Automating Recyclable Materials Collection

West Grove Borough
117 Rosehill Avenue
West Grove, PA 19390
610-869-2792

SCS ENGINEERS

02217011.01 – Task 27 | March 19, 2020

11260 Roger Bacon Drive
Reston, VA 20190
703-471-6150

Table of Contents

Tables

Figures

1 PROJECT DESCRIPTION

For the last three years, West Grove Borough (Borough) has operated a recycling program which has become increasingly burdensome on the Borough's operations. Collecting recyclable materials each Wednesday requires the full commitment of seven staff members. Some of these staff are full-time employees that must balance their recycling collection duties with completing other essential public works projects. Other staff are part-time and have been hired by the Borough to specifically support the recycling program. This recycling technical assistance project focuses on improving the efficiency of the Borough's recycling program by specifically evaluating the potential for automating the collection.

2 SUMMARY OF WORK

The following tasks were completed as part of this recycling technical assistance project.

Task 1 – Data Collection

SCS requested technical and operational information/data on the Borough's solid waste and recycling collection programs. SCS received and reviewed available information in order to understand key metrics and characteristics of the Borough's recycling program.

Recycling Collection in West Grove Borough

Task 2 – Site Visit and Field Observations

The site visit and field observations occurred over a one-day period in December 2019. This task was completed on a Wednesday prior to the holidays when normal recycling collection activities were completed. For much of the day, SCS staff rode along with Borough collection staff to observe collection operations and evaluate the physical characteristics of the Borough and their compatibility with an automated collection system. As part of the "ride-along," SCS obtained data from a number of residential collection points to understand how long collections take on a per household level.

Task 3 – Identify Program Efficiency Opportunities

SCS identified and described opportunities the Borough may have to increase recycling collection efficiency. This analysis included the benefits and challenges of moving to an automated collection system and discussed operational considerations to evaluate prior to making a decision to automate. This task also includes planning level cost estimates for converting to an automated collection system.

Task 4 – Final Report

The final task of this project was to develop this report that describes the opportunities and potential for transitioning the Borough's recycling collection program to an automated system.

3 CURRENT PROGRAM

OVERVIEW

The Borough of West Grove operates weekly curbside trash and single stream recycling programs that service approximately 915 households. Trash is collected by the Borough's contracted hauler A.J. Blosenski. Residents are limited to 96-gallons of waste per week that must be placed inside of the trash cart. If additional waste capacity is needed, residents may purchase stickers for $2.00 each and affix them to bags (no larger than 30-gallons), which must be placed next to the trash cart.

The Borough is not required by the Pennsylvania Municipal Waste Planning, Recycling and Waste Reduction Act (Act 101) to have a recycling program. However, in 1991 the Borough established a recycling ordinance that requires residents to recycle. Recyclable materials are collected single-stream by Borough staff.

The Borough also provides the following curbside services to residents:

- Bulky Waste – Collection of one bulky refuse item per month, which is collected on the last Tuesday during regular trash collection. This does not include collection of electronics, hazardous waste, construction/demolition materials, or items containing Freon. There is no fee for this service.

- Appliances – Appliances containing Freon are collected curbside for a fee of $20 per appliance. Collection of appliances must be scheduled in advance and the fee paid prior to collection.

- Yard Waste – Residents may place yard waste curbside for collection each Wednesday. Yard waste must be contained in paper bags purchased from the Borough (10 bags for $10). Yard waste may also be bundled.

RECYCLING COLLECTION

The Borough collects recyclable materials curbside from residents each Wednesday using their own collection equipment and staff. Although the Borough does not formally track participation in the recycling program, it is estimated that about 80 percent of households participate in the program (740 households out of an established 925 total). The Borough provides 18-gallon recycling containers free of charge to each household. Households have the opportunity to request additional bins or use personal containers or bags to contain recyclable materials as needed.

Materials

Materials are collected curbside single-stream. The Borough's program accepts the typical mix of curbside recyclable materials, including glass. The recyclable materials collected as part of the Borough's program is based off the list of materials accepted by the Southeastern Chester County Refuse Authority (SECCRA), which is the Borough's vendor for accepting their materials. Table 1 lists the materials that are collected as part of the Borough's recycling program.

Table 1. Materials Accepted for Recycling in West Grove

Material	Description
Glass	Bottles and jars (all colors)
Newspapers	Includes brochures and inserts
Metal	Aluminum, tin, and bi-metal food and beverage containers, foil, trays, and lids/caps
Plastic	Food and beverage containers made of #1, #2, #4, #5, and #7 plastic
Mixed paper	Includes corrugated cardboard, paper bags, paperboard, cartons, mail, phone books, office and school paper, paperback books, magazines and catalogs

Staffing

Recycling collection involves a full-day commitment for seven Borough staff members that operate three different collection units. Staff supporting the recycling program include both full-time staff that complete other public works functions when not collecting recyclable materials and part-time staff that only work on Wednesdays to assist with the collection of recyclable materials.

