

Swarthmore Zero Waste Plan

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**Presented by the
Ecosphere Waste Working Group**

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Purpose: Identify a clear path to achieve zero waste in a cost efficient manner.

Intended Outcomes of the Plan:

- Clearly articulate the vision for improved waste management and reduction of waste (zero waste and educated community)
- Consolidate and organize key findings and next steps from numerous initiatives and stakeholders into one comprehensive document
- Serve as a benchmarking document
- Ensure that there is a consistent approach and design to waste management and education across campus
- Create a resource to guide actions, align stakeholders, inform budgets, and foster future improvements
- Identify the required financial and human resource investments to achieve the stated goals, particularly in 2017-18
- Clarify the key steps for 2017-18 to move Swarthmore towards zero waste
- Clarify roles and responsibilities of key parties
- Create a timeline for implementation
- Clarify the many moving parts of the waste strategy and the interconnections between them (interior, exterior, hauling, education, composting, recycling, metrics, policy)

Executive Summary

The Swarthmore Waste Plan is designed to achieve two long-term objectives. The first is to create a zero waste campus. This reduces Swarthmore's environmental impact on the community and creates a long-term process for continuous improvement of Swarthmore's waste management.

The second objective is to educate the Swarthmore community on ways to minimize their waste footprint via their on and off-campus actions and engender an awareness of their actions and impacts on the environment.

The plan consists of operational changes in:

- Interior waste collection
- Waste movement
- Waste removal from campus

It also addresses the roles and responsibilities of the stakeholders from implementation of the plan. For some community members, such as EVS techs and staff, and Green Advisors, there will be considerable realignment of responsibilities. For every Swarthmore community member, there is the requirement to be a responsible disposer of waste.

The education plan uses waste management best practices and includes an "advocate" program for faculty and staff as well as peer group-specific and site-specific education and training.

Concomitant with the breadth of the operational and educational changes in this plan, policy changes must be considered and are enumerated in the plan.

Reliable and accurate metrics are central to achieving the long-range objectives. Included are the parameters needed to develop appropriate and useful metrics for each component of the plan.

Finally, subjects for future consideration are identified and their significance to ongoing improvement is explained.

I. Long Term Waste Objectives

The Swarthmore Waste Plan is designed to achieve two long-term objectives. The first is to create a zero waste campus - one in which no trash is sent from campus to the incinerator or landfill (in other words, a close to 100% diversion rate). This includes reducing Swarthmore's environmental impact on the community and creating a long-term process for continuous improvement of Swarthmore's waste management.

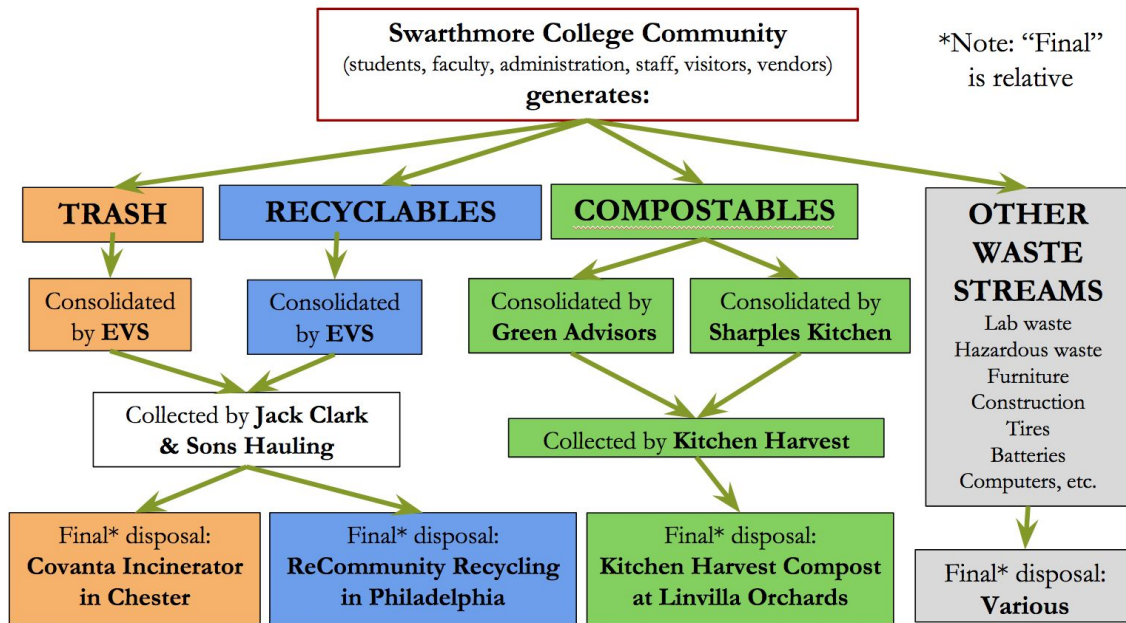
The second objective is to educate the Swarthmore community on ways to minimize their waste footprint via their on and off-campus actions and engender an awareness of their actions and impacts on the environment.

II. Background

This plan is the result of work done during the 2016-17 academic year under the direction of C. Stuart Hain, Vice President for Facilities and Capital Projects, and Aurora Winslade, Director of Sustainability. The project involved Swarthmore administrators, faculty, staff, students and PSRF fellows as well as consultants from iSpring. Detailed documentation of the work done can be found in the [May 2017 Final Report](#): The Swarthmore Waste System created by PSRF Fellows Adina Spertus-Melhus and Vanessa Meng and in the January 2017 [Development of Integrated Waste Management System Report](#) prepared by iSpring.

III. Interior Waste Collection

A. Categories of Waste – The Swarthmore College community generates twenty-two categories of waste managed by a minimum of eight different Swarthmore personnel and involving contracts with at least nine different haulers/disposal companies. This plan addresses only trash, mixed recycling, and compostables. These three categories represent the bulk of the waste generated on the campus. Horticultural waste is handled by the Grounds and Horticulture staff which has specific expertise to manage this type of waste. The plan assumes that the remaining eighteen categories of waste will continue to be managed as they are presently until such time as there is funding for a campus-wide Zero Waste Manager. [See Section X. [Future Considerations](#)] Currently all interior waste collection from the trash and mixed recycling bins is performed by EVS techs. Compostables are collected by students. See [Part E](#) below for more on compostables.



Current Waste Streams

B. Waste Management Strategies – Trash, which is hauled to an incinerator in Chester to be burned, represents the largest category of waste and Swarthmore’s most negative environmental impact on the community because of the degradation of air quality surrounding the incinerator. Based on waste characterization studies completed in September 2016, items deposited in trash bins comprised 68% of the waste generated by the representative academic, administrative and residential buildings tested. If that waste had been correctly deposited in the appropriate bins, only 18% was actually trash. The remaining 50% was a mixture of recyclable and compostable waste. If that remaining 50% were correctly deposited in recycling and compostable bins along with the 32% that was originally correctly deposited, the potential diversion rate rises to 82% (by weight). This number would seem to be achievable simply through better waste categorization. Increases are possible beyond that based on changes in consumption practices.

