SUSTAINABILITY & SOLID WASTE

A COLLABORATIVE REPORT OF
ARIZONA STATE UNIVERSITY'S PROJECT CITIES
& THE CITY OF APACHE JUNCTION

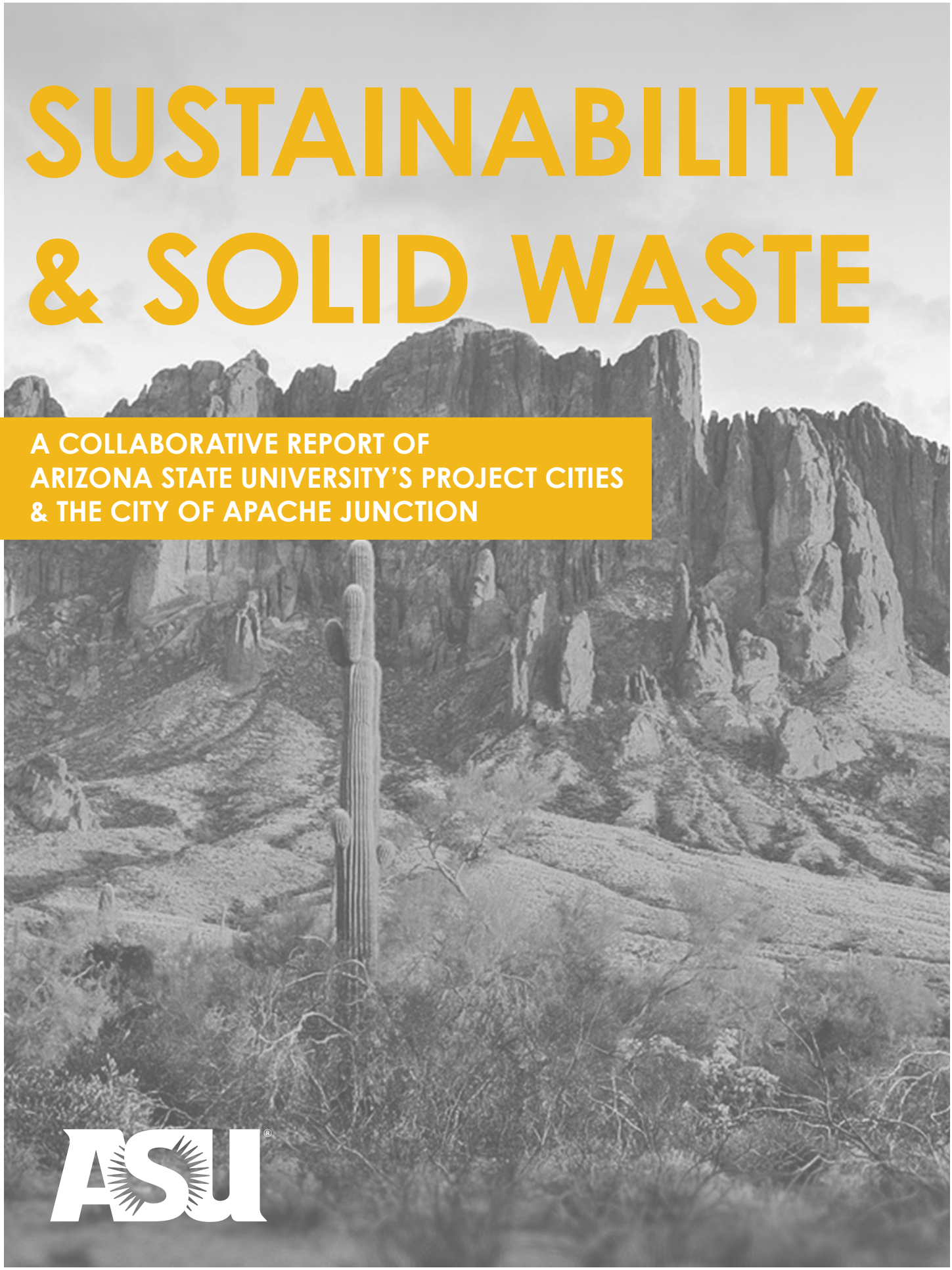

TABLE OF CONTENTS

PART 1
GET ACQUAINTED WITH THE PROJECT

PART 2
GO IN-DEPTH: *SUSTAINABLE SOLID WASTE MANAGEMENT*

PART 3
GO IN-DEPTH: *PUBLIC AFFAIRS CAPSTONE*

PART 4
APPENDIX: *STUDENT REPORTS & PRESENTATIONS*

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On behalf of the ASU Wrigley Institute and the School of Sustainability, we extend a heartfelt thank you to the City of Apache Junction for enthusiastically engaging with students and faculty to confront difficult problems facing the community. Your real-world projects provide students with hands-on opportunities to apply knowledge that can create positive changes to Apache Junction's future livelihood and community wellbeing.

City of Apache Junction

300 East Superstition Boulevard• Apache Junc tion. Arizona 85119 • www.ajcity.net

February 20, 2018

Dear Apache Junction residents and community members,

On behalf of the City Council and the City of Apache Junction we wanted to let you know about our experience as the inaugural partner city for ASU's Project Cities program. We were extremely grateful for the opportunity to work on four projects with over one hundred-forty students, and eight university professors, in six courses. Each of the projects provided Apache Junction citizens with opportunities for involvement in community improvements.

As a smaller community, Apache Junction doesn't always have the resources to undertake every project that needs to be done. With a small investment in a Project Cities program, we can now work toward completing a few backlogged projects that have been identified in our city work programs and plans. The four projects that were undertaken in the Fall semester of 2017 (Positively AJ, Off-leash Dog Park, Sustainability and Solid Waste, and Understanding Homelessness), have been identified over a number of years as important issues in the Apache Junction community. By engaging with ASU on the four projects, the city has been able to advance each project more quickly than we otherwise would have been able to do with city employees alone.

The research and recommendations for each project gave the city objective insights into some of our ongoing challenges as a city and how we can better serve residents and visitors. The city is already using the report's findings and recommendations to take the next logical steps in moving the projects forward. We look forward to working with ASU and the Project Cities program on future projectsl

With gratitude,

Jeff Serdy, Mayor

Bryant Powell, City Manager

ABOUT PROJECT CITIES

Arizona State University's (ASU) Project Cities program is a university-community partnership. For an entire academic year, faculty and students work with a single city to co-create strategies for better environmental, economic, and social balance in the places we live. Students from multiple disciplines research difficult problems chosen by the city, and propose innovative sustainability solutions that will help it achieve a better future. Project Cities is a member of the Educational Partnerships for Innovation in Communities Network (EPIC-N), a growing network of more than 30 educational institutions partnering with cities throughout the United States and world.

ABOUT SUSTAINABLE CITIES

Project Cities is a program of ASU's Sustainable Cities Network. This network was founded in 2008 to support communities in sharing knowledge and coordinating efforts to understand and solve sustainability problems. It is designed to foster partnerships, identify best practices, provide training and information, and connect ASU's research to the front-line challenges facing local communities. Network members come from Arizona cities, towns, counties, and Native American communities, and cover a broad range of professional disciplines. Together, these members work to create a more sustainable region and state. In 2012, the network was awarded the Pacific Southwest Region's 2012 Green Government Award by the U.S. EPA for its efforts. For more information, visit *sustainablecities.asu.edu.*

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Sustainability Through Local Action
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ABOUT APACHE JUNCTION

The City of Apache Junction is well situated on the eastern edge of Greater Phoenix, the twelfth largest metropolis in the United States, yet it has a small-town, Western feel. This is both intentional, and influenced by geography. Apache Junction sits at the base of the Superstition Mountains and Goldfield Mountains, and is near attractions such as the Lost Dutchman State Park, Goldfield Ghost Town, Superstition Mountain Museum, Canyon Lake, Tortilla Flat, and the historic Apache Trail. Home to 39,000 residents, the city has a population that nearly doubles in the winter, when seasonal residents arrive to enjoy its pleasant weather and unique setting.

It was named Apache Junction because it is located at the intersection of US Route 60 and the historic Apache Trail, which was used by Native Americans and later stagecoaches to traverse the Superstition Mountains, and for the construction of water-reclamation dams along the Salt River. The city also straddles Maricopa County and Pinal County. Incorporated in 1978, Apache Junction has arrived at another crossroads as it matures. While the city wants to retain its small-town character, it must prepare for an increasing population, and has set out to develop greater economic opportunities. In the spring of 2005, Apache Junction debuted the first LEED-certified city hall in Arizona. It is Apache Junction's aspirations and potential for sustainability, and the unique challenges it is facing, that form the basis of its partnership with Arizona State University's Project Cities.

Apache Junction Team

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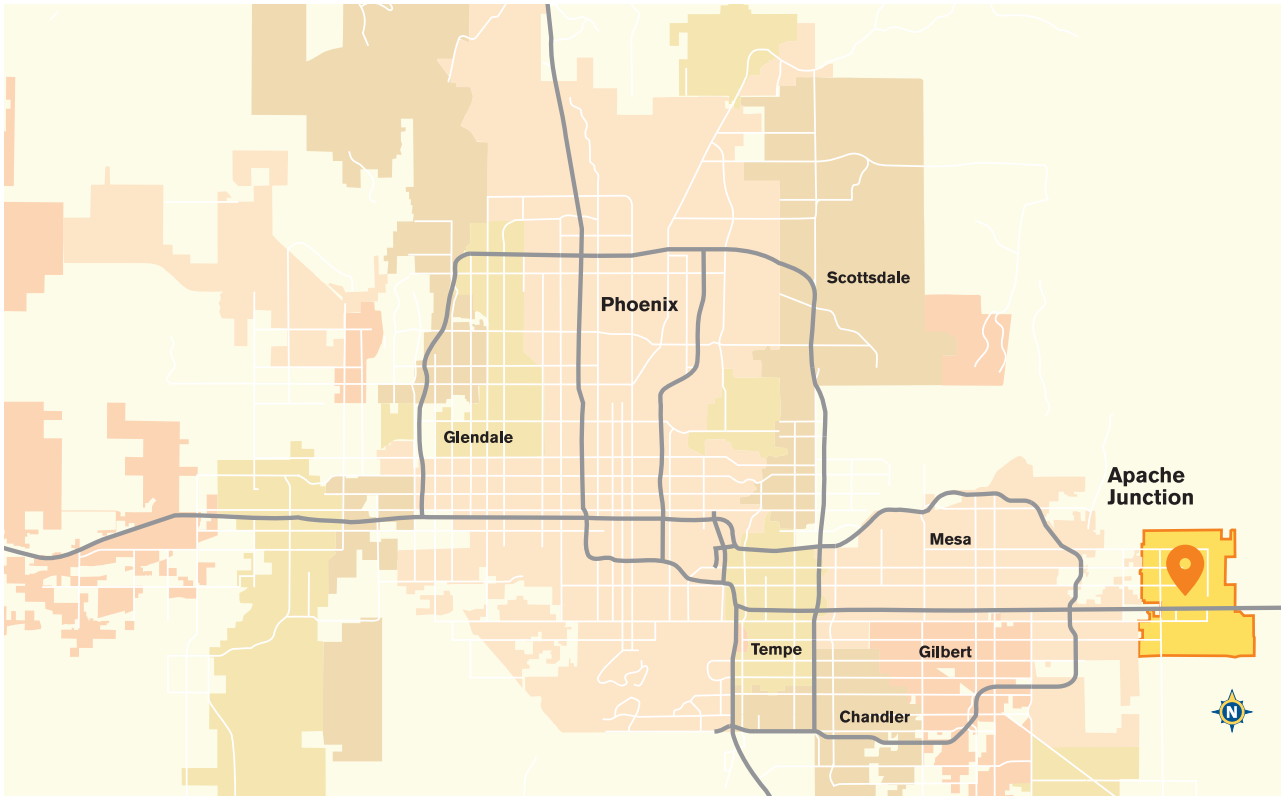
Map of the City of Apache Junction and Greater Phoenix, Arizona



EXECUTIVE SUMMARY

The City of Apache Junction lies on the picturesque border where metropolitan Phoenix meets the Arizona wilderness. This convenient location with easy access to nature continues to draw new residents and reoccurring winter visitors to this young city, incorporated in 1978. Today Apache Junction has a population of nearly 40,000 residents, reflecting an 11.8% increase between 2010 and 2016. In the winter, this population nearly doubles. While growth and consistent tourism are boons, they also reveal growing pains. One issue is Apache Junction's current solid waste management system.

As of 2017, Apache Junction does not require residents to subscribe to weekly solid waste collection. Instead, it allows them to choose whether or not to contract with a solid waste pickup service, of which there are three available. The Apache Junction landfill is also located within city jurisdiction, has low rates, and offers city residents four weeks each year to dispose of one truckload of waste for free. However, this landfill is slated to close in 2035, and the next closest is more than 30 miles way. Further, while the city's solid waste ordinance prohibits illegal dumping and storage of solid waste on residential properties, Apache Junction's hands-off approach still results in a significant number of complaints about solid waste that has been abandoned or stored on residential properties. City officials are concerned about safety issues related to these occurrences, compliance with regulations, and ensuring a desirable quality of life for all residents.

While the city is looking forward to more sustainable solid waste management, it is unclear how it should proceed due to its unique seasonal demographics and existing system. In fall 2017, two courses —ERM 432/532 Sustainable Solid Waste Management and PAF 509 Public Affairs Capstone—enlisted in Arizona State University's Project Cities program to provide Apache Junction with insight on issues related to its current solid waste management and present potential pathways for sustainable alternatives. To do so, ERM 432/532 students analyzed complaints received by Apache Junction and Pinal County about solid waste, researched related environmental health aspects, and assessed the city's online complaint filing system. PAF 509 students researched Apache Junction and the solid waste management practices of similar entities, then presented solutions for how the city can move forward.

ERM 432/532: Students in this course focused on understanding the current and potential impacts of Apache Junction's existing solid waste

management. To get a wider perspective, students broke into two teams. The first analyzed complaints filed with Apache Junction and Pinal County regarding solid waste, looking for trends and insights. This team also reviewed the city's online complaint filing system and compared it with similar municipal websites to determine how this system could better serve residents and city management. Results showed that Free Dump Week did not interrupt the flow of complaints received, and certain neighborhoods would benefit from increased educational campaigns regarding solid waste ordinances and bulk pickup services. The second team reviewed literature related to environmental and health aspects of improperly stored or disposed solid waste. Their findings highlighted issues related to odors, vector control, air pollution, soil contamination, water pollution, injury control, and aesthetics.

PAF 509: Individual students in this course each produced a capstone report for their master's degree that was focused on Apache Junction's current solid waste management system. Each chose different investigative approaches, such as surveying residents or comparing practices of peer cities. Based on their research methods, the students generated their own findings and recommendations. Among these were: 1) discontinuing Free Dump Week, 2) joining another city in contracting a solid waste provider for mandatory weekly pickup, and 3) implementing a pay-as-you-throw solid waste service. An additional element that was prioritized was recycling.

The ideas and recommendations (see Tables 1, 2, and 3) presented by these students are kickoff points for Apache Junction. They are meant to support the city in making improvements through plans informed by research, demographics, and opportunities. The work is not comprehensive or totally cohesive, and any pursuit of the recommendations requires professional review and consideration. That being said, the course reports are meant to stimulate deeper conversations for managers and policy makers.

Following this executive summary and the goals and recommendations of each report are introductory summaries of the final reports generated by each course. These cover the problem targeted, research methods used, research findings, resulting recommendations, and areas for further exploration. Each summary is followed by select student deliverables in their entireties, which can be consulted for greater depth and more clarity on how the recommendations were reached.

SOLID WASTE COMPLAINTS AND ENVIRONMENTAL HEALTH ANALYSIS GOAL & RECOMMENDATIONS

Goal

The goal of this report is to identify existing or potential issues arising from Apache Junction's current solid waste management system and policies, and create recommendations to address them.

Apache Junction receives a significant number of complaints from residents about solid waste. Such issues have potential environmental health impacts. This indicates that the quality of life of citizens and the city's visitor-based economy are being negatively affected by improperly managed solid waste.

SOLID WASTE IMPROPERLY STORED OR ILLEGALLY DUMPED IN APACHE JUNCTION

Photos of abandoned solid waste and residential solid waste storage in Apache Junction. Taken by Larry Kirch, Albert Brown, and Gandhar Pandit in 2017.

Recommendations for Addressing Complaints & Environmental Health Aspects

Change solid waste management	Make use of existing codes	Prioritize community education
Implement policies mandating weekly solid waste pickup at every occupied property.	Strictly enforce the city prohibition on illegal dumping.	Offer educational classes about reducing, reusing, and recycling to adults and children.
Ensure solid waste is properly stored in covered containers to be picked up by the waste disposal service.	Strictly enforce codes prohibiting excessive accumulation of trash, weeds, and fire hazards.	Encourage the removal of standing water to control the mosquito population.
Provide a weekly recyclable material pickup service.	Educate residents about the existing city code prohibition on excessive outdoor storage.	Offer educational programming for backyard composting.
As an alternative to mandating weekly collection, offer quarterly bulk trash pickup and increase the frequency of free waste disposal days at the landfill.	Enforce the existing code prohibiting abandoned vehicles, to prevent potential water pollution and other health hazards.	Promote the importance of healthy soil to a healthy environment and share how uncontained solid waste, including abandoned vehicles and horse manure, can contaminate soil.
Place waste and recycling receptacles at sites that have problems with the accumulation of solid waste, as determined by pinpointed complaints.	Strictly enforce the existing ban on open burning, to reduce air pollution.	Encourage residents generating large amounts of waste during construction, renovations, or landscaping to rent large roll-off bins from a disposal company.
	Educate residents about existing city and county codes that prohibit open burning.	Provide educational materials about best practices for loading solid waste for hauling to reduce the risk of personal injuries and traffic accidents.
		Educate residents about the value of good aesthetics for the welfare of the city, its residents, and its economy.
		Inform residents of health issues associated with accumulating solid waste and the positive effects of a solid waste removal service.

Table 1. Recommendations from the students of ERM 432/532 about how Apache Junction can address complaints and environmental health aspects of solid waste.

Recommendations for Improving Apache Junction's Online Complaint Filing System

Improve filing process and categorizing	Improve communication
Group sections together more effectively on the complaint page to improve navigation.	List a clear, step-by-step description of the process for how complaints will be handled.
Allow the website user to select a category from a dropdown menu that would then direct them to a specific page displaying the types of complaints in that category.	In complaint filing confirmation emails sent to users, include a time estimate for getting an inspector to respond to the issue.
Tie complaint selections to existing codes or enforceable rules.	Allow complaint filers to request a follow-up phone call or email.
Revise the system so each complaint type can easily be categorized in a spreadsheet.	On the complaints page, clearly list the phone number residents can call to make a complaint.
Allow users to upload photographs of complaints.	Add a "Contact AJ" tab to the website to encourage residents to verbalize and follow up on complaints.
Allow users to file complaints without creating accounts or submitting an email address, or allow anonymous filing.	

Table 2. Recommendations from the students of ERM 432/532 about how Apache Junction's online complaint filing system can be improved to generate greater insight tied to existing codes, and to encourage communication to build trust with and better serve residents.

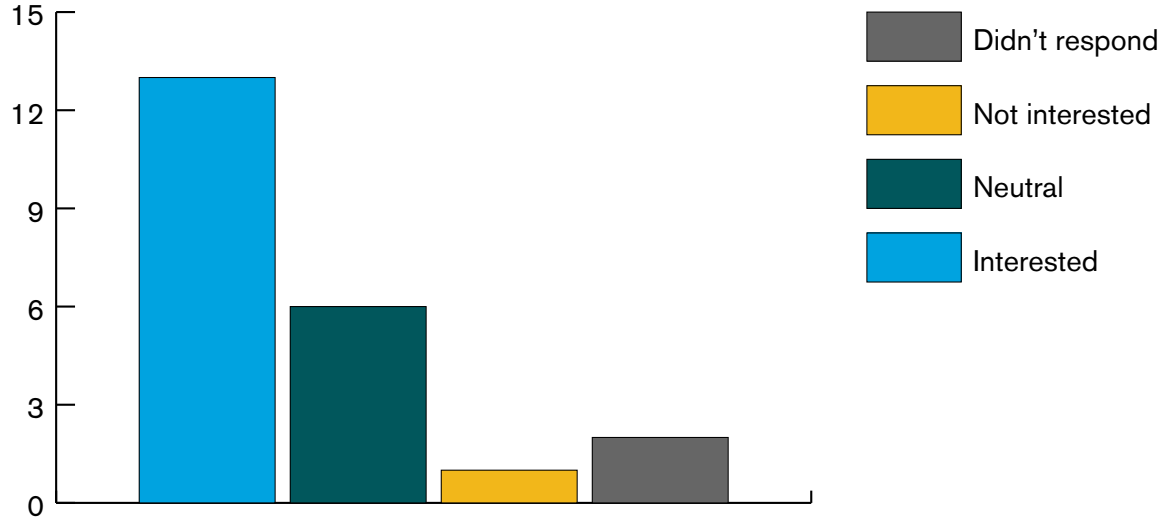
POLICY PATHWAYS TO SUSTAINABLE SOLID WASTE SERVICES GOAL & RECOMMENDATIONS

Goal

The goal of this report is to assess Apache Junction's current solid waste management practices and present alternatives.

There is momentum in Apache Junction to change its hands-off solid waste management system as the city's population is growing and its landfill is slated for closure in 2035. However, the city does not know if residents support the status quo, or which alternative would be most fitting and cost-effective.

INTEREST IN CURBSIDE PICKUP SERVICES EXPRESSED BY 22 APACHE JUNCTION RESIDENTS



Level of interest in curbside recycling pickup service of 22 surveyed Apache Junction residents who participate in a citizen engagement group.

Recommendations for Pathways to Sustainable Solid Waste Management

Provide Solid Waste Services	Eliminate Free Dump Week	Support Recycling
Continue a phased approach to changing solid waste services policy, as there appears to be widespread support for curbside solid waste and recycling services.	Eliminate Free Dump Week, since it creates legal issues for the city regarding self-hauling of solid waste.	Implement a mandatory recycling program with curb-side collection, as well as an incentive for participation.
Mandate weekly solid waste pickup and outsource the curbside solid waste and recycling services.		Undertake an education and information campaign to facil-itate residents' understanding of the need for recycling and waste diversion.
Consider an intergovernmental agreement with a neighboring mu-nicipality for solid waste services. Specifically, City of Apache Junction officials should approach the Town of Queen Creek about entering a shared service agreement.		
If a shared service agreement is not of interest to Apache Junction, it should consolidate solid waste ser-vices providers through a request-for-proposal. Keep resi-dents' budgets and needs in mind.		
For solid waste pickup consider a pay-as-you-throw rate structure rather than a flat fee, using collection vehicle measurement of waste.		
For household hazardous waste, analyze the potential for cost savings associated with a shared service agreement. Consider entering into an agreement with the City of Mesa.		
If shared service agreements are pursued, the city should make out-reach efforts to explain the benefits and goals of such strategies.		

Table 3. Recommendations for Apache Junction for changing its solid waste management approach.

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FACULTY ALBERT BROWN
ENVIRONMENTAL AND
RESOURCE MANAGEMENT

432/532 SUSTAINABLE SOLID
WASTE MANAGEMENT
FALL 2017

A Solid Waste Complaints and Environmental Health Analysis

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INTRODUCTION

An important part of how a city functions is how it manages the solid waste generated by its residents. The effectiveness in this endeavor impacts the health and happiness of its citizens. To help Apache Junction better understand the impacts of its existing solid waste management strategy, students in ERM 432/532 Sustainable Solid Waste Management, an environmental and resource management course at Arizona State University (ASU), evaluated Apache Junction's existing solid waste management practices, their potential health impacts, and complaints received regarding solid waste. The goal was to identify existing or potential issues arising from Apache Junction's current system and policies, and to create recommendations for coping with them. This report describes the methods, findings, and recommendations used during the course.

The ERM 432/532 students split into two groups to tackle the project. One team focused on complaints related to solid waste that were received by the City of Apache Junction and Pinal County between 2015 and mid-2017. For this report, solid waste is considered to be waste generated by residents including food scraps, yard waste, and items discarded by households. Solid waste is also called garbage, rubbish, or trash. Upon receipt of the data, students sorted and analyzed the complaints. They also assessed the city's complaint filing system and researched the systems of other cities for comparison. Through this process, they aimed to identify ongoing solid waste trends in the city, and determine how to maximize the effectiveness of Apache Junction's complaint filing system.

Solid waste is also called garbage, rubbish, or trash. For the context of this report, solid waste is waste generated by residents including food scraps, yard waste, and items discarded by households.

The other ERM 432/532 student team focused on identifying potential environmental health aspects associated with the accumulation of solid waste on residential property. They consulted academic literature and municipal information from numerous cities, reviewed the complaints about solid waste, and visited Apache Junction. Using their research, they elaborated on the origins and impacts of environmental health aspects. Specifically, they focused on odors, vector control, air pollution, soil contamination, water pollution, injury control, and aesthetics. This

team also made recommendations for how to prevent potential negative environmental health outcomes through specific solid waste management strategies.

The goal of this report is to help Apache Junction understand better the negative impacts of its existing solid waste management strategy, and how they might be prevented. The remainder of this "A Solid Waste Complaints and Environmental Health Analysis" report section explains the methods students used. It then details their findings and resulting recommendations. The report concludes with areas for further exploration, and a concise conclusion, followed by the team reports in their entirety.

PROBLEM

Complaints filed with Apache Junction and Pinal County indicate that there are reoccurring solid waste issues in Apache Junction, including illegal dumping and storage of solid waste on residential properties. Such practices have potential environmental health impacts, and may negatively affect quality of life and the city's visitor-based economy. As Apache Junction grows, it should determine if its existing policies for management of solid waste have become problematic for its population, and if so, how to move forward.

METHODS

To better understand the problem, the two teams of students in the ASU course ERM 432/532 Sustainable Solid Waste Management analyzed solid waste complaints submitted to Apache Junction and Pinal County and researched related environmental health aspects under the guidance of Senior Lecturer Brown. They also assessed the city's complaint filing system. What follows highlights their methods of data analysis, benchmarking, and literature review, and how the students used them to obtain insightful results.

Data analysis: Data analysis is the process of collecting data and then sorting, quantifying, and assessing it to gain greater insight into a topic. Apache Junction and Pinal County both have online systems through

which residents can submit complaints about solid waste and other issues. Residents may also call the government agencies to register a complaint. Because of this, students were able to begin their research with data already collected through these channels. Apache Junction provided all documented complaints received from January 1, 2010 to August 31, 2017, and some complaint narratives. The Pinal County Public and Environmental Health Department provided complaints received from January 2015 through June 2017. The complaint analysis student team looked at all complaints from January 2015 to mid-2017 (as far as the data allowed). They sorted each source's complaints by type and time of year, and plotted geographic locations for visual representations of the data. The health aspects team of students also looked at selected complaints for insight into illegal burning of solid waste in the city.

Literature review: In the context of this report, literature review is a method of finding data that informs a specific subject. The students used this method to gather information about Apache Junction's solid waste management and about environmental health aspects related to the accumulation or improper discarding of solid waste. Their review included academic sources, class lectures, online posts, city resources, and educational and regulatory materials produced by the federal government. One such document used for the literature review was "Sustainability and Waste in Apache Junction," a 2016 report generated by ASU professor Nalini Chhetri and her students in the course SOS 498/594 Urban Sustainability Best Practices Application.

Benchmarking: This method involves measuring something, such as the solid waste management of a city, and then comparing it with those of similar entities to get a sense of where the first stands and how it could be improved. In this case, the students focused on Apache Junction's complaint filing system, which they compared with systems of Pinal County, Arizona Department of Environmental Quality, Maricopa County Environmental Services Department, the City of Mesa, the City of Buckeye, and the City of Avondale. To measure the performance and organization of these systems, students conducted user experience studies, attempting to file complaints themselves. They got supplemental information from discussions with City of Apache Junction staff representatives Larry Kirch and Dave Zellner.

To measure the performance and organization of the system, students attempted to file complaints themselves.

FINDINGS

Using these qualitative and quantitative research methods, the two student teams were able to shed light on solid waste issues and impacts in Apache Junction. They also determined how Apache Junction's complaint filing system could be improved. Below, this report delves into findings revealed by each method, respectively.

Solid Waste Complaints in Apache Junction

By analyzing complaints filed with Pinal County and Apache Junction, the students determined that **solid waste was the most reported issue** for both government entities. **Complaint categories that fit within the definition of solid waste also had the highest frequency, which indicates solid waste needs the most attention of any complaint concern.** Further, the students found that residential waste is a recurring concern in Apache Junction, as **there was no year or season in which complaints significantly reduced**. Based on these results, the students inferred that **the city's existing strategy of allowing residents to determine their own solid waste practices, and offering a Free Dump Week, is insufficient to address the documented accumulations of solid waste.**

Types of complaints

First, the students analyzed the types of complaints received by Apache Junction and Pinal County from January 2015 through mid-2017. Solid waste was the most common complaint of the six categories from the Pinal County database, topping the other categories of fecal matter, oil, furniture/appliances, pests, and other. (See Table 1 for the categories of each entity.)

THE CATEGORIES RELATED TO SOLID WASTE OF PINAL COUNTY AND APACHE JUNCTION COMPLAINT DATABASES

PINAL COUNTY	THE CITY OF APACHE JUNCTION
Solid Waste	Outside Storage
Fecal Matter	Waste Matter
Oil	Household Waste
Furniture/Appliances	Abandoned Vehicles
Pests	Zoning
Other	Residential Weeds, Trees, Shrubs

Table 1. How solid waste complaints were categorized in data from 2015 to mid-2017 provided by Pinal County and the City of Apache Junction. (These categories of the complaints do not necessarily match category options for filing a complaint online.)

Since 2010, more than half of the more than 15,000 complaints received by the City of Apache Junction have been about solid waste, which itself falls into multiple categories (see Table 1). Regarding the complaints assessed from 2015 through the first eight months of 2017, 1,455 were about solid waste. (There were 789 in 2015, 360 in 2016, and 306 in the first eight months of 2017.) Of these, **75 percent were filed as "outdoor storage."** (See Figure 1 for all percentages.) The complaint narratives also shared by Apache Junction imply that the outdoor storage complaints include vehicles, bulk furniture, large appliances, and other miscellaneous household waste. Interestingly, in 2017, there was a shift in the majority category of Apache Junction's solid waste complaints, with 53 percent of the complaints filed as "waste matter." The students proposed that this category's wording indicates the waste is not associated with a residential property, which means the city will have to dispose of it. From this initial analysis, **students speculated that Free Dump Week, during which residents can dispose of one load per household at the landfill at no charge, is not enough to address the volume of some accumulated waste.**

REASONS FOR SOLID WASTE COMPLAINTS IN APACHE JUNCTION DATA FROM 2015 TO MID 2017

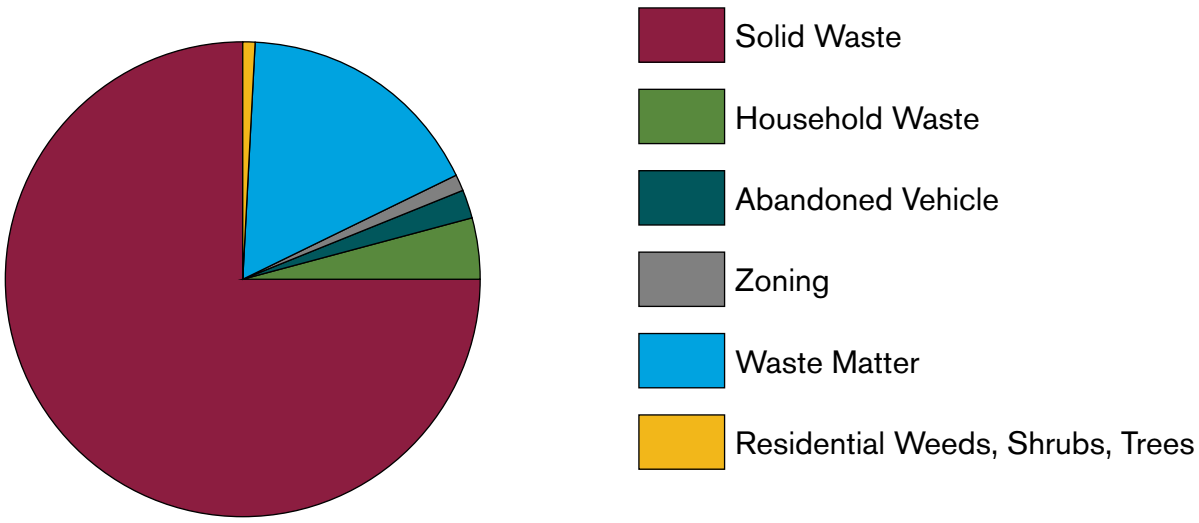

Figure 1. Sorted and Analyzed Solid Waste Complaints received by Apache Junction from 2015 to mid-2017

Times of Complaints

The students also sorted the data by season and month. **Of Apache Junction's complaints regarding solid waste, the month of June 2015 had the most, totaling 93. However, Pinal County's solid waste complaints located in Apache Junction increased during the winter.** Students explained this as a reflection of the influx of seasonal residents to Apache Junction and Pinal County, who may be less tolerant of visible waste. **That the number of complaints regarding solid waste didn't decrease after Free Dump Weeks —which occur the first week of February, May, August, and November—indicates that the opportunity to dump waste for free does not reduce complaint-worthy waste** (see student report pages 2-14 and 2-15).

Locations of Complaints

Finally, students analyzed the complaints by location, producing some insightful results. First, **while Apache Junction's population is 10 percent of Pinal County's, 15 percent of the solid waste complaints the county received were located in the city.** This indicates that solid waste may be a bigger issue in Apache Junction than in other cities located within Pinal County. Further, by plotting the complaints on Google maps, the students found that Apache Junction's complaints had more repeated locations in 2017 than in the years prior. In 2015, complaints were dispersed across the city without any obvious trends. **In 2016 and 2017, complaints became more concentrated in the area north of West Southern Avenue and southwest of West Old West Highway** (see Figure 2). **This information identifies areas where Apache Junction should focus educational efforts, make greater effort to enforce solid waste codes, and plan bulk-waste pickup services.**

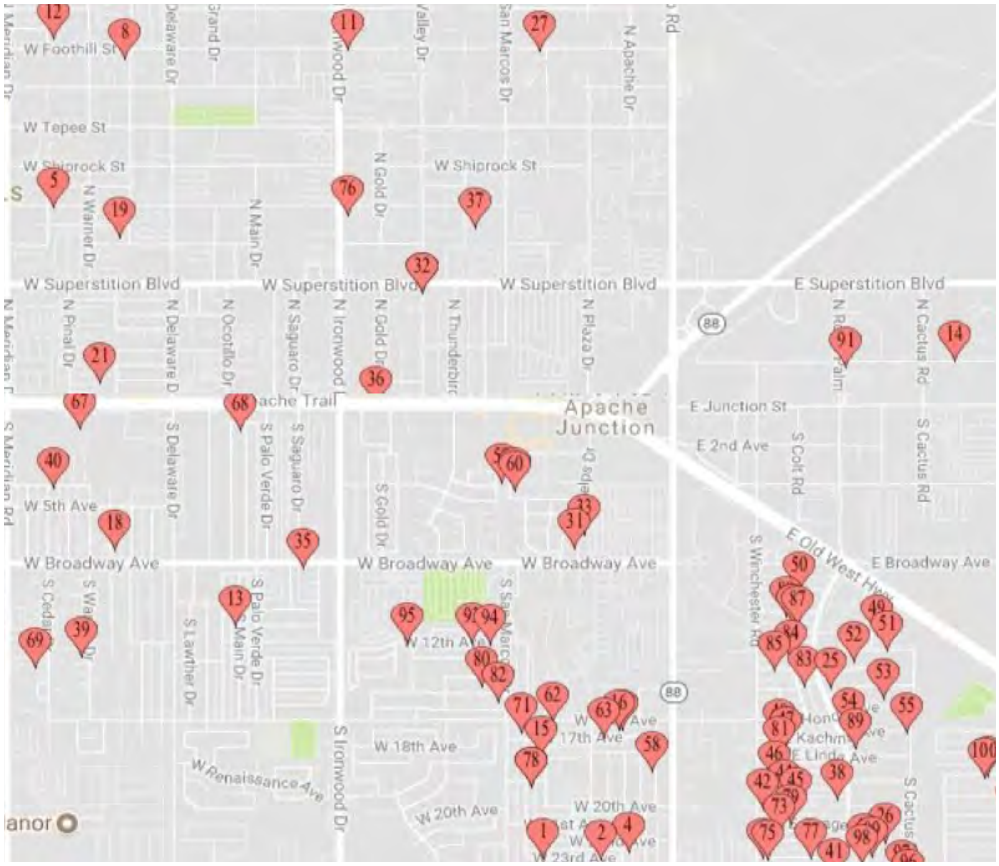

Figure 2. 100 Addresses from 2015 Apache Junction City Complaints.

Environmental Health Aspects

The second team of students focused on gathering information about how the accumulation of solid waste for more than one week may have negative impacts on the health of residents and the environment (see Figures 3, 4, and 5 for photos of such accumulation in Apache Junction). Because of this, the majority of their report outlines what these environmental health effects are, how they are created, and how they can be prevented. Findings related directly to Apache Junction were limited; however, that being said, they were informative. For example, the students noted that noxious odors are classified as an environmental nuisance by the Arizona Revised Statute, A.R.S § 49 – 141. A known method to stop odors associated with stored residential solid waste is to offer reasonably affordable curbside trash pickup once a week.