Equipment and Routes

Vehicles

The Borough utilizes three different types of vehicles to collect recyclable materials from residents. The two primary and larger collection units, include:

- Unit 1 – 2003 International truck with roll-off box; and
- Unit 2 – 2009 GMC dump truck with a 1990 Timco trailer.

The third collection unit (Unit 3) is a pick-up truck that traverses the Borough to collect recyclable materials (mainly cardboard) from high-volume generators. The purpose of dispatching this truck is to relieve pressure on the other two collection units.

Collection vehicles used by the Borough do not have compacting capabilities and their capacity is insufficient to collect the recyclable materials placed curbside each week. The insufficient capacity of these vehicles prolongs collection activities each Wednesday. Collection staff must interrupt their work activities multiple times mid-route when the vehicle reaches capacity to transport materials to the recycling facility. Additionally, as the vehicles fill up with materials, it becomes more difficult for collection staff to load materials. Materials must be manually pushed further into the bed of the trucks. It is not uncommon for items to fall onto the street during this process. This further delays collection as staff must manually pick up items that have fallen out of the truck. Unit 3, the pick-up truck, does not transport materials to the recycling center, but instead unloads collected materials in the dumpsters at the truck yard on multiple occasions.

In an effort to delay a trip to the recycling facility located outside of town, collection staff return to the truck yard to off-load some large or bagged recyclable materials into front-load dumpsters when the vehicle is nearing capacity. This frees up additional space for the collection crew to continue their route. Eventually collection vehicles reach capacity and the materials must be transported to the recycling facility. **Table 2** summarizes the characteristics of each recycling collection vehicle that operates in the Borough.

Table 2. Summary of Recycling Units

Unit Number	Description	Crew Size	Estimated Capacity (cubic yards)	Collection Area
Unit 1	2003 International Truck with Roll-off Box	3	10.8	Established route; northern and central parts of the Borough (yellow highlight – Exhibit 1)
Unit 2	2009 GMC Dump Truck with 1990 Timco Trailer	3	22.5	Established route; southern parts of the Borough and along major streets (Prospect and Evergreen) (purple highlight – Exhibit 1)
Unit 3	Pick-up truck	1	--	No established route; collects from high-volume recyclable material generators throughout the Borough; both commercial and residential properties

Containers

The Borough provides residents with 18-gallon green recycling bins for the placement of recyclable materials curbside. Residents are initially issued one bin; however, additional bins can be requested. SCS observed that many households have multiple bins or they utilize personal containers. Note that bagged recyclable materials are also collected.