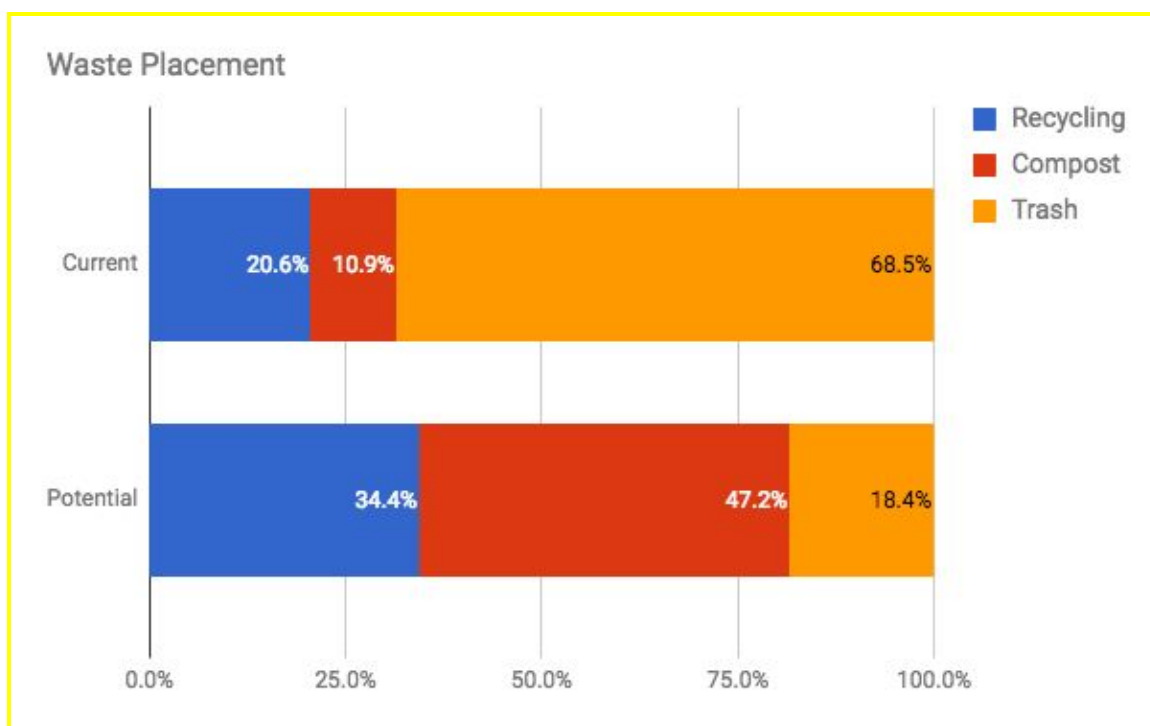


Chart based on all waste disposed from Sept. 7, 2016, and Sept. 9-11, 2016, in the following buildings: Black Cultural Center, Kohlberg, Parrish, Science Center, Willets. Percentages calculated by weight.

For a more detailed discussion of the Waste Characterization Study, see [Appendix B](#).

Input from on-campus stakeholder meetings and interviews revealed a high level of confusion regarding how to categorize a piece of waste for proper disposal. This was compounded by the more than 40 different types of waste receptacles that were placed throughout campus. Recycling bins were particularly confusing because many still carried signage from prior to the advent of mixed recycling. Bins for compostables are not available in many locations on campus and are inadequate for the quantity of compostables generated in others.

Objective: Improve capture rate, i.e. increase the quantity of recyclable and compostable waste deposited in the appropriate receptacle instead of as trash.

Strategies:

1. Better educate campus population on accurate waste-disposal choices (see [Section VII](#) below)
2. Standardize bins and signage to reduce confusion.

C. Bin Design and Cost - Because of the cost of waste bins and the number necessary for a campus of Swarthmore's size, it is not financially feasible to replace all of the bins at once. In addition, all locations are not conducive to the same bin design. Additionally, the built-in waste disposal cabinets in some locations would require removal or modification and will need to be assessed in lengthier case by case basis.

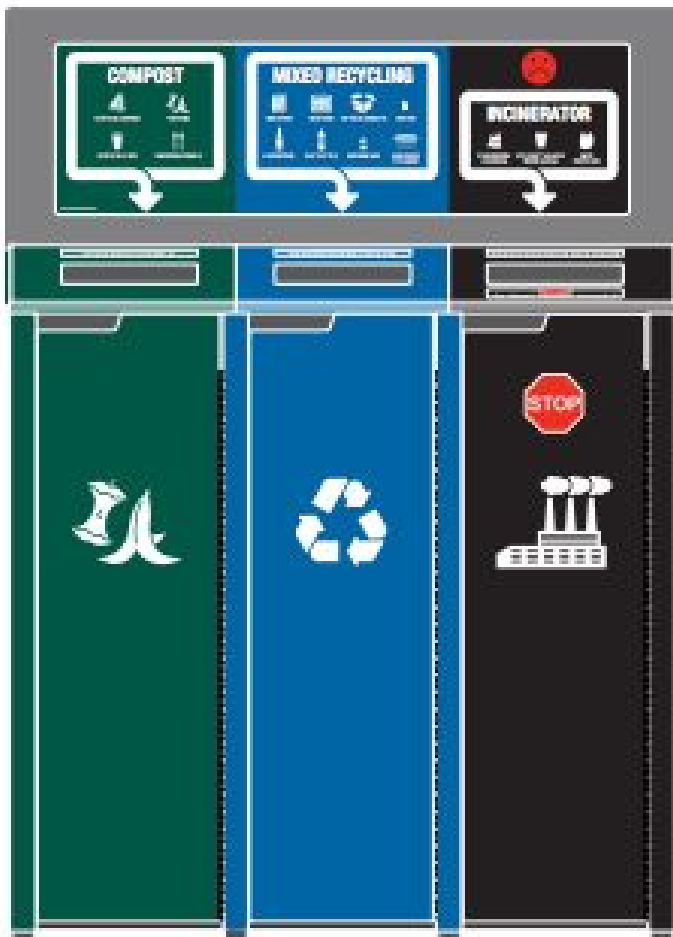
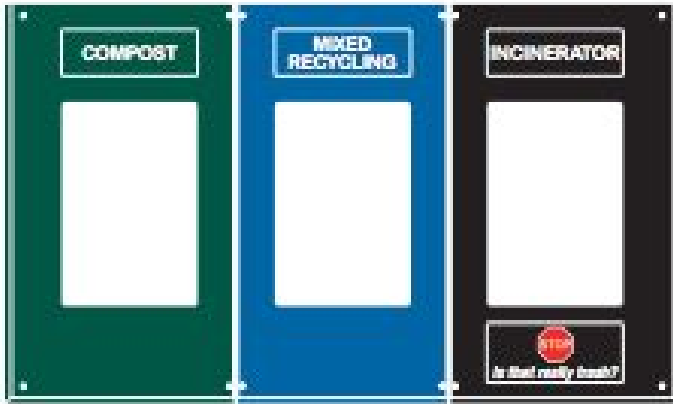
The following bin standard has been created to guarantee consistency of style and signage:

1. Each bin either has a compostable segment or is to have a compostable segment added.
2. Bins will have consistent colors based on type of waste: trash – black; mixed recycling – blue; compostable – green.
3. Bins will have consistent labeling: Incinerator/Trash; Mixed Recycling; Compost.
4. Bins will have attached signage behind the bin that though standardized, can be customized for unique waste disposal locations and changed as conditions change.
5. Bins will be consistently positioned in the order (left to right) Compost, Mixed Recycling, Incinerator/Trash.
6. Bin liners will coordinate with the bin colors - compostable bins will have green liners; recyclable bins will have blue liners; trash bins will have clear liners.

