



An Efficient and Sustainable Waste Management Plan for Abby's House

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Abstract

The goal of this project was to implement an effective waste management system for Abby's House that included recycling, was cost effective, and promoted personal responsibility and independence among the residents. To manifest these goals our group held in person interviews with staff and residents, met with waste haulers and analyzed their services and costs based on the needs of Abby's House, analyzed post-renovation floor plans to determine indoor bin needs, and designated responsibilities for trash and recycling throughout the building. The project resulted in a comprehensive plan for post-renovation waste management that met all the above listed project goals and put an end to the confusion and ongoing conflict with regards to waste management at Abby's House.

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Staff and Residents at Abby's House

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Executive Summary

A waste management plan, whether it is as simple as taking a trash bag out of a single-family home and putting it out on the sidewalk or as complex as coordinating the waste in a multi-resident apartment building, is an essential part of maintaining a clean and hospitable living environment. Recycling is an ever expanding and important aspect of these plans and the waste management system at 52 High Street is lacking recycling. Recycling would substantially reduce the amount of waste put in their single waste dumpster, allowing for fewer weekly pickups and reducing the issue of the dumpster being overfilled. The thrift shop alone produces roughly 40% of the trash placed in the dumpster on a weekly basis, and nearly half of that is recyclable cardboard. Not only is recycling one of the best things that each person can do to help the environment, but it is also a cost saving measure, as many waste haulers charge less to pick up recycling than they do to pick up waste. As the positives of recycling are being more widely realized, apartment managers have implemented it into their waste management plans. Abby Kelley Foster House in Worcester, Massachusetts was one such organization. Amid a much-needed renovation at their 52 High street location that is costing over sixteen million dollars, Abby's House enlisted the help of our project team to assist in the planning of an overhaul of the existing waste management system. When renovations have been completed, the building will be able to accommodate 56 women in need of a varying amount of support, personal advocacy, but most importantly a home. Not the same as an individual home, and not the same population as an apartment complex, Abby's House needed special consideration in not only the planning of a new waste management system, but how it would incorporate recycling into the building for the first time in its history.

Abby's House struggled with managing waste in their 52 High Street building in a few key areas which resulted in inter-resident conflict as well as conflict between residents and the staff at Abby's House. Education on the current waste system and tenant responsibilities was limited, leaving questions as to what could be thrown away and where. Residents were not adequately educated on the process of disposing of waste. Abby's House has also struggled with holding residents accountable for disposing of trash properly. The flowchart below portrays the 52 High Street waste management system before the renovations. It shows where waste was produced, who was responsible for disposing of that waste, and where it was to be brought.

The overall goal of this project was to identify the current waste management system at Abby's House and work with the residents, staff, and volunteers to create a new waste management system, with the inclusion of recycling, that would best fit the needs of their living environment considering the upcoming renovations. Creating this new waste management system was intended to increase the dynamic between staff and residents as well as encourage independence and responsibility for residents.

To implement the most effective waste and recycling program for Abby's House, our team focused on accomplishing specific objectives. First, we assessed the current waste management system in place. Our group did this by handing out surveys, as well as meeting with staff and residents and receiving input on their daily trash obstacles. We then investigated local waste haulers in the area through a comparative cost analysis to determine which company provided the best economic benefits. These waste haulers were also compared against the current waste provider for Abby's House, AJ Letourneau. Next, our group met with the architects and the project managers to discuss and analyze the post-renovation floor plans. Once these tasks were completed, educational literature regarding trash and recycling was obtained through the local waste haulers our group was in contact with. Collecting this educational literature was important given that recycling had not been previously offered.

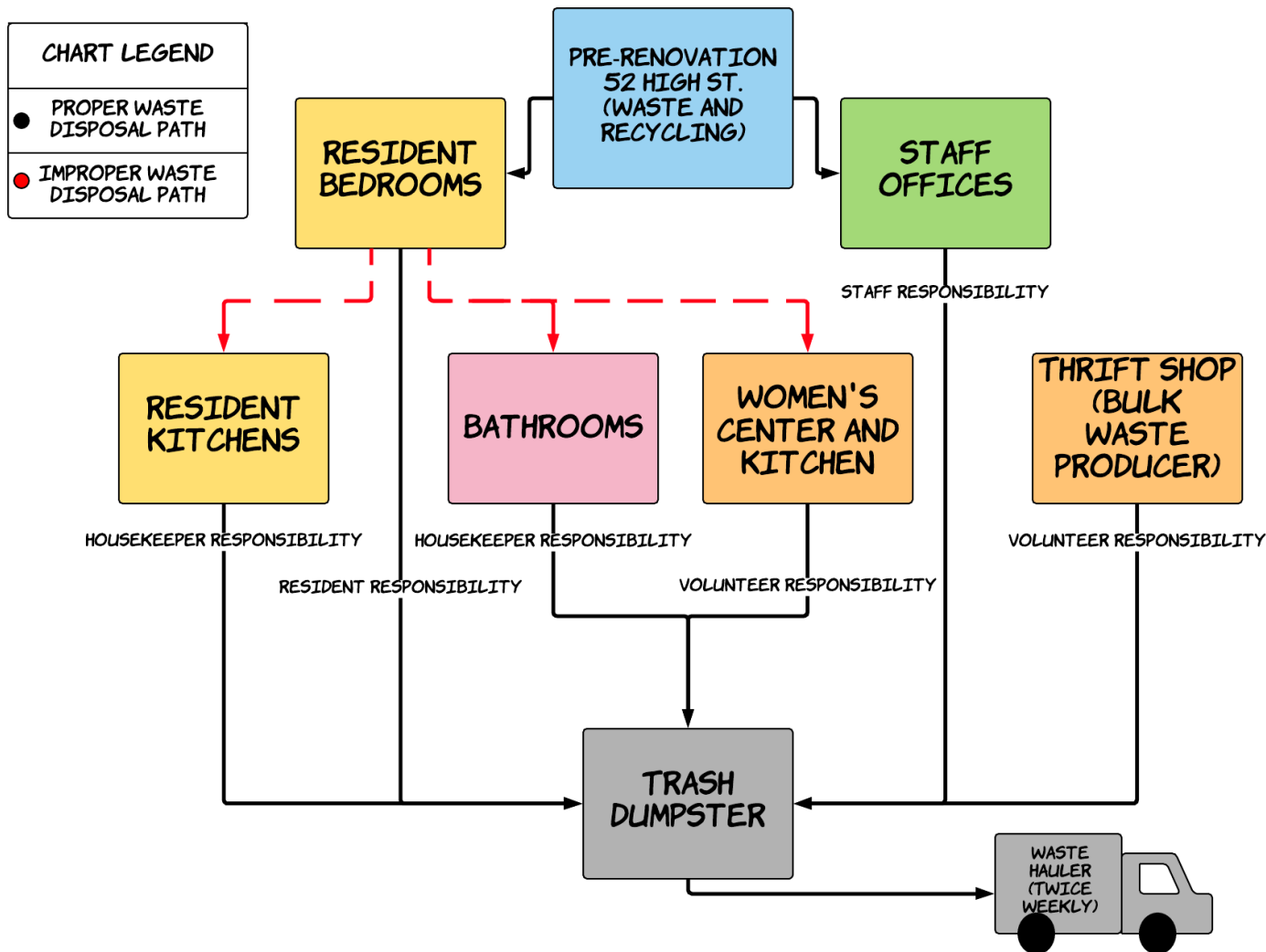


Figure 1 Pre-Renovation Waste Flow

Ensuring residents bring trash to the dumpster and not common trash bins throughout the building is a challenging task which could be better solved by more in-depth education of their responsibilities, and the rules regarding their personal trash. Implementing recycling required a change in waste hauler. AJ Letourneau (Abby's House's current waste hauler) did not provide single stream recycling services, but current costs of their services were used as a benchmark of for cost comparison. It was determined that the new waste hauler needed to provide single stream recycling, limited fees, a flexible contract, and cost-effective services. Two waste haulers submitted proposals, E.L. Harvey and Sons and Waste Management. It should also be noted that Casella waste services were reached out to but did not submit a proposal, and therefore were no

longer considered as an option. While both haulers were close in costs, there were a few major differences which set them apart. They are listed below.

- AJ Letourneau only provides cardboard and paper recycling.
- Waste Management and E.L. Harvey and Sons provide single stream recycling.
- Waste Management charges a \$75 initial fee for dropping off the dumpsters, and a \$150 fee for changing dumpsters.
- E.L. Harvey and Sons does not have a drop off fee or a fee for changing dumpsters.
- E.L. Harvey and Sons currently donates to Abby's House.

Ultimately, E.L. Harvey and Sons was chosen as the recommended waste hauler. They had nominally cheaper annual costs for services, the most flexible contract options, and no associated fees with dumpster drop off or change out.

Our recommendations for the leaders at Abby's House regarding the waste management system at 52 High Street are as follows:

- Recycling should be implemented at 52 High Street.
- 52 High Street should use E.L. Harvey and Sons as a waste hauler and take advantage of their single stream recycling program and comparatively lower costs.
- Residents should be responsible for disposing of their personal trash and recyclables.
- The housing manager, working in lieu of paying rent, should be responsible for emptying the waste and recycling containers in resident kitchens, laundry rooms, and the women's center.
- The housekeeper should be responsible for emptying the waste containers in the bathrooms on each floor.
- All residents should be provided with educational literature that describes their responsibilities, what can and cannot be recycled, and why adhering to these rules is important.

Below is a visual representation of how the proposed waste management system would work.

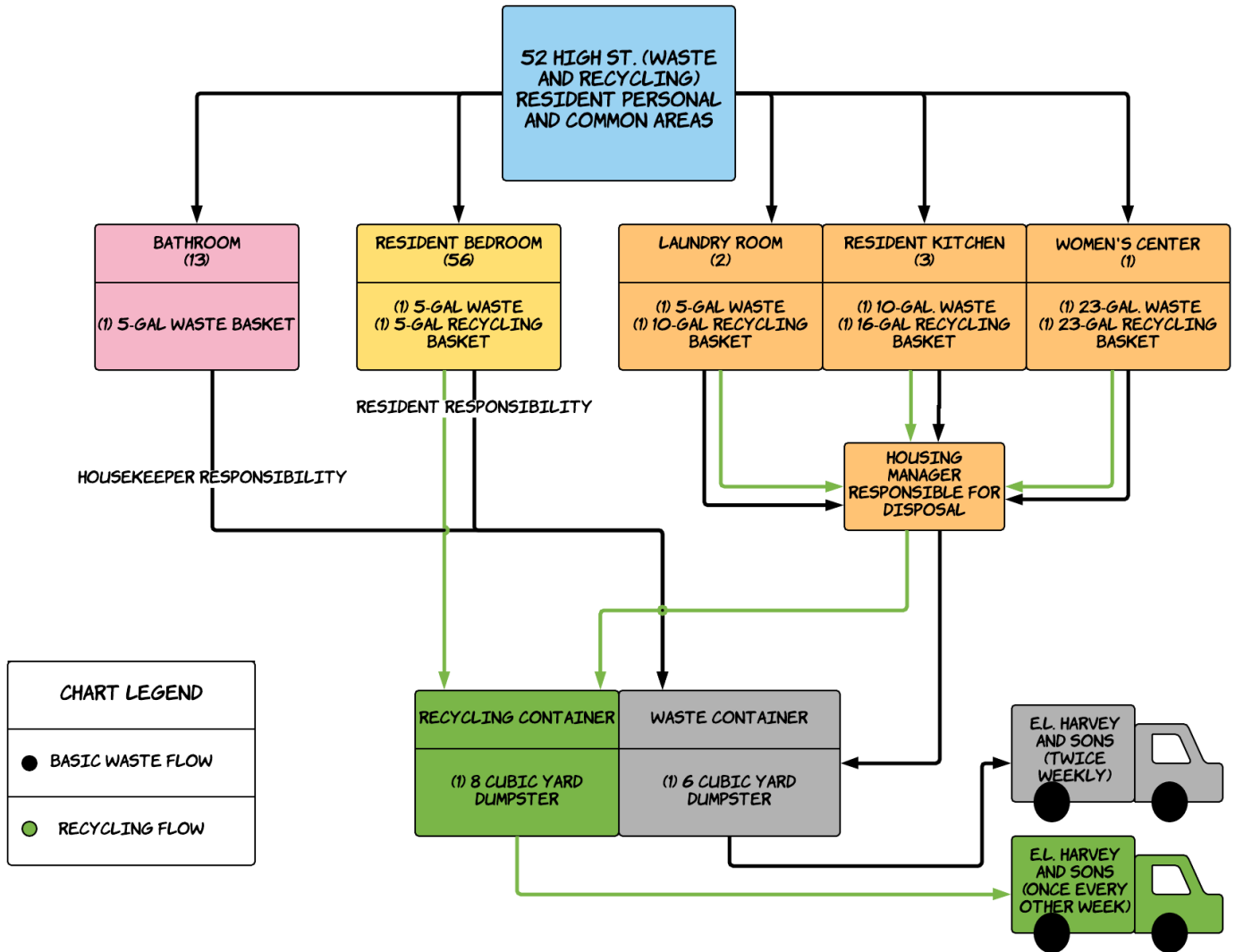


Figure 2 Post-Renovation Residential Waste Flow

Chapter 1: Introduction

Waste. It is something that every person must deal with whether he or she lives in a single-family home or a high-rise apartment building. What to do with waste and figuring out a system to properly dispose of the various types of waste created in one's living environment is a common problem that needs to be addressed by all. Recycling first started to expand and become more popular among the American public during the early 1970's and has only become more popular and efficient more recently (Waxman, 2016). Now an important feature of many people's and building's waste management plans, recycling is cheaper than disposing of all materials as waste and is much more environmentally friendly. A waste management system that includes recycling must be convenient and work for all those who reside in the building to work at maximum efficiency. Multi-residential buildings have a harder time implementing systems such as this than a single-family home would. Catering a waste management system to a larger number of people means accounting for their larger and more diverse list of needs for the system to work for them.

Waste management can be a challenging problem especially for the homeless population. Within Massachusetts, 17,565 people were reported to be experiencing homelessness, and over 1,500 of these individuals reside in Worcester (Central Massachusetts Housing Alliance Inc., 2015). An ongoing and escalating issue, homelessness is being addressed by shelters, like Abby's House, across the state. Abby's House has provided a home for over 11,500 homeless women over the past 40 years (Abby Kelley Foster House Inc., 2017). Some of these women stay for prolonged periods of time to get the support and balance they may need before leaving. By providing shelter, food, individualized support, and structure, Abby's House can do its part in taking on such a comprehensive and widespread problem in Worcester. However, with an increasing number of residents being housed comes an increasing amount of waste being produced and the need for an improved waste management system. Many other shelters that are dealing with similar issues have started to implement new systems to keep up with the expanding waste production. Abby's House would like to continue to the trend by creating a new waste management system that includes recycling.

Managing waste is a complex problem in today's world. Since 1960, the total municipal solid waste (MSW) produced each year in the United States has increased by 170 million tons, with each person producing nearly 1.8 more pounds per day (University of Michigan, 2017). An

estimated 50% of MSW is recyclable and many options for waste management, including recycling, exist. Massachusetts has published a basic plan for implementing effective waste management programs for multi-family buildings (Massachusetts Department of Environmental Protection, 2002). Relatively simple, it includes steps such as communicating with a service provider, choosing optimum locations for waste and recycling containers in the building and educating tenants on how the program works and what their personal responsibilities are. Mckenna Morrigan (2016) defined the four basic C's for implementing a waste management program: Convenience, Clarity, Capacity, and Color. The "four C's" developed by Mckenna Morrigan and the "seven steps" suggested by the state of Massachusetts focus on the education of tenants and having a comprehensive and convenient plan as being the two main criteria for creating an effective waste management system.

Simply adopting a "one-size-fits-all" waste management system will not solve the problems at Abby's House. Home to a diverse and ever-changing population of women, Abby's House strives to not only provide people with a place to stay, but to help them transition them to a self-sufficient living situation. These women have dealt with a myriad of issues including where their next meal was coming from or if they were going to have a place to stay that night because of homelessness. When considering those problems, where to put one's trash doesn't seem important. However, once these larger issues have been taken care of by Abby's House, focusing on other life skills, such as taking out the trash and maintaining a clean-living environment, is an important part of transitioning into complete independence. Stephanie Page (personal communication, February 2, 2018) executive director of Abby's House, said it best: "This is more than just a trash issue." Creating a system that works will require more research into the root causes of the problem as well as staff, volunteer, and resident involvement in finding a solution.