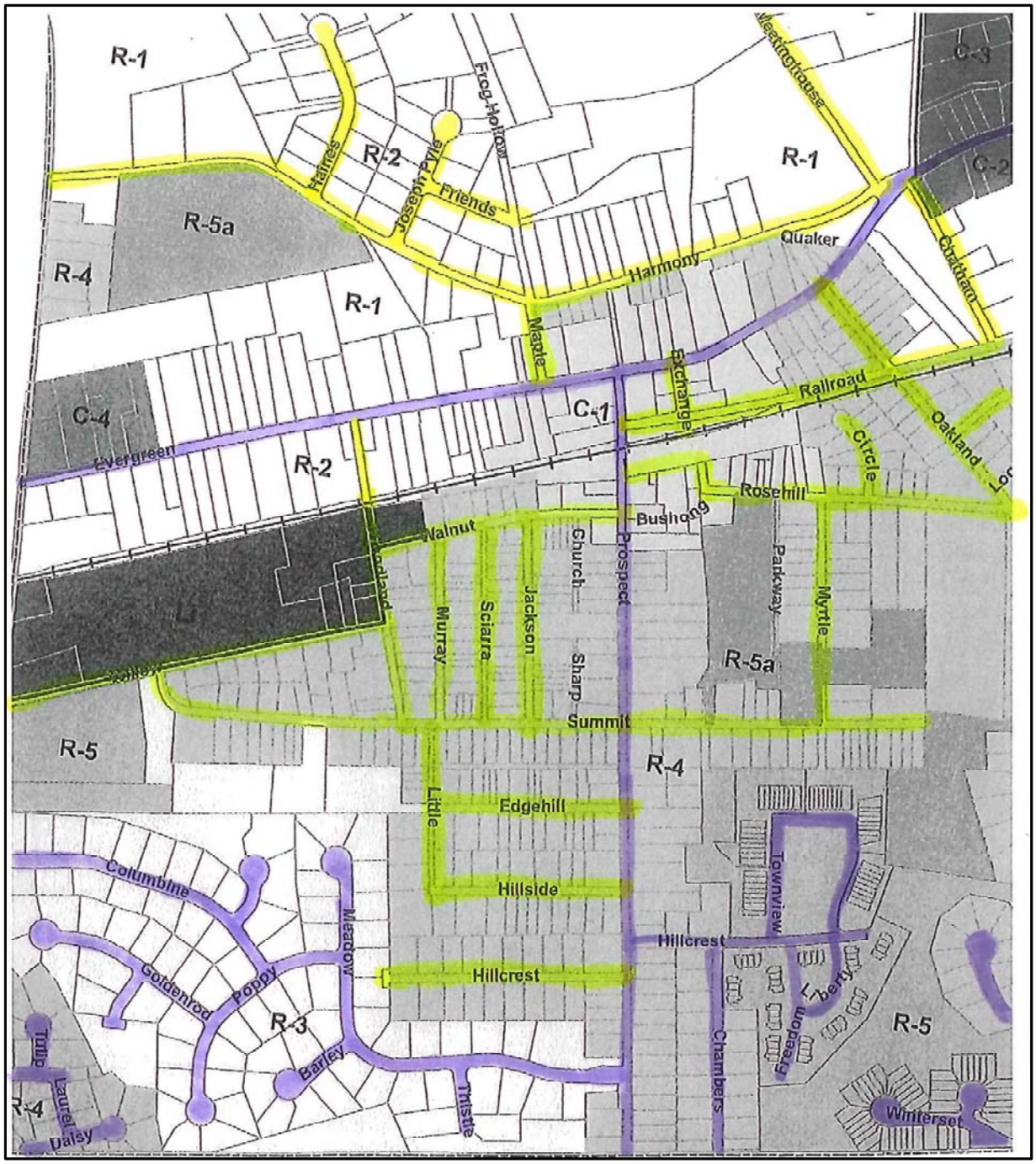
Routes

The Borough has established two distinct recycling routes. Unit 1, the roll-off truck, collects recyclable materials from the denser areas in the center of the Borough west of Prospect Avenue and south of Evergreen Street. Unit 1's route also includes residents who live north of Evergreen Street along Harmony Road and in the cul-de-sacs in the far northern area of the Borough. The Borough estimates that Unit 1's collection route includes about 460 households.

Unit 2's collection route primarily serves neighborhoods on the south side of the Borough, including South Hills, West Meadows, Morningside Court, and Heather Grove. These neighborhoods are newer and thus have wider streets and are less dense than other areas of the Borough. It is estimated that the collection route serviced by Unit 2 also includes about 460 households. Unit 3, the pick-up truck, does not follow a particular route.

Figure 1 is a map of the Borough with the collection routes highlighted. The Unit 1 route is highlighted in yellow and the Unit 2 route is highlighted in purple.

Figure 1. West Grove Borough Route Maps



Market

Recyclable materials collected in the Borough are transported to SECCRA, which is located in the northwest corner of the Borough. Based on observations in the field, it takes approximately 30

minutes to transport materials to SECCRA, unload, and return to the collection route. It takes Unit 2 longer to unload because the materials in the trailer and truck must be dumped separately. If Borough collection vehicles must wait in line to dump at SECCRA the trip can take much longer. The busier times are well established and Borough staff aim to avoid those times.

Recyclable materials are tipped on the floor of a building on the landfill property. Recyclable materials are visually screened by the loader operator prior to pushing them into a tractor-trailer. No processing or compaction of the materials occurs at the recycling facility where the materials are tipped. **Figure 2** illustrates aspects of the Borough's recycling collection program.

Figure 2. Recycling Operations in West Grove

Unit 1 Collection Vehicle

Recyclable Materials Placed Curbside

Unloading Large Items into Dumpsters at the Truck Yard

Unloading Recyclable Materials at SECCRA

Picking-up Materials that Fall out of the Recycling Truck

Residential Street in West Grove

4 FINDINGS

AUTOMATED COLLECTION ANALYSIS

Overview

Automated collection of solid waste was first developed in the 1970s in Phoenix, Arizona to minimize collection worker injuries and improve collection efficiency. Over the next four decades, thousands of local governments and private haulers transitioned from the traditional manual loading of residential waste and recyclables collection to semi-automated or fully-automated collection systems. Automation requires standardized containers and a collection vehicle equipped with a side-loading, driver-controlled, robotic arm. Automated collection has been shown to improve worker safety and increase efficiency for most programs, lowering the overall cost of waste and recycling collections.

Although the capital costs of automation are higher than the costs of equipment used in manual or semi-automated collection, many benefits are realized that can make automated collection cost-effective. Automation most notably reduces labor-related costs. Instead of the Borough deploying three staff to collect recyclable materials on each route, an automated system would require one truck driver/operator. Reduced staff requirements coupled with a large reduction in the manual handling of containers and individual materials also generally leads to reduced worker compensation claims from injuries. These cost savings can offset the additional costs of purchasing and maintaining automated collection vehicles and carts.

Benefits and Challenges

This section details the benefits and challenges of automated collection systems.

Benefits

Enhanced Worker Safety

Refuse and recyclable material collection is the fifth most dangerous job in the United States according to data released by the Bureau of Labor Statistics[1]. Collection workers are exposed to a variety of personal health and environmental safety risks. These risks include exposure to potentially hazardous or infectious materials, acute and lasting harm from bodily stress, and potential for contact with heavy equipment and traffic. The Borough's current collection operations require manually lifting bins of materials into collection vehicles. Uncontrolled heavy, repetitive exertion tends to result in an increase in the number and severity of injuries. Additionally, manual collection increases the potential of staff to be exposed to dangerous materials such as broken glass, sharp objects, and unknown chemicals or infectious agents. Automated collection keeps collection staff largely within the confines of their vehicle. This results in safer collection, as staff have reduced need to jump on and off trucks and navigate streets on foot to retrieve containers and materials. The reduced physical requirement enhances the diversity and longevity of the workforce able to be retained for curbside collections.

Increased Worker Productivity

By reducing the strain of physical labor, automated collection increases productivity by keeping employees on the job rather than having them injured and out on temporary leave or disability. As a result, employees are happier, healthier, and better able to maintain a high quality of life. Employees may be more willing to innovate and more capable of providing a high level of service when decisions are made to prioritize their comfort and safety.

Redirect Collection Staff

Fewer collection staff are required in an automated collection program. Currently, the Borough's recycling collection program requires seven staff each Wednesday. Many of these individuals are specialized in other areas of operations, and their duties primarily consist of providing other critical public works services to residents. On Wednesdays, these individuals must be redirected to collect recyclable materials which leaves a gap in providing other water, wastewater, and utility services. An automated collection crew usually consists of just one staff whose job is to operate the collection vehicle and maneuver its robotic arm to tip containers. An automated system is often phased-in over an appropriate period of time to transition staff assignments in support of other City services. This would not be necessary for the Borough, as most staff that collect recyclable materials currently provide other municipal services that could be completed on Wednesdays.

Improved Aesthetics

Automated collection systems require uniform carts that can be tipped by the robotic collection arm. The uniform container system conveys a more professional and polished image for the collection program. Identical, sturdy carts provide a consistent, more aesthetically-appealing picture of recycling collection compared to small, open-top bins that often overflow or are accompanied by excess recyclable material that cannot fit in the bin. Standard collection carts are sized to accommodate all recyclable materials that may otherwise be left alongside or fall out of an open-top bin or similar unsecured container.

Reduced Litter

A significant advantage of an automated, cart-based collection program is the potential to reduce litter. The Borough's current 18-gallon recycling bins are open-top and are often overfilled with recyclable materials. This often creates instances of litter because paper, plastic containers, and metal cans often blow out of the bin creating litter on Borough streets and in residents' yards. Carts

[1] www.bls.gov

are secured with a lid that should remain closed at all times. This prevents materials from blowing out and producing litter, potentially reducing litter abatement costs for the Borough

Enhanced Program Branding

Similar to the recycling bins currently in use by the Borough, carts used as part of an automated collection system provide an opportunity for the Borough to brand the program. Carts can be printed or stamped with the name of the municipality and logo/seal to professionally establish their program.

Reduced Contamination

The 18-gallon recycling bins used by residents often do not provide adequate capacity for residents to recycle all their materials on a weekly basis. As a result, residents place extra recyclable materials in plastic bags or boxes and set them next to their bins. Plastic bags are not an accepted material for recycling at SECCRA. In particular, recyclable materials placed in plastic bags create problems, as the materials cannot be efficiently removed from the bags and the bags can get caught in the equipment that processes the materials. This contaminates the recycling stream and may prevent recyclable materials from being recycled. Issuing larger carts as part of an automated program has the potential to reduce recycling contamination by reducing or eliminating the need for residents to contain recyclable materials in plastic bags.

Increased Capture Rate

Another advantage of implementing an automated collection system that includes larger recycling carts is the potential to capture more recyclable materials. Research conducted by SCS indicates that even among households that participate in municipal recycling programs, there is potential to recycle more materials. This may be particularly true in West Grove Borough as 18-gallon recycling bins oftentimes do not provide the capacity a household needs to recycle all accepted program materials. While some residents will obtain a second or third bin or place materials in bags and boxes, others will simply place recyclable materials that do not fit in the recycling bin in their trash cart. Implementation of larger recycling bins would increase the potential for additional recyclable materials to be captured.

Expanded Use of Technology

Automated collection presents opportunities for the Borough to utilize technological advances to obtain program data that may allow for more efficient collection operation. For example, radio-frequency identification (RFID) technology would allow the Borough to track their inventory of carts. The use of on-board scales coupled with RFID would allow the Borough to quantify the amount of recyclable materials generated per residence. Although the Borough may not be ready to invest in these new technologies to manage their recycling program, the new cart roll-out associated with transitioning to an automated system could set the stage for implementing them in the future as necessary.

Increased Collection Efficiency

Automated collection has the potential to increase collection efficiency in several ways, including:

- Household Service Time – As discussed below, using limited data points from the Borough's collection program, the average household service time is about 20 seconds. This is about

twice as long as the average service time for an automated collection program according to recent studies completed by SCS.

- **Truck Capacity** – Automated collection vehicles are generally able to collect a significantly higher quantity of materials than the Borough's existing collection units. Automated units vary in hopper size, but 28 and 30 cubic yard capacity trucks are frequently utilized. Additionally, these trucks have on-board compacting capabilities to help the Borough better utilize the capacity available.
- **Transportation Time** – The increased capacity of automated collection reduces or eliminates the need for making multiple trips to the truck yard or SECCRA to unload recycling materials. This will improve collection efficiency and potentially reduce fuel and other transportation related costs.

Challenges

Increased Capital Costs

The primary disadvantage of automated collection is higher up-front capital costs for purchasing specialized vehicles and collection containers for residents. Additionally, the life of an automated vehicle can sometimes be less than a rear-load vehicle or semi-automated vehicle because of the increased reliance on mechanical parts (primarily those associated with the mechanical robotic - arm) that allow the automated collection of materials. Phasing in automated collection and purchasing new collection vehicles over an appropriate period of time can help control and manage capital costs and variable recurring expenses. SCS estimates that the cost of an automated collection vehicle to be approximately $350,000. Act 101 Section 902 recycling grants may be used to help offset the cost of an automated collection vehicle. Details on the Section 902 grants can be found on PADEP's website at https://www.dep.pa.gov/Business/Land/Waste/Recycling/Municipal-Resources/FinancialAssistance/Pages/902-Recycling-Grant-Application-Guidelines.aspx.

Higher Maintenance Costs

Truck maintenance costs tend to be higher due to the mechanical parts of the collection arm. For example, the September/October 2007 edition of *MSW Management*[2] summarizes average annual truck maintenance costs for automated, semi-automated, and manual collection programs to be $35,000; $15,000; and $8,000, respectively. By escalating those costs three percent each year through 2020, the annual maintenance costs are estimated to be approximately $51,000 for automated vehicles, $22,000 for semi-automated vehicles, and $12,000 for manual vehicles.

Issues with Recycling Cart Placement

As identified below, automated collection requires residents to be mindful of where they place their recycling carts curbside. Automated collection reduces program flexibility because obstructions along the roadway can prevent efficient collections. Impediments such as vehicles, mailboxes, telephone poles, overhead lines, bulk waste, and even other waste or recycling carts can get in the way of automated collection. The key to reducing the incidence of obstructed carts is extensive public education and outreach that informs residents on proper placement of carts. In areas of the Borough with persistent obstructions such as on-street parking, a hybrid or semi-automated system could be employed so that some automated collection benefits can be realized.

2

Finding Qualified Operators/Drivers

Automated collection requires hiring collection staff with a more in-demand technical skill than commercial truck driving. The task of operating an automated collection vehicle requires careful thinking and judgement that generally results in elevated salaries for skilled staff. This tends to limit the number of qualified personal that are available for hiring, although internal training can potentially minimize the adverse effects to the program

Implementation Period

Implementing a new collection system is challenging and requires an appropriate transition. The transition to automation can be managed and made less daunting by completing it over an extended period of time. A gradually phase-in allows staff to target one or two geographic areas at a time for transition to automated collection. in this way, program staff's full attention can be devoted to a smooth transition, and the obstacles and challenges encountered can be used to facilitate a smoother transition to automation in other areas of the Borough.

Estimated Costs

Implementing automated collection typically requires a higher capital investment because of the specialized nature of the trucks, which includes a robotic arm and compatible carts. However, operating costs, typically related to labor, trend lower in automated systems because fewer employees are needed to collect materials. Higher capital costs can be offset completely or partially by reduced operating costs. The economics of automated collection are unique to each jurisdiction.

SCS developed some preliminary planning cost estimates for an automated recycling collection program involving the procurement of one truck to collect recyclable materials. The following assumptions are made for these preliminary cost estimates:

- One man collection crew; one driver and no collectors;
- Automated collection route would be completed over one day each week;

SCS estimates that a fully-automated collection vehicle would cost about $350,000. Annual operation and maintenance costs for an automated truck are higher due to the mechanical arm that requires specialized maintenance. Our cost estimates also assume funding for the purchase of roll-out carts compatible with the automated collection vehicle. Conservatively, an automated collection program could adequately service approximately 450 households, or about 60 percent, of the 740 households that actively participate in the Borough's recycling program. SCS's initial assessment is that the presence of parked cars and one-way/narrow streets will limit automated collection Borough-wide unless significant changes are made to limit parking and upgrade infrastructure.

SCS estimates the cost of a 65-gallon roll-out recycling cart to be $60 per cart, which totals $30,000 for 500 carts. This assumption allows enough carts to be purchased to provide service to 450 households with 10 percent excess to maintain a cart inventory for program flexibility. **Table 3** summarizes these preliminary cost estimates.

SCS amortized the capital costs of the trucks and carts to develop the annual cost of acquiring an automated collection system. Based on an interest rate of 5.5 percent, it is estimated the automated collection truck will cost the Borough about $4,500 monthly (just over $54,000 annually). The amortized cost of the carts is estimated to be about $325 monthly (about $4,000 annually) for 10 years. The potential exists for the Borough to apply for and receive Act 101 Section 902 recycling grant funds to help offset these costs. **Table 4** summarizes the amortized costs.