Two bin designs were chosen:



Busch Systems Waste Watcher Station at a list price of \$330 each for standard size and \$435 each for the XL size. This style will be used throughout campus in most locations, particularly dorms, classroom areas, office areas and maintenance/ support areas.



Max-R Oxford Custom (and size variants) at a list price of \$2209 each for the “slim style” as shown. This style will be used in high visibility, public areas such as the non-residential portions of Parrish and large meeting rooms.

D. Bin Type by Building and Rollout Timeline

Bins for new buildings will be chosen based on the standards in Section C. The acquisition cost of these bins will be from funds budgeted for those buildings and are not considered as part of

this plan, except to guarantee consistency of design and signage. Bin replacement/additions in existing buildings will be contingent on availability of funds. The following prioritization schedule lists the preferred order of rollout.

Phase 1 includes the following locations:

- All residence halls (AP/DK, Danawell set, ML, Mertz, PPR, Parrish, Wharton, Willets, Woolman)
- Bond | main hall only
- Clothier
- Facilities Service Building | kitchen only
- Kohlberg
- Lang Center
- LPAC | extensive lobby area only
- Lang Music Building | lobby only
- Matchbox | 3rd floor only
- Parrish | LL & 1st floor, res hall, and Admissions
- PPR Apartments (new building - separate budget)
- Science Center | Eldridge Commons, Cornell
- Whittier (new building - separate budget)
- Wister Center | Gillespie Room

Unfortunately, the quote for a full Phase 1 implementation exceeded initial budgeted funds. Therefore a second, abbreviated prioritization schedule was created to more closely meet budgetary constraints.

Phase 1A would include just the following subset:

- All residence halls (AP/DK, Danawell set, ML, Mertz, PPR, Parrish, Wharton, Willets, Woolman)
- Bond | main hall only
- Clothier | 1st floor & Upper Tarble only--half
- Kohlberg | Scheuer Room only
- Matchbox | 3rd floor only--half
- Parrish | Shane Lounge & res hall only
- PPR Apartments (new building - separate budget)
- Science Center | Eldridge Commons only--half
- Whittier (new building - separate budget)

Bins for the areas identified in the Phase 1A list have been ordered with the likelihood that the WasteWatcher bins will be in place by the beginning or within the first week of the Fall semester. The timing of the placement of the bins is especially critical in the dormitory areas.

Providing the consistent three-bin setup within the dorms reinforces the training that incoming freshmen will be given in Orientation on the “Swarthmore way” to deal with waste.

If additional funds become available during the 2017-2018 academic year, Phase 1B could be implemented which would complete the remainder of the original Phase 1 list.

Phase 1B would include the following locations:

- Clothier - 1st floor & Upper Tarble only--remaining locations
- Facilities Service Building | kitchen only
- Kohlberg - remaining locations
- Lang Center
- LPAC | extensive lobby area only
- Lang Music Building | lobby only
- Matchbox | 3rd floor only--remaining locations
- Parrish | LL & 1st floor, res hall, and Admissions--remaining locations
- Science Center | Eldridge Commons, Cornell--remaining locations
- Wister Center | Gillespie Room

Phase 2 (planned for 2018-19) includes the following locations:

- 101 S. Chester
- 504, 506, 508 Field House Lane
- Benjamin West
- Bond Memorial/Lodges
- Cunningham House
- Lang Performing Arts - remaining locations
- Lamb-Miller Field House
- Lang Music Building - remaining locations
- Matchbox - remaining locations
- McCabe Library
- Meeting House
- Mullan Tennis and Fitness Center
- Parrish Hall - remaining locations
- Robinson House
- Science Center - remaining locations
- Sharples
- Ware Pool
- Women’s Resource Center
- Worth Hall
- Worth Health Center

Phase 3 (planned for 2019-2020) includes the following locations:

- 550 Elm
- Ashton House
- Beardsley
- Kitao Student Art Gallery
- Kyle House
- Martin Hall
- Old Tarble
- Olde Club
- Pearson
- SEPTA Train Station
- Service Building
- Sproul Alumni
- Strath Haven
- Trotter
- Wister Education Center (remaining locations)

Phase 1A includes 141 Busch Systems Waste Watcher bins and 13 Max-R Oxford custom bins. Phase 1B includes 45 Busch Systems Waste Watcher bins and 17 Max-R Oxford custom bins.

A preliminary estimate of the cost of the bins required for each phase is shown below. The costs for Phase 1A are actual costs, based on vendor quotes. The costs for Phases 1B, 2, 3, and 4 are estimated based on average bin numbers for each building from Phase 1A applied to the square footage of each of the remaining buildings and using the cost per square foot of each bin type required.

Phase 1A (actual cost):	\$ 57,823
Phase 1B (est.):	\$ 49,115
Phase 2 (est.):	\$ 96,236
Phase 3 (est.):	<u>\$ 30,543</u>
Total Estimated Cost:	\$233,717

For a more detailed analysis of the bin studies and calculations, see [Appendix C](#).

Collection of waste from external bins is the responsibility of the Grounds and Horticulture Department and was not included in the current Plan. However, external bins are covered as a future consideration. See Section X. [Future Considerations](#).

E. Compostables - The compostable collection system at Swarthmore is currently student-run. As such, it has limited reach on campus both in the number of buildings serviced and in the number of months that collection takes place. This plan provides for expansion of compostable collection campus-wide by means of the requirement that all bins have or can have added a compostable segment. Some student-run expansion of these collections is expected over the life of this plan. The issues associated with complete campus-wide

collection of compostables is covered in Section X. [Future Considerations](#).

F. Desk-side Waste Disposal - For office areas, the plan is to gradually transition to having individual employees empty their own desk side bins. The two bins will be a standard size desk receptacle for recyclables along with a smaller “trash buddy” attached to the recycling receptacle. These receptacles will be emptied by the office occupant into the appropriate hallway bins on an as-needed basis. Research shows that this arrangement leads to more accurate sorting of waste by office occupants. This system has already been implemented in 101 S. Chester. This transition to increased participation by employees addresses the challenge presented by a growing campus and the expansion of compostables collection without a proportional increase in the number of EVS techs.



