songbirds, ducks, geese, and various native small mammals) which themselves may draw the public to a park and add to their enjoyment. This natural wildlife can be at significant risk of harm from both rats and rat poisons if rat management programs are not performed with caution and care.

Finally, then, rats cannot be tolerated as park inhabitants. But for all the reasons above, controlling rat infestations in city parks must be done with considerable and professional care. It certainly isn't as simple as a lay person thinking pouring poison baits down rat burrows, or installing poisons or rat traps into boxes around Boston's parks is all that is required in so valued an area used by the public, including families with children, and pets.

Recommendations:

Integrated Pest Management (IPM) programs must be practiced for all efforts to control city rats. For many years, poison baits (rodenticides) were a main portion of controlling rats in parks. However as is discussed below, this is no longer the case due to research revealing the ecological threat of rodent baits to not only parks to exterior areas in general. Alternative approaches to the use of poison baits are listed below which include sanitation, anti-rat garden maintenance practices, and when necessary, the use of gaseous burrow treatments comprising the largest portion of a current effective IPM park program for Boston's parks.

A. Park Sanitation Practices

- 1) The most elementary principle for effective, sustainable rat management in parks is: "No food = no rats." But with hundreds (even thousands) of citizens visiting a

popular park every day (e.g., Boston Commons), this is notably a challenge for all staff. The goal is eliminating the rat food sources as much as possible (frequent litter basket collection and removal of bags. Rats crash their own populations when they are stressed due to hunger or inconsistent occurrences/ amounts of daily food.

- 2) In general, litter baskets and/or refuse bags should never be available to rats once dusk occurs (Figure 54).
- 3) Similarly, a general sweeping of foods dropped beneath benches should be done prior to the evening.
- 4) Some commercial litter baskets are equipped with solar panels to power compaction and are also designed to be rat-proof provided they are not overfilled. These baskets also come equipped with apps that alert staff when the baskets are full or approaching full, and when they are low enough to not have park staff wasting time checking baskets that may have hours or even days to go before needing emptying. (note: models are available with foot pedals to facilitate not having to grab the pull-down draw handle which most people are averse to touching).
- 5) The speedy removal of all basket bags from the park property. Bags should never be staged overnight for morning pick up. This would be the equivalent of using the park as a rat-rearing area.
- 6) Always eliminate any removable rat harborages (debris left about construction, clutter piles, etc.).
- 7) Pigeon, squirrel and duck feeding within the park should be strongly discouraged via park signs and staff reminders to visitors. Each of these habits are highly conducive to attracting and rewarding rats, which then results in rats attempting to establish permanent burrows nearby.

B. Anti-rat Garden Maintenance Practices

- 1) Interestingly, rats are very attracted to rose beds. This is because they benefit from the predator protection provided by the strong thorns of rose bushes. Careful monitoring of these areas is necessary.
- 2) During the warm days of summer, garden beds in day-long full sunlight that may be vulnerable to rat burrows (i.e., litter baskets or a pond nearby, heavy food drops, etc.) can be protected from rats by using mulch beds with thicker depths than ordinary mulching. This is because rats also must maintain critical mammal homeothermy in their daily lives. The thicker mulching renders burrow temperatures below too hot for the rats causing them to evacuate that ground area (akin to placing a heavy wool blanket on a bed during summer).

- 3) Ponds in parks containing ducks, geese and other waterfowl are particularly prone to experiencing rat invasions. Rats benefit from the constant source of freshwater (highly important to urban rats), as well as the abundance of natural foods such as fishes, waterfowl (and their eggs) turtles, frogs and abundance of invertebrates associated with pond embankments. Pond perimeters must be checked weekly for any new invasions (see remote rat monitor systems below).
- 4) It is not necessary to rip out shrubbery and/or ground covers to eliminate rats. After all, the lush green plants are a unique part of what attracts the public to want to visit parks. Besides, if rats are infesting any landscaping, it's not because there are bushes and ground covers, it is because there is a dependable source of food nearby the bushes and ground covers (i.e., remove the food; not the plants).
- 5) However, weekly inspections beneath those cavernous bushes nearby litter baskets or other sources of food for rat burrows (e.g. yew, boxwood, creeping juniper and arborvitae, etc.).
- 6) Keep cave-shaped bushes pruned up to allow for about 12-18 inches of open space from the ground to the lower branches to minimize attracting rats to these low shadowy areas.
- 7) Regularly inspect any carpet-style ground covers (e.g., ground ivy, pachysandra, liriopse) for both rat trails and/or burrows.

C. Population Reduction and/or Discouragement

- 1) Burrow Harassment: Caving in all rat burrows with a long-handled hoe or trowel and strongly compacting the soil by foot will often cause rat families to evacuate the area (e.g., sometimes they leave the park, or migrate to areas where it is easier to control them). This should be done several times a week for the first 2-3 weeks.

For best success with burrow harassments, begin them at the very first signs of new burrows appearing early in the season (typically, the first warm days of late March are when park and landscape rats begin establishing their summer breeding nests). It usually takes 4-6 times of technique in the same area to evict the rats.

- 2) Burrow Asphyxiants: Two burrow asphyxiants are currently registered for treating earthen rat burrows in parks and other landscaped zones (e.g., residential yards). These include the gasses a) carbon dioxide and b) carbon monoxide. Both materials are highly effective against burrowing park rats. They are also the No. 1 preferred methods of rat control for parks because they are the most humane approaches for killing rats (compared to all other methods) as most of the rats pass into a stupor first, and then pass during a sleep.

These products also pose no threat whatsoever to any of a park's non-target wildlife (see below).