Table 3. Planning Level Costs for Automated Collection

Cost Item	Description	Qty	Unit Cost	Total Cost
Labor (Annual)	Truck Driver[1]	1	$8,000	$8,000
	Solid Waste Collectors[2]	0	$7,000	$0
Equipment/ Supplies	Collection Vehicle	1	$350,000	$350,000
	Carts[3]	500	$60	$30,000
Operation, Maintenance and Repair (Annual)	Frontline Truck -- Average Annual Maintenance and Repair Cost per Truck	1	$51,000	$51,000
	Frontline Truck -- Average Annual Fuel Cost per Truck	1	$12,000	$12,000
TOTAL				**$451,000**

[1] Assumes one fifth of an annual salary/benefits of $40,000 (collection one day per week)

[2] Automated collection does not require staff to collect the materials

[3] Assumes 60 percent of 740 active recycling program participants can be serviced by automated collection

Table 4. Amortized Truck and Cart Costs

Automated Truck	
Capital Cost	$350,000
Rate	5.5%
Period (Years)	8
Monthly Cost	(4,514.76)
Annual Cost	(54,177.15)
Total Cost	**(433,417.23)**
Carts	
Capital Cost	$30,000
Rate	5.5%
Period (Years)	10
Monthly Cost	(325.58)
Annual Cost	(3,906.95)
Total Cost	**(39,069.46)**

Physical Constraints

As identified above, there are both benefits and challenges of automating the Borough's recycling collection program. Although overcoming the initial increased capital cost investment for automated collection can be challenging, the practicality and ability of implementing automated collection would be notably influenced by physical constraints in the Borough's service area. The following lists the most common physical limitations that may impede the implementation of automated collection. Based on field observations SCS completed in December 2019, a short description of SCS's assessment of the applicability of these constraints follows.

On-Street Parking

Streets in West Grove Borough are varied in terms of size and the accommodations for on-street parking. Utilizing streets for on-street parking varied considerably from one area to the next. On-street parking was most prevalent in the central core of the Borough, an area serviced by Unit 1. This includes streets such as Hillcrest, Hillside, Edgehill, Murray, Sciarra, Jackson, and Summit. Housing in these areas is denser, and on-street parking appeared more prevalent, with parking on both sides of the street. This may pose challenges for implementing automated collection in this area.

Multi-Unit Housing Space Constraints

Space constraints for multi-unit housing is not expected to be a major impediment to implementing automated recycling collection in West Grove Borough. SCS observed one large multi-unit complex located on Railroad Avenue, between Exchange Place and Oakland Avenue, where implementation of automated collection may be difficult. Unit 1, the recycling dump truck, has to snake its way through the parking area of the apartment complex to collect about 12 recycling bins that residents place at the end of the sidewalks leading from their living unit to the parking lots. Automated collection for this complex would likely require residents to roll their recycling carts to the curb on Railroad Avenue. However, the number of recycling carts that would be issued to residents in this complex may be more than the curb on Railroad Avenue would be able to accommodate.

Tight Cul-De-Sacs

Numerous cul-de-sacs exist in the Borough, particularly in the newer southwest and northern collection areas. Cul-de-sacs can be a significant challenge for an automated collection system because an oversized collection vehicle often must navigate a tight turning ratio, and in many cases such vehicles have difficulties avoiding contact with obstacles such as parked cars and mail boxes. The cul-de-sacs SCS observed in West Grove appeared to be relatively new and were designed with ample space for a large automated collection vehicle to navigate and turn around without the need to do a two- or three-point turn. SCS observed few cars to be parked on these streets.

Dead-End Streets

Dead-end streets may pose a challenge to automated collection in the Borough. Although many of the dead-end streets in the Borough are cul-de-sacs (as discussed above) that have adequate space for turning around, a few dead-end streets may prevent the Borough from going completely automated. Dead-end streets that may pose a challenge are Hillcrest, Meetinghouse, and the east end of Summit. Backing down dead-end streets is not a desired strategy due to safety concerns. Additionally, some dead-end streets have residents on both sides of the street that will need recycling collection services. Backing down these streets will require the operator exit the vehicle to move collection containers to the side of the truck with the extendable arm in order to collect. Unless the Borough can arrange for residents to have all carts placed on the same side of the street regardless of the side of the street they live on. This area would present difficulties under an automated collection program.

One-Way Streets

One-way streets in the Borough can pose challenges for implementing an automated collection system. SCS identified three one-way streets in the Borough where recycling collection occurs. This includes Murray and Jackson avenues between Summit and Walnut avenues and Exchange Place between Evergreen and Railroad streets. In order to implement automated collection on one-way streets, the municipality must work with all residents that live on the street to place recycling

collection containers on the right side of the street. This would allow the automated collection vehicle to service all residents living on the street in a single pass.