G. Sharples Waste Management

Sharples Dining Hall has an efficient waste management system already in place that complements the system being implemented campus-wide. It has its own trash compactor and a comprehensive compostables collection system. An important recent upgrade to the Sharples system has been the installation of a waste oil disposal system. This system resolves safety concerns related to the movement of hot oil and streamlines the removal of waste oil from the campus.

This waste management plan includes no changes to the Sharples system at this time. However, Dining Hall Services management is already considering future additional assessment and planning based on Sharples capacity and the possible need to create a new dining facility. Among those considerations are the addition of a pulper to reduce the volume and water content of compostable food waste, ensuring the front of the house is zero waste and that materials in the back of the house at least be recyclable, more local food suppliers to reduce food miles, and simplifying the vendor system to reduce the number of trucks and deliveries each day.

Based on the overall effectiveness of the current system, it is a low priority to align Sharples public bins with the rest of campus.

A '16-17 PSRF report analyzed student food consumption and waste generation. Three quarters of surveyed students indicated that the sustainability of their food systems was of importance to them; at the same time, only a third stated that they consistently take the right amount of food while at meals in Sharples. Students also shared that they did not have a good grasp of proper composting technique in food locations other than Sharples (this is especially evident at Essie Mae's). These findings suggest that more education is necessary to promote

sustainable food consumption. Improving signage targeted to specific food locations and that makes use of typical behavioral nudges is a primary goal. The report also recommends further digitizing records of where the College sources its food and consider the removal of trays from Sharples.

IV. Waste Movement

A primary cost driver of the current Swarthmore waste management system and a source of logistics headaches and visual blight is the system of dumpsters scattered throughout campus for both trash and recycling. These dumpsters are serviced individually by the current hauler's garbage trucks, requiring dozens of individual stops on campus each day. Because not every building has its own dumpster, this system also requires EVS techs to, in some cases, haul or roll trash and recycling bags over long distances to other buildings that have dumpsters. This is especially treacherous in inclement weather and creates significant physical wear-and-tear on the techs and increases risk of injury.

Objective: Improve efficiency of waste movement on campus and reduce number of service points for hauler

Strategies:

1. Create central service yard behind Clothier Field Grandstand
2. Replace dumpsters with system of tilt trucks for each building
3. Acquire vehicles to allow movement of waste on-campus to central service yard by EVS personnel
4. Configure pick-up routes that deliver the tilt trucks to the central service yard
5. Acquire three additional compactors to reduce volume of waste before leaving campus

A. Central Service Yard – The ultimate objective is to design and build a central service yard that will consist of three large, 35-cubic-yard self-contained compactor units. A fourth compactor already exists at Sharples and is used for trash. The new three would be used for trash, mixed recycling, and cardboard recycling. The cardboard recycling compactor can serve as a back-up to the 35-cubic-yard trash or recycling compactors. These compactors would eliminate the need for most of the small, open topped dumpsters spread around campus. The projected location of the central service yard is behind the Clothier Field Grandstand. Funds for design of the yard have been included in the 2017/2018 capital budget with construction planned for the 2018/2019 fiscal year. There is an executed contract for a feasibility study and concept plan for the central service yard with Langan Engineering with a Fall 2017 study completion date.

Because the design and construction of a central service yard is a multi-year project, an interim plan was created to allow for ongoing building projects and to serve as a pilot to test the feasibility of components of the central service yard plan before commitment is made to the final design.

In the interim period, a temporary service yard consisting of one 35-cubic-yard compactor for trash and a 25-cubic-yard covered mixed recycling dumpster will be created at the loading dock of the Science Center. The compactor and the recycling container will be rented from Swarthmore's current hauler rather than purchased to allow flexibility based on the results of their performance during the interim period. The compactor at Sharples will continue to be used in its current capacity as a trash compactor.

B. Internal Waste Movement – Tilt trucks that are 30" wide x 5' long will be used for buildings served by the interim waste pick-up routes. These tilt trucks can be loaded with both trash and recycling bags by the EVS techs and then wheeled to a designated pick-up point for each building on the route. Differently colored bags for trash and recycling will permit EVS techs to easily identify bag contents. Tilt trucks will be stored largely in the specific buildings that they service, though they will be moved and transferred as is most efficient. These tilt trucks reduce the physical strain on the EVS techs since they eliminate the need to carry bags from one building to another.



C. External Waste Movement – Swarthmore already owns a small, off-road trash cart (pictured right) with a dump body that is used to move trash from PPR, Dana, Hallowell, Dwell, Wharton, Kyle House, and the Lang Center. Acquisition of a trailer in the Summer of 2017 (pictured left) to be attached to the trash cart increases capacity and allows for moving trash and recycling at the same time. In the interim, this waste will be delivered to the Science Center loading dock area. The trash cart is capable of dumping its contents directly into the trash compactor. The contents of the recycling bags will be loaded into the covered recycling container.



Lease of a cab-over Chevy stake-body truck with a lift-gate, beginning in Summer 2017,

provides the capability to transport the waste-filled tilt trucks to the Science Center loading dock area. This model was chosen for its shorter length and greater maneuverability and has been leased for 3 years rather than purchased, again to provide maximum flexibility based on performance during the interim period.



Routes have been designed based on the strengths of each truck. The smaller, lighter weight trash cart with trailer will be used primarily to service buildings located on internal campus roads. Trash and recycling bags will be brought by EVS techs to the trash cart for

movement to the Science Center waste site. The larger cab-over stake-body truck will primarily service buildings located on public roads. These buildings will have tilt trucks located in them. The cab-over truck will transport the tilt trucks to the Science Center waste yard where they can be dumped directly into the compactor and recycling bin. For this interim period, dumpsters will remain at Lang Performing Arts Center, Parrish, Martin, Lang Music, Mary Lyon, 101 and the Service Building.

The map below shows the routes for the two vehicles.



Based on the projected routes for the trash cart and the cab-over stake-body truck, the current supply of tilt trucks can be repositioned on campus without the need to purchase additional units. New buildings will require the purchase of additional tilt trucks, the cost of which will be covered in the budgets for the new buildings.

D. Component Costs

Trailer for trash cart: \$1200 - purchase

Cabover Chevy stake-body truck: \$981.11/month - lease

V. Waste Removal from Campus

Future changes to haulers and hauling contracts should be considered, though until the central service yard is fully operational, Swarthmore will continue with the current vendor. In anticipation of the temporary service yard functionality by early September 2017, Swarthmore will negotiate with the current hauler for a reduction in the cost of hauling based on the reduced number of dumpster locations and pick up sites. Compacted trash and the open recycling bin will be priced on a “per pull + tonnage” basis and Swarthmore will be able to monitor when those pulls are necessary.

Monitoring the frequency of trash and recycling pulls will provide more accurate waste generation and disposal data. The present situation with waste collected in dumpsters as part of a larger non-Swarthmore route allows only estimates of waste quantities. The consolidation of waste into a central service yard combined with data gleaned from the interim plan will allow Swarthmore to solicit competitive bids from several vendors.