Carbon dioxide is available in the form of dry ice (Rat Ice™) applied by hand into active rat burrows, or via pressurized cylinders (IGI Carbon Dioxide Eliminator System™). These are the same types of cylinders that render beverages their "fizz" in restaurants the world over).

EPA-approved labels and application directions are readily available online and via pest control supply warehouses and product specialists (Bell Laboratories, Liphatech, others).

Carbon monoxide can be applied from carbon monoxide generator machines (gasoline powered small engines with hoses for directing the combustible gas results down into rat burrows. One brand (Burrow X™ machine) employs a lawn mower sized engine attached to a wheel cart; another brand, The Cheetah™ is a handheld (portable) 2-cylinder powered machine (very similar to larger hand-held gasoline powered leaf blowers).

- 3) Poison Baits (Rodenticides) and Traps: As of 2023, the use of poison baits (especially anticoagulant baits) in nearly all parks on a global scale is now considered a severe secondary threat to the urban wildlife and secondarily to park visitor's companion animals.

Recent published research during the past five years has revealed the more advanced rodenticide poisons have had secondary lethal impacts to:

- Hawks
- Owls
- Eagles
- Songbirds (consuming ants that consume the rodent poisons)
- Urban Carnivores (fox, coyotes, weasels, mink)
- Reptiles (beneficial snakes, turtles)
- Fish and other aquatic animals
- Beneficial non-target small mammals (mice, voles, shrews) important for ecological balance in parks and other areas

Inside and around occupied park structures, (restrooms, offices, supply sheds, etc.), where the alternative approaches are not applicable, snap trapping programs in conjunction with enhanced sanitation using trapping stations and conducted by experienced pest professionals are highly effective techniques.

- 4) Remote Rat Sensors for Parks: Recent technology has developed highly useful remote rodent systems that would have very useful benefits and high cost-savings to urban parks. Remote sensors provide the following advantages (Also see Appendix B).

- a. Canaries in the coalmine. Remote sensors can alert park personnel upon the first rat entry in a park, or those specific areas in which the largest numbers of rats are most activity (often unknown to park staff because rats are active at night when staff are absent.
- b. Remote Rodent Sensors (RRS) eliminate a significant amount of the redundant portions of the expensive physical labor needed for repeating “rat walk abouts” and inspections of “park hot spots” that recur repeatedly several times during year following burrow gas treatments, or anti-rat garden practices.

Final Note

The trade off to the ‘loss’ of easily applied (convenient) poison baits of the past is park rat IPM the world over now requires an increase in scheduling, recurring area assessments, and the labor allotments by park administrators to facilitate personnel performing the additional attention to litter baskets and drop-pickups, repeating burrow harassments and /or carbon monoxide/dioxide applications.

All these practices and time requirements must be built into park staff budgets by city administrators. It is a different economic day for parks in this regard.

Section VII

BRAP Best Practices C. Monitoring and Controlling Rat Infestations in Boston Sewers and Utility Systems

BRAP Best Practices C.

Monitoring and Controlling Rat Infestations in Boston Sewers and Utility Systems¹¹

“If the Norway rat could design the ideal environment for the survival of its species, it most likely would be a system of sewers and drains”. S. A. Barnett. 2001. (World’s foremost scientist on Norway rats).

Introduction and background of city rats and city sewers

Studies conducted on sewer rats over the past five years in various cities both in and outside of the U.S. as well as the older Big Dig Boston sewer rat infestation studies by Bruce Colvin during the 1990s all continue to indicate the significance and infrastructural importance of sewer rats in large cities. No matter the sophistication of a “Rat Action Plan” for Boston or any city, sewer rat populations below strongly affect rat populations above on the surface. In other words, sewer rats cannot be ignored in any rat action plan. To do so, would render rat actions like harvesting crops of seeding, growing, and harvesting rats year after year.

Contrary to the above, however, many city citizens mistakenly believe all rats are somehow associated with sewers, which, of course, is not true by a long shot. A sewer system, like rat habitats above ground, must provide the right environment and resources to sustain a rat population. For example, a sewer system containing tons of food wastes flowing daily is not enough to render the sewer to be a rat-infested sewer. In fact, most modern-day sewer systems are not conducive to rat infestations.

The following discussion points and updates are important here in 2024 to the Boston Rat Action Plan.

1. Rats gain entry to sewer systems via broken manholes covers, broken laterals (due to heavy stress loads from traffic, or some local geological force), from separated joints connecting sections of pipes, or where water-seeking tree roots have penetrated pipe cracks and/ or joints. Breaks in a system allow for vertical rat highways to become established and rats may utilize the surface areas and subsurface/surface areas in foraging patterns.
2. In some cities or areas, rats may migrate seasonally out of the sewers to the surface during the warm weather months (new burrows are often reported during May) and descend back down into the protection of the sewers again with the onset of winter to avoid the harsh cold temperatures. Subsurface rat populations can serve as reservoir sources for future ground level rat infestations (i.e., rats moving into restaurants, apartments, emerging through toilet bowls, etc.).

¹¹ Also refer to the additional discussion in the BRAP Photo Report; Figures 62-68.

3. The presence of rats at street level (foraging in the gutters), around alleyways, in downtown parks, and so forth is not necessarily an indication that the sewers below the area are infested. Still, when street-level rat sightings and infestations are persistent despite baiting programs, the sewer system of the area should be inspected and baited to confirm the presence or absence of sewer rats serving as a source of the above-ground infestations.

4. Rats do not always flee from sewers due to noise and vibrations of construction nearby or above the sewers on the streets. In fact, rats usually continue to hole up in their sewer environments while they are under construction. Researchers over the years have all noted that it takes direct excavation to roust rats out of their sewers. Colvin et.al (1998) noted that rats will readily inhabit cut-and cover trench excavations during utility construction.

5. The food source of sewer rats comes from food wastes poured down toilets and garbage grinders (from both residences and food serving establishments) as well as from undigested food particles in fecal material. (As most pest professionals know, rats in all types of above ground infestations make frequent use of the feces of dogs, horses, livestock, zoo animals, etc., by separating the food out from the feces). As will be discussed below, it is important to note that food alone does not necessarily mean rat populations can exist or proliferate within the sewer system.

6. Cities that contain old brick sewer systems (e.g., from 50-175 years old) are most vulnerable to sewer rat infestations. This is because the brick construction provides the rats with crevices among the brick edges to gain a “toehold” facilitating moving along the sewer tunnel walls. Similarly, the brick allows the rats to move vertically up and down the walls accessing or avoiding the effluent flow. As the brick and or mortar deteriorate over years within the older systems rats are also capable of utilizing nest sites behind or between missing or deteriorating bricks. These brick environments no doubt also allow for various types of invertebrate populations to thrive such as the American cockroach (*Periplaneta americana*), which, as a food source, may also contribute towards the success of a rat population.

7. Sewer system pipes and tunnels constructed of clay, concrete, and PVC do not become seriously infested by rats because there are few opportunities within the tunnels for the rats to nest and harbor. However, depending on the situation, rats may travel among various sections of these types of subterranean tunnels. Too, rats may nest within various areas of earth surrounding these types of sewers and access food in the sewers through breaks and cracks. Still, such sewer systems and scenarios are more representative of “pockets” of rat families and small colonies, and not the larger rat “populations”.

8. Certain sewer systems in Boston are more rat-vulnerable than others (i.e., Rat Vulnerable Sewers (RVS). Back in 1998, Colvin and his associates found the RVS of Boston fit this profile: populations (RVS) were mostly found in sewers with the following designs and operation:

- a. In residential areas:
- b. Old brick sewers (> 100 years old).
- c. Low flow rate areas (high end of systems), and,
- d. Pipes with diameters less than 24 inches (61 cm).

In these areas, and among these types of sewer systems, these researchers found during the initial phases of their baiting programs, up to 38% of the manholes exhibited rat activity. Sewer systems constructed with pipe sizes larger than 24 inches/61 cm were not prone to serious rat infestations

regardless of the construction materials. Interestingly, they also found that the clay sewer systems in the non-residential areas of Boston (strictly commercial and industrial areas) contained minor infestations not worthy of any formal baiting programs.

9. Large rat infestations do not become established in those portions of sewer systems containing the heaviest and fastest-flowing effluent (i.e., the “upstream sections” of the sewer system). Rats can be swept away in such areas, and foods cannot be easily captured from fast moving flow streams.

10. Populations of rats may exist in “isolated areas” of the sewers away from manholes and other access points providing the walls have areas (breaks, crevices, etc.) allowing for nesting opportunities and the flow rate provides food accessibility.

Depending on where these isolated populations occur, they may not be immediately vulnerable to initial baiting efforts made at manholes. As the rats closest to the manhole areas are killed via poisoning, the isolated rats may over several weeks redistribute and reshuffle their tubular territories and begin feeding at the manhole areas.

11. Surface dwelling rats and migrating sewer rats may both opportunistically burrow and breed in soil areas next to catch basins, or beneath deteriorating walkway slabs in heavily trafficked city streets. In these areas, food refuse is abundant all along the curb/street intersection, as well as in any clogged storm drains.

Sewer Baiting Programs.

1. For proactive sewer baiting (or trapping –see below) programs should be matched to Sewer Line Database to eliminate the non -RVS systems. As previously mentioned, new sewer lines (or 100% clay and cement monolithic pipes do not harbor rats).

2. For RVS areas:

- a. The goal of sewer rat control programs is to cost-effectively suppress a sewer rat population. Total eradication is not likely (or probably not even possible). Reactive programs of baiting only those manholes in areas of rat complaints, or “toilet bowl sightings” is ineffective and wasteful of allocated monies for rat abatement. Additionally, unless fresh droppings are easily visible on ledges, it is difficult for BWS employees to simply look down a manhole and determine whether or not rats are currently active in the sewer at that day (heavy rains are constantly washing away droppings down below).
- b. Sewer rat management programs must be organized with a systematic approach and that closely review and adjustment the baiting strategy be based on complain clusters, the results of camera scoping (especially crawlers) and the quantities and geographic patterns of bait consumption of past months and even years. Rat colonies year after year remain very loyal to their historical sewer homes providing, they remain as per the RVS characteristics above.
- c. The specific baiting regimes for a particular area of Boston can vary depending on all the factors of the local infrastructure, (e.g., types of sewers, manpower, budgets, and so forth). As a general model however, manholes in RVS areas should be baited during the

initial assessments of chronic complaint streets. In this way, rat presence and distributions can be determined.

1. Bait Formulation

Prior to the selection of any bait, rodenticide labels must be reviewed as not all sewer bait blocks have label clearance for installations into sewers. This is particularly important here in 2024 as many rodenticides have been discovered to be secondarily impacting fish and other aquatic animals.

Certainly, baits used for rat control programs will be subject to high levels of moisture, and even direct contact from sewage or rain runoff. Thus, high density bait blocks, which also used high quality grains and advanced active ingredients, are a wise choice for baits (maintenance baiting programs allow for more flexibility as described below).