This project aimed to assist Abby's House residents, staff, and volunteers in the creation and implementation of a waste management system, with the inclusion of recycling, that strengthens group dynamics, maintains a clean and hospitable living environment and promotes personal responsibility and empowerment. Our project team utilized a survey and in-person discussions with staff, volunteers, and tenants to obtain the most information possible in relation to trash management at Abby's House. Sales representatives from various waste management providers were also interviewed to create cost estimates for their services. Finding a waste hauler

that would both fit the needs of Abby's House and be the most financially sound for them was a key aspect in the planning of the new waste system. Creative solutions from collaboration between our group and the Abby's House community was the best way to close the gap between creating a generic, ineffective trash system, and an effective sustainable one. By collecting critical information and performing a thorough evaluation of the practical capabilities Abby's House will have after the building renovations, we were able to create a plan for a new waste management system that will be practical for residents and staff alike for years to come.

Chapter 2: Background

2.1 Summary

In this chapter, we study the history of Abby's House, including demographics, mission and values, and the ongoing renovations. Next, we shift our focus to general recycling and trash statistics in America and conclude with a discussion of effective waste management strategies and programs. These topics form the background of our project. With this knowledge, our group hopes to improve the waste issue at Abby's House by developing and implementing an effective waste management system that will be maintained considering the upcoming renovations.

2.2 Abby's House

2.2.1 History

Since its establishment in 1976, Abby's House has helped over 11,500 women (Abby Kelley Foster House Inc., 2017). Named after Abby Kelley Foster, Abby's House is the largest women's shelter in the city of Worcester, Massachusetts. Abby Kelley Foster was an abolitionist and women's rights activist who was born in 1811 in Pelham, Massachusetts. She was raised in the Quaker faith and spent much of her life going around the country speaking on both feminism and abolishing slavery. Mrs. Kelley also played a pivotal role in financing and passing the 15th amendment, giving African-American men the right to vote (Library of Congress, 2017). The first Woman's Rights Convention was planned and held by Mrs. Kelley in Brinley Hall located right in downtown Worcester, only six minutes from the current Abby's House main shelter (Abby Kelley Foster House Inc., 2017). Abby Kelley was an extremely influential woman who sought to bring equality to women and stands as the inspiration for Abby's House today.

2.2.2 Mission and Values

Abby's House looks to provide help to all women and children in need that come to them. Through individual plans created by advocates in one-on-one meetings, the staff help their clients achieve their goals. Affordable housing is one way that Abby's House provides for women in need. They currently have 78 housing units spread across three different buildings. These units are offered at affordable rates and give women partial economic independence. In addition to providing longer term affordable housing, Abby's House also runs an overnight shelter for women and children. The assistance that Abby's House provides does not stop at housing. They offer many developmental programs for women, as well as running a thrift shop and a food kitchen.

2.2.3 Current Programs

The thrift shop run by Abby's House is currently their largest source of revenue, and sells new and lightly used items only. Abby's House is very dependent on the success of the thrift shop as they receive no federal funding because they do not require any of their clients to be on welfare. Abby's House also provides meals to their clients twice a week. More than 10,000 meals a year have been cooked right in house at 52 High Street. For those who cannot make it to the food kitchen, Abby's House provides food delivery as well. The thrift shop and the kitchen are only two of Abby's House's many programs.

The women's center at Abby's House hosts a variety of developmental programs, many of which are run by volunteers. Some of them include educational programs that look to build job and social skills, financial literacy, computer training, English classes, etc. The women's center also provides health promotion services, advocacy and supportive services. The women's center, kitchen, and thrift shop all rely heavily on volunteers to continue to operate.

2.2.4 Staff and Volunteers

Without volunteers and donations, it would be hard to imagine how Abby's House would stay afloat. They receive only \$15,500 a year in grants, and the shelter alone costs \$157,600 per year to keep running. Mix in the costs of running the kitchen, maintenance of all the buildings, and the new \$16 million renovation of 52 High Street, \$2 million of which they must come up with, and Abby's House is a costly non-profit to run. Volunteers save Abby's House a total of \$440,000 per year.

Approximately 55% of their budget comes from donations and their thrift shop sales. Twenty percent of their budget comes from private funding and grants, and another 25% comes from a coin operated laundry machine, rent, and memberships to their women's center. The community surrounding Abby's House is what keeps it alive today.

2.2.5 Demographics

Abby's House supports a diverse and ever-changing population of women ranging from 19-81 years of age, and some have young children. All the women at Abby's House have had some aspect of, or have been very close to, experiencing homelessness. Ninety-two percent of the women living in Abby's House over the past year had an income below 250% of the federal poverty level of \$12,060. Recently, Abby's House has noticed a shift in its residential population, with a larger portion moving towards the older side of the spectrum. Fifteen percent of the units

are currently serving a senior population, and the median age of their residents is now 49. It is expected that this trend will continue over the next few years and Abby's House will continue to serve an older population for the time being.

The residents at Abby's House have very diverse backgrounds, and experiences which influence the atmosphere and way of living at Abby's House. Nearly all the women have experienced homelessness and for many different reasons. Substance abuse, job loss, and domestic abuse are all common contributors to homelessness and shape those which they affect in different ways. Due to the diverse backgrounds at Abby's House, the trash problem is not a simple one. While 52 High Street is not a transitional living program, it is not your average apartment building either, and cannot be treated as one (Abby Kelley Foster House Inc., 2017). There are special considerations that must be made in creating a plan that will accommodate the residents who have experienced far worse than where to throw away their trash. For more information on the causes of homelessness to give important insights on the population at Abby's House, see Appendix A.

2.2.6 Renovations

Abby's House has begun renovations on their 52 High Street location. In addition to updating the resident rooms and common areas, Abby's House will be adding full kitchens on each of the building's four floors (Abby Kelley Foster House Inc., 2017). The thrift shop located in the bottom floor of the same building will also be a part of the renovations. It is predicted that the addition of multiple kitchens will escalate the current waste problems if nothing is done to accommodate it. The renovations provide an opportunity for Abby's house to implement a new and improved waste management system, in addition to all the other benefits the renovations will bring.

2.2.7 Trash Problems

Both staff members and residents have raised concern regarding the trash problem at Abby's House. Executive Director Stephanie Page and Director of Housing Glamedys Rodriguez have personally seen and have been receiving complaints about trash not being disposed of properly. Maintenance staff and the housekeeper have had to step away from their daily tasks, in part, to deal with the disposal of residential waste. The waste from residents has been accumulating in common spaces of Abby's House instead of being taken out to a dumpster. Not only have the complaints been coming from staff members, but also from other residents.

What is largely unknown about the issues surrounding the current waste management system is a detailed understanding of the residents' views on the problem. There are features of the current system that are making the proper disposal of waste difficult for some residents living in the building. They have resorted to throwing waste out into common areas, such as kitchen waste containers, where it will have to be dealt with by staff members. Once the residential viewpoint of the issues has been established, developmental planning on a new waste management system that benefits the organization and the residents can be started.

2.3 Waste Management

In this section, our team will discuss relevant research and statistics regarding waste and recycling. Information posed will begin with waste production on both a global and national level to a local level in relation to Abby's House and its specific population. We will then transition into what makes a waste removal system effective and how to implement a waste management program. These include multiple, relevant studies, including the pros and cons of each unique approach to the implementation of these programs.

2.3.1 Waste Management and Statistics

Recycling is defined as “the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products” (United States Environmental Protection Agency, 2014). Shockingly, the United States has a recycling rate of only 34%. According to the United States Environmental Protection Agencies (EPA) 2014 annual report, about 258 million tons of Municipal Solid Waste (MSW) was generated in the United States. Of that waste, about 24.6% (89 million tons) was recycled and composted, while 52.6% (136 million tons) of the remaining waste was sent to landfill. 66.4 million tons of MSW was solely recycled, meaning that only about 25% of all waste generated in the United States in 2014 was recycled. 13% of all MSW was plastic, accounting for 33.25 million tons, of which, only 3.17 million tons was recycled. This means that the plastic recycling rate in 2014 was only 9.5%. Seventy-five percent of the total plastic MSW was sent to landfills. It is important to note, that items that are not properly disposed of, can cause extreme damage to the environment (Parker, 2017). For example, a gallon of paint can pollute up to 2,500,000 gallons of drinking water if it is not disposed of in the appropriate manner.

In a global analysis of the production of plastic, its recycling and the consequences, *Science Advances Journal* explained that of the 8.3 billion metric tons of plastic that have been produced, 6.3 billion metric tons become plastic waste, and only 9% have been recycled (Parker, 2017). Over 79% of this waste either ends up in landfills, somewhere in the environment as litter, or in the oceans. At this rate, by 2050 there will be over 12 billion metric tons of plastic in landfills, and 8 million metric tons of plastic ending up in the oceans every year.

Two hundred fifty-eight million tons of trash can be hard, if not impossible, to imagine. It may be easier to imagine the average of 4.44 pounds of trash created every day per person in the United States (University of Michigan, 2017). Of that 4.44 pounds of trash every day, Figure 3 shows the general breakdown of municipal waste in the United States. It is important to note that these statistics do not include industrial waste, hazardous waste or waste that comes from construction. From the chart below paper, glass, metals, and plastics make up 51.4% of the total municipal waste and all are common recyclables. Theoretically, more than half of all garbage created in the municipal sector could be recycled. In Massachusetts, there are specific grants and loans for businesses which can relieve businesses of recycling costs (Massachusetts D.E.P., 2002). In addition to this, many waste management service providers will offer to pick up recyclables at reduced rates, for free, or at times even pay for recycled materials.

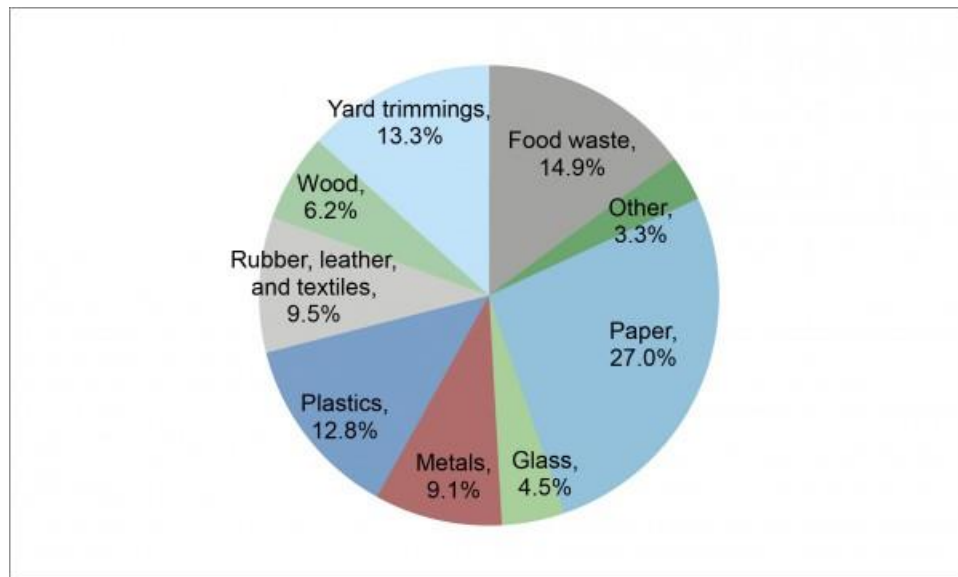


Figure 3 MSW Breakdown (University of Michigan, 2016)

As it pertains to Abby's House, 4.4 pounds per day, times 56 tenants, is over 246 pounds of trash every single day. In fact, Abby's House creates even more trash than this because that 246 pounds of trash does not include trash created by staff, waste from the kitchen from people who come to eat twice a week, or all the trash that is created in the thrift shop (Abby Kelley Foster House Inc., 2017). Being able to separate this waste between trash and recyclables could prolong the time between dumpster pick-ups, which reduces cost, and help the environment. Benefiting the environment and saving money may give tenants the necessary motivation to dispose of trash in the proper way and engage recycling.

2.3.2 Effective Trash Removal Program

Dealing with municipal waste is not a new issue and it is not going away. It is an issue that continues to get more complex as technology becomes better and MSW becomes more complicated than simply organic material (University of Michigan, 2017). The U.S. is making progress with waste management however, as the percentage of municipal waste being recycled in the U.S. has gone up roughly 15% since 1960. That does not include the 10% increase in composting since 1960. Improved waste management, along with increased recycling, starts with individual homes and people. Effective waste management systems must be implemented everywhere for the trend to continue. The state of Massachusetts has created seven basic steps to follow that will help multi-family buildings such as Abby's House implement an effective and long-lasting waste management system (Massachusetts D.E.P., 2002). These seven steps can be found in Appendix B. In addition to the seven steps that the Massachusetts government suggests, some key concepts taken from the Melbourne, Australian government have been adopted as well in creating a fundamental list for implementing effective waste management.

Before anything begins, a waste management coordinator needs to be appointed that will be held accountable for ensuring the program runs smoothly (Morrigan, 2016). Whether the coordinator is a single person or a group of people, they need to have a good understanding of the waste management situation in the building as they will be the main liaison between the tenants, apartment managers, and the waste management service provider. Step one is assigning a leader to spearhead the project.

Selecting the number and= types of containers necessary is another fundamental step in implementing a successful waste management (WM) system (Morrigan, 2016). Many waste collection services provide bins to collect both trash and recycling, but there is a chance that

containers may need to be purchased. For a small, multi-family building such as Abby's House, there will need to be at least three steps towards collecting and separating waste, requiring three separate types of containers. There will need to be personal containers, common area collection containers, and main dumpsters. Each tenant should have a trash and recycling container (Massachusetts D.E.P., 2002). There should be a collection area on every floor that has larger, wheeled carts to collect separated waste. These containers need to be large enough to be emptied every other day without overflowing (Morrigan, 2016). The table below shows approximate container sizes for whole floor collection containers. Finally, the main collection dumpsters should be large enough to be emptied weekly to bi-weekly for units of 56-150 units (City of Melbourne, 2017). This is likely where Abby's House will fall for waste collection. Typically, recycling takes up about twice as much space as traditional garbage, so most containers for day-to-day use should be at least 20-30 gallons (Morrigan, 2016). In an ideal system, 50% of total waste capacity would be dedicated to recycling; however, 30% of total waste capacity is a good baseline goal for most operations. Color is also important in making separating waste easy and reducing confusion. In addition to clear labels, bins should be colored according to what they should hold. Colors should be chosen based on what tenants will see on a day-to-day basis in the public. Step two is choosing the proper containers for the job.

Table 1: Suggested Bin Sizes (Morrigan, 2016)

Size of wheeled cart or toter	Approximate weight of material each cart or toter will hold		Estimated number of units each cart or toter will serve (+)
	Mixed paper	Commingled containers	
64 gallon size	127 lbs	57 lbs	3-4 units
96 gallon size	190 lbs	86 lbs	4-5 units

(+) Estimated number of units served is based on an apartment with two people filling the equivalent of one 18-gallon container emptied weekly. Different people generate varying amounts of material based on their purchasing habits. Some programs may collect every two weeks. As a result, the number of containers needed will vary.

After formulating a plan for waste disposal and collection, the next step is to communicate with the waste management provider and ensure that they can fulfill the needs of the program (Massachusetts D.E.P., 2002). When containers will be picked up will be dependent on cost and the size of the containers. In many cases, waste management providers will reduce the cost of pick up if recycling is included and they might even pick up recycling for free. Communicating effectively with the service provider is the job of the waste management coordinator.

Location of containers is extremely important in designing a WM system. Trash and recycling containers should be located beside each other for convenience (Morrigan, 2016). Collection containers on every floor should be easily accessible and easy to move from the collection location to the main dumpsters. It is important to have a set location and design for this area on every floor so that there is no confusion about where waste needs to be collected before it is finally disposed of in the main dumpsters. It is also useful to post the basic floor plan with highlighted areas for where the collection areas are set up and how they are organized on every floor (City of Melbourne, 2017). In addition to this, any containers that contain recycled cardboard and paper must meet fire code (Massachusetts D.E.P., 2002). Finally, all containers must be in place and ready for use before the program and education begins. Once the program kicks off, residents will likely begin using them immediately.

Once everything is in place and a schedule is set with the service provider, it will be time to begin planning out how to educate residents, set schedules and responsibilities for who will be handling the waste, when in-building containers will be emptied into the main dumpsters, and doing final checks with apartment leadership and the service provider to ensure everyone agrees (Massachusetts D.E.P., 2002). The created plan should be comprehensive and cover the five W's: who, what, when, where, and why. It is important to determine the fine details of the plan in this step, as it is the last step before the new waste management program would begin. This is the time to iron out any major issues. After a well-polished plan is in place, step five is complete, and it would be time to educate the tenants.