Alley Collection

Communities that provide solid waste and recycling collection service in alleys often are challenged when they transition to an automated program. Automated collection vehicles are typically much larger than rear-loader collection vehicles and significantly larger than Units 1 and 2 that the Borough uses to collect recyclable materials. The large size of these vehicles poses a number of challenges for alley collection, including:

- Narrow passageway;
- Low hanging wires;
- Tight turns, particularly when entering and exiting

The Borough collects recyclable materials from some alleys. Based on SCS's field observations, it is difficult to ascertain if the alleys currently being utilized for recycling collection would be inaccessible to automated collection vehicles. In procuring automated collection vehicles, the Borough will need to evaluate its options and see if automated recyclable material collection could be feasible in alleys.

On-Street Parking Challenges

Image of Multi-Unit Housing in West Grove

Recycling Collection in a Cul-De-Sac

Narrow Alleyway

Other Considerations

Service Times

As part of field observations, SCS quantified residential service time for a select number of residences for the recycling routes completed by Unit 1 and Unit 2. Appendix A contains the full data and summarizes details of each stop timed, including the number of Borough-issued recycling containers and the number of additional containers/items placed curbside. SCS measured the service time of 71 residential units. This represents roughly nine percent of households the Borough services. Time measurements commenced when the collection vehicle came to a complete stop and ended when the wheels started rolling again.

Based on the data SCS obtained, it takes on average 20.8 seconds to service each household. The shortest service time was six seconds and the longest service time was 123 seconds. SCS notes that as the collection vehicles begin to fill up, collection times were extended as staff began manually pushing items further into the truck, increasing the time spent at each residence. Recent studies of automated collection programs indicate average service stop times range from approximately eight to 10 seconds per household. This suggests the Borough could potentially cut their household service time in half by switching to an automated collection system.

Increased Mileage on Route

Implementing an automated collection system will increase the number of truck miles required to service all recycling containers along routes in the Borough. Although the number of truck miles traveled will increase, it will not necessarily double because of the number of cul-de-sacs serviced. Whether the collection system is manual or automated the recycling truck will only need to make their way through the cul-de-sacs one time each. Additionally, since the Borough only collects recyclable material from one side of the street at a time on the major thoroughfares of Prospect and Evergreen, no additional mileage will be incurred. Sections of the Borough that will likely require two passes of an automated recycling truck (one for each side of the street) will be in the central and eastern parts of the Borough, along with collection on Harmony Street. The increase in mileage required along routes under an automated collection program is expected to be offset by efficiencies obtained from the reduced number of trips to SECCRA anticipated from the larger vehicle size and on-board compaction.

Grants

The Pennsylvania Department of Environmental Protection (PADEP) provides grant money through Section 902 of Act 101 to help the Borough develop and improve upon their recycling program. The Section 902 grants reimburse municipalities up to 90 percent of approved eligible recycling program development and implementation expenses. Grant money may be used to purchase recycling collection vehicles and equipment. The Section 902 grant program is available annually and the current deadline for application has been extended to May 22, 2020. The Borough should consider the Section 902 grant program as an important resource for upgrading the Borough's recycling collection equipment. More information on the Section 902 grant program is available at https://www.dep.pa.gov/Business/Land/Waste/Recycling/Municipal-Resources/FinancialAssistance/Pages/default.aspx.

UPGRADE MANUAL COLLECTION EQUIPMENT

The initial assessment indicates there is potential for automation; however, based on our field observations it may not be possible to automate collection in the entire Borough. Automating a portion of the recycling collection in the Borough has the potential to fragment collection activities and lead to an inconsistent program. Although the focus of this study was on automation, SCS believes that the most pressing concern for the Borough to address is the inadequate capacity of the Borough's current recycling collection fleet.

SCS estimates that the inadequate capacity of the Borough's recycling collection fleet potentially extends recycling collection activities by as much as two- or three hours each Wednesday. This added time comes from making multiple trips to SECCRA, stopping to unload materials at the truck yard, and packing materials in the trucks as they are nearing capacity. This added collection time increases costs for the Borough through increased labor hours, fuel usage, and overall length of on-road operations.

To address the immediate need of expanded truck capacity, SCS identified another solution to upgrade the Borough's recycling collection program: purchasing a rear-load compacting recycling collection vehicle. A collection crew of three would still be required (one driver and two collectors), but SCS believes that upgrading the Borough's recycling collection vehicle to a rear-loader could offer the following benefits:

- Increased Capacity – Rear-load collection vehicles have more capacity than the Borough's existing collection vehicles. Standard sizes include 20, 25, 28, and 32 yard trucks, although larger sizes may be available.

- Compacting Capabilities – Rear-load collection vehicles have compacting capabilities that allow for more materials to be collected.

- Reduced Staff Resources – The Borough's desire to achieve recycling collection efficiency stems from the increased staff resources that it takes to collect recyclable materials on a weekly basis. Utilizing a compacting rear-loader of sufficient size has the potential to reduce or eliminate the need to have multiple collection crews operating in the Borough every Wednesday.

- Improved Efficiency – The larger size of a rear-loader increases collection efficiencies by reducing or even eliminating extra trips to SECCRA and the truck yard to unload materials.

- **Reduced Capital Costs** – When compared to implementing an automated collection system, a rear-load collection vehicle offers substantial savings (see **Table 5** below).

- **Compatibility with Existing Containers** – Utilizing a rear-load vehicle avoids the need for the Borough to upgrade their collection containers at this time. Recycling carts are associated with significant capital and operating expenditures.

- **Implementation Borough-Wide** – SCS's initial conclusion is that unlike automated collection, using an appropriately-sized rear-loader to collect recyclable materials could provide a consistent level of service for recyclable material collection for all Borough residents.

- **Allows for Program Expansion** – Use of a rear-load collection vehicle can facilitate the Borough expanding their recycling program in the future. SCS notes that the 18-gallon recycling bins used by residents do not provide sufficient capacity for residents' recycling needs. The Borough could upgrade its open-top recycling bins to carts so that simple cart tippers could be installed on the back of the rear-loader to facilitate collection.

Table 5. Planning Level Costs for Rear-Loader Recycling Collection

Cost Item	Description	Qty	Unit Cost	Total Cost
Labor (Annual)	Truck Driver[1]	1	$8,000	$8,000
	Solid Waste Collectors[2]	2	$7,000	$14,000
Equipment/ Supplies	Collection Vehicle	1	$250,000	$250,000
	Carts[3]	0	$60	$0
Operation, Maintenance and Repair (Annual)	Frontline Truck -- Average Annual Maintenance and Repair Cost per Truck	1	$25,000	$25,000
	Frontline Truck -- Average Annual Fuel Cost per Truck	1	$9,000	$9,000
TOTAL				**$306,000**

[1] Assumes annual salary/benefits of $40,000 for driver; cost is for 1/5 time

[2] Assumes annual salary/benefits of $35,000 for each collector; cost is for 1/5 time

[3] No new carts would be necessary for this collection program

SCS notes drawbacks to upgrading the recycling collection equipment to a rear-loader, including:

- **Increased Operational/Maintenance Costs** – When compared to the current recycling collection fleet, the Borough can likely expect to pay more for operating and maintenance costs.

- **Impact on Materials** – Use of compacting collection vehicles has the potential to modify the recyclable materials as they are collected, which may make them less marketable. For example, when glass is collected in a compacting vehicle it may be crushed into tiny pieces, which can make it more difficult to recover and recycle at the materials recovery facility. It also has the potential to degrade the quality of other recyclable materials collected. Before

upgrading the collection equipment to a unit with a compactor, the Borough should discuss the potential impacts to the recyclable material stream with its processor.

5 CONCLUSIONS

The Borough is in need of upgrading their recycling collection program to capture efficiencies and provide better service to their residents. Although automation holds some promise, SCS believes there are some areas of the Borough that will offer pronounced challenges during a hypothetical transition to automated collection. Those challenges, coupled with the significant capital investment for a new truck and carts, leads SCS to recommend against moving to an automated collection system at this time until a more holistic street-by-street assessment of the feasibility of automated collection is completed.

SCS does recommend that the Borough overhaul their recycling collection vehicles so that more capacity is available for collection and transport. Based on our field observations and familiarity with the Borough's recycling collection program, SCS recommends the Borough procure a rear-load collection vehicle of sufficient capacity to collect recyclable materials generated in the Borough in a single pass.

Appendix A
Field Data – Time at Stop

Stop No.	Time (sec)	# of Borough Issued Bins	Other Containers
1	15	1	
2	15	2	
3	6	1	
4	35	2	Y
5	23	1	Y
6	10	1	
7	10	1	
8	8	1	
9	19	1	Y
10	27	2	
11	38	2	
12	30	1	Y
13	10	1	
14	27	0	Y
15	12	1	
16	16	1	
17	34	2	Y
18	17	1	
19	24	2	
20	19	1	
21	20	1	
22	11	1	
23	32	2	Y
24	123	2	Y
25	23	1	Y
26	17	1	Y
27	81	3	Y
28	27	1	Y
29	14	1	
30	14	1	
31	16	1	Y
32	16	1	Y
33	16	1	
34	22	1	
35	24	2	Y
36	21	2	
37	35	2	
38	12	1	

Stop No.	Time (sec)	# of Borough Issued Bins	Other Containers
39	15	1	
40	17	2	
41	30	2	
42	6	1	
43	20	1	
44	8	1	
45	12	1	
46	27	1	
47	50	0	
48	19	0	Y
49	15	1	Y
50	12	1	
51	17	1	
52	33	1	
53	19	1	Y
54	6	1	
55	10	1	
56	10	1	
57	8	0	Y
58	7	1	
59	22	1	Y
60	19	2	
61	17	1	Y
62	21	1	Y
63	15	2	
64	10	1	
65	22	1	Y
66	24	1	
67	22	2	Y
68	14	1	Y
69	12	1	
70	8	1	
71	14	1	
AVG	**20.8**	**1.2**	