2. Baiting Regimes

Traditional sewer baiting in cities is usually of the following model¹² :

- a) Installation: Approved bait blocks on 24-gauge plastic-coated wire attached to a latter rung or to a nail just below the manhole top. The blocks are adjusted to hang a few inches from the manhole base. A metal tag fastened to the top of each wire identifies the manhole number so the amount of bait and the manhole location is accurately recorded. Baited manholes are then marked with orange paint on the street surface.
- b) Inspection: Baiting manholes are inspected at 14-day intervals, and re-baited until all activity ceases. Bait Blocks can be inspected for gnaw marks by rats feeding on the blocks. The plastic-coated wires also help to confirm the presence of rats (i.e. cockroaches often consume the block baits).
- c) Deactivation: All inactive holes are culled from the baiting program at the end of the second baiting period except for a few sentinel holes maintained in locations in rat vulnerable areas (e.g., holes in areas of previous rat activity, near restaurants, residences).
- d) Feeding Variability: The amount of rat feeding on installed baits might vary widely. Some manholes may have their entire bait contents consumed within the first baiting period. Others may not show any activity whatsoever. In some cases, it is impossible to predict the most active areas, and may simply depend on what areas the sewer rats have found ideal vs. suitable harborage within a particular stretch of the sewer system. Or it may be from what part of a uniformly rat-ideal sewer system the rats simply populated first.
- e) Seasonal Baiting: The number of seasonal baiting periods performed each year is based on the level of control necessary and the extent of the existing infestations. When systems are infested, an initial program the first year should consist of three baiting periods: March, June and September. By baiting during these months, adults can be eliminated prior to the onset of peak reproductive periods of the spring and fall and thereby slow the recovery rates.

¹² Boston Water and Sewers very likely already employs an SOP for Baiting Sewers for Rats. However, the procedures discussed here can be compared to any existing SOPs for possible upgrades.

- f) Peripheral Baiting: Thereafter, the baiting regiment should be customized annually, centers of activity targeted, and holes prioritized based on baiting histories. Utility maps are important for determining and plotting the most effective distribution of baits. In those manholes showing the heavy rat activity (as indicated by large consumption of baits), areas beyond the immediate manhole or utility tunnels should also be inspected. Baiting of zones within an additional 3 blocks beyond the high activity manholes will often produce a good knockdown of peripheral and fringe level populations. If this is not done, these populations may simply move into the now vacant area and re-populate, undoing re-populate undoing all the hard work and monies spent on the original effort.

Maintenance baiting and monitoring programs.

- a) Following the knockdown of any sewer populations, or to sustain suppression of any existing low numbers of rats in cities, municipalities must have on-going (i.e., maintenance) programs.
- b) Programs that only bait sewer areas once or twice in response to complaints, or bait on a random fashion accomplish little in reducing city rat populations on a long-term basis. Research has repeatedly shown in many different studies that reduced animal populations, if left alone following the initial knockdowns, will consistently rebound to original levels (and often exceed them) in only about 22-24 weeks.
- c) For routine maintenance baiting programs, manholes that were once active (or from where complaints might be still occurring) should be baited during the spring (March/April), and again in the fall (August /September). For high activity areas or in areas of persistent populations, baiting can also occur during June and November.
- d) In the famous Boston Big Dig project, Colvin and his associates were successful in reducing their baiting project from an original of 1,288 holes to 225 holes being baited and/or monitored routinely, a reduction of greater than 90%. As a result, their maintenance budget for a two-person baiting crew was reduced to less than \$20,000.00 per year for a five square mile area (in 2024 dollars).
- e) As mentioned above, care should be taken relative to determining the presence or absence of rats during maintenance monitoring inspections based on the presence or absence of the rodent bait alone. American cockroaches are common inhabitants (sometimes, their populations will reach into the hundreds of thousands) of sewers. In fact, this consultant in his inspections of sewers and infested basements has witnessed rats eating American cockroaches. It is common in sewers to find the wings and legs of American cockroaches on various sewer ledges, presumably the result of rats disassembling the legs and wings of these large insects and consuming their nutritious abdomen.
- f) Sewer cockroaches will totally consume rodenticide cereal bait blocks. Thus, pest management professionals and municipal vector control agents must identify whether activity is due to rats or cockroaches.

This can be done by:

- a) Observing for droppings (often containing the blue dye color of the bait) to identify whether roaches or rats are present.
- b) If some of the bait blocks remain, the rat's incisor imprints will be visible on the blocks; and (or nontoxic bait blocks can be hung to inspect for rodent incisor marks to monitor a positive or negative on rat activity for that area.

c) Inspecting the block-holding-wire for incisor imprints.

Sewer Rat Trapping Possibility 2024

In 2019, a novel sewer rat trap was developed by the professional pest management corporation Anticimex® (Copenhagen) named the Smart Pipe™ (SP). The SP is an automatic, re-setting pneumatic kill- trap designed specifically for sewer systems. The SP sends digital alerts to a staff's smart device (phone, tablet, desktop computer) for each kill. Consequently, based on currently on-going research of the SP, there is the potential for local area sewer rat populations to play a role in sewer rat control (especially considering possible heavy restrictions to currently labeled rodenticides that may be forthcoming from the Environmental Protection Agency late in 2024).

The SP has been informally trialed (i.e., non-research applications) in Copenhagen, Sweden, Portland, (ME), and Somerville, MA. Other municipalities (e.g., Boston, MA) are also considering trialing this technology.

Based on some of the current trials, the Anticimex corporation scientists and engineers (i.e., original designers of the SP) expressed their support and on-going collaboration and are open to SP version updates and possible suggested modifications based on the results of discoveries of the 2024-2025 field trials.