Educating the tenants is an integral part of the program because without them, the WM program will not work. The same five W's that were established in step five would need to be reiterated to all tenants in step six (Massachusetts D.E.P., 2002). Tenants need to know who is responsible for what. They need to know what can be recycled and what is considered trash. What can be recycled should not only be spoken verbally but should also be portrayed in signs at all locations where there are trash and recycling bins. In fact, Melbourne requires that there is proper signage at all bin locations (City of Melbourne, 2017). A good example of a proper sign is shown in Figure 4. Giving tenants a proper timeline of when certain containers need to be emptied as well as when the main dumpsters will be emptied is vitally important as well (Massachusetts D.E.P., 2002). Arguably, the most important W is the why. A well put together education plan is going to teach the tenants why they are doing what they should do and how that

will benefit them. Motivated tenants who understand why they are going to benefit from the program will be the key for an effective and successful WM system.



Figure 4 Proper Signage (City of Melbourne, 2017)

The recycling habits of twelve apartment buildings within Ontario were closely examined before and after implementing a trash chute and providing reminders to recycle (Lakhan, 2016). This study is a great example of how important proper education of tenants and convenience is in a WM system. Before the recycling chutes were implemented in the buildings, 57% of people throughout the buildings knew there was recycling, but a staggering 72.3% of the tenants were not recycling at all. Education on recycling was clearly an issue as only about half of the tenants were aware that they could recycle. In addition to this, convenience was an issue for the tenants as 53.9% of them claimed that they would recycle if it was more convenient. These statistics are further evidence that a recycling program needs to be easy and require very little extra effort. With convenience seeming to be a main issue, there were recycling chutes installed in every building, but there was very little change in the amount of recycling. Another survey was held, and it became apparent that education was also an issue. Fifty-six percent of tenants reported that they were not aware that the recycling chutes existed. To further educate the tenants, the apartment complexes posted signs about recycling and sent mail to all the tenants informing

them about the chutes and how to recycle. This proved futile as well, as 62.3% of the tenants never actually saw the mail. In 2001, a study was done by the Environmental Protection Agency (EPA), which they published in "Multifamily Recycling-A National Study." They found that the most effective way to educate tenants in apartments was to speak with them one on one, or at the very least as a group of people (Morrigan, 2016). It was determined that the apartment managers did not have the time or resources to speak to each tenant separately (Lakhan, 2017). Instead, they put a large blue recycling bin in the lobby with a sign reading "Remember to Recycle". This blue bin was noticeably out of place and worked well as a reminder to recycle as 42% of tenants began recycling after seeing the bin. A combination of added convenience and tenant education increased the number of tenants who recycled by roughly 14 percent.

The final step in implementing a WM program is to monitor it closely and fix small problems as they occur (Massachusetts D.E.P., 2002). The waste coordinator should be tasked with solving these issues. This manager should also be listening to tenant complaints and suggestions, as well as answering any questions that might arise. In this step, it is important to inform tenants of their success in the program. Showing tenants statistics of the past month's waste management, what they are saving by recycling, or a simple thank you for keeping their apartments clean helps to keep tenants motivated, which will be challenging but is very important.

The steps listed above are merely fundamental guidelines intended to be modified in a unique way for every location or community they are being applied to. Good planning will allow for the system to run more smoothly which will require strong leadership. With solid planning, good communication, and extensive tenant education, a well-developed, economically efficient and long-lasting WM system can be created.

2.4 Conflict Resolution

This section discusses effective conflict resolution techniques and describes them on a step-by-step basis. The current waste management system at Abby's House has caused much tension between staff and residents, and conflicts have arisen because of it. Due to the close living quarters and diverse population makeup, it is important to touch upon different approaches to solve such conflict. Without a collaborative effort, the waste management system, regardless of how well it is designed and implemented, would fail from the beginning.

When working or living in any setting, conflict may arise due to varying beliefs, work ethics, and habits an individual acquires over their lifetime that differ from person to person (Dodoiu, 2015). With a group of individuals, smooth cooperation can sometimes be difficult to attain because of different visions and interests. It is important to note that conflict can usually never be prevented as it is human nature, but it is possible to minimize continuous negative conflict from occurring repeatedly by adapting strategies to overcome it. Conflict resolution entails a process that is made up of different steps that can lead a team or group of individuals to a point of agreement. When deciding on how to resolve a conflict, different types of methods may need to be used depending on the individuals. If individuals show self-interest versus interest for others, the issue may not be resolved. Also, if the individuals take more of a passive role in addressing and working through the conflict, the issue will persist and possibly worsen, as the entire group's presence physically and mentally is vital in conflict resolution. A group that focuses on the needs of the group rather than themselves as individuals will see benefits in the long run. Additionally, and seemingly the most important factor, everyone must develop his or her own opinion about the conflict at hand rather than adhere to their peer's beliefs.

To manage conflict collaboratively, everyone in the group must express their opinions as well as listen to and be open to what others suggest (Ajzen, 1991). In many cases, collaborative resolution has a positive relationship to performance in a diverse group setting. When resolving a conflict, many different solutions can be considered based on everyone's personality, attitude, and social norms. This is largely due to The Theory of Planned Behavior/Reasoned Action. According to Icek Ajzen, The Theory of Planned Behavior/Reasoned Action suggests that:

a person's behavior is determined by his/her intention to perform the behavior and that this intention is a function of his/her attitude toward the behavior and his/her subjective norm.

There are many approaches that can be taken to resolve team or group conflict. MindTools (2018) is a company that specializes in developing leadership skills, team and project management, problem solving, strategy tools, and many other skills that are essential for life. They have developed a three-step process to mediate the issues presented (Mind Tools, 2018). Step 1 is to "Prepare for Resolution". Before anything, it is important to acknowledge that there is an issue at hand that needs attention from the entire group, because it is human nature for an

individual to try and avoid or dismiss the first signs of conflict. As a group, it is also important to discuss to what extent the conflict is affecting the group dynamic. Everyone in the group must also agree to take part in resolving the group conflict. This is crucial, and the needs of the entire group must take precedence over the individual's self-interest. During the first step of resolution, communication is very crucial. It is necessary to continue to keep an open mind and let everyone have a say in how they feel about the issue at hand. During this stage, everything everyone is thinking should be expressed, even if it may not be along the same lines as the other individuals. Listening is extremely essential, as the group needs to understand where everyone is coming from to address it, accept it, and continue to move on.

Step 2 is Understanding the Situation (MindTools, 2018). Once the individuals in the team or group have openly expressed their feelings about the conflict, the next step is to understand the situation and every individual's thoughts about the issue. Emotions may be heightened during the first and second stages, but it is essential to work through the emotions to get to the root of what the problem is. It can be beneficial to the group if everyone explains what they believe, what they value, and why they think this way. For example, instead of an individual expressing that Car A is a "good car," it would be more useful to say that Car A is a reliable car, which can be backed up by the information that it gets 30 miles to a gallon. Next, the individuals should analyze and discuss their beliefs in smaller groups. This separates individuals who may have formed an "alliance," or all complied with one belief system. The smaller groups should break down the problem on a microscopic level, analyzing every fact, assumption, and belief that is brought up. During this process, it is important to ask which facts and assumptions are true, which are important for the outcome, if there is uncertainty, and what other information may be vital for the conflict to be resolved that may not have been addressed. Pros and Cons lists may aid this process as well. Once the group has a better understanding of everyone's thought process, they can better understand the group dynamic regarding the conflict. During this process, frustrations may arise as other individuals are bound to have opposing viewpoints, but remaining open and listening to others will only help the outcome. After meeting in small groups, the group should reassemble. At this point, the group or team should be one step closer to reaching agreement regarding the issue. When alliances are separated by forming small groups that have different opinions, it can be much easier to talk and see the issue in a more abstract way.

The third and final step is to reach agreement (MindTools, 2018). When each “party” understands and accepts the other views, the next step is what course of action to take. If more analysis or evaluation needs to be accounted for, this should be addressed given an appropriate deadline. Giving a deadline gives group structure and ensures that the team is committed to working with the outcome of the evaluation in a timely manner.

When all conflict has been resolved, it is important to acknowledge that and focus on the contributions everyone made toward reaching the prospective solution. Celebrating these strides can strengthen team dynamic and boost confidence in problem solving skills as well as help future conflicts from avoiding. The three-step process works to smoothly solve team conflict by starting at the root of the problem, gaining understanding of everyone's perspective, and using that information to broaden individual thoughts and beliefs about the issue.

Chapter 3: Methodology

Mission Statement and Objectives

This project aimed to assist Abby's House residents, staff, and volunteers by cooperating with stakeholders to create and recommend a waste management system that intended to strengthen group dynamic, maintain a clean and hospitable living environment, promote personal responsibility and empowerment, and implement recycling. The following objectives served as milestones throughout the project.

1. Assess current waste management system and identify opportunities for improvement
 - i. Analyze basic waste flow within 52 High Street
 - ii. Identify social dynamics regarding waste
2. Identify the most appropriate local waste haulers for Abby's House
3. Identify waste management options for stakeholders
4. Analyze post-renovation floor plans
5. Draft educational literature

This chapter will clearly define the process through which our group accomplished these objectives. Due to the demographic of people we worked with we had to keep in mind the unique backgrounds and experiences of the tenants involved. Consent forms were filled out by all interviewees prior to their interviews. The waste management plan was modeled from fundamental requirements for successful waste management programs as described in the section 2.3.2.

3.1 Assess current waste management system and identify areas needing improvement

To analyze the waste management system at Abby's House effectively, we broke down the system in two main topics, the basic waste flow within the building and the social conflict regarding waste at 52 High Street. This section will define the steps taken to fully understand the waste management system at Abby's House.

3.1.1 Analyze basic waste flow within 52 High Street

When breaking down the basic flow of waste at Abby's House, two main things were considered. First, we identified who was responsible for waste throughout the building. This was done through interviews with key staff members such as the thrift shop manager, executive

director, housing director, and the kitchen manager. These interviews were done in person in a casual conversational setting. Participants were not required to answer any questions which they did not wish to, and could leave at any time. From a waste flow perspective, the goal for the interviews was to understand who was responsible for the waste in their respective areas of 52 High Street, and what type of waste was being produced there. Our interviews can be found in Appendix C. Second, our group had to identify the location and type of waste basket throughout 52 High Street. This was accomplished by physically walking through 52 High Street and looking for waste bins throughout the area. To figure out what bins were used in the kitchen at Abby's House, we had to go to 77 Chatham Street as the kitchen was moved from High Street to Chatham Street during the period of renovations.

3.1.2 Identify social dynamics regarding waste

We interviewed eight staff members and three tenants regarding waste management at 52 High Street to obtain as much information as possible surrounding the system and conflicts they have experienced regarding waste. Staff members interviewees were suggested to us by Stephanie Page, and the resident interviewees signed up to meet with us. In addition to the staff members mentioned in 3.1.1, we also interviewed the Special Projects Coordinator, and the Housekeeper. Interview questions with regards to social dynamics were focused primarily on conflicts they had seen regarding waste at 52 High Street and potential solutions.

To meet with tenants, we scheduled numerous times and days when they could voluntarily speak with us regarding the trash and their concerns. Interview sessions were scheduled in one-hour increments with no more than five tenants at a time. Two interview sessions were held, and three tenants were interviewed in total. During the interviews, tenants could leave at any time and refuse to answer any question asked of them. The goal during the interview was to encourage each tenant to discuss her view of how waste was managed at 52 High Street and what she had experienced because of it. Specific interview questions can be found in Appendix C. Tenants were encouraged to bring up conflicts as well as their opinions on how the system could be improved. In addition to scheduled interviews, we also attended numerous weekly lunches at their 77 Chatham Street location to speak with the tenants in a casual setting. Lunches were held every Tuesday and Thursday and were open to all residents of Abby's House, not specifically the 52 High Street tenants.

In addition to meeting with tenants directly, a survey was given to every tenant at 52 High St. regarding the waste management system. This was done based on a recommendation from Ms. Page and Ms. Rodriguez. The survey, which can be found in Appendix D, consisted of five multiple choice and three optional free response questions. This served as an assessment of the current waste management system, as well as what could be done to improve it. The survey questionnaire was emailed to Ms. Rodriguez, who distributed copies under each resident's door, and made them available to staff and volunteers. Survey questionnaires were also distributed during the resident lunches at 77 Chatham Street. Residents were not required to complete the survey, but we did encourage them to do so. Survey data was collected and analyzed to help gain a better understanding of how residents, staff, and other volunteers perceived the existing waste management system and its problems.

3.2 Identify the most appropriate local waste haulers for Abby's House

To provide Abby's House with the most comprehensive waste management plan, our team conducted research on what services local waste haulers provided, and made a recommendation based on what best fit the needs of Abby's House 52 High Street and 77 Chatham Street locations. Waste services for 77 Chatham Street were not initially considered part of the project, however it was brought to our attention that this secondary location also had a dumpster being serviced by AJ Letourneau. Moving forward, if a change in waste hauler was going to be considered, our project team had to take this location, and the services it would require, into account when researching new waste haulers. Three new waste haulers were set to be compared against that of Abby's House's current waste hauler, AJ Letourneau. Waste Management Services, Casella Waste Systems, and E.L. Harvey and Sons, were believed to be able to fulfill the needs of Abby's House and their services were chosen to be investigated in further detail. Major considerations while analyzing the waste haulers included whether they offered some form of recycling, were willing to make a site visit, provided comprehensive pricing structures, financial options that were close to the cost Abby's House was currently paying, and if they were flexible with contract structuring. Waste haulers were encouraged to make on site visits to 52 High Street to assess the waste management needs and service options. The conversation during these visits was facilitated by prepared questions regarding important topics and information needed to best assess the overall value of each waste company. Our team briefed sales representatives on all relevant aspects of Abby's House's waste production and gave

an estimated breakdown of waste vs. recyclable materials. In addition to current waste production, our team provided estimated waste output and architectural insight to give the representative an idea of what Abby's House would be dealing with post-renovation. Waste haulers were questioned on their pricing structures, what type of recycling they offered, as well as what bins, signs, educational documents, and guidance (on implementing a waste management plan) they would provide. Additional information was exchanged through follow-up emails with each company's sales representative. Finally, our group recommended the waste hauler that provided the widest range of services at a financially viable price for Abby's House.

3.3 Identify waste management options for stakeholders

There were many options for the level of tenant involvement, and who would be responsible for trash in different areas throughout the 52 High Street building. Four options were presented to Stephanie Page to choose from or modify. In addition to breaking down each option, our group created a list of pros and cons for each option to help in the decision-making process. The breakdown of each option and the list of pros and cons can be found in Appendix E.

To create effective options for a waste management system, all data that pertained to waste flow, production, and responsibility, which was collected through interviews and surveys, was compiled and analyzed. To help spot the deficiencies in the current system, a spreadsheet was created that broke down each area of 52 High Street, what bin was in that location and who was responsible for that bin. This gave a clear picture of what people were responsible for trash throughout the building, and the need for bins in the building. In addition to this, we gathered information on the floor layout of the building post renovation through Stephanie Page. From the information collected, and the research done during the previous term, a list of options was presented to Stephanie Page, and she chose a modified version of one of those options.

3.4 Analyze post-renovation floor plans

Once a final decision was made regarding who was responsible for the removal of waste and where it would be brought, we focused on the more detail-oriented aspects of the plan. These details included who was responsible for waste removal in specific areas, what bin types and sizes were to be placed there, what size dumpsters were necessary, and what service provider would be used to empty them. To help accomplish these tasks, we met with the lead architect for the renovations at 52 High Street as well as the project managers. The meeting was focused on the lay out of the future renovations, space limitations for dumpsters, and where bins would be

placed within the building. Final details of the plan can be found in figures 6 and 7, in the Recommendations chapter, which were created to help further explain the system. Collecting and analyzing this information from the architects and project managers was extremely important and helpful when communicating with the waste haulers. Before attending the architect meeting, it was not brought to our attention that the architects were already planning on accounting for recycling in each kitchen with the renovations. This knowledge was helpful because it gave insight on space limitations for bins in the resident kitchens.

3.5 Draft Educational Literature

As a final waste management system became finalized, educational documents were created and collected. Some educational documents were collected from E.L. Harvey and Sons, while others were retrieved from the internet. Educational literature was also drafted, laying out specific rules for tenants regarding their responsibilities and how the system at 52 High Street would work. Examples of some educational literature can be found in Appendix F.

3.6 Summary

Information was collected from multiple sources to create an effective waste management plan for Abby's House. In addition to necessary background research on how to design a waste management plan, we interviewed and surveyed staff and residents at Abby's House. The information collected in each interview and survey gave valuable insight on the different perspectives surrounding the waste management issue. Waste haulers also performed site visits, where they collected information on the production of waste at 52 High Street and created proposals based on that information. Finally, once the system began to take form and the waste haulers provided some educational literature, the final educational document for residents was drafted. Chapter 4 will go into the detailed results we obtained from carrying out the methods we have described in this chapter.