Hauler contracts should be reviewed at least every three years or as the needs of the campus change. A consideration for future contracts are the waste disposal facilities used by the hauler. For example, the current hauler utilizes a recycling facility that does not permit plastic bags in the recycling stream. This requires substantial additional EVS tech time to remove recycling from plastic bags before dumping into the closed recycling container (or the recycling compactor in the future). Not all recycling facilities have this restriction on plastic bags. A different hauler might use a different facility that does not prohibit plastic bags, making recycling collection much faster and less labor intensive. It is also worth exploring alternatives to the Chester Incinerator for disposal of trash.

VI. Roles and Responsibilities

The waste management plan is the result of collaboration between Facilities Management and the Office of Sustainability. Effective implementation of the plan will provide clearer definition of the roles and responsibilities of many different college departments.

A. Facilities Management - The Vice President of Facilities provides strategic oversight to many of the areas most affected by the implementation of the waste plan as well as contract negotiation with haulers.

1. Environmental Services Department – The Environmental Services (EVS) Department staff, under the leadership of the Director of Environmental Services, is at the heart of the efficient movement of waste from campus buildings to waste collection sites. The

changes in the current system outlined in this plan will have the most impact on the day-to-day activities of the EVS techs.

EVS responsibilities include:

- Removal of waste from buildings and management of all waste movement on-campus
- Management of all contracts pertaining to the movement or removal of trash, recycling, and compostables
- Planning, in coordination with the Office of Sustainability, for replacement schedule for interior waste receptacles
- Purchase and placement of all interior trash and recycling receptacles on campus
- Maintenance of all trash and recyclables receptacles (Green Advisors manage compost)
- Tracking of metrics relative to waste composition and flow with support from the Office of Sustainability
- Compostables collection in 101 S. Chester, Essie Mae's and the Service Building
- Collaboration with the Office of Sustainability to increase EVS role in compostables collection
- Mentorship of President's Sustainability Research Fellow(s) when assigned to work on waste reduction

EVS and the Office of Sustainability partner closely on planning, reporting metrics, and education and good communication has developed between the two partners. Many of the changes in waste movement incorporated into this plan came from recommendations offered by EVS techs as they observed areas for improvement during their daily routines.

As this plan is implemented, it will be the responsibility of the EVS staff and techs to understand and adopt the new or revised practices that the plan will require. They will also be counted on as an important part of on-going process improvement, providing feedback on the success or deficiencies of system changes.

2. Grounds and Horticulture Department - The Grounds Department is responsible for emptying all exterior trash and recycling receptacles and moving the contents to the appropriate collection site. In the future, they could play a role in a on-campus food composting system. (See [Section X](#) below)

B. Office of Sustainability - Under the leadership of the Director of Sustainability, the role of the Office of Sustainability is to support the campus to design and implement sustainability best practices. That broad design includes, among many other categories,

overseeing the development of best waste management practices campus-wide.

1. Green Advisors (GAs) – Green Advisors are students employed by the Office of Sustainability who work to encourage sustainable lifestyles among all Swarthmore community members. GAs primarily serve three roles: (1) residential peer leadership; (2) campus compost management; (3) direct liaisons to academic departments and staff offices through the Sustainability Advocates program. Their responsibilities are detailed in the document available [here](#). GAs are assigned to almost every dorm where they serve as the most visible faces of sustainability in action on the campus.
2. PSRF Fellows and PSRF Waste Fellow – PSRF Fellows participate in a one-year high-impact learning program to research and develop solutions to sustainability-related challenges on campus. For the 2017-2018 academic year there is one PSRF Fellow designated to focus on achieving a zero waste campus. His work will complement and advance the solutions outlined in this plan, particularly the education component. Other PSRF Fellows may contribute to the implementation of plan elements depending their area of focus. For example, Fellows in the areas of behavior change, sustainability planning (OSE, Athletics, and 101 S. Chester), and purchasing could have a role to play in the education components of the plan or the policy considerations. Two Fellows in 2016-17 played an instrumental role in the research that led to the development of this plan.
3. Sustainability Advocates - Sustainability Advocates are college employees in each department and/or building who are taught the basics of waste management best practices and serve as a primary contact and liaison between the waste management program and their segment of the Swarthmore community. The 2017-18 year is the first year of this new program. It is housed within the Office of Sustainability.

C. Auxiliary Services

1. Dining Services

- a. Dining Hall Services - Within the waste management plan, dining hall services provides support for best practice waste management in Sharples. Their responsibilities include accurate sorting and disposal of trash, recyclables and compostables, planning for enhancements to the current system, and promotion of food waste reduction practices.
- b. Dining Retail Services - The role of dining retail services with respect to the waste management plan is to provide support for best practice waste management in Essie Mae's and other retail food sites on campus. Several current practices are under consideration for revision.
- c. Catering Services - The role of catering services is to provide support for best practice waste management in all catering situations. Their responsibilities include providing appropriate dinnerware and utensils, and implementing and

enforcing policies for both on-campus and off-campus catered events that promote best practice waste management. The current default practice for on-campus catering uses all compostable items.

2. Office Services - The role of office services with respect to the waste management plan is to provide support for best practice waste management in printing and mail and package delivery.
3. Campus and Community Store - The Campus and Community Store is run by the College, and the Inn at Swarthmore is contracted to outside managers. The Store's waste is disposed of as part of the Inn's contract (not directly by the College). Auxiliary Services management requires that the outside managers adhere to Swarthmore policies relative to waste management practices.
4. One Card - The One Card program is managed in accordance with campus waste management best practices. Particular attention will be paid to the large number of disposable batteries generated by the current system and how that can be better aligned with best practices.

D. The Office of Student Engagement – Although not primarily focused on sustainability or waste management, student Residential Advisors (RAs) and staff Residential Community Coordinators (RCCs) play a crucial role in maintaining the health, safety, and welfare of their communities. As such, they can be a backup resource for information on proper waste disposal practices.

E. Students – Students have a large impact on the success of the waste management plan. The ultimate success of the plan depends on significant improvement in the diversion rate. Since students comprise the largest proportion of the community, their actions to correctly dispose of waste will have a significant impact on the diversion rate. Their responsibility is to learn and incorporate good waste management practices into their personal lives.

F. President's Staff and Sustainability and Climate Executive Committee - The Sustainability and Climate Committee reports to the Executive Committee and is responsible for evaluating what policy and budget changes might be necessary to support the implementation of the changes in the waste management plan. Based on those evaluations, they can make recommendations to the President's staff. The President's staff is responsible for understanding the contents of the plan and communicating the priorities of the plan to their direct reports and department heads. They are vital to maintaining open lines of communication to ensure that teams can enthusiastically implement best practices.