Data Collection and Analysis

As was emphasized for all 311 complaints, inspections, violations, and IPM work within the BRAP, detailed record keeping is an essential element of on-going municipality sewer rat management programs as well. Standardized inspection and baiting forms if not already in place with BSW should be developed and maintained for the program.

For example, manhole and catch basin baiting forms require classification by whether the manhole type is a sanitary sewer, combined sewer, storm sewer, catch basin, and so forth. Water volumes can be rated as none, low, moderate, or high. Bait location, quantities (replaced or remaining), and presence and number of rat droppings should also be recorded. Other forms for all other aspects of municipal rodent management programs should be developed as the specific program dictates.

Rats emerging in toilet bowls.

Rats are excellent swimmers and gymnasts, so it is not uncommon to hear of reports of the occasional sewer rat finding its way into a specific residential toilet. Usually, toilet bowl rat incidents occur in those systems where lateral lines break or other sewer systems malfunctions of some sort.

Dealing with a toilet bowl rat is not difficult if a pest professional is called in (or experienced plumbers). Of course, closing the lid and flushing the toilet will not flush or chase the rat back down to the sewer. Many homeowners report pouring a full cup of bleach in the toilet, closing the lid and removing a dead rat ten minutes later (which for sure will kill a rat).

Experienced pest professionals will usually remove toilet rats via the simple use of a wild animal grab stick, placing the rat in a pillowcase type sack, and dealing with the rat outside of the occupant.

SECTION VIII.

Best Practices for Rat Management Strategies for Construction and Demolition Sites

BRAP Best Practices D.

Recommendations for Rat Management Strategies for Construction and Demolition Sites¹³

Introduction: Rats and New Construction Sites

The process of construction itself does not suddenly cause rats to be noticed in a neighborhood unless there is a pre-existing rat population present at, or very close to the site scheduled for the jackhammering, earth moving, removal of old subterranean utilities, and other heavy disruptive operations. If rats are already established, they will certainly be disturbed (like one hitting a hornet's nest with a stick) and force-evicted or frightened from their subterranean tunnels and nests. Displaced rats may invade the nearest properties, or they may return to the exposed earthen areas now exposed by the street removal, or they may travel significant distances over the course of days and weeks searching for suitable new habitats away from the area. But most commonly, businesses and residents within the immediate area begin seeing disoriented rats or begin noticing rat burrows suddenly appearing on their properties.

Once construction is underway, construction sites and their associated equipment and supplies staging alcoves often become attractive to the displaced rats and even to rats from nearby areas for a few reasons. But the bottom line (and thus the persistent urban myth) because of the above reasons, is the lay public concludes that “any construction anywhere will cause rats to infest their street areas, or suburban development, neighborhood, etc. (Boston’s Big Dig Project back in the 1980’s disproved this conclusion as did other major capital construction projects (e.g., the NYC 2nd Ave Subway project).

But once construction sites are set up for the long-term work ahead, local rats are attracted to them because these sites are inherently prone to messiness, clutter and being temporarily disorganized. Rats can locate easy harborage beneath the sudden appearance of equipment pallets, wooden platforms, trailer offices, gang boxes, and any stagnating equipment and machinery. Too, any exploring rats new to the site usually have little trouble finding food scrap leftovers from worker lunches, pedestrian littering, or from on-site dumpsters and garbage cans that do not get emptied frequently enough.

Thus, as part of city-scale rodent management programs, city coda typically requires pest management operations be a contractual component of any capital construction and demolition projects. The following are summary points regarding the techniques and procedures for city capital project contractors and their sub-contracted pest management professionals hired to perform rodent pest management for construction and demolition sites.

¹³ Also refer to the additional discussion in the BRAP Photo Report; Figures 85-89

A. Pre- Construction

All RFPs for rodent control for construction sites (especially capital construction) must be written carefully (with strong input from rat control staff/ specialists at Boston ISD).

With any significant construction project, it is important for contractors to allow enough time beforehand to be able to accomplish effective rat assessments and if necessary, rat exterminations prior to the actual construction start-up. Typically, this requires several weeks of time prior to any earth disturbances from heavy equipment for inspections, assessments, possible exterminations and on-going inspection and service visits. Under-bidding construction rat control work by simply skipping to the lay-down of bait boxes around the construction fence (regardless of how many and the baits inside) usually results in on going complaints to the contractor as well as public relations problems (311 complaints, letters to the Mayor Council, neighborhood leaders, etc.) from the residents and businesses of the area because rats will be seen scattering in all directions from the massive disturbance to their subterranean harborages. Bait boxes will not impact any of this at all.

2. At all construction/demolition sites, rat control begins with the project's contractors before the exterminators

Construction site rodent management programs must detail everyone's role in preventing rodent problems because of the construction project. For example, the building contractor must agree to maintaining proper sanitation of the site. This includes:

- a) the correct use of refuse garbage cans and dumpsters (which includes the correct type of garbage receptacle, tight fitting lids, etc.). (Refer to photo report for relevant discussion).
- b) daily pickup of any food trash discarded by workers (must never be allowed to sit overnight).
- c) sanitation maintenance of the site's perimeter areas (both sides) of all types of food discards (including any city litter baskets).
- d) not creating rat harborages via:
 - (1) proper storage (i.e., neatly stacked, organized) of large equipment, sand and cement bags, and wooden supplies (walking platforms, pallets, etc.).
 - (2) monitoring of any straw bales used for erosion control (disturbed site rats often tunnel into any perimeter straw bales soon after being dislodged).
 - (3) management of weeds and fence line vegetation, and,
 - (4) maintaining 18-24 inches of space beneath trailers, and any other such conditions conducive towards attracting rats and allowing them access to proliferate at the site.