Chapter 4: Results

Through a combination of interviews, tenant surveys (Appendix D) background research a waste management system was designed, and data was collected on local waste haulers. The most economical waste hauler was chosen based on the cost analysis detailed in this chapter. Responsibilities, waste container size and locations, and how waste would be disposed was all accounted for in the waste management system created. Although the system created will not be implemented for at least a year, is designed to be efficient, cost effective, and include recycling. This chapter will give the detailed results that the methodology explained in chapter three produced. The chapter breakdown is as follows.

- Findings Regarding the Current Waste Management System and Opportunities for Improvement
- Findings Regarding Local Waste Haulers as Potential Future Haulers
- Findings Regarding Waste Management Options
- Findings Regarding Post Renovation Floor Plans

4.1 Findings Regarding the Current Waste Management System and Improvement Opportunities

The waste management system at 52 High Street which provides for basic waste disposal struggles with accountability, and proper education. In addition, it does not include recycling. Figure 5 below shows the basic layout of the current, pre-renovation waste system and highlights the issue of trash being disposed of improperly throughout the building. Residents were disposing of trash in areas other than the dumpster which other people such as staff and volunteers were then responsible for. Key findings, which were identified as essential to the project's final goals are listed below.

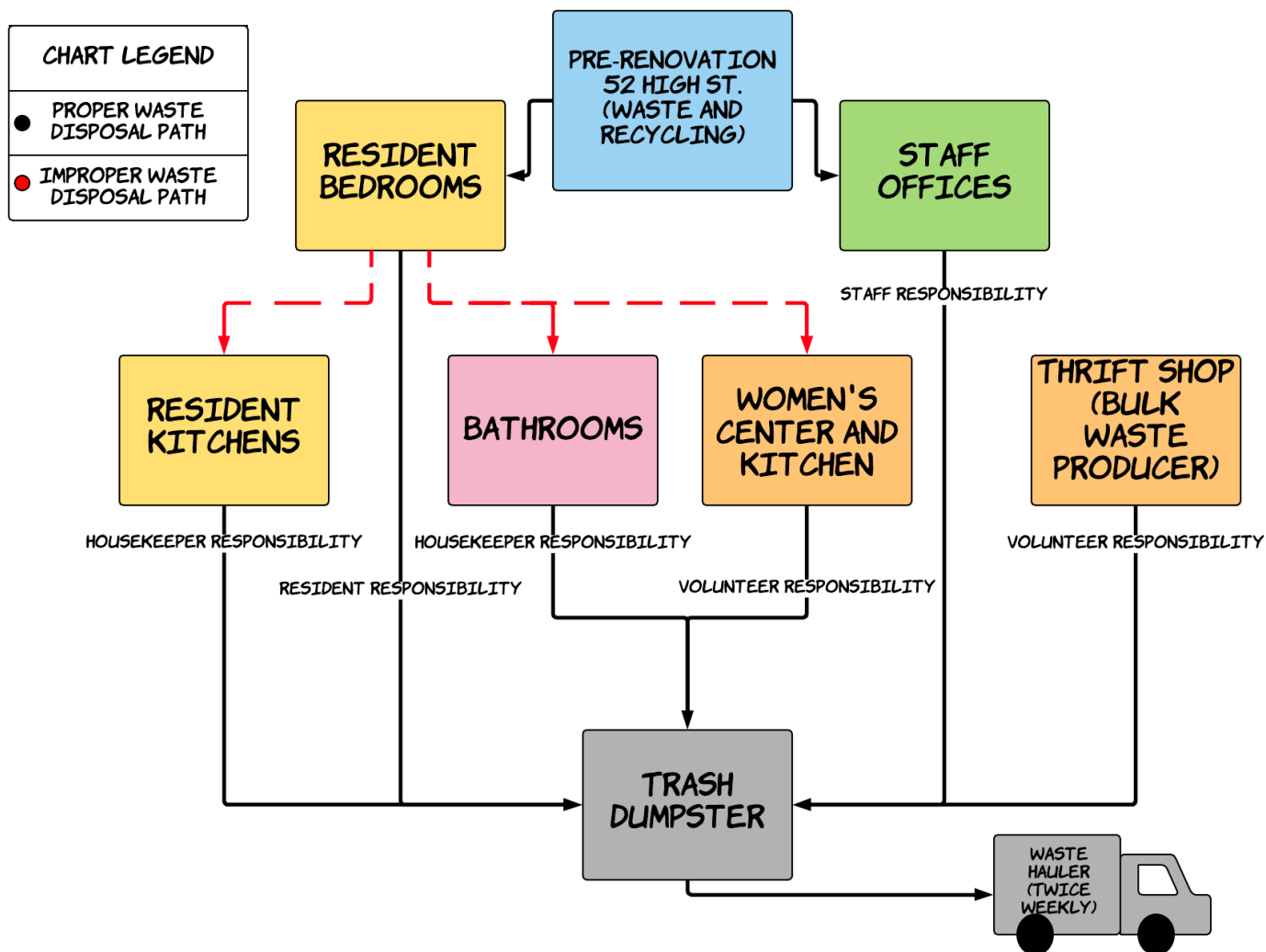


Figure 5 Pre-Renovation Waste Flow

Findings regarding Current Waste at 52 High Street

Trash and Recycling

- There is currently no recycling at 52 High Street.
- There is one 8-yard waste dumpster which is emptied twice weekly by AJ Letourneau and is frequently full. (Abby's House Resident, personal communication, March 21, 2018)
- Dumpster is not locked or fenced in and reportedly used often by the public (Abby's House Staff Member, personal communication, March 23, 2018). This causes an

inconvenience to those at Abby's House as it contributes to the issue of the dumpster often being full. However, this use by the public does not cost Abby's House additional money unless 25% or more of the dumpsters space is consistently used by the public. The 25% threshold is the difference between Abby's House requiring an 8-cubic yard dumpster

Residents

- While it is hard to tell how many, some tenants were placing personal waste in common area trash cans such as the first-floor kitchen trash can. Several residents and staff alike saw this as a significant problem.
- Some tenants are allowing trash to build up in their rooms.
- Instead of disposing of certain waste properly, such as food and feminine products, residents have flushed them down the toilet causing damage to the plumbing at 52 High St.

Staff and Volunteers

- Trash bags in the kitchen can become too heavy for most of the women and volunteers to handle after community meals.
- The thrift shop is using an estimated 40% of the dumpster, half of which is estimated to be cardboard.

4.1.1 Findings Regarding the Current Waste Hauler

AJ Letourneau is a small locally run company that is currently serving Abby's House's waste disposal needs. AJ Letourneau informed us they do not have a sales representative who can make site visits. Instead, all pricing and services were discussed over the phone and from prior bills. AJ Letourneau does not provide single stream recycling and instead only provides cardboard and paper recycling (AJ Letourneau sales representative, personal communication, April 10, 2018). Abby's House is currently utilizing an eight-cubic yard dumpster which is being emptied twice a week at 52 High Street, and a 4-cubic yard dumpster which is emptied once weekly at 77 Chatham Street another residential building owned by Abby's House. The 8-cubic yard dumpster at 52 High Street is frequently full in between pickups. The annual cost for this service is \$7,201. Table 2 below shows a breakdown of the pricing structure for A.J Letourneau. This information was extremely vital in comparing the three was haulers' annual cost for

multiple waste production scenarios at Abby's House. Comparing multiple scenarios for waste production allowed for the most comprehensive and fair assessment of all three waste providers.

Table 2: AJ Letourneau Cost Analysis

Waste Hauler	Size of Dumpster (Cubic Yards)	Type of Dumpster	Frequency of Pickup (Weekly)	Cost of Dumpster	Fuel and Environmental Fee	Total Cost (Monthly)	Est. Annual Cost
AJ Letourneau	8	Waste	1	\$238	\$12	\$250	\$3,000
	8	Waste	2	\$410	\$20	\$430	\$5,160
	8	Recycling	1	\$162	\$8	\$170	\$2,040
	6	Waste	1	\$195	\$10	\$205	\$2,460
	6	Waste	2	\$357	\$18	\$375	\$4,500
	6	Recycling	1	\$138	\$7	\$145	\$1,740
	4	Waste	1	\$162	\$8	\$170	\$2,041

4.2 Findings Regarding Local Waste Haulers as Potential Future Haulers

This section discusses the information our group obtained from meeting with two waste haulers, Waste Management and E.L. Harvey and Sons. This includes services both waste providers offer, as well as their final recommendations for dumpster sizes at 52 High Street and 77 Chatham Street, based on the knowledge we presented them with.

4.2.1 Waste Management

Our group met with one of the sales representatives of Waste Management (WM) in Worcester, MA. Regarding recycling, WM accepts single stream recycling which includes cardboard, paper, tin, aluminum cans, glass, and plastic (Waste Management Sales Rep., personal communication, April 11, 2018.). Because of this, there is only a need for one recycling dumpster, instead of an alternate dumpster for just paper and cardboard. With recycling being implemented, the sales representative explained that the current size dumpster, which services both trash and potential recyclable material, can continue to be used with the frequency of pickup per week adjusted. He suggested that Abby's House may benefit from having an 8-cubic yard waste dumpster emptied once a week, and a 6- cubic yard recycling also emptied once a week. Waste management also recommended adding 6-cubic yard waste dumpster to be emptied once weekly at their 77 Chatham Street location. This plan would cost Abby's House \$6,385.80 annually. Table 3 below shows a breakdown of the pricing structure for Waste Management.

This information was extremely vital in comparing the three waste haulers' annual cost for multiple waste production scenarios at Abby's House. Comparing multiple scenarios for waste production allowed for the most comprehensive and fair assessment of all three waste providers.

The thrift shop often comes across broken appliances, such as microwaves, refrigerators, batteries/bulbs, and other miscellaneous electronics. An important question that was discussed was what to do with these electronics as they cannot be thrown out in a general waste dumpster. Waste Management has a program called "The Tracker Program" to accommodate when things of this nature need to be thrown away. When an individual is ready to dispose of these items, they contact a number provided, who will send them a box to be picked up later by FedEx. The box can be tracked until it gets back to Waste Management, where the individual will get a verification call or email that the item was disposed of and recycled under correct state and federal rules. The pricing differentiates based on the quantity and type of waste being picked up.

Table 3: Waste Management Cost Analysis

Waste Hauler	Size of Dumpster (Cubic Yards)	Type of Dumpster	Frequency of pickup (weekly)	Cost of Dumpster	Fuel and Environmental Fee	Total Cost (Monthly)	Est. Annual Cost
Waste Management	8	Waste	1	\$152	\$57	\$209	\$2,508
	8	Recycling	Every other week	-	-	\$110	\$1,320
	6	Waste	1	\$115	\$43	\$158	\$1,898
	6	Recycling	1	\$120	\$45	\$165	\$1,980
	4	Waste	1	-	-	\$135	\$1,620
	4	Recycling	1	-	-	\$138	\$1,656

4.2.3 E. L. Harvey & Sons

E.L. Harvey and Sons (2015) is a waste management company based in Westborough, Massachusetts and was chosen to be one of the waste service providers chosen by our project team to be evaluated. Founded in 1911, Harvey and Sons handles residential, commercial, and construction waste disposal and recycling services, among other services (E.L. Harvey & Sons, Inc., 2015). From the interview held with a sales representative of Harvey and Sons and the proposal provided, we determined that the services they provided both fit the needs of Abby's House and were an economically practical option.

Harvey and Sons indicated the most reasonable and economically sound option to start with would be an 8-cubic yard, single stream, recycling dumpster that would be picked up every other week, in combination with a 6-cubic yard waste dumpster that would be picked up twice weekly (E.L. Harvey and Sons sales representative, personal communication, April 12, 2018). It was also recommended that the dumpster located and utilized by residents at 77 Chatham Street be a 4-cubic yard waste dumpster, emptied once weekly. This plan would cost Abby's House an estimated \$6,664 annually. Any changes to the size of the dumpster and/or frequency of pickup would not incur additional fees to Abby's House, but would change the above cost in accordance to the changes being made. In addition to this, Harvey and Sons would be able to provide Abby's House with indoor bins and educational materials on waste and recycling free of charge. Table 4 below shows a breakdown of the pricing structure for E.L. Harvey and Sons. This information was extremely vital in comparing the three waste haulers' annual cost for multiple waste production scenarios at Abby's House. Comparing multiple scenarios for waste production allowed for the most comprehensive and fair assessment of all three waste providers.

Table 4: Harvey and Sons Cost Analysis

Waste Hauler	Size of Dumpster (Cubic Yards)	Type of Dumpster	Frequency of Pickup (Weekly)	Cost of Dumpster	Fuel and Environmental Fee	Total Cost (Monthly)	Est. Annual Cost
Harvey and Sons	8	Waste	2	\$395	\$16	\$411	\$4,930
	8	Waste	1	\$210	\$9	\$218	\$2,621
	8	Recycling	Every other week	\$71	\$3	\$74	\$886
	6	Waste	2	\$324	\$13	\$337	\$4,044
	6	Waste	1	\$175	\$7	\$182	\$2,184
	6	Recycling	1	\$104	\$4	\$108	\$1,298
	4	Waste	1	\$139	\$6	\$145	\$1,735

4.2.4 Waste Hauler Conclusion

Table 3 below gives a simple summary for the annual costs for the initial proposals from each waste hauler as well as the cost for maximum estimated waste and recycling production as well as minimum waste and recycling production. Prices are expected to vary between the minimum and maximum costs as the system grows and changes during the first year of

implementation. It is important to note that Waste Management has additional fees not included in this table such as the initial \$75 drop off fee for dumpsters, and a \$150 fee for changing dumpster sizes.

Table 5: Waste Hauler Cost Comparison

Company	52 High Street		77 Chatham Street	Total Yearly Cost	Proposal Type
	Total Yearly Waste Volume Est. (yd ³)	Total Yearly Recycling Volume Est. (yd ³)	Total Yearly Waste Volume Est. (yd ³)		
AJ Letourneau	832	-	208	\$7,201	Current
Waste Management*	416	312	312	\$6,446	Initial Proposal
Harvey and Sons	624	208	208	\$6,664	
Waste Management	416	208	208	\$5,448	Minimum Estimated Waste
Harvey and Sons	416	208	208	\$5,242	
Waste Management	624	312	312	\$7,934	Maximum Estimated Waste
Harvey and Sons	624	312	312	\$7,525	

4.3 Findings Regarding Post Renovation Floor Plans

Findings regarding the renovations

After sitting in on the architect's weekly meeting with the lead architect, project manager, and the owners project managers, we could get a better idea of what Abby's House will look like following the renovations at 52 High Street. Based on the floor plans presented to us, our group discovered the following information regarding space for recycling and trash in the bathrooms, kitchens, common areas, and the dumpsters in the back of Abby's House.

Recycling and Trash

- There will be room in the parking lot for both a garbage and recycling dumpster.
- A wheel chair ramp will be added which will lead directly to the back of the building from a side entrance.

- A ramp is being implemented around the back side of the building that will provide easier access to the recycling and trash dumpster

Bathrooms, Kitchen, and Common Areas

- There will be space for trash and recycling bins in each kitchen. Space for recycling is 1'3" wide 1' deep, and trash is 1' wide and 2' deep. Both are 1' 15" high. This is especially important because it limits the size of the baskets which can be used in the resident kitchens.
- Bathrooms will need only trash receptacles.
- There is enough room in the budget to provide personal waste and recycling bins in each residential bedroom.
- Commercial kitchen trash and recycling receptacles will need to be wheeled and bins will need to be at least 20-gallons.
- Recycling and waste containers in the women's center must be large enough to handle community meals and activities which occur there, but must also be aesthetically pleasing.
- There will be some form of water purification system for use by the residents to promote the use of reusable water bottles.
- There will be stairs at every exit from the thrift shop unless an elevator is used to get outside.

4.4 Summary

There are a few key findings which heavily influenced the recommendations in Chapter 5, which will further explain the logic behind the final recommendations for a waste management system at Abby's House following renovations next year.

1. Stephanie Page decided that a housing manager would be responsible for trash in resident common areas and working in lieu of rent. This finding allowed us to form a waste management system which included the housing manager and eliminated resident responsibilities for the removal of waste in common areas throughout 52 High Street.

2. AJ Letourneau did not provide single stream recycling requiring Abby's House to contract with a new waste hauler. (AJ Letourneau Sales Rep., personal communication, April 10, 2017)
3. E.L. Harvey and Sons provides a more flexible contract, and lower prices than Waste Management. (E.L. Harvey and Sons Sales Rep., personal communication, April 12, 2017)
4. Abby's House would have to purchase nearly all indoor bins for the future system adding to initial startup costs to the program.

The recommendations found in Chapter 5 were based mainly from these findings.

Chapter 5: Recommendations

Our recommendation for a new waste management plan at 52 High Street can be broken down into a few important sections. The first is a basic recommendation for waste flow and responsibilities within the building for disposing of trash. Next are the four-internal waste management and resident responsibility options our group came up with to make it easier to identify who is responsible for what. Our last section consists of our overall recommendation about which local waste hauler would be the best fit for Abby’s House, accounting for recycling, dumpsters, and indoor bins.

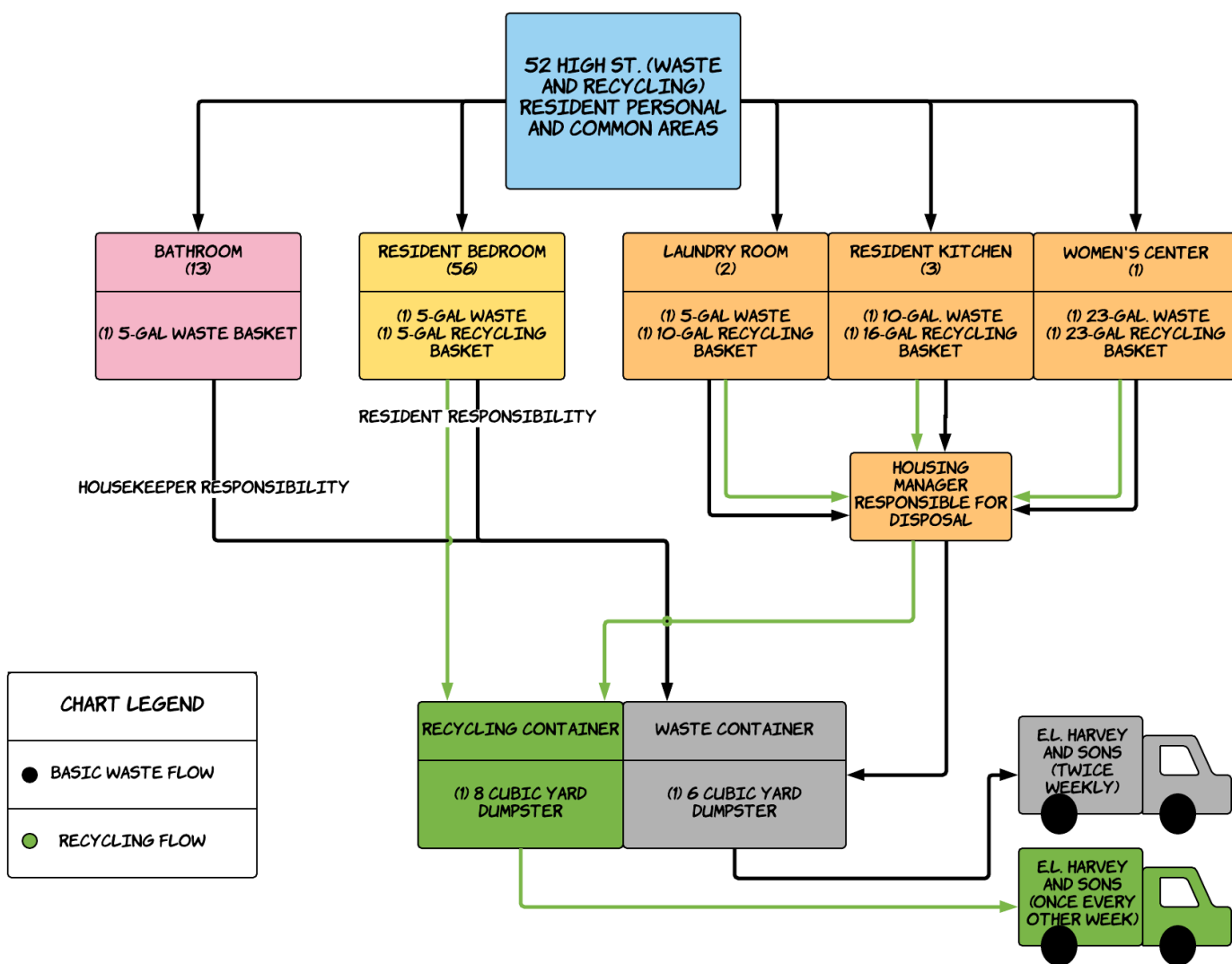


Figure 6 Resident Personal and Common Area Waste Flow

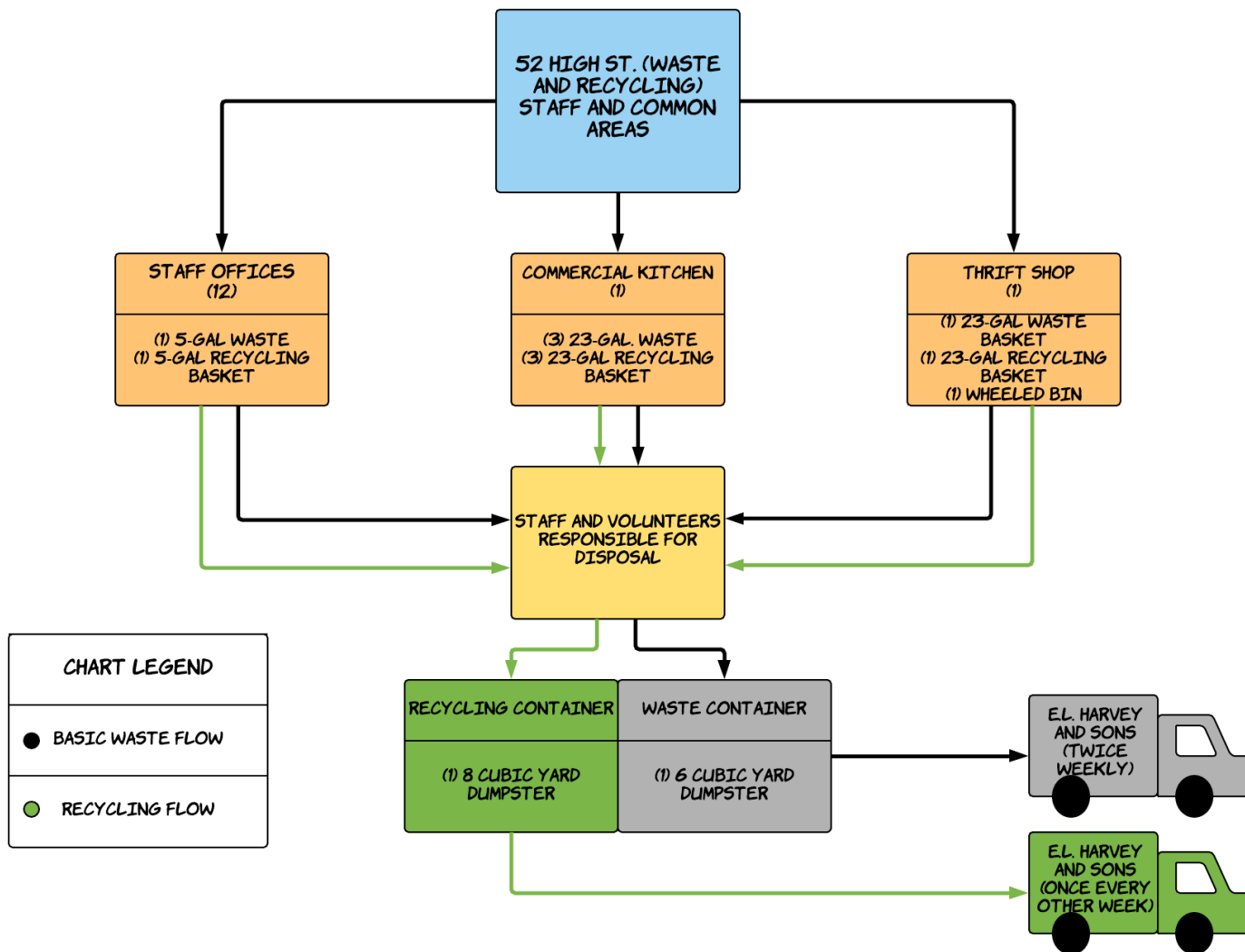


Figure 7 Staff and Common Area Waste Flow

5.1 Recommendations Regarding Waste Responsibility and Basic Waste Flow

Internal Waste Management Options

Four options for internal waste management and resident responsibility were presented to Abby's House. The biggest difference among them was who was responsible to deal with trash once it left resident bedrooms, and where it was to be brought. The first option mandated tenants to bring trash and recycling from their rooms to the main collection room which was to be emptied, in addition to resident common spaces, by residents on a mandatory rotating schedule. This option would have required Abby's House to make a lease addendum. Resident common spaces after the renovation will be the kitchens and laundry rooms made available to them.

Option two was very similar to the first option, except instead of mandating a chore rotation, Abby's House would be encouraging participation in the chore rotation with gift cards or other incentives. The third option also included a tenant chore rotation for emptying the main collection room and common space containers, except this chore rotation would be voluntary, and incentivized through a stipend or reduced rent. In this option tenants would be locked into a contract stating their responsibilities in exchange for the incentive. Finally, the fourth option required tenants to remove trash from their room, but the main collection room and common areas would be emptied by a paid staff member.

Ms. Page chose a modified version of option four for tenant involvement in the waste management system at 52 High Street. To instill a sense of personal responsibility, and independence in the residents at 52 High Street, it was decided that residents would still be responsible for removing trash and recycling from their rooms.

After analyzing the pros and cons of each option for waste management, it is recommended that:

- Residents will be responsible for their own waste generated in their bedrooms
- Kitchens and laundry rooms, considered common spaces for the residents, will be emptied by the housing manager who will be working in lieu of paying rent at Abby's House.
- Bathrooms will be emptied by the current housekeeper working at Abby's House.
- Staff will be responsible for emptying personal trash and recycling in offices, as well as the meeting room.
- The housing manager will need to empty trash and recycling receptacles in the kitchens and laundry rooms daily.
- The housing manager may also need to assist with trash removal in the Thrift Shop.
- Volunteers and staff will be responsible for removing waste and recycling from the commercial kitchen area.
- The housing manager will be responsible for removing waste and recycling from the women's center.
- A lock-pad and signs advertising surveillance may be useful for the dumpsters to ensure no illegal dumping occurs.

5.2 Recommendations regarding the Waste Hauler for Abby's House

Abby's House should use E.L. Harvey and Sons as their waste hauler. Based on the findings presented in section 4.2.3, E.L. Harvey and Sons is the best option for Abby's House. Harvey and Sons has cheaper yearly costs for dumpsters, and they do not include an initial fee for dropping off dumpsters, or a fee for changing dumpsters out. It is likely that Abby's House will have to change their dumpsters sizes based on production of waste. E.L. Harvey and Sons does not charge for dumpster replacement, whereas Waste Management does, which is an important distinction when analyzing potential costs between the two companies. E.L. Harvey and Sons is a more cost efficient and flexible option for a waste hauler than Waste Management.

5.3 Recommendations regarding recycling at 52 High Street

Recycling will help to cut down the total waste production at Abby's House, which will save money on waste removal. For example, a six-cubic yard recycling dumpster being emptied once a week is only 59% of the cost of the same volume waste dumpster being emptied once a week according to the rates provided by E.L. Harvey and Sons. In addition, the thrift shop is a very large contributor to waste at Abby's House, and nearly half of the waste produced by the thrift shop is recyclable cardboard. Based on the data provided in section 4.1, many of the staff and residents at Abby's House would like to begin recycling. Abby's House would benefit both socially and economically from implementing recycling at 52 High Street.

5.4 Recommendations Regarding Dumpsters for Abby's House

- Abby's House will start off using a 6-cubic yard waste dumpster that gets emptied twice a week and an eight-cubic yard recycling dumpster that gets emptied every other week at 52 High Street.
- Abby's House will start off using a 4-cubic yard waste dumpster that gets emptied once a week at 77 Chatham Street.
- Residents should utilize Worcester's curbside recycling program at 77 Chatham Street.

5.5 Recommendations regarding indoor bins for Abby's House

- Relatively small bins in the common areas make it so that an excessive amount of trash cannot be put in each bin, but they are there if needed.
- A recycling container for paper must be placed in the printer storage room for the staff to empty as needed.

- A wheeled bin will be needed for the housing manager to efficiently remove trash from all common spaces which she is responsible for.
- Abby's House should provide trash bags for residents to line their personal trash cans.
- Recycling containers and bins must fit the specified dimensions of their respective cabinets in the kitchen.
- All trash and recycling receptacles in the commercial kitchen should be on wheels.
- Each resident bedroom will need a small trash and recycling bin.
- Bathrooms will need a small trash can, but no recycling bins will be necessary for bathrooms.
- The copier room will only need a recycling bin for office paper.
- Space for trash and recycling in the kitchens should be switched because recycling will most likely take up more space.
- Trash and recycling bins should be placed underneath the serving counter in the commercial kitchen instead of storage racks.
- Abby's House should purchase bins from Uline.com. The total estimated cost for all indoor bins is \$2,438. A more in-depth cost analysis can be found in Appendix G.

5.6 Recommendations Summary

In summary, Abby's House should use E.L. Harvey and Sons as their waste hauler. At 52 High Street, there should be an 8-cubic yard recycling dumpster that is emptied once every other week, and a 6-cubic yard waste dumpster that will be emptied twice weekly. There should be a 4-cubic yard dumpster that gets emptied once weekly at 77 Chatham Street. We calculate that this waste management plan will cost Abby's House \$6,446 annually. Residents will be responsible for disposing of trash and recycling produced in their bedrooms, while a housing manager will be responsible for the trash and recycling in resident kitchens, laundry rooms, and the women's center. Staff and volunteers will be responsible for the thrift shop, staff offices, and the commercial kitchen. We believe that the waste management system we have designed for Abby's House will effectively introduce recycling while reducing conflicts surrounding waste, and promote a sense of community among the residents, staff and volunteers.

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Appendices

Appendix A: Homelessness

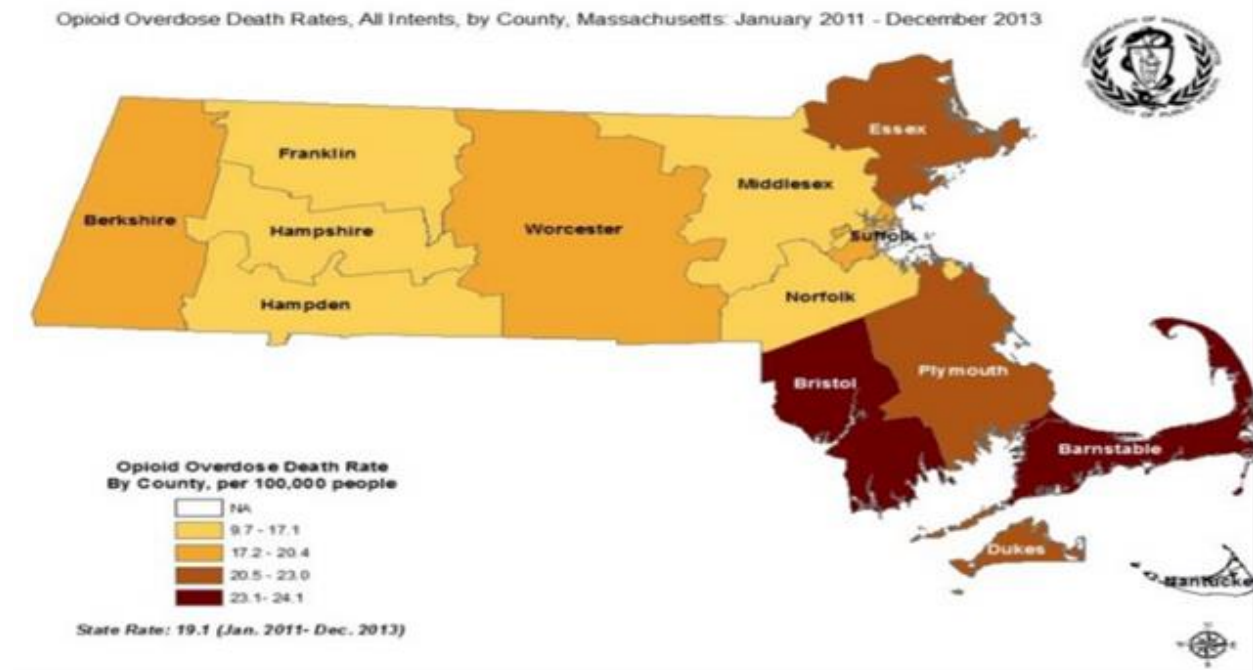
Homelessness as an Issue

A homeless individual is defined as one who lives without permanent shelter, whether that means they live on the streets, in a shelter or vehicle, or doubled up with extended family (although the latter inclusion is more controversial) (Gee, 2017). The key to homelessness is instability in housing situations. The Department of Housing and Urban Development (HUD) estimates that on a given night, over 550,000 Americans are considered homeless. Researchers extrapolate this number to estimate that two million are homeless one or more nights a year. It is important to note, however, that the HUD figure includes those living in shelters. In fact, the number of unsheltered – defined as people with a primary nighttime residence that is not intended for human habitation – constitute 35% of the homeless population. Women are more likely to be sheltered than men (Henry, 2017). The number of poor doubling up is much greater, about seven million (Gee, 2017). The homelessness population nationwide increased between 2016-17 for the first time since the Great Recession.

This contrasts with the Massachusetts homeless population, which increased 16% over the past decade, but decreased by 10% in 2017 (Moulton, 2017). A strong contributing factor is the rising cost of housing. Fortunately, the vast majority (94%) of the Massachusetts homeless population was sheltered. This number is likely impacted by the state's "right to shelter" mandate shared by only two other states, which guarantees a bed for qualified individuals. The Worcester region specifically has followed the statewide trends, though the per capita homeless population is smaller, and housing is less expensive compared to the Greater Boston region.

Substance abuse

Substance abuse is an ongoing issue in not just the city of Worcester, but the entire Commonwealth of Massachusetts (Massachusetts Department of Public Health, 2017). This epidemic is one that has been escalating rapidly over the past few years. In Massachusetts there were 2,094 confirmed cases of opioid-related overdose deaths for 2016. This represents a 24% increase over confirmed cases in 2015 (1,687 deaths) and a 54% increase over 2014 (1,364 deaths). The city of Worcester itself accounted for 5% of all the overdose deaths reported in the entire state of Massachusetts during 2015.



Opioid Overdose Death Rates, All Intents, by County, Massachusetts: January 2014 - December 2016



Figure 8 Change in Massachusetts Opioid Death Rates between 2011-2013 and 2014-2016 (MDPH, 2017)

There is a known belief that substance abuse is related to homelessness or may be a large contributing factor leading an individual to homelessness. In fact, homeless individuals are more than twice as likely to have or develop substance abuse problems (Didenko, 2007). The Coalition for the Homeless has estimated roughly one-third of the homeless population abuses alcohol. Alcohol use is more common among the elder homeless population, while drug abuse is most

common among the younger homeless population (18-25 years of age). Twenty-six percent of the homeless population abuse drugs other than alcohol. When an individual is restricted financially yet spends what little money they have on drugs and alcohol due to addiction, it makes affording housing even more difficult.

The National Coalition for the Homeless states that substance abuse is often a cause and effect of homelessness (National Coalition for the Homeless, 2009). Through their research, it was found that individuals who develop substance abuse disorders taint relationships with family and friends and often lose their jobs. It is not hard to imagine that when people are already struggling to pay their bills, an addiction may cause result in an exacerbation of these issues and result in the loss of their home. A survey conducted in various cities across the United States and the city governments were asked to provide the top three causes of homelessness. Substance abuse was listed as the most common and often biggest contributor to homelessness for single adults (reported by 68% of cities). Substance abuse was also mentioned by 12% of cities as one of the top three causes of homelessness for families.

A study done in Pennsylvania noted that since becoming homeless, substance abuse increased around 30% for those individuals who already suffered from abuse issues. This increase was largely due to mental health disorders that can be temporarily alleviated with alcohol. In the other 70% of males and females, drug abuse disorders developed before the individual experienced homelessness.

Homelessness and substance abuse among women

A Boston study performed in 2015 that focused on how homelessness affects substance abuse, stated that homeless women have a high prevalence of risky use of both alcohol and illegal drugs, five to fourteen times higher than the general population of women. There were no significant differences between women experiencing homeless days versus continuously housed women in the odds of reporting high motivation to change alcohol or drug use. However, a current substance use disorder, or frequent continued consumption of alcohol or drugs are associated with lower odds of exit from homelessness, prolonged episodes of homelessness, and housing instability. One aspect of this decision process for homeless women may be the experience of discomfort in programs that serve predominantly men and resulting fears of re-victimization. Women's shelters, such as Abby's House, help to break these cycles and assist women in recovery by providing a stable and safe housing atmosphere. (Upshur, 2015)

Mental Health

Mental health problems can be a large factor contributing to homelessness. People suffering from mental health disorders are often subject to three factors: disaffiliation, poverty, and personal vulnerability (HomelessHub, 2017). When an individual is mentally ill, they often are unable to perform everyday tasks, such as self-care, management skills in a household setting, and/or in a working environment (National Coalition for the Homeless, 2017). This type of behavior can contribute to a state of isolation. They may begin to withdraw from friends, family and other loved ones who are trying to help and get them the support they need, severing any chance of forming or maintaining relationships. This is often detrimental, leading the individual with little to no resources while in a fragile mental state. Mental illness can often impair judgment, leading the individual to think they may not need help. This becomes harmful, because loved ones are often the only ones that may be able to provide the individual with adequate access to treatment. This type of behavior leads to poverty.

Due to their declining mental state, many mentally ill individuals are unable to maintain a steady job, and because of this, have little to no income (National Coalition for the Homeless, 2017). These factors lead to personal vulnerability. At this point, the individual is exposing themselves to a destructive situation that they are not able to escape without adequate support, eventually leading to homelessness. According to the National Coalition for the Homelessness, mental illness is the third leading cause for homelessness in America (National Law Center on Homelessness and Poverty, 2015). Given the three factors mentioned above, individuals that are mentally ill are more likely to become homeless than the rest of the general population. Poor mental health can also lead the person to neglect their physical health on the streets, leading to respiratory infections, skin diseases, and other chronic illnesses (National Coalition for the Homeless, 2017). Homelessness can also negatively affect mental health by intensifying anxiety, fear and depression. Individuals who are mentally ill experience homelessness for longer intervals of time than individuals who do not suffer from mental illnesses. Of the homeless population, up to 75% of women struggle with their mental health, while 20-25% suffer from mental illness coupled with substance abuse (HomelessHub, 2017).

Other research shows that an individual's upbringing can significantly influence their mental health state. A research study from Children's Hospital in Los Angeles, California

worked with Hollywood Homeless Youth Partnership to investigate a homeless individual's trauma experience before and during homelessness, in relation to their mental health state. The results showed that in a sample of 600 individuals, 58.9% experienced emotional abuse/neglect, 51.4% experienced physical abuse, and 33.2% experienced sexual abuse as a child (Wong, 2014). While the homeless population may experience trauma on the street such as crimes, violence, or physical diseases, results conclusively showed that trauma induced on the individual during childhood made them three times more likely to develop mental health disorders than individuals who were not, giving them a greater chance of experiencing homelessness.

Economic Factors

Economic factors are a large contributor to homelessness. Poverty, a lack of affordable housing, and unemployment have been cited as some of the major causes of homelessness throughout the United States (Family Promise, 2017). Currently, the state of Massachusetts has roughly 653,000 people below the poverty line, making up 9.6% of the population, which for a family of four is only \$24,300 per year (US, 2016; Family Promise, 2017). Massachusetts also has 17,565 people in the state who are homeless (Semega, 2017). On average, renting a two-bedroom home in Worcester is \$947 per month. Affording this would require an hourly wage of \$18.21 to prevent cost of housing to be greater than 30% of total income. There is an obvious gap between affordable housing and wages in Worcester. As the average income for renters is \$11.83, individuals would have to work at least 60 hours per week to afford an average two-bedroom home. Another factor that may contribute to economic struggle leading to homelessness is lack of education. Somewhere between 38% and 50% of the homeless population in the United States is composed of women and children. Forty-seven percent of those mothers did not graduate from high school, and over a third of the children will not graduate. Homelessness and economic struggles due to lack of affordable housing, low income, lack of education etc. are heavily connected (Thompson, 2015). In 2015, the Hunger and Homelessness Survey concluded that the lack of affordable housing was the number one leading cause of homelessness among individuals and families.

Domestic Abuse

Domestic abuse can tear families apart at the seams and 38% of women who leave situations involving domestic abuse become homeless. Additionally, women who are part of

homeless families are more susceptible to domestic abuse (Long, 2015). Domestic abuse puts physical and mental strain on women, and can put their children into potentially dangerous situations. Once homeless, resettling their lives can be broken up into three general phases. First, women obtain basic needs such as food, shelter and emotional help. Next, they develop and improve on those basic needs to find more consistent sources while also seeking further emotional help. Finally, they begin the transition to economic independence where they begin to obtain long lasting resources which will benefit their future. There are a few barriers which keep women from reaching this third stage of recovery from domestic abuse. Some of which are children, little access to emotional and physical resources, education level, and the economic situation of the surrounding area (Long, 2015).

Seeking support from domestic abuse is not easy for women, and although there are many options for formal support, women tend to try and fix the situation on their own first. When they cannot help themselves, women typically seek help from informal support such as friends and family. Informal support can be futile because of the amount of stress it puts on the friends or family members providing shelter. They can become overwhelmed by being required to provide both physical support and emotional support. If informal support proves ineffective, women have many options for formal support ranging from homeless shelters to transitional housing (Long, 2015).

Types of shelters

Homeless shelters provide temporary housing for women in need at no cost. However, many women will be required to be on welfare, and typically can only stay during the nighttime to stay in homeless shelters (Long, 2015). Having to leave every day makes it nearly impossible for women to settle in, meaning that shelters will only provide temporary basic needs. Homeless shelters can also put women and children into undesirable situations based on the population of homeless which surrounds them (Long, 2015). Emergency shelters are much like homeless shelters and provide basic needs for women and their children. They typically offer food, showers, and counseling. Emergency shelters, like homeless shelters, also have hours when clients can be there. Domestic violence shelters provide more substantial support, especially mental support in the form of counseling. The downside to women's shelters is sons may not be able to live in the shelter if they are above the age which the shelter permits. Finally, transitional

living shelters offer the most substantial support for women looking to recover from domestic abuse. The typical stay for a temporary women's shelter ranges from 1-3 years and provides women with some economic independence. Women in temporary living shelters typically have individual rooms and access to resources such as job training, counseling, GED classes, parenting classes, children's programs etc. Women in these shelters are typically required to attend certain programs while living in transitional housing, which could take them away from their specific needs (Long, 2015). Each shelter described above has its own benefits and drawbacks, but all have their place in assisting women who experience homelessness.

Appendix B: Seven Steps to Setting up a Multi-Family or Apartment Building Recycling Program (Massachusetts D.E.P., 2002)

1. Designate a coordinator
2. Determine method of sorting and containers needed
3. Arrange for pick-up
4. Plan the storage and collection system
5. Set up your collection and storage system and start the program
6. Provide basic education
7. Monitor program and provide follow-up services

Appendix C: Staff and Resident Interview Plan

- I. Introductions
 - Our names, where we go to school and what we study.
 - Informed Consent
 - Resident introduction
- II. How long have you been residing/working at Abby's House?
 - How frequently do you interact with volunteers and staff/residents?
- III. Have you encountered any problems with disposal or buildup of waste?
 - Have you had conflicts with staff, volunteers, or other tenants, regarding waste?
 - What has been done about problems you have encountered?
 - While living/working here have there been other systems that have worked better/worse?
- IV. What type of waste is produced, and how much could be recycled?
 - What would you estimate your volume (in bags) of waste production daily/weekly would be?
 - Do bags ever become too hard to handle, and what happens if they do?
 - When you dispose of waste where do you bring it? Does it go straight to the dumpster or do you drop it off somewhere else to be picked up?
 - Is recycling a reasonable expectation for you and those you live/work with?
- V. Do you have any suggestions for fixing/ improving the current waste management system?
 - How efficiency of the waste management system be improved?
 - How can conflicts regarding waste management be reduced?
 - Would some form of a rotating chore schedule be useful?
- VI. Would you be willing to work with a team of staff, residents, and ourselves to help create a new waste management plan?

Appendix D: Waste Management Questionnaire and Results

Thank you for taking the time to fill out this short questionnaire. This questionnaire aims to help us identify the complexity of the waste management issue at Abby's House. We appreciate your valuable input and will be keeping your responses anonymous. If you have any comments or concerns regarding this survey, please contact Glamedys Rodriguez. Creating an effective waste management program for Abby's House will not be possible without your participation. Thank you.

1. Do you feel there is a waste management problem at Abby's House?

Yes

No

Sometimes

2. Does the waste management problem affect you daily?

Yes

No

Sometimes

3. Do you feel that you contribute to the waste management problem?

Yes

No

Sometimes

4. Do you feel that you do anything to help combat the waste management problem?

Yes

No

Sometimes

5. Would you be willing to participate in a weekly chore rotation to help empty waste baskets within the building?

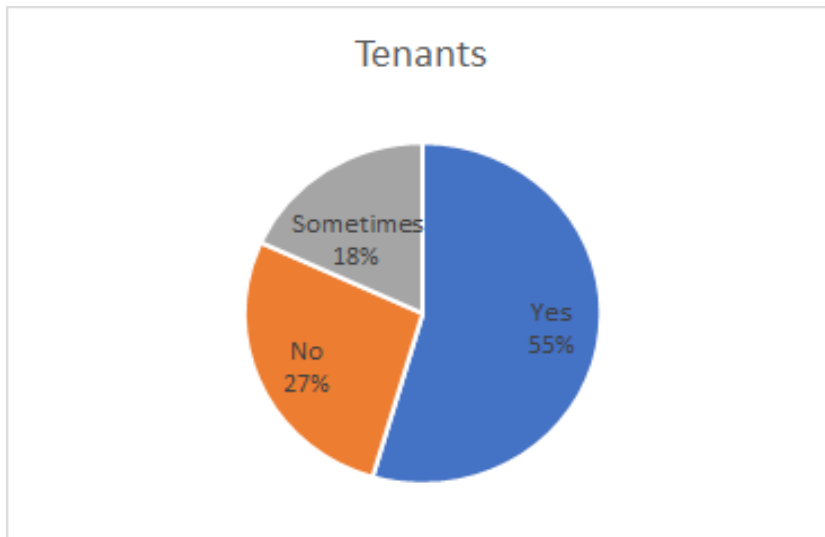
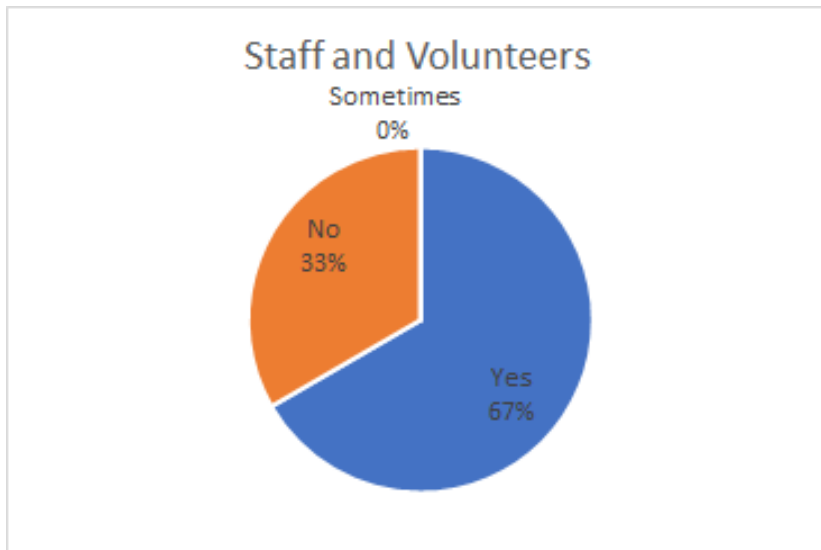
Yes

No

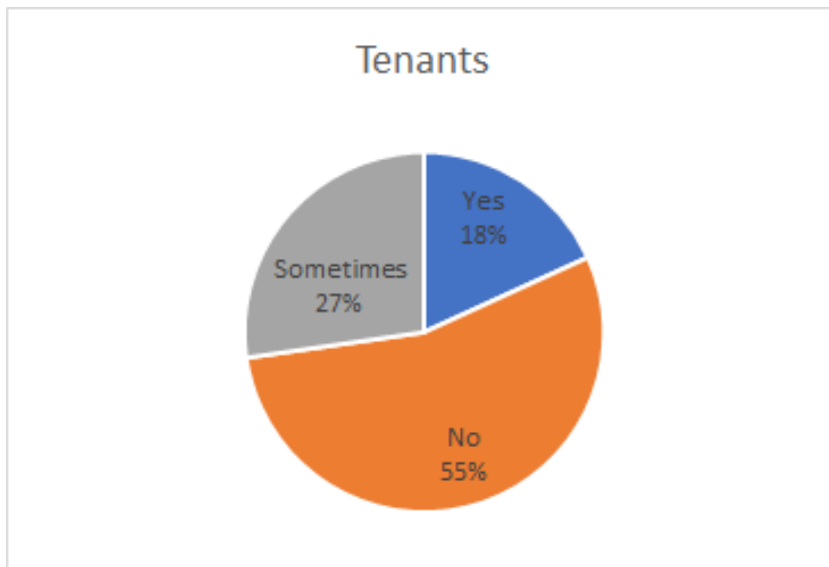
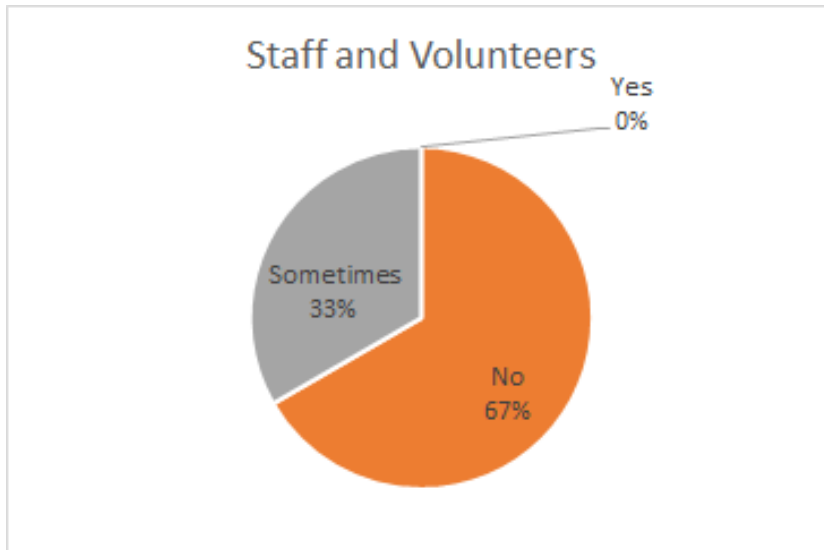
6. What are your largest concerns regarding the waste management problem? Please explain.

7. What questions do you have regarding trash and recycling? (What can be recycled and what cannot? What do I do with broken electronics? etc.)
8. Do you have any suggestions/advice on how to improve waste management? If so, please explain

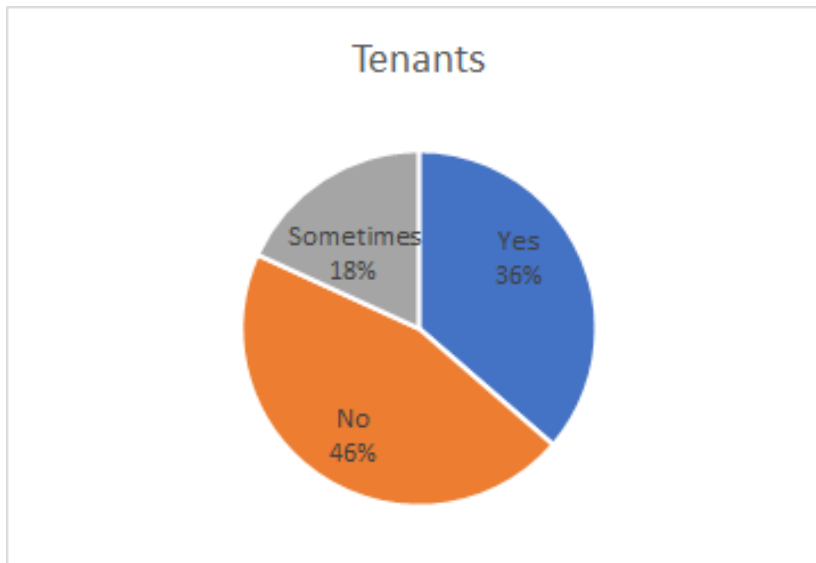
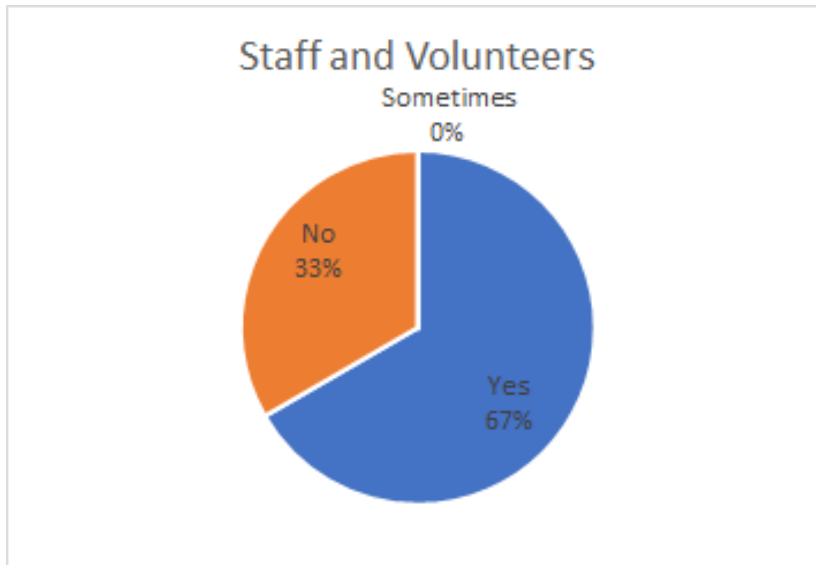
Do you feel that there is a trash problem at AH? (Q1)



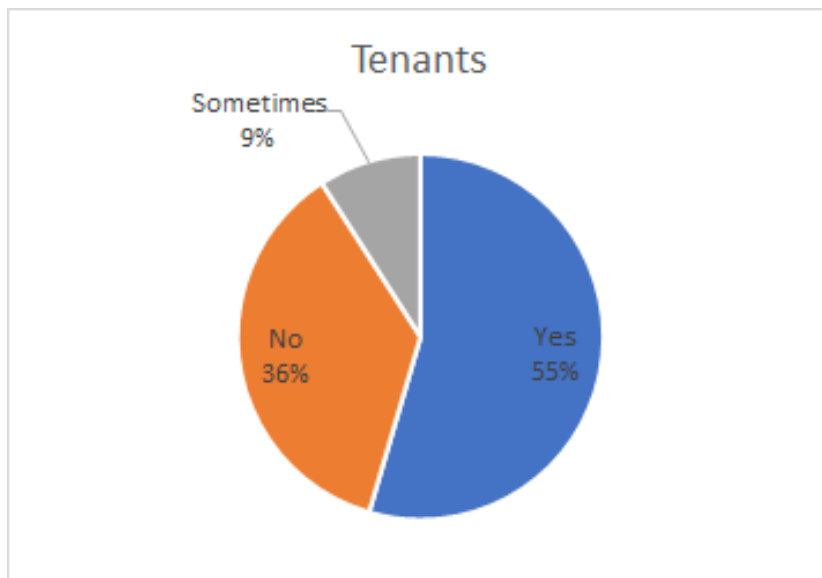
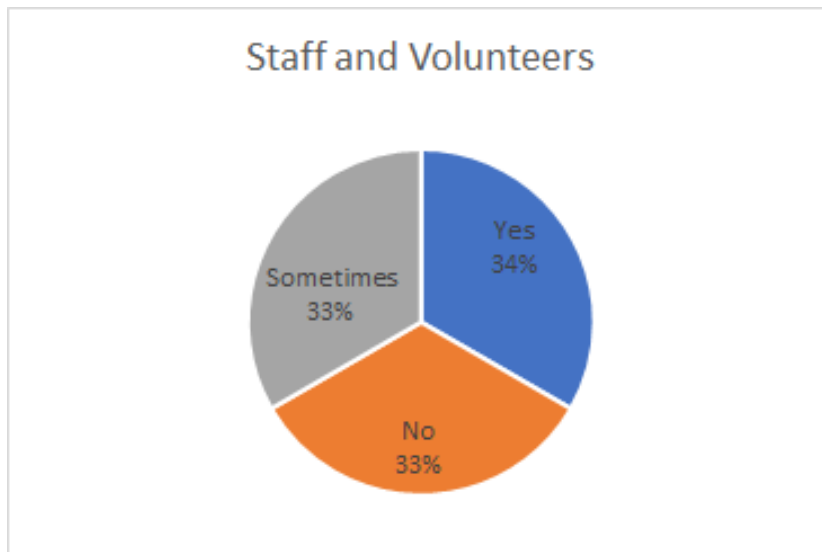
Does the problem affect you daily? (Q2)



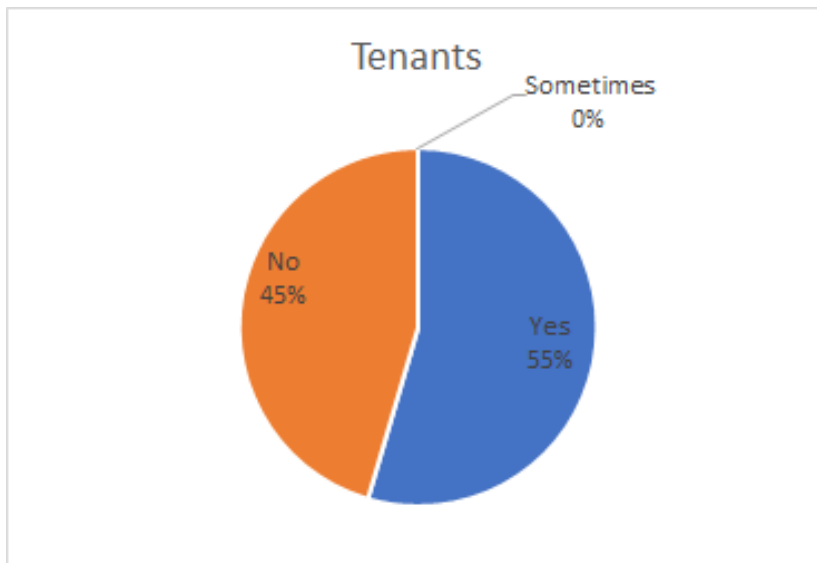
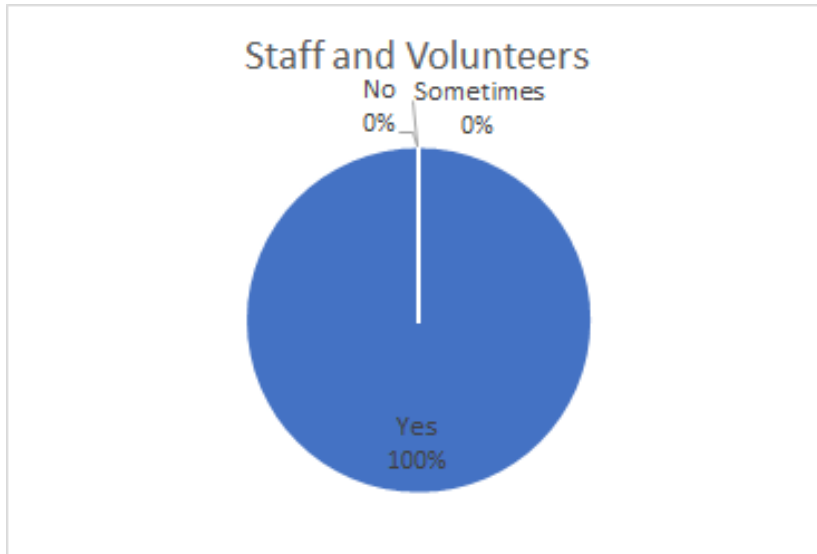
Do you feel that you contribute to the problem? (Q3)



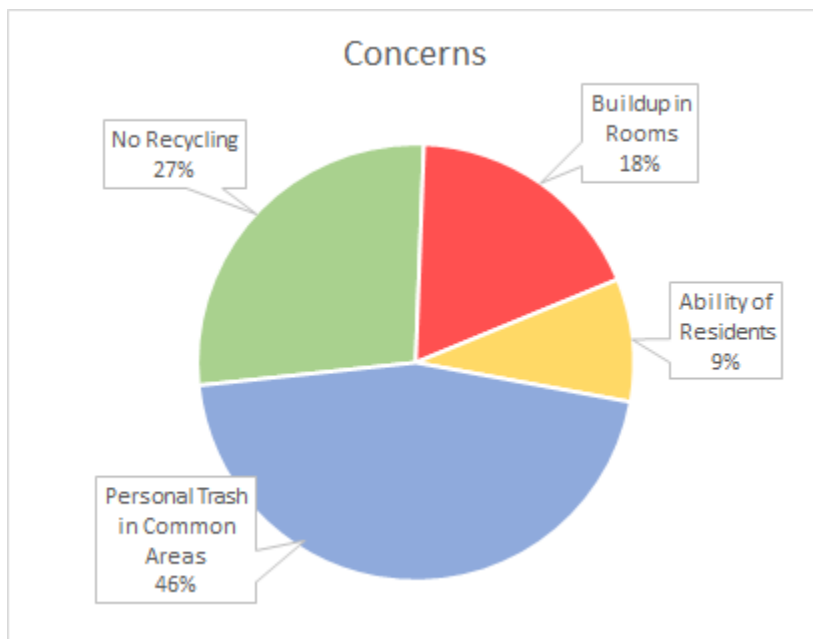
Do you feel that you are doing anything to help combat the waste issue? (Q4)



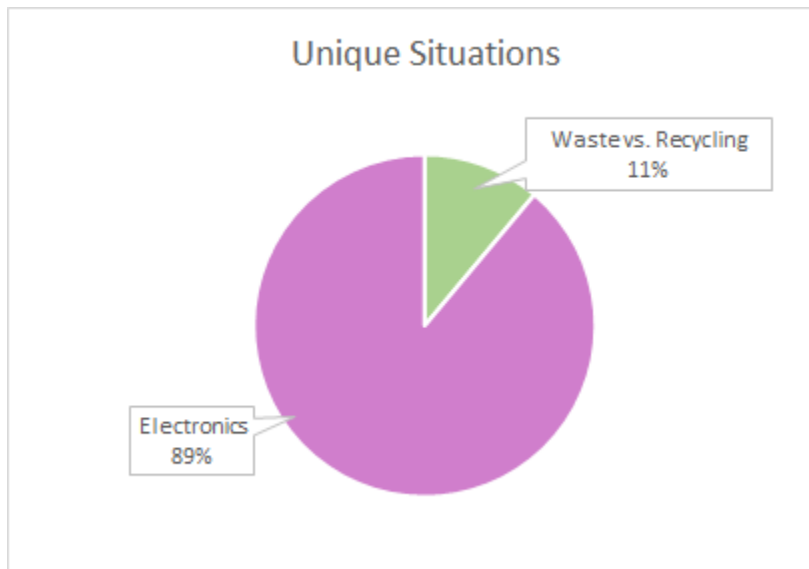
Would you be willing to participate in a weekly chore rotation to help empty waste baskets within the building? (Q5)



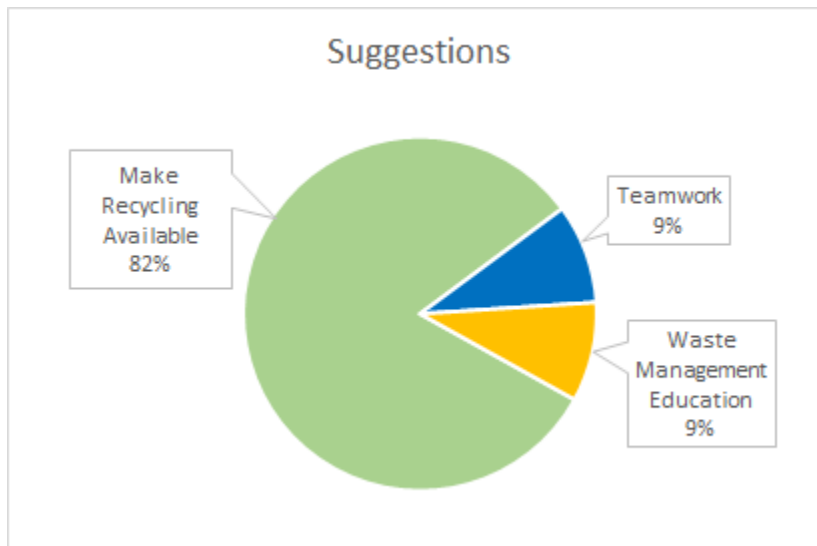
What are your largest concerns regarding the waste management problem? (Q6)



What questions do you have regarding trash and recycling? (What can be recycled and what cannot? What do I do with broken electronics? etc.) (Q7)



Do you have any suggestions/advice on how to improve waste management? (Q8)



Appendix E: Internal Waste Management Solutions

Potential Solutions for Waste Management

1. Residents have full responsibility of waste disposal and work on a mandatory chore rotation
 - a. Residents store waste in separate recycling and trash bins within their rooms and empty the bins on a weekly basis or as needed.
 - b. Residents will empty waste bins into main collection units found in a common area on every floor
 - c. Residents will empty main collection units, twice weekly, into the dumpster on a schedule dictated by a rotating responsibility chart
 - d. Residents who are responsible for emptying main collection units will also be required for gathering trash and recycling from the common kitchen throughout the week as it fills up. If they are bringing trash out on Wednesday, but the kitchen units need to be emptied on Tuesday then that will be done in addition to an emptying of the main collection units on Wednesday.
 - e. All trash from the kitchens will be brought to the main collection units
 - f. Personal trash bags will need to be provided by Abby's House
 - g. Chore rotation will be written into lease and dictated by room number (I.e. on Tuesday rooms 123, 124, and 125 will be responsible for emptying kitchen and main collection units)
 - h. A resident advisor will be responsible for ensuring the schedule is fulfilled
2. Residents have full responsibility of waste disposal, but are given an incentive/stipend for participating in chore rotation
 - a. Previous a-f apply for this solution as well
 - b. The chore rotation in this solution will be volunteer based and tenants who choose to volunteer will be provided an incentive such as gifts cards or a small paid stipend by Abby's House
3. Residents are responsible for removing waste from their rooms, but waste is removed from main collection units by outside volunteers
 - a. Residents store waste in separate recycling and trash bins within their rooms and empty the bins on a weekly basis or as needed.
 - b. Residents will empty waste bins into main collection units found in a common area on every floor
 - c. Main collection units will be emptied into the dumpster by outside volunteers as community service hours
 - d. Kitchen collection bins will be emptied by the residents on a voluntary basis through the form of a sign-up sheet into the main collection units every other day
 - e. Kitchen collection bins may also be emptied by volunteers twice a week before emptying main collection units
 - f. Personal trash bags and trash bags for kitchen units will be provided by Abby's House

4. Residents are responsible for removing waste from their rooms, but waste is removed from main collection units by paid staff
 - a. Steps a-f from solution 3 apply to this solution
 - b. As opposed to volunteers dealing with the main collection units paid staff will take care of them
 - c. Paid staff could be a new housekeeper, the nightly security staff, or tenants who decide to apply for job as opposed to just earning a stipend
 - d. Personal bags and bags for kitchen collection units will be provided by Abby's House

Pros/Cons

1. Residents have full responsibility of waste disposal and work on a mandatory chore schedule

Pros	Cons
Ensures accountability for waste removal	Requires a lease addendum
Teaches women responsibility and accountability	Some women may not be physically capable of fulfilling their duties
Very low cost on Abby's House	Will require supervision to ensure women are staying on schedule
Legally binding contract that women will have to follow	Conflict will arise from those who do not want to help, but are being forced to
Gives women ownership of their space	

2. Residents have full responsibility of waste disposal, but are given an incentive/stipend for participating in voluntary chore rotation

Pros	Cons
Residents are participating because they want to	Overhead costs of paying participants or paying for gift cards
Participation is rewarded	Will require supervision to ensure that the rotation is fulfilled
A system of accountability remains in place	Women who are physically incapable do not have a chance to participate
Responsibility and accountability are still lessons learned by all who participate	
Gives residents ownership of their space	

3. Residents are responsible for removing waste from their rooms, but waste is removed from main collection units by outside volunteers

Pros	Cons
Convenience for women is maximized	Women do not learn as much responsibility or accountability
Higher convenience will likely mean higher participation	Volunteer participation is not dependable
	Residents will not earn a sense of ownership for the apartment complex

4. Residents are responsible for removing waste from their rooms, but waste is removed from main collection units by paid staff

Pros	Cons
Waste is removed on time and without conflict	Women do not learn as much responsibility or accountability
System is well organized and there is clear accountability	Residents will not learn a sense of ownership for apartment complex
	Could be conflict between staff and residents if residents take advantage of staff

Appendix F: Waste System Educational Literature

Recycling at Abby's House

PLEASE RECYCLE

PAPER



phone books, mail, mixed papers, office paper, envelopes, folders, newspaper & inserts, magazines, catalogs, brochures, pamphlets

PLASTIC



plastic bottles, plastic jugs, plastic tubs

CARDBOARD



boxboard, cereal boxes, food boxes, flattened corrugated cardboard

METAL



metal food and beverage containers

GLASS



glass bottles, glass jars

DO NOT RECYCLE

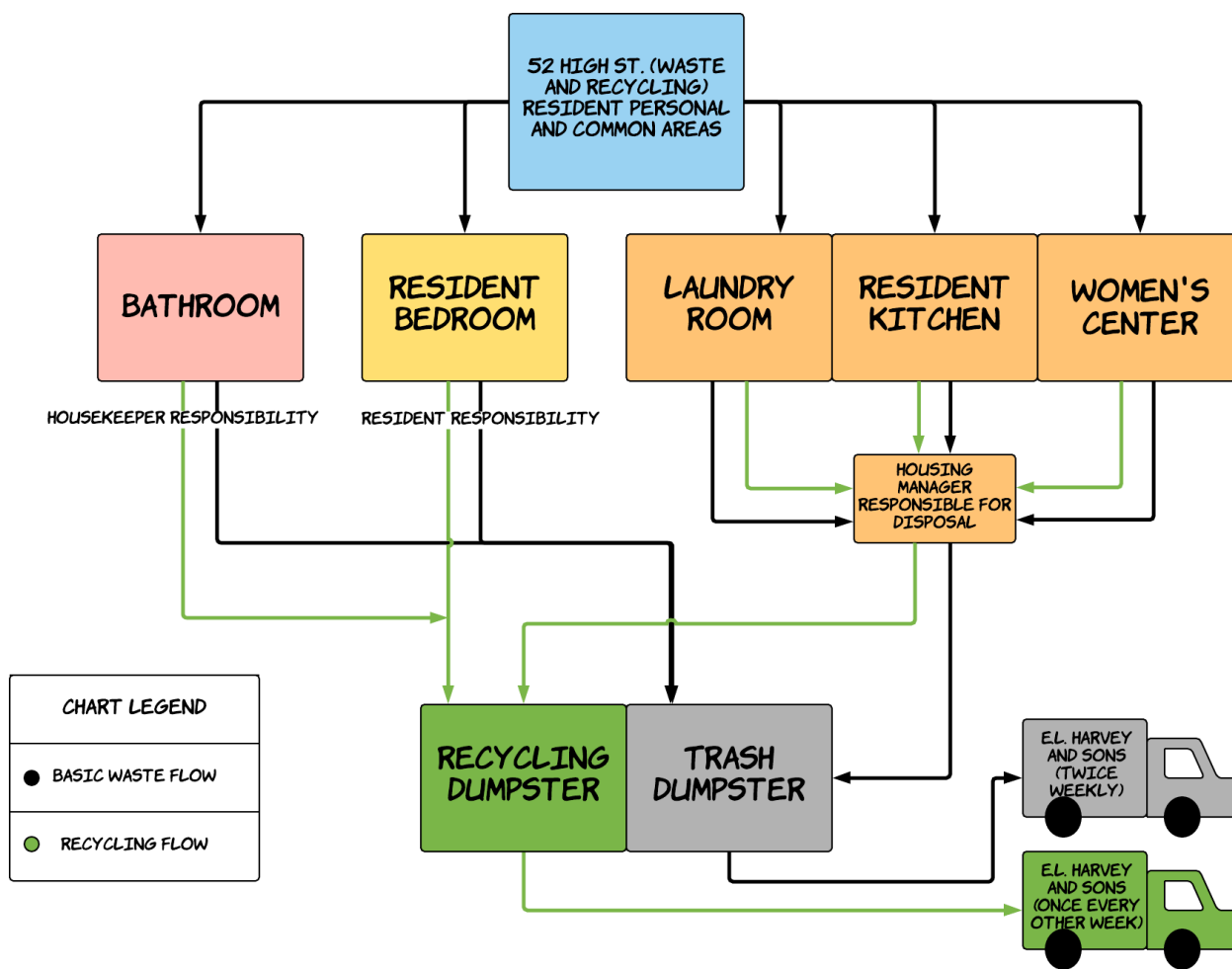
- Shredded Paper
- Wood material and products
- K-Cups
- Packaging contaminated w/food or grease
- Plastic Grocery Bags
- Plastic/Wire Hangers
- Plastic Wrappers (candy wrappers, chip bags)
- Plastic Film/Plastic Tarps
- Office Equipment
- Foam packaging and Styrofoam
- Aerosol cans
- Glass dishes/Pyrex/Ceramics
- Windows and light bulbs
- Mirrors



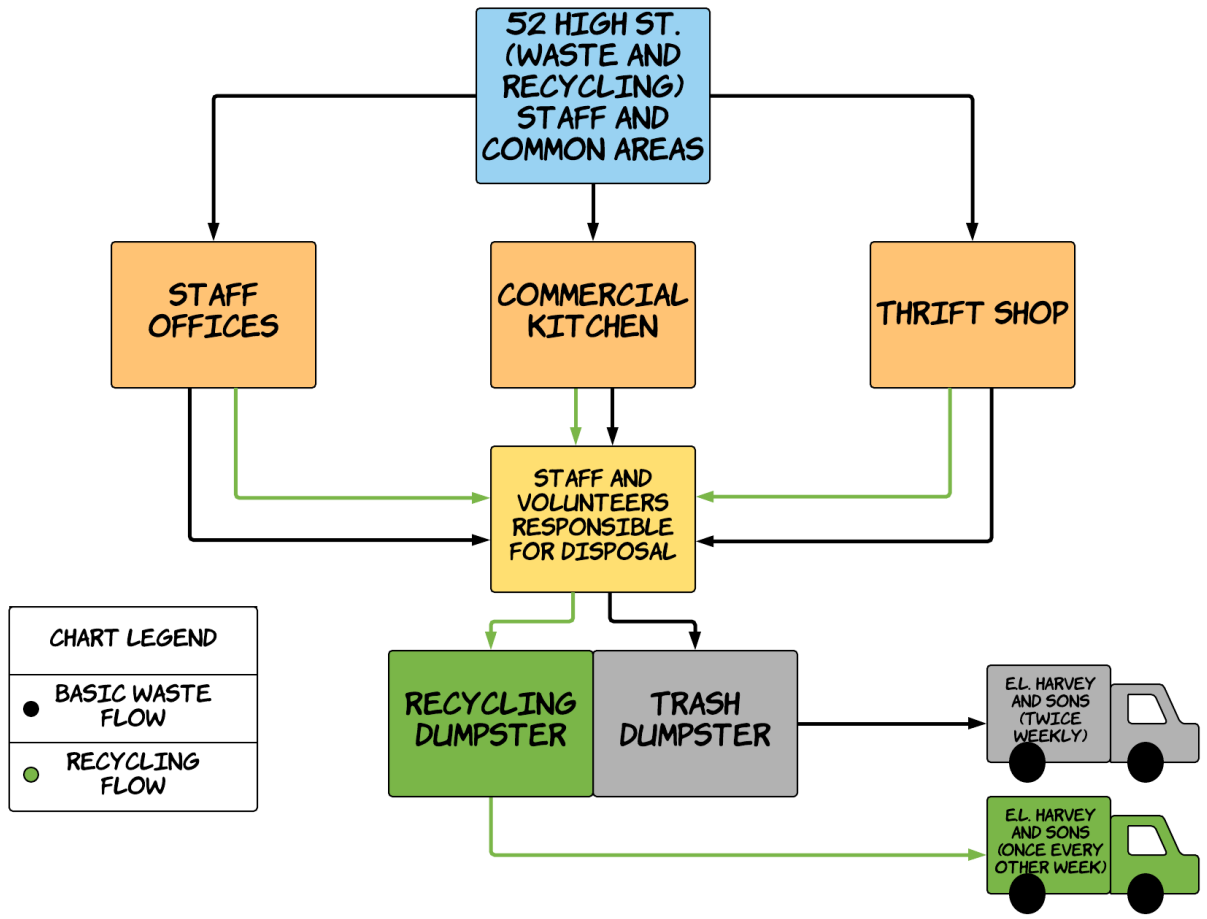
Resident Guidance on Waste Management at 52 High Street

Welcome to 52 High Street and your newly renovated home! You will be an integral part in keeping this beautiful building clean by disposing of your trash and recycling properly. Your room has been outfitted with personal trash and recycling bins which you will be responsible for emptying on a regular basis. Both trash and recycling dumpsters are located at the rear of the building by the thrift shop. In addition to the bins located in your room, there are trash and recycling bins located in the kitchen in their respective cabinets for your use while you are in the kitchen. They are not for personal trash generated anywhere else. The housing manager is responsible for emptying these bins and we ask that you please respect this. In addition to the bins in the kitchen there are also garbage disposals which can be used for light food waste, but nothing that is not organic. For a better explanation of the system please refer to the diagrams below. If you stay committed to following these guidelines, and not abusing common area bins we can keep this building beautiful.

Resident Waste Flow and Responsibilities



Staff and Common Area Waste Flow and Responsibilities



Appendix G: Indoor Bin Sheet and Cost Analysis

Indoor Bin Sheet

Location	Area on Location	Amount	Description	Bin Type	Number of Bins	Bin Comments	Person Responsible for Emptying
52 High St.							
	Bedroom	56	Personal Area	5-gal waste basket	56		Resident
				5-gal recycling basket	56		Resident
	Kitchen	3	Common Space	10-gal waste basket	3		Housing Manager
				16-gal recycling basket (Slim Jim)	3		Housing Manager
				1 Large Wheeled Bin	1	For clearing trash from every floor	Housing Manager
	Commercial Kitchen	1	Common Space	23-gal waste basket (Slim Jim)	3	Needs to be wheeled for kitchen use	Staff/Volunteers
				23-gal recycling basket (Slim Jim)	3	Needs to be wheeled for kitchen use	Staff/Volunteers
	Laundry Room	4	Common Space	5-gal waste basket	4		Housing Manager
				5-gal recycling basket	4		Housing Manager
	Bathroom	13	Common Space	5-gal waste basket	13		Housekeeper
	Offices	11	Staff Space	5-gal waste basket	11		Staff

				5-gal recycling basket	11		Staff
	Copier Room	1	Staff Space	23-gal recycling basket	1		Staff
	Women's Center			23-gal waste basket	1		Housing Manager/Volunteers/Residents
				23-gal recycling basket	1		Housing Manager/Volunteers/Residents
	Thrift Shop	1	Common Space	23-gal waste basket (Slim Jim)	1		Thrift Shop Staff/Volunteers
				23-gal recycling basket (Slim Jim)	1		Thrift Shop Staff/Volunteers
	Dumpster	2	Collection Area	8-yard waste	1		Waste Hauler
				6-yard recycling	1		Waste Hauler
				Total	175		

Bin Cost Analysis

Bin List		Cost Per Bin	Total Cost
7-gal waste	84	\$7	\$588
7-gal recycling	71	\$7	\$475
10-gal waste	3	\$14	\$42
16-gal recycling (Slim Jim)	3	\$42	\$126
23-gal waste (Slim Jim)	5	\$50	\$250
23-gal recycling (Slim Jim)	6	\$50	\$300
1 Large Wheeled Bin	1	\$519	\$519
Slim-Jim Trolley	2	\$69	\$138
Total	175		\$2,438

Appendix H: Interview and Photo Consent Forms
Informed Consent Form

Hello,

We are a group of students from Worcester Polytechnic Institute (WPI) in Massachusetts, participating in a project working with Abby's House. We are looking to interview both staff and residents at Abby's House to learn a little bit more about the waste management issue. We hope this research will ultimately improve the efficiency of maintaining and disposing of trash, as well as contribute the long-term success and sustainability of an effective system.

Your participation in this interview is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear in any of our project reports or publications.

This is a collaborative project between Abby's House and WPI, and your participation is greatly appreciated. If interested, we can send you a copy of our results after the study. Thank you so much.

Signature of Participant:

Printed Name:

Date:

PHOTO CONSENT FORM

I, _____ grant permission to _____
for the use of the photograph(s) or electronic media images as identified below in any
presentation of all kind whatsoever. I understand that I may revoke this
authorization at any time by notifying _____ in writing. The
revocation will not affect any actions taken before the receipt of this written
notification. Images will be stored in a secure location and only authorized staff will
have access to them. They will be kept if they are relevant and after that time
destroyed or archived.

Name _____

Signature _____ Date _____

Image(s) Description _____