1. Waste Working Group - The role of the Waste Working Group is to coordinate the design, planning and implementation of waste management strategies between the

Office of Sustainability and the Office of Environmental Services. Working together, the WWG develops the overall waste management plan for the campus as well as the tactical plans for implementation. In addition to the work already done to complete this plan, the WWG is responsible for the development of a plan for movement to a zero waste campus, the future campus-wide composting strategy, the comprehensive waste management education program and mentorship of the PSRF Fellow assigned to EVS to work on waste. The WWG reports to the College's Sustainability Committee.

G. All Faculty, Administration and Staff – As members of the community, all those who are not primarily sustainability-focused share a responsibility to their fellow community members to learn good waste management practices including waste separation as the campus transitions to desk-side waste disposal.

VII. Education

Education in minimizing each individual's waste footprint is fundamental to the achievement of the long-term objectives of the waste plan. Different segments of the Swarthmore community offer different opportunities for training and education. Coordination of these segments is critical to accomplishing campus-wide understanding of the best practices for waste management and how they can be incorporated into individual lifestyles.

A. Sustainability Advocates – As described above, Sustainability Advocates serve as the primary contact persons for their own building, floor, or department on campus. A program to identify additional new advocates and train all the advocates will be implemented in Fall 2017.

B. Peer Group Specific (such as incoming students, GAs, new faculty, staff and administration, current students, current faculty, staff and administration) – Education by peer group can be the most efficient way to teach best practices. Fall 2017 GAs will be trained on waste management best practices during their pre-semester training period. Training has been incorporated into the incoming Fall 2017 freshman orientation. Training was conducted for the occupants of 101 S. Chester in Spring 2017 and is ongoing.. As new buildings come on-line, training will be conducted for new occupants. A comprehensive timeline for reaching all campus participants will be developed. By focusing on new arrivals to campus (students, faculty, staff, administration), Swarthmore introduces best practices as “the Swarthmore Way” right from the beginning of the individual's relationship with the school. Following freshman orientation prior to Fall 2020, the entire student population will have received waste management best practice education. Other campus events, such as the Friday, September 8, 2017, Fall Community Event which will be a zero waste lunch, will provide excellent opportunities to model zero waste practices for the entire community. These types of events also provide opportunities for different college entities to work cooperatively in promoting zero waste.

C. Site Specific (public areas, lab areas, food areas, such as coffee shops) – Specific campus areas may require additional education because of the nature and waste character of the particular site. Science labs and art studios are such examples. Coffee shops with large quantities of compostables and public areas that attract off-campus visitors require heightened waste management education. Instead of training sessions, these areas will employ additional signage and reminders.

D. Off-campus Groups Using Facilities for Summer/Short-term Programs - Minimum waste management requirements for use of campus facilities by off-campus groups will need to be integrated into regulations regarding use of those facilities.

VIII. Policy Considerations

In the move toward a zero-waste environment, there are policy considerations that can accelerate change. These include:

1. Vendor qualifications that include waste management and packaging requirements. This has begun for new buildings and renovations and can be expanded to other vendors.
2. Event waste management requirements, like the use compostable materials, and the availability of appropriate waste stations. These requirements would be applicable to both on-campus and off-campus caterers.
3. Campus and Community Store waste management requirements for the contracted management company to comply with.
4. OneCard and off-campus merchant partner waste management requirements that may require a longer discussion and education program to encourage merchant willingness to make the desired changes.
5. Student and employee handbook language that incorporates waste management requirements.
6. Summer and short-term programs by off-campus groups should comply with regulations that incorporate minimum waste management requirements.
7. Employees for whom desk-side waste management would pose an undue burden should be considered in the development and implementation of an exception policy.

IX. Metrics

Critical to monitoring progress toward the long-term objectives of this plan is the creation and application of appropriate metrics. Currently there are few reliable metrics for any of the components. The implementation of the plan will make accurate measurement much easier. Some examples include:

- Regular waste characterization studies of campus buildings to assess capture and contamination rates.
- Use of a trash compactor (and eventually a recycling compactor and a cardboard compactor) will provide more accurate measurement of the weight of trash generated.

- Analysis of capture and contamination rates before and at intervals after training events will create metrics on the effectiveness of training on waste diversion.

As part of this plan, EVS staff with the Office of Sustainability staff and the PSRF fellow for waste will develop and implement appropriate metrics for each component of the plan and design and implement a schedule for taking measurements that will 1) create a baseline for future measurement and 2) guarantee that measurements will be taken on a regular, ongoing basis.

X. Future Considerations

The following items are not part of this plan but should be under consideration for inclusion or implementation.

A. Zero Waste Manager – To truly move to a zero waste campus, it is important that one individual views the total picture of all waste management activities on campus. Currently there are at least eight different people responsible for nine different haulers/disposal companies. While this plan addresses moving towards zero waste in the areas of trash, mixed recycling and compostables, it does not address the other eighteen categories of waste. Central coordination of waste management activities, including contracts with haulers, permits a holistic view of the Swarthmore waste landscape. A zero waste manager could serve as not only the coordinator of all those activities, but also as the accountable person for moving toward zero waste.

B. Expanded Compostables Collection – Compostable collection is currently a student-run activity and therefore limited to the number of buildings served and the number of months per year it is in operation. Improved diversion of compostables and greater capacity to collect them would create a step-function change in the diversion rate of compostables to a composting facility. However, such an increase in capacity would require EVS techs to participate in the compostables collection, perhaps even to the point of taking over the bulk of the program. This is a step which has both financial and cultural impact (because it is no longer a student-run activity but now a “paid for” activity). To move towards zero waste, this will likely become a future necessity.

C. On-site In-vessel Composting – In tandem with item 2 above, the acquisition of an in-vessel composting system sited at the central service yard would permit Swarthmore to reclaim and reuse compostables that are currently hauled to a composting facility. Such an on-site composting system would not only deliver usable compost for the campus, but it would also be a strategic move in the case that external compost facilities become unavailable. As the industry is still in its unstable infancy, commercial composting facilities are currently few and far between and are frequently known to close without notice. The ability to compost on-site eliminates that risk. An in-vessel composter harnesses and supercharges natural systems to

transform organic waste materials into a top-quality agricultural product. A properly functioning system emits no odors, and eliminates the environmental and financial costs of vehicle transportation to an industrial composting site. Such a system would require a bulking agent like wood chips that could be provided by Grounds, while finished compost could be used by Grounds or other campus entities.

D. Upstream Waste Management - Everything in this plan is focused on improved disposal of waste while the issue of upstream waste reduction and diversion (i.e. before the products come to campus) is left unaddressed. Preventing waste is preferable to having to find the best way to dispose of it. Addressing upstream waste management combines the education of the campus community in behavior modification with amendments to college policy to reduce the quantity or nature of materials purchased via vendor management. More resources are necessary to identify current supply chains and material sources and strategize how to reduce incoming waste.

E. Exterior Waste Collection - Even though this Plan does not expressly address replacement of external bins, in the short term consideration should be given to creating additional signage for the bins that is consistent with the indoor bins. In the longer term, consideration should be given to changing the external bins to match the interior system, with particular attention to locations where there are a lot of “grab and goes.”

APPENDIX A.

Timeline for Waste Management Plan Implementation

SWARTHMORE WASTE MANAGEMENT PLAN TIMELINE Fall 2017-Spring 2019																								
	Fall 2017					Spring 2018					Fall 2018					Spring 2019								
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Interior Bin Replacement																								
Purchase bins for Phase I Partial locations																								
Place Phase I Partial bins																								
Purchase bins for remaining Phase I Full locations																								
Place bins for remaining Phase I Full locations																								
Purchase bins for Phase II locations																								
Place bins for Phase II locations																								
Expand compostables collection																								
Waste Movement																								
Design central service yard																								
Construct central service yard																								
Build temporary service yard																								
Purchase tilt trucks for new buildings																								
Purchase Chevy stake-body truck																								
Purchase trailer for Club Cab																								
Reconfigure route designs for waste collection																								
Pilot reconfigured routes and temporary service yard																								
Waste Removal from Campus																								
Renegotiate contract with current hauler																								
Monitor weights from temporary service yard																								
Identify qualified vendors, solicit bids																								
Education																								
GA training																								
Incoming freshman orientation																								
Training for Sustainability Advocates (faculty & staff)																								
Develop additional training modules for each group																								
New faculty, staff, administration training (as needed)																								
Training for new building occupants (as needed)																								
Training for current students (TBD)																								
Training for current faculty, staff, administration (TBD)																								
Training for EVS staff on new routes and practices																								
Policy Considerations																								
Vendor requirements re: waste																								
Events requirements re: waste																								
Off-campus partner requirements re: waste																								
Metrics																								
Develop metrics for each project component																								
Implement metrics tracking procedure																								
Monitor metrics on regular schedule (ongoing)																								
Ongoing evaluation for process improvement																								
Future Considerations																								

APPENDIX B.

Waste Characterization Study

A waste characterization study was performed in September 2016 to obtain basic metrics on Swarthmore's waste stream composition. Waste was gathered from five buildings - Willets, Parrish, Kohlberg, Science Center and the Black Cultural Center - to provide a representative sampling from different types of campus buildings (dorms, academic buildings and student spaces). The sampling was done on a Thursday to collect data from a typical 24-hour weekday period and a Monday to collect data from a weekend period.

More than 30 people volunteered to participate in the study. Those included PSRF fellows, Green Advisors, other Swarthmore students, faculty, administration, staff, several alumni and one member of the Board of Managers.

On the mornings of the study, EVS techs delivered bags of trash and recyclables and buckets of compostables to Parrish Beach. Volunteers generally took 2-hour shifts between 8 AM and 3 PM and were provided with glasses and puncture and cut resistant gloves.

Two tents were erected on Parrish Beach with specially constructed sorting tables beneath. As illustrated in the figure below, bins were placed around the sorting table to sort waste by destination (trash, recycling, or compostables) and specific material category (e.g. office paper, mixed paper, cardboard, pizza boxes, paper towels).

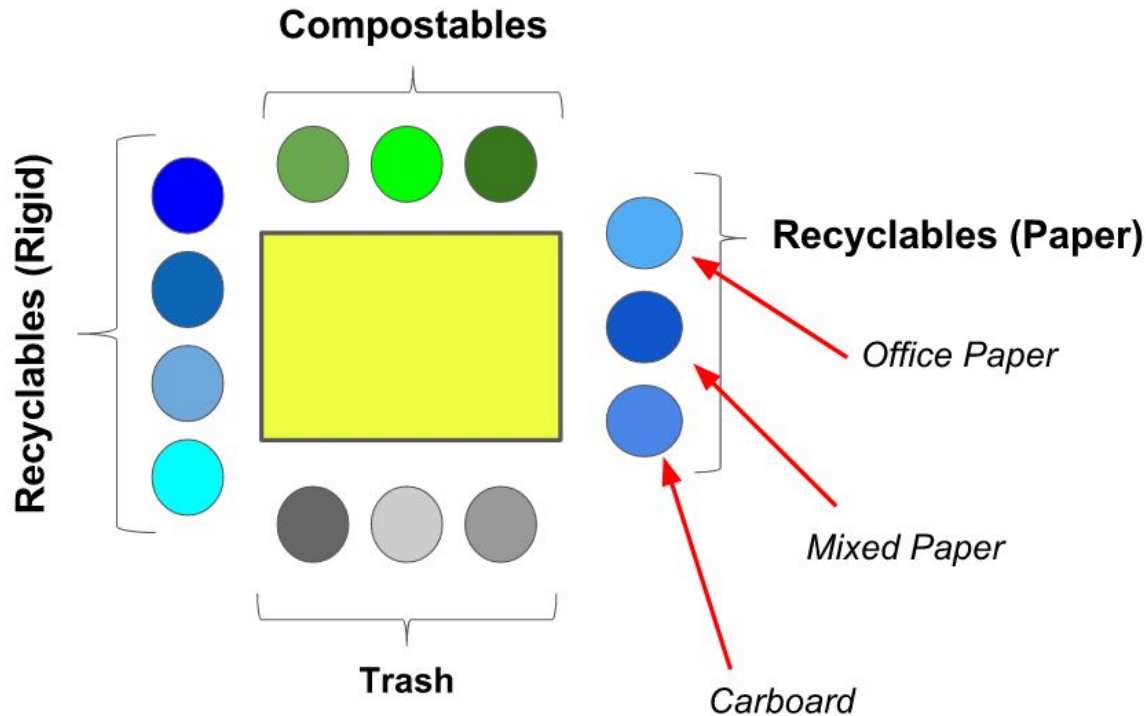
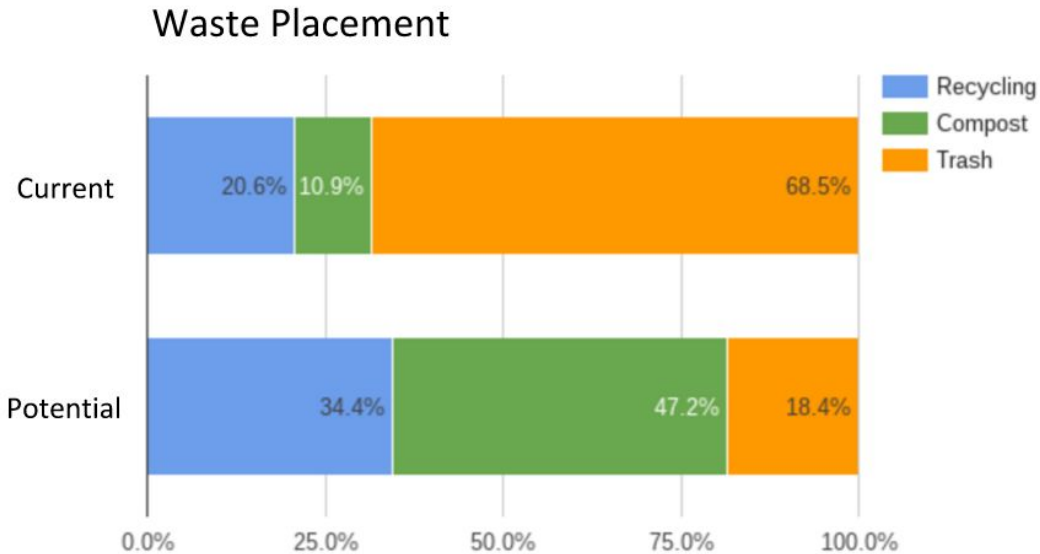