3. Distribute easy-to-read one-page fact sheets for the site employees.

Fact sheets about construction sites and rodent problems containing the above listed items in Step 2 are helpful in educating construction workers as to their role in not attracting and feeding rodents. Fact sheets should be multilingual for whatever languages are appropriate for a particular contractor.

4. Rat Exterminations

a. If the initial assessment determines that rats are present or exist immediately nearby (within a 200 ft radius), the IPM approach is the best practices path during the construction and demolition work from start to finish. This is because (and it can't be stressed enough) years of repeated sound research has proven that attention to sanitation is likely 80% more effective than relying on poison bait boxes to 'magically' substitute for deficiencies as listed above in Step 2. (Usually, the lay citizen and even Agency inspectors outside the profession of pest control are unfortunately appeased when noticing black boxes neatly spaced around sites mistakenly assuming the boxes are the "necessary professional techniques" for controlling construction site rats.

b. To eliminate any current rat infestations, using conventional professional level rodenticide baits the following practices are essential to success:

c. The baiting program must occur concurrently with the removal of food refuse.

d. Once site food refuse (and any other sources of food) is eliminated so that the disrupted foraging rats no longer discover any food, they aggressively enter bait stations and feed on all installed baits.

e. However, when food scraps or full litter refuse barrels remain on a construction site overnight facilitating rats feeding with familiarity and taste approval, rats completely disregard any installed bait boxes).

f. If assessments determine the sewers or other utility tunnels are rat-active, baiting programs will need to be coordinated with each appropriate Departmental personnel (E.g. Boston Water and Sewers). Department management will need to know specifics as to how the baiting will be done (via contract specs, procedural sheets, etc.), servicing routines, and so forth. Rodenticide labels and MSDS sheets must be delivered to the Purview Department (e.g., BWS).

5. Estimating labor input for construction site rat management.

a. The number of hours required of quality pest contractor work for construction site rat management depends on the size and complexity of the site. Minor construction projects may only require an hour or two for a proper assessment, followed by an hour or two to install several stations either for surveillance purposes only, or for installing rodenticide baits if needed. Thereafter, the site can be checked and serviced on a weekly basis via typical pest control service visits. For Major (capital) projects, scale up from this example in time and materials.

b. Quality control for contracted pest management services of construction sites is strongly encouraged. Unannounced, periodical walkabouts with the servicing pest professional should involve observing on-going inspections, the servicing of the bait /monitoring stations and a review of the service recommendation notes provided to the contracting party from the pest professional.

6. Public relations and a community education effort for nearby property owners are important.

Similar to the importance of educating the construction workers on the importance of keeping conducive conditions to a minimum, it is also important to inform and educate local property owners nearby. An educational fact sheet which outlines the importance of basic sanitation (not placing food trash in plastic bags on streets, proper use of garbage cans, etc.), rodent proofing of their properties, and other helpful information helps to dispel the various rat “myths” associated with construction projects and rats.

B. During Construction

1. Perimeter Construction Fence monitoring/baiting/trapping programs.

Around the construction site, a perimeter rodent monitoring and (supplemental defense program) should be considered in addition to the IPM program listed above as follows:

- a. The monitoring and/or bait stations should be installed around the interior of the entire site construction perimeter fence or site barricades. If rodenticide baits are used, the stations should be secured to the ground, and the stations maintained in a tamper-proof fashion. On sites where Jersey barriers (the heavy concrete wall barriers) are used, the spaces beneath the barriers are often subject to collecting wind-blown trash and food scraps. These sites are ideal for installing bait /trap stations within any available base voids. In some cases, heavy duty secured PVC bait stations with bait blocks or non-toxic monitor blocks secured inside will provide ideal bait/monitoring stations that cannot be destroyed by even the heaviest construction work.
 - b. The spacing of the bait or trap stations is determined by the severity of the rodent pressure around the site, but typically they are spaced an average of 50 -100 ft: the closer spacings for active infestation pressure.
 - c. Any closer than 50ft. distance is usually scientifically unnecessary and economically wasteful.
 - d. Distances greater than 100 ft are acceptable, but stations should only be maintained if they continue to show visits from rats.
 - e. Bait stations can also (and to some degree, more importantly), be installed around employee break areas, beneath trailers, nearby food refuse dumpsters and any other areas where foods may collect or be thrown by local pedestrians beneath any nearby landscaping.
- #### **2. Rodent Sighting Logs should be established for the construction site.**

On site construction workers should be encouraged to report any sightings of rodents around the site or within any new building. Because construction workers are always on the go, and hard to track down, activity logs facilitate the contracted pest professional being able to follow through on any sightings and halt any new developments before they become troublesome.

3. **Schedule service and inspection visits appropriately.**

For any construction sites with active rodent infestations, weekly service visits are usually (but not always) necessary. For minor or sites with no current infestations, bi-weekly visits will usually.

Regardless of the presence or absence of rats, construction zones where large swaths of soil have become exposed, and or are mounded onto the surface (as is typical), this now available earthen space, or soil mounds are very attractive to the burrowing instincts of the Boston Norway rat. It may also be that such soil is laden with rat colony pheromones and the rats will be constantly drawn to re-burrow into their previous neighborhood and family scents. Such exposed soils and soil mounds must be checked regularly until construction activities re-encloses the ground and completes the work.

4. **On-going communication is essential.**

Because construction sites are dynamic, on-going communication is essential between the contracted pest professional and the project engineer (PE) (or the designated project manager). Meetings should occur before and after each service visit by the pest professional to review the status of any on-going rat issues or any sanitation issues as listed in negating progress in gaining or maintaining control.

II. Controlling Rats at Building Demolition Sites

Despite how Hollywood portrays it, rarely do old and vacant buildings by themselves harbor rat infestations. To be vulnerable to rat invasions such buildings must also have food nearby (a local eatery, park, active litter baskets, etc.), or have food brought onto the property daily (vagrants, squatters, etc.). (I.e., no food= no rats.). Therefore, it makes little scientific sense to unquestioningly install rodent poison bait stations on every building site to be demolished simply because it appears like a “ghost house” (this is still an entrenched coda in many cities. (See appeasement comment above in Section 4a above).

Nevertheless, should rodents exist and be harboring within a soon-to-be demolished building or street, highway or subsurface utility systems (e.g., sewer replacements), they will be evicted and may disperse in all directions to nearby areas as was previously discussed. Therefore, performing rat management assessments and extermination efforts (should they be needed) prior to demolition makes most sense. Conducting rat management at demolition sites is very similar to the steps for pre-construction phases of the new construction projects discussed earlier.

1. City coda should require professional-level inspections/assessments to determine the presence or absence of rats at surface and subsurface areas / systems of the scheduled demolition site.
2. When rats are present, the food source, if possible, of the rats must be identified and eliminated via sanitation efforts. (i.e., an IPM-oriented program).
3. Concurrent to the sanitation program, rodenticide baits can be applied in interior and exterior areas showing active rat signs.
4. Once the food sources of the rats are eliminated and the initial bait acceptance is good, a rat colony may be significantly reduced or even eliminated in as early as 10 days. When the food that was sustaining the rats at the site is not eliminated, it can take up to 3-4 weeks or longer for extermination.
5. Depending on the type of area (e.g., industrial vs. nearby residential) community outreach and education efforts may also be necessary.

Appendix A.

The 2024 IPM Toolbox:

Effective Alternative Options to the use of Second Generation Anticoagulant Rodenticides (SGARs) for Controlling Rats within the Boston Rat Action Plan¹⁴

1. Substitute baits to replace the wildlife toxic second generation anticoagulant baits:
 - a) Fast Track™ (Bell Labs) ; (Active Ing. Bromethalin)
 - b) TakeDown™ Liphatech (Active Ing. Bromethalin)
 - c) Selontra™ (Cholecalciferol (VitD3))
 - d) Cadet (Cholecalciferol (VitD3))
 - e) Flatline™ (Active Ing: Chlorophacinone: 0.005%).

2. Carbon dioxide and carbon monoxide burrow treatments for parks and landscapes

3. New Trap Technology is emerging to fill in the gap created by a decrease reliance on rodenticides.

4. Pest Proofing technology and practices will increase with fewer chemical tools

5. Digital monitoring Sensors (RRS) to assess the needs for baits, or traps, or simple conducive conditions removal.

6. New wildlife-friendly (i.e., no secondary poisoning) bait actives are currently in development by bait manufacturers.

¹⁴ This outline is discussed in greater detail in Section VI. Best Practices for Controlling Rats in Boston Parks and Other Green Spaces.

Appendix B.

The Utility of Using Remote Rodent Sensors Within the Boston Rat Action Plan 2024

Background:

A significant part of the challenges with sustainable rat management in current day metropolises like Boston is associated with the *complexity of urban rat populations as they exist and use our complicated cities.*

But monitoring of large-scale rat populations at a level the scale and scope of Boston using city staff is labor intensive and thus expensive because of the multiples of complex interacting factors. The current cursory inspection in most cities involves teams of public health inspectors in combination with an element of general ‘insight’ as provided by a citizen-based complaint system of rat sightings (i.e., 311).

These two ‘data inputs’ provide useful insight but are nevertheless still limited in providing a true understanding of local and/or area-wide true population fluctuations in either direction over time. Human inspections are barely more than snap shots in time and place and are in fact, laden with inherent false negatives (e.g., rat signs such as droppings, rat damage, visible live rats, etc. are not present or visible during the human inspection can occur hours, days, or a week or two later).

Consequently, municipal rat ‘control’ programs have remained fragmented for nearly two centuries in the USA. It is to this fragmentation, coupled with the same long-term mis-directed control strategy of relying on unrelenting and overly simplistic poison baiting campaigns rather than *data driven root causes* (environmental management) that urban rats have been able to sustain their continuous increase in most cities.

Effective (i.e., *sustainable*) city level rat control is entirely possible in Boston (and other rat-afflicted cities), at least within acceptable thresholds. But for sure, global rat populations are seriously out-pacing people’s limited resources to keep pace with them even when considering all the municipal programs, the entire global pest control industry, farmers, and private individuals targeting billions of DIY poison and traps against them.

But sustainable city rat control can only be achieved by managing rats at the *local population* level, not by remaining with the century old practices of killing *small groups of rats here and there* on a 311-complaint response system. This sustainable control of urban rats requires technological assistance beyond the limited resources mentioned above.

Emergence of remote rodent sensor technology.

Beginning in 2016, remote rodent sensor technology (RRS) emerged on global scale that provides monitoring of rodent infestations/city populations of both indoor and exterior rodent infestations from single homes to entire cities.

The RRS technology is highly encouraged for inclusion into the Boston Rat Action Plan. Relatively, it is a low-cost program additive, is easy to learn and implement, and, as listed below, provides multiple advantages of assisting not only ISD, but most of the essential departmental partners within the BRAP Working Group.

The RRS consideration could start out as a pilot (e.g., in a prestigious park, in Haymarket, in a North End alley etc.) to become familiar with the technology and its benefits and then expand to larger areas.

Advantages of Employing Remote Rodent Sensors Into the Boston Rat Action Plan

1. Provides quantitative indices for measuring rodent control efforts (e.g., “How effective was the carbon monoxide treatment in the Boston Commons this past spring?”).
2. Provides an early intervention dynamic (“canaries in the coal mine”). (An elementary school was alerted for presence of rats in Allston for the first time).
3. Remote sensors provide a 24/7/365 alert system and running count of rats interacting with activity stations as well as within non-toxic trapping stations.
4. RRS technology delivers the severity level (minor, moderate, severe) of rat activity at the neighborhood level.
5. Remote sensors can identify and pinpoint a building’s rodent high activity areas (HAA).
6. Rodent sensors installed in strategic locations (i.e., rat vulnerable areas) track activity (indices) in measurements of increasing, static or decreasing rat numbers based on control programs by city agencies.
7. When coupled to large scale trapping programs, RRS greatly assists in profiling local population make up (e.g., “Is the recent leptospirosis outbreak increasing, decreasing, remaining static? “Is the population consisting of founder groups arriving from other zones?” and so on.

BRAP 2024-2025 Remote Rodent Sensors Possibilities Per City Infrastructures and Business Entities

1. Boston's Major Public Parks (E.g., Boston Commons, Christopher Columbus Waterfront Park, Fenway Park, etc.)
2. Monitoring the progress of a Priority Action Neighborhood within a multi-department control effort as part of the BRAP.
3. Important Historical Sites (Along Boston's Red Line, Faneuil Hall, Old Church, etc).
4. City Civic Centers.
5. Public Markets (The Boston Public Market, Haymarket, etc.).
6. Block Level Monitoring of Rat Hot Spots (supplements 311 complaint data history and ISD inspectional data).
7. City Public Housing Campuses (e.g., Boston Housing Authority)
8. Public School Exteriors (Rats); Interiors (mice)
9. Capital Construction Sites (Prior to excavations or demolitions to determine mitigation plans)
10. Sewer Catch Basins (field trials currently underway; 2024)
11. Shopping Malls
12. University Campuses (Exteriors Rats); Interiors (mice in dorms, etc.)
13. Logan International Airport: Planes and Terminals (Food courts and Plane Staging zones).
14. Train Stations (Amtrak, Boston South Station, etc.)

Appendix C.

Important Potential BRAP Affiliated Members

1. Business Improvement Districts (BIDs)

Where they are established, BIDs play important roles in rat prevention and control. Clearly, this is because of the primary role businesses (especially food serving establishments) play in an area's food refuse dynamics (varying refuse containers from cheap plastic to high-volume dumpsters, collection frequencies, rat-proofed delivery doors, exterior sanitation practices to avoid drawing rats, etc. (Refer to Part I of this BRAP Final Photo Report for in-field examples).

- a. Because the Downtown Neighborhood of Boston is among the top areas of rat sightings (and active rodent signs as per ISD inspections, and the BRAP in-field surveys of March 2024), it is recommended to request the Downtown Boston BID collaborate closely with BRAP at the same level as the BRAP Essential Departments listed earlier. Especially since the Downtown Boston Bid's mission statement emphatically supports a collaborative effort for a clean, safe, and vibrant environment for everyone who experiences this critical tourist and business district of the city.
- b. In addition to the Boston Downtown BID, *the Boston Greenway BID* should also be a collaborator to the BRAP because as has been emphasized throughout this report and is already well understood by the Boston ISD, rats and greenways/parks form a very close association.

2. Periodical (Quarterly) Guest Participation by a Massachusetts Pest Management Association Member/Officer (that services the Greater Boston Area).

Quality private pest professionals (especially family-owned companies that have a long history of serving the citizens of the Boston area) often have perspectives and experience that municipalities do not (of course vice versa). This perspective and input would be very valuable indeed to the BRAP Working Group.

These pest professionals are often utilizing the latest cutting-edge products and software.

Appendix D.

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Appendix E. Consultant and Report Author's Background: 2024

Robert (Bobby) Corrigan is a city rodent scientist and has been studying/researching city rat control programs for over 30 years. He started out by answering a help-wanted ad to exterminate rats in the sewers of New York City so he could save money to go to college.

Bobby holds an AAS degree in pest control from the State University of New York, a B.S. degree in urban and industrial pest management from Purdue, and his M.S. and Ph.D. degrees in rodent pest management also from Purdue.

Following graduate school, Bobby joined the staff at Purdue University where he conducted rodent control research and taught Rodent Pest Management for 16 years.

Dr. Corrigan works on a national and international basis analyzing city infrastructures (refuse, parks, sewers, construction projects, and transportation (trains, airports) applying practical approaches for how science and urban operations can work together for sustainable and cost-effective urban rat control.

In 2011, the New York City Mayor Michael Bloomberg awarded Dr. Corrigan "*The City of New York's Distinguished Service Award for Innovative Rodent Research for The City of New York.*"

Bobby is a frequent guest lecturer to cities and Universities on a global scale and trains pest control and municipality professionals on city rat control. He has developed and conducted rat control academies and training in over 44 US states and 12 countries across 6 continents.

Bobby's work was featured in the April 2019 issue of the National Geographic Magazine, and he continues to be interviewed across a wide selection of radio and newspaper outlets.

Bobby and his wife Ruth live in North Westchester, New York close to the beautiful hiking trails along the Hudson River and the fabulous fly fishing streams of the Catskills.

He tweets educational messages (only) about city rats and mice on Twitter (X) @ Bobby Corrigan, Rodentologist.