



**North American Development Bank  
IMPACT ASSESSMENT**

Solid Waste Landfill Expansion, Transfer Station Improvements and Equipment  
Replacement (SCSWA Corralitos Landfill)  
Doña Ana County, New Mexico

SOLTA-R-21-001

**Project title: Evaluating the impacts of the Corralitos Landfill on the quality of  
life of the residents of Las Cruces and Doña Ana County**

**Final Report submitted to the North American Development Bank**

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## Executive Summary

The South Central Solid Waste Authority (SCSWA) of southern New Mexico began operating in 1994, and faced difficulties that included financial mismanagement, inadequate equipment, and an inability to expand their primary landfill, the Corralitos Regional Landfill. In 1998, the SCSWA applied for grant and loan monies from the North American Development Bank (NADBank), who provided about \$2.5 million USD in 2004 and 2005. The SCSWA had two primary objectives when applying for funding: (1) construction of the new cell (to replace the exhausted active receiving area), and (2) buying equipment.

This project aims to evaluate the impacts of the enhancements made to the Corralitos Regional Landfill using funding from NADBank on regarding its operational capacities, financial efficiency, and improvements on the quality of life of the residents in the region of Las Cruces, and throughout Doña Ana County, New Mexico.

Through a mixed-methods approach, the study reviewed documents and literature, collected data from reports, visited the site, interviewed stakeholders, held a focus group with the staff, and conducted a survey to collect perceptions around waste management among the wider community of Las Cruces and Doña Ana County. The assessment consisted of three sections: (1) Institutional Development, (2) Quantitative Study, and (3) Qualitative Study.

The institutional development section of this study aimed to understand the effects of NADBank funding on the development of the solid waste utility company, as an institution. Results indicate that **NADBank funding helped the SCSWA move from a money-losing organization to a profitable one.** As a government agency the SCSWA is not operating to maximize profits but rather operate on more of a nonprofit model (some years they make money, some years they lose money). Overall, their aim is to keep rates as low as possible for their constituents. Nevertheless, their financial situation has improved significantly from the time they applied to the NADBank grant to the time of this study. In 1999, the Authority operated with a deficit of - \$0.19/ton of waste, whereas in 2019, the Authority operated with a profit of \$3.68/ton of solid waste (transfer and disposal only). The timing when the NADBank funding arrived **was critical for maintaining their independent operations**, and not being absorbed by El Paso. In addition, healthy financial operations helped the **SCSWA transition from a local utility to a regional sanitation system**, extending the scope, scale, and geographical extent of their operations. Results show an expansion of the types of waste received and processed (adding recycling materials) and service area coverage to include Doña Ana County. The study also finds a transition **toward more sustainable solid waste management practices**, including curbside recycling and reuse programs, which have been recognized nationwide.

The quantitative assessment suggests that **waste management capacity has increased and diversified in the region.** In terms of waste management capacity, the study documents an increase of 68.5% from the time the organization received NADBank funding (2004) to the time of the study (2021). The assessment found **no observable adverse impact on ground and surface water quality.** Results show that waste management programs to address illegal dumping are likely to be effective in reducing water contamination and flooding risks. In addition, the operations of Corralitos Landfill **reduce environmental health risks** with a “very low” risk factor (average risk index of 4.58 on a scale of 0-25), mostly because of the long distance between the landfill and the city limits of Las Cruces (11.4 miles). The quantitative assessment concludes that the **facility promotes health and safety** of the population of Las Cruces and Doña Ana County.

Results from the qualitative analysis indicate that **most residents (72%) report general satisfaction with waste management services**. Most qualitative measures suggest there is an effective communication from the SCSWA regarding the disposal of different types of waste. Most residents (80%) perceive that **quality of life has improved in the region** since the time the SCSWA received NADB funding (2004) to present time. However, the analysis suggests that the SCSWA's communication regarding illegal dumping may be insufficient, because 45% of participants reported dissatisfaction with the management of illegal dumping, and this result in social perception does not align with results from the quantitative study (the study found effective illegal dumping efforts).

Recommendations include continued innovation in terms of management on site and with programs to manage more unusual types of waste and adopting a comprehensive data management plan. In addition, the study indicates opportunities to mitigate potential water quality problems, including a site-based disaster management plan to mitigate erosion and contaminated sediments. Furthermore, findings suggest that the addition of a storm event-based water monitoring system to identify any intermittent ground infiltration of stormwater would be beneficial, as well as the installation of an improved wind barrier. Finally, the study recommends SCSWA to improve communication efforts regarding waste management successes (e.g., illegal dumping) and project completions.

Waste management globally has been affected by a significant increase in the use of plastics and other disposable materials. A general increase in online shopping and the pandemic have exacerbated the use of packaging that ends up in waste containers. While the SCSWA has handled waste management using best management approaches, the region is not exempt from long-term consequences of increased waste that may develop from these global trends.

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## I. Institutional Development

The purpose of this study on institutional development is to understand the potential effects that the NADBank funding had on the solid waste management utility as an institution. The study seeks to understand the evolution of the institution in the past 17 years, in terms of increase in capacities, institutional consolidation, and potential maturation from the time they received NADBank funding (2004) to the time of the study (2021-2022).

### Summary of findings

**Finding 1.1 - Healthier finances.** NADBank funding (2.5 MD) helped the South Central Solid Waste Authority (SCSWA), the organization managing the solid waste operations in Las Cruces and Doña Ana County, move from a money-losing organization to a profitable one.

**Finding 1.2 - The timing of the funding.** The timing when the NADBank funding arrived to the SCSWA (2004) was critical for maintaining their independent operations. If the funding had not arrived, the SCSWA may have been absorbed by Central El Paso Waste Management.

**Finding 1.3 – From a local facility to a regional system.** Organization stability and maturity has led to a transition from a local waste management facility to becoming a regional system, which has increased the number of customers served and the geographic extent of the service.

**Finding 1.4 - Sustainable practices.** Healthy financial operations helped the SCSWA transition toward more sustainable solid waste management practices, including curbside recycling and reuse programs, which have been recognized nationwide.

**Finding 1.5 - Concerning waste management trends.** Waste management globally has been affected by a significant increase in the use of plastics and other disposable materials. Online shopping and the pandemic have exacerbated this trend, and while the SCSWA has handled waste management well, the region is not exempt from long-term consequences that may develop from these global trends.

### Introduction

The South Central Solid Waste Authority (SCSWA) of southern New Mexico, U.S.A. began operating as the region's municipal solid waste management utility in 1994, and faced immediate difficulties that included financial mismanagement, inadequate equipment, and an inability to expand their primary landfill, the Corralitos Regional Landfill. The SCSWA applied for grant and loan monies from the North American Development Bank (NADBank), a binational financial institution established and overseen jointly by the United States and Mexico to support the design and implementation of infrastructure projects in the border region of those two countries. NADBank provided about \$2.5 million USD to the SCSWA in 2004 and 2005 as grants and loans, and these monies provided direct benefits to the Corralitos Regional Landfill in the form of necessary upgrades to active disposal area (Cell 2) and equipment. Nearly two decades later, the SCSWA has become a nationally recognized leader in municipal solid waste management (South Central Solid Waste Authority 2021a), and has achieved particular recognition for its recycling program. In this project deliverable, we report findings as we examine how the NADBank monies influenced the evolution of municipal solid waste management in Las Cruces and Doña Ana County in southern New Mexico.

## Methods

To understand the development of the Corralitos Regional Landfill and the SCSWA, a review was conducted of news media, gray literature, and academic work, including public notices for permitting and other activities (e.g., SCSWA 2014), transcripts from local government proceedings regarding the formation and operation of the SCSWA (e.g., Business Advisory Group 1996; Doña Ana County Board of County Commissioners 2018), relevant literature from related waste organizations (e.g., New Mexico Recycling Coalition 2012), and reports prepared both for and by the SCSWA regarding its operations (e.g., NewGen Strategies & Solutions 2021a and 2021b; Peck 2015).

After gaining a knowledge of the institutional development of both the Corralitos Regional Landfill and the SCSWA, a timeline of events was created. The goal was to analyze the extent to which institutional changes and/or events were associated in trends with volume and types of waste treated at Corralitos (see Appendix A for abridged timeline). This understanding informed an interview sampling strategy. Key stakeholders were identified from news publications and gray literature, and were approached for interviews. Of the 29 people and institutions approached, 9 participated in full interviews. The study also included a site visit in late September 2021 of the Corralitos Regional Landfill, the main office and operations centers of the SCSWA (Amador Transfer Station and Las Cruces Recycling Center), and other relevant facilities in and around Las Cruces and Doña Ana County (Figure 1.1). The site visit added observational data and provided an additional opportunity to verbally clarify events and context with SCSWA leaders and staff.



**Figure 1.1.** Team site visit to the Amador Transfer Station in Las Cruces, NM.

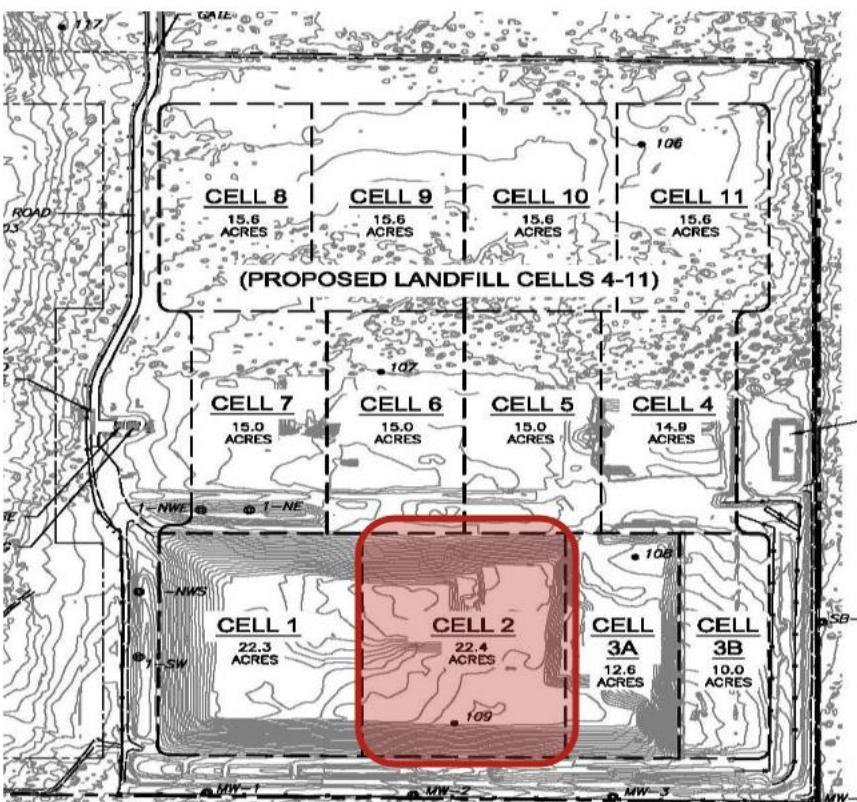
### Finding 1.1 – Healthier finances

The SCSWA’s inaugural financial model was overly optimistic, resulting in financial mismanagement. Although the waste management service in Las Cruces and Doña Ana is managed by the county, the collection system for sanitation services was managed by a private organization at the time (mid 1990s). SCSWA was not charging the cost of the collection service in their fees. Therefore, the operation of the sanitation service was not profitable, and they were “in the red,” or were losing money. By the end of the first year of operations, the SCSWA owed about \$25,000. SCSWA leaned heavily on both city and county employees to run the system to keep costs down, but was clearly an unsustainable business model.

As debts increased, the SCSWA was unable to expand the Corralitos Regional Landfill, purchase necessary equipment, or otherwise conduct actions necessary to grow, simply because they had no financial capacity.



Cell 1 was exhausted, and the decision was made to open only half of Cell 2. But financing the development and operations of Cell 2 was challenging. Based on their dire situation, the decision was made to apply for grant and/or loan money. However, the southern U.S. borderland counties often have a difficult time implementing infrastructure projects without grants. The area is often underdeveloped, contains informal settlements, and has a low tax base. In many cases, public infrastructure projects do not generate revenue, continuing a cycle of underdevelopment. The SCSWA was falling into this cycle, unable to easily generate revenue from the money that had been spent on the initial project to fund the needed expansion (Figure 1.2).



**Figure 1.2.** At the time when NADBank funds were released (2004), Cell 1 was exhausted, and Cell 2 was under construction. NADBank funds were used to upgrade Cell 2 (shown in red) and buy machinery. Presently, Cells 1, 2, and 3 have been retired, while Cell 4 is currently receiving waste. Cells 5 through 11 remain undeveloped but are a part of the Corralitos Regional Landfill.

The SCSWA had two primary objectives when applying for the NADBank grant: (1) construction of the new cell (to replace the exhausted active receiving area), and (2) buying equipment. The SCSWA’s finalized application for funds was submitted in 1998, and the approved funding arrived in 2004 and 2005 (US States News 2005).

The SCSWA received \$999,660 in grant money and \$1,510,000 in loans, for a total financial commitment from NADBank of \$2,508,757, and with an equity investment from the SCSWA of \$627,788, \$3,137,545 in total project funds were available (US States News 2005). Approximately \$745,000 was allocated to lining Cell 2B (totaling 13 acres) at the Corralitos Regional Landfill, which was space enough to receive an estimated four years of waste (ibid.). The remaining monies were used to upgrade the physical plant of the SCSWA’s Amador Transfer Station (ibid.) and purchase machinery. In terms of financial operations, this combined funding allowed the SCSWA to move from the “red” (losing money), to the black (making



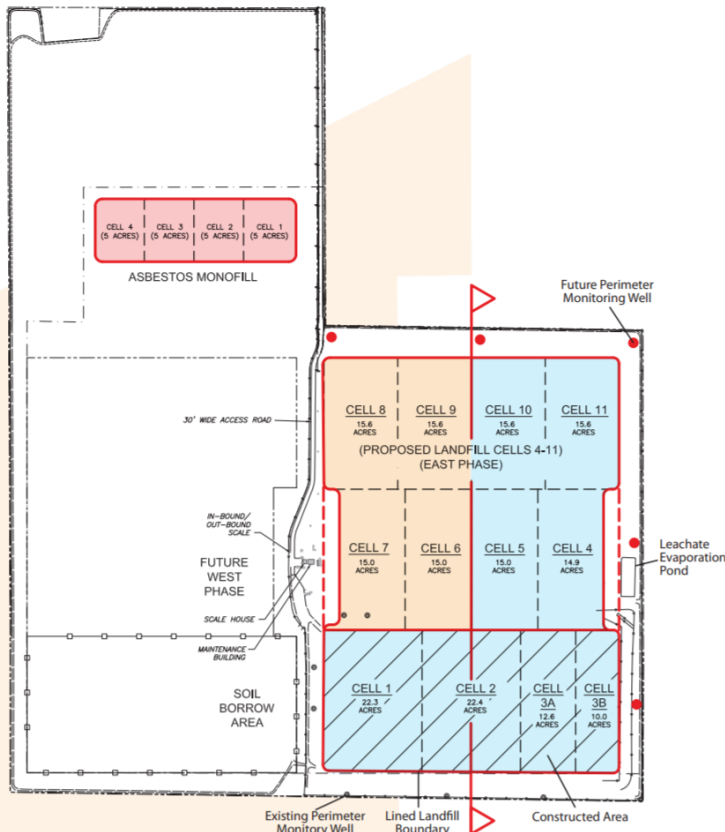
profit), and develop a sustainable business model that resulted in healthier finances for the future operations of the landfill, as explained below.