Diagram of Waste Characterization Sorting Table

Each building was sorted separately and within each building each stream of waste as disposed (trash, recycling, compost) was sorted separately. For example, all of the trash bin

contents from Parrish were dumped onto the table and sorted into the 13 component categories and weighed. By totaling the weight of all of the trash, recyclable, and compostable categories in each of the three disposed streams, the study yielded statistics for the percentage of waste that was inaccurately deposited. This data spreadsheet shows all the raw data categorized by section, building and also in which bin the materials were found; consolidated data is also in the same spreadsheet.



Based on all waste disposed from Sept. 7, 2016 and Sept. 9-11, 2016 in the following buildings: Black Cultural Center, Kohlberg, Parrish, Science Center, Willets. Percentages calculated by weight.

Findings from Waste Characterization Study

In the above figure, the top bar represents Swarthmore’s current waste stream. The blue section represents the recycling that was placed in the correct bin (the recycling bin), the green represents the compostables that were placed in the correct bin (the compost bin) and the orange represents all items that were in the trash and items placed incorrectly in the recycling or compost. This means that slightly more than 30% of the waste stream is being diverted from the representative campus buildings..

The second bar represents the composition of the waste stream if all items had been correctly deposited. More than 81% of the waste stream is either recyclable or compostable and shows that more accurate sorting of waste could provide significant increases in diversion rates with a comparable reduction in the amount of trash sent to the incinerator.

Of note was the significant quantity of paper towels and pizza boxes that with modifications to the waste system, could be diverted with the compostables.

This initial waste characterization study provided valuable data to support a focus on strategies to improve waste sorting and disposal. While the study should not be taken to

represent all campus waste in all circumstances, it can be used to demonstrate the possible improvement through more accurate waste separation.

APPENDIX C.

Bin Studies and Calculations

One of the first and most important components of the waste management plan is the installation of consistent bin designs with consistent signage to simplify correct waste disposal.

During stakeholder meetings in the Fall 2016, the loudest and most common refrain was that it was difficult to correctly separate and dispose waste because of confusing and incomplete signage, and myriad types of bins.

Over Spring Break 2017, three PSRF fellows conducted a “Binventory” of the campus cataloguing not only different types of existing bins, but also their signage and location attributes entered into a spreadsheet using the Airtable app.

The results of the Binventory provided data that confirmed the subjective responses that were recorded in the stakeholder meetings. Nearly forty different kinds of trash bins alone were identified on campus. It appeared as if many of the bins had been put out by individuals rather than by any coordinated program of the school. In addition, bins varied widely in color, size, and signage both within and between buildings.

Recycling bins were especially difficult because signage and colors were still in place from the period when the College collected paper separately from bottle and cans in a dual stream system. The Binventory also identified many built-in waste bin cabinets, particularly in the Science Center and Parrish, that make coordination with campus-wide standards challenging.

Based on the evidence from the Binventory, a six standards were created to inform the decision process for new bins:

1. Each bin either has a compostable segment or is equipped to have a compostable segment added.
2. Bins will have consistent colors based on type of waste: trash – black; recycling – blue; compostable – green.
3. Bins will have consistent labeling: Incinerator/Trash; Mixed Recycling; Compost.
4. Bins will have attached signage above and behind the bin that can be customized by Swarthmore and changed as conditions change.
5. Bins will be consistently positioned in the order (left to right): Compost, Mixed Recycling, Incinerator/Trash.
6. Bin liners will coordinate with the bin colors - compostable bins will have green liners; recyclable bins will have blue liners; trash bins will have clear liners.

Based on this standard, two bin styles were chosen - one for the bulk of campus, particularly dorms and academic buildings, and one for the more public areas of campus such as Parrish Hall’s non-residential areas and the Lang Performing Arts Center.

A survey was circulated to the Waste Working Group to prioritize buildings for bin replacement.

BUILDING SELECTION CRITERIA SHEET										
Name:										
CRITERIA	EXPLANATION	BEARDSLEY/ TROTTER	BEP DESIGN	CLOTHIER	KOHLBERG	LANG CONCERT HALL	LANG PERF ARTS	MCCABE LIBRARY	PARRISH (FLRS 1&2)	SCI CTR/ELDRIDGE
TIME SENSITIVITY	2-low time sensitivity; 10-high sensitivity - urgency related to purchasing of bins for new space or other priority reasons									
VISIBILITY	1-low visibility; 5-high visibility - how broadly used is the building? Does it have high public usage?									
BIN SIGNAGE PLACEMENT AND EFFECTIVENESS	1-mostly correct messaging; 5-mostly incorrect messaging - Do most of the bins have correct signage? Is the signage placed where its easily visible?									
EVS EASE-OF-USE OF CURRENT BINS	1-mostly bin types that EVS likes; 5-mostly bin types that EVS dislikes - EVS dislikes the plastic liner bag clips. Are many of the bins of the type that EVS dislikes? Only a few?									
AGE/AESTHETICS OF CURRENT BINS	1 - most in good condition; 5 - most in poor condition - Are most of the bins in good condition? Are they presentable? How motley an assortment is it?									
QUANTITY OF WASTE	1 - relatively small waste production; 5 - relatively high waste production									
QUANTITY OF ORGANICS	1 - few organics; 5 - large quantity of organics									

Based on the survey results, the Waste Working Group adjusted some of its subjective priority decisions. Ultimately, the survey served as a basis for the more in-depth analysis undertaken by Melissa Tier, Sustainability Program Manager of the Office of Sustainability, and Christopher “Chip” Proctor, Manager of Administration for Environmental Services.

Using the results of the Binventory, the specific dimensions of the bin styles, building data, and their own experience and knowledge of waste management best practices and waste functions specific to campus locations, Melissa and Chip undertook a campus-wide analysis of the placement of new bins and the order in which they should be replaced. The results of this exhaustive analysis can be found in these [spreadsheets](#). For Phase 1 and Phase 1A bin placement, they identified the exact location, positioning within the space, type and size of every new bin. These figures were used for RFQs from potential vendors.

To calculate cost for the entire project, the number of bins needed for Phase 1 was multiplied by the anticipated cost of the bins. This number was then divided by the total square footage that this number of bins would service to get a Phase 1 cost per square foot figure. This number was then used along with the square footage figure for each of the buildings in Phase 2, 3, and 4 to estimate the cost of the total project. A summary of these calculations can be found [here](#).