The aspects the students focused on were odors, vector control, air pollution, soil contamination, water pollution, injury control, and aesthetics. Along with generating odor, **stored solid waste attracts vectors—animals that carry and transmit pathogens, like rats and mosquitoes—because it provides hiding places, nest sites, and travel routes** for such creatures. If vectors are able to spend time in such spaces, they become comfortable and likely breed. Accumulated solid waste and uncovered trash containers also create opportunities for stagnant water, where mosquitoes can breed. Regular pickup of solid waste and covered containers, help remove these opportunities. **A formal strategy to combat vectors is "integrated pest management," which prioritizes educational campaigns and solid waste removal, rather than pesticide application**, which should be a last resort.

As solid waste degrades, it can contribute to another environmental health impact, which is air pollution. Discarded items like fluorescent light bulbs also discharge hazardous air pollutants. A third way solid waste generates air pollution—in the form of nitrous oxide, carbon dioxide, sodium oxide, and particulates—is through illegal burning. The burning of plastics creates further hazardous air pollution, like dioxins and furans. In the four-year period leading up to August 2017, there were 476 complaints filed with Apache Junction about illegal trash burning. According to the U.S. Environmental Protection Agency, people burn solid waste to avoid paying for collection or because it is easier than hauling it to the landfill. Therefore, mandatory solid waste pickup would

address this. Another practice that might prevent the burning of solid waste is composting, which would help residents dispose of landscaping waste. A third is recycling, which would reduce combustible materials on residential properties. For example, **through curbside recycling, the City of Chandler saved $68 per ton of 42.5 million pounds of trash collected yearly. With these savings, the city offered its residents composting boxes at no cost, which reduced organic waste going to the landfill and provided residents with resources for landscaping and gardening** (see student report page 2-7). This is a strategy that Apache Junction could consider.

Soil and water pollution are other possible environmental health aspects of improper solid waste management in Apache Junction. These are generated by accumulated solid waste (see Figures 4 and 5), illegal dumping (see Figure 3), and abandoned vehicles. Household hazardous waste like cleaners, paints, and leftover pesticides can spill and infiltrate water and soil. Abandoned vehicles can leak gasoline, crankcase oil, transmission oil, antifreeze, hydraulic oils, battery acid, and other toxic automotive fluids. Illegally dumped solid waste is especially dangerous because it could contain hazardous wastes that may contaminate the soil or water, but more importantly, it is also easily accessed by the public, including children. According to the students, if Apache Junction residents are fully informed of these risks, they may be more willing to support changes in the city's management of solid waste.

Another environmental health aspect is injury. This could occur when residents are transporting solid waste to the landfill, if they improperly lift the waste or improperly secure it for transportation. According to the Arizona Department of Transportation, debris on roadways causes 25,000 accidents nationally each year. Solid waste may also contain sharp objects that could cause cuts and life-threatening bacterial infections. Further, the waste may be stored in a pile, or include flammable materials

Figures 3, 4, 5. Photos of abandoned solid waste and residential solid waste storage in Apache Junction. Taken by Larry Kirch, Albert Brown, and Gandhar Pandit in 2017.

like paint thinners, which could catch fire and cause injuries or death—especially when stored near residences. **On average, according to the City of Apache Junction's database, there are 100 instances of illegal trash burning a year, with approximately 10 burnings a month. In September 2017, the Apache Junction Fire Department was called to five fires involving solid waste.**

The final aspect is aesthetics. This is of special concern to Apache Junction because it impacts tax revenue that comes from wintertime tourism, and the quality of life of its residents. According to students' research, **the more pleasing an environment looks, the greater its chance to attract visitors** (see student report page 2-27). This means that if there is unsightly solid waste in view, either gathered on residences or dispersed by wind if it was unsecured, visitors may be discouraged from returning. The report also asserts that if an area looks nice, people will likely do their part to keep it clean. This implies that if they are used to seeing solid waste, they may think this is acceptable and contribute to the problem. As clean, well-maintained, and visually appealing places help promote positive feelings, aesthetics are something Apache Junction needs to keep in mind as it determines its strategy for solid waste management.

Clean, well-maintained, and visually appealing places help promote positive feelings.

Apache Junction's Complaint Filing System

The first team of students also assessed the user experience of complaint filing on the websites of Apache Junction, Pinal County, the Arizona Department of Environmental Quality, Maricopa County Environmental Services Department, the City of Mesa, the City of Avondale, and the City of Buckeye. Through this research method, they found that navigating the Apache Junction website and its code compliance information was straightforward. However, **where to file a complaint was unclear and the categories were disorganized**. Therefore, there are ways in which the experience of filing a complaint on Apache Junction's website can be improved.

An example of a clearly explained process was found on the City of Mesa's website, which helps residents understand what to expect after filing a complaint. **Mesa also had an insightful mapping function that allowed those filing complaints to pin locations.** Further,

its website listed multiple ways for residents to reach the city, including phone numbers. These are all practices Apache Junction could use to improve its system. However, the actual process of filing a complaint through Mesa's website was overly complicated and is an example of what should be avoided.

In contrast, the Arizona Department of Environmental Quality's website offered the most straightforward complaint filing system. Unfortunately, it did not have categories to choose from when filing a complaint, which could slow processing time, and does not help quantify complaints. The City of Buckeye was also lacking on categories for its filing process. (See page 1-19 of the complaint analysis student report for a comparison table.)

The City of Avondale had multiple characteristics that students found promising for Apache Junction. One was the option to upload a picture with the complaint. Photos uploaded with complaints are helpful to city officials because they depict what exactly the violation is, and how extreme. Moreover, Avondale's online filing process is nicely streamlined, which will encourage residents to finish filing their complaints. However, while this form relatively simple to use, it is not simple to find, which is problematic. Finally, Avondale allows complaints to be filed without a login. This is also true of Pinal County and the City of Buckeye, which also allows anonymous complaints. The ability to file a complaint without logging in or submitting an email account may encourage residents to complete the process and be more detailed in their reports. For residents who do submit an email, as was required by Apache Junction in 2017, follow-up emails are helpful. However, the students felt the follow-up emails lacked information about how soon the complaint would be inspected. By increasing communication and creating a streamlined, well-organized complaint filing system, Apache Junction will receive more helpful information from residents, and be able to more quickly address these complaints and issues.

Photos uploaded with complaints are helpful to city officials because they depict what exactly the violation is, and how extreme.

RECOMMENDATIONS

By assessing the complaints that Apache Junction and Pinal County received regarding solid waste, and research related potential environmental health impacts, the student teams determined that Apache Junction must stop accumulation at the source. The volume of complaints received over the span of years implies that the Free Dump Week is not a sufficient management approach to residential solid waste generated in Apache Junction. Further, there are a range of environmental health aspects related to the complaints filed, from increased odor to decreased satisfaction. Therefore, the students recommend that the city not rely solely on the existing Free Dump Week to address solid waste accumulation. The following are the student recommendations, sorted by those regarding services, code enforcement, public education, and the complaint filing system.

Change Solid Waste Management System

The first set of recommendations regards solid waste services for residents. Both teams agreed that solid waste needs to be better addressed at the source. Students offered several recommendations for how this could be done, depending on the extent to which Apache Junction would like to change its existing management practices. However, they strongly encourage mandating weekly collection of solid waste.

1. Implement policies mandating weekly solid waste pickup at every occupied property.
2. Ensure solid waste is properly stored in covered containers to be picked up by the waste disposal service. This will prevent various environmental health aspects, including odor, vectors, and potential injuries.
3. Provide a weekly recyclable material pickup service. This can reduce the cost of weekly waste removal service for the city, and there are already companies providing recycling service in Apache Junction. This collection would also reduce combustible material at residential properties and reduce pollution.
4. As an alternative to mandating weekly collection of solid waste, offer quarterly bulk trash pickup and increase the frequency of free waste disposal days at the landfill.
5. Place waste and recycling receptacles in unincorporated areas and other sites that have problems with the accumulation of solid waste, as determined by pinpointed complaints.

Make Use of Existing Codes

Apache Junction already has an existing solid waste ordinance. The second set of recommendations regards how to better employ these codes to reduce environmental health impacts and complaints.

1. Strictly enforce the city prohibition on illegal dumping.
2. Educate residents about the existing city code prohibition on excessive outdoor storage.
3. Strictly enforce existing codes prohibiting excessive accumulation of trash, weeds, fire hazards, and dilapidated buildings.
4. Enforce the existing code prohibiting abandoned vehicles, to prevent potential water pollution and other health hazards.
5. Strictly enforce the existing ban on open burning, to reduce air pollution.
6. Educate residents about existing city and county codes that prohibit open burning.

Prioritize Community Education

The third set of recommendations regards educational efforts. Apache Junction could employ these to improve how its residents manage their solid waste. Such efforts could also improve the general understanding of why specific ordinances exist, or how weekly services would benefit the community. If the public better understands this, it may be more willing to accept changes in city-wide solid waste disposal methods.

1. Offer adults and children educational classes about reducing, reusing, and recycling materials.
2. Encourage the removal of standing water to control the mosquito population. Best practices are to weekly empty, scrub, turn over, cover, or throw out items that hold water such as tires, buckets, planters, toys, birdbaths, and flowerpots.
3. Offer educational programming for backyard composting. This is an efficient approach for reducing yard waste, which is otherwise a fire hazard.
4. Educate the public about the importance of healthy soil to a healthy environment, and how uncontained solid waste including abandoned vehicles and horse manure can contaminate soil.

5. Encourage residents who are generating large amounts of waste during construction, renovations, or landscaping to place the waste in large roll-off bins rented from a disposal company, who can also remove it.
6. For residents who haul waste to the landfill, provide educational materials about practices that reduce the risk of injuries like strained backs.
7. Share online resources about how to properly secure loads for transportation, to prevent items from falling onto roads and causing hazardous driving conditions.
8. Educate residents about the value of good aesthetics for the welfare of the city, its residents, and its visitors.
9. Inform residents of health issues associated with accumulating solid waste, and the positive effects of employing a waste removal service.

Improve the Online Complaints System

The fourth set of recommendations regards the online complaints system of Apache Junction's website, which is located at www.ajcity.net/requesttracker.aspx and titled "Suggestions and Concerns." While this topic may seem somewhat unrelated to previous recommendations, maximizing this resource will allow Apache Junction to gain a better understanding of solid waste issues in the city, and more efficiently address them. It will also help residents build trust in the city, and motivate them to actively improve their environment. According to the student team, the most important attributes for such complaint filing systems are: ease of navigation, relevant categories and subcategories, ease of filing, and description of the process. Below are recommendations that support this.

1. Tie complaint selections to existing codes or enforceable rules. This will enhance the city's ability to analyze this data.
2. Reorganize the complaint page so that sections are grouped together more effectively (i.e. roadway issues, public spaces concerns, residential concerns), which will improve navigation.
3. Allow the user to select a category from a dropdown menu (i.e. development services, parks and recreation, fire department, public safety/police department). After selecting this category, users should be directed to a specific page displaying the types of complaints in that category.

4. Revise the complaint system so that each complaint filed can easily be defined in categories in a spreadsheet.
5. Create a mapping function to allow residents to pin the location of a violation when filing a complaint. For an example of this, refer to the City of Mesa's filing system, located at http://www.mesaaz.gov/residents/code-compliance. This will give the city insight on where to increase code enforcement or emphasize educational efforts.
6. Allow users to upload photographs of complaints.
7. Allow users to file complaints without creating accounts or submitting an email address, or even file anonymously. This makes the process less confrontational, and may encourage more detailed reports. (As of February 2018, this seems to have been addressed.)
8. List a clear, step-by-step description of the process for how complaints will be handled.
9. In emails sent to users confirming that the complaint was filed, include how long it will take for an inspector to look into the issue. (Sending an email confirmation is current Apache Junction practice, and can continue even if contact information is optional if the user chooses to provide an email address for follow-up.)
10. Allow those filing complaints to request a follow-up phone call or email.
11. On the complaints page, list the phone number residents can call to make a complaint. (It is currently hard to find.)
12. Add a "Contact AJ" tab to the website, which will encourage residents to verbalize and follow up on complaints.

AREAS FOR FURTHER EXPLORATION

If Apache Junction were to decide to require weekly solid waste removal, there are a number of ways ASU students could contribute to the process. This includes helping develop the proposed code revision, engaging with stakeholders, and creating educational materials to be shared with stakeholders. Such materials could be developed by students who study Environmental Resource Management, who could then collaborate with Graphics Information Technology (GIT) students to produce short videos and deliverables that could be distributed through social media, online, and in print.

Another topic Apache Junction will need to explore further is what to do with the Republic Services' Apache Junction landfill when it closes. With the landfill nearing capacity, the closing date will arrive in 18 years. To help the city prepare for this event, ASU students could research landfill alternatives when this one is no longer available for Apache Junction's solid waste. They could also research redevelopment options for the landfill site after closure.

CONCLUSION

Currently, Apache Junction's role in solid waste management is limited. However, student research suggests that there are ongoing issues and possible environmental health aspects resulting from current waste management policies and procedures. Further, while the city's complaint filing system is sufficient, there are ways in which it could be improved. Through their research, the student teams generated recommendations to address their findings. The primary recommendations are to institute mandatory solid waste pickup, and provide residents with educational information about the benefits of modifying solid waste management in Apache Junction. However, they offered a number of recommendations for improving the management of solid waste in Apache Junction (Tables 2 and 3). By implementing such changes, Apache Junction may be able to reduce the number of solid waste complaints it receives, and provide its residents and visitors with a healthier environment.

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SCHOOL OF PUBLIC AFFAIRS

509 PUBLIC AFFAIRS
CAPSTONE
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Policy Pathways to Sustainable Solid Waste Services

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INTRODUCTION

Apache Junction is at a crossroads in regards to its solid waste management for residents. Should the city continue its status quo of Free Dump Week and optional private solid waste services? Should it mandate that residents enroll in weekly collection? If so, what is the best way to go about this, in terms of cost, public support, and regulatory requirements? The city has the opportunity to shape how it works, looks, and serves its population in the future. The students of PAF 509: Public Affairs Capstone in the School of Public Affairs at Arizona State University set out to help Apache Junction determine the best path forward. This report describes the methods the students used and their results.

The five students involved in this report worked independently and each generated his or her own findings and recommendations, as this was the capstone project for their master's degrees. However, their research methods overlapped. All reviewed relevant literature and the practices of comparable cities. A few of the students researched relevant case studies and benchmarked Apache Junction's services. One student also conducted a survey with residents of Apache Junction. Using these methods, the students defined Apache Junction's context, its existing practices, and strategies for more sustainable solid waste management.

Through this project, the city wanted to better understand the position of its current solid waste management practices, and be presented with alternatives. Accordingly, each student generated findings and recommendations, among which were: 1) discontinuing Free Dump Week, 2) joining another city in contracting a solid waste provider for mandatory weekly pickup, and 3) implementing a pay-as-you-throw (PAYT) solid waste service. An additional element was recycling. Importantly, it is up to Apache Junction to identify which report and strategy aligns best with its interests, or how to combine these results into a cohesive plan. All students recommend conducting further surveys and cost-benefit analyses prior to pursuing any of these.

The remainder of this Policy Pathways to Sustainable Solid Waste Services section of the report explains the methods used by the students, as well as their findings. It then delves into the most promising strategic recommendations. The report wraps up with areas for further exploration and a concise conclusion, followed by select student reports in their entireties.

PROBLEM

There is momentum in Apache Junction for a change in solid waste management strategy. However, it is unclear if the city's hands-off solid waste management style is sufficient to meet the needs of a growing city, or even strongly preferred by residents. Solid waste challenges will be exacerbated as the city population increases, which it is predicted to do. Further, the city's quarterly Free Dump Week may violate county and state regulations. Finally, at its current rate of input, the Apache Junction landfill is slated to close in 2035. While Apache Junction is aware of these dilemmas, it is uncertain what strategic change would most fit, and benefit, the residents and the city.

METHODS

To better understand and confront the solid waste challenge, students in ASU course PAF 509: Public Affairs Capstone used literature review as their primary research method. Under the guidance of Professor Goggin, they evaluated and compared Apache Junction's management practices and those of other cities. The policy and practice reviews helped the students identify or reflect upon potential strategies for Apache Junction to implement. One student also conducted a survey, which is a qualitative, human-centered research method. His survey, though limited in scope, revealed possible trends in the solid waste practices of Apache Junction residents, and their perceptions of different solid waste strategies.

Before conducting their research, students identified background issues to explore, but also specific questions they wanted to answer. An example of such questions identified by one student was:

- "Is there value in entering into a cooperative service agreement with the Town of Queen Creek and its current solid waste service provider to provide solid waste service?
- Would a cooperative service agreement allow for significant cost savings and increased efficiency in program development and implementation?" (Pruitt report page 7-2)

The research methods they used to answer their questions are explained next.

Literature Review:

Literature review requires compiling and analyzing information and data on, or related to, a specific subject. In this case, literature does not mean novels or plays, but rather the broad scope of written work on a specific topic. For this report, the students reviewed academic papers; class lectures; online posts; city resources; and educational and regulatory materials produced by city, county, state, and federal governments. Case studies were a specific type of literature focused on by several students. They are in-depth analyses of particular situations or decisions. For example, one case study examined a pay-as-you-throw solid waste system implemented in a small Greek city. Literature review can be a general or structured research method. Some students used a comparative method structure to extract information for their recommendations. The specific literature review methods used for comparison are detailed below.

Case studies are in-depth analyses of particular situations or decisions.

Quantitative comparison: In contrast to qualitative research methods, which focus on non-numerical information like answers to interview questions, quantitative comparison analyzes numerical data. One student used this method to compare and contrast the makeup and solid waste fee structures of peer cities.

Benchmarking: This research method pulls data from case studies and quantitative comparison to measure something, such as the solid waste management of a city, and then compare it with that of similar groups to get a sense of where the first stands and how it could be improved. In this case, a student focused on measuring the solid waste management programs of Apache Junction and similar cities. The student compared types and levels of solid waste services that various cities offered (Table 4), and where Apache Junction falls in this lineup.

Community Engagement:

Survey: One student conducted a survey regarding solid waste management that received answers from 22 members of a citizen engagement group of Apache Junction residents (Benedict report, page 4-1). He compiled the results and analyzed this data for insight

A COMPARISON OF THE SOLID WASTE PROGRAMS OF BENCHMARK MUNICIPALITIES

	Buckeye	Queen Creek	Fountain Hills	Goodyear
Provider	Republic Services	Right Away Disposal	Republic Services	Waste Management
Trash	Once/week	Once/week	Once/week Optional twice/ week	Once/week
Recycle	Once/week alternate day from trash	Once/week same day as trash	Once/week same day as trash	Once/week same day as trash
Bulk	Once/quarter on schedule	Once/month by request	NA	Once/month on schedule
Household Hazardous Waste	Anytime by appointment	Via Town of Gilbert through a voucher program (20 vouchers/ month first come first serve)	Will be implementing HHW events	Twice/year at special event
Exemption Allowed	NA	Yes, if large lot with livestock	NA	NA

Table 4. This table compares the solid waste services of four municipalities a student researched for her benchmarking method (Kirkland Chapell report, page 5-10).

into existing practices and how mandatory pickup is perceived. While acknowledging that this was a small survey pool, the results provide a baseline measurement against which future data collection can be compared. The questions he asked are presented in Figure 6.

SURVEY QUESTIONS POSED BY ONE STUDENT RESEARCHER

1. Which of the following best describes your current solid waste preferences?
2. If so, which provider do you use for solid waste services?
3. Overall, how satisfied are you with your provider?
4. How interested are you in receiving weekly, street side recycle pickup?
5. How interested are you in receiving weekly, street side solid waste pickup?
6. How interested are you in having solid waste services be provided by the City of Apache Junction?

Figure 6. These are the survey questions one student posed to participants from an Apache Junction citizen engagement group (Benedict report, page 4-5).

FINDINGS

Using literature reviews and community engagement, the graduate students in PAF 509 generated important findings regarding Apache Junction's existing solid waste management practices. Insight collected from the community indicates that residents do not rely primarily on Free Dump Week for waste disposal and are not opposed to weekly pickup of solid waste and recycling. Literature reviews demonstrated that Apache Junction's Free Dump Week is likely violating city and county codes related to hauling solid waste. Further, the students found that the makeup of Apache Junction—including its population size and demographics—defines what strategies the city should consider, specifically a shared service agreement with a neighboring city and a pay-as-you-throw system. Finally, they determined that Apache Junction should consider strengthening its recycling options.

Community Insight

According to one student's survey, **a high percentage of residents already subscribe to private weekly solid waste pickup services** (Figure 7). **In contrast, self-hauling is not highly utilized.** Further, his survey revealed that **participants support recycling service and curbside solid waste collection services** (Figure 8). However, the question with the highest negative response was "How interested are you in having solid waste services be provided by the City of Apache Junction," which likely indicates that **they are likely already satisfied with their existing private service providers** (Figure 9). While these results are helpful in determining what strategy Apache Junction should pursue, they should be interpreted with caution, because this survey had a low response rate. To verify the broader implications of the findings, Apache Junction needs to gather information from more of the neutral respondents, or try to replicate the survey on a larger scale. (See Benedict report, starting page 4-1, for details.)

Dumping

Apache Junction should reconsider its Free Dump Week because it already may not be highly valued by its residents, but also because it is violating numerous city and county codes. Specifically, **Pinal County's Environmental Code, Regulation 6 says that no person shall haul solid waste without a permit to do so** (with some exceptions for other types of compliance). **Maricopa County, which part of Apache Junction lies in, also requires haulers to have a permit, and does not make exceptions for self-haulers.** Further, **Apache Junction itself mandates in its Chapter 9, Article 2, Section 2 in Ordinance 1255 that it is "unlawful for any person to haul … [solid waste] unless it is contained in watertight vehicles or receptacles."** The State of Arizona and Pinal County have similar codes for vehicles hauling solid waste. (See Benedict report, page 4-6 for details.)

It is "unlawful for any person to haul … [solid waste] unless it is contained in watertight vehicles or receptacles," according to Apache Junction Ordinance 1255.

SURVEY RESPONSES REGARDING: CURRENT SOLID WASTE PRACTICES

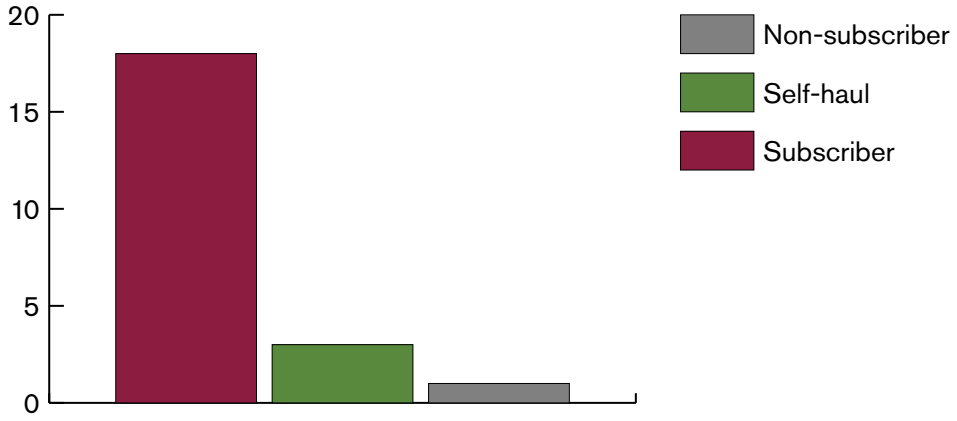

Figure 7. Solid waste practices of 22 surveyed Apache Junction residents.

INTEREST IN CURBSIDE PICKUP SERVICES

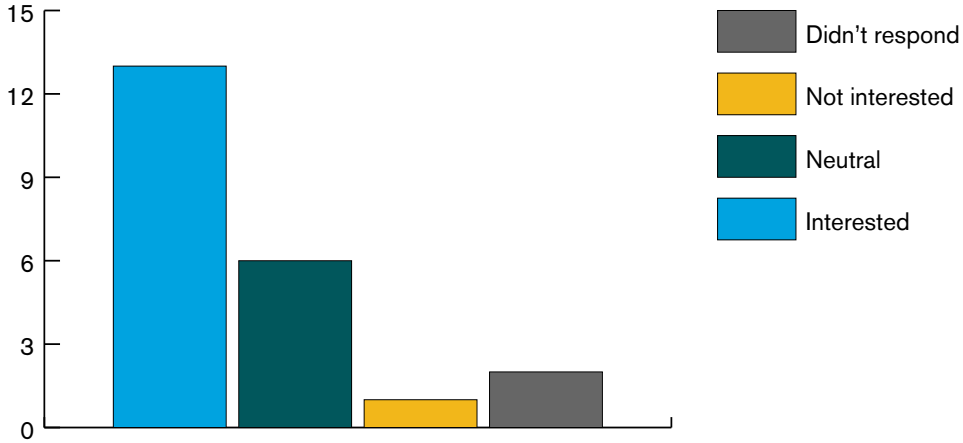

Figure 8. Level of interest in curbside recycling pickup service of 22 surveyed Apache Junction residents.

INTEREST IN APACHE JUNCTION PROVIDING CURBSIDE PICKUP SERVICES

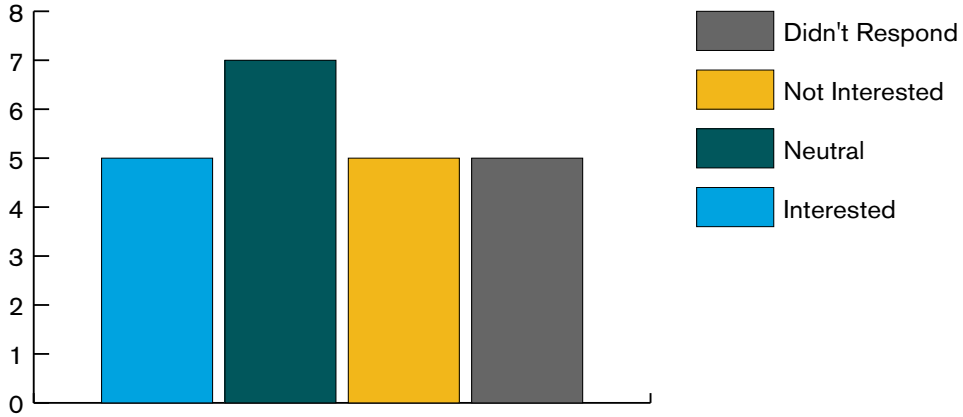

Figure 9. The level of interest expressed in Apache Junction providing curbside solid waste pickup of 22 surveyed Apache Junction residents (Benedict report, page 4-1).

In conflict with these regulations, Apache Junction offers its residents four Free Dump Weeks each year during which they can bring one truckload to the landfill for free. It is likely that related regulations are not being enforced during this week. Therefore, **the city may be violating state and county law, and providing unfair incentive for self-haulers to do the same.**

Choosing Management Strategy

The demographics and size of Apache Junction played an important part in determining how to proceed with solid waste management. **The median age of Apache Junction residents is 50.9 years, which indicates that the population is less likely to self-haul waste or recycling than a younger demographic.** However, the size and organizational structure of the city implies that providing solid waste and recycling services with in-house resources is not viable or even desirable. **Other cities of similar size to Apache Junction, used contractors to perform mandatory pickup services**, unlike larger cities in the Phoenix Metropolitan area, which did everything themselves. **A sole third-party contract for waste management services may also be better than a city-run service for Apache Junction because of its unique location and seasonal fluctuations in population**.

Service Options

Currently, **residents of Apache Junction pay the same monthly rate for private solid-waste pickup as residents of other cities for city-provided solid waste services, but receive fewer benefits.** The average monthly fee for curbside solid waste and recycling pickup and periodic bulk pickup is $20.38 per month in Phoenix and its ten largest suburbs. In Apache Junction, the current rate for new Waste Management customers is $20.16 per month for a household, which only includes twice-weekly curbside pickup for solid waste, and does not include recycling or bulk waste services (Sederstrom report, page 6-12). When compared with monthly fees of municipalities of similar size to Apache Junction, this is actually higher than average (Table 5).

MUNICIPAL REFUSE FEE COMPARISON

Municipality	City of Buckeye	Town of Queen Creek	Town of Fountain Hills	Average
Monthly Fee	**$20.38**	**$16.22**	**$15.37**	**$18.30**

Table 5. A comparison of municipal refuse fees of other nearby Arizona municipalities (Pruitt report, page 7-17.)

This demonstrates that centralized, city-run management systems allowed for comparative cities to provide equal or better service, due to economies of scale in waste management and collection. However, this does not mean that Apache Junction needs to provide the service itself, or even independently contract a provider for mandatory services. Instead, **the city should consider entering into a shared agreement with another city**. The student who explored this concept, found that **other municipalities with shared services agreements experienced increased revenues and cost savings** (For details see the Pruitt report, page 7-1).

One town to consider for a shared service contract is Queen Creek, which has a contract with monthly refuse fees that are below the market rate. **Entering into a contract with Queen Creek would allow Apache Junction to offer its residents increased services at compelling rates.** This would also mean that **Apache Junction officials wouldn't have to duplicate the process of bidding and awarding a new service contract**—while its procurement code requires offering service contracts to the lowest responsive and responsible bidders, there is a provision in this code that allows the city to take approaches that align with cooperative service agreements. An important part of entering into a shared agreement is realizing that it aims to meet the needs of both communities, which may become a source of conflict. To counter this, Apache Junction would need to understand the long-term costs and revenue associated with the agreement (and there is a chance it could pose an initial cost increase). Further, an important part of entering any shared contract is a well-conceived exit strategy, in case the agreement doesn't work as planned.

Typically, municipalities charge residents a standard monthly fee to pay for solid waste services. That fee structure works well when cities have stable population levels. However, Apache Junction's population fluctuates seasonally. Consequently, **Apache Junction may want to consider allowing seasonal residents to suspend services as needed.**

A pay-as-you-throw fee may also be worth considering. Pay-as-you-throw models charge residents only for the weight of the waste they dispose. However, the model poses logistical challenges in measuring the amount of waste to charge accordingly—either the trucks or waste bins would need to be equipped to measure the waste's weight upon collection. In the case of apartment complexes, it may also be difficult to hold any one resident accountable for waste, in which case, the total would need to be divided between all residents. According to the student who explored this option, the added cost of infrastructure for pay-as-you-throw could be offset by the cost savings of decreased waste, as residents would have incentive to generate less. If there is significantly less waste generated, Apache Junction Landfill may be able to stay open longer, postponing costs associated with its closure. (See Sederstrom report, page 6-1, for details.)

Recycling

According to EPA estimates in 2014 regarding per capita waste generation in the United States, **the residents of Apache Junction produce over 86 tons of solid waste annually.** As mentioned, one way to extend the lifetime of the Apache Junction landfill beyond its estimated closure in 2035 may be to decrease per capita waste through a pay-as-you-throw fee structure. However, **the most effective way to reduce municipal waste and its environmental impacts is recycling,** which keeps reclaimable materials from being discarded in the landfill. Recycling is also a general component of forward-thinking sustainable solid waste management. One way to get residents to recycle is mandated recycling pickup. According to a survey one student consulted as part of a literature review, nearly half of respondents with negative attitudes toward recycling felt this way because the practice was perceived as inconvenient, largely because of lack of proximity to a

recycling bin. Economic incentives, like deposit refund programs, have also been found to be most persuasive for those not already interested in recycling. A bill credit for recycling is one option, which could be justified by the value of recycling in extending the life of the landfill. Somehow, waste diversion must be a part of Apache Junction's waste management plan if the city is to postpone the projected costs of closing the landfill, which could be borne by Apache Junction residents in the form of rate increases.

RECOMMENDATIONS

After examining their research findings, each student generated his or her own recommendations for Apache Junction. Every student determined that the city should mandate solid waste pickup and use a private service provider. However, the specifics of how the city should implement the mandate were approached differently by the students. Suggestions included contracting a service provider, entering a shared service agreement with a neighboring city or town, and instituting a pay-as-you-throw fee for collection. Further, one student emphasized ending self-hauling of waste in the city for legal reasons, and another pointed out the financial and sustainable benefits of recycling as well as solid waste management services. Accordingly, while these recommendations are useful to the city, since each student approached the project from a different angle, their recommendations are not directly aligned with each other.

It is up to Apache Junction to determine which of these recommendations seem most applicable and beneficial. When implementing them, Apache Junction should proceed with care. Each recommendation requires the city to collect further input from residents and explore costs and benefits in more detail. This section presents paths for the city to consider, but it is up to Apache Junction to further define which is best for its constituency, budget, and future.

Eliminate Free Dump Week

1. Eliminate Free Dump Week, since it creates legal issues for the city regarding self-hauling of solid waste.

Provide Solid Waste Services

1. Continue a phased approach to changing solid waste services policy, as there appears to be widespread support behind curbside solid waste and recycling services.
2. Outsource curbside solid waste and recycling services for mandated weekly solid waste pickup. This will allow the city to manage and monitor waste production and logistical details, and get better rates for residents through the economy of scale, while preventing the need to purchase expensive collection and maintenance materials.
3. Consider entering into an intergovernmental agreement with a neighboring municipality, using either a new service provider or the municipality's existing service provider.
    a. Specifically, City of Apache Junction officials should approach the Town of Queen Creek to discuss entering into a shared service agreement with Right Away Disposal, the Town of Queen Creek's current solid waste service provider. A key emphasis should be on a mutual reduction of the current contracted service fee.
    b. In developing the shared service agreement, both parties should work to mitigate possible challenges by developing strong relations, involving all stakeholders, thoroughly planning implementation, and creating backup exit strategies.
4. If a shared service agreement is not of interest to Apache Junction, it should consolidate solid waste services providers through a request-for-proposal process.
5. When determining service, the city must keep residents' budgets and needs in mind, to determine what services and frequencies will be satisfy both.
6. For solid waste pickup, consider a pay-as-you-throw rate structure rather than a flat fee, using vehicle measurement of waste at the collection point. (To implement pay-as-you-throw for multiuser bins at multi-family sites, it would likely be preferable to divide the cost equally among users).
7. For household hazardous waste (HHW) services, analyze the potential for cost savings associated with a shared service agreement. (For example, the Town of Queen Creek has a shared

HHW service agreement with the Town of Gilbert). If a shared service agreement for HHW is desirable, Apache Junction should consider entering into an agreement with the City of Mesa.

8. If shared service agreements are pursued, the city should make outreach efforts to explain the benefits and goals of such strategies.

Encourage Recycling

1. Implement a mandatory recycling program with curbside collection, as well as an incentive for participation.
2. To improve recycling participation rates, undertake an education and information campaign to facilitate resident understanding of the need for recycling and waste diversion.

Data and Support

1. To determine if these recommendations are indeed accurate, the city should also attempt to replicate the survey to gather a more representative data sample.

AREAS FOR FURTHER EXPLORATION

Little is known about Apache Junction residents' solid waste management practices or preferences. More data needs to be gathered if a new system is to be implemented. The student who conducted a survey for his project reported informative results regarding current solid waste practices and residents' openness to change, but his participants belonged to an Apache Junction citizen engagement group, and low survey response rates decrease its ability to represent majority viewpoints in Apache Junction. As community engagement and education will be important in determining the best solid waste management system for Apache Junction to adopt, conducting a more extensive survey is highly recommended. To do so, the city should survey a more representative sample set of residents. A computerized statistical

As community engagement and education will be important in determining the best solid waste management system for Apache Junction to adopt, conducting a more extensive survey is highly recommended.

data analysis tool such as Stata will help city leaders understand the results. The larger survey could also be used to identify desirable scopes of service for vendor proposals and agreements. (See an example in Kirkland's report, page 5-ii.)

Related to strategies the students proposed, the city should further analyze the potential for cost savings through a shared service agreement before moving forward with this option. To do so, officials can review previous such agreements, and see what the average potential cost savings is. Doing so will help officials negotiate a fair fee for shared contractual waste services. There is also a need to better understand how landfill services will be incorporated into the agreement. This could be negotiated with the existing service, but other options can be considered (Pruitt report, page 7-19).

CONCLUSION

Apache Junction has unique demographics that should inform how it pursues solid waste management. However, this should not prevent the city from ensuring its residents get the best services. For their capstone projects in PAF 509: Public Affairs Capstone, five graduate students conducted independent research and, based on their findings, recommended strategies the city should consider. These included entering a shared service agreement with the Town of Queen Creek to contract solid waste pickup services, eliminating Free Dump Week to avoid legal repercussions, and emphasizing recycling as a way to extend the life of the Apache Junction Landfill (see Table 6). These strategies are painted with broad strokes and Apache Junction will need to fill in the details through further surveys of residents and cost-benefit analyses before confidently proceeding in one or more of these directions. Setting out from these recommendations, Apache Junction is on the path to a sustainable solid waste management plan that will serve its residents well into the future.

Analysis of the City of Apache Junction's Solid Waste Related Complaints and the City Complaints Management Intake Process

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Abstract

An analysis was conducted of the city of Apache Junction's solid waste complaints from 2015 to current date. The report also reviewed the city's complaints intake and processing system. It was hypothesized that at least half of the complaints voiced to the city would be related to misplacement and poor management of solid waste in residential housing and that there would be an increase of complaints leading up to the "Free Dump Weeks" offered by the landfill in the city. After studying a spreadsheet of city provided data, it was discovered that about half of the complaints were due to solid waste related issues, thus proving the first hypothesis correct. It was also discovered that there was no clear correlation between the "Free Dump Days" and the frequency of complaints submitted. Our analysis of complaints describes geographic areas of the city where the most complaints are coming from. Most of the solid waste complaints are related to residences, with far fewer related to commercial and industrial properties.

When considering the process for submitting complaints, it was hypothesized that the number of complaints and complexity of the data on the spreadsheet were attributed to the accessibility of the website itself. It was discovered that the website was well established in certain areas however the study team identified areas of the website that should be simplified, and improved to make it more concise, easier to navigate and easier to use. Our method for identifying areas for improvement compared other cities' websites and processes and analyzing the discrepancies between the City of Apache Junction's process and other processes within Arizona. This study was conducted so that the City of Apache Junction could improve their systems and therefore streamline the process of analysis to create changes of solid waste related policy in the future.

Table of Contents

Introduction

The incorporated city of Apache Junction is located in south-central Arizona in Pinal County. Arizona State University's Apache Junction Visioning Project in May of 2016 reported that the city of Apache Junction housed 35,838 residents in 2010, and the largest percentage of its population was between the ages of 65 and 69 at about 9%. It was also found that in 2010, the percentage of white residents was 89.5%, and the second highest population group is Hispanic. The report also reflected that between 2010 and 2014, 34.7% of the residents older than 25 had high school diplomas. This report showed that the city had a median income level of about $36,771 in 2014. The wages are lower than the whole of Pinal County and Arizona, which had a median income of $50,248 and $49,928, respectively (ASU, 2016). It is important to understand the residential demographics for this area because it can shift the approach the city makes when contemplating policy changes.

The information presented on Apache Junction's website states that the city does not provide residents with waste collection services. This leaves the residents with the options to either hold onto their waste until they take it to the Apache Junction Landfill during the quarterly Free Dump Week (Free Dump Week), or pay for one of three companies to provide them with waste removal services. The three waste service companies available are Republic Services, Right Away Disposal and Waste Management. The issue that arises within these two options is that many residents choose to participate in the Free Dump Week instead of pay for a waste removal service. Some residential properties have waste piles that have accumulated for more than six months. Understanding the cost-to-benefit data of paying for a waste removal service versus partaking in the Free Dump Week could change the behavior patterns of the residents. Figure 1.1. shows the type of solid waste related problems that are present within the City of Apache Junction.

Figure 1.1. shows selected street views in Apache Junction. These pictures demonstrate three types of solid wastes within Apache Junction complaint system: outside waste, waste matter and household waste. The pictures show the extent of some of these issues in 2017. The practice of solid waste accumulation creates an eyesore within the community and poses potential safety hazards. It is clear that residents within Apache Junction are aware of these potential risk factors due to the content of the complaint narratives. The purpose of this report is to suggest improvements in solid waste related policies that will benefit the city and its inhabitants by analyzing the city of AJ's submitted complaints and its complaints system.

Focusing on solid waste related complaint data from 2015 to 2017 can help the city gauge where and why the city needs to make adjustments in order to improve the overall livability and cleanliness of the area. Critiquing the process of filing complaints and suggesting areas of improvement will help the city more easily gain information regarding the solid waste complaints, so that they can continue finding ways to improve the standards of the city.

Figure 1.1. Solid waste in front of Residential Space.

Complaints Analysis 1 - Types of Filed Complaints

The city of Apache Junction provided complaint data since 2010 and a document containing some complaint narratives. According to the complaint data, over fifteen thousand complaints have been submitted since 2010 and over half of them were related to solid waste. Within the complaints filed since 2015 specifically, there were 1455 complaints dealing with solid waste alone. The complaint narratives file showed the true extent of residents' issues.

Within years 2015, 2016 and 2017, a total of 1455 complaints related to solid waste were submitted: 789 complaints in 2015, 360 complaints in 2016 and 306 complaints in 2017. Approximately 75% of the complaint types were described as "Outside Storage" (see figure 1.4). In 2015, 95% of the total complaints were related to solid waste (see figure 1.1). In 2016 and 2017, 64% and 41% of complaints were attributed to outside storage, respectively (see figure 1.2 and 1.3). The files of complaint narratives indicated that outside storage related complaints include vehicles, bulk furniture, large appliances, and other miscellaneous household waste. The figures showed that over the years residents are consistently participating in negligent behaviors when it comes to managing large waste. In 2014, the city of Apache Junction stated that Free Dump Week allows people to bring only one pickup truck bed full of waste per household. If this still remains the case, a problem arises: residents are likely accumulating large waste outside in higher volumes than they are allowed to dispose of for no cost during Free Dump Week. An increase in the no-cost volume of waste may decrease residential complaints. It is also important to educate residents about the existing city code prohibition on excessive outdoor storage.

In 2016 and 2017, there was a rise in complaints matching the term "Waste Matter." In 2015, no complaints were categorized as waste matter. In 2016, 24% of complaints were described as waste matter; and in 2017, 53% of the complaints were waste matter related (see figure 1.2, and 1.3.). The term waste matter may refer to problems that are similar to the problems related to the term outside storage. The vagueness of the two terms makes it difficult to analyze distinctions between these two types of complaints. The only other information that can be gathered about this complaint description is that it can be also associated with improper dumping on a curb or storage. The phrasing of "waste matter" implies that the materials being left are no longer under residential possession. This means that dealing with this material requires the city to try to find out who dumped the material and then to properly dispose of it.

Figure 1.1. Sorted and Analyzed Complaints from 2015

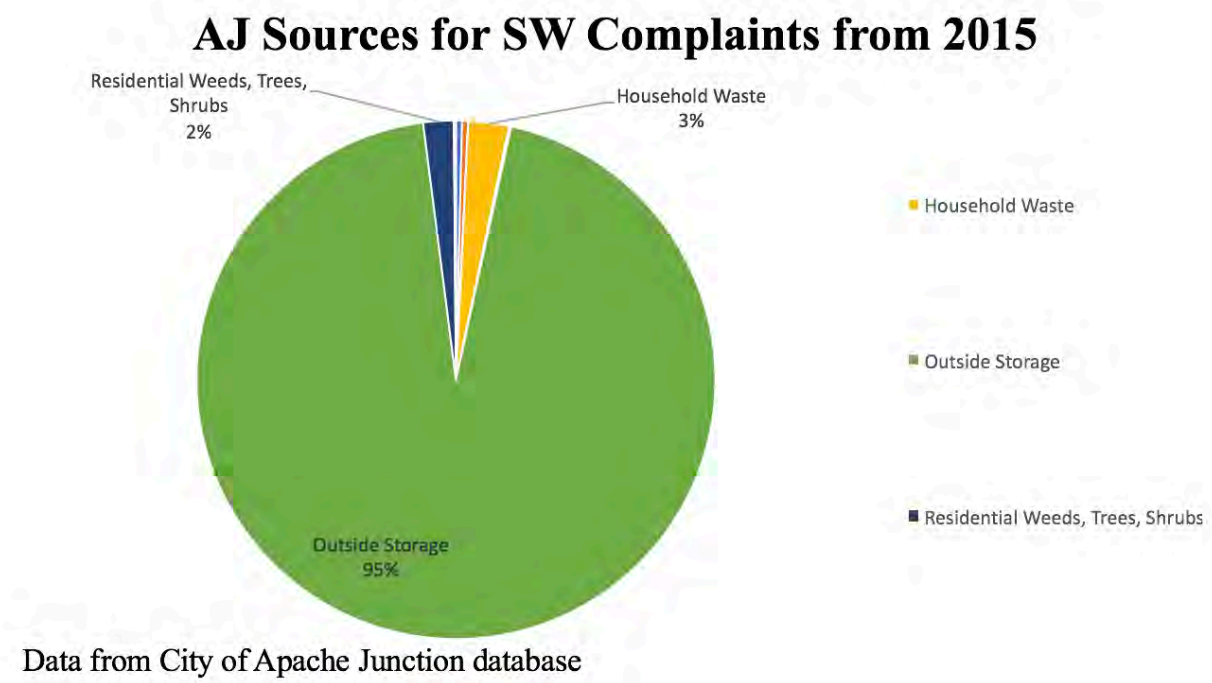


Figure 1.2. Sorted and Analyzed Complaints from 2016

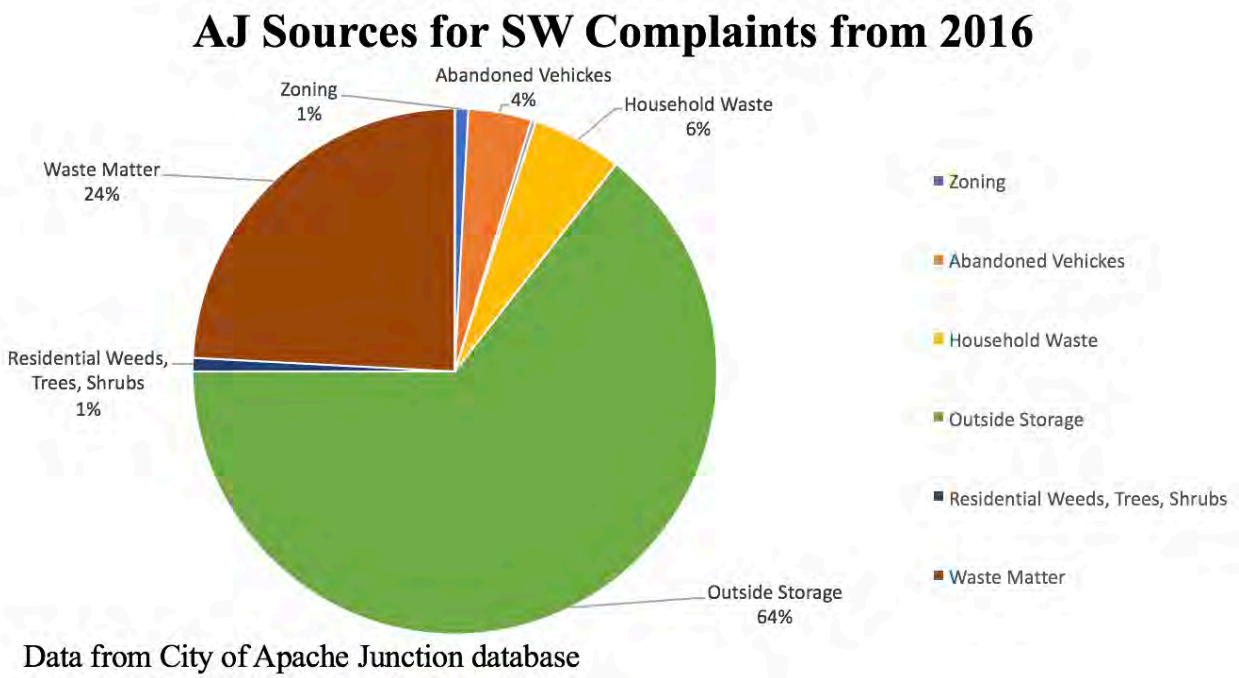


Figure 1.3. Sorted and Analyzed Complaints from 2017

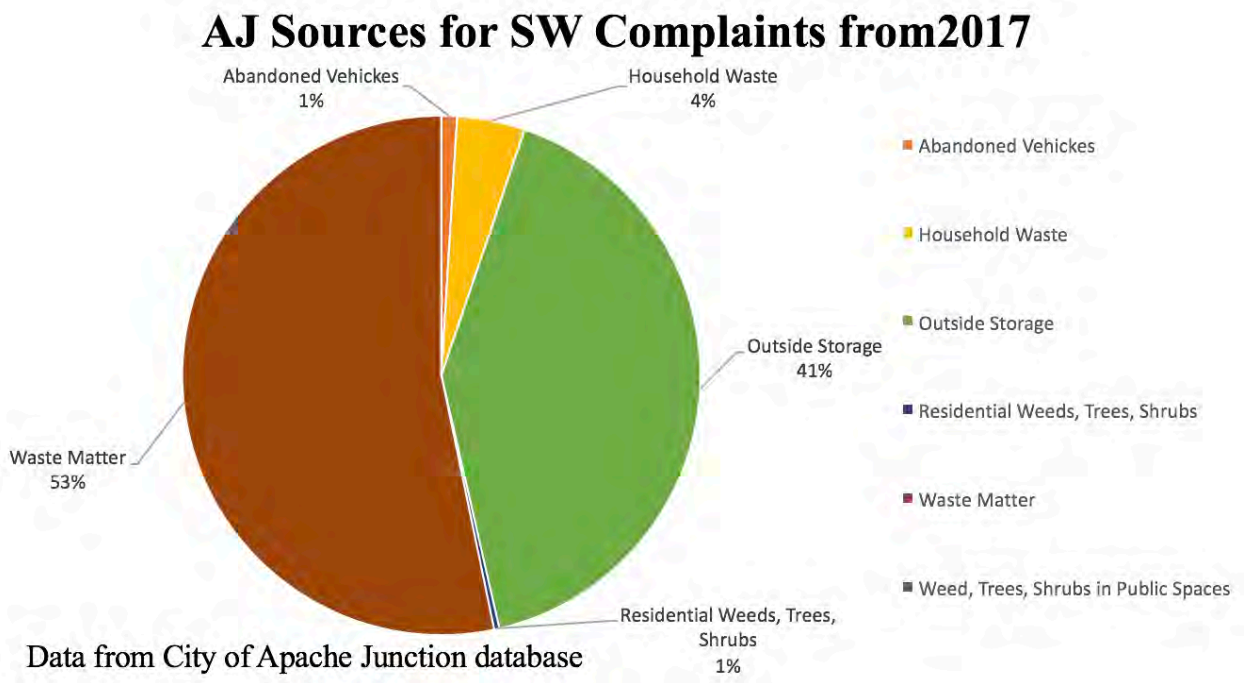
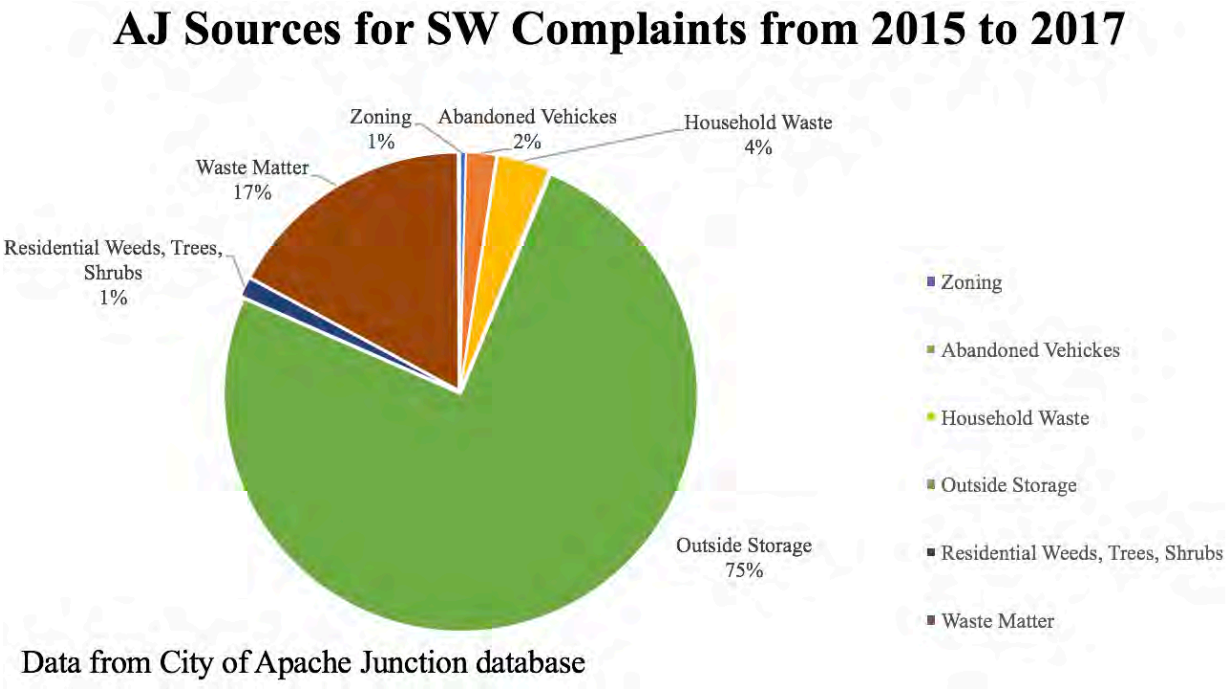


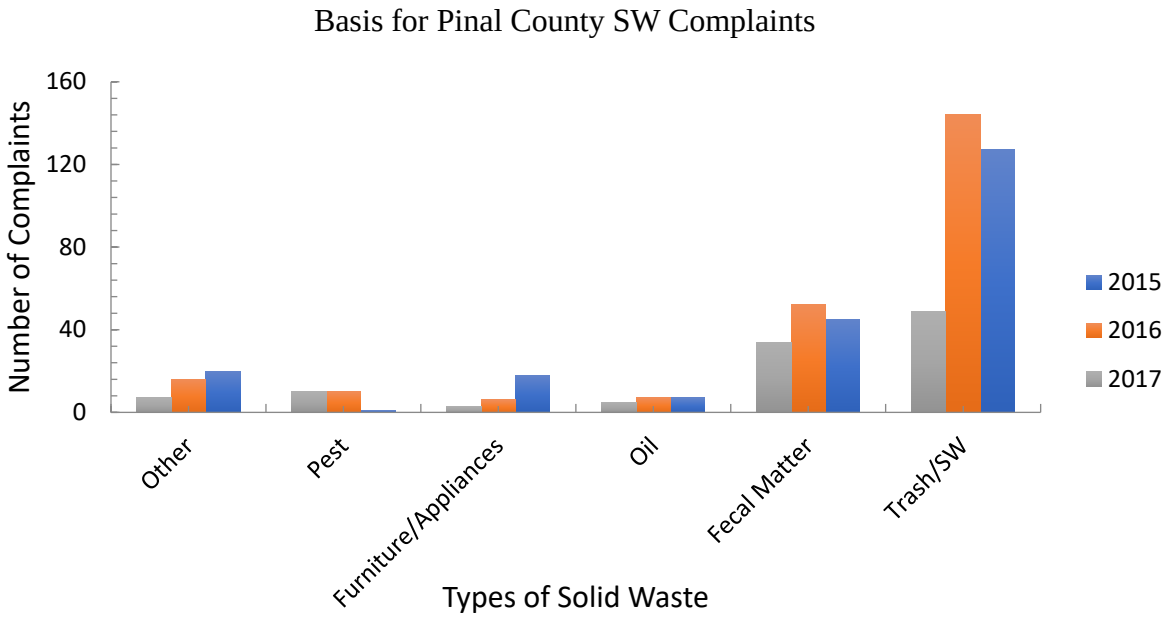
Figure 1.4. Sorted and Analyzed Complaints from 2015 to 2017



The smallest percentages of complaint descriptions received by Apache Junction are the most specific ones: abandoned vehicles, weeds at residential properties, weeds at public properties, household waste, illegal dumping, zoning and business storage. We were unable to determine how many of the complaints classified as “waste matter” were related to residential properties.

The Pinal County Public and Environmental Health Department also provided solid waste related complaints for the years 2015, 2016, and 2017. These complaints were categorized into five groups, which were displayed in Figure 1.6. A majority of the complaints were associated with solid waste. Year 2016 had the most complaints related to solid waste. Thus, both city and county compiled complaints show that solid waste issues are the highest environmental and public health concerns on the minds of the persons who filed the complaints.

Figure 1.6. Pinal County Monthly Solid Waste Complaints (original data are in Appendix I)



Complaints Analysis 2 – Location of Filed Complaints

A geographical analysis of the complaint data was performed for city of Apache Junction in order to offer an easier visualization of locations of complaints. The Apache Junction Code Enforcement Office provided solid waste complaints data for the years 2015, 2016 and 2017. Figures 2.1, 2.2, and 2.3 reflect the locations of solid waste related complaints in 2015, 2016 and 2017, respectively. One trend consistent among the results from all three years is that a significant portion of the complaints are stemming from the area north of West Southern Ave and southwest of West Old West Hwy. In 2015, the locations of filed complaints dispersed in selected territories without obvious trend, but the locations of filed complaints became more concentrated in 2016 and 2017. The geographic analysis also highlighted that there were more complaints for repeated locations in 2017 than in 2016 and 2015. This indicates that these locations had more severe solid waste related problems than other locations. A possible future use of the maps may be to explore the hypothesis that areas having a high frequency of solid waste complaints also have a higher percentage of households that choose to self-haul their waste in comparison to other areas of the city with lower frequencies of solid waste complaints.

The plotted locations of complaints from the City of Apache Junction in 2015, 2016, and 2017 show that there are specific neighborhoods having repeated solid waste related complaints. This information is important for the City of Apache Junction because it highlights the areas where the city should emphasize code enforcement and public education efforts. This information provides evidence in support of establishing a required weekly waste pick-up service at every property that generates solid waste at least once per week. The information can also be used to plan targeted bulk waste pick-up services and public education.

Figure 2.1. 100 Addresses from 2015 Apache Junction City Complaints

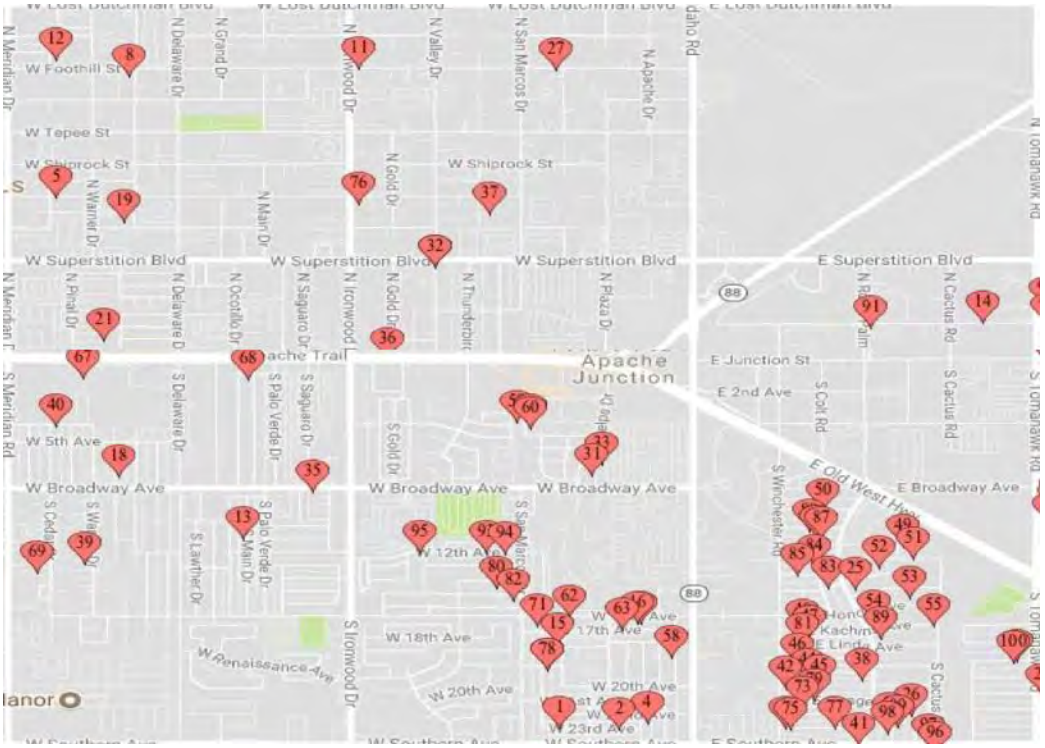


Figure 2.2. 100 Addresses from 2016 Apache Junction City Complaints

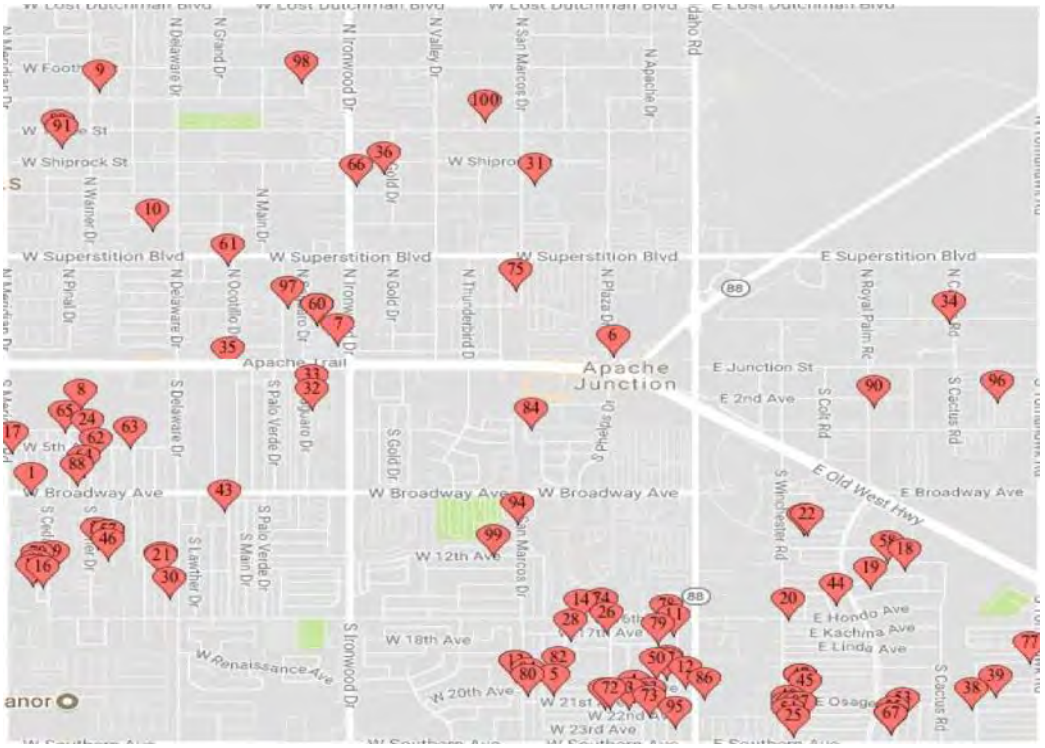
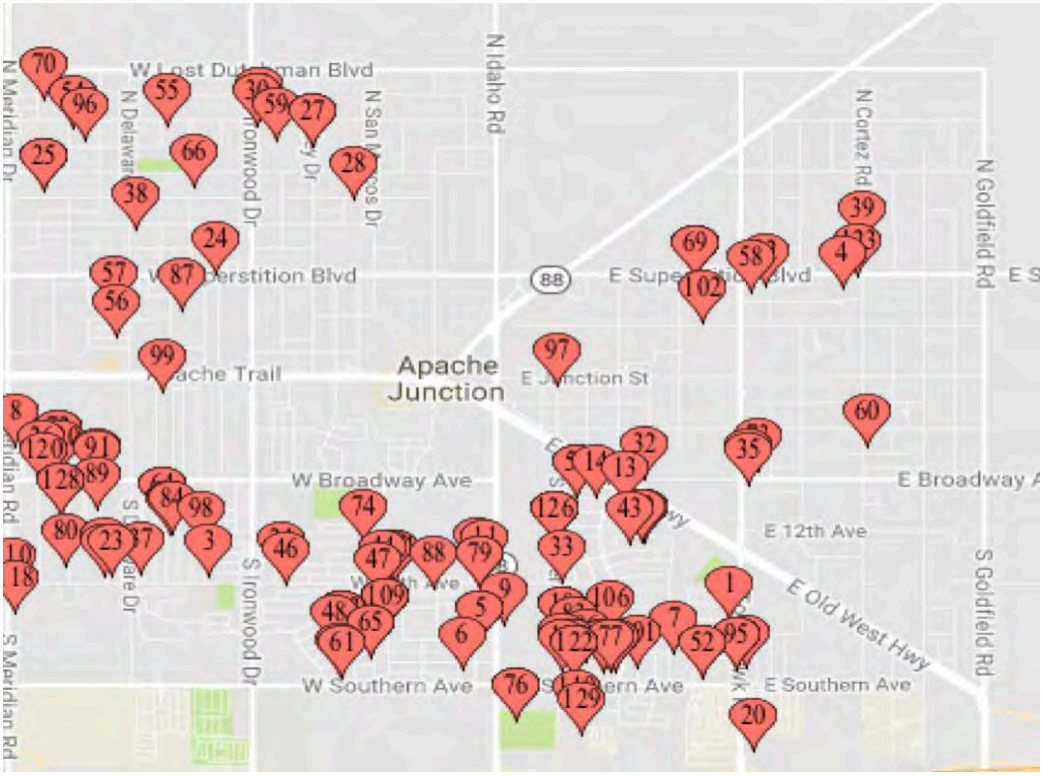


Figure 2.3. 100 Addresses from 2017 Apache Junction City Complaints



Complaints Analysis 3 – Time of Filed Complaints

In the initial analysis of the complaint data compiled by Pinal County Environmental Health Services, it was found that 15% of the solid waste related complaints were within the City of Apache Junction. For perspective, the population of Apache Junction is about 10% of the population of Pinal County. In Figure 3.1., the majority of complaints made were in the month of October in 2015 and 2016, with 7 and 6 complaints respectively. Pinal County receives about three complaints per month on average related to the city of Apache Junction. It can be inferred from Figure 3.1. that complaint volume increased during the winter seasons. This observation can be explained by an increase in population due to seasonal visitors that reside in the city of Apache Junction and Pinal county during the winter.

Figure 3.1. Monthly Complaints from Pinal County Public and Environmental Health Department (data is not available after June 2017)

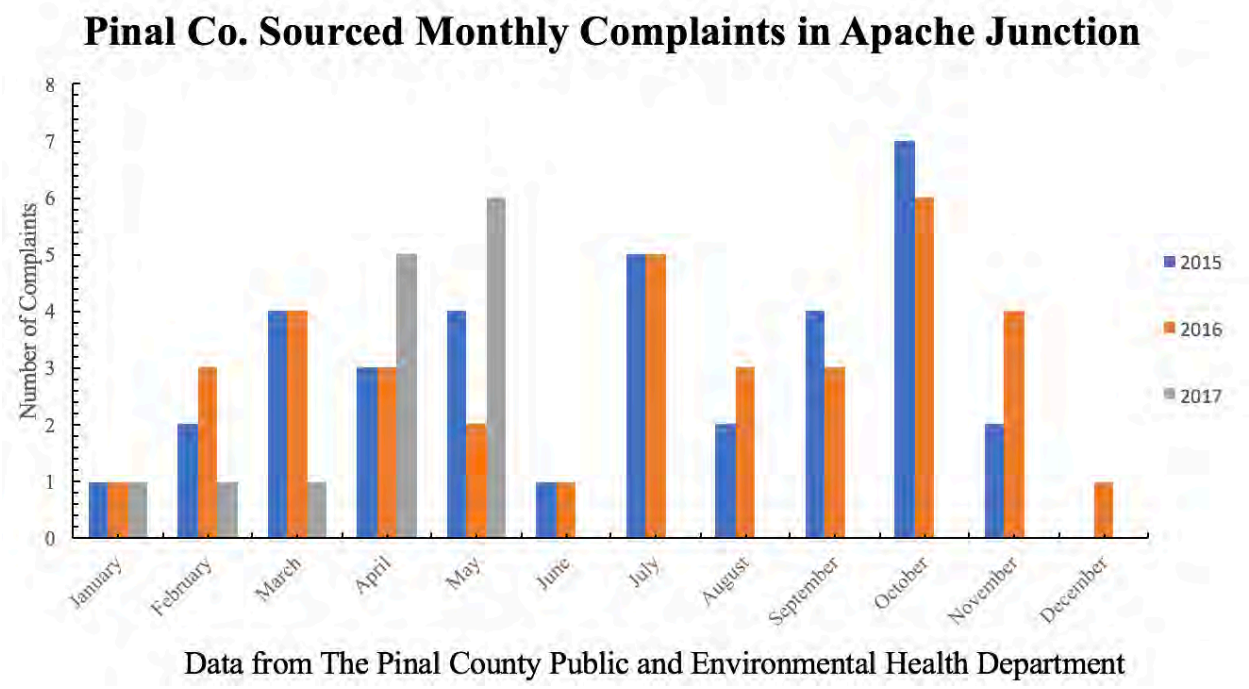
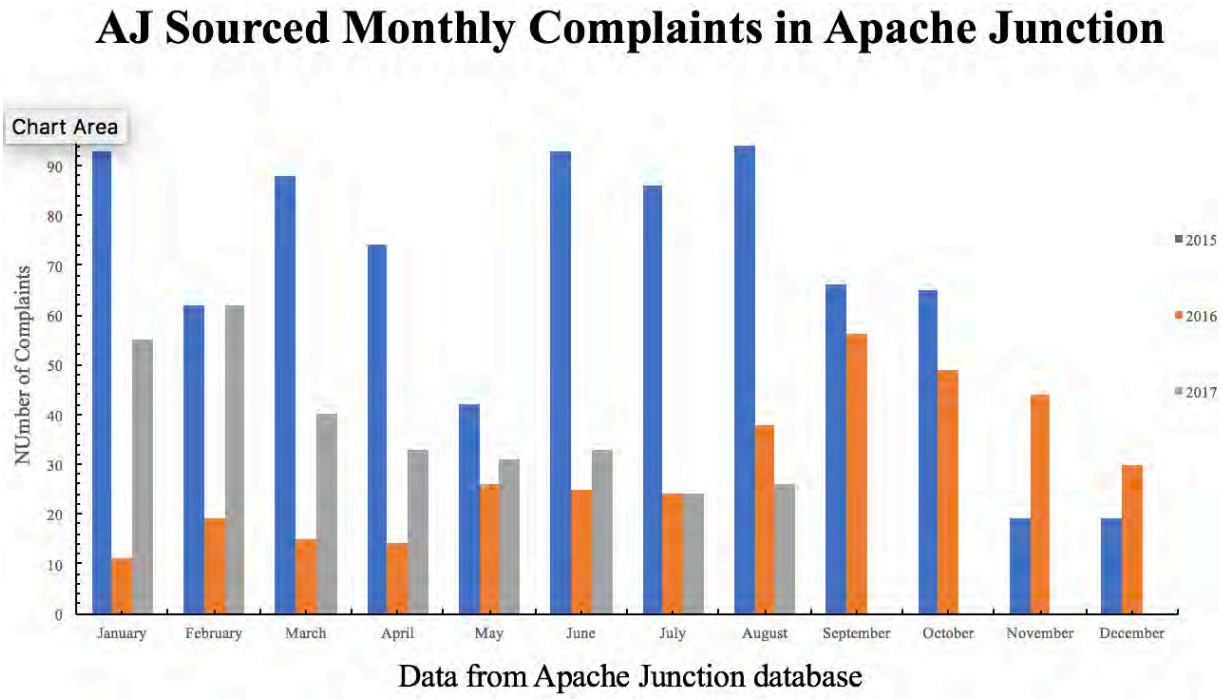


Figure 3.2. is a bar graph that shows the monthly solid waste related complaints from Apache Junction Code Enforcement Office. The amount of solid waste related complaints decreased from 2015 to 2016, but increased in comparison from 2016 to 2017. The variation is most likely due to staffing changes (Kirch, personal communication). The waste complaints, when considering seasons or months, did not show any consistent trends. It indicates that Free Dump weeks, which are the first week in February, May, August, and November, do not reduce the frequency of solid waste complaints. Year 2015 has the most solid waste related complaints (35.1%) among 2015, 2016, and 2017. The month having most complaints was June of 2015 with 93 solid waste related complaints.

Figure 3.2. Number of Monthly Solid Waste Related Complaints for the City of Apache Junction (data is not available after September 2017)



Complaints Management – Benchmarking the Complaints System

In order to understand the efficiency of Apache Junction's complaint filing system, an analysis of the current system was conducted and then a benchmark was created by analyzing other cities' filing systems. The data on Apache Junction's system was obtained by online information derived from first-hand experience with the online process of filing a complaint, information gained from a user experience study for the Pinal County, the Arizona Department of Environmental Quality, and Apache Junction websites, as well as discussions with the City of Apache Junction representatives Larry Kirch and Dave Zellner (personal communication, August 30, 2017).

Pinal County

The Pinal County homepage requires that you navigate to its online services page to report a violation regarding improper disposal or storage of waste. Once on the online services page, the user must select the "More" option to reveal "Other Health Nuisances." It is the only option revealed when selecting "More…," so it makes little sense to conceal it. The Other Health Nuisances option covers many issues such as feral beehives and poor sanitation at permitted

establishments. These issues should be separated from a dedicated “Residential Debris, Junk and Litter” option so that these types of complaints are easier to report.

The complaint form for the Pinal County website does not require an account to file. The form also has an option to request a follow-up phone call or email. These are attributes that would improve the user experience for people that use the Apache Junction website instead.

Arizona Department of Environmental Quality (ADEQ)

The Arizona Department of Environmental Quality offers the most direct path to file a complaint. The only possible issue is that the complaint is not sorted into a category, and it could cause a longer processing time.

Maricopa County Environmental Services Department

Reporting a concern on the Maricopa County Environmental Services Department website is difficult. Under the “I want to… Report” tab there is no option for compliance violations. The Environmental Services Complaint Form is misleading in that it prompts the user to identify a business as the problem. This suggests to the user that there may be another place to file a complaint about a residential location. The Maricopa County Environmental Services website complaints portal should specify that the form will accept complaints about non-business locations.

Apache Junction

Navigating the Apache Junction website is straightforward. Apache Junction does have a dedicated complaint category, but requires an account that must be authenticated through an emailed link. This could limit users who do not have an email account. Alternatively, one can file a complaint by phone. However, the phone number to file a complaint is difficult to find and could easily be listed next to the complaint form. Most organizations prefer that users select an online form option because a phone call requires a person to transcribe the details. We recommend that Apache Junction should adopt Pinal County’s process because it does not require the user to establish an account. The user experience with the Apache Junction website is enriched by its easily navigated code compliance information regarding property maintenance. This type of information is buried among other information on the Pinal County website**.**

There are a couple of issues with Apache Junction’s online complaint system. For example, there is no contact tab on the website that allows for easy and direct contact with the city. One way to fix this would be to add a “Contact AJ” tab, so that residents can have follow-

up communications with city staff. Adding this feature would be important in encouraging residents to verbalize and follow up on complaints. There is also room for improvement when it comes to responses from the city as well. After residents send the complaint, the city sends back a confirmation email, which is a summary of the complaint. In this email, they mention that the expected compliance deadline is at least 14 calendar days from the date of notice. However, it does not mention about how long residents will have to wait until inspectors come. They should put this on the response email to let residents know how long they will have to wait.

In order to fully analyze and critique Apache Junction's complaint system and its processes, a benchmark was created to understand how it compares with other Phoenix-area cities. By researching the City of Avondale, the City of Buckeye, and the City of Mesa's complaint processes, it was easier to gauge where the City of Apache Junction was lagging or excelling. Table 3.1 rates the four different cities Avondale, Buckeye, Mesa and Apache Junction. This table gives users examples of best practices for complaints management by the selected cities.

Table 3.1. Analysis of Apache Junction, Avondale, Buckeye and Mesa Complaint Systems.

	Avondale	Buckeye	Mesa	Apache Junction
Ease-of-use/ Description of Process	Simple, easy to follow online form for complaints. Disclaimer that name/contact information will only be used for follow-up purposes. No description of process after complaint is submitted.	Minimalistic online complaint form. No description of process after complaint is submitted. Option to be anonymous	Have to create an account to file a complaint; this information isn't highlighted well. Description of what happens once your complaint is submitted and many options to check status of complaints	Categorization of compliant is first step, then have to create an account to submit a complaint. Website states that an email will be sent to appropriate city staff to promptly address the issue
Category and Subcategory	6 categories: -Overgrown grass and weeds -solid waste -abandoned vehicle (private property) -outside storage -front yard parking (private property) -Graffiti	0 categories	56 categories 25 subcategories	4 categories 28 subcategories
Extra Features	-Option for person from Code Enforcement to call residents regarding the complaints. -"Other violation" box: allows residents to complain about something not included already in the options -"Upload photo" boxes, maximum 3 photos	-Info about household hazardous waste, landfill, … -Residents can report about illegal dumping	-Phone numbers and email of departments of concerns on complaint page -Residents can pin the violation location on the map	-People can submit suggestions to apache junction about their system without logging in

When looking at other cities' processes, it is easy to compare and adopt certain features with the intention of improving the City of Apache Junction's process of complaint submissions. For example, there is room for improvement when describing the process itself on the website. The City of Mesa offers a clear, step-by-step description of the process for handling complaints listed on their website. Persons filing a complaint with the City of Mesa know what to expect after filing a complaint. Creating a mapping function similar to the City of Mesa's will also allow residents to accurately pin the location of violation. In addition to that, the City of Mesa provides official department phone numbers and emails so that residents have multiple ways to reach out to city officials. The City of Apache Junction could add this feature to their complaint website. However, certain aspects of the City of Mesa's process such as the level of complexity to submit a complaint and a cumbersome website set-up should be looked at as example of what to avoid. The city of Avondale offers helpful features that should be taken into consideration. For example, the complaint form itself is easy to access online and doesn't require a login to submit. This makes the process of filing a complaint simpler since certain steps are avoided and may cause residents to be more willing to go through the process of filing a complaint. Avondale also has an "upload picture" feature. This feature is important because it allows residents to easily show where the issues reside and how extreme they are. This also aids the city because officials know exactly what the violation is. Allowing residents to request that alleged offenders be called by city officials is another unique feature Avondale incorporates. This option ensures residents filing the complaint that the violators will be made aware of the issue and demonstrates to residents that the city is serious about handling complaints. The city of Buckeye also has features that should be considered for adoption by the city of Apache Junction. For instance, access to filing the complaint without creating a login and an added option to remain anonymous may make residents more likely to file complaints because it isn't as confrontational as other processes. It is important to note that although having anonymous complaints filed eliminates the ability to follow up, it may result in more descriptive complaints. One aspect of the city of Buckeye's complaint process that should be avoided is the absence of categories for types of complaints. It is difficult for the city to organize and analyze the narratives of complaints without specific categories.

Conclusions and Recommendations

Our analysis of Apache Junction's complaints and complaint filing process from 2015-2017 highlights areas that should be improved. It also identified areas of successful public service delivery.

Complaint Data Implications

The volume of complaints within the span of three years and the content of complaint narratives implies that the Free Dump Week service is not, by itself, a sufficient measure for adequate solid waste management. From the analysis of complaints data, it can be inferred that residential waste is a recurring concern that needs to be addressed. The mismanagement of solid waste has the highest frequency, thus it requires the most attention. Considering how much waste has already accumulated within neighborhoods and the limited volume of waste allowed during Free Dump Weeks, the documented waste accumulations are not likely to be significantly reduced by the current Free Dump Week policies. It is evident that the city needs make a change in their waste removal processes. Many residents are negligently allowing waste to accumulate on their properties.

Our research group hopes that through this study, the city will understand that the current city solid waste collection policies are contributing to a high frequency of resident dissatisfaction due to excessive accumulations of outside waste. The residents need proper solid waste management to reduce risks to their health and safety. Ideally, city of Apache Junction will require all properties that generate solid waste on a weekly basis to arrange for weekly waste removal. The city should strictly enforce its existing solid waste code sections to eliminate excessive accumulations of solid waste. The city should not rely on the existing Free Dump Week service as a solution to its solid waste management issues.

Complaints Management System

It is important to continue implementing the positive attributes of the website as well as implement solutions that will improve the user experience. The most important attributes for all city government complaint intake website attributes are:

- Ease-of-use: making it simple and quick to file a complaint;
- Description of the process: explaining how the city will respond to a complaint and the subsequent steps in the code enforcement process;
- Ease of access: providing coherent and user-friendly navigation of the website;

- Category and subcategory: giving detailed descriptions of the categories of complaints for persons to select.

For accessibility, it is suggested that the website include a drop down menu for complaint categories. The intended results are to help in the analysis of the complaints and to create less confusion for residents submitting a complaint. In addition, a clear description of the complaint process and follow-up should be added. This could increase the confidence of the complainant in the city's ability to resolve their problems.

The categories for the current complaint page are disorganized. A possible suggestion for improvement in this area would be to allow the user to select a category from a dropdown menu (i.e. development services, parks and recreation, fire department, public safety/police department). Once the user has selected a category, they would be taken to a page displaying the types of complaints in that category. Additionally, it is suggested that Apache Junction should reorganize the complaint page so that sections that are alike are grouped together more effectively (i.e. roadway issues, public spaces concerns, residential concerns).

Our suggestions are intended to make it easier for residents to submit complaints and to increase communication/credibility between residents and the city. Having increased communication and a streamlined processes is beneficial to the city because it gives city officials access to more information that will help resolve complaints quickly. Improvements to the online database will enable a simpler and more accurate analysis of the complaints. Richer complaints data will help city officials conduct studies to develop improved intervention strategies.

We also suggest that Apache Junction should revise their complaint system so that each case/report/complaint in the system can easily be defined in categories in a spreadsheet. Currently each complaint does not have a category and therefore it is difficult to know how many of each complaint type are filed by residents. If the system was revised so that the spreadsheet containing all the cases/reports/complaints is categorized based on each type of complaint, then the City of Apache Junction could create a dashboard showing instantaneous frequencies of each type of complaint.

The Apache Junction complaint system has complaints regarding roadway issues, public safety, development services, and parks and recreation concerns all in one large page combined with the residential and public waste concerns. The City of Avondale has a complaint system that only gives the complainant six options for complaints: overgrown grass or weeds, abandoned or

inoperable vehicle, front yard parking, solid waste, and outside storage. The complaint selections should tie to existing codes or enforceable rules. Apache Junction lists many categories on one page. Each category should have nexus with an existing enforceable code. Categories, like roadway issues, parks and recreation, utilities, development concerns, and public safety, should be on separate pages of the website. The goal of the website design should be to capture complaints of similar nature with nexus to specific codes. The expected results of the recommended reorganization of the complaints web page include enhanced data analysis capability and complaints resolution efficiency.

Recommendations for future research and tasks for ASU students

The following sentences offer suggested research questions and tasks that could be assigned to future classes of ASU students or as specific internship assignments.

A new hypothesis for research is: areas of the city having a high frequency of solid waste complaints also have a higher percentage of households that choose to self-haul their waste in comparison to other areas of the city with lower frequencies of solid waste complaints. If the hypothesis is upheld by additional research, then the information can be used by the city for targeting resources. Possible enhanced resource commitments include public education, bulk waste pick-up, and code enforcement.

Due to the limited scope of the 2017 fall semester project, our data analysis was limited to only the years 2015 – 2017. Sufficient data are available for a retrospective analysis of complaints data going back to a baseline year of 2010. This would allow for more robust statistical analysis because the sample size is much larger.

If the City of Apache Junction decides to propose changing the city code to require weekly solid waste removal, then a future ASU class could be tasked to assist the city during a stakeholder process. This task could include the development of a proposed solid waste code revision for consideration by the City Attorney, City Council, city staff and all stakeholders. Other associated tasks may include assisting city staff with stakeholder meeting planning and during the stakeholder meetings. Educational materials for presentation during stakeholder meetings may be produced.

ASU offers classes in website development and enhancement. A future class project or internship may be to make complaints intake website improvements using some or all of the changes suggested by the findings in this report as a starting point for the project.

ASU appreciates the opportunity to serve the City of Apache Junction in ways that mutually benefit our students and the welfare of the city.

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Environmental Health Aspects Associated with the Accumulation of Trash on Private Property in the City of Apache Junction, Arizona

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Abstract

This report examines the environmental health problems the City of Apache Junction currently faces and will face due to existing solid waste management practices. The city does not require a regularly scheduled waste pickup service, and the local landfill offers four free waste disposal weeks per year (Chhetri, et al., 2016). The current solid waste disposal policy results in the accumulation of trash on private property, which poses multiple and significant health problems to the residents of Apache Junction. This paper discusses the environmental health aspects associated with odors, vector control, air pollution, soil contamination, water pollution, and injury control. Quality of life resident expectations are also discussed. Urban runoff from accumulated trash can carry organic pollutants, oil, debris, and other harmful substances into soils, surface water and groundwater. (United States Environmental Protection Agency, 2003). Uncontrolled solid waste can cause injuries in a number of ways, including lacerations from sharp objects, acute poisoning from toxic substances, back injuries from hauling waste, burns from trash fires, and bites from vermin. The Arizona Department of Environmental Quality and Pinal County Health Department require once a week solid waste collection from all residences in a community. The report recommends modification of City of Apache Junction policies and programs to ensure weekly trash pick up from all residential, business and industrial sites.

Table of Contents

Introduction

Short history on Apache Junction, current resident demographics, purpose of paper

Apache Junction is a city in Pinal county, located 40 miles east of Phoenix. It became a city in 1978, and was named for the junction of the Apache Trail with the U.S. 60 (Apache Junction Public Library, 2017). Apache Junction is a popular place for retirees, and the median age is 50 years old. Today, the city has a population of 39,954, which increased 11.8% from 2010 (U.S. Census Bureau, 2017). As the area prepares for more growth, the city solid waste management system must be updated to keep up with the growing population.

The major reason why Apache Junction needs to update their solid waste program is that no scheduled trash pickup is required by city code (Chhetri, et al., 2016). Although it is not compulsory for residents to use a waste removal service, there are three private companies offering trash pickup services to city residents. They are Republic Services, Right Away Disposal (RAD), and Waste Management (Kirch, L, City of Apache Junction, by personal communication 9-27- 17). Many citizens choose to self-haul their solid waste to the Apache Junction Landfill instead of utilizing one of the private waste hauling services. The landfill is owned by the Apache Junction Landfill Corporation, which is a subsidiary of Republic Service. The Apache Junction Landfill Corporation offers four free trash disposal weeks a year to city residents. Many residents accumulate their trash on their properties until one of the free trash disposal weeks occurs. Some residents accumulate their trash for longer intervals as evidenced by a review of complaint records and observations of city neighborhoods (see Figure 1).

The following report will present reasons why periods of trash accumulation exceeding one week contribute to a degradation of environmental health. The report also provides mitigation methods and possible solutions for city planners and policy makers to consider. The paper briefly examines environmental health aspects related to trash accumulation including odors, soil contamination, water pollution, air pollution, vectors of disease, risk of injury, and aesthetics.

Figure 1. Solid waste accumulated on private property in Apache Junction, Albert Brown, 2017

Environmental Health Aspect 1 - Odors

Introduction of Odors

An odor is a distinctive smell, as a lingering quality attached to something, and it is may be unpleasant. One of the benefits of sense of smell is to alert the subject to potential danger. The human olfactory system detects specific molecules that result in a signal to the brain that is interpreted by the person as a positive, negative or neutral odor. Some vapors of chemicals, when inhaled, have negative effects health such as shortness of breath, headaches, eye irritation, and even death. Offensive smells serve as a warning that something is amiss (Miller, 2005). A bag of garbage smells for a very simple reason. It contains decaying, putrid materials such as food waste and other organic wastes like diapers. Food waste includes meat scraps. As meat decays, it attracts bacteria that feast on the amino acids in the meat's proteins. Vegetable waste rots and slowly liquefies as microbes attack the vegetables' cell structure and the fermenting liquids warm

up the garbage bag (Juutinen, 2016). Noxious odors are classified by the Arizona Revised Statute, A.R.S § 49 – 141, as an environmental nuisance (Justia U.S. Law, 2017).

Oxidative rancidity of fats such as lard, shortenings, salad and cooking oils cause the undesirable odors that develop when such products are exposed to the oxygen in the air. Products containing these fats, including but not limited to food products such as fish, poultry, meat, frozen vegetables, and dry milk, can become rancid when the fats in the products react to air. The polyunsaturated fatty acid portions of these foods react with oxygen to form peroxides. The peroxides decompose to yield a complex of mixtures, including aldehydes, ketones, and other volatile products. These products are responsible for rancid odors (Neel, 2008).

One of the outcomes of overflowing residential garbage is air pollution, the introduction into the air of harmful substances, which cause various respiratory diseases and other adverse health effects as contaminants are absorbed from lungs into other parts of the body. The toxic substances in air contaminated by waste may include volatile organic compounds, toxic chemicals, and substances associated with household waste (Rohrig, 2017). As household trash decays, unpleasant odors are emitted. The chemical compounds causing malodorous conditions are ammonia, hydrogen sulfide, and mercaptans. In everyday life we identify the polluted air especially through bad odors, which are usually caused by decomposing solid and liquid waste items.

Odor Control

Odor control is the removal of a nuisance smell. Many cities in the United States have opted to regulate and ban any kind of accumulation of trash on properties. For example, the city of Charlottesville in Virginia prohibits the accumulation of trash and debris on private property, including but not limited to: garbage, rubbish, trash, paper, ashes, manure, food waste, glass, or even stagnant water (City of Charlottesville, Virginia, 2017). With Apache Junction’s population growing along with the rest of the cities within the east valley, it is important to take this into consideration.

A known method to stop odors associated with storing residential trash is to offer reasonably affordable curbside trash pickup once a week. Weekly removal of putrescible waste prevents the formation of most noxious odors caused by decomposition. The best solution for odor and vermin control regarding trash accumulation would be to require weekly trash

collection and removal from all properties that continuously generate solid waste within the community (Shah, 2000).

The City of Chandler, Arizona and many other Arizona cities also offer a weekly curbside pickup of recyclable materials (City of Chandler, 2017). Curbside recycling may offset the cost solid waste management by the organization performing this vital environmental health service. Recycling saved Chandler $68 per ton over their entire 42.5 million pounds of annually collected trash. This savings allowed the city to offer alternative programs to reduce waste even further. They offered residential composting boxes for no cost to residents to keep many organics out of the landfill. Residents benefited by producing mulch for on-site landscaping and gardening. The city also offered classes on the practice of backyard composting. The City of Chandler places 300 gallon bins for recyclable material in adjacent unincorporated areas. The city also created an internet resource page to inform city residents on how to properly recycle and reduce at the source of residential trash generation (Heumann, 2014).

Recommendation

Unpleasant odors within the City of Apache Junction can be reduced by making it illegal to store household waste on private property and requiring everyone to pay for a weekly waste removal service along with a recycling service. A recycling service can reduce the cost of weekly waste removal service, and there are already two companies providing recycling service in city of Apache Junction. Other recommendations include, placing large trash and recycle dumpsters in unincorporated areas and other problem sites; and offering free adult and children educational classes on reducing, reusing, and recycling materials. Lastly, trash accumulation can be mitigated by offering quarterly bulk trash pickup and increasing the frequency of free waste disposal weeks at the Apache Junction landfill.

Environmental Health Aspect 2 – Vectors

Introduction

A vector is an organism that is responsible for the spreading of disease causing organisms called pathogens. The term “vector” is often mistaken to mean “pest”. A pest includes animals and plants that are annoying or unwanted, while vectors specifically refer to animals that carry pathogens and transmit them to animals or humans. A vector must first contract the pathogen from a host before spreading it to another.

In a general sense, accumulated trash attract vectors because it provides hiding places, nest sites, and travel routes for rodents and insects (Williams, 2012). This problem is worse when accumulated trash is left for several months. If a rodent or colony of insects is undisturbed for long periods of time, the vectors will become accustomed to that particular hiding place. If the vectors are comfortable with the hiding place, they will breed and become a significant problem to either deal with or ignore.

According to the CDC, the most common types of vectors found in the USA are “rodents, cockroaches, fleas, flies, termites, mosquitoes, and fire ants. Rodents destroy property, spread disease, compete for human food sources, and are aesthetically displeasing. Rodent-associated diseases affecting humans include plague, murine typhus, leptospirosis, Rickettsialpox, Hantavirus, rabies and rat-bite fever” (CDC, 2006). Cockroaches are unsightly and cause stress and anxiety in many people. One significant problem cockroaches bring to a property or neighborhood is that many other vectors feed on cockroaches; so the presence of cockroaches will invite other pests and vectors to reproduce around properties or neighborhoods that have high concentrations of cockroaches. Cockroaches also feed on decaying materials and biofilm in sewage plumbing. Flies are the most common type of insect noticed by humans. Steve Jacobs of Penn State’s Department of Entomology (2013) identities the most common diseases spread by flies to be “typhoid fever, dysentery, cholera, poliomyelitis, yaws, anthrax, tularemia, leprosy and tuberculosis,” though they are known to carry at least 65 different diseases. Flies can grow from egg to adult in less than seven days under optimal conditions (Brown, A., 2015). Mosquitoes in particular pose a significant threat to Arizonans, with several different types being common throughout the state (Maricopa County, n.d.). Mosquitoes can breed and thrive in any environment that has standing or stagnant water, and these conditions are commonly found in areas with accumulated trash. In addition to providing mosquitoes with a place to breed, these conditions also protect the mosquitoes from predators, allowing them to live and reproduce in large numbers. This means that if the stagnant water goes untouched for long periods of time, the populations of harmful mosquitoes will grow very rapidly. (CDC, 2006). Objects that meet these criteria and are commonly found in trash piles are “tires, buckets, planters, toys, flowerpots, or uncovered trash containers” (Help Control, 2016). Mosquitoes are known to carry Malaria, Yellow Fever, West Nile Virus, St. Louis Encephalitis, Lyme disease, Zika virus, Chickungunya

and other diseases. West Nile Virus is the most common disease transmitted by mosquitoes in Arizona, and it is carried by permanent (standing) water (Pinal County, n.d.).

Some animals are vectors of the deadly disease Rabies. The most common Rabies vectors in Arizona are bats, skunks and unvaccinated dogs (Levy, 2016). Other animals that carry Rabies include coyotes and foxes. All of these animals, except bats, are attracted to uncontrolled solid waste. Bats are attracted to abandoned buildings including RV's and mobile homes.

Vector Control

Vector control includes any action taken to limit or eradicate the animals that carry diseases transmittable to humans. Vector control may be carried out by residents, home owners associations, and more commonly by county or city governments. The purpose of vector control programs is to reduce the risks to the community from disease vector animals. There are several widely-accepted methods of vector control in the United States. The most important approach is called Integrated Pest Management.

Integrated Pest Management (IPM) is "an ecologically-based pest management strategy that provides long-term management of pest problems with minimum impact on human health, the environment and non-target organisms. IPM programs are educationally based and apply the knowledge of pest biology and its relationship within the environment to prevent and resolve pest problems" (Gouge, et al., 2009). The key to a good IPM program is educating the public and getting everybody involved. Scheduled fogging or spraying is not a sustainable method of pest management, and it should be preceded by a good IPM strategy that will cover all aspects of pest management. This includes: IPM education of all schools, colleges and universities; general public IPM education; taking actions to prevent the pests from appearing in the first place; and using targeted pesticide applications as a last resort. A true IPM program should be healthy for people and the environment, and should not have adverse effects on any beneficial organisms.

Prevention is an essential concept for implementing an IPM program. Prevention of vector harborage is the cleanest, healthiest, cheapest, and least labor-intensive method of pest management. Every property owner must accept responsibility for maintaining the property so that it will not provide harborage to vectors and pests. When trash accumulations occur, they must be removed to eliminate and prevent vector and pest animals. Mosquitoes, flies, rodents and other animals love to hide or make nests in garbage, manure, grass clippings and yard waste. Scavenging animals such as unleashed dogs, pigeons, skunks, coyotes and foxes are attracted to

trash piles. It is important to maintain properties in a manner that will prevent the vectors and pests.

Removing standing water helps to control the mosquito population because the larval stage of their life cycle is dependent on standing water (CDC Newsroom, 2017). The easiest way to remove these breeding grounds is to "once a week, empty and scrub, turn over, cover, or throw out items that hold water, such as tires, buckets, planters, toys, birdbaths, flowerpots, or uncovered trash containers" (Help Control, 2016). With respect to trash accumulation, the easiest way to achieve this is to remove the trash from the property and prevent its accumulation in the future.

It is important that the people of Apache Junction know about the prevalence of vectors and how to deal with them. Information on how to control and eliminate vectors and pests should be disseminated to all school systems and the general public. The messages should be reinforced seasonally. Mosquitoes, flies and scorpions flourish during warm months. Rodents seek shelter in dwellings when the weather cools in November.

Each of the solutions mentioned here will have a positive impact in its own way. A fully integrated pest management program as explained above would incorporate each of the above in order to create long-lasting results for a community's vector control problems.

Recommendation

The City of Apache Junction should use an Integrated Pest Management plan that incorporates all of the solutions mentioned above. A good IPM plan includes educating the public through outreach programming, integrating IPM education into all schools, preventing pests from showing up in the first place by removing accumulated trash from private residences and keeping those residences clean, and finally pesticide application only as needed. The use of pesticides should be a last resort with respect to vector control.

Environmental Health Aspect 3 - Air Pollution

Introduction

Air pollution is a broad term that encompasses any pollutants including noxious odors that go into the atmosphere. Sources of air pollution include natural and human sources. The regulations for criteria air pollution are established by the EPA in the National Ambient Air Quality Standards (NAAQS) under 40 CFR part 50. These pollutants are considered harmful to public

human health and the environment. The six criteria pollutants are carbon monoxide, lead, ground-level ozone, particulate matter, nitrogen dioxide, and sulfur dioxide. These harmful agents appear as gases or particulates.

Gas emissions from household hazardous waste can have a negative impact on air quality (Shen, 1981). The degradation of trash can introduce volatile organic compounds (VOCs) into the atmosphere. Some of the common VOCs associated with solid waste include methane, ammonia, and hydrogen sulfide. Most VOCs are precursors to the formation of ground-level ozone. The hazardous air pollutant can be discharged from items that may be present in residential trash including waste fluorescent light bulbs, thermometers and thermostats. Trash fires and open burning of trash emit nitrogen oxides (NO_x) and particulate matter. NO_x is a precursor to the formation of ground-level ozone. Both ozone and particulate matter contribute to smog and haze within the urban area. Ozone is not directly emitted, but is formed when NOx and VOCs react in the presence of sunlight. The disposal and transportation of solid waste contributes to particulate matter (PM) pollution. PM can be emitted, or it can be formed when emissions of NOx, sulfur oxides (SOx), ammonia, organic compounds and other gases react in the atmosphere.

Illegal burning of trash and uncontrolled trash fires do occur in the city of Apache Junction. For the past 4 years, there have been 476 complaints regarding illegal trash burning. On average, there are 100 noted instances of illegal trash burning a year with approximately 10 burnings a month (City of Apache Junction Database, 2017). Many harmful effects are associated with burning trash including the release of air pollutants and hazardous compounds. “It can increase the risk of heart disease; aggravate respiratory ailments such as asthma and emphysema, and cause rashes, nausea, or headaches” (EPA, 2016). Burning trash in backyards also produces dioxins, highly toxic chemicals that can settle on crops and waterways (EPA, 2016). Most gases produced by burning trash including CO_2, CO, NOx, SOx, are emitted at ground level where they are inhaled by people and impact health. Plastic burning in solid waste produces toxic emissions that are very damaging to human health (e.g. PVC burning can generate dioxin and furan) (Vreeland 2016). Dioxins and furans are known human Class A carcinogens. Dioxins can also cause reproductive and developmental problems, damage the immune system and interfere with hormones. Trash burning contributes to the formation of atmospheric brown cloud. According to a study of global sources of air pollution, Wiedinmyer

et.al (2014) reported “29 % of particulates, 10 % of mercury, and 40 % of gases known as polycyclic aromatic hydrocarbons (PAHs) come from trash burning fires.”

Particulate matter concentration may be increased by the presence of uncontrolled solid waste, especially construction and landscaping debris because the City of Apache Junction is located in an arid and windy climate zone.

Air Pollution Control

The goal of air pollution control is to eliminate the pollutants that are emitted into the atmosphere. Air pollution control measures applicable to the City of Apache Junction include elimination of trash burning, elimination of open uncontrolled storage of solid waste and encouraging recycling.

Burning of trash is mostly caused by heavy accumulation of waste on a resident’s property. People burn trash because, “It is easier than hauling it to the local disposal site or to avoid paying for regular waste collection service (EPA, 2016).” One solution is to educate residents about the existing city and county code and rule prohibitions against open burning. Strict enforcement of the open burning ban is necessary to deter others from open burning.

When residents have easy, affordable access to recycling options, then there will be less combustible material present at residential properties. In addition to providing a weekly recyclable material pickup service the city may wish to consider educational programming for backyard composting. Composting is an efficient approach for reducing organic material in residential solid waste. Amita Fotedar (2017) found that by segregating, recycling and backyard composting, a family of four can reduce their waste from 1000 kg to less than 100 kg annually. Four specific forms of onsite composting are: Vermicomposting or composting with worms, Aerated (Turned) Windrow Composting, Aerated Static Pile Composting and In-Vessel Composting. Vermicomposting, In-Vessel Composting and Aerated Composting in bins are suitable for household locations.

The practice of vermicomposting uses Red-worms (Eisenia foetida) to break down organic waste including decomposed food scraps, vegetable waste, coffee grounds, tea bags, etc into black, earthy-smelling, nutrient-rich humus. One pound of worms (approximately 800 to 1,000 worms) can devour up to half a pound of organic matter per day. Within three to four months the waste has been composted into humus. Another product of vermicomposting is

known as “worm tea” It is a leachate draining from the composting bins that may be used as a liquid fertilizer for houseplants or gardens (Garg & Satya, 2006).

Using in-vessel composting organic waste is turned into a compost within a container such as a drum. The most common back-yard equipment is a drum mounted horizontally on rollers. A hatch opens to allow addition and removal of recyclable materials. The best design allows for air flow, moisture and temperature control. The drum may be manually or mechanically turned for mixing and to keep the material aerated. Primary compost is generated in just a few weeks and removed from the drum for curing. Final microbial degradation takes another three to four weeks of “curing” to ensure the compost is ready to use (Kim et al, 2008).

The least costly and simplest backyard composting method utilizes an open bin or pen made of scrap wood, chicken wire or similar materials. Organic household wastes and yard wastes are placed in the pen and periodically turned with a pitchfork to promote aeration and mixing. This method requires regular manual turning of the decaying materials to prevent flies and odors (Shah, K., 2000).

Recommendation

Recommendations for minimizing air pollution from solid waste in Apache Junction are to strictly enforce the existing ban on open burning, mandate weekly trash disposal and encourage recycling.

Environmental Health Aspect 4 - Soil Contamination

Introduction

Soil pollution is defined as the presence of toxic chemicals (pollutants or contaminants) in soil at high enough concentrations to pose a risk to human health and/or the ecosystem. In the case of contaminants which occur naturally in soil, even when their levels are not high enough to pose a risk, soil pollution is still said to occur if the levels of the contaminants in soil exceed the levels that should naturally be present (Environmental Pollution Centers, 2017).

Some of the most important characteristics of the soil include porosity, pH, soil salinity, soil moisture, nutrients present in the soil. All these characteristics of the soil are significantly changed when soil becomes polluted.

With respect to the City of Apache Junction, the soil in the region was deposited during the Holocene and late Pleistocene ages of earth’s geologic history. Some of the Late Pleistocene

and Holocene alluvial fan surfaces have alluvial sediments with particle sizes ranging from sand to cobbles. Other areas are rich in pedogenic clay (Soil Survey Staff, 1975:159). Surfaces that are predominantly sand and cobble allow rapid surface water infiltration and are known areas of groundwater recharge. Areas that are flat, contain mostly fine gravel and finer sediments, and contain a variety of young and old soils. These surfaces are only marginal areas of groundwater recharge due to the fine-textured nature of the soils. Most areas of the city are associated with high porous soil, especially the Holocene areas (Huckleberry, 1994). Microorganisms live in the soil and are necessary for decomposing organic material into forms that are used by the native plants. The flora and fauna of the city highly depend on the soil characteristics because wildlife depend on the native plants for harborage and food. Any change in soil characteristics soil will cause an adverse effect on the biodiversity of the area. Since most of the soil in the area is permeable to water infiltration, illegal dumping may have adverse effect on the soil characteristics and subsequently groundwater quality.

There are some industrial wastes produced in and around the City of Apache Junction. Improper disposal of industrial wastes is a significant threat to soil and groundwater. However, the control of industrial waste is not within the scope of this report. Another form of waste that may cause significant soil contamination is sludge from drinking water and wastewater treatment plants. The scope of this report is limited to residential-level solid waste. Therefore, the topic of wastewater sludges is not discussed.

Residential-level waste generated in Apache Junction includes food waste, discarded household items, household hazardous waste, landscape and yard waste, animal manure, abandoned vehicles and construction debris. All of these types of wastes can cause soil and groundwater contamination. Abandoned vehicles often leak or spill gasoline, crankcase oil, transmission oil, antifreeze, hydraulic oils battery acid and other toxic automotive fluids. These fluids kill soil microorganisms, prevent soil aeration and cause surface water and groundwater contamination. Apache Junction has many horse properties. Improper management of animal manure will affect soil fertility (Soil Pollution. N.D).

Household hazardous waste which usually consists of cleaners, automotive fluids, paints, and leftover pesticides will contaminate soil if spillage occurs. These chemicals not only disturb the fertility of soil but also block the natural aeration process of the soil that is necessary for soil microorganisms. Some of the pesticides that citizens use for the gardening process are persistent

and do not readily biodegrade. These chemicals are harmful to soil productivity and cause long-term soil contamination. (Soil Pollution, N.D.)

Areas of illegal dumping were observed during a September 27, 2017 field trip hosted by Larry Kirch and Dave Zellner, City of Apache Junction. Please see Figure 2 depicting two of the illegal dumping sites. Illegal dumping is especially dangerous to the soil and the environment because the waste piles may contain hazardous wastes and they are totally open to access by the general public including children.

Figure 2. Illegal dumping within City of Apache Junction

Soil Contamination Control

Education of the public is an effective pollution prevention method. The first educational message should be an explanation of the importance of healthy soil for maintaining a healthy environment. A second educational message should be an explanation of how uncontained solid waste can cause soil contamination. If the public understands that soil can become contaminated by improperly contained solid waste, abandoned vehicles and horse manure, they may be more willing to accept changes in city-wide solid waste disposal methods. Other elements of the public education program should include switching to non-chemical forms of weed control, garden fertilization and pesticide control. As discussed earlier, residents need to receive integrated pest management education in order to reduce pesticide use. When pesticides must be used, residents should be educated about the least toxic pesticides that are available to them at over the counter retail stores. Proper containerization of solid waste at the residential level is in covered trash containers that are picked up by a waste disposal service once a week. The availability of affordable and easy to use recycling methods will also minimize soil pollution.

Recommendations

Apache Junction should include information about how improper solid waste control can contaminate soil in its public outreach and educational materials. The city should strictly enforce its illegal dumping prohibition. The city should mandate weekly trash pickup at all occupied properties. The city should enforce the existing code prohibition on abandoned cars and other vehicles. The city should offer recycling services and public education about recycling include waste reduction and reuse.

Environmental Health Aspect 5 - Water Pollution

Introduction

Water pollution is known as the contamination of water bodies (lakes, rivers, aquifers, ocean and groundwater sources) in which degradation transpires within the ecological system (EPA, 2016). The EPA considers pollutants to be, “Any substance that is dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water (EPA, 2016).”

Even in areas as small and young as Apache Junction, storm water runoff can carry chemical and biological pollutants such as oil, nitrates, phosphates, and coliform bacteria that can affect the nearby waterways.

Trash accumulation can also lead to excess leachate, a liquid that has percolated through solid waste and has therefore become contaminated. Leachate from solid waste can contaminate both surface waters and groundwater (Cummins, 1970, Frumkin, 2016). Direct rainfall onto trash piles and occasional sheet flooding will saturate the uncontained solid wastes and cause leachate to be formed.

The biggest impacts of solid waste accumulation according to the EPA are: infiltration and percolation of leachate, solid waste decomposition, gas production and movement, groundwater contamination and direct runoff from solid waste into bodies of water. Each of these factors may have an impact on water quality. Solid wastes contain high concentrations of mineral and organic substances which can cause pollution of surface and underground water supplies. The surface area, and particle size in the waste material are significant factors for dissolution of pollutants into the leachate (Cummins, 1970).

Common Water Pollutants

There are four general categories for drinking water contaminants. They are physical, chemical, biological, and radiological. These categories allow the EPA to define a contaminant as anything other than a water molecule (EPA's drinking water contaminants).

Chemical contaminants are a large concern for urban runoff (United States Environmental Protection Agency, 2003). The common inorganic chemical contaminants are: Arsenic, Barium, Chromium, Fluoride, Nitrate, Nickel and Selenium (Basic 2017). The common organic chemical contaminants are dibromochloropropane, trichloroethylene, and tetrachloroethylene (Basic, 2017).

With respect to biological contamination, bacteria does not usually remain in underground water when in the direction of flow for more than 50 yards. However, recharge of polluted water to underground aquifers has resulted in bacteria traveling approximately 1,000 feet. Coliform bacteria are used as an indicator of human waste contamination of water. An average of 740,000 coliform bacteria per gram of solid waste was reported according to a study by Weaver (Cummins, 1970).

Chlorides and other inorganics persist in water, and are therefore hard to get rid of. Nitrogen compounds at unsafe levels are often found in groundwater. They are relatively non-biodegradable. Organic matter in wastes go through aerobic and anaerobic decomposition processes which produce carbon dioxide and methane, and small amounts of ammonia and hydrogen sulfide (Cummins, 1970).

Many of the contaminants that have chemical hazards come from household sources that are used and discarded into uncontained trash piles. This is especially a problem in Apache Junction because there is no required weekly municipal solid waste collection. Items in household waste that can cause water contamination include detergents, fertilizers, pet waste, automotive products, paint, cleaners, pesticides, yard waste and litter.

Lead can be distributed in the environment and into water sources from uncontained solid waste. Sources of lead in trash piles include construction debris, old pottery, older household items such as furniture, imported spices and imported candies. One of the most frequently found sources of lead In Arizona is lead-based paint in older homes. Construction debris containing lead based paint is likely to be present in some waste piles.

Health Aspects of Water Pollution

Nitrogen compounds, especially nitrates are one of the pollutants from improper management of solid waste. Nitrogen compounds easily migrate to surface water and groundwater. High nitrate levels can cause blue baby syndrome and nitrate levels above 10 ppm are a health risk for children who are less than six months old. This is because nitrates react with blood to make methemoglobin from hemoglobin, which makes blood cells unable to transport oxygen (Anilkumar, Sukumaran, & Vincent, 2015).

Carbon dioxide resulting from decomposition of organic materials combined with water forms carbonic acid. This acid can dissolve magnesium, iron, toxic metals, and other substances causing water pollution.

Recommendations

The environmental health aspect of water contamination can also be easily mitigated by instituting mandatory weekly waste disposal. Water contamination will be prevented if wastes are not allowed to accumulate in the open where rain and flooding will cause pollutants to form and enter the environment.

Environmental Health Aspect 6 - Injuries

Introduction

As previously mentioned, there are only four free waste drop off weeks per year at the nearby Apache Junction landfill. Some residents choose to accumulate their domestic solid waste on their property for three months or longer. There are many risks that can be involved in storing municipal solid waste in a backyard for three months and then trying to haul it to the landfill all at one time. Physical hazards are particularly dangerous, and can lead to injuries.

There are many different ways the process of self-dumping of waste can cause injuries to occur. While there is virtually no data on how often these injuries can occur as a result of self-dumping, common sense can give us a good look into the matter. Musco-skeletal injuries such as back injury and other muscle strains and sprains are likely to happen when loading and unloading all of the rubbish onto a trailer or in the back of a truck. The American Chiropractic Association states that “as much as 80% of the population will experience a back problem at some time in their lives.” (Back Pain Facts and Statistics). Another hazard is the risk of garbage

and debris flying off the vehicle on its way to the landfill and causing a serious accident. According to the Arizona Department of Transportation “debris on roadways nationwide causes 25,000 accidents each year and more than 80 fatalities.” (Highway Littering Facts). Improperly secured loads can be deadly.

If flammable items or chemicals such as used oils, lighter fluids, gasoline, paint thinners, or any sort of flammable powders are disposed of and improperly stored in a pile it is more likely to ignite. Another potential risk is lacerations from handling sharp edged materials often present in solid waste. In addition to non-life threatening infectious wound bacteria, the deadly bacteria *Clostridium tetani,* which cause tetanus may be present (Woundcaresociety, 2015). Any deep laceration from handling solid waste should be treated by a medical professional.

Rubbish fires present a risk of injuries in Apache Junction. The Apache Junction Fire Department has to deal with trash fires on a regular basis. In September, 2017, there were 5 fires involving trash or rubbish (Apache Junction Fire Department Data Set, 2017). This raises many concerns, particularly for the safety and health of residents. Figure 3 shows trash accumulating next to an occupied dwelling. Fire in a trash pile can easily spread to nearby inhabited structures.

Figure 3. Combustible material stored next to a dwelling; source Gandhar Pandit

Injuries to children and adults playing or scavenging in publicly accessible trash piles are another hazard to consider. No data on the incidence of injuries from scavenging trash were found for this report. However, uncontained trash on an unfenced property is an obvious hazard and an attractive nuisance. The risk of injury to children is highest at residences where children are living or visiting if the occupants accumulate their trash on the property for months.

Recommendations

The best way to prevent injuries from solid waste is disposal of the waste into properly constructed containers that are dumped weekly by a trash removal service. When a resident generates a large amount of waste during a home remodeling project, the construction debris or landscaping materials should be placed in a large roll-off bin and removed by a waste disposal company. The owners of waste disposal companies and municipal solid waste departments in government must protect the health and safety of their workers as required by U.S. Occupational Health and Safety rules (U.S. Department of Labor, 2017). The workers are trained and properly equipped with protective clothing and equipment. Individuals who haul waste themselves should become educated on the proper practices and steps for reducing the risk of injuries. While not specific to hauling solid waste, there are many great resources giving information on how to properly load and haul large items. One of these resources is from a website called Moving, which stresses using legs and not the back to lift heavy objects and making sure you are adequately stretched out beforehand. (Celeste, 2015). There are also great tools online that give information on how to properly secure loads to a pickup truck so items do not fall onto roads during the transportation process.

Environmental Health Aspect 7: Aesthetics

"Quality of life" is an indicator that is often used in public perception studies of the overall attractiveness of a community for residents, visitors, and employers (Twaddel, 2017). The term "quality of life" encompasses a holistic and comprehensive assemblage of community health status indicators including environmental, social and economic welfare. Words and expressions such as unpolluted, scenic, safe, diverse, healthy, literacy, and access to government, health and entertainment services are often associated with the understanding of the welfare status of a population. A high quality of life means enjoyment of everyday living by all who belong to the community.

In the City of Apache Junction, a large portion of tax revenue for the city comes from tourism during the months of November – April. Tourists are attracted to areas that are aesthetically pleasant, especially because of the scenery and climate. In a study of the The Wuling Yuan Scenic Area in China, the importance of sustainability along with economic growth were examined (Wang, 2010). Throughout the 1990's the park experienced rapid growth, however sustainable development was not considered, and the park suffered

aesthetically. This study concluded that “The aesthetic value can also influence ethical and economic value. When tourists feel any part of the landscape is ugly, the feeling will cause discomfort and even hatred of the trip. Negative feelings will affect the tourist buying and consuming habits thereby weakening economic value.” (Wang, 2010) This concept applies to any community that relies on tourism for economic prosperity.

Aesthetics has an impact on a community, especially for one that highly depends on tourism to fund city services. The more pleasing the environment looks, the greater the chance of visitors in that area (Wang, 2010). A study by Leslie, et.al. (2008) study showed that the more aesthetically pleasing a place is, the more likely people are to find comfort and naturally gather there. An example is provided using Figures 4 & 5, Figure 4 is more clear, clean and unpolluted from human waste. While Figure 5 is quite the opposite of Figure 4. In addition to the unsightly appearance of uncontained trash, it is easily spread by wind, thus, expanding the area that lacks visual appeal.

Figure 4. Apache Junction’s natural environment; source: Apache Junction website

Figure 5: An Apache Junction residential property; source: Albert Brown, 9/27/17

The perceived effects of aesthetics on communities is hard to quantify. It has been shown by Leslie that a person's accessibility to safe walkable spaces where they can socialize has a direct impact on mental health. Quality of life is another expression that is often used to describe a general feeling of well-being. Places that are clean, well maintained and visually appealing promote a positive feeling in most people (Twaddell, 2017). When a location is already visually pleasing to the audience, people will tend to do their part to keep the area and environment clean from trash (Wang, 2010). If the residents begin to view the trash as acceptable then they will as a whole contribute to the problem. Complacent community members, even if not stockpiling trash themselves only add to the problem by their acceptance of the practice.

Recommendations

The City of Apache Junction should strictly enforce existing codes prohibiting excessive accumulation of trash, weeds, abandoned vehicles, fire hazards, dilapidated buildings and litter. The City of Apache Junction should implement policies requiring weekly solid waste pickup by a waste disposal service at every occupied property. The City of Apache Junction should include in its educational outreach materials a section explaining the value of good aesthetics for the welfare of the city, its residents and its visitors.

Conclusions

There are strategies for combatting these many issues, but the best solution is to stop accumulation at the source. The first step is to prohibit illegal waste accumulation of trash, weeds, abandoned vehicles, fire hazards, dilapidated buildings and litter. Then the City of Apache Junction should require a mandatory weekly waste removal service along with recycling service for every property. All waste needs to be disposed in properly constructed containers. The City of Apache Junction needs to provide necessary education for its residents regarding health problems associated with accumulated solid waste, disposal of household waste (including reduce, reuse, and recycle), and positive effects of waste removal service. The residents in Apache Junction need to realize the value of an aesthetically pleasing environment. These suggested solid waste management improvements should be integrated into a comprehensive solid waste management system, and organizationally combined within city government to ensure the most efficient delivery of government services to the public.

Recommendations for future research and tasks for ASU students

The following sentences offer suggested research questions and tasks that could be assigned to future classes of ASU students or as specific internship assignments.

If the City of Apache Junction decides to propose changing the city code to require weekly solid waste removal, then a future ASU class could be tasked to assist the city during a stakeholder process. This task could include the development of a proposed solid waste code revision for consideration by the City Attorney, City Council, city staff and all stakeholders. Other associated tasks may include assisting city staff with stakeholder meeting planning and during the stakeholder meetings. Educational materials for presentation during stakeholder meetings may be produced by the student(s).

ASU students in the Environmental & Resource Management degree program could be engaged by the city to write environmental educational materials. The educational content would be given to ASU students in the Graphics Information Technology (GIT) program who will produce short videos, and a wide variety of environmental educational materials for dissemination via social media, websites and traditional printed media. The GIT program has direct access to an ASU print shop capable of producing state of the art graphics and an ASU video production studio.

ASU students in the Environmental & Resource Management, Landscape Design and Public Affairs programs could be assigned to do research into future landfill alternatives and reuse of the existing landfill after it closes in approximately 20 years.

ASU appreciates the opportunity to serve the City of Apache Junction in ways that mutually benefit our students and the welfare of the city.

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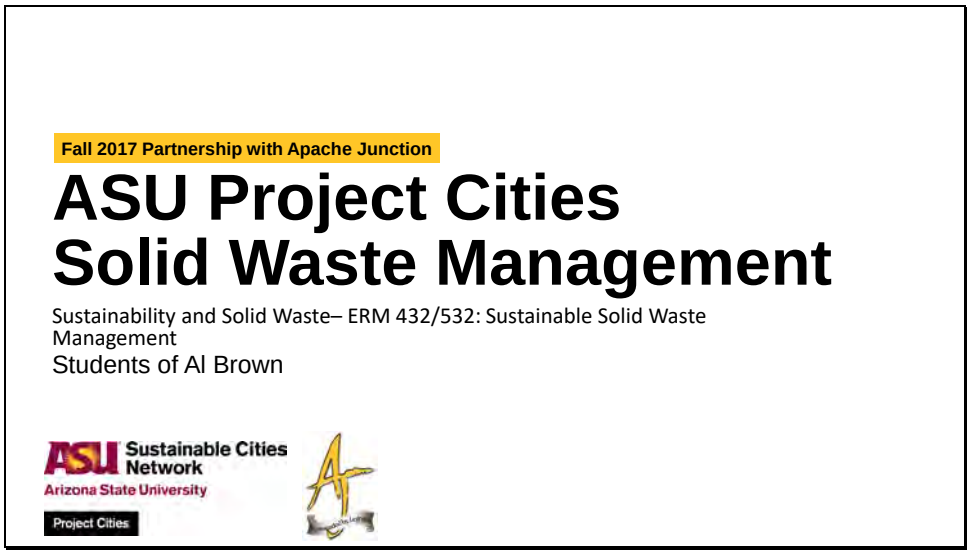
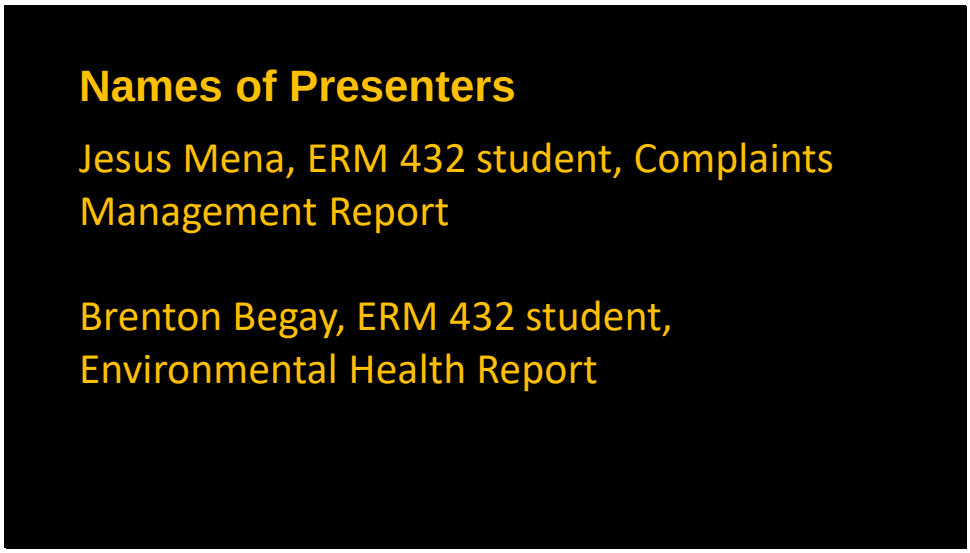
PRESENTATION SLIDES AND NOTES FROM FALL 2017 SHOWCASE

View the whole presentation at https://vimeo.com/247879922





Names of Classmates

Sunny Tyler Adrian Angelo Nguyen Duy Robert Skyler Anuja Kishansinh Jason Hazel Matthew Loren

Anand Natekar Andrews Castillo Cortez Dang Xuan Dao Follini Gellerman Gohil Gomez Hannah Huitt Hupe

Shuo Bryan Alaric Min-Hsien Luis Reid Ioana Cierra Raul Gandhar Lindsay Brandon Rohan Samuel

Jiang King Laney Lin Lopez Mertens Mihalcescu Navarrette Olivares Pandit Rogers Sarhad Shah Tomlinson

Report editor: Zhihao Chen, ERM MS Student

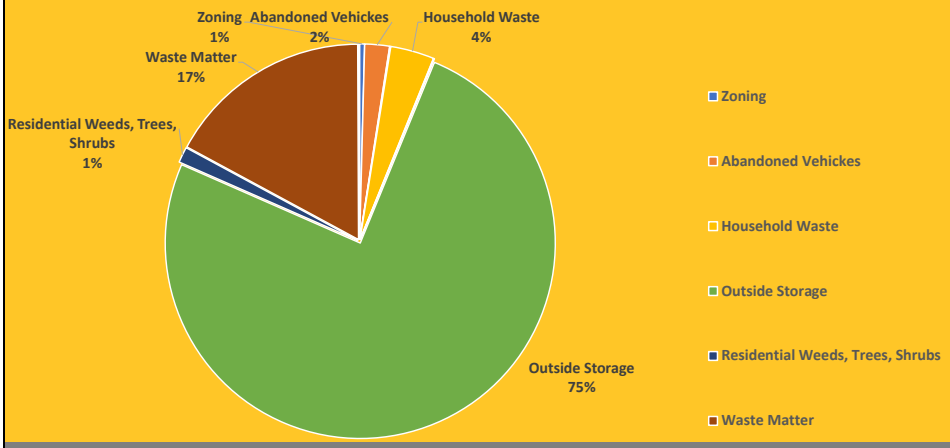
Presentation Outline

- Project Goals & Objectives
- Complaints Analysis
- Environmental Health Aspects
- Conclusions & Recommendations

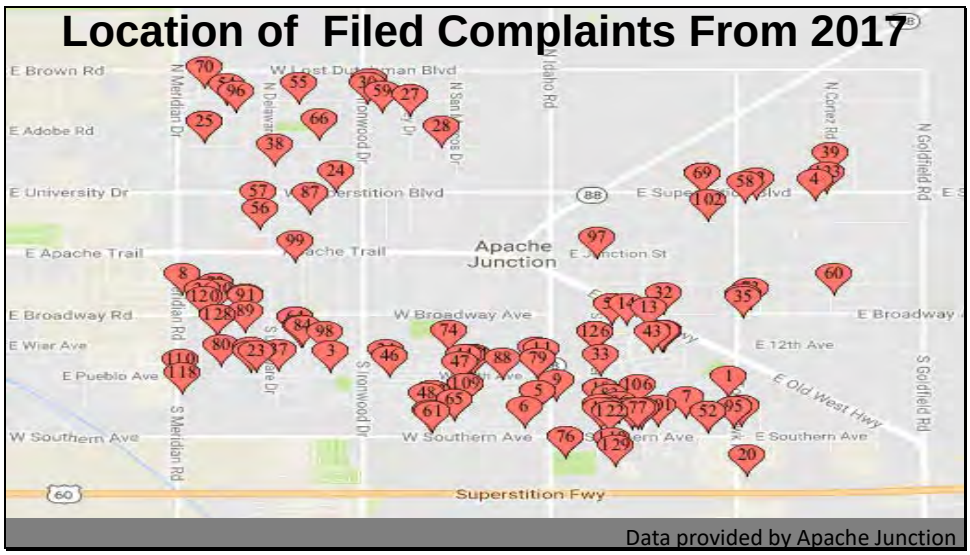
Project Goals & Objectives

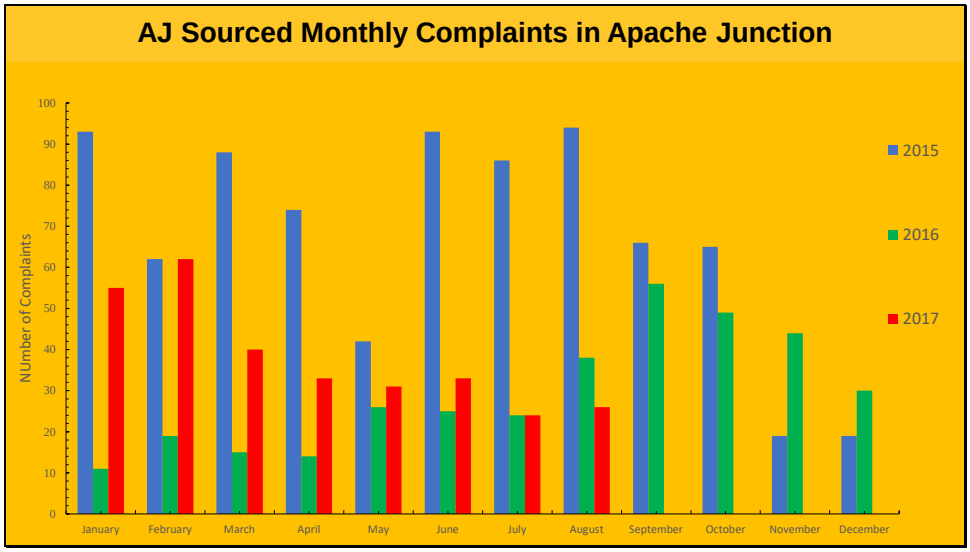
- **Goals**: suggest improvements in waste pick-up related policies and mitigate solid waste associated environmental health problems
- **Objectives**:
  - ❖Analyze filed complaints regarding solid waste
  - ❖Compare complaint systems
  - ❖Describe environmental health aspects
  - ❖Propose recommendations

AJ Sources for SW Complaints from 2015 to 2017



Data from City of Apache Junction database


Location of Filed Complaints From 2017
E Brown Rd
E Adobe Rd
E University Dr
E Apache Trail
E Broadway Rd
E Wier Ave
E Pueblo Ave
W Southern Ave
W Broadway Ave
E 12th Ave
E Old West Hwy
Apache Junction
N Meridian Dr
S Meridian Rd
N Idaho Rd
N Goldfield Rd
S Goldfield Rd
Superstition Fwy
Data provided by Apache Junction


AJ Sourced Monthly Complaints in Apache Junction
NUmber of Complaints
0
10
20
30
40
50
60
70
80
90
100
January
February
March
April
May
June
July
August
September
October
November
December
2015
2016
2017

Comparison of Complaints Systems in 4 Phoenix Area Cities

	Avondale	Buckeye	Mesa	Apache Junction
Ease-of-use	Easy	Easy	Medium	Medium
Category	6 categories 0 subcategory	0 categories	56 categories 25 subcategories	4 categories 28 subcategories
Features	Can upload photos	Can be anonymous	Can pin the violation location on the map	Can submit suggestions online about the system

Types of Environmental Health Aspects

- **Odors**
- **Vectors of disease**
- **Air Pollution**
- **Soil Contamination**
- **Water Pollution**
- **Injuries**
- **Aesthetics**

Odors

Decomposing household solid waste emits objectionable odors.

Photo taken by Al Brown

Vectors

The most common types of vectors in the USA are rodents, cockroaches, fleas, flies and mosquitoes (CDC, 2006).

Photo taken by Al Brown

Air Pollution

Decomposing trash emits volatile organic compounds into the atmosphere. Uncontained trash contributes to particulate pollution.

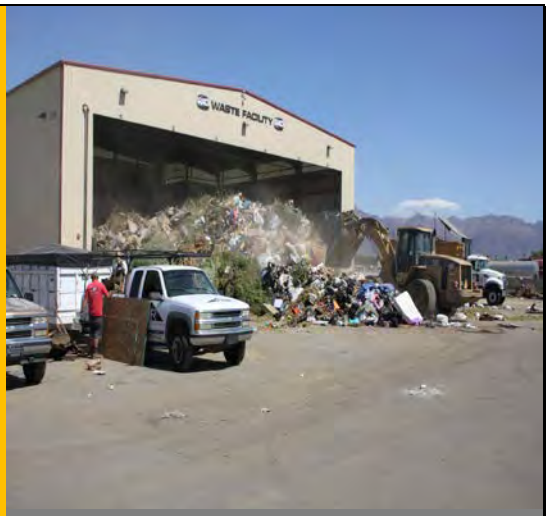


Photo taken by Al Brown

Soil Contamination

Illegal dumping is especially dangerous to the soil because the waste piles may contain hazardous wastes and they are totally open to access by the general public including children.

Photo taken by Al Brown

Water Pollution

Trash accumulation causes leachate, a liquid that has percolated through solid waste and has become contaminated.

Photo taken by Larry Kirch

Injuries

Rubbish fires present a risk of injuries and property damage in Apache Junction.

Photo taken by Gandhar Pandit

Aesthetics

CDC Healthy Community Design recommendations include maintaining a clean and safe community for all to enjoy.

Photo taken by Al Brown

Recommendations

For Complaints Management

- **Ease-of-use:** make it simple and quick to file complaints
- **Description of the process:** explain the subsequent steps to complaints
- **Ease of access:** provide user-friendly navigation of the website
- **Category:** give detailed descriptions of each category

Recommendations (cont'd)

- For Accumulated Solid Waste
  - ➢Remove current accumulated solid waste
  - ➢Require a weekly solid waste pickup
  - ➢Augment solid waste management public education
  - ➢Provide easy and affordable solid waste recycling services

Thank you!

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ASU Sustainable Cities Network
Arizona State University
Project Cities

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Solid Waste: Problems and Solutions in Apache Junction, Arizona

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Abstract

The City of Apache Junction is facing growing problems as a result of their lack of a specific solid waste policy. Currently Apache Junction does not mandate solid waste services and allows citizens to self-haul their solid waste to the dump at a comparable price to the professional solid waste collection services. Additionally, Apache Junction allows three different professional solid waste contractors to serve the community. By allowing three different contractors, Apache Junction fragments the waste stream making it more difficult to implement a comprehensive solid waste policy to include sustainability. Furthermore, it is highly likely that by allowing self-haulers to handle their own refuse without going through the permitting process or vehicle inspections, Apache Junction may be violating county health codes and state laws. Solutions to the problem are presented and successful municipality examples are provided.

Table of Contents

Solid Waste: Problems and Solutions in Apache Junction, Arizona

When a municipality experiences growth their consumption increases and sustainable practices become much more relevant and crucial. Human activities have always produced waste, and the generation rates increase with population expansion and economic growth (Ghinea et al., 2016). There is a multitude of reasons why proper solid waste management (SWM) policy is crucial to a growing and developing city like the City of Apache Junction (AJ). First, the current policy in Apache Junction is ambiguous because the city does not mandate solid waste collection. Residents are able to elect whether they want to subscribe to trash collection from one of three different vendors or self-haul their solid waste to the dump (Chhetri et al., 2016, p. 2). This lack of clear direction poses code enforcement issues as people collect their own trash instead of using curbside collection without a permit. This further creates problems with neighbors including unsightly solid waste collection on individual property and, in some cases, people disposing of solid waste incorrectly on their own property or on the sides of city right-of-ways (Kirch, 2017). The lack of clear direction also may create legal considerations because the current policies of self-hauling may violate state and/or county requirements.

Another problem concerning the lack of a clear policy has to do with the sustainability implications because the City of Apache Junction has the potential to grow significantly in future years. The prediction of municipal solid waste generation plays an important role in solid waste management policy (Dyson & Chang, 2005, p. 669). An aggravating circumstance includes the fact that AJ currently does not possess information on subscribers. Therefore, the prediction of solid waste generation is all but impossible, which will have wide ranging implications including the impediment to healthy growth and eventual general growth. Also of note is that AJ currently has three different solid waste collection providers. This type of policy puts more strain on city streets and reduces the usable life therein by increasing the truck traffic and increasing pollution for the supposed benefit of citizen choice (Chhetrie et al., 2016, p. 2). AJ will have to weigh the future benefits of citizen choice, to include the added cost of reduced street life, against the negative externalities those choices are complicit in producing.

With inaction, the problems created by not having a policy will be exacerbated in future years. AJ is foregoing the possibility of being able to utilize an overarching and comprehensive strategy for solid waste collection and disposal, this choice has clear cost consequences. One piece of a comprehensive strategy is using solid waste diversion. Diversion can create several

positive externalities including landfill life extension. The life of a landfill is important, especially considering how difficult landfills are to site, operate, and shut down. Additional considerations include environmental impacts, costs of landfilling, and the renewable resources that are lost to landfilling. In this context, the value of extending the life of a landfill is clear and should be considered even in light of the proposed close date for the current landfill.

There was a survey conducted and data that were analyzed. The goal of the survey was to ascertain whether there exists a desire for the AJ to change the way it manages solid waste. The questions used in the survey are included below:

1. Which of the following best describes your current solid waste preferences?
2. If so, which provider do you use for solid waste services?
3. Overall, how satisfied are you with your provider?
4. How interested are you in receiving weekly, street side recycle pickup?
5. How interested are you in receiving weekly, street side solid waste pickup?
6. How interested are you in having solid waste services be provided by the City of Apache Junction?

Survey respondents provided crucial information that may serve as a baseline for additional data collection. AJ currently possesses no information on solid waste accounts because private entities manage the information on their own subscribers and there exists no database concerning self-haulers. Furthermore, this survey sheds light on whether there exists support for changing the way that AJ manages solid waste collection.

Literature Review

The City of Apache Junction is situated at the base of the majestic Superstition Mountains in the State of Arizona. AJ is located in two counties. Pinal County is where the vast majority of AJ resides with a small southwestern portion of the city situated in Maricopa County. AJ, both counties, and the State of Arizona maintain requirements regarding solid waste definitions, collection, and disposal. Both counties have different standards for solid waste. However, the City of Apache Junction also has a self-haul option for solid waste disposal that is still utilized by many residents, though no numbers exist as to the extent.

Ordinances and Laws

The City of Apache Junction's regulation of solid waste refuse is mainly found in City Code, Volume 1, Article 9 (City of Apache Junction, 2014). In a review of municipal code

Chhetri et al. (2016) contends that mandates are predominantly focused on how waste should be collected such as permitted days and hours, container standards, and vehicle maintenance standards (p. 2). Chhetri et al. (2016) also notes there is no mandate to use city contracted solid waste service providers, of which there are three (p. 3). There are very few mandated behaviors the people of Apache Junction must comply with in researching through city ordinances concerning solid waste disposal. Chapter 9, section 5, article 1; city code states the purpose of the article is to:

> Regulate the collection of residential solid waste to promote public health, safety and general welfare of the citizens of the city, and to avoid and mitigate the detrimental effects of random trash collection, insufficient solid waste containers and substandard collection vehicles and equipment through reasonable regulation. It is not the purpose of this article to prohibit or unreasonably restrain private enterprise from delivering solid waste collection services within or to the residents of the city. (City of Apache Junction Ordinance 1255, 2006)

As Chhetri et al. (2016) contends, "the regulation of residential solid waste collection requires the promotion of public health and safety as well as the need to follow minimum state and county mandates" (p. 3). With the lack of a specific policy or city ordinance mandating behavior relating to solid waste disposal, it is unclear whether Ordinance 1255 meets the greater county and state requirements.

There are various county and state requirements. Pinal County has several mandates for solid waste including the proper storage, disposal, removal, and permit issuance for removal (Pinal County Environmental Code, 2015). Pinal County Environmental Code Regulation 5 (2015), establishes the maximum size of container at 20 gallons, the shape has to be able to be lifted readily for the purposes of disposal, and the material is required to be metal of other easily cleaned material. Perhaps the most contradictory application of the self-hauling provision allowed by Apache Junction concerns Pinal County Environmental Code, Regulation 6 (2015). Regulation 6 states:

> No person, firm or corporation shall haul, remove or dispose of garbage, rubbish or refuse as defined in this Regulation, fore hire or for a consideration, without a valid solid waste permit to do so from the Department, or other than in compliance with this code

> and any other applicable state or county regulation. (Pinal County Environmental Code, 2015)

The extension of self-hauling provisions by the City of Apache Junction clearly violates this code by not expressly issuing permits, as the county requires of those hauling solid waste. Maricopa County Environmental Health Code Chapter 2, section 5, regulation 1, establishes the need for haulers to obtain a permit before hauling solid waste (Maricopa County Environmental Health Code, 2011). The Maricopa County code fails to carve out any exceptions for self-haulers.

Additionally, the City of Apache Junction mandates proper vehicle specifications. Chapter 9, article 2, section 2 states:

> It is unlawful for any person to haul or cause to be hauled on or along any public street in the city any refuse, garbage, junk, debris, trash, litter, unless such material is contained in watertight vehicles or vehicles with water tight receptacles constructed to prevent any such material form falling, leaking or spilling and any odor from escaping. (City of Apache Junction Ordinance 1255, 2006)

The above referenced section of Ordinance 1255 establishes requirements for vehicles transporting or hauling solid waste. This ordinance echoes the State of Arizona requirements laid out in Arizona Administrative Code section R18-13-31, it states:

> A. Vehicles used for collection and transportation of garbage, or refuse containing garbage, shall have covered, watertight, metal bodies of easily cleanable construction, shall be cleaned frequently to prevent a nuisance or insect breeding, and shall be maintained in good repair.
>
> B. Vehicles used for collection and transportation of refuse shall be loaded and moved in such a manner that the contents, including ashes, will not fall, leak, or spill therefrom [sic]. Where spillage does occur, it shall be picked up immediately by the collector and returned to the vehicle or container. (A.A.C. R18-13-310, 2016)

The Maricopa County Environmental Health Code Chapter 2, section 5, regulation 2 is almost identical to the state's requirements establishing vehicle specifications for hauling solid waste as well (Maricopa County Environmental Health Code, 2011). Pinal County Code lists no vehicle specifications for hauling solid waste but operates under the state. A closer investigation of the terminology established by the state shows the City of Apache Junction's Ordinance governing

solid waste hauling vehicles to be deficient in that state verbiage requires the vehicle to have a metal body. It is important to note that while vehicle requirements are mandated at the state, county and city levels of government, the issuing agency is at the state level, the Arizona Department of Environmental Quality (ADEQ). However, ADEQ does not have the authority to enforce the vehicle standards according to inspector Raymond Rivera (2017). According to Rivera (2017) his focus as an inspector for ADEQ is predominantly focused on solid waste facility operations. Vehicle inspection programs are delegated to the counties while initial vehicle inspections are conducted by Arizona Department of Transportation (ADOT) and enforced by Department of Public Safety (DPS) or other applicable law enforcement agency (Rivera, 2017).

Given the lack of clearly mandated prohibitions and enforcement of said prohibitions in the City of Apache Junction concerning self-haulers, the city may be in violation of state law and county law. Furthermore, though solid waste providers like Right Away Disposal (RAD) or Waste Management (WM) have to abide by state law through the permitting process, random audits and Arizona Department of Transportation (ADOT) enforced standards; self-haulers are able to effectively skip the inspection unless a compliance officer essentially catches them. This double standard establishes a type of defacto incentive for self-haulers to sidestep the state and local laws because they are not subject to an applicable level of government scrutiny and regulation as professional haulers. The lack of a clear solid waste policy is also a likely contributor to the ongoing illegal dumping problems Apache Junction is facing currently, a costly externality (Kirch, 2017; Carney, 2016).

A Path Forward

Concerning solid waste management, the size and complexity of the issue both decline as a community becomes more sustainable (Coyle & Duany, 2014, p. 296). Sustainability is not easily defined. The Arizona State University School of Sustainability has no fewer than 21 statements through video and direct quote of what constitutes sustainability (Arizona State University, n.d.). In the *Journal of Sustainability*, David Little II remarks that sustainability has many facets that are difficult to understand and since it attempts to address many issues on a global scale, sustainability is a transdisciplinary field (Little, 2014, p. 2). The commonly used definition of sustainability is referred to as the Brundtland definition from the United Nation's World Commission of Environment and Development Report with Gro Harlem Brundtland as it

chairwoman (Little, 2014, p. 3). Under the Brundtland definition sustainable development is characterized as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (as cited in Little, 2014, p.3). The Brundtland definition is applicable in the discussion of sustainability as it pertains to the solid waste policies in Apache Junction. Moving forward, best practices identified by the Maricopa Association of Governments (MAG) should function as a guideline for actions necessary by the City of Apache Junction to accomplish sustainability.

Though Apache Junction resides almost exclusively within Pinal County and is subject to the Central Arizona Association of Governments (CAG), in 1979 the Governor of Arizona declared MAG the regional solid waste planning organization as a result of a mandate from the federal government through the Resource Conservation and Recovery Act of 1976 (Municipal Association of Governments, 2017a, p. 13). The federally mandated regional solid waste plan for Apache Junction is coordinated by MAG. As a result, MAG is uniquely positioned to offer regionally based sustainability advice and has communicated their recommendations through the Solid Waste Best Practices in the MAG Region (MAG, 2017b).

In their 2012 solid waste plan, MAG identified best practices among member agencies designed to address sustainability in solid waste and promote recycling (MAG, 2017b, p. 1). The 2017 update produced by MAG evaluated 18 solid waste target areas that member agencies were participating (MAG, 2017b, p. 1). Appendix A is a complete accounting of the programs and corresponding member agency participation. Apache Junction is involved in two of the 18 target areas identified by the MAG report, therefore, it is advisable for Apache Junction to evaluate the 16 target areas they are not currently involved in to look for ways to move their solid waste policy towards a more sustainable future (MAG, 2017b).

The proper understanding of the waste stream produced by any municipality provides critical information for planning and execution of solid waste policies. Accurate projection of solid waste is crucial for the successful planning of efficient and effective waste management systems (Abbasi & Hanandeh, 2016, p. 13). Abbasi and Hanandeh (2016, p. 13) contend that future estimations of waste streams serve as a basis in the development of waste management infrastructures as well as their further sustainable development and optimization. Furthermore, accurate current data that allows for a more realistic forecast protects against imprecise forecast. Significant problems are associated with imprecise forecast, such as inadequate or excessive

waste disposal infrastructure (Abbasi & Hanandeh, 2016, p. 13). The need to effectively manage solid waste has become an environmental issue as much as an economical and social one (Ghinea et al., 2016, p. 80; Dyson & Chang, 2005, p. 669).

Apache Junction is placing itself in a compromising situation by not mandating solid waste collection. First, by not mandating services there are three different collection providers which diversifies the waste stream and the stakeholders associated with it. Furthermore, because the waste stream is fragmented, implementing a collective policy toward future solid waste management projects or infrastructure becomes much more difficult. Second, the fragmented waste stream also has the effect of making the collection and analysis of user information and demographics data not possible. User's demographics are an important tool used by forecasters in service delivery, especially in the realm of solid waste as shown by Dyson and Chang (2005). Third, the fragmented waste stream complicates the city's ability to maintain existing sustainability factors in addition to hindering new sustainability efforts established by MAG.

Future Policy Priorities

Apache Junction should be looking toward the future in terms of solid waste management policy. Waste management policies of the future focus on diversion tactics (Reynolds, 2017, p. 39; Denison & Rustin, 2014). Recycling and composting were at around 34.6% in 2014, up from 28.5% in 2000, which is up from 16% in 1990 (Reynold, 2017, p. 39). The data are trending toward more utilization of recycling and composting programs as a means of becoming more sustainable and offsetting the harmful effects of landfilling (Reynolds, 2017; Denison & Rustin, 2014; Eriksson et al., 2005). However, there are cities that are pledging more. For example, San Diego is aiming for 75% diversion by 2020, 90% by 2035, and 100% by 2040 (Reynolds 2017, p. 40). It is important to note the diversion plans, infrastructure, and policy are being crafted and implemented now by the respective municipalities with help from their respective councils. Deployments of multispectral imaging technology in which optical sensors identify and help sort object by their chemical makeup are being invested in and utilized now so that in the future, 100% diversion rates are possible (Reynolds, 2017, pp. 39-40). Reynolds contends that New York City is behind the curve with a diversion rate of only 17%, however, in the City of Apache Junction the diversion rate is fragmented and unknown. Furthermore, the policy of the city is being driven in three potentially different directions.

The City of San Francisco has a large and dense urban population. The goal of the city is to obtain 100% diversion (Reynolds, 2017, p. 42). San Francisco has seen a diversion rate reach 80% in less than a 10-year span (Reynolds, 2017, p. 42). San Francisco is deploying several different tactics to get to 100% diversion including a three container program, food service waste reduction ordinance, a ban on polystyrene, a plastic bag reduction ordinance, a construction debris recovery ordinance, a bottled water ordinance, and door-to-door multilingual education (Reynolds, 2017, p. 42). Apache Junction has the ability to utilize some of the same tools on a much smaller scale.

Methodology

The method of survey is the most applicable in this context. The survey will inform the conclusions herein and assist leaders in their decision-making moving forward. The question here is, does there exist the citizen support to implement sweeping changes in solid waste management policy in the City of Apache Junction by mandating single provider collection, private or public, with the city as the administrator? The qualitative survey is the best type of survey to utilize in this context.

The population for this survey is comprised of the citizens who reside in the City of Apache Junction. The sample will be from a volunteer, citizen engagement group of City of Apache Junction residents. The findings of the survey will be used to generalize the data obtained from the sample to the population.

Limitations of this data are clear. The citizen engagement group is not randomly selected and may be prone to bias. To limit bias, several citizen engagement group emails may be necessary to obtain a representative depiction of citizen sentiment concerning the solid waste management policy change. Additionally, reliability is hindered by a total sample size of 22. A simple statistical analysis of the data collected through the survey will be sufficient to gauge public sentiment concerning the policy change. The mean and mode were the statistical analyses used to analyze the data with respect to survey responses. Additionally, survey responses were analyzed across different providers and within the self-haul option.

Findings

The findings of the survey were interesting. There are several inferences that may be drawn and the raw survey data is included in Appendix C. The vast majority of respondents were subscribers of the one of the professionally delivered services. Approximately 81% of

respondents were subscribers where as 19% of respondents were not subscribers. Of those who identified themselves as subscribers, 58% identified themselves as Republic Waste Services customers while RAD represented 26% and Waste Management represented only 16%. Overall, customers expressed they were satisfied or very satisfied at a rate of 73% while only 27% of respondents were neutral on the question of how satisfied they were with their provider. There were no responses indicating dissatisfaction.

When the issue of street side recycling was asked, 68% of respondents were interested or very interested in receiving recycling while only 27% responded as being neutral. Only about 5% of respondents indicated they were uninterested. There was considerably more interest in street side solid waste services with 77% of respondents indicating they were interested or very interested while only 18% were neutral and only 5% marking uninterested. The final question yielded the most mixed results. When respondents were asked how interested they would be to have Apache Junction providing their solid waste services, 41% indicated they were interested or very interested while 32% remained neutral. This question also generated the most uninterested as 23% indicated they were uninterested while 5% indicated they were less interested.

Discussion

The results of the survey were informative. The results indicate there is a high degree of participation among residents in terms of subscription to professional solid waste services and that the self-hauling option is not particularly highly utilized. The indication therein is a transition to a solid waste collection services mandate may not affect a substantial portion of the public due to the already high level of participation. Additionally, the reasoning behind maintaining the self-haul option as a popular citizen choice issue may not necessarily be corroborated by the data. Furthermore, the survey shows broad support among citizens concerning recycling services and even higher support for curbside solid waste collection services. This data indicates there would be broad support behind the elimination of the self-hauling option as the vast majority of citizens support the two alternative solutions, curbside collection of recycling and solid waste.

The most problematic of all the responses was contained in the final question. The question asked, "How interested are you in having solid waste services be provided by the City of Apache Junction?" This question generated the most negative responses from the survey. This indicates that Apache Junction residents are not necessarily excited about the prospect of

changing their solid waste providers from their situation to a single-municipal provider. However, the overall response to this question was more positive than negative. This lends support to the conclusion that this survey serves as a preliminary benchmark that suggests the people of Apache Junction are ready for a change in the management of their solid waste. The initial negative responses generated by this question could throw off the overwhelming support that survey respondents indicated in favor of Apache Junction as a provider. 41% of respondent indicated they were interested or very interested with 32% of respondents neutral. It is easy to conclude that there is support for sweeping change in Apache Junction concerning solid waste management. The 32% of respondents that indicated they were neutral are an interesting group and it is important to find out why they feel the way they do. Ascertaining sentiment from neutral respondents should allow for a more confident conclusion by City of Apache Junction leadership.

Recommendations

There are several recommendations that are relevant. First, there were only 22 survey respondents. The ability of the survey data to be generalized is significantly limited by the low survey response; therefore, several more attempts need to be made at replicating the survey so a larger body of data may be gathered. Gathering a larger body of data will strengthen the findings of the surveys and the conclusions therein. Second, Apache Junction should continue forward on a phased or stepped approach to changing their solid waste services policy. There appears to be widespread support behind the current model of three solid waste services providers, curbside recycling, and curbside solid waste services. Additionally, there appears to be lower levels of interest in and utilization of the self-haul option. However, as discussed previously, the self-haul option creates legality issues for the City of Apache Junction, as well as, inefficiency issues with higher costs. Therefore, elimination of the self-haul option should be considered a confident first step in a phased approach to the formation of a coherent solid waste policy. Third, long-term recommendations should focus on consolidation of solid waste services providers through a Request-for-Proposal (RFP) process. Moving toward one solid waste provider will allow the City of Apache Junction to plan for future solid waste services infrastructure, promote healthy growth through control of the waste stream, and implement sustainability practices like diversion. Though survey data indicated there was some negativity toward Apache Junction becoming a solid waste services provider, 41% of respondents were interested or very interested

and 32% of respondents were neutral. These data indicate there is support for sweeping changes to SWM policy in Apache Junction. Neutral respondents may pose a challenge or become supporters and subsequent research should be directed at finding why citizens feel neutral. Education of the public through a public ad campaign is an option to shore up support for consolidation. At a minimum, consolidation should be something that Apache Junction moves toward as a foundation for the formulation of a comprehensive solid waste policy and is considered to be the standard model.

One final recommendation is the need to alter subsequent surveys to capture more data. One additional piece of information that is crucial concerns who citizens believe the city should have as a single provider and the disposition of that provider. It is important that city administrators know if people support creating a system similar to Phoenix or an alternative system. In Phoenix, city employees provide collection services, facilitate disposal, and manage landfill operations. In the alternative system, the City of Apache Junction may or may not function in an administrative capacity but would select a single provider who would be in charge of SWM with the city providing guidance through a competitive bidding process. Additionally, this information is important to the implementation and inclusion of SWM policy in the early stages of data collection. Furthermore, it will save money and time on the backend should the city decide to go in the direction of provider consolidation and institute sweeping changes.

Conclusion

In many cities across the United States municipalities have restrictions and long-standing historical precedence that makes policy determination and formulation more difficult. Apache Junction leaders and citizens have a unique opportunity to shape how the future of their city looks and functions as it currently stands. This research and the accompanying survey data serves to shed light on a viable path forward for Apache Junction to formulate a coherent and progressive solid waste policy. The difficulties will only grow with the population within the city limits of Apache Junction and sustainable diversionary practices will become crucial. Though human activities have always produced waste and solid waste generation rates have always tended to increase with population, responsible and visionary solid waste policy should effectively manage the same problems. The path forward for Apache Junction is full of opportunity with challenges along the way.

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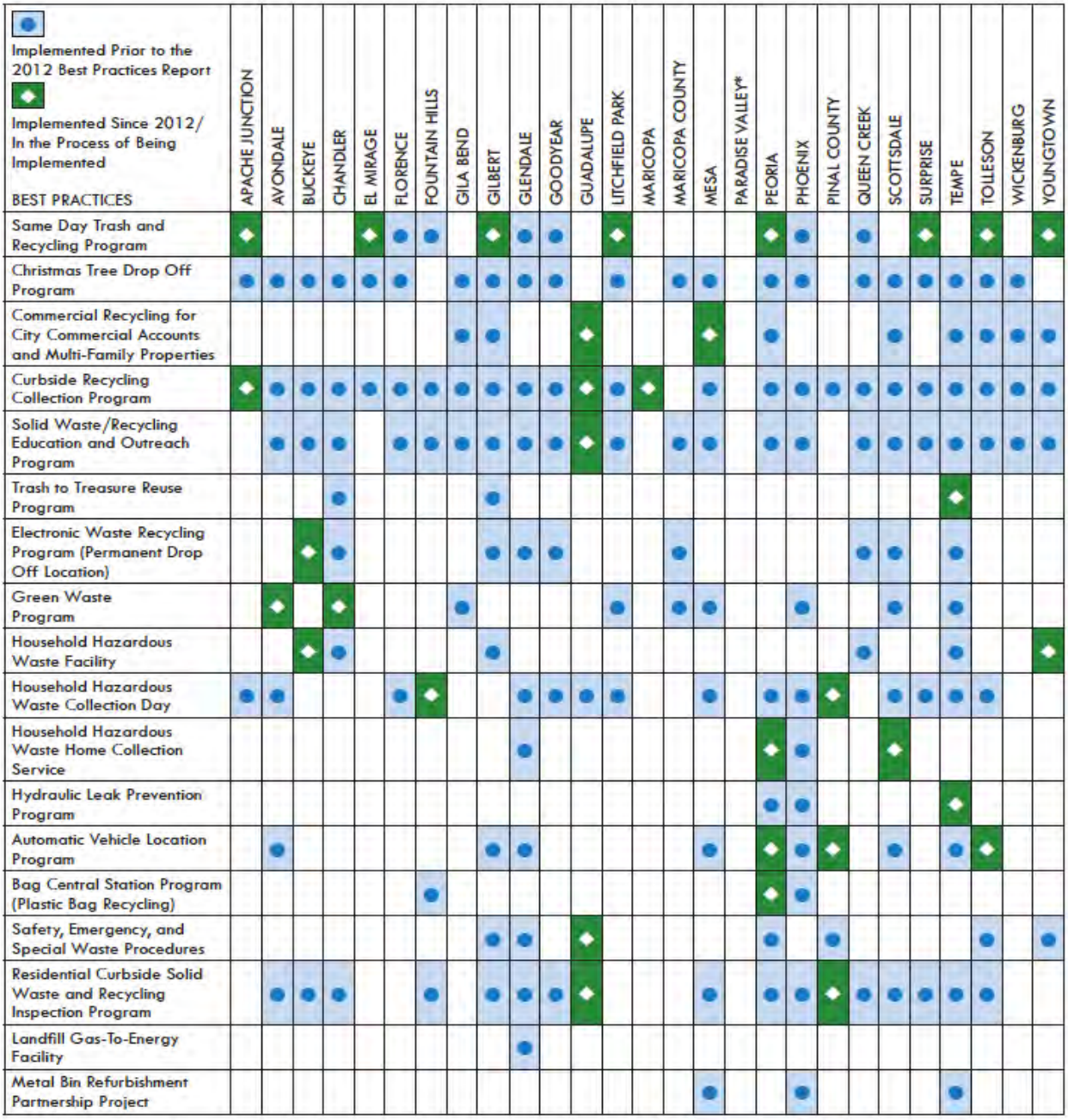
Appendix A



Implemented Prior to the 2012 Best Practices Report ● / Implemented Since 2012/ In the Process of Being Implemented ◆ — BEST PRACTICES	APACHE JUNCTION	AVONDALE	BUCKEYE	CHANDLER	EL MIRAGE	FLORENCE	FOUNTAIN HILLS	GILA BEND	GILBERT	GLENDALE	GOODYEAR	GUADALUPE	LITCHFIELD PARK	MARICOPA	MARICOPA COUNTY	MESA	PARADISE VALLEY*	PEORIA	PHOENIX	PINAL COUNTY	QUEEN CREEK	SCOTTSDALE	SURPRISE	TEMPE	TOLLESON	WICKENBURG	YOUNGTOWN
Same Day Trash and Recycling Program	◆				◆	●	●		◆	●	●		◆					◆	●		●		◆		◆		◆
Christmas Tree Drop Off Program	●	●	●	●	●	●		●	●	●	●		●		●	●		●	●		●	●	●	●	●	●	
Commercial Recycling for City Commercial Accounts and Multi-Family Properties								●	●			◆				◆		●				●		●	●	●	●
Curbside Recycling Collection Program	◆	●	●	●	●	●	●	●	●	●	●	◆	●	◆		●		●	●	●	●	●	●	●	●	●	●
Solid Waste/Recycling Education and Outreach Program		●	●	●		●	●	●	●	●	●	◆	●		●	●		●	●		●	●	●	●	●	●	●
Trash to Treasure Reuse Program				●					●															◆			
Electronic Waste Recycling Program (Permanent Drop Off Location)			◆	●					●	●	●				●						●	●		●			
Green Waste Program		◆		◆				●					●		●	●			●			●		●			
Household Hazardous Waste Facility			◆	●					●												●			●			◆
Household Hazardous Waste Collection Day	●	●				●	◆			●	●	●	●			●		●	●	◆		●	●	●	●		
Household Hazardous Waste Home Collection Service										●								◆	●			◆					
Hydraulic Leak Prevention Program																		●	●					◆			
Automatic Vehicle Location Program		●							●	●						●		◆	●	◆		●		●	◆		
Bag Central Station Program (Plastic Bag Recycling)							●											◆	●								
Safety, Emergency, and Special Waste Procedures									●	●		◆						●		●					●		●
Residential Curbside Solid Waste and Recycling Inspection Program		●	●	●			●		●	●	●	◆				●		●	●	◆	●	●	●	●	●		
Landfill Gas-To-Energy Facility										●																	
Metal Bin Refurbishment Partnership Project																●			●					●			

Note: This table reflects the implementation of the best pratices identified in the 2012 Solid Waste Best Practices in the MAG Region Report, as indicated by the MAG member agencies in the 2016 survey.

* In Paradise Valley, residents work directly with one of five private haulers to provide solid waste and recycling collection. As a result, the services provided to Town residents vary depending on the private hauler.

Reprinted from "Solid waste best practices in the MAG region: 2017 Update," by Maricopa Association of Governments. (2017). Phoenix, AZ: Maricopa Association of Governments.

Appendix B

Solid Waste Survey

1. Which of the following best describes your current solid waste preferences?

Subscriber Do not Subscribe Self haul

2. If so, which provider do you use for solid waste services?

Waste Management Republic Waste Services Right Away Disposal

3. Overall, how satisfied are you with your provider?

1	2	3	4	5
unsatisfied				Very Satisfied

4. How interested are you in receiving weekly, street side recycle pickup?

1	2	3	4	5
Uninterested				Very Interested

5. How interested are you in receiving weekly, street side solid waste pickup?

1	2	3	4	5
Uninterested				Very Interested

6. How interested are you in having solid waste services be provided by the City of Apache Junction?

1	2	3	4	5
Uninterested				Very Interested

Appendix C

Raw Encoded Survey Data

	Q1	Q2	Q3	Q4	Q5	Q6
Respondent 1	self haul	self haul	5	5	1	5
Respondent 2	sub	rad	5	5	5	5
Respondent 3	sub	rad	5	5	5	3
Respondent 4	sub	repub	5	5	5	5
Respondent 5	sub	repub	5	5	5	3
Respondent 6	self haul	wm	5	5	5	5
Respondent 7	sub	repub	5	5	5	1
Respondent 8	sub	repub	3	3	3	0
Respondent 9	sub	repub	3	3	5	3
Respondent 10	no subscribe	none	3	5	5	5
Respondent 11	sub	repub	5	5	5	3
Respondent 12	sub	rad	5	5	5	0
Respondent 13	sub	repub	3	3	3	3
Respondent 14	sub	wm	5	1	5	0
Respondent 15	sub	repub	5	5	5	1
Respondent 16	sub	repub	0	0	0	3
Respondent 17	sub	rad	0	0	0	1
Respondent 18	sub	repub	5	5	5	1
Respondent 19	sub	rad	3	3	3	1
Respondent 20	self haul	self haul	0	3	3	3
Respondent 21	sub	wm	5	5	5	0
Respondent 22	sub	repub	3	3	0	0

sub = subscriber

self haul=self-hauler

rad=Right Away Disposal

repub=Republic Services

wm=Waste Management

0=No Response

Comprehensive Solid Waste Program

for Apache Junction, AZ

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PAF509 Public Affairs Capstone

Master's in Public Administration

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Abstract

This proposal is intended to assist the City of Apache Junction, AZ with the implementation of a comprehensive solid waste management program. Managing solid waste is a complex and important task for local municipalities and may be required by a regulating agency as is the case for Apache Junction. A comprehensive solid waste management program can reduce illegal dumping and improve appearance of private property. A program that includes various services such as recycling and household hazardous waste will also protect the environment and public health. What does a Comprehensive Solid Waste Program look like for Apache Junction? A review of benchmark cities, selected based on comparisons to Apache Junction, will provide a basis for the types and level of services offered by similar cities. Since needs vary from city to city it is recommended that a survey of Apache Junction residents and winter visitors be completed to confirm the services that should be provided.

Keywords: solid waste, solid waste collection, curbside refuse and recycling

Table of Contents

Introduction

Apache Junction is a young city, incorporated in 1978, with a population of just over 39,000 year round residents, this population nearly doubles in the winter ("City of Apache Junction, AZ", 2017). It sits on the eastern edge of the Phoenix Metropolitan area at the base of the Superstition Mountains with an area of 34.81 square miles. It is within the boundaries of Maricopa and Pinal Counties with the majority of its residents in Pinal County. According to the Apache Junction General Plan, the City's population is expected to grow to just under 100,000 by 2030 and have a build out of 140,000 (2010). As the Phoenix Metropolitan area builds out, it is expected that Apache Junction will see a larger percentage of year round residents than they currently experience ("Maricopa Association of Governments-Programs", 2017).

The City's Solid Waste Ordinance does not require residents to procure solid waste collection services (Adams, Ansara, Fernandes, Ferree, Howes, Ogden, & Powell, 2016, p. 2). Further, the Apache Junction Landfill Corporation's nearby landfill offers low landfill rates ($8.00 per ton) to residents which may be encouraging self-hauling. The current practice of not mandating waste collection may be contributing to illegal dumping and unsightly personal property, becoming a burden to the City's Code Enforcement Officers and is non-compliant with Pinal County regulations which requires removal of such material two times per week ("Pinal County Environmental Health Code", 2015, p. 40). Adding to this issue is the City's dense population (1,051.71 people/square mile) compared to that of Maricopa County as a whole (435.64 people/square mile) ("Maricopa Association of Governments-Programs", 2017).

The City currently has three vendors that offer solid waste collection; Republic Services, Right Away Disposal, and Waste Management that residents may hire for this service with varying service levels. The City's Solid Waste Ordinance defines the days and hours this activity may occur. Unfortunately this creates a situation where up to three different companies may be driving down the same street on the same day, contributing to premature wear and tear of the streets and increased traffic (Adams et al., 2016, p. 2).

The City has no data related to the number of households participating in collection services. There is no way of the City knowing how much refuse is being generated or materials diverted due to recycling by residents. Adding to the complexity is Apache Junction's mix of urban and rural residential areas; rural areas may create a completely different waste profile as compared to an urban environment ("Apache Junction General Plan", 2010). So what does a

comprehensive solid waste program look like for Apache Junction? As the City moves forward with implementing a solid waste program they will need to fill in some of the blanks through a combination of research and public outreach that may include interviews and a survey of residents and winter visitors.

Literature Review

Management of municipal solid waste is one of the most important tasks for a city. The system, if properly designed and implemented, will help protect natural resources, the environment, and human health (Gallardo, Carlos, Peris, & Colomer, 2015, p. 1). When a solid waste system includes a recycling component, it has the added benefit of saving virgin materials and energy and prevents those items from being returned to the environment. A solid waste program can also have the effect improving property maintenance and reducing illegal dumping (Beccali, Cellura, & Mistretta, 2001, p. 243).

Designing a solid waste collection system is a complex process. Information such as set out distribution, stop to stop travel time and distance, total travel time and loading time are necessary to develop a model for a collection system (Wilson & Baetz, 2001, p. 1032). The city's mix of high and low density residential development pattern will impact stop to stop travel time, stop to stop distance, and total travel time greatly. It will also impact the type of refuse the homeowners generate. Without a single provider of services in the city, this information is not readily available. Without this information it is nearly impossible for the city to know the number of employees and vehicles that would be required to deliver these services in-house (Wilson & Baetz, 2001, p. 1031).

Once collected, the refuse materials will need to be disposed of. This is typically done through one of three methods; landfill, incineration, or recycling. Landfills are becoming more heavily regulated, require large areas of land, and are unsightly. Incineration used to be seen as a resource recovery method because, as the garbage was burned, the heat was used for energy however, air quality concerns have made this method less desirable in urban areas. Recycling can be an economic alternative to the first two methods and is becoming more popular ("Solid Waste Management", 1988, p. 3-8).

The most popular type of curbside recycling today is known as single stream recycling, a comingling of various recyclable materials into one bin. The implementation of single stream

recycling has contributed to increased participation in recycling activities (Shi, Thanos, & Celik, 2014, p. 190). While single stream encourages recycling and reduces tipping fees, it is not without its setbacks. Contamination of materials and the need for sorting the materials after collection are a real issues with this method of recycling (Farrell, 2003, p. 47).

Solid waste management is an expensive venture, Financing Solid Waste Management Programs A Survey of the States reports that $340 - $350 million is spent on solid waste annually in the United States with little to no federal funding (1990, p. 2). Recently, Apache Junction has sponsored household hazardous waste and neighborhood cleanup events free of charge to its residents (Adams et al., 2016, p. 2). Typically solid waste programs are funded through user fees (collection and tipping fees[1]), special item fees (tires, oil, etc.), and permit fees ("Financing Solid Waste Management Programs a Survey of the States", 1990, p.2). Consideration should be given on how the program adopted by Apache Junction will be funded.

Cost is another important factor in how municipalities deliver services. One of the most common approaches for smaller municipalities is to outsource, or privatize the service. Outsourcing will bring about an economy of scale that the smaller municipality would not otherwise experience (Bel & Fageda, 2014, p. 89). This is typically more advantageous when the municipality is located within a metropolis with multiple potential vendors. An alternative to partnering with a private entity is to enter into an intergovernmental agreement with another, nearby, municipality to provide the service. Partnering with another public entity may be more favorable as they tend to have similar goals and objectives as the City (Bel & Fageda, 2014, p. 90).

The Resource Conservation and Recovery Act (RCRA) is the federal law that focuses on solid waste. RCRA addresses both hazardous and non-hazardous materials, any program the city adopts should also include household hazardous waste. Household hazardous wastes are items such as paint, pesticides, herbicides, and motor oil that should not be disposed of in a standard container ("Resource Conservation and Recovery Act Overview", 2017). RCRA is administered by the US Environmental Protection Agency (EPA) who in turn grants primacy to the states that have an environmental department to implement.

[1] Tipping fees are the fees charged by a landfill for dumping waste and are levied on a per ton basis.

Arizona's Department of Environmental Quality is such an agency that has been granted primacy. The Arizona Department of Environmental Quality Solid Waste Program focuses on two areas, permitting and ongoing compliance of landfills ("Arizona Department of Environmental Quality Solid Waste Program" 2017). Since the City of Apache Junction does not own and operate a landfill this program is not applicable. The next line of regulation for the city would be through the county. Chapter ten of the Pinal County Environmental Health Code covers the handling and disposal of solid wastes. Items of note in the chapter are the prohibition of burning garbage, and its storage and disposal requirements. Pinal County requires solid wastes be stored in containers that close and can be kept clean, and must be removed from the grounds twice per week where services are offered (2015, p. 41).

While there is no one size fits all when it comes to municipal solid waste management there is much to be learned from nearby communities (Gallardo et al., 2015, p. 1). Social, economic, and legislative factors play a large role in waste generation and programs offered by municipalities (Gallardo et al., 2015, p. 2). Utilizing benchmark cities, with similar geography, demography, and economy, this project will provide a final report to Apache Junction with recommendations for moving forward with solid waste and recycling programs. Programs that are performance-based and will provide the necessary data to measure successes. The true success will be in the form of improved public health and safety for the community.

Methods

Three methodologies were explored to examine the solid waste issue in Apache Junction. One method would be to conduct a phone interview with a Code Enforcement Official to obtain any data they may have in regards to property maintenance violations and illegal dumping within the City of Apache Junction, helping determine the type of wastes that are generated within city limits. Another method would be to survey residents to determine the level of service they find valuable (See Appendix A for a prototype of a survey instrument) however, time does not permit this approach. The third and final method is a comparison to benchmark cities. The benchmark method involves collecting information about cities of similar geographic, demographic and economic characteristics and using it to develop a program for our subject city. This author chose to use the benchmarking method to analyze the issue.

Utilizing benchmark cities is a common research practice and will be the primary method for determining the path forward for Apache Junction. The cities or towns used as benchmarks for this project are Buckeye, Queen Creek, Fountain Hills, and Goodyear. These benchmark cities offer slightly different services but in general provide (and require) weekly curbside refuse and recycling services. These curbside services are done either on the same or different days but typically once per week each ("Solid Waste Best Practices in the MAG Region", 2012). In addition to the curbside contained services, many cities offer curbside uncontained pick up for items that are too large to fit in the containers. These occur at differing frequencies from once per month to not at all depending on the jurisdiction. Household hazardous waste collection is another service offered throughout the valley with differing methods of collection and frequencies (Adams et al., 2016). Looking for commonalities among the benchmark cities will help develop what a solid waste program should look like for Apache Junction.

While there are some similarities between Apache Junction and the benchmark cities there will be some significant differences. Finding a city of similar size that exhibits similar social and economic profiles that also included the age of population was not possible. Some generalizations were made based on representativeness of the population that may create some inefficiencies with the benchmark method of analysis. Due to these shortcomings, it is important to gauge the services that Apache Junction residents will find useful and are willing to pay for, this can be accomplished through a survey of a sample set of residents.

Findings

The benchmark cities are geographically similar as they are located on the fringes of the Phoenix Metropolitan area and are primarily residential. However, demographically and economically there are some similarities and some differences. Table 2 provides a list of characteristics for Apache Junction and the benchmark cities that can be used to demonstrate these variations. For example, Apache Junction's population is made up of just under 80 percent white individuals, which is very similar to Queen Creek, but quite a bit higher than Buckeye and Goodyear which have percentages in the 50's. Fountain Hills has the highest percent white population at 92 percent which is rather high for the Phoenix Metropolitan area.

Some other distinguishing characteristics are based on the economy of the cities. As Table 2 shows, the median household income ranges from $35,671 to $83,678 whereas Apache

Junction falls at the bottom of this range. The city also falls at the bottom of the range for median house value of $87,500. Apache Junction also has the highest percent of population with incomes falling below the poverty level at 24 percent. While this seems high, there are a large amount of retirees in the community that may be contributing to this. The poor economic conditions for the city will make it important to provide services at a good value for the residents as their ability to pay may be lower than the other benchmark cities'. This may also lead to development of alternative funding for the program to offset the cost to the low income customers.

Table 1: Benchmark City Statistics

	Apache Junction	Queen Creek	Fountain Hills	Buckeye	Goodyear
Race					
Percent White	79.7%	76.0%	92.0%	52.4%	55.4%
Percent Hispanic	14.6%	17.7%	3.2%	34.8%	26.9%
Percent Black	0.8%	2.2%	1.9%	8.1%	9.2%
Percent Other	4.9%	4.1%	2.9%	4.7%	8.5%
Economy					
Median Household Income	$35,671	$83,678	$73,272	$58,939	$70,323
Median Housing Value	$87,500	$261,200	$346,200	$152,800	$215,500
Percent persons with income below poverty	24.0%	8.60%	5.80%	14.80%	8.80%
Other Statistics					
Median age in years	50.9	30.3	56.6	32.3	37.1
Population density per square mile	1051.07	1032.66	1145.70	145.69	381.17

Information from Maricopa Association of Governments Report

On the topic of retirement communities, Apache Junction is among the highest of the benchmark cities in the area of median age. The median age in years for Apache Junction residents is 50.9 years. Fountain Hills is the only community of the benchmark cities that has a higher average age, 56.6 years. The remaining cities have relatively young populations, with a median age in the 30's. Age was thought to be another important factor as the elderly are less likely to be able to self-haul their refuse and recyclables, making curbside collection a more attractive alternative. Also the type of curbside container may need to accommodate those with limited mobility.

Another area of similarity is in population density. Apache Junction's density is at 1051.07 persons per square mile while Queen Creek and Fountain Hills are 1032.66 and 1145.70 respectively. The far west valley cities of Buckeye and Goodyear are much lower. This is of particular importance for this study as it indicates that there are some larger lots in the community that would increase the time and distance from stop to stop for a sanitation truck. There is also the potential of larger lots to allow livestock which would generate a much different type and volume of waste stream.

After researching the most common services offered by the benchmark cities, each of them were further researched to determine the frequency of the services they offered. The results of this can be found in Table 2 Comparison of Benchmark Cities Programs. As expected, they vary slightly but there are some common themes among them.

Table 2: Comparison of Benchmark City Programs

	Buckeye	Queen Creek	Fountain Hills	Goodyear
Provider	Republic Services	Right Away Disposal	Republic Services	Waste Management
Trash	Once/week	Once/week	Once/week Optional twice/week	Once/week
Recycle	Once/week alternate day from trash	Once/week same day as trash	Once/week same day as trash	Once/week same day as trash

Bulk	Once/quarter on schedule	Once/month by request	NA	Once/month on schedule
Household Hazardous Waste	Anytime by appointment	Via Town of Gilbert through a voucher program (20 vouchers/month first come first serve)	Will be implementing HHW events	Twice/year at special event
Exemption Allowed	NA	Yes, if large lot with livestock	NA	NA

Information from Sustainability and Waste in Apache Junction and www.goodyearaz.gov

One common theme to point out is that each benchmark city uses a contractor to perform the services. This is not necessarily the case across the Phoenix Metropolitan area. Some, typically larger cities, provide solid waste and recycling services with in house resources. Due to the size and organizational structure of Apache Junction this may not be a viable option and therefore, outsourcing of the services may be more practical. Another area of commonality is with trash and recycling collection, most of the cities are providing once per week curbside trash and recycling collection for their residents. Further, the majority provide the service on the same day of the week so that residents are only required to move their bins out and back one day per week. While the practice of “same day service” does not reduce the wear and tear on streets (still two trucks through the neighborhood each week), it will reduce traffic for all other days of the week.

Bulk service is an additional service offered by all but one of the benchmark cities. It is performed either once per month or once per quarter in the cities studied. This is an important service to lower income individuals who may not have landscape services to dispose of large yard debris. Bulk service provides an option for disposing of items too large to fit in a bin for those that do not have the means to self-haul large debris to a landfill. Cities who offer this program either include in the monthly fee paid by all residents or charge on an as used basis.

Household hazardous waste is defined as any surplus household product that is flammable, or may react or even explode under certain conditions. Some items are paint,

pesticides, herbicides, motor oil, etc. ("Resource Conservation and Recovery Act (RCRA) Overview", 2017). It is important to provide residents a means for disposing of these items in order to keep them from being poured down the drain, on the ground, or in the storm sewer. The dangers of this type of disposal can pollute the environment, upset the sewerage system, and can threaten human health.

Each of the cities studied requires residents to subscribe to the services offered. While some allow for suspension of service for various reasons such as military service or for seasonal residents, only one community allowed an exemption. The Town of Queen Creek allows those individuals who live on larger lots with livestock the option to opt out of the citywide service in lieu of obtaining their own contract for service. This allows those residents the ability to enter into a contract with a provider that can service a larger container for the additional rubbish generated by this type of residence. Regulation of these users may pose a challenge and may require regular compliance inspections to ensure these residents are maintaining an account for collection.

Recommendations

There is a need to revise the City Ordinance to better define the disposal methods for waste streams generated within city limits, beginning with requiring subscription service, and following through with identifying various types of wastes such as recyclables, bulky items, and household hazardous wastes. A comprehensive program that address the various types of wastes will improve the aesthetics of the community, the environment and public health. This will also drive the need for a more comprehensive program of services that would be better delivered through a single service provider.

Based on the size of the city and its organizational structure, it is recommended that the city outsource curbside solid waste and recycling services. This could be accomplished either by contracting with a service provider, entering into an Intergovernmental Agreement with a neighboring municipality, or utilizing an existing municipality's contract with a service provider. If the city chooses to enter into their own contract, it would require a solicitation for Request for Proposals for Solid Waste and Recycling Services. Defining the scope of services to be offered will be an important step in obtaining consistent proposals. If a neighboring community's existing contract offers the desired services and includes cooperative purchasing language,

Apache Junction may be able to enter into a contract with that entity, saving them time and money a solicitation would take.

While there are the basic levels of service such as weekly trash and recycling pick up, as demonstrated by the benchmark cities, there are other components of the program that may be desirable. The city has recently sponsored events to address some of the resident's needs, for example, the household hazardous waste drop off for selected neighborhoods. Additionally, in the past the city provided bulky item collection seasonally. It is further recommended that these events be offered on a regular basis citywide. They may still be accomplished via in-house resources or be added to the scope of services for the solicitation. If they are accomplished using in-house resources, a mechanism for funding these programs should be put into place.

Finding out the level of service and frequency the residents of Apache Junction desire and are willing to pay for is another challenge. One way this can be gauged is through a survey of a sample set of residents (see Appendix A for a sample survey). Survey data should then be analyzed utilizing Stata (or similar), a computerized statistics data analyst tool, and summarized in order to complete the scope of services for vendors to develop proposals. Monthly rates should be established that cover the cost of service provided.

As a result of mandating service, more people will be subscribing which should drive down the unit cost of service. This economy of scale should occur regardless if the City chooses to enter an Intergovernmental Agreement, utilize an existing contract with cooperative purchasing language, or enter into their own contract for service. The rate should be structured such that it covers the entire cost of service, both outsourced and city provided services.

Another area that will be impacted by this mandate is enforcement. Public outreach and education will play a large role in the implementation of the new code. If single stream recycling is part of the program, as recommended, the city will need to perform annual inspections to maintain compliance with the program. This extra burden may be offset by fewer calls for property maintenance violations and illegal dumping to Code Enforcement Officers.

Conclusion

One of the most important functions of a city in the United States is to provide a comprehensive solid waste program for its residents. A comprehensive solid waste program is one that addresses the need for disposal of all types of waste generated by residents. It takes into account the geography, demographics, and economy of the community it serves. When well implemented, it will improve the aesthetics of the community by reducing illegal dumping and the need for storing waste on private property until it can be hauled away. The program will protect human health and the environment by providing options for properly disposing of waste. It has the added benefits of protecting the environment when it includes a household hazardous waste and recycling component. Recycling programs protect the environment by keeping those items out of the landfill that can be reused or recycled thereby protecting virgin materials. Household hazardous waste programs prevent items such as chemicals and motor oils from being dumped in areas that can migrate to aquifers and streams contaminating the environment and threatening wildlife and human health.

When developing and implementing such a program, a city must keep its residents (customers) ability to pay in mind. Providing services that the community needs at a frequency they find valuable will help keep costs down. While residents may think they need increased frequency of a particular service, they may not fully understand how that translates to rates. Therefore, it is incumbent on the municipality to manage the wants and needs of their residents and develop a program that will achieve the goals they have set at a reasonable rate. The City of Apache Junction residents will benefit by the implementation of a comprehensive solid waste program. The benefits will be in improved aesthetics of their community, consistent curbside refuse and recycling service, and protection of the environmental and public health.

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Appendix A

Municipal Solid Waste Survey

Municipal Solid Waste Survey

Please complete this brief summary about your experience with sanitation services provided for Apache Junction residents. The city is particularly interested in services you are currently subscribing to and if you have any interest in curbside solid waste and recycling services. This survey should take no more than 15 minutes of your time.

1. Do you subscribe to curbside solid waste services (if no go to #3)?

☐ Yes
☐ No

	Very satisfied	Satisfied	Neutral	Unsatisfied	Very unsatisfied	N/A
2. Overall, how satisfied are you with your sanitation service?	○	○	○	○	○	○

Landfill

	Once	Twice	Three times	Four Times	More than four times	Never used
3. How often have you visited a solid waste landfill in the past year?	○	○	○	○	○	○

4. Do you participate in curbside recycling services (if yes go to #6)?

☐ Yes
☐ No

5. Reasons for not participating in curbside recycling

○ Self haul
○ Price
○ Not offered in my area
○ Takes too much time
○ I don't have enough recyclables
○ Not interested

	Very Satisfied	Satisfied	Neutral	Unsatisfied	Very unsatisfied	N/A
6. Overall, how satisfied are you with your recycling service?	○	○	○	○	○	○

Continued on next page

7. How do you dispose of green waste (yard clippings)?

- ○ Curbside refuse
- ○ Self haul to landfill
- ○ Compost
- ○ Leave on lawn
- ○ Have landscape service
- ○ Don't have grass
- ○ N/A

8. How do you dispose of household hazardous waste (pesticides, herbicides, paint, etc)?

- ○ Curbside refuse
- ○ Household hazardous waste drop off location
- ○ Self haul to landfill
- ○ Pour in yard or gutter
- ○ N/A

Thank you for completing this survey. The city appreciates your time and assistance helping them reach their goal to provide vital services at a good value to its residents.

Sean Sederstrom

PAF 509: Public Affairs Capstone

Sustainable Solid Waste Solutions for the City of Apache Junction

Sustainable Solid Waste Solutions for the City of Apache Junction

Abstract

In collaboration with the Arizona State University's Project Cities Program, this study examined the existing solid municipal waste management practices of the City of Apache Junction, Arizona and seeks to determine where opportunities for improvement exist. Using regional case studies as a basis for comparison, management and rate structures were examined. It was determined that given the unique circumstances that exist in Apache Junction, namely its location and seasonal fluctuations in population, a sole sourced third-part contract would be better suited the city rather than the city run structure of its neighbors. Furthermore, it was determined that a pay-as-you-throw rate structure in which residents pay by unit of waste rather a flat fee would be most effective in Apache Junction. Recycling and waste diversion was also examined as a means of extending the life of the regional landfill. As such, mandatory curbside pickup with a pay-as-you-throw monetary incentive is likely to be the most effective and efficient means of improving recycling participation rates.

Introduction

Although far from a new problem, the dilemma of waste management and disposal remains a matter of great importance and concern for many municipalities. Among the cities grappling with how to effectively control the waste produced by its citizens is Apache Junction, Arizona. Straddling the counties of Maricopa and Pinal, Apache Junction sits on the far eastern edge of the Phoenix metropolitan area. Incorporated in 1978, the city was built at the base of the Superstition Mountains near the site of the long abandoned mining town of Goldfield. Both recreational use of the city's natural resources and tourism are a major source of revenue. According to the 2010 census, the city's population is approximately 39,000. However, unlike most cities where population remains relatively stable over the course of a year, Apache Junction sees its population nearly double in the winter months due to seasonal residents that come to Arizona for the mild climate it enjoys during that time period. The 2010 census data also revealed that the median household income among permanent residents is just over $38,000 per

year which is below the national average as well as the median household incomes for both Maricopa and Pinal counties. As a relatively young city, many traditional pieces of infrastructure are still in development. For instance, Apache Junction's city government does not include a water, waste management departments. Solid waste services are left to private vendors which residents may choose from (City of Apache Junction, 2017). The nature of this piecemeal approach has left Apache Junction with a critical issue – they currently do not have a method for monitoring municipal solid waste collections and ultimate disposal. This poses a considerable problem for the city as it continues to grow. City officials are concerned that the city may not have sufficient infrastructure to meet future needs and feel that there may be more effective and efficient means to managing the city's waste. Further complicating the issue is the city's fluctuating population. The large influx of seasonal residents makes the waste problem more challenging for city planners; they must not only consider how to manage waste for their permanent residents but must also be prepared to accommodate the needs of the seasonal visitors as well.

As mentioned above, waste collection and disposal is currently contracted to three private companies: Right Away Disposal (RAD), Republic Services, and Waste Management. The city does not dictate which company residents can use nor does it divide the city into service areas; residents are free to choose from any of these three companies (City of Apache Junction, 2017). Alternately, should residents choose not to hire one of these contractors, they can take their waste directly to the Apache Junction Landfill (AJL) which is within the city limits and is owned and operated by Republic Services. The landfill's useful life is expected to last through 2035 when it is scheduled for closure. The next closest landfill, operated by Waste Management, is more than 30 miles way meaning waste disposal will become a great deal more expensive if the lifespan of the AJL can't be extended or other alternatives are not enacted. One way to extend the use of AJL past 2035, as well as make the city's waste manage more environmentally sustainable, would be to increase waste diversion through a city wide recycling program. Currently, among the three waste contractors only RAD and Republic offers curbside recycling pickup. The city does not keep customer records for either company so it unclear how many Apache Junction residents currently participate in the recycling program (City of Apache Junction, 2017).

Apache Junction solicited proposals to further examine the city's current and future waste disposal needs. Arizona State University's (ASU) Project Cities Program agreed to partner with the city to leverage the university's considerable knowledge and research capabilities to help in the city's waste management goals. This project is one of several that has worked to design policy and management strategies to meet the city's waste needs now and in the foreseeable future and to do so in an environmentally conscious and sustainable manner. The purpose, of this effort, is to provide the city and relevant partners with a detailed study that will include an examination of how the city of Apache Junction can ensure future infrastructure needs, prevent undue burden on its residents, preserve the natural environment through proper waste disposal and management, and follow all local, state, and federal regulations regarding. This study will also examined relevant waste management strategies such as voluntary versus mandatory curbside pickup, continued self-hauling, and implementing a recycling program. With the additional data and policy framework included in the study, the city of Apache Junction should be able to make more informed decisions regarding waste management solutions and be better equipped to implement the proposed policies.

Literature Review

In the case of municipal waste management, a large base of literature exists. This literature includes both qualitative and quantitative data as well as numerous case studies of both domestic and international examples. As part of this project and study, existing literature was examined for a variety of topics pertinent to the area of waste management. These included waste management strategies, case studies, and literature examining public interaction and participation in waste management decision making.

Public Engagement

As expressed by city officials from the City of Apache Junction, this point is of particular interest and will be key to developing a holistic waste management policy. Studies have previously examined this question though many involve populations outside of the United States so some of the data collected may need to be adapted to fit an American audience. For instance,

in their 2016 paper "A conceptual framework for negotiating public involvement in municipal waste management decision-making in the UK" Garnett, et. al. performed surveys and focus groups on public participation that will likely be of interest to Apache Junction. The debate in the UK was largely based on what technologies should be used, namely incineration versus more environmentally conscious means. While that may not be directly translatable, one of their findings that is certainly applicable to the case of Apache Junction is that availability of information to the public is key to their participation in the process. In the UK waste handling contractors engaged directly with local communities by sending representatives to town hall meetings and opening lines of communication. This, perhaps more than any other method, may be the best means for including the residents of Apache Junction in waste management decisions. Using Garnett et al. as an example, involving citizen groups is paramount to overcoming the information barrier. The city has a Citizen Leadership Institute that along with city officials will be key in this endeavor. In a previous work, Garnett also described that communicating an often technical issue effectively city officials and convincing them that public participation in the decision making process is both difficult and important (Garnett & Cooper, 2014). Garnett and Cooper conclude that,

> The research has demonstrated that communicating the practical benefits of more inclusive forms of engagement is proving difficult even though planning and policy delays are hindering development and implementation of waste management infrastructure. Some local authorities perceive engagement as time consuming, costly, politically risky or ineffective and, as a result, there is little opportunity to link analytical–deliberation to institutional or policy change.

Luckily, in the case of Apache Junction, the city is already on engaged with the concept of public participation so the issue described by Garnett and Cooper hopefully will be less of an issue than in the communities studied in the United Kingdoms.

Management Strategies

The literature also provides numerous and detailed comparison of waste management strategies. These examine strategies such as centralized collection, mandatory and voluntary collection, privatization, and incentives based systems (Greene & Tonjes, 2013; Przydatek, 2016;

Plata-Díaz, et. al, 2014). Plata-Díaz et al. provide a strong case for the involvement of and extent to which economic factors play into the success of any given waste management strategy. They found, perhaps not surprisingly, that there is a strong correlation between the economic factors of a community and which waste management strategy was effective (Plata-Díaz et al., 2014). What is perhaps more interesting is their findings regarding of how the strength of this correlation varies between different management strategies. They examine 685 Spanish municipalities of a similar size to Apache Junction (1000-50000 residents) between 2002 and 2010. Despite a different legal structure in Spain, the results of their study do help explain how Apache Junction came to the system it has today as well as offering some insight to what strategies may be effective moving forward,

> When the municipality is facing fiscal stress and when, moreover, a particular service is especially costly, it will tend to contract out (individual or joint form) as a means of restructuring the service. This implies that small and medium-sized municipalities such as those discussed here may still prefer to provide this service by means of a private operator, rather than seek to achieve economies of scale through public inter-municipal cooperation. The results also show that this type of municipality is an attractive business proposition for private operators. (Plata-Díaz et al., 2014)

This finding, as well as the data presented by Plata-Díaz et al, suggests that a hybrid municipal/privatized system similar to what Apache Junction already has may be a reasonable strategy. Moreover, because the city already collaborates with three waste collection companies serving the city such a strategy may have a lower cost and be easier to implement in the near term.

Environmental Factors

Additional literature also examines environmental impacts and implication of varying waste management structures. Environmental considerations include land use, protection of surface and groundwater, health impacts on humans and wildlife, and contribution to carbon pollution (Herva, Neto, & Roca, 2014; Perez, et. al., 2017; Mesjasz-Lech, 2014; Lee, Kim, & Chong, 2016). Much of the literature that examines the environmental impacts of waste and waste management looks at the impact of waste on the production of greenhouse gasses and

pollution. While this is certainly a consideration in the case of Apache Junction, the majority of existing literature focuses on large municipalities with far more resources than Apache Junction. What is clear, however, is that most effective means for reducing the environmental impact of municipal waste is diversion through a recycling program (Friedrich & Toris, 2015). For Apache Junction implementing a city wide recycling program is likely the most effective means of improving the environmental sustainability of the city's waste management system. The other consideration relevant to Apache Junction that is evident in the literature is improving efficiency. Currently the city's waste collection is extremely inefficient given the lack of monitoring and controls in place. A management strategy that improves collection and disposal efficiency would have both financial and environmental positive benefits (Põldnurk, 2015).

Methodology

This project utilized a diverse set of methodologies for both data collection and analysis of key goals. Initial study was conducted through a detailed literature review including case studies and an examination of existing research. Various case studies and examples were used as a basis for comparison. These included both a comparison of other Phoenix area municipalities as well as other communities similar to Apache Junction. These case studies provided strong evidence for what methods have been effective for other communities and provide important lessons that Apache Junction can use for its future development. Qualitative comparison of waste management and policy structures was conducted to determine whether meaningful conclusions can be drawn from the experiences of other cities. The purpose of this analysis will be to both establish a basis of comparison between Apache Junction and similar municipalities and to examine any possible correlation between existing factors. Using the data acquired, and qualitative assessment of waste management strategies an appropriate procedure was then be developed.

Findings and Analysis

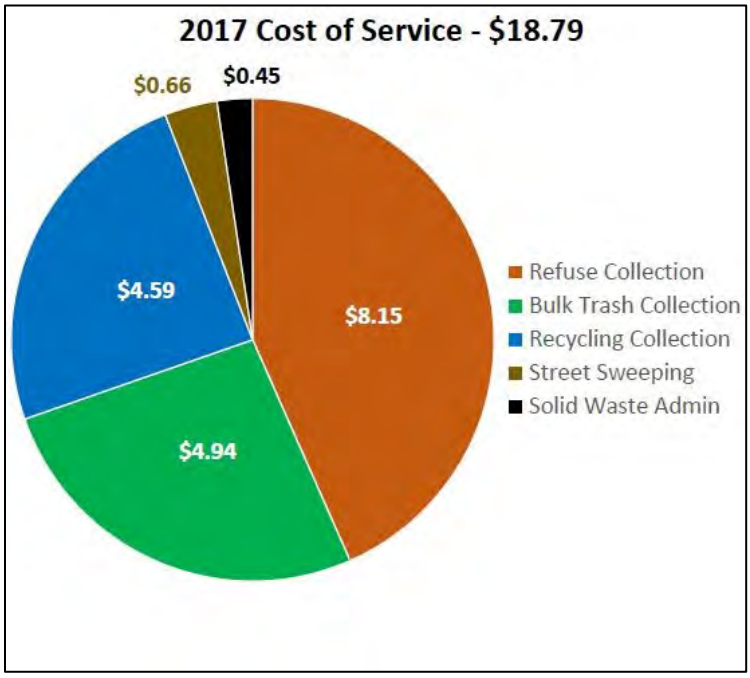
Case Studies

In an attempt to further understand the factors and circumstances that influence the waste management structure and decisions in the City of Apache Junction, other cities of similar size and that exist within a similar regulatory structure were examined and used as case studies. These case studies provide real world examples of potential options for the city and eliminate some of the uncertainty involved and provide a diverse set of waste management strategies each with specific valuable qualitative and quantitative lessons for Apache Junction.

The first such example is the City of Glendale, Arizona. Glendale, while larger than Apache Junction in terms of geography and population, exists in a very similar regulatory structure. Glendale, like Apache Junction, is in Maricopa County and is a suburb of Phoenix. As such, it is subject to the same state and county laws, rules, and regulations as Apache Junction. Glendale offers a prime example of a classic centralized city run waste management strategy that is easily translatable to Apache Junction. In 1998, the federal Environmental Protection Agency (EPA) did an extensive study of Glendale's municipal waste disposal procedures. The EPA study analyzed Glendale and other cities on the context of economic considerations with what they report refers to as "full cost accounting" or FCA. This FCA analysis looked primarily at direct, indirect, hidden, and future costs (EPA, 1998). Glendale began using FCA as means to understand its MSW needs in the early 1990s. At that time the city's population, based on the 1990 federal census, was approximately 180,000. Even then Glendale was nearly four times larger than Apache Junction which may on its face seem to make the comparison difficult to make. However, much like the current projections for Apache Junction, Glendale experienced a 52% population increase during the 1980s. Glendale both currently and in 1996 utilizes a city run waste collection system out of the city's Field Operations Department. For fiscal year 1996, Glendale's sanitation and landfill budget was approximately $20.8 million (2017 dollars) which was comprised of approximately $9.6 million for curbside pickup operations (46%), $6.72 million landfill operations (32%), and $5.12 million container service (25%) which is contacted to a third party. Glendale manages, operates, and maintains its own waste services including a city owned fleet of vehicles. Revenue is derived from four

primary sources: residential rates (42%), tipping fees (30%), commercial rates (24%), and interest income (4%) (EPA, 1998). These revenue sources fully fund the city's waste collection and operation needs. More recently, Glendale released an estimated cost of service breakdown which can be found it Figure 1 below. It should be noted, however, that the current cost estimate of $18.79 exceeds the current monthly service fee of $16.30 and the city is currently proposing a rate increase (City of Glendale, 2017). While not explicitly stated it is assumed the values listed include all derivative costs such as personnel, physical assets such as collection vehicles, and maintenance. Unsurprisingly, the majority of cost is associated with refuse collection (43%) followed by bulk trash collection (26%) and recycling collection (24%). What is significant, however, is the administrative costs which only accounts for approximately 2% of the overall cost to residents. In the context of Apache Junction, the relatively low figure suggests that the city could internally take on administrative processing of administrative management such as contracts and billing without putting undo stress on the city budget. This would further suggest that a hybrid city managed/privately contracted waste management structure would likely be viable for Apache Junction.

Figure 1

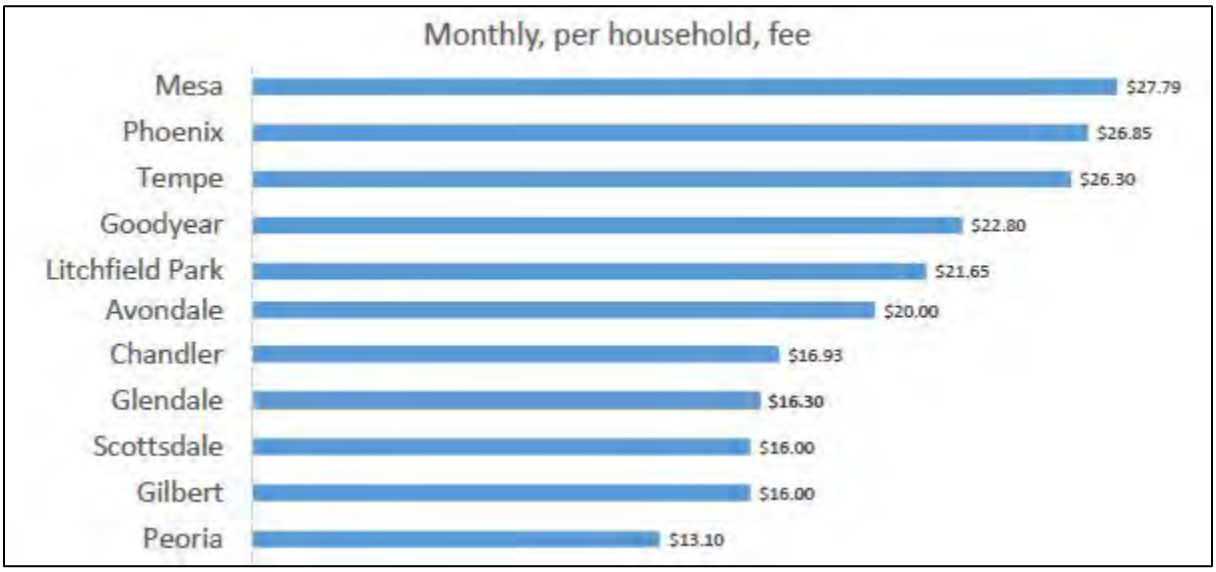


Source: City of Glendale Public Works Department

Management Structures

Currently in Apache Junction, the rate a resident pays is dependent on which of the three available companies they choose to contract for their waste disposal. Of the three approved companies, only Waste Management and Republic make their rates readily available. The current rate for new Waste Management customers in Apache Junction in $20.16/month for a household. That rate includes twice weekly curbside pickup for general landfill waste. It does not include recycling and Waste Management does not currently offer curbside recycling pickup as an option for Apache Junction residents. That rate is in line with the average monthly fee for the Phoenix Metropolitan area. Among Phoenix and its ten largest suburbs, the average monthly fee is $20.38/month (City of Glendale, 2017). Figure 2 below contains the current monthly fee charged by the eleven Phoenix Metropolitan cities. While the services provided among the municipalities varies a great deal, the major difference to the service provided in Apache Junction is the rate for the other regional cities includes both trash and recycling. Also included in these rates is periodic bulk pickup days.

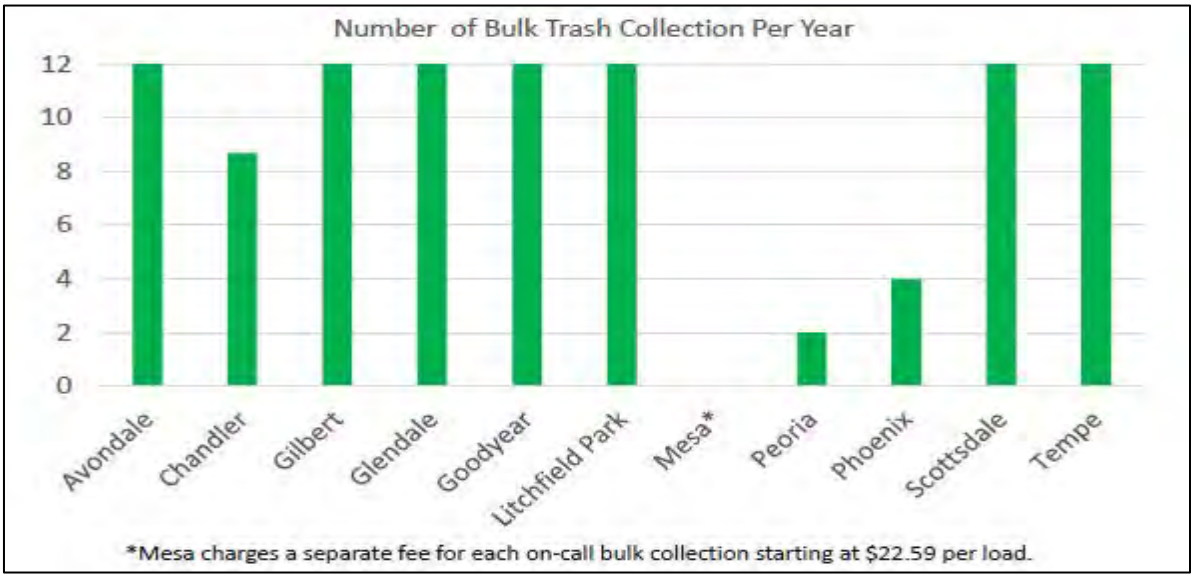
Figure 2



Source: City of Glendale Public Works Department

Figure 3 details the number of available bulk pickup days for the various municipalities. Based on the available date, there does not appear to be a strong link between the number of bulk collection days offered and the rate charged to residents. This is likely do to the high upfront cost associated with material assets needed to provide the service. Once the provider has

Figure 3



Source: City of Glendale Public Works Department

obtained the necessary materials, the marginal cost of additional collection days is relatively low. It assumed this concept holds true for both publically and privately provided waste collection and management.

In short the economies of scale that exist in waste management and collection suggest that a centralized, city run strategy allows other municipalities to provide equivalent or better service than what currently exists in Apache Junction. Residents of Apache Junction currently pay the same monthly rate as residents of other cities, but receive less benefit. It is highly likely Apache Junction would be able to offer a higher level of service compared to those that currently exist using either a city operated waste department or a sole-source waste contract.

Standard Fee vs. Pay-As-You-Throw

In designing a rate structure that is appropriate for their residents, most Phoenix area municipalities use a standard monthly fee that charged to the resident as part of their utility bill. The fee rate is set based on the relatively simple calculation of determining the services provided

and the relative cost of providing them. There are also administrative and personnel costs associated with a standard fee structure which is typically accounted for in the fee itself. This rate structure is an option for Apache Junction, though it may present some additional challenges. A standard fee structure works well for areas that have relatively stable populations and easily predicable growth rate. That is, however, not the case for Apache Junction. Apache Junction sees large fluctuations in its population both year-over-year and seasonally. A second option, pay-as-you-throw, may be a way to compensate for the variability of Apache Junction's population.

As the name likely suggests, a pay-as-you-throw fee only charges the participant for the waste they produce and is collected. The simple concept does however present significant logistical challenges; primarily monitoring how much waste users are producing and verifying the person charged is the person who produced the waste (Karagiannidis et al., 2008). The key to doing both is likely found in technology both on the part of the user and the provider. In a pay-as-you-throw paradigm, monitoring and fees are based on the weight of waste collected. Once in a landfill it is impossible to distinguish where the waste originated which means the monitoring needs to be done at the point of collection (Elia et al., 2015). In order to do so, collection vehicles would need to be equipped to weigh collected trash which would require a modification for a vehicles that are not already able to so. Alternately, the point of measurement can also be the waste bin itself. Several methods exist for the bin to measure the volume of trash inside. While all involve increased use of technology, they measure the trash through very different means. The first is by using a small camera attached to the inside of the bin that monitors trash levels and through an integrated RFID chip transmit the trash level to the collection vehicle at the time of collection. The second method is by using either an LED or ultrasonic sensor which measures the trash level inside the bin (Arebey et al., 2011). Also required for both collection vehicle measurement and bin measurement is a method for identifying which waste bin the trash came from which resident it belongs to. This can be done by installing either an RFID chip, barcode, or QR code in each bin which is then read by the collection vehicle. These codes are unique to the user and thus allows the appropriate user to be billed (Elia et al., 2015). Multi-resident living situations with shared trash bins such as Apache Junction's many manufactured home communities present another challenge as it is difficult to individually identify how much

waste each user generates. Two options exist for managing and monitoring multiuser waste bins. The first option is for the bin to be locked using an electronic lock with each user having a unique keycard. Each time the user places trash in the bin, they would need to first unlock the bin with their keycard. The bin is equipped with a scale that registers the amount of waste deposited in the bin. Each of these uses is logged and they can then be used to bill the individual users (Elia et al., 2015). More simplistically, the total weight of the bin can be measured at the time for collection and the charge equally divided among users. For waste disposal in an apartment complex for instance, the total weight would be recorded, billed to the apartment complex and it

Figure 4

Options for waste collection in a PAYT system.

		Waste measurement	
	User identification	Volume-based	Weight-based control
Single user service (Door-to-door collection)	Stickers (tags) based on barcode, QR code or RFID technologies	Bins/bags equipped with tags	Bins/bags equipped with tag, collection vehicle equipped with sensor weighing systems
	Stickers (tags) based on barcode, QR code or RFID technologies	Prepaid bags	Bins equipped with tag and sensor weighing systems
Multiple user service (Street side collection)	Physical or electronic keys, mobile technologies	Locked street container/bins equipped with bin level detection systems	Locked street containers/bins collection vehicle equipped with sensor weighing systems
	Physical or electronic keys, mobile technologies	-	Locked street containers/bins equipped with a sensor weighing systems

Source: Elia et al., 2015

would then be responsibility of the complex to divide the charge among their tenants. In their 2015 paper "Designing Pay-As-You-Throw schemes in municipal waste management services: A holistic approach" Elia et al. summarized the available options which can be found in Figure 4. Given the relative logistical challenges and cost of implementation, and necessary education of participants, bin level measurement would likely find the vehicle measurement more feasible. For multiuser bins, the simpler option of dividing the cost equally among users is likely preferable.

For Apache Junction, a pay-as-you-throw rate structure would be attractive for two main reasons. First, residents are only charged for the waste they produce which means that residents that live in Apache Junction on a seasonal basis would be charged while there, but would not receive a bill during the months they live elsewhere. Second, a pay-as-you-throw structure makes the user accountable for the amount of waste they produce. This accountability will have the

added effectives of appropriately charging those users who produce waste at a higher than average rate and providing a direct monetary incentive for users to reduce the amount of waste they produce (Elia et al., 2015). This second benefit, given Apache Junction's concern with the longevity of the Apache Junction Landfill, may be the most significant reason for the city to consider a pay-as-you-throw structure. Any reduction in residential waste production means an expanded lifetime for the city's landfill. As such, the additional cost of a pay-as-you-throw option would likely be more than offset by avoided cost of finding an alternative landfill option.

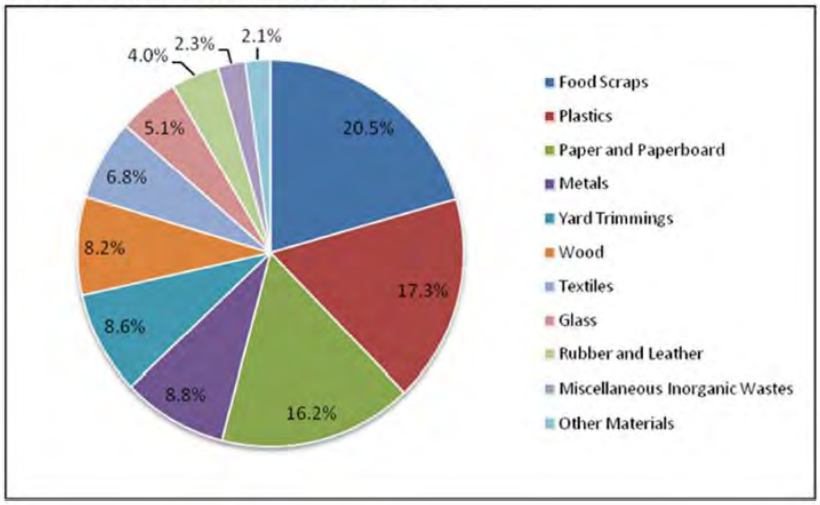
Recycling and Waste Diversion

As part of the Apache Junction's long term waste management strategy, recycling and waste diversion are imperative for two reasons: increased lifespan of the Apache Junction Landfill and improved environmental outcomes. Data are not currently available for the number of users who opt for recycling, but it can be assumed the rate is lower than either a mandatory recycling program or a sole sourced contract with recycling available to all residents. Household waste production accounts for as much as 55 to 65 percent of all landfill bound municipal waste with per capita generation rates of approximately 4.43 pounds of waste per person per day (EPA, 2014). Accordingly, the 39,000 permanent residents of Apache Junction produce over 86 tons (approximately 229 cubic yards) of municipal solid waste annually. For every pound of waste diverted from the landfill, extends the life of the AJL. It should be considered that while there will be increased costs including material costs, collection, and education of residents, those costs can be seen as a direct offset to the looming cost of developing new landfill options. According to a 2005 study, landfill construction costs can range between $336,000 and $774,000 per acre (Duffy, 2005; EPA 2014). The AJL is permitted for 96.3 acres of landfill area meaning construction of a new landfill of equivalent size would cost as much as $74.5 million. Furthermore, capping a landfill, the procedure of closing a landfill, can cost anywhere between $80,000 and $500,000 per acre (Duffy, 2005; EPA 2014).

Figure 5 shows the composition of waste collected nationally. Assuming Apache Junction is in line with national averages, many of these categories can be kept out of landfills through various waste diversion methods.

Figure 5

Material Composition of the MSW Stream, 2010



Source: EPA, 2014

While participation and waste diversion rates vary widely across the United States, the national average for recycling is 26% (EPA, 2014). Before that can be achieved, however, residents must first be convinced that recycling not only prudent, but also in their best interest. Not surprisingly, local culture has a strong influence on determining the likelihood of participation. Public awareness of the personal and collective benefits as well as providing social and monetary incentives play are large part in improving recycling participation (Crociata et al., 2015). The first hurtle that must be overcome is the come perception that recycling is difficult or inconvenient. In a survey meant to determine attitudes towards recycling, of respondents that expressed a negative opinion of recycling and did not participate, 40% of the negative response was due do the perceived inconvenience of recycling. Among those who felt recycling to be too much of a burden, the largest stated reason was proximity to a recycling bin (Miafodzyeva and Brandt, 2013). This further suggests the need for curbside recycling collection in Apache Junction.

Management structure and availability are also important in the success of a recycling program. Of the three approved waste disposal companies all offer recycling as an option. These are, however, entirely optional and are at the expense of the customer. In order to improve participation, the city of Apache Junction should either:

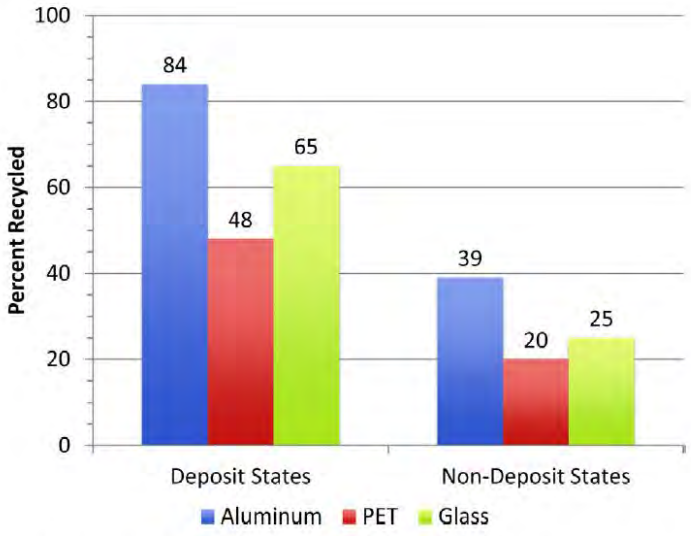
1) mandate recycling participation;

2) allow recycling to remain optional and provide a participation incentive;

3) maintain the current structure with recycling as optional

In the interest of extending the life of the AJLC landfill, an incentive based structure is likely to be the fastest and most effective strategy for increasing participation (Elia et al. 2015). While incentive options are strongly tied to rate structures, a direct bill credit would be the simplest. If, however, the city decided to adopt a pay-as-you-throw structure incentives for recycling could be directly tied, pound for pound, to diversion rates. Residents could be offered a reduction of their monthly bill for every pound of waste they keep out of the landfill. A direct incentive structure would offer residents a means of tracking their personal diversion rate and allow for monitoring and identification of specific and targeted area for improvement. The data also suggest this to be an effective means of improving participation. One the clearest examples of this effect is in comparing states with and without bottle deposit laws. In states with "bottle bills" there is a deposit paid at the point of sale for all recyclable containers. Consumers then have the option to turn in used containers for a refund of that deposit. As seen in Figure 6, states with recycling deposits experience more than doubled diversion rates for the materials subject to the point of sale deposit (Saphores and Nixon, 2014). Furthermore, providing an economic incentive helps drive participation rates among some of the hardest to reach groups. Among individuals who found the monetary incentive of deposit refund programs to be persuasive, there was a greater impact among non-recyclers, lower income households, self-described "non-environmentalists" (Viscusi et al., 2013; Saphores and Nixon, 2014).

Figure 6



Comparison of beverage container recycling rates in states with and without bottle bills

Source: Saphores and Nixon, 2014

Recommendations

Management Structure

Currently, the City of Apache Junctions allows its residents to independently select and contract with one of three approved waste disposal companies. Notably, waste contracts remain optional for residents and, should they choose, they can either haul their waste themselves or store it until the quarterly free bulk pickup dates. While this has worked in the past, logistical and efficiency concerns are likely to become a factor as the city's population continues to grow. It is in the city's best interest to mandate resident waste disposal contracts. Two methods are available: mandatory contracting or a city run sole-sourced contract. Based on the findings of this study, the second option of a city run contract is optimal as it would allow for management and monitoring of waste production, control of logistical details, and would allow the City of Apache Junction to take advantage of the economies of scale embedded in large scale waste management. A third-party contract, rather than city run program, would also prevent the need to purchase expensive collection and maintenance materials. Based on the examples provided by other regional municipalities, particularly the data provided by the City of Glendale, the administrative management of city waste collection could be conducted by the City of Apache Junction without significantly increasing costs.

Rate Structure

For a city with a fluctuating population such as Apache Junction, a pay-as-you-throw rate structure is highly attractive. Residents, both permanent and season are directly accountable for their share of the waste produced and part-time residents they will only be charged when present. This structure is also likely familiar to residents as it would bring the city's waste rate structure to be more in line with the structures that exist for electricity or water where the amount paid is commensurate with the amount of the resource used. In relation to waste management in the City of Apache Junction, the shared limited resource being consumed is space at the landfill. Furthermore, it can be coupled with an incentive structure for both reducing waste and participation in recycling. Providing a direct economic incentive provides a powerful tool for improving participation.

Recycling and Waste Diversion

Recycling and waste diversion is paramount to the sustainability of the City of Apache Junction's long term waste management structure. Particularly given the scheduled closure of the AJLC landfill, waste diversion through recycling is the most effective and cost efficient way to extend the useful life of the landfill. It is recommended that the City of Apache Junction implement a mandatory recycling program as well as an incentive for participation. In order to overcome the barrier of perceived inconvenience, curbside collection should be made available to all city residents. In order improve participation rates, it would also be beneficial for the city to implement an education and information campaign to further facilitate resident understanding of the need for recycling and waste diversion. Recycling is not only the environmentally conscientious thing to do, it is fiscally responsible. Waste diversion must immediately become a part of Apache Junction's waste management plan if the city is to postpose the costs that will be incurred by the closing of the landfill. These costs would undoubtedly be transferred to the Apache Junction in the form of rate increases.

Conclusions and Future Research

The City of Apache Junction as a relatively young city is working to design a waste management structure that fits its rapidly changing population. While this is certainly a challenging task, the city has taken positive steps. There are, however, areas in need of improvement. In order to plan for the future, the City of Apache Junction should look to both the proven strategies of other municipalities and adapt new innovation that will allow the city to continue to grow sustainably and develop into a leading example for the 21st Century. Apache Junction has the opportunity to build its waste management structure from the ground up with technologies and information that will give it an unprecedented ability to manage and monitor its waste. Some additional research is needed before an action plan can be draft. A survey should be conducted among Apache Junction residents to determine current attitudes towards the city's waste management and recycling. Community engagement and education will be key to determining the city's needs and appropriate actions moving forward.

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Solid Waste Service in the City of Apache Junction:

Evaluating the Benefits of Entering into a Shared Service Agreement for Solid Waste Service

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1.0 Introduction

This work focuses on the solid waste practices in the City of Apache Junction Arizona with an emphasis on proposing a viable option for providing cost effective and value based solid waste service. Currently, the City does not have a mandated solid waste collection or recycling program. For the most part, citizens have the option to transport discarded items to the local landfill or utilize a private hauler. At the behest of city officials and residents, there have been previous studies into potential enhanced solid waste options. As with many communities, there are a number of elements that go into determining the appropriate approach to solid waste management. Two key elements are growth and economic vitality. The city's current year round population includes approximately 40,000 residents, which represents an 11.8% growth from 2010 through 2016 (United States Census Bureau, 2017). This figure does not account for winter visitors and partial year residents. While the city is poised for continued growth in its populous, city officials are also expecting localized economic expansion. Job expansion in Apache Junction is projected to increase by 37.6% over the next ten years (Chhetri, N., Reichman, A, Prosser, P., 2016). Beyond these two factors, city officials are also concerned with safety, compliance with state/federal regulations, and ensuring a desirable quality of life for residents.

Considering these factors, it will be important for Apache Junction city officials to design a solid management approach that supports current user needs, while setting a path for effective sustainable waste management into the future. In this paper, the question is posed, is there value in entering into a cooperative service agreement with the Town of Queen Creek and its current solid waste service provider to provide solid waste service? Would a cooperative service agreement allow for significant cost savings and increased efficiency in program development and implementation? These are critical questions because implementing a solid waste management approach can be costly and pose both positive and negate impacts on citizens.

This project builds off of the December, 2016 Arizona State University School of Sustainability paper, *Sustainability and Waste in Apache Junction*. It includes the following key deliverables: A comprehensive description of the benefits and challenges associate with cooperative service agreements; information on state and local contracting laws and guidelines associated to shared service agreements; a detailed description of the solid waste services

provided under the Town of Queen service contract; and a culminating statement of recommendations and items needing additional research. In all, this work is a client based project designed to provide guidance to Apache Junction city officials on the way forward in designing and implementing a highly effective approach to solid waste management and recycling in the community. The overall recommendation is that the City of Apache Junction enter into a shared service agreement with the Town of Queen Creek to provide solid waste service to the citizens of Apache Junction. The agreement will build off of the Town of Queen Creek's existing contractual solid waste service agreement. It is important to note, there is a significant amount of research and literature on the topic, all of which provided a strong basis for the analysis and recommendations provided.

2.0 Literature Review

There is an extensive amount of literature available on solid waste management and shared service agreements. In researching the subject, there were an ample amount government documents and websites detailing all legal requirements relating to government contracting and shared service agreements. The information ranged from Federal level to state, and local jurisdictions. The information seem to connectively fit well with each level of government with little to no contradiction. For example, the State of Arizona Department of Procurement Code offered a broad overview of the state procurement laws governing shared contracting (Arizona Department of Administration, 2015). The local City of Apache Junction and Town of Queen Creek contracting codes build off of the State regulations (City of Apache Junction 2015 & Town of Queen Creek, 2010).

In researching the benefits of entering into a shared agreement for solid waste services, there were a number of sources. The general theme of most of the sources was very supportive of shared service agreements. Although these sources speak mostly to various types of shared service agreements, such as police dispatch service, sewer service delivery, and others. There was not a broad range of sources specific to solid waste service shared contracting. However, the general information on shared contracting provided consistent confirmations on benefits such as cost savings and efficiencies in the procurement process. It is important to note that there is a lack of literature on the challenges of associated with entering into a shared service agreement. While in this paper, examples of challenges are referenced from a study completed by Smith,

Henschel, & Lefeber, due to the limited amount of literature on this aspect of the topic, the explanation of potential challenges should be taken with due consideration (2008).

The case study of a cooperative service agreement for solid waste service, which is referenced in this paper, offers confirmation of the reported benefits found in the general research. However, again, there were a very limited number of case studies on solid waste specific cooperative service agreements. As noted, a number of sources confirmed the general notion that entering into a cooperative service agreement is very beneficial for government organizations. Each spoke specifically to the financial benefits of shared agreements. However, the major gap in the research appears to be a lack of clear analysis on the specific level of cost savings. This is a recommended area of continued study and future research.

The Solid Waste Association of North America (SWANA) technical policy report is also an important resource (The Solid Waste Association of North America, 2013). It is critical source of information for shaping both the resulting analysis on best practices and recommendations. It is important to note that the SWANA technical report is intrinsically tied to the notion of mandated solid waste management and as such, resulting information is not an analysis of whether mandated solid waste management is the best option, but rather a commonly used best practices. This does not mean that this source of information is not useful. Instead, it is extremely useful, as the assumed approach to mandated waste management is consistent with the broader body of literature. It also directly serves the intended goal of identifying the best solid waste practices.

3.0 Methods

The project was conducted using a qualitative and qualitative review of the associated literature. In general, the project relies heavily on government documents and also case studies to better understand the benefits and challenges of government shared agreements for solid waste service, as well as the legal considerations. In the paper, there are identified items in need of continued research as well as shortcomings of the overall body of literature. The Literature was reviewed and compiled in a comparative structure, listing the significant benefits and drawback to entering into a shared service agreement for solid waste service.

In addition, a significant amount of emphasis was placed on understanding and describing government contracting laws related to shared service agreements. This included, state statutes and local codes specific to both the City of Apache Junction and The Town of Queen Creek. Also, both the benefits and challenges associated with shared service agreements are thoroughly assessed to properly inform the way forward. A review of a case study on a shared solid waste service is reviewed to help offer additional insight on the potential of a shared service agreement. The specific solid waste service currently provided under the Town of Queen Creek service contract are listed and assessed to allow for clear understanding of the potential services that would be offered under a shared service contract. A comparative review of the community profiles for The City of Apache Junction and the Town of Queen Creek are included to provide an assessment of the level compatibly between the two communities. Understanding the level of community compatibilities foretells the probability of a successful shared service agreement. A comparative review of the solid waste service fee under the current Town of Queen Creek contract is included in the work. The review gives an indication of the potential cost savings from entering into a solid waste service agreement. In general, the research methods used include a mixed method based analysis of the relevant literature on the topic. In all, the methods used serve to provide guidance and direction for developing an effective solid waste management approach in the City of Apache Junction.

4.0 Data and Analysis

4.1 Background on Government Cooperative Service Agreements

The goal of this project is to assess the potential value and benefits of the City of Apache Junction entering into a shared service agreement with the Town of Queen Creek for the delivery of Solid Waste Services. To understand the potential value and benefits, it is necessary to analyze the nature of shared service agreements in general. Local governments have a history of engaging in cooperative agreements. The underlying goal of which is to promote mutually beneficial outcomes. That history includes collaborative efforts in forms such as mutual aid agreements, intergovernmental service contracting, shared facilities, and coordinated growth management. These are just some of the forms that inter-governmental collaboration takes. There are a number of municipalities driven by either need, innovative will, or both, whom are

taking creative approaches to collaboration that is helping them to maximize resources and operational outcomes.

4.2 Benefits of Cooperative Local Government Agreements

As noted, local governments are taking more aggressive approaches towards employing cooperative agreements. One of the most beneficial aspects of cooperative agreements is the resulting cost savings. More and more municipalities across the nation are facing spending restraints and budget short falls. Local leaders are increasingly called on to do more with less. As such, cooperative agreements are becoming a means for dealing with these challenges. As example, in a study conducted by the New York State Comptroller's Office, officials examined the relationship between cooperative agreements and increased revenue from intergovernmental transfers. They found that those engaged in cooperative agreements had higher revenues (DiNapoli, 2009). When it came to refuse, garbage, and sewer fees, the New York municipalities with sharing agreements experienced a 23.8% increase in revenue going from $74.7 million in 2002 to $92.5 in 2007 (DiNapoli, 2009).

As one example of a beneficial solid waste shared service agreement, the Cape May County Municipal Utilities Authority (CMCMUA) and the Borough of Avalon formed an agreement on 23rd of September, 2011 (Cape May County Utilities Authority, 2011). The CMCMUA is an extending body of the State of New Jersey, thus giving it a governmental designation. The Borough of Avalon functions under a local jurisdiction designation. In the agreement, the CMCMUA assumes responsibility for providing solid waste services to commercial and residential customers throughout the borough. This includes curbside refuse and recycling collection as well the processing of recycling material and facilities management. The CMCMUA also owns and operates the associated landfill. Both parties express that the reason for the agreement is that it will help stabilize the maximum solid waste fee, by taking advantage of economies of scale pricing structures (Cape May County Utilities Authority, 2011). It is also reported that the agreement will allow the CMCMUA to more efficiently provide recycling services (2011). The overall agreement is governed by the State of New Jersey contracting and procurement laws. A similar agreement was originally established in 2005 and set to expire on December 31, 2011. The original agreement was renewed on September of 2011, with some minor provision changes. The accord is a seven year agreement, which expires in December of

2018. At that time officials will determine to either renew the agreement or pursue an alternative approach to solid waste service delivery. In this example, the CMCMUA is acting as a service provider in administering all solid waste delivery for the Borough of Avalon. As such, it is not a direct shared service agreement between these two parties. It is more of a quasi-shared service agreement, in which service are rendered by a cooperating government entity. However, it is important to note that identical agreements have been established with all 16 municipalities in Cape May County. This allows the local government to take advantage of efficiencies resulting from economies of scale. In a sense, each individual municipality is in a sort of broader cooperative agreement, and as such has an opportunity to reap the benefits.

4.3 Cooperative Service Agreements – Important Items of Consideration

In considering the possibility of the City of Apache Junction entering into a cooperative agreement with the Town of Queen Creek to provide solid waste service, there are a number of potential challenges that could impede the success of the agreement. However, leaders can still reap the benefits of cooperative of agreements by planning for these challenges and taking assertive steps to mitigate them. For example, it is always helpful if the organizations entering into a cooperative agreement have prior relationship and a history of cooperation (Smith, Henschel, & Lefeber, 2008). If there is no prior history of cooperation, leaders from each organization should take the time to establish meaningful relations. This will help to promote an environment of mutual respect and cooperation. The underlined recommendation is to know your partners well. The City of Apache Junction executive and environmental service leaders should take assertive steps in establishing healthy relationships/partnerships.

It is also important to include all stakeholders in developing a shared service agreement. This mean also including those stakeholders who may oppose the agreement. This is critical because it will to gain public support in general, which will be highly beneficial in the long run. Outreach efforts explaining the benefits and challenges of a cooperative service agreement should be taken early and often. For example, leaders should look to involve union leaders, members of the media, and potential critics early and often, explaining the benefits and challenges of a cooperative service agreement.

As described, there are a number benefits to engaging in a cooperative service agreement to provide solid waste service. However, like anything else in life, the endeavor is not without

challenges. One of the most significant potential challenges is the perceived or real sense of loss of control (Smith, Henschel, & Lefeber, 2008). The purpose of entering into a contract for service is to meet the organization's/community's needs. However, in the case of a shared service contract, the goal becomes meeting both community's needs, which may differ in some areas. Typically, when communities are close in proximity, the community make-up may be similar which helps mitigate challenges related to loss of control. Also, if the communities have a history of working together, this also helps to ease related concerns. However, it is important to understand that anytime some portion of control is relinquished, leaders will feel uncertain. It is human nature to feel safer with more control. Relinquishing control is a part of shared service agreements. The key is, the benefits of the shared service agreement, must outweigh the drawback of relinquishing control.

Another potential concern is loss of community identity related to service (Smith, Henschel, & Lefeber, 2008). Some local leaders feel that under a shared contract, service providers may not understand the unique wants and needs of their constituents. They worry that the underlying organizational mission may be lost in the interpretation of multiple missions. This is absolutely a valid concern that must be considered.

Cost containment is another potentially negative impact associated with cooperative service agreements (Smith, Henschel, & Lefeber, 2008). Often when organizations enter into cooperative service agreements, the underlying goal is to reduce costs. While improving service is also an important consideration, in today's environment local leaders must be prepared to find cost savings without compromising service. The inability to contain cost can mean the complete failure of a solid waste program. An organization must have a clear understanding of the long-term costs/revenue associated with an agreement. It is also important to note that, while some programs may pose an initial cost increase on the short-term, cost containment should be evaluated on a long-term basis, up to seven years, thus allowing for the realization of long-term benefits.

As with any project, implementation issues are a critical concern for leaders. When it comes to cooperative service agreements, implementation concerns become even more magnified (Smith, Henschel, & Lefeber, 2008). Just as the case with cost containment, implementation issues can lead to program failure. Decisions related to equipment, managing

structure, procedures, and facilities should be well throughout in advance. The truth is, leaders cannot think of everything and any new program will be subject to some level of implementation issues. However, the key to programmatic success is to minimize implementation issues.

One of the most important elements of a cooperative agreement that is often not considered is a well-conceived exit strategy (Smith, Henschel, & Lefeber, 2008). When entering into an agreement, it is not immediately intuitive to plan how to dissolve the agreements. Leaders want the agreement to work and continue to work into the future. However, having a planned exit strategy can allow for less tumultuous dissolution, if needed. Remember, cooperative agreements may call for shared investment in personnel, equipment, and facilities. If an agreement does not work out as planned, the absence of a well throughout exit plan may result in an inability to dissolve an agreement in a timely fashion or even litigation.

In all, there are a number of potential challenges leaders may face when considering entering into a cooperative service agreement. Challenges such as loss of control, cost containment, implementation issues, and having a well thought out exit strategy. Each may all play into program success or failure. However, in light of these challenges, a cooperative service agreement can still be useful tool in achieving cost savings and effective service delivery. When considering a cooperative service agreement, leaders must take proactive approaches in planning for and mitigating these noted challenges.

4.4 Arizona Contracting/Cooperative Service Agreement Regulations

Procurement activities in Arizona are governed by the Arizona Procurement Code. In the code, Chapter 23, ARS 41-2632 allows governing units to participate in, sponsor, administer, or conduct cooperative purchasing agreements (Arizona Department of Administration, 2015). This includes contracts relating to material, construction, and/or services. The governing bodies involved, may enter into joint or multi-party contracts. To participate in a cooperating purchasing agreement with another governing entity, the Chief Procurement Officer for each entity must submit a request to the State Procurement Administrator. The request must specify how the request complies with A.R.S. § 41-2634. It is up to the State Procurement Officer to approve the request, deny it, or request additional information to allow the officer to make a final decision.

The City Apache Junction procurement code requires service contracts to be awarded to the "lowest responsive and responsible bidders" (p. 1, 2015). This means in most cases, contract proposals would have to go through a sealed bidding process by which, any contract awards would be based on ability to perform a service or quality of the good and best price. However, there is a provision in the code that allows the city to take procurement approaches that align more with cooperative service agreements. Under section 3-7-4, Exemptions (H), the code allows City officials to enter into service agreements, purchases supplies, or buy equipment based on the solicitation or contracts issued by other government entities (City of Apache Junction, 2015). This exemptions, forgoes any general requirement to obtain bids, utilize a bidders list, or post notices regarding bids. An important caveat to the exemption, as expressed in the City of Apache Junction Procurement Code is that the alternative bid procedure may be used, "When deemed to be in the best interest of the city" (p. 4, 2015). A reasonable basis for deeming the approach to be in the best interest of the city may be reduced cost, more efficient use of resources through reduced redundancy, and timely delivery of goods or services. In general, the Alternative Bid Procedure provision of the City of Apache Junction Procurement Code allows City officials to enter into mutual service agreements with other government entities. In the case of Apache Junction, this could give way to establish an inter-governmental service agreement for solid waste service delivery.

The Town of Queen Creek has a similar provision that authorizes cooperative procurement between government entities. In its procurement code, under Article 9-Cooperative Purchasing, subsection 9-101, Cooperative Procurement Authorized, Town officials may purchase goods or service without following the normal bidding process (p. 30, 2010). The code also stipulates that the Town may enter into a cooperative procurement contract, given that the normal bidding process would not result in a lower price (Town of Queen Creek, 2010). In general, the Cooperative Purchasing provision of the Town of Queen Creek Procurement codes allows the Town to enter into Cooperative Service Agreements for services such as solid waste service delivery.

4.5 Solid Waste Fees

The Town of Queen Creek currently contracts with Right Away Disposal (RAD) to provide solid waste service to both residents, HOAs, and commercial entities (Town of Queen

Creek, 2017B). Services provided include same day curbside collection of both recycling and household refuse. Items are picked up once a week for all customers. In addition, residents can place larger household items out for pick-up once a month in accordance with a pre-determined pick-up schedule. In addition, the residents are allotted five special pick-up events each year, during which items can be dropped off at designated drop-off at designated locations. All waste items collected are taken to the RAD transfer station for disposal.

As noted, the goal of this work is to examine the potential for entering into a mutually beneficial cooperative service agreement for solid waste service with the Town of Queen Creek and its existing solid waste service provider. To help in reviewing this option, included is a list of the solid waste services provided under the Town of Queen Creek Solid Waste contract. The list also includes customer prices citizens pay for those services.

As shown in Figure A, the standard monthly service fee for residential customers in The Town of Queen Creek is $16.22 (Town of Gilbert, 2017B). This allows customers once per week collection of both normal household solid waste and recycling. The standard fee also allows customers to dispose of up to six cubic yards of specified bulk trash waste each month. Residents can place bulk trash out for collection, by leaving it at the edge of their property facing the street, on their assigned pick-up date. If the standard solid waste cart does not meet the citizens need, an added cart can be purchased for an additional monthly fee of $7.15 and a one-time cart delivery fee of $15. Customers are encouraged to recycle. As such, an additional recycling cart is provided free of charge, upon request. Request for pick-up on a non-collection day or as a result of a missed pick, are processed for a fee of 21.75. Also, residents can exchange a cart for $15 per cart. As noted earlier, a resident may request one bulk pick-up once per month. Additional requests for bulk pick-up can be done at a cost of $82 for up to 6 cubic yards of bulk trash waste. Residence requesting a temporary discontinuance of service may do so, however a $25 application fee will be assessed. Damaged carts can replaced for a fee of $75. If the damage is due to normal wear and tear, there is no charge for the replacement.

Figure A. Town of Queen Creek Solid Waste Services & Fee Chart

Town of Queen Creek Solid Waste Service Fee Chart

Monthly Service Fee - $16.22
Once per week collection of solid waste cart.
- once per week collection of recycle cart
- once per month collection of six (6) cubic yards of bulk waste

Monthly Service Fee Recycle Only (Exempt) - $ 6.75
Reside on a lot on which large livestock are kept legally in conformance with the Town Zoning Ordinance or a lot of two acres or more in size, and; demonstrate alternative service for disposal of solid waste that complies with all Town, County, State and Federal rules.
- once per week collection of one recycle cart
- no additional Town trash services which includes bulk pick up and HHW drop off

Additional Solid Waste Cart Monthly Fee - $ 7.15 and a one-time cart delivery fee of $15.00
Once per week collection of additional solid waste cart.

Additional Recycle Cart - *FREE*
Once per week collection of additional recycle cart.

Full Manure Cart Fee - $15.15 and a one-time cart delivery fee of $15.00
Once per week collection of 95 gallons of manure. Must be dried and bagged.

Half Manure Cart Fee - $11.15 and a one-time cart delivery fee of $15.00
Once per week collection 47 gallons of manure. Must be dried and bagged.

Non Collection Day or Missed Pick Up Fee - $21.75
Fee is per cart.

Exchange Cart Fee - $15.00
Fee is per cart.

Extra Bulk Pick Up Fee - $82.00
one scheduled collection of up to six (6) cubic yards of bulk waste.

Temporary Discontinuance Application Fee - $25.00
Payment due upon submission, and may not exceed six (6) months per calendar year.

Cart Replacement Fee - $75.00
This fee will be assessed upon inspection when a cart is required to be replaced for any reason other than normal wear and tear.

Source: Town of Gilbert, 2017B Trash and Recycling. Retrieved from http://www.queencreek.org/departments/trash-recycling

The potential fees a customer may pay is an important aspect of a solid waste program. While citizens desire quality service, they typically are not open to paying exorbitant fees. The fee chart below provides a description of the standard monthly fees for basic curbside refuse and recycling for the City of Buckeye, the Town of Queen Creek, and the Town of Fountain Hills. It also includes an average of the fees for all three municipalities. This gives a perspective on the typical fee charged to citizens in communities of similar size, makeup, and need as compared to the City of Apache Junction. It should be noted, the contract that the Town of Queen Creek currently operates under at $16.22 is lower than the average fee of $18.30.

Figure B. Municipal Refuse Fee Comparison Chart

Municipal Refuse Fee Comparison Chart

Municipality	City of Buckeye	Town of Queen Creek	City of Fountain Hill	Average
Monthly Fee	$20.38	$16.22	15.37*	$18.30

*the monthly refuse fee is an average of 4 monthly billing options

Source: City of Buckeye (2017). Utility Information. Retrieved from http://www.buckeyeaz.gov/water-resources/utility-information-2/; Town of Queen Creek (2017A). Services Explained. Retrieved from http://www.queencreek.org/departments/trash-recycling/introduction-to-services; Republic Service (2017). Fountain Hills, AZ. Retrieved from https://www.republicservices.com/locations/arizona/fountain-hills/85268

4.6 Community Comparisons

When considering the possibility of entering into a shared service agreement, it is important to assess the compatibility between the communities involved. While the City of Apache Junction and the Town of Queen Creek are not identical, they do have some similarities. Most notable is population size. Based on 2016 estimates, the City of Apache Junction has a population of 40,000 residents and the Town of Queen Creek has 41,000 residents. The two communities also have a similar demographic make-up at 81.3% Caucasian for Apache Junction and 74% for the Town of Queen Creek. All other racial categories were also relatively similar.

While there are clear similarities in population size and racial profile, there is a significant difference in economic make-up. In Apache Junction, 23.9% are in poverty and the median home value is $88,000, with a median gross rent of $772. In contrast, in the Town of

Queen Creek, only 8.6% of residents are at or below the poverty line and the median home value and median gross rent is $237,800 and $1,305 respectively. The significant disparity in the economic make-up between the two communities, emphasizes the importance of finding an economically viable option for solid waste service delivery in the City of Apache Junction.

Figure C. Community Make-up Comparison: Apache Junction & Queen Creek

	Pop. Est. (Apr 2010)	Pop. Est. (Jul 2015)	Veterans	Persons in poverty	Median value of owner occupied housing	Median gross rent
Apache Junction	35,838	38,074	4,928	23.9%	$ 88,000	$ 772
Queen Creek	26,348	34,614	1,942	8.6%	$237,800	$1,305

Source: Sustainability and Waste in Apache Junction. https://sustainability.asu.edu/sustainable-cities/wp-content/gios-uploads/sites/22/2016/12/SustSWinAJ_FINALFall2016.pdf?x99006

Figure D. Community Demographics: Apache Junction & Queen Creek

	Caucasian	Hispanic	African American	Asian	American Indian / Alaska Native	Others
Apache Junction	81.3	14.4	1.2	0.8	1.1	1.2
Queen Creek	74	17.3	3.4	2.8	0.7	1.8

5.0 Conclusion and Recommendations

There is significant value in the City of Apache Junction entering into a shared service agreement with the Town of Queen Creek for solid waste service delivery. The Town of Queen Creek has a current contract under which the monthly refuse fee paid by citizens for services rendered is below the market rate. By entering into a shared service agreement, City of Apache Junction officials may acquire the same rate as the Town of Queen Creek or even negotiate for a lower rate based on the shared agreement. In addition, the Town of Queen Creek may also benefit by renegotiating their current rate as term of the shared agreement. In general, the City of Apache Junction would benefit from a shared solid waste service agreement with the Town of Queen Creek by receiving a favorable solid waste service fee. In addition, the shared service

agreement would also allow City of Apache Junction officials to avoid the substantial duplication of effort that would go into bidding and awarding an individual service contract.

It is recommended that the City of Apache Junction Officials approach the Town of Queen Creek officials and discuss the possibility of entering into a shared service agreement with the Town of Queen Creek's current solid waste service provider Right Away Disposal (RAD). A key emphasis of the discussion should focus on a mutual reduction of the current contracted service fee.

In developing the shared service agreement, both parties should work to mitigate the possibilities of challenges by developing strong relations, involving all stakeholders, thoroughly planning aspects of implementation, and drafting plans for possibly exiting the agreement. The following elements will require some additional analysis. City of Apache Junction officials will need to better understand how they will incorporate landfill services into the shared service agreement. This may be a matter of negotiation with RAD. In addition, it will also be important to further evaluate options for household hazardous waste (HHW) service. The Town of Queen creek currently has a shared service agreement with the Town of Gilbert for HHW service. City officials may consider replicating the agreement with the City of Mesa. However, it will take further analysis to determine the best option. The most important item in need of additional analysis is the potential for cost savings associated with a shared service agreement. Officials should review previous shared solid waste service agreements to understand the average cost savings potential. This information should be used in negotiating a shared contractual solid waste service fee. In all, the City of Apache Junction entering into a shared solid waste service agreement with the Town of Queen Creek would allow both parties to achieve benefits.

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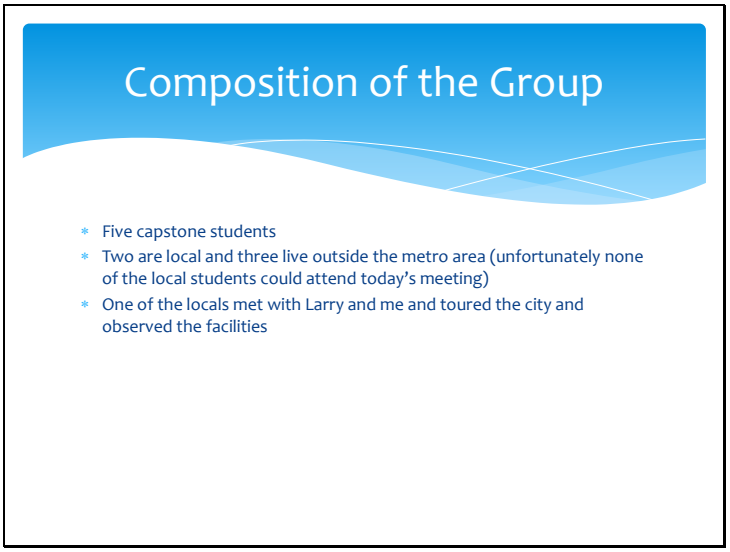
PRESENTATION SLIDES AND NOTES FROM FALL 2017 SHOWCASE

View the whole presentation at https://vimeo.com/247879795



Sample Research questions

* How satisfied are residents with the current providers?
* Is there citizen support for sweeping changes in solid waste management policy?
* What is the correlation between code compliance and solid waste?

Students' Research Methods

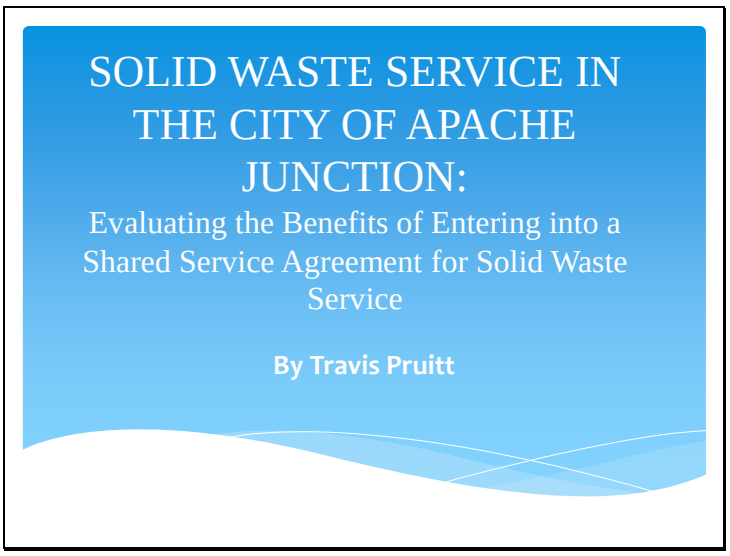
* Data collected through a survey of citizens of Apache Junction
* Case studies about programs and strategies that have been implemented in other cities
* Content analysis of documents

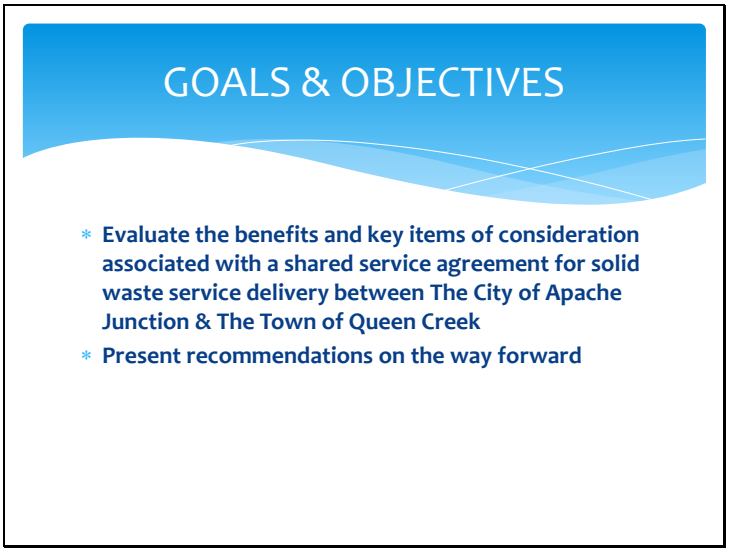
Sample of Key Findings

* In a preliminary survey, 73 % of city resident who were interviewed were either very satisfied or satisfied with the current system
* No respondents to the survey expressed dissatisfaction
* A vast majority supported a 2-pronged approach: 1) curbside collection, and 2) recycling and solid waste
* The pay-as-you-throw rate structure was most likely to improve recycling participation rates

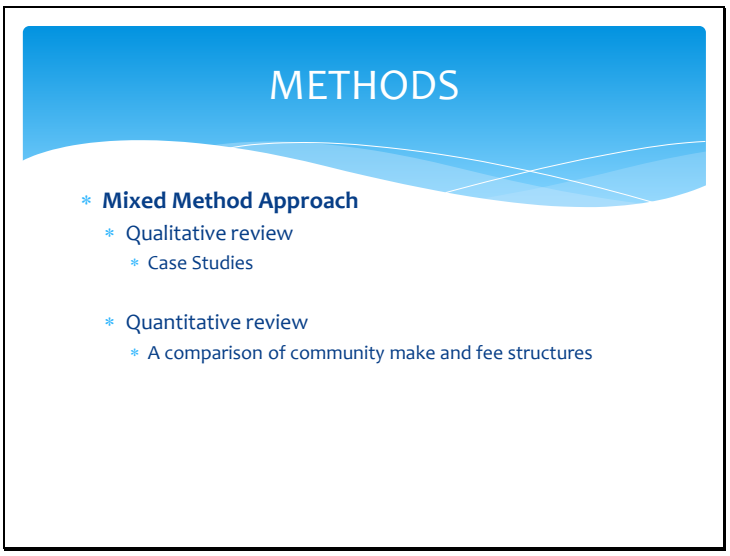
Sample Recommendations

* Implement a pay-as-you-throw system
* Revise the city ordinance and require subscription service
* Conduct a more comprehensive survey of residents and winter visitors
* Outsource solid waste and recycling service

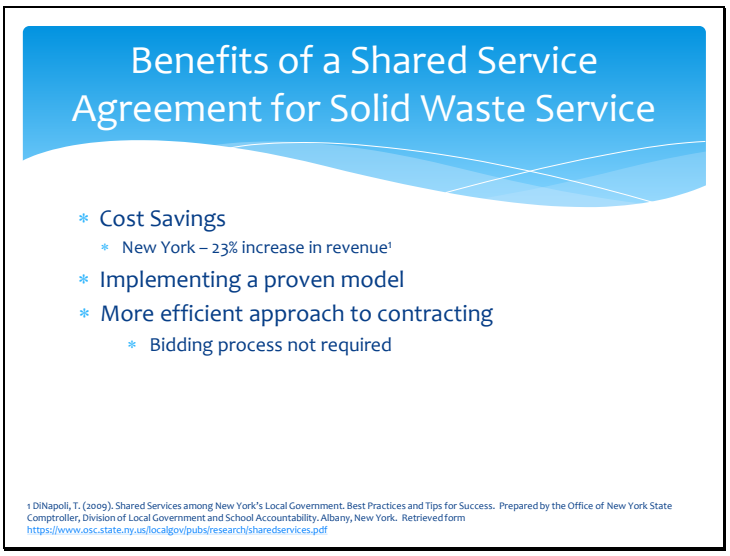


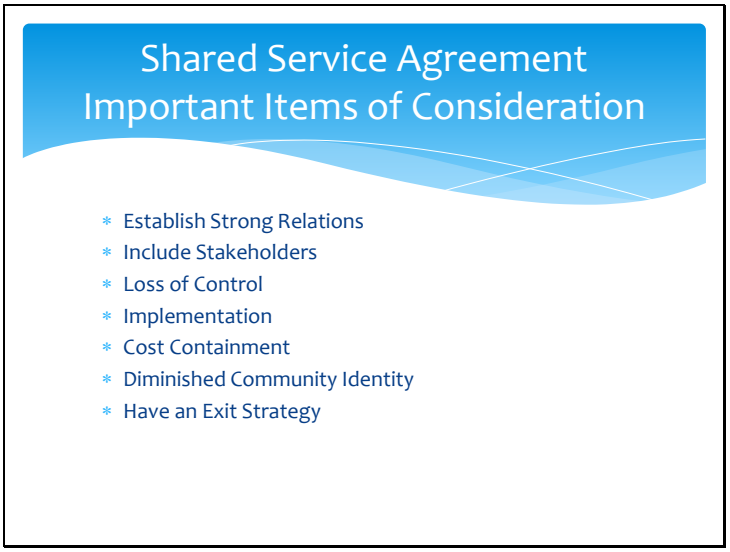


The City of Apache Junction currently does not have a mandated solid waste program. The city's current year round population includes approximately 40,000 residents, which represents an 11.8% growth from 2010 through 2016 (United States Census Bureau, 2017). As a result of this growth and considering economic needs, it is important to start thinking forward about a mandated solid waste program.



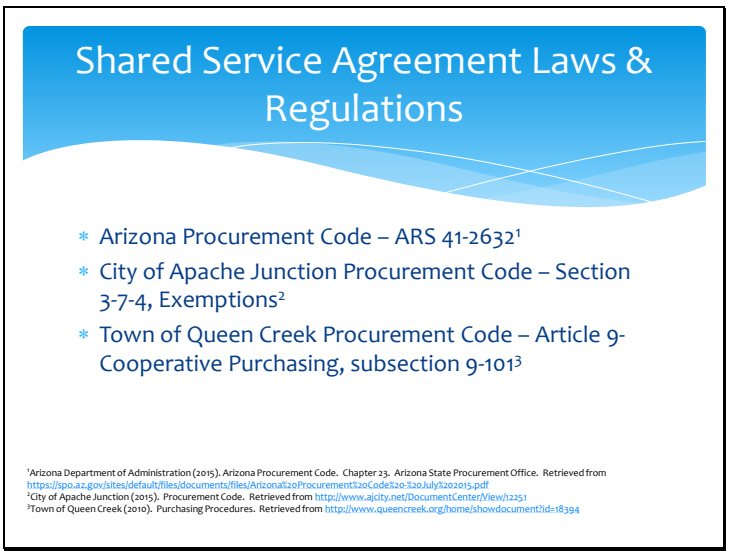
A review of a case study on a shared solid waste service is reviewed to help offer additional insight on the potential of a shared service agreement. A comparative review of the community profiles for The City of Apache Junction and the Town of Queen Creek are included to provide an assessment of the level compatibly between the two communities. Understanding the level of community compatibilities foretells the probability of a successful shared service agreement. A comparative review of the solid waste service fee under the current Town of Queen Creek contract is included in the work.





It is always helpful if the organizations entering into a cooperative agreement have prior relationship and a history of cooperation (Smith, Henschel, & Lefeber, 2008). If there is no prior history of cooperation, leaders from each organization should take the time to establish meaningful relations. This will help to promote an environment of mutual respect and cooperation.

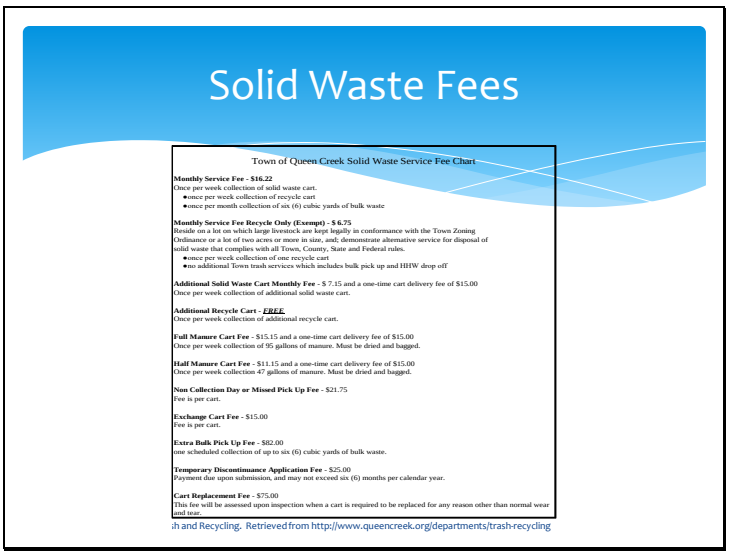
It is important to understand that anytime some portion of control is relinquished, leaders will feel uncertain. It is human nature to feel safer with more control. Relinquishing control is a part of shared service agreements. The key is, the benefits of the shared service agreement, must outweigh the drawback of relinquishing control.



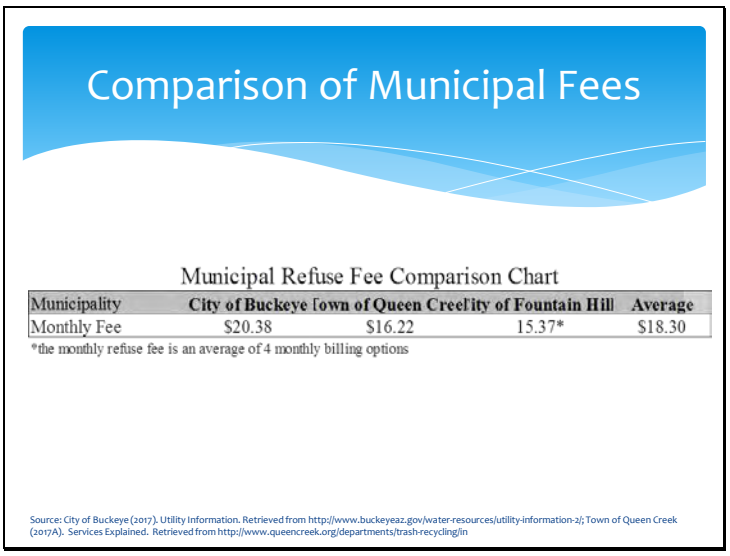
Procurement activities in Arizona are governed by the Arizona Procurement Code. In the code, Chapter 23, ARS 41-2632 allows governing units to participate in, sponsor, administer, or conduct cooperative purchasing agreements. This includes contracts relating to material, construction, and/or services. The governing bodies involved, may enter into joint or multi-party contracts. To participate in a cooperating purchasing agreement with another governing entity, the Chief Procurement Officer for each entity must submit a request to the State Procurement Administrator.

Under section 3-7-4, Exemptions (H), the code allows City officials to enter into service agreements, purchases supplies, or buy equipment based on the solicitation or contracts issued by other government entities

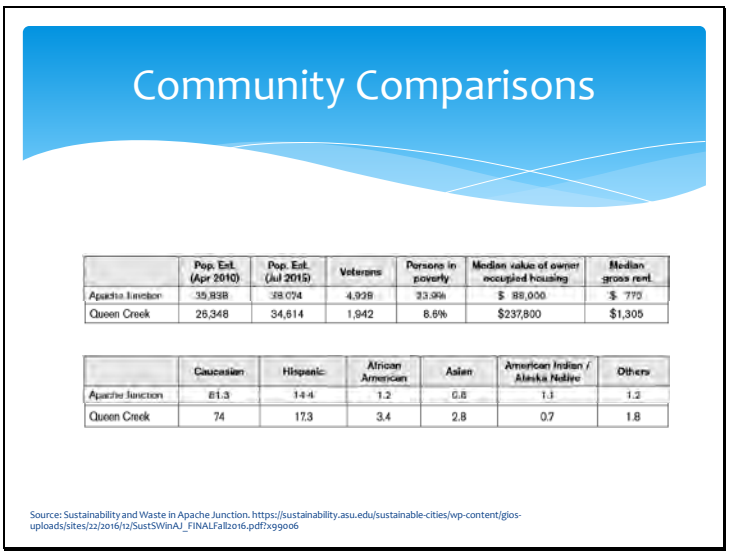
under Article 9-Cooperative Purchasing, subsection 9-101, Cooperative Procurement Authorized, Town officials may purchase goods or service without following the normal bidding process.



The Town of Queen Creek currently contracts with Right Away Disposal (RAD) to provide solid waste service to both residents, HOAs, and commercial entities (Town of Queen Creek, 2017B). Services provided include same day curbside collection of both recycling and household refuse. Items are picked up once a week for all customers. In addition, residents can place larger household items out for pick-up once a month in accordance with a pre-determined pick-up schedule. In addition, the residents are allotted five special pick-up events each year, during which items can be dropped off at designated drop-off at designated locations. All waste items collected are taken to the RAD transfer station for disposal.



The fee chart below provides a description of the standard monthly fees for basic curbside refuse and recycling for the City of Buckeye, the Town of Queen Creek, and the Town of Fountain Hills. It also includes an average of the fees for all three municipalities. This gives a perspective on the typical fee charged to citizens in communities of similar size, makeup, and need as compared to the City of Apache Junction. It should be noted, the contract that the Town of Queen Creek currently operates under at $16.22 is lower than the average fee of $18.30.



Based on 2016 estimates, the City of Apache Junction has a population of 40,000 residents and the Town of Queen Creek has 41,000 residents. The two communities also have a similar demographic make-up at 81.3% Caucasian for Apache Junction and 74% for the Town of Queen Creek. All other racial categories were also relatively similar.

In Apache Junction, 23.9% are in poverty and the median home value is $88,000, with a median gross rent of $772. In contrast, in the Town of Queen Creek, only 8.6% of residents are at or below the poverty line and the median home value and median gross rent is $237,800 and $1,305 respectively. The significant disparity in the economic make-up between the two communities, emphasizes the importance of finding an economically viable option for solid waste service delivery in the City of Apache Junction

Recommendations

- *Pursue entering into a shared service agreement for solid waste service with the Town of Queen Creek*
- *Key Reasons*
  - *Cost Savings*
  - *Compliance with local and state regulations*
  - *Efficiency in the contracting process*
  - *Implementing a known effective model*

Questions?