### Finding 1.2 – The timing of the funding

While the SCSWA has received numerous grants, loans, and other resources to operate and grow over the last 20 years, the timing of the NADBank grant came at a crucial moment and made a significant difference in moving the financial operations from losing to gaining money. With this assistance, the SCSWA firmly established its independent operation and secured future operations (Participant 2, 7/30/2021). If the SCSWA had not begun to generate profit in the early 2000s, they might have faced closure and a potential merger with Central El Paso Waste Management (Participant 5, 9/3/2021).

As a government agency the SCSWA is not operating to maximize profits but rather operate on more of a nonprofit model. This means that some years they make money, some years they lose money. Overall, their aim is to keep rates as low as possible for their constituents. Nevertheless, their financial situation has improved significantly from the time they applied to the NADBank grant to the time of this study, moving from the red to the black. During the fiscal year 1999-2000, the Corralitos Landfill received 126,334 tons of solid waste and operated in a deficit of \$25,000 (Participant 1, 7/23/2021). In comparison, in 2019 the SCSWA received 225,401 tons of waste and their revenue from transfer and solid waste disposal only was \$7,764,112 and operating expenses were \$6,934,447 leaving a positive cash position of \$829,665 (Participant 5, 8/9/2022). This amount excludes their debt and several other items that would not have been in the profit and loss statement from the late 1990. Unitary cost calculations allow the comparison of the cost of processing solid waste between 1999 (before the loan and grant) and 2019 (20 years later). In 1999, the Authority operated with a deficit of - \$0.19/ton of solid waste, whereas in 2019, the Authority operated with a profit of \$3.68/ton of solid waste.

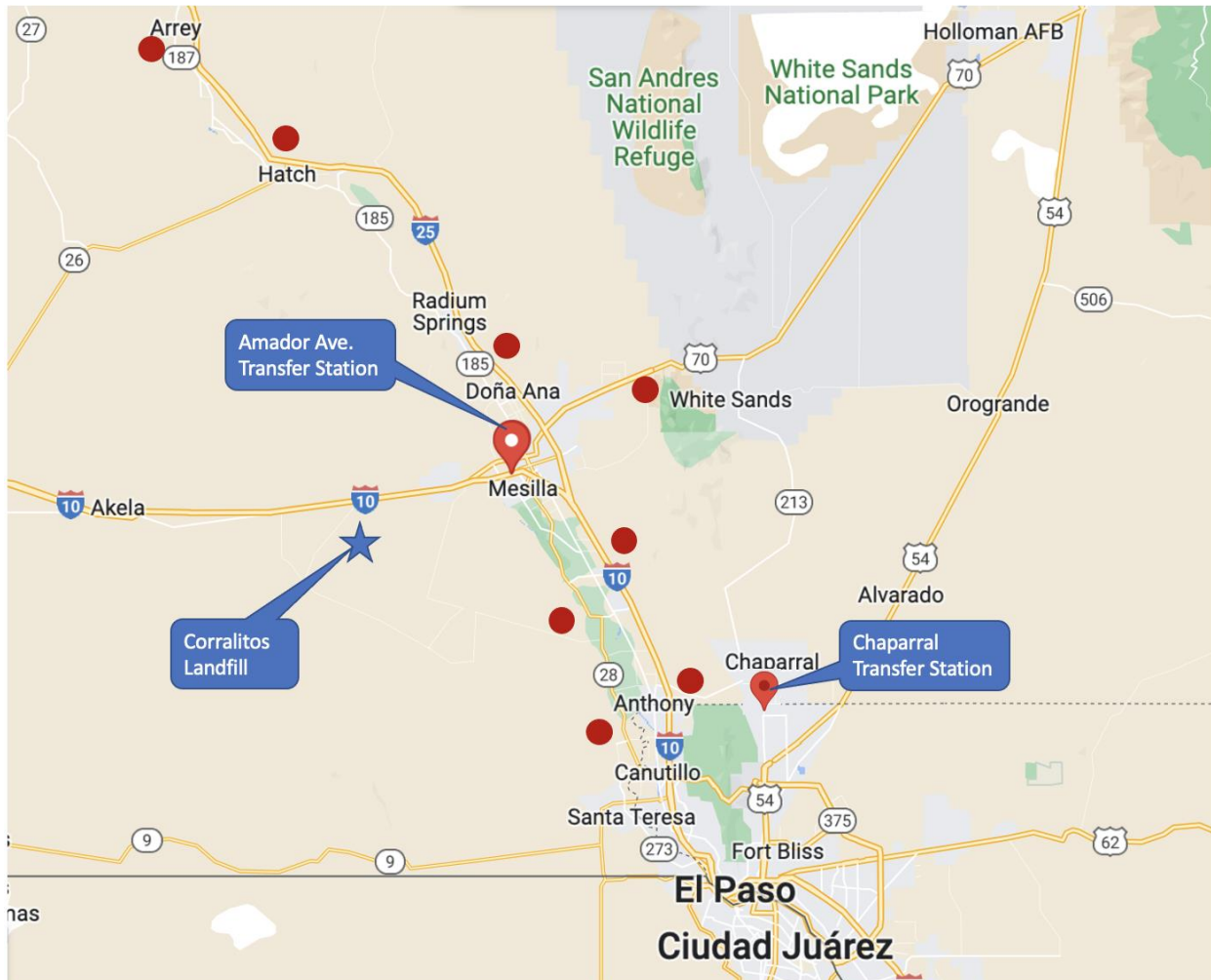
The NADBank funding allowed for immediate needs at the Corralitos landfill, including development, construction, and equipment purchasing, and it also increased the cash flow enough for the SCSWA to pay off its outstanding debts. The landfill area developed at the time was expected to last only for a couple of years, but new, efficient, money-saving practices put into place stretched its active life to a full decade, with the development of a new cell (McClure and Michaels 2020). At this rate, and as articulated during the permit renewal in 2015, estimated facility lifetime is over 200 years (Peck, 2015) (Figure 1.3).



**Figure 1.3.** Future growth of landfill operations includes 4 more cells (up to cell 8 shown in this image, but they own more land on the eastern side), assuring service for the next 200 (South Central Solid Waste Authority 2021b).

### Finding 1.3 – From a local facility to a regional system

The analysis of waste management capacity managed by the SCSWA clearly demonstrates a maturing system reflective of stability. Over the last 17 years (from the time they received NADBank funding in 2004 to present day), the SCSWA has acquired enough expertise in municipal waste management that is reflected by the financial stability of the system, as well as the reduction of reported issues, multiple awards and recognitions, and its leadership continuity. Because of this stability, they were able to expand the scope, scale, and geographical extent of their services. From being a local waste management facility serving local customers in Las Cruces, the SCSWA has grown into a regional organization that serves customers in Las Cruces and throughout Doña Ana County, through its multiple transfer stations facilities and community collection centers (see geographic extent in Figure 1.4).

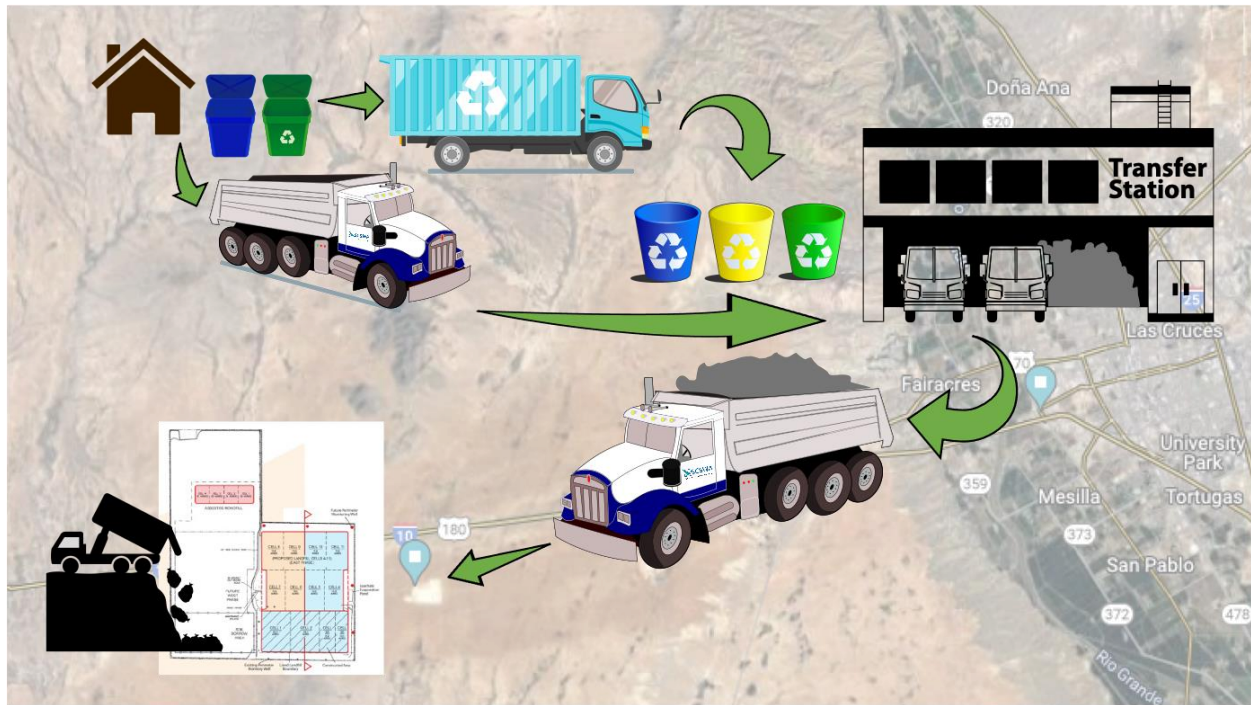


**Figure 1.4.** Approximate location of the Corralitos Landfill (blue star), the eight Community Collection Centers (red dots), the Amador Ave Transfer Station, and Chaparral Transfer Station.

The waste stream that ends at the Corralitos Landfill start at the curbside of the residents of Las Cruces and Doña Ana County (see waste flow in Figures 1.5 and 1.6). Within the city limits, trucks pick up solid waste once a week, and recycling from a separate container every two weeks. Recycling at the curbside is for plastics, aluminum, paper, etc. (not glass). Trucks take both streams of waste to either the Amador Transfer Station or the Chaparral Transfer Station, and from there, solid waste is transported to the Corralitos Landfill in multiple truckloads every day. The Chaparral Transfer Station & Recycling Center is located in Chaparral, NM and receives waste and recycling material directly from customers (does not offer pick-up services). (Figure 1.5).

For residents living outside the city limits (unincorporated areas within Doña Ana County), the eight Community Collection Centers are spread out to receive waste and recycling directly from the customers

(without pick up services).<sup>1,2</sup> These centers ship both waste and recycling to the Amador Transfer Station, but some may ship solid waste directly to Corralitos (if the trip is shorter).



**Figure 1.5.** Local municipal solid waste flow ending at the Corralitos Landfill.

The Amador Ave. Transfer Station (located 16 miles from the Corralitos Landfill and close to Motel Boulevard, therefore also referred to as the Motel facility) is an important urban hub for municipal solid waste in the region. Right next to it, the Las Cruces Recycling Center receives other types of waste directly from customers, such as electronics, glass, appliances, scrap metal, etc.

Table 2.1 below documents the types of waste accepted into the SCSWA system (left column) and those that are processed at the landfill itself (right hand column) over time. The expansion of types of waste generally occurs with the filing of decade long permits in 1995, 2005, and 2015. Results show that diversification of types of waste started after the 2005 permit renewal and intensified after the 2015 permit renewal. These findings suggest an increase in the scope and scale of the waste management operations.

**Table 1.1.** Types of waste accepted by SCSWA and landfilled at Corralitos.

Type of Waste	Accepted by SCSWA (Dates if known)	Landfilled at Corralitos Regional Landfill (Dates if known)
General Municipal Waste	1996-present	1996-present

<sup>1</sup> The eight Community Collection Centers are: Anthony, Butterfield, Garfield, Hatch, Hill, La Mesa, La Union, and Mesquite. See locations and more information here: <https://www.scswa.net/BusinessDirectoryII.aspx?lngBusinessCategoryID=23>

<sup>2</sup> It costs rural customers about \$5 (from \$4-\$8, depending on the volume or weight) per drop off. Customers must pay with coupons, because collection centers do not receive cash (for safety reasons). Coupons can be purchased at the Amador Transfer Station and at many other locations throughout the county.

Construction & Demo	2006-present	2006-present
Bio-solids (treated sewage, non-hazardous)	2006-present	2006-present
Recycling – Metal, Plastics and Paper in single stream	2009-present; collected by Friedman Recycling to haul through 2021	No – trucked to El Paso
Recycling – Glass	Yes, processed separated starting in 2014	No – ground into sand for reuse
Recycling - Electronics	2015 – present	No – sold to another processor
Agricultural/animal waste	2016-present	2016-present
Asbestos	2016-present	2016-present
Industrial Waste (non-hazardous)	2016-present	2016-present
Petroleum contaminated soil	2016-present	2016-present
Scrap Tires	2016-present	2016-present – shredded and used as cover layers
Green Waste and Clean Fill	Diverted to Old Foothills Landfill	No
Hazardous Waste	No	No
Medical Waste	No	No

#### Finding 1.4 – Sustainable practices

NADBank funding and ongoing efficient practices set up the SCSWA for future success. The best practice for solid waste management is to ensure that the solid waste stream does not have a single destination (in this case, the Corralitos Regional Landfill), and that as much waste as possible is diverted to recycling programs, reuse programs, etcetera. NADBank funding put the SCSWA on a path toward those practices.

Further, a key reason the SCSWA was able to absolve itself of debt and begin generating profit was the Corralitos Regional Landfill itself. The SCSWA owns the Corralitos Regional Landfill outright, and so they are able to fund other programs (including recycling, education and outreach, and monitoring of illegal dumping) with the revenue generated by the efficient workings of the landfill rather than paying rent on the land (Participant 4, 9/2/2021).

When the SCSWA began its recycling program, about five years after receiving funding from NADBank, their foundational goal was to make sure the program paid for itself. It did so, and the SCSWA has been recognized both regionally and nationally for the strength of its waste management programs, particularly its recycling program. Their operations have been recognized through several awards over the last decade (see Table 1.2 and Figure 1.6).

**Table 1.2.** Awards received by the South Central Solid Waste Authority’s waste management programs.

Date of Award	Awarding Body	Specific Recognition
2019	City of El Paso & Rio Grande Recycling Corridor	1 <sup>st</sup> place, outstanding recycling partnership.
2018	Solid Waste Association of North America	Biggest safety improvement collection and transfer.
2018	New Mexico Occupational Health & Safety Bureau	Safety and health achievement recognition program.



2017	New Mexico Recycling Coalition	Recycling	Diversion program of the year.
2017	United States Recycling Coalition	National	Best recycling program nationwide.
2015	New Mexico Recycling Coalition	Recycling	Distinguished member.
2013	New Mexico Recycling Coalition	Recycling	Bronze excellent award.
2010	New Mexico Recycling Coalition	Recycling	Recycling program of the year.

Along with its recycling programs, the SCSWA had made every effort to extend the life and efficiency of the Corralitos Regional Landfill by making sure that waste that can be diverted, extending the life of the landfill and the potential impacts derived from it. At the Amador Transfer Station and Old Foothills Landfill in Las Cruces, the SCSWA runs a smaller location for yard waste, green waste, and clean fill, and it collects and processes glass locally (Michaels 2018; 2017). These programs provide products free of charge to residents and divert waste away from the landfill. They have strong ties to the community that foster collaborations. Their communication and educational programs seem to be effective in reaching the community at large. For all these reasons, the study finds that the SCSWA fosters the most sustainable practices in solid waste management.



**Figure 1.6.** Awards are displayed in the Amador Transfer Station facility in Las Cruces (photo: Sandra Bernal).

#### Finding 1.5 – Concerning waste management trends

After analyzing waste management standard practices not specific to Las Cruces and Doña Ana County, NM, it became clear there are serious concerns around waste management trends at a larger scale. The literature has established that there is no one-size-fits-all approach to waste management, and that strong waste management programs tend to build on the strengths of the city where the waste management occurs (Wilson et al. 2012). When a significant proportion of the waste stream is recyclable, it is important to establish that there is a local accessible market for recycling (de Vega, Benitez, and Barreto 2008). U.S. residents in general have various concerns about solid waste management and disposal, which often include



(but are not limited to) “national policy, particularly the lack of waste management policy and coordination; the lack of hazardous waste management; concerns regarding local policy, particularly with regard to consistency and waste minimization, including lack of incentives and markets for recycled materials, the cost of recycling and the lack of cleaner production efforts” (Boyle, 2000: 517). These and other considerations become increasingly important as populations increase and solid waste management must handle greater amounts of waste, as has continued to happen globally (Bartone, 1991; Kollikkathara, Feng, and Stern, 2009) and in the region served by Corralitos Regional Landfill.

The analysis points to three main concerns: (1) an increase in the use of plastics and challenges in plastic recycling, (2) a change in consumer behavior that favors online shopping and the massive use of packaging, and (3) the pandemic effect that exacerbates waste production.

Plastics have increasingly replaced other materials, especially with respect to packaging (e.g., Risch 2003). With China putting a ban on receiving plastic waste from the U.S. and other countries in 2017 (e.g., d’Ambrières 2019), cities and counties in the U.S. have been dealing with plastic recycling themselves or exporting to other developing countries, who do not have sustainable practices in place. Due to market forces, plastic recycling is limited in the U.S. For example, the recycling industry in New Mexico is not accepting most plastics that are labeled as recyclable. Only plastics labeled as #1 and #2 are recycled, while the rest (#3 through #7) go directly to the landfill. In addition, plastic that is eligible for recycling (#1 and #2) must be completely clean to be recycled. If a single piece in a batch of recyclable waste is contaminated, the entire batch is directed to landfill. Therefore, it is important to educate the public around the importance of cleaning recyclable waste. This trend aligns with what is happening in the world. Only 9% of plastic is recycled worldwide, and most plastic ends up in landfills, is incinerated, or is mismanaged (Wen et al. 2021). In 2015, 75% of the plastic produced (407 million tons) ended up as waste (Neo et al. 2021).

In most situations, the infrastructure needed to wash recyclable plastic before putting it in the recycling bin is missing. Many fast-food establishments, for example, may serve food in recyclable containers and provide recycling receptacles, but will not provide a way for customers to clean waste before depositing it. Therefore, despite appearing to be recycled, all these plastic containers are, in fact, going to the landfill. This lack of sanitary infrastructure was not needed when the U.S. shipped their plastic waste to China, because Chinese recycling management accepted contaminated waste. However, automatization of the recycling industry in the U.S. makes it unfeasible to divert contaminated waste by hand. Sorting and cleaning must be done by customers, and consumers have not caught up with this need.

In addition, there has been a general shift in consumer behavior toward online shopping, which has been exacerbated by the “Amazon effect,” in which a greater proportion goods are now shipped directly to consumers, but recycling of shipping packaging has declined (Maxwell and Miller, 2019). The convenience of online shopping has impacted shopping malls dramatically, but also waste management. The packaging used for online shopping results in considerably more waste going to landfill.

Finally, the COVID-19 pandemic and the associated lockdown measures have increased online shopping, reduced reusable bag usage, increased the amount of food takeout containers, and provided a new waste stream in the form of disposable masks (Hantoko et al. 2021; Sarkodie et al. 2021; Sharma et al. 2020).

These concerning trends in waste production and management are not particular to the case study in Las Cruces and Doña Ana County. These global trends are being experienced in several countries, and are included to provide context regarding waste management issues and challenges. Microplastics can easily enter the food chain and be consumed by people. Therefore, an increase in the use of plastics that end up in landfills is likely to impact human health and the health of other species (Manikanda Bharath et al., 2021).

## Conclusion

In this study, the impacts of the Corralitos Landfill on the quality of life of the residents of Las Cruces and Doña Ana County were evaluated both quantitatively and qualitatively. The examination of the institutional development resulting from the NADBank funds concludes that despite early financial mismanagement and a lack of institutional or operational knowledge, the Corralitos Regional Landfill has become an efficient, productive facility, and its revenue generation is one important driver in the success of the various programs and projects of the SCSWA, including the SCSWA's award-winning recycling program.

The study also concludes that funding from NADBank arrived at a critical time to positively impact the SCSWA's operations by providing necessary facility upgrades and allowing the Corralitos Regional Landfill and the SCSWA to begin generating revenue rather than remaining in deficit. From that important turning point, the SCSWA was able to build successfully and has become a regionally- and nationally recognized waste management utility that supports sustainable solid waste management. Finally, we provide some context in terms of the trends that we see in waste generation and management in the U.S. and worldwide that do not point toward sustainability.

## II. Quantitative Analysis

This chapter focuses on quantitative data, including the volume/weight of solid waste management operations over time (since the NADBank funding was released in 2004 to present) and their potential effects on water quality and public health and safety.

### Summary of Findings

**Finding 2.1 - Waste management capacity has increased** - from 131,000 tons of solid waste in 2004 to 191,831 tons in 2021, which represents an increase of 68.5%.

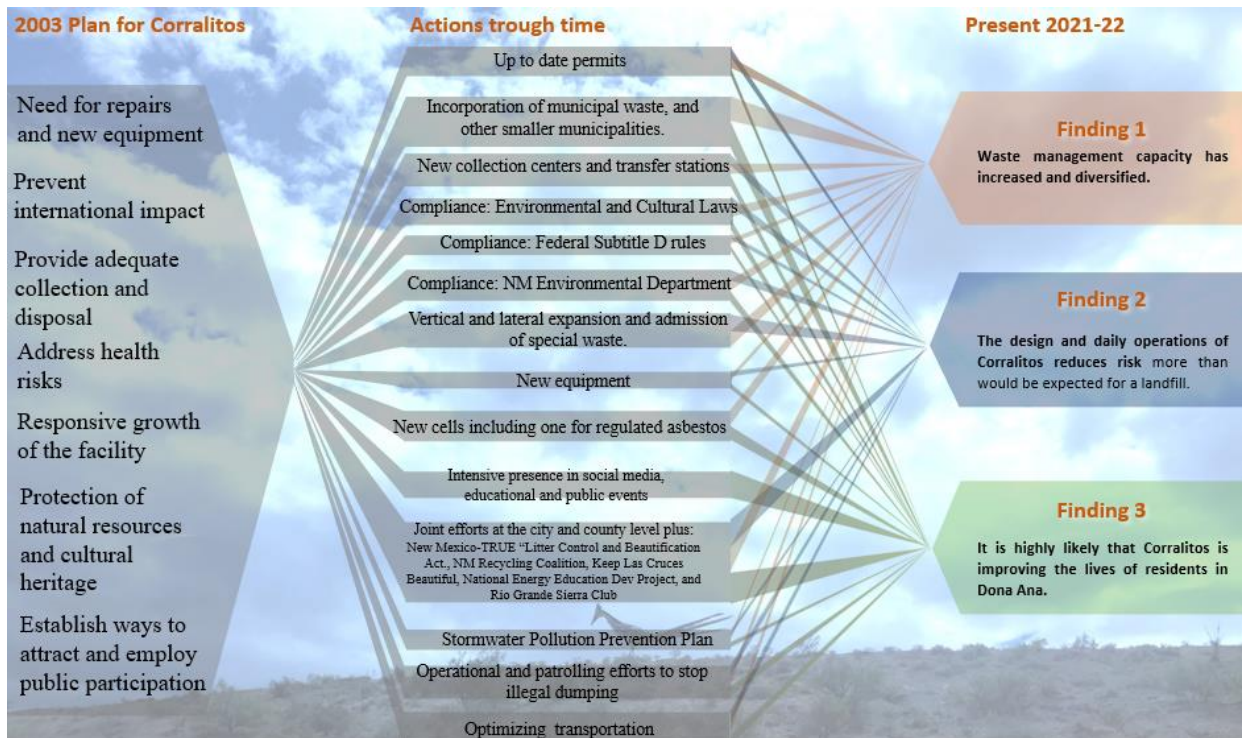
**Finding 2.2 - No observable adverse impact on ground and surface water quality.** Due to the depth of the region's aquifer, there was no observable, adverse impact on ground and surface water quality. Waste management programs to address illegal dumping are likely to reduce water contamination and flooding risks.

**Finding 2.3 - The operations of Corralitos Landfill reduce environmental health risks.** The facility promotes health and safety mainly through the long distance between the landfill and the city limits (11.4 miles). The risk assessment, which compares the level of risk for a particular facility to standard industry-wide risk factors, shows an overall "very low" risk factor (average risk index of 4.58 – see Table 2.2).

- The study finds no significant concern regarding exposure to air pollution. The assessment shows a "low" risk factor (average risk index of 1.2)
- Handling and disposal of waste minimizes risk. The assessment shows a "low" risk factor (average risk index of 7.9)
- Risk to onsite workers for encountering unexpected substances is "low" (average risk factor of 6.3).

**Finding 2.4 - Improvement of the quality of life.** It is highly likely that Corralitos is improving the lives of residents in Doña Ana because it has significantly reduced illegal dumping and has minimized health-related risks from sanitation practices.

These findings are in comparison to the baseline, as represented by the plans in 2003 just prior to financial grants and loans from the NADBank to the SCSWA to improve the Corralitos Landfill. Incorporating information from SCSWA, public records, and media reports, Figure 2.1 provides a visualization of the actions associated with Corralitos between 2003 and present day.



**Figure 2.1.** Visualization of the significance of the findings. Note: This figure is composed by information in the SCSWA,'s application for landfill expansion, transfer station improvements and equipment replacement (2003), documentation also provided by SCSWA, and the development of the assessment that led to this report.

## Introduction

This section is a part of a larger evaluation project to document the impact of bi-national lending of NADBANK. It reports on the environmental health risk assessment of Corralitos and focuses on waste management capacity trends in Doña Ana County over the past 25 years. Review of public records and extensive documentation showed that the two major goals of the original NADB funding were to:

- **Increase capacity of Corralitos**, including facility growth and replacement of equipment at the end of its useful life, to provide adequate solid waste collection and disposal for Doña Ana County.
- **Continue developing a safe landfill site that minimized risks associated with waste** including health risks of workers; health risks to the surrounding community; environmental risks (plants and animals); and cultural resources.

## Methods

Analysis of capacity and health and safety were accomplished through two different processes:

1. Analysis of waste growth was based on summarizing documentation provided by the SCSWA and public records from the New Mexico Environment Department (NMED).
2. The environmental health risk at Corralitos followed the steps from the Guideline for Environmental Impact Assessment that apply to the type of assessments requested (EPA,2017), a modification of the methodology EVIAVE (which stands for *Evaluación del Impacto Ambiental en Vertederos*) (Calvo et al., 2007), and an Assessment of Water Quality.

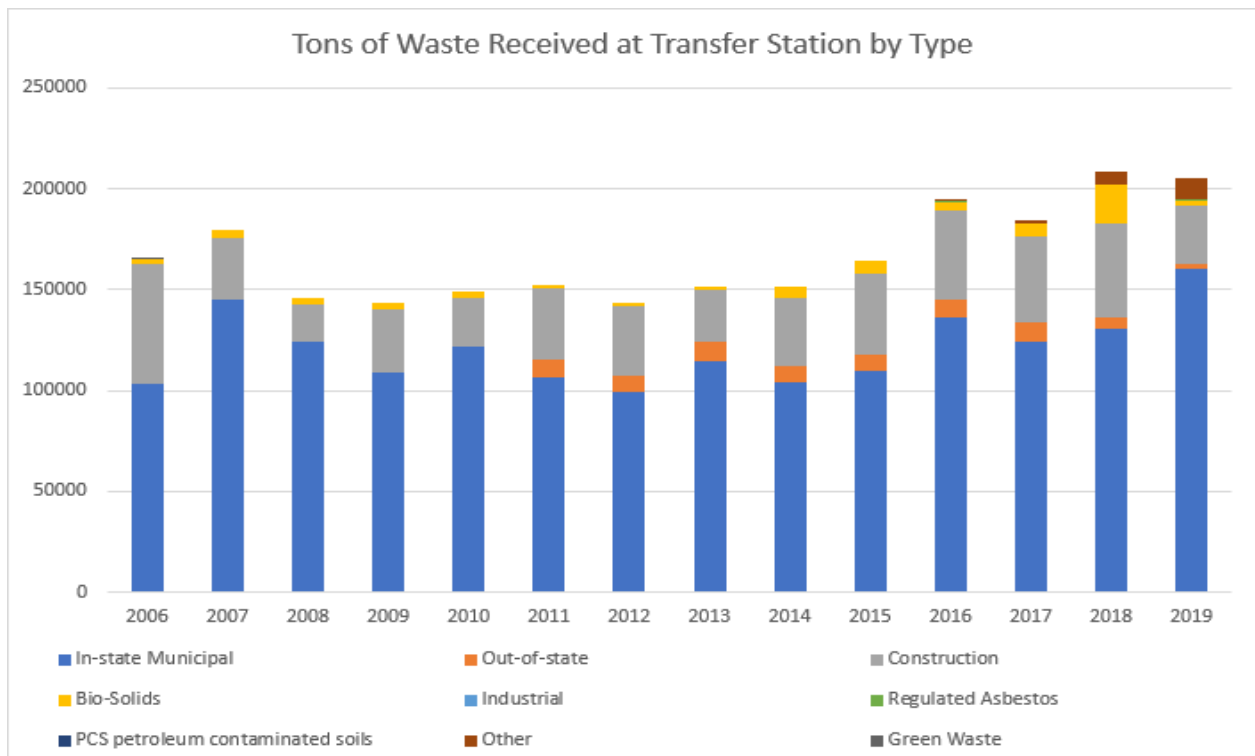
*EVIAVE is a methodology for environmental diagnosis of landfills that involves the formulation of indexes representing potential environmental problems due to operations (Zamorano, Calvo,*

Moreno, & Ramos , 2006). For this assessment, the EVIAVE methodology was adapted to assess the known risks in the Corralitos Landfill. First, we created a Risk Index (RI) score based on EVIAVE and the literature for air pollution, water quality (surface & ground); waste handling and disposal; exposure to unknown materials; and general worker safety at different spatial and exposure scales. Secondly, we created an Environmental Landfill Index (ELI) using information gained from document review, site visit, and interviews to assess the extent to which there is evidence of actual probability impact. To determine the values, we asked team researchers for their assessment. We also collected data during our site visit, considered data from reports, analyzed content from interviews, and other documents.

**Finding 2.1 – Waste management capacity has increased and diversified**

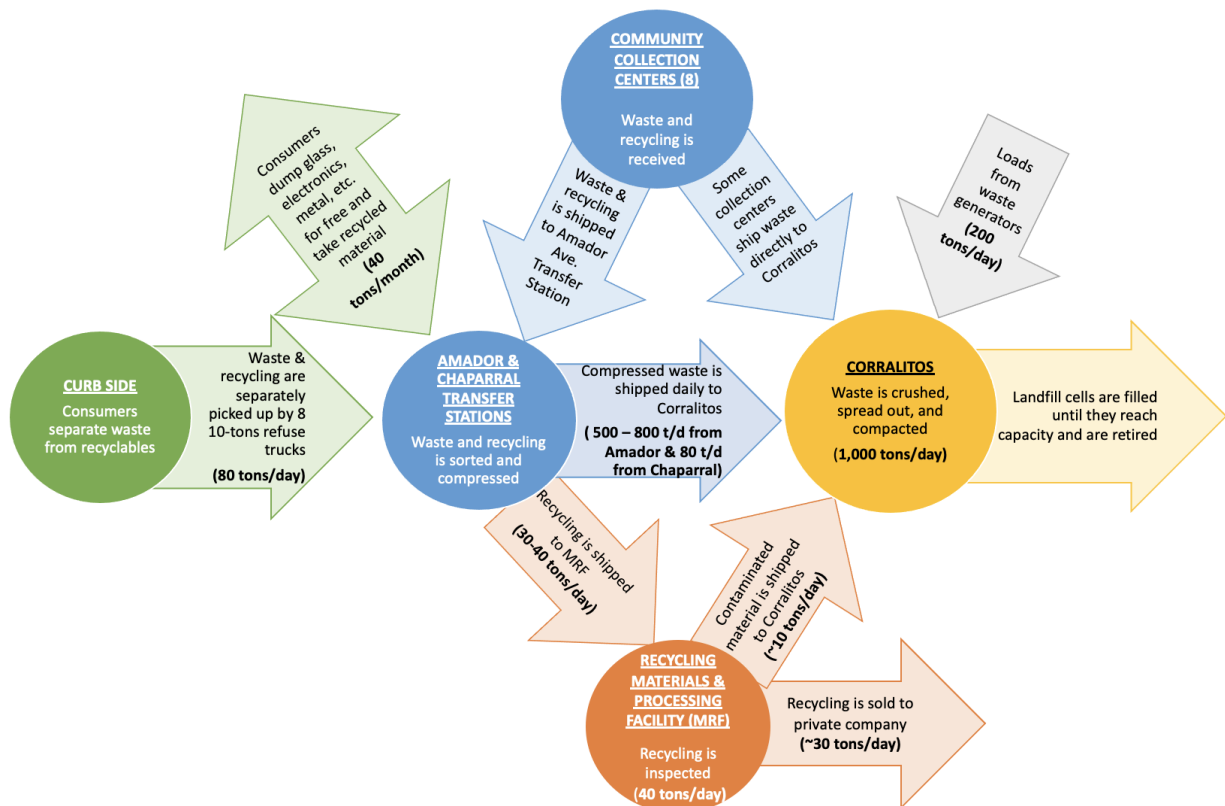
Results show that there has been an increase in waste management capacity from the time the SCSWA received NADBank funding to the time of this study (2021-2022). In 2004, when NADBank released the funds, the Corralitos Landfill received 131,000 tons of solid waste and in 2021 they received 191,831, which represents an increase of 68.5% of waste.

The composition of waste has also changed over time (Figure 2.2). The graphic shows broad categories of waste types in tons received each year at the transfer stations. Over the past 13 years, municipal waste from Las Cruces, unincorporated Doña Ana County, and other smaller municipalities are the primary type of waste (72%) sorted and taken to Corralitos. Construction & debris (C&B) is the second most common type of waste. After 2011, out-of-state waste – rejected recycling originating in Las Cruces but processed in El Paso - became a bigger part of the stream. As the SCSWA system has matured, SCSWA have begun to process niche types of waste such as bio-solids and some very small amounts of contaminated soil, regulated asbestos, and green waste.



**Figure 2.2.** Composition of waste (Tons) processed by SCSWA over time.

The quantitative analysis shows a complex regional system of waste management (see streamflow chart in Fig. 2.3). Curbside pick-up for customers in Las Cruces is currently done by 10-wheeled automated side loader refuse trucks. Each refuse truck services about 450 homes per route and holds 10 tons of waste. In Las Cruces there are eight of these trucks that have two routes per day for municipal solid waste. The same type of trucks is used in recycling, but recycling is serviced every other week. Because recycling is lighter, they only get six tons per load, and only use four trucks to service the same routes.



**Figure 2.3.** Regional waste streamflow managed by SCSWA.

The Chaparral Transfer Station and the Amador Ave. Transfer Station are two facilities that do the same work – receive and compress municipal solid waste and ship it to Corralitos – except Chaparral is much smaller. From Amador Ave. Transfer Station to Corralitos the flow represents about 500 to 800 tons of MSW per day. From Chaparral Transfer Station to Corralitos waste flow is about 80 tons per day.

In addition, there are waste loads shipped to Corralitos directly from the waste generators, which represent cases of large buildings that are being demolished and need to dump construction and debris (C&D) waste, or industrial waste. This hauling is managed by a third party (not SCSWA), but Corralitos receives the waste. Currently, Corralitos receives about 200 tons per day from waste generators.

In terms of recycling materials, consumers can dump glass, electronics, and scrap metal at the Las Cruces Recycling Center, right by the Amador Ave. Transfer Station, and all the other locations (Chaparral, and the eight Community Collection Centers). Weight amounts of recycling material combined represent about 40 ton per month. Recycling materials, including plastic and cardboard are shipped to the Recycling

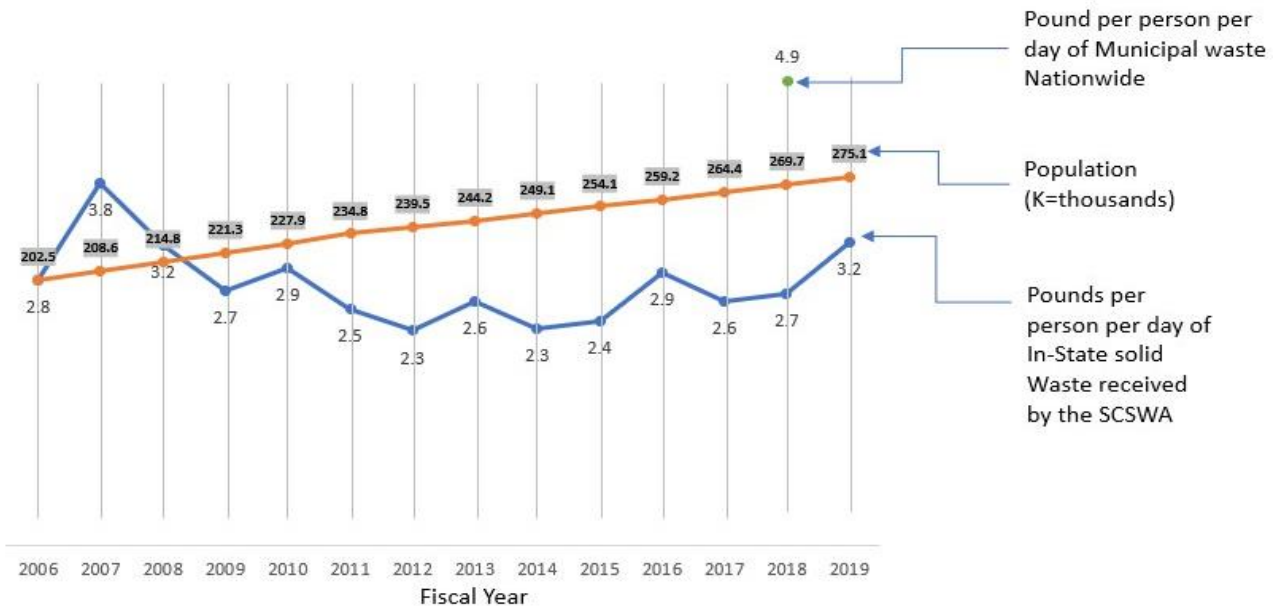


Materials Processing Facility (MRF) in El Paso, Texas. SCSWA ships 30 to 40 tons of recycling material to the MRF in El Paso from both facilities – Amador and Chaparral – each day. Types of recycling material shipped to El Paso and sent to private companies (e.g., Friedman Recycling Company) includes newspaper (26%), mixed paper (6%), old corrugated containers (32%), PETE (or polyethylene terephthalate) (4%), HDPE (high density polyethylene - natural/color) (2%), tin cans (1%), aluminum cans (1%), plastics (#3-7) (.06%), rigid plastics (#1-2) (0.3%), pots and pans/scrap metals (1%). At the MRF, recycling materials are inspected for contamination, rejecting all of the contaminated materials. In return trips, the MRF sends back approximately 23 percent as contaminated residual waste to Corralitos Landfill, which amount to approximately 10 tons/days.

Corralitos waste and contaminated recycling material crushed and spread represents about 1,000 tons per day. SCSWA uses about 225,000 cubic yards (cy) of air space at Corralitos each year. Of this amount, 20 percent is on-site soil used to cover the layers of trash.

**Finding 2.2 – Less waste dumped in landfill per capita.**

Waste generation per capita in the studied area is below national average – 35% lower. According to the U.S. Environmental Protection Agency in its National Overview of 2018, the total generation of municipal solid waste in 2018 was 4.9 pounds per person per day (EPA, 2021). Results of this quantitative analysis suggest that the Corralitos Landfill currently receives about 3.2 pounds per day (Figure 2.4), which is 1.7 pounds per capita less than the national average (or 35%). From the fiscal years 2006 to 2019, Corralitos Landfill report separated their solid waste into In-State and Out-State. Out-State refers to the contaminated recycling material that is shipped back to NM from the MRF in El Paso, TX. Therefore, the In-State collection data correspond to the population served (Figure 2.4). The early peak in pounds per person per day in 2007 may correspond to the opening of the landfill to C&B and biosolid waste in 2006 (see Table 1.1 in Chapter 1 above).

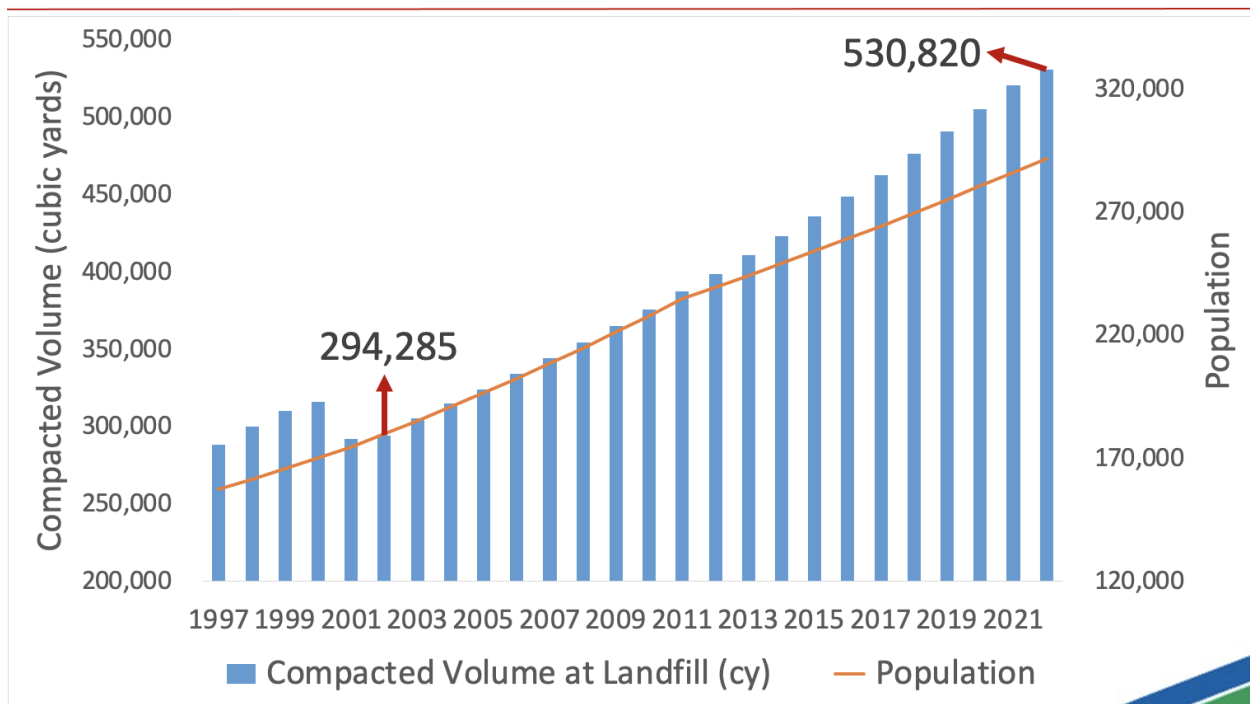


**Figure 2.4.** Average municipal in-state waste (pounds) per capita per day.

Although below national averages, results suggest an anticipated increase in waste generation per capita in the studied region since the gap between waste and population growth is closing (see blue vs. orange lines in Figure 2.5). Note that the records are from before the pandemic when, according to multiple local and

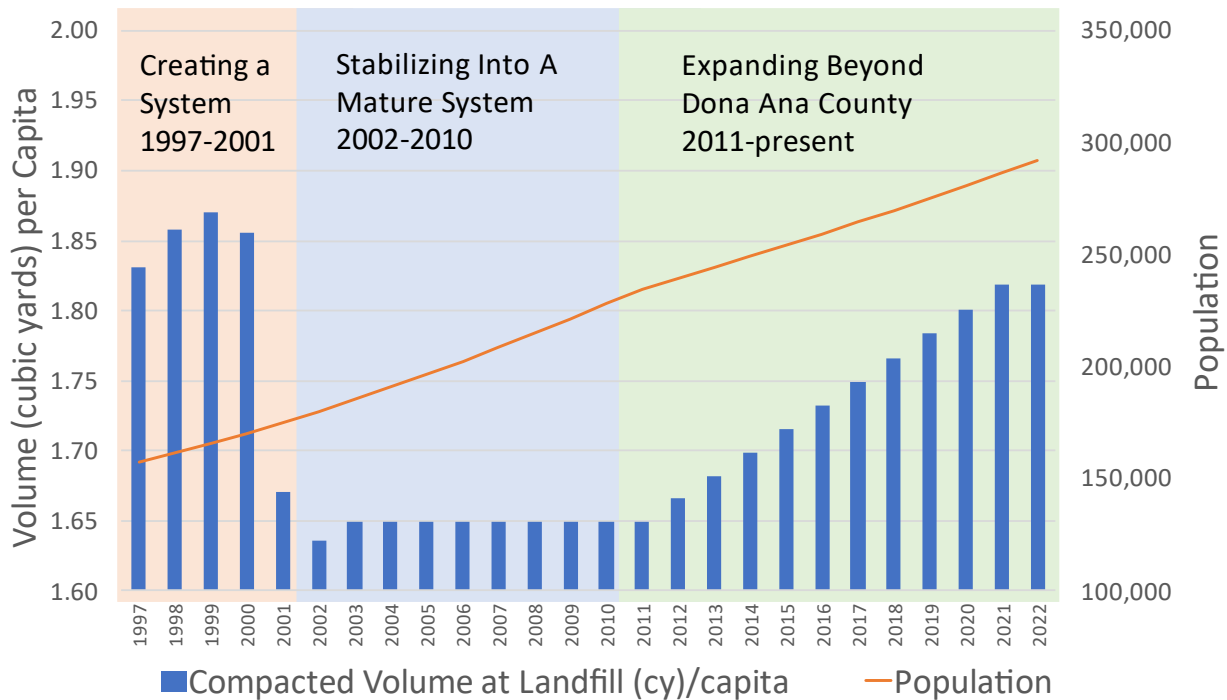
global trends, waste generation increased due to packaging, medical, and Personal Protective Equipment (PPE) single use items. Therefore, the increase in pounds of waste per capita in the region is explained by these global trends.

Another way to assess the growth of the SCSWA system is to look at compacted volume at Corralitos. Figure 2.5 shows compacted volume (in cubic yards) normalized by county population over the past 25 years. Doña Ana population has grown from 157,368 persons in 1997 to 291,890 in 2022, an increase of 54%. Similarly, compacted volume – a good proxy for the landfill’s capacity – has also grown by 54% from 294,285 cubic yards during the year of the NADBank financial assistance to over 530,820 cubic yards annually today. Although both metrics show the same increase (54%), during the last decade, the trend of compacted volume exceeds the trend in population. This discrepancy may be explained because the landfill is receiving other types of waste (C&B, industrial, contaminated recycling, etc.) that were not received before, and from different sources (e.g., waste generators, MRF, Community Collection Centers). In addition, illegal dumping has been reduced significantly, which means that these waste is now ending in the landfill.



**Figure 2.5.** Compacted volume at Corralitos and growth in Doña Ana County.

Figure 2.6 displays the *per capita* volume of waste by year at Corralitos. Viewing waste volumes in this way with the history of SCSWA hints at the influence of institutional stability described in Chapter 1. When waste volumes are normalized by population of the county, there are three distinct eras, each of which can be explained by institutional realities. From 1997 through 2001, per capita waste volumes hovered above 1.85 cubic yards per person. During this time, the system was relatively unstable as SCSWA struggled to implement a waste management system that was priced correctly (the utility was losing money). This finding could be explained by operational issues, as the SCSWA did not have the adequate equipment to compact waste.



**Figure 2.6.** Compacted per capita volume at Corralitos.

The period of 2002-2009 reflects a stabilization of the system, and it is noticeable that the **NADB loan and grant in 2004 is associated with that stabilization period.** During the stabilization (2002-2010), per capita volume of waste dropped significantly to under 1.65 cubic yards per person, largely due to diversion to increased recycling and management. This finding suggest that the recycling system was effective in reducing waste volume reaching the landfill, which is the goal of sustainable waste management practices. Once financial stabilization had occurred, SCSWA could hire more employees and develop strategically to reach out to more customers. Indeed, the 2005 waste permit hints at a landfill system that was hoping to do more.

Expansion of types of waste explains the third period (2011-present) in Fig. 2.6 above. After a tragic occupational death of a contractor in 2009, SCSWA became more convinced of the need to control additional aspects of the waste flow, again expanding types of waste processed directly by SCSWA. Per capita waste begins to rise again in 2012. However, interviews suggested this rise was because SCSWA was expanding to take waste beyond the city limits. Thus, the difference between 1.65 and 1.80 cubic yards per person does not reflect an increase in waste production by Doña Ana resident. Rather it reflects the maturation of SCSWA transforming from a local utility into a regional landfill that took waste from across Doña Ana, NM. In addition, Corralitos also receives out-state waste, which is contaminated recycling waste shipped back from MRF at El Paso, TX (although the flow can be considered insignificant as this flow amounts to 1% - out-state flow is 10 tons/day and the landfill’s flow is 1,000 tons/day (1%) (see Fig. 2.3 above).

**Finding 2.2 – No observable adverse impact on ground and surface water quality**

The main risks posed by a landfill site to water quality is toxic chemicals in leachate. See Appendix B-1 for background information around risks for water contamination from landfill operations, as well as site location and climate information and hydrogeology of the region.

### *Corralitos design specifications and operation*

The landfill has an effective liner, leachate management, and water monitoring system in place to prevent migration of leachate before it can contaminate groundwater (see Figure 2.7). The landfill is lined using a thick (6 inches) four-layer composite liner system. The multi-layered lining consists of: i) a 4-6-inch layer of caliche (calcium carbonate) used as a stabilizing base; ii) a geofabric (or carpet-like cover) injected with bairite; iii) a welded waterproof plastic (HDPE 4); and iv) a 2 feet protective layer of native sand. Although leachate is limited due to low rainfall, the facility has a dual liner, leachate evaporation pond located next to Cell 4. SCSWA reports the average retention time of leachate in pond as being about 4 months. There is a system to check for leaks underneath the liner of closed and active cells and to pump excess leachate when generated from the waste pile to the leachate pond.



**Figure 2.7.** Components of Corralitos on-site contaminant management system: L-R: Leachate in lined evaporation pond; vadose well used to monitor groundwater; vegetative cover being installed on closed cell to manage erosion of sediments.

Corralitos' improved site location and design specification ensures that **the sanitary landfill program is unlikely to negatively affect water quality**. Water quality data shows the lowest levels of arsenic (a heavy metal) in groundwater occurs in the Corralitos area (Figure B.3 in Appendix B). Regulatory monitoring records show that **there is no documented evidence of infiltration of water or moisture from the landfill through the unsaturated vadose zone (layer directly above the water table) to the aquifer that stores groundwater**. In addition, there are no surface water bodies within 10 miles of the landfill (see Figure B.4 in Appendix B). The nearest surface water body is the Lower Rio Grande River which flows through the city of Las Cruces and dissects Doña Ana County. The river is the main source of water recharge to the groundwater aquifer that provides the main source of domestic water supply for people throughout the county. There are no groundwater bodies near the land surface of the landfill. The Hueco-Mesilla Bolsons Aquifer underlies the landfill. Depth from the land surface to the groundwater table at Corralitos is greater than 125 feet and groundwater flows in a southeasterly direction.

Corralitos has eight vadose wells that are 125 feet deep for monitoring groundwater quality to detect any leachate that may migrate from the landfill. The vadose wells are installed along the perimeter of the landfill; upgradient of the landfill to track background levels of pollutants in groundwater and downgradient of the landfill cells to identify contamination from landfill leachate. Reports from SCSWA show that **no water or moisture has ever been observed** in any of the vadose wells due to the thickness of the aquifer and low precipitation. Consequently, under the terms of the solid waste management permit regulations, SCSWA received a water quality monitoring exemption from the New Mexico Environmental Department.

### Watershed water quality

The NADB's investment in Corralitos has indirectly supported minimization and mitigation of water quality contamination risks. The operation of the landfill enables proper solid waste disposal with the closure of multiple dumps and makes it less likely that solid waste will get in to water bodies and degrade water quality. In particular, the SCSWA along with county level partners are managing water contamination risks by combatting illegal dumping, via education and enforcement programs. The programs have achieved dramatic increase in material capture and elimination of illegal dump sites. For example, in 2015, throughout the county 721 illegal dump sites were identified; over 181 were remediated; SCSWA removed 20 tons of illegally dumped materials weekly during the summer; and, cleaned up about 500 tons of illegal dumped materials over the course of two summers.

### Future concerns for water quality

Local geology indicates several faults and possible fractured rocks present near the landfill. During high precipitation events, these features can be pathways for quick transport of contaminated runoff into the subsurface and water bodies. Slight stormwater erosion of waste pile slopes and along the perimeter fence suggest intermittent on-site impact from surface runoff associated with heavy rainfall events (during monsoon) (Figure 2.8). This may potentially be discharged from the landfill via the outfall on the southern boundary. More severe storm events are projected for the region under climate change conditions. Above-normal stormwater runoff can potentially transport contaminated sediments below monitoring wells.



**Figure 2.8.** Illustration of stormwater flow, detention pond, discharge outfall, and water erosion at Corralitos.

### Finding 2.3 – The operations of Corralitos Landfill reduce environmental health risks.

Waste management facilities often become an environmental justice issue as waste facilities (landfills) are often located close to less affluent communities. According to Mataloni et al., (2016) and Tomita et al. (2020), **People living within 5 km** of landfills may be exposed to high levels of hydrogen sulphide, which is related to lung cancer and respiratory diseases, as well as increases the risk of asthma, tuberculosis,



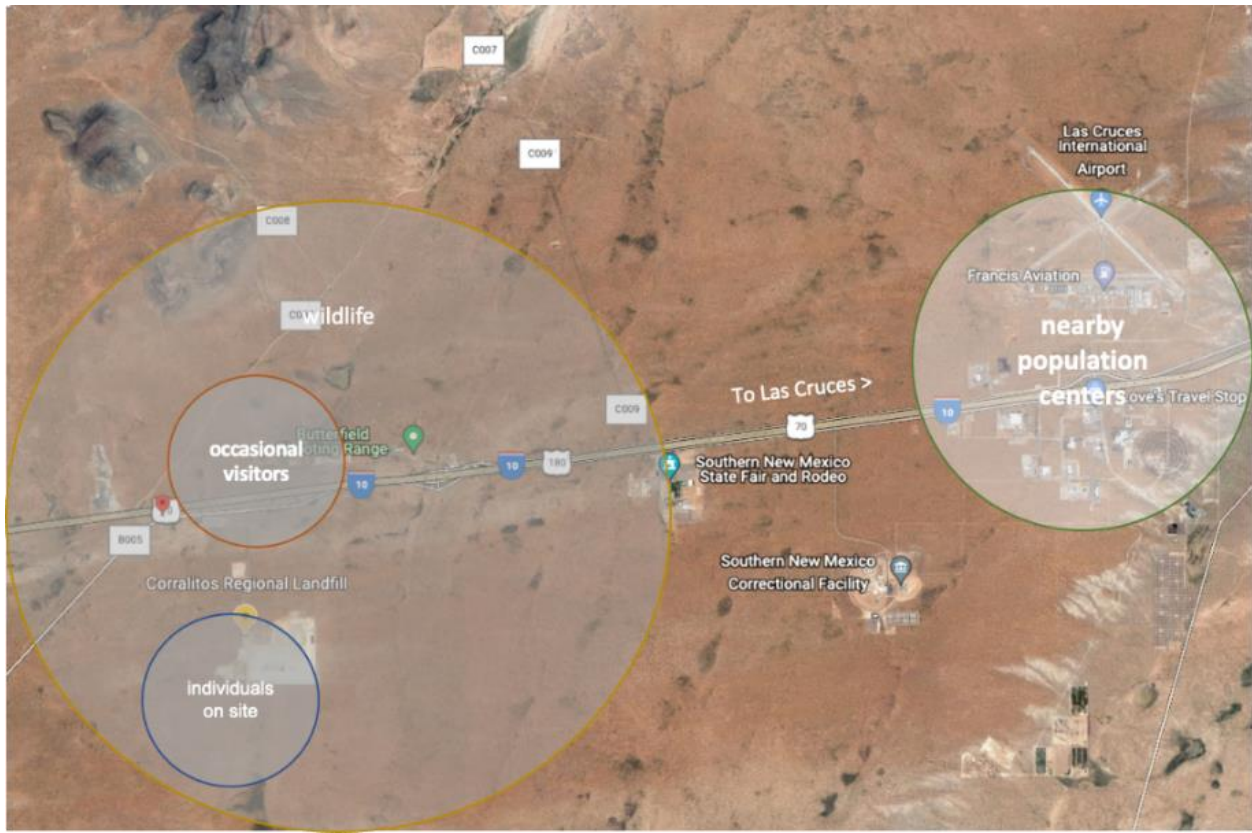
diabetes, and depression. In addition, **people living within 2 km of landfills** that receive toxic waste may develop congenital anomalies (2% risk) and low birth weight (6% risk). However, distance between the Corralitos Landfill and the city limits is 11.4 miles. **Nobody lives within 5 km of the landfill**, which reduces potential health impacts significantly (Figure 2.9). Some might find the expansion of Corralitos, especially the expansion of geographic area served, concerning for this reason. However, Corralitos is not a typical environmental justice facility for two reasons. Expanding the geographic area served by the waste authority has created an economy of scale that benefits the Las Cruces region. Having such a big facility increases control and quality of services. It also subsidizes an exemplary waste management system that would otherwise not be available in Las Cruces. In addition, the expansion of geographic extent has directly reduced illegal dumping as people have a nearby location to dump their waste, which benefits both people and the environment.



**Figure 2.9.** Distance between the Corralitos Landfill and the city limits of Las Cruces is 11.4 miles.

The impact assessment study is centered around quality of life of the residents living in this area. Inherent in any waste management system are environmental and human risks. A modern, well-functioning waste management system minimizes those risks through compliance with policy and guidelines, design, and day-to-day operations. Elements analyzed for Corralitos include **air pollution, waste handling and disposal, exposure to unknown materials, and general worker safety**. The approach to the risk assessment includes a systematic examination of different spatial and exposure scales: **individuals on site; occasional visitors; nearby population centers; and wildlife** (Figure 2.10).





**Figure 2.10.** Scales observed during the assessment.

To determine the risk values, the assessment followed a 5-step process:

- 1) the review of the initial concerns (specified in the proposal)
- 2) the calculation of the Risk Index (RI) that evaluates how the landfill contributes to surface water, groundwater, atmosphere, soil, individuals (humans), communities, infrastructure, and wildlife (see methods section below)
- 3) the development of the Environmental Landfill Index (ELI), which is the result of the evaluation of the actual risks of exposures observed during the appraisal (visit to the facility), literature review (Deliverable 1), public health and environmental records (municipal and city data), SCSWA archives, and expert interview
- 4) the analysis of each exposure risk through its potential factors based on its source, the location, its routes and its pathways
- 5) a comparison between the RI versus ELIs.

Health risk assessment (in the scale of 0-25) indicates an overall **very low risk** with an average of 4.58. The analysis shows a **low risk** (1.2) of air pollution, **no risk** (0.0) in impacts on water quality, **low risk** (7.9) in the handling and disposal of waste, **low risk** (7.5) in exposure to unknown materials, and **low risk** (6.3) in work safety. Results can be seen in Table 2.2 below. (Additional detail in Appendix B)

**Table 2.1.** Summary of findings for the environmental and human health risk assessment. Total average of 4.58 – **Very low** (sum of 5 subtotal averages divided by 5).

Element of Concern	Scale affected	Risk Index for Landfills	Risk Index for Corralitos (Environmental Landfill Index)
<b>Air Pollution</b>	<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>3.6 – Low</b>
	<i>Wildlife</i>	<b>14.29 Average</b>	<b>0.0 – None</b>
	<i>Occasional visitors</i>	<b>10.71 Average</b>	<b>0.0 – None</b>
		Subtotal average	<b>1.2 - Low</b>
<b>Water Quality</b>	<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>0.0 None</b>
	<i>Wildlife</i>	<b>25.0 Very High</b>	<b>0.0 None</b>
	<i>Occasional visitors</i>	<b>25.0 Very High</b>	<b>0.0 None</b>
	<i>Closest town or city</i>	<b>25.0 Very High</b>	<b>0.0 None</b>
		Subtotal average	<b>0.0 None</b>
<b>Handling &amp; Disposal of Waste</b>	<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>9.2 Low</b>
	<i>Wildlife</i>	<b>21.1 Very High</b>	<b>11.8 Average</b>
	<i>Occasional visitors</i>	<b>21.1 Very High</b>	<b>9.2 Low</b>
	<i>Closest town or city</i>	<b>6.6 Low</b>	<b>1.3 Very Low</b>
		Subtotal average	<b>7.9 Low</b>
<b>Exposure to Unknown Materials</b>	<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>10.0 Low</b>
	<i>Wildlife</i>	<b>17.5 High</b>	<b>10.0 Low</b>
	<i>Occasional visitors</i>	<b>20.0 High</b>	<b>2.5 Very Low</b>
		Subtotal average	<b>7.5 Low</b>
<b>Worker Safety</b>	<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>6.3 Low</b>

**\*\*The risk indices here have been normalized to a scale of 0 to 25 where 0-5=Very Low; 6-10=Low; 11-15=Average; 16-20=High; and 21-25=Very High.**

The assumption of risk for a generic landfill located away from population centers is reflected in the Risk Index for Landfills (Table 2.1, 3<sup>rd</sup> Column from left to right). Again, the risks index associated with landfills is relatively high, reflecting inherent risks from managing a diverse and large amount of waste. Notable exceptions are air pollution exposure to wildlife and occasional visitors (average) and waste handling for the nearest town (low) due to the relatively rural siting (over 10 miles from a population center).

Column 4 of Table 2.1 reflects the assessment of risk specific to Corralitos. The assessment of conditions at Corralitos, after significant document review and interviews, showed that **the design and daily operations of Corralitos successfully manage risk**. The results show an average risk index of 4.58, which represents a very low risk (see legend in Table 2.1 above). This finding is demonstrated by the risk index values for Corralitos (4<sup>th</sup> Column from left to right) being lower than the risk index for landfills at large (3<sup>rd</sup> Column from left to right). Further, the Corralitos-specific risks are relatively low across the board.

Specifically, the analysis found no risk to wildlife or occasional visitors to air pollution, no observable risk to water quality at any scale, low or very low risk at all scales for waste handling, low risk to visitors on unknown material exposures, and low risk to worker safety. Areas where risk is average includes risk to standard conditions that are difficult to control: workers encountering unknown contaminants hidden the waste stream and wildlife – primarily coyotes, birds, and snakes – ability to cross into the landfill. (Supporting images in Appendix B-2)

## Finding 2.4 – Improvement of the quality of life

Over the past decade, per capita volume at Corralitos Landfill has increased 9%. Interviews suggest this is not because more waste per Doña Ana resident is being produced. Rather, it reflects an expansion of the service area and types of waste that can be processed by SCSWA to maintain a competitive advantage and provide continued service. Because the landfill also serves people from outside Las Cruces, this facility likely contributes to an improved quality of life for people living in this extended area. Results from the qualitative study (Chapter 3) corroborates this finding as 72% of the participants reported satisfaction with the sanitation service and 80% of the participants reported an improved quality of life. The benefits of this extended service area help support the financial operations of the landfill.

The SCSWA manages a network of eight collection centers and two transfer stations<sup>3</sup> only possible due to the positive results and timely action which built trust on the New Mexico authorities, community, and partners, including the following actions:

- Joint efforts at the city and county level plus as well as with the New Mexico-TRUE “Litter Control and Beautification Act., NM Recycling Coalition, Keep Las Cruces Beautiful, National Energy Education Dev Project, and Rio Grande Sierra Club.
- Development and implementation of a Stormwater Pollution Prevention Plan.
- Efforts to reduce illegal dumping with operational and patrolling.
- Optimization of transportation to reduce carbon footprint.
- Intensive presence in social media and in educational and public settings; and
- Ongoing full compliance to the NMED Technical Guidance, Federal Subtitle D rules and the Environmental and Cultural Laws.

## Recommendations

1. The **primary recommendation is continued innovation in terms of management on site and with programs to manage more unusual types of waste.** Specifically, the study suggests the SCSWA:
  - Continue to invest in systems that confine waste, particularly on site, to minimize potential impact on wildlife and individuals.
  - Explore additional programs or incentives to minimize potential exposure to unknown materials that carry higher risk of toxicity but are commonly thrown into the typical household or commercial business waste stream.
2. **A second recommendation is for the SCSWA to consider a more mature and comprehensive data management plan.** A central concern of a lending institution – particularly one that also provides philanthropic support - is the ability to document impact. We found the SCSWA to be transparent with their operations, providing good access to information. However, the type of data was often in hard, paper form or in various spreadsheets.
  - Create a data management system/plan that centralizes all mandated reporting data (waste volumes, waste composition, all environmental monitoring) in electronic form and easily facilitates trend analysis over multiple years. This may require coordination with state agencies to minimize duplication of effort.
3. **Opportunities to mitigate potential water quality problems.** The study also recommends site-based disaster management planning to mitigate erosion and contaminated sediments being discharged from the landfill and infiltrating through the vadose zone. Also, consideration can be given to adding storm

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<sup>3</sup> The eight Community Collection Centers are: Anthony, Butterfield, Garfield, Hatch, Hill, La Mesa, La Union, and Mesquite. The two transfer stations are Amador Ave. Transfer Station and the Chaparral Transfer Station. The Amador Ave. Transfer Station includes the Las Cruces Recycling Center.

event-based water monitoring to identify any intermittent ground infiltration of stormwater. Finally, we recommend improvement of wind barrier to prevent solid waste escaping into the surrounding environment due to heavy winds (Figure 2.11). Given the changing volume and composition of waste streams, SCSWA should also evaluate leachate composition to identify present contaminants.



**Figure 2.11.** Potential problems that may affect water quality: L-R Wind barrier is not effective in preventing waste from escaping the landfill especially after a storm. Waste is getting into the natural environment and can be transported to water bodies. Birds feeding on recently spread waste pile can transfer contaminants to water bodies.

## Conclusions

While waste management carries inherent risks, the study found evidence of maturation from a waste system in Las Cruces from sub-standard dumps in the 1990s to a thriving regional facility in Corralitos that anchors a well-run waste system by SCSWA. The analysis shows an increase in waste managed at Corralitos from 2004 (when NADBank released the fund to present time) of **68.5%**. Findings suggest that the Corralitos Landfill does not deteriorate the environment and minimizes waste management risks. The funds provided by NADBank were likely one of several factors in the mid-2000s that helped the SCSWA establish itself as a stable and growing agency that follows best waste management practices, meeting initial concerns, and continuing to operate above what it is expected for a regular landfill. The communities surrounding the area, water quality, and air quality are, based on the evidence, safe. Risk factors for all elements analyzed resulted in a **very low risk** assessment with an average of 4.58 in the scale of 0-25. In an unlikely event of exposure (i.e., inadequate confinement of waste, presence of unknown waste, deterioration of the routes inside the landfill, or incidental infiltration of leachate), the exposure would likely only affect individuals and minimal wildlife on the site. The operation of Corralitos is likely to be an asset to the community that collects and disposes waste safely, is well positioned for future growth, and has both operational and financial capacity to succeed in the safe closing process of cells.

### III. Qualitative Analysis

Previous chapters in this report looked at the potential effects of NADBank funding on the institutional development of the SCSWA and on the amount and type of waste managed by this institution. Last chapter also focuses on the impacts of the Corralitos Landfill on the risk of people’s health and safety, and on water quality and environmental health. *The purpose of this chapter, qualitative analysis, is to analyze public perception toward the sanitation service and its relationship to the quality of life.* The overall aim is to understand the changes in public perception from the time the SCSWA received NADBank funding (2004) to present time, and its potential relationship with quality of life of the residents of Las Cruces.

#### Summary of Findings

**Finding 3.1: Residents are generally satisfied with waste services.**

- The results in this section are based on surveys completed by Las Cruces and Doña Ana County residents (N=78).
- 72% of respondents were satisfied with solid waste management.
- 62% were satisfied with recycling services.
- 38% were neither satisfied nor satisfied with the handling of illegal dumping.

**Finding 3.2: Communication efforts are mostly effective.**

- 80% of respondents reported familiarity with curbside collection.
- Most respondents (66%) report familiarity with glass disposal and about half (49%) with disposal of electronic waste.
- Disposal of tires showed the least level of familiarity (46%).

**Finding 3.3: Most measures show quality of life has improved.**

- Most respondents (78%) feel their neighborhood is cleaner or has remained the same.
- Half of respondents (50%) and many (36%) reported positive or no change in bad odors.
- Many respondents perceived no change in air quality (44%) or water quality (47%).
- Most respondents (80%) reported a positive change in their quality of life.

**Finding 3.4: Satisfaction with waste services has increased over time.**

- 56% of respondents indicated that waste management is moving in a positive direction.
- About 33% of respondents think illegal dumping is better than 20 years ago, whereas 45% of respondents think illegal dumping is worse.

#### Introduction

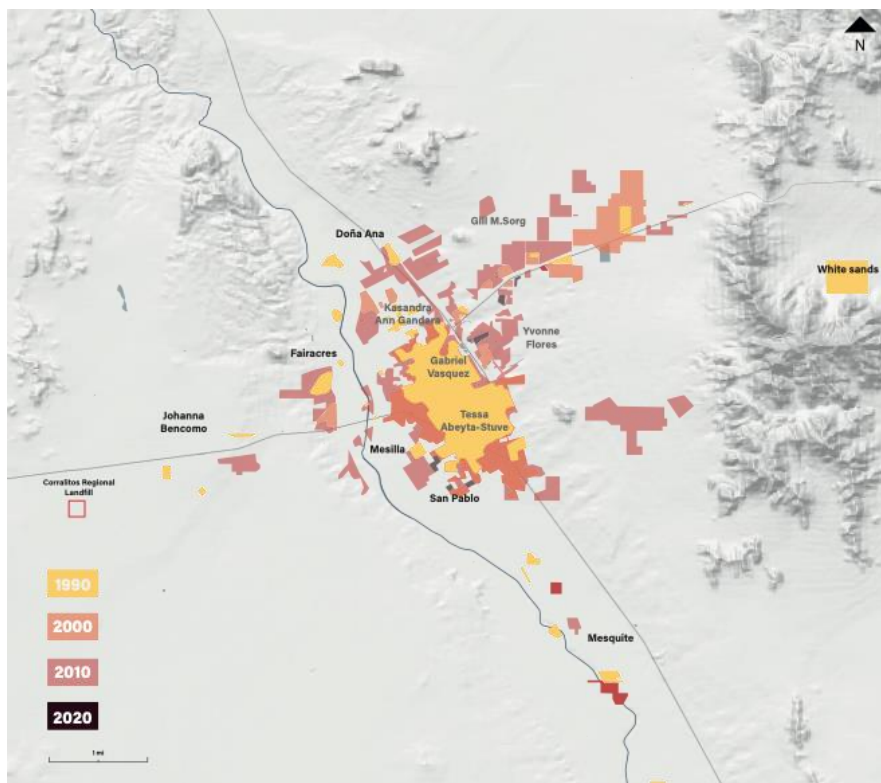
This section reports on community satisfaction with waste management in Las Cruces and around Doña Ana County, New Mexico, specifically how satisfaction may have changed over the previous 20 years, since NADB provided grant and loan monies to the South Central Solid Waste Authority (SCSWA), the entity that oversees waste management for the region.

#### Methodology

For this part of the evaluation project, a survey was designed for community households with residents who had resided in the area for at least 20 years. The survey was distributed online beginning on March 8, 2022.



The survey was distributed via email to neighborhood and homeowner associations provided by the City of Las Cruces. In total, 26 neighborhood association contacts were contacted in a series of 18 emails (some associations had multiple contacts) and were asked to distribute the survey to their residents. While the response rate was initially strong, it tapered off quickly and the decision was made to supplement these responses with mailed surveys. The survey was reformatted slightly for ease of printing (Appendix C) and 250 copies were mailed to households in the identified neighborhoods on April 2, 2022. For both the physical and digital versions of the survey, neighborhoods that existed prior to 2000 and, when possible, prior to 1990, were targeted. Figure 3.1 illustrates these areas.



**Figure 3.1.** Map showing the urban extent of Las Cruces, NM, over time, from 1990 to 2020. Map by Yves Chesnot.

After receiving no responses to the mailed surveys initially, it was decided to approach recruiting for the online survey differently. A spreadsheet of publicly available email addresses was compiled from faculty at New Mexico State University, key employees at the NASA White Sands Test Facility, all departments at City of Las Cruces, key individuals at Doña Ana County and Las Cruces Public Schools, and from several private employers in the city. After adding the email addresses into a spreadsheet, multiple emails were sent inviting individuals to participate and distribute the survey through their networks.

This approach posed several limitations. For one, most of the largest employers in Las Cruces did not have publicly available email addresses of their employees, limiting the recruitment efforts to fewer options. Moreover, other employers had barriers that impeded the public from accessing the contact information of their employees. For example, one employer required a connection to the employer’s VPN or to physically be at their facilities to get access to email addresses. Other employers seemed to have email addresses available, but their websites were poorly programmed making many pages inaccessible by the means of broken URLs.



The survey stopped online data collection on April 27, 2022. In total, 12 responses to the mailed surveys and 93 responses to the online survey were collected. 37 mailed surveys were returned to sender. However, 27 of the collected online surveys were blank, leaving 78 total valid responses to the survey (N=78). Notably, 68 of the 78 (or 87%) indicated they had lived in the region prior to 2003 and were able to provide some insights into changes of sanitation service over time.

Table 3.1 below summarizes the demographics of those that completed the survey. Respondents were slightly more likely to identify as female, and more likely to be older with higher incomes. While 31% identified as Hispanic or Latinx, the ratio of Hispanic to White respondents is lower than expected given the demographics of Las Cruces.<sup>4</sup>

**Table 3.1.** Demographic profile of survey respondents

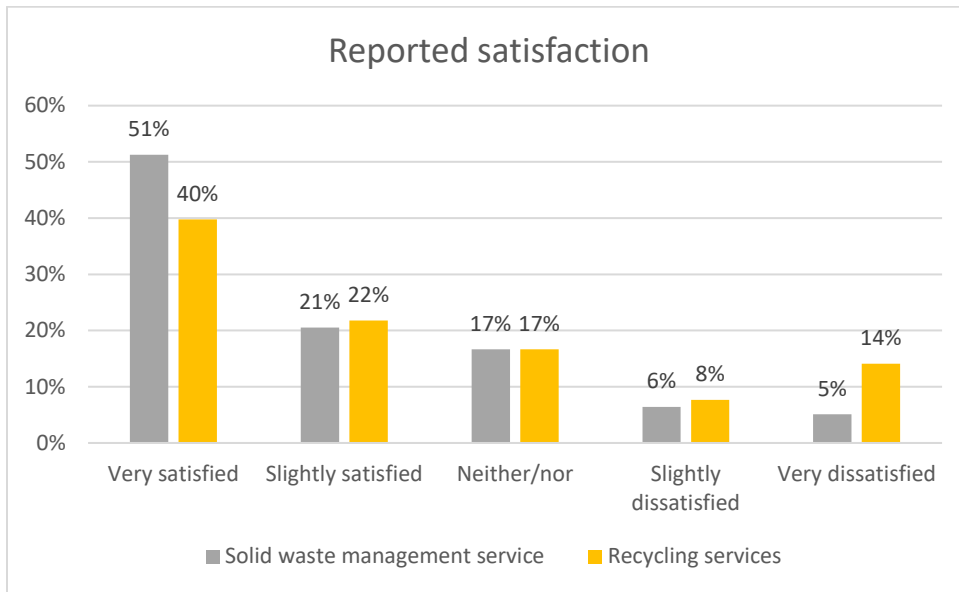
Category		Count	Percent
Completed Surveys (N)		78	--
Gender	% Male	34	44%
	% Female	41	53%
	% Gender non-conforming	-	-
	% Do not want to say or missing	3	4%
Age (years)	18-35	8	10%
	36-55	26	33%
	56-75	35	45%
	75+	9	12%
Race/Ethnicity*	Asian & Pacific Islander	-	-
	Black	-	-
	Hispanic	24	31%
	Native American	-	-
	White	48	62%
	Biracial	3	4%
	Not listed / Other	3	4%
Household Income	<\$30,000	3	4%
	\$30,000-\$59,999	16	21%
	\$60,000-\$89,999	19	24%
	\$90K+	30	38%
	Prefer Not to Say	8	10%
Lived in the Region Prior to 2003		68	87%

\*Respondents could affirm multiple race and ethnicity categories

### Finding 3.1: Residents are generally satisfied with waste services.

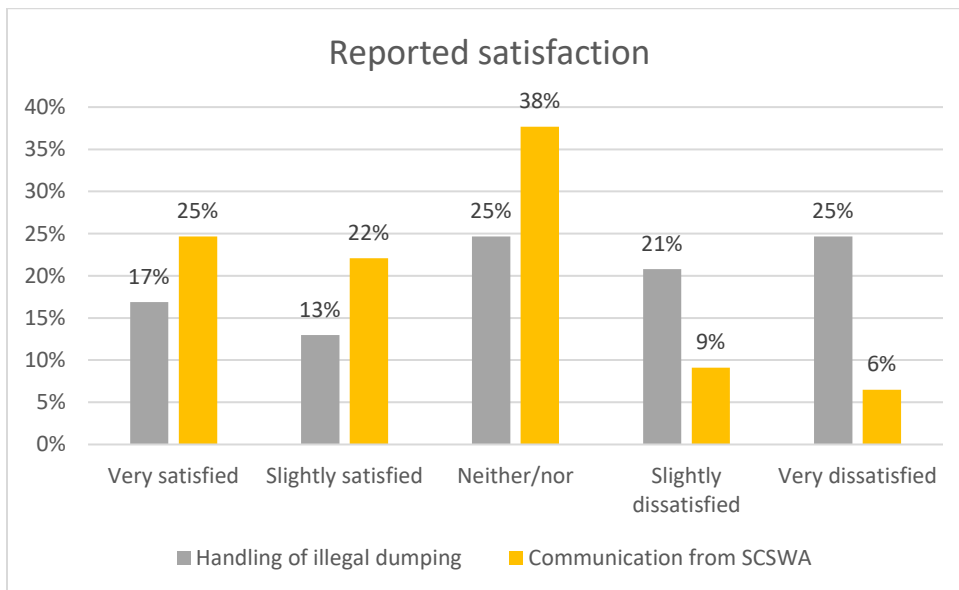
The study asked four distinct questions regarding satisfaction with sanitation services provided by the South Central Solid Waste Authority (Figure 3.2, Table 3.2). 72% of respondents were “very satisfied” (51%) or “slightly satisfied” (21%) with solid waste management, and 62% with recycling services (40% very satisfied and 22% slightly satisfied). These basic services were satisfactory to most respondents.

<sup>4</sup> The Hispanic population in Las Cruces, NM is 60.5%, according to datausa (<https://datausa.io/profile/geo/las-cruces-nm>)



**Figure 3.2.** Percent of responses for satisfaction with solid waste management and recycling services.

However, 46% of respondents were “slightly dissatisfied” or “very dissatisfied” with the SCSWA’s handling of illegal dumping (Figure 3.3). This may relate in a keyway to the way that respondents indicated their satisfaction with communication from SCSWA (38% were “neither satisfied nor dissatisfied,” the largest single response category, see Figure 3.3). Because the majority of respondents indicated that they were ambivalent regarding communication from the SCSWA and that they were dissatisfied with illegal dumping, this majority of respondents may be unfamiliar with communication from the SCSWA regarding successes in campaigns to decrease illegal dumping. This finding is more thoroughly explored in Finding 3.2.



**Figure 3.3.** Percent of reported satisfaction with the handling of illegal dumping and communications from SCSWA.

**Table 3.2.** Respondents’ satisfaction with waste management.

Question	Very Satisfied	Slightly Satisfied	Neither Dissatisfied Nor Satisfied	Slightly Dissatisfied	Very Dissatisfied	Total Responses to Question
How satisfied are you with solid waste management?	40 (51%)	16 (21%)	13 (17%)	5 (6%)	4 (5%)	78 (100%)
How satisfied are you with recycling services?	31 (40%)	17 (22%)	13 (17%)	6 (8%)	11 (14%)	78 (100%)
How satisfied are you with the handling of illegal dumping?	13 (17%)	10 (13%)	19 (25%)	16 (21%)	19 (25%)	77 (100%)
How satisfied are you with communication from the utility?	19 (25%)	17 (22%)	29 (38%)	7 (9%)	5 (6%)	77 (100%)

Finding 3.2: Communication efforts are mostly effective.

Despite specific campaigns to decrease illegal dumping, such as those featuring the character “Carlos the Coyote” (Figure 3.4), these successful efforts may not be communicated effectively or broadly.



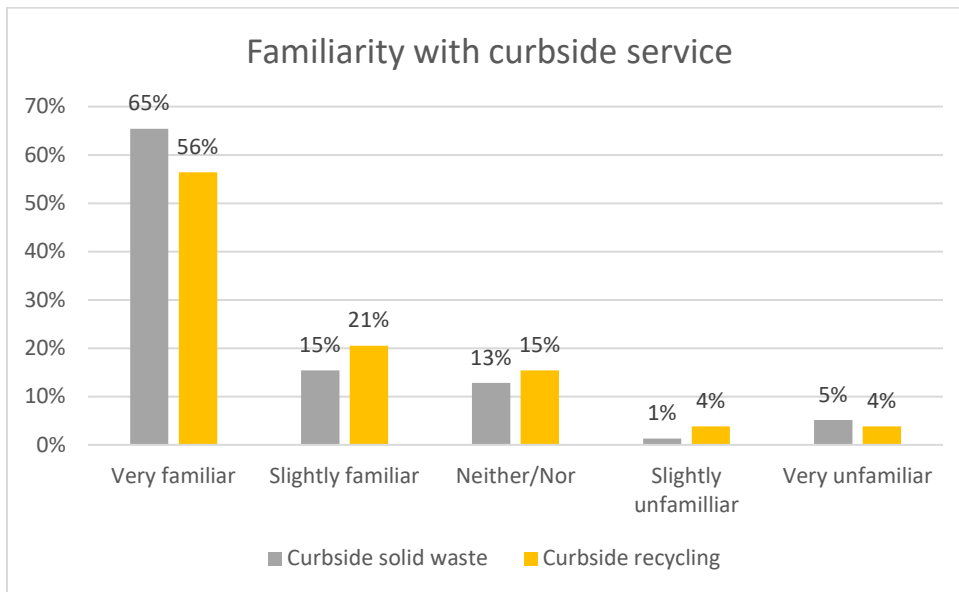
**Figure 3.4.** “Clean up with Carlos” banner at the Amador Transfer Station (photo: Molli Bryson)

The quantitative results of this study show that illegal dumping has been thoroughly addressed. Therefore, reported dissatisfaction does not correspond with reality, which suggests focused efforts to reduce illegal dumping may be poorly communicated. While the SCSWA website has a thorough section devoted to illegal dumping (SCSWA Illegal Dumping 2022), it is focused on curbing dumping and does not communicate the successful trajectory of the program. Further, it provides access to a bilingual newsletter, *Caring for Your Community / Cuidando Su Comunidad*, from the Illegal Dumping Partnership (a joint

program provided by the SCSWA, Doña Ana County, the Bureau of Land Management, and other partners), but the most recent issue is from winter 2017 (The Illegal Dumping Partnership 2017).

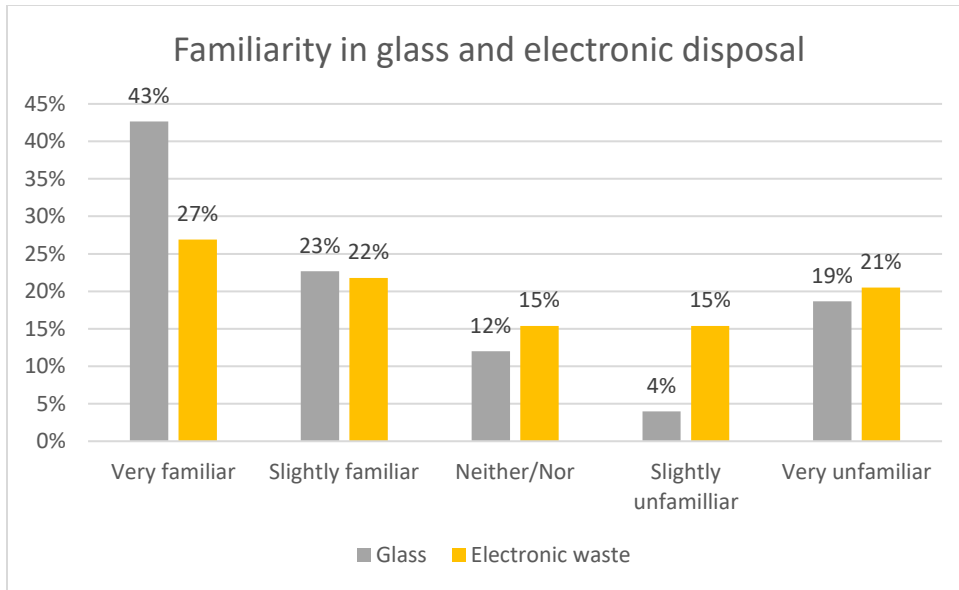
This may be a recurring problem that impacts, to a lesser extent, public perception in other areas. In the first section, the study established that the SCSWA recycling program is excellent, as evidenced by strong support from professionals involved with recycling organizations and with local and national awards. However, 22% of survey respondents indicated that they were “slightly” or “very dissatisfied” with recycling (Figure 3.3). The SCSWA website (SCSWA Recycling 2022) provides clear instructions regarding what, how, and when to recycle, but does not provide information regarding the awards the program has won or the progress toward reaching recycling goals.

The study looked at the level of familiarity with the disposal of various types of waste to evaluate the effectiveness of the SCSWA’s communication efforts. Regarding familiarity with sanitation services, survey most respondents (80%) indicated that they were “slightly” (15%) or “very familiar” (65%) with curbside solid waste, and many (77%) with curbside recycling (Figure 3.5, Table 3.3).



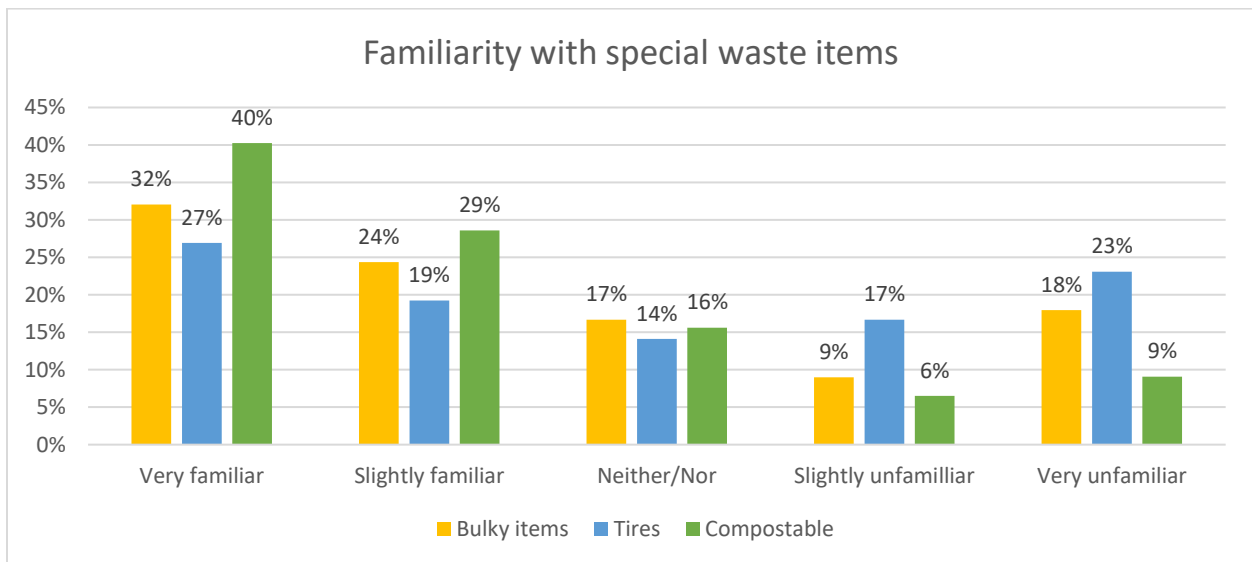
**Figure 3.5.** Percent of level of familiarity with curbside service.

For glass, most respondents (66%) reported familiarity with the disposal system (“slightly” 23% or “very familiar” 43%), while about half of the respondents (49%) reported some level of familiarity with the disposal of electronic waste (Figure 3.6).



**Figure 3.6.** Percent of familiarity with glass and electronic disposal

Familiarity with the disposal of tires resulted in about half (46%) of respondents indicating some level of familiarity (Figure 3.7). This was the disposal element with the least familiarity from our sample. The disposal of the other two items, compostable and bulky items, showed high levels of familiarity (compostable – 69%, bulky items – 56%). Therefore, it seems reasonable to conclude that Las Cruces and Doña Ana residents are able to find answers to questions regarding waste disposal of most types of waste, suggesting communication efforts around waste disposal are effective.



**Figure 3.7.** Percent of familiarity with the disposal of special waste items (bulky, tires and compostable).

**Table 3.3.** Respondents' satisfaction with waste management.



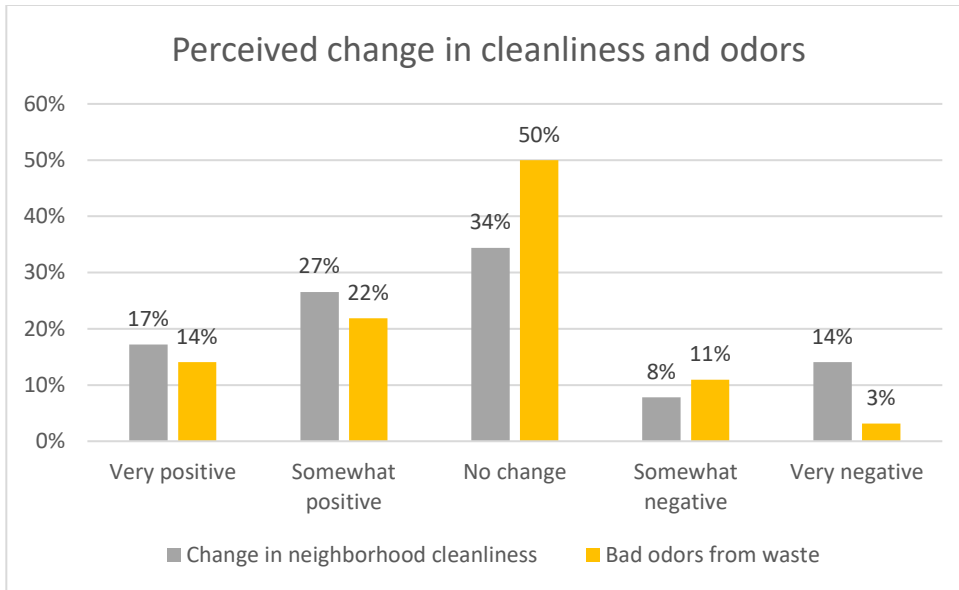
Type of waste	Very Familiar	Slightly Familiar	Neither Unfamiliar nor Familiar	Slightly Unfamiliar	Very Unfamiliar	Total Responses to Question
Regular, curbside solid waste	51 (65%)	12 (15%)	10 (13%)	1 (1%)	4 (5%)	78 (100%)
Regular, curbside recycling	44 (56%)	16 (21%)	12 (15%)	3 (4%)	3 (4%)	78 (100%)
Glass	32 (43%)	17 (23%)	9 (12%)	3 (4%)	14 (19%)	75 (100%)
Batteries and other electronic waste	21 (27%)	17 (22%)	12 (15%)	12 (15%)	16 (21%)	78 (100%)
Mattresses and other large, bulky items	25 (32%)	19 (24%)	13 (17%)	7 (9%)	14 (18%)	78 (100%)
Tires	21 (27%)	15 (19%)	11 (14%)	13 (17%)	18 (23%)	78 (100%)
Green/compostable waste	31 (40%)	22 (29%)	12 (16%)	5 (6%)	7 (9%)	77 (100%)

In conclusion, these findings suggest that while the SCSWA is effective at communicating information about the disposal of various types of waste and conducting campaigns to improve waste services, it may not effectively communicate successes around combating illegal dumping to its customers. This was the only metric that showed the least level of satisfaction. Responses around recycling also suggest that SCSWA can improve communication of these efforts to their customers.

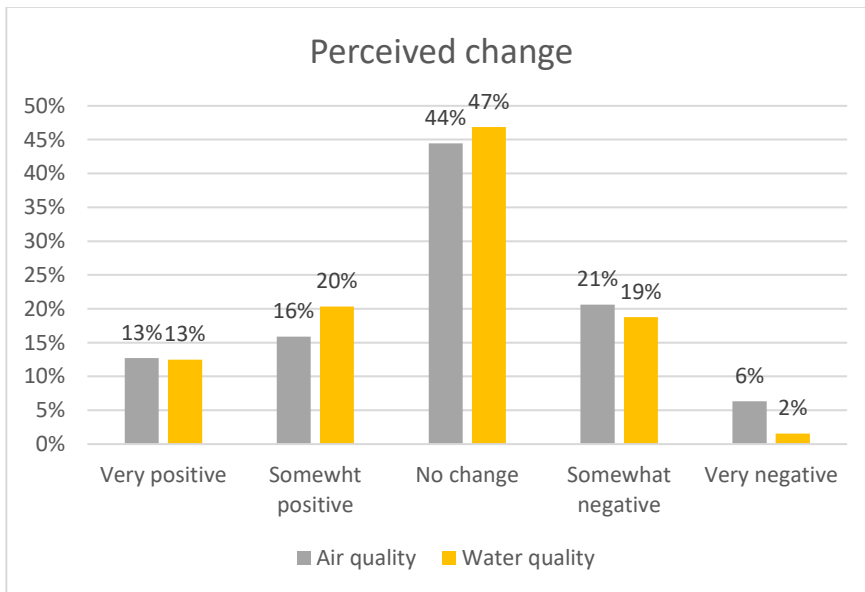
### Finding 3.3: Most measures show quality of life has improved.

Survey respondents who reported living in the region prior to 2003 were asked several questions about changes to their quality of life over the past 20 years. Sixty-eight individuals (N=68) responded that they met this threshold. Questions reflecting on the past 20 years included changes to their neighborhood cleanliness, air quality, water quality, bad odors from waste, and changes to waste management directly (solid waste management and recycling services).

Respondents generally feel life has improved their quality of life or remained the same. From the 64 people who responded these questions (n=64), the majority of respondents (78%) indicated that the changes in neighborhood cleanliness had been “very positive,” “somewhat positive,” or “no change” (Figure 3.8, Table 3.4). Perceived change in bad odors showed half reported a “no change” (50%), and many (36%) reported positive changes. Regarding perceived change in air and water quality, many respondents reported “no change,” 44% for air quality and 47% for water quality (Figure 3.9).

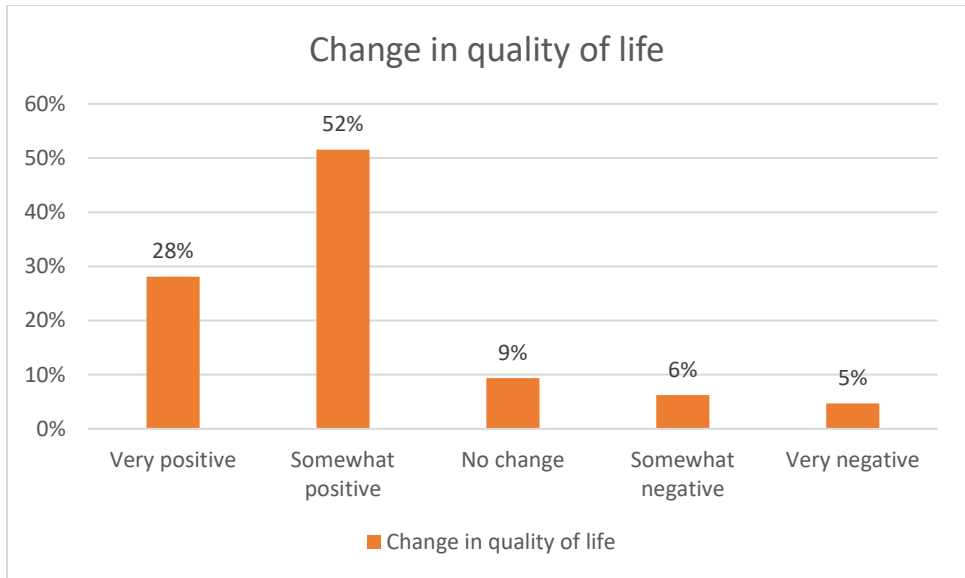


**Figure 3.8.** Perceived change in neighborhood cleanliness and odors from waste.



**Figure 3.9.** Perceived change in air and water quality.

Most participants (80%) reported a positive change in their quality of life (“very positive” 28%, “somewhat positive” 52%) (Figure 3.10).

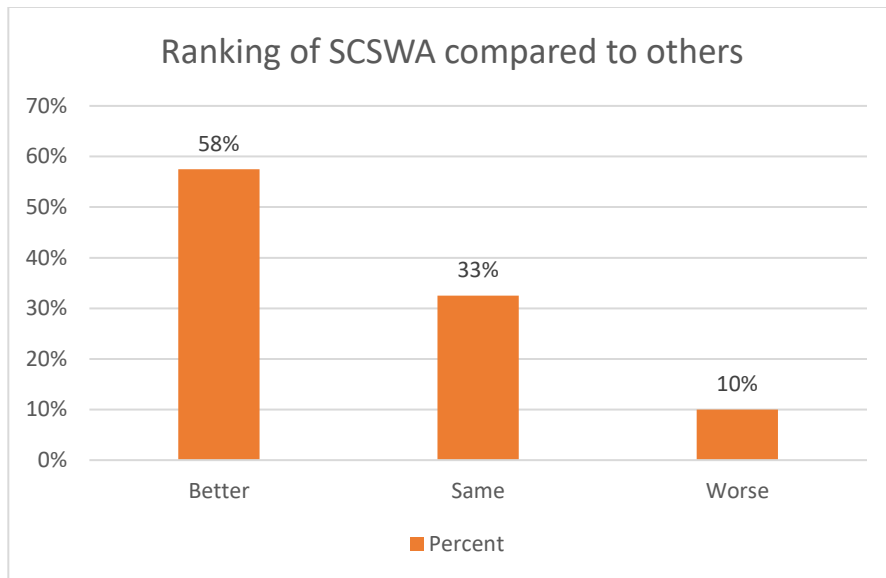


**Figure 3.10.** Perceived change in quality of life.

**Table 3.4.** Respondents' changes to quality of life over the past 20 years.

Measure of quality of life	Very Positively	Somewhat Positively	No Change	Somewhat Negatively	Very Negatively	Total Responses to Question
Neighborhood cleanliness	11 (17%)	17 (27%)	22 (34%)	5 (8%)	9 (14%)	64 (100%)
Air quality	8 (13%)	10 (16%)	28 (44%)	13 (21%)	4 (6%)	63 (100%)
Water quality	8 (13%)	13 (20%)	30 (47%)	12 (19%)	1 (2%)	64 (100%)
Bad odors from waste	9 (14%)	14 (22%)	32 (50%)	7 (11%)	2 (3%)	64 (100%)
Quality of life	18 (28%)	33 (52%)	6 (9%)	4 (6%)	3 (5%)	64 (100%)

Results from this qualitative analysis suggest that survey respondents are also satisfied with the job that the SCSWA has done with respect to waste management. When asked how they would rank the SCSWA's handling of waste management with respect to the operations of other area utilities and public services, 57.5% indicated that they were "better than some" or "better than most," and only 10% said that the SCSWA was "worse than some" or "most" of other utilities and public services (Figure 3.11, Table 3.5).



**Figure 3.11.** Ranking the SCSWA with respect to other utilities and public services. NOTE: results from “better than most” and “better than some” were compiled in “better,” while results from “worse and some” and “worse and most” were compiled in “worse.”

**Table 3.5.** Respondents’ rankings of SCSWA compared to other utilities and public services.

	Better Than Most	Better Than Some	Exactly in the Middle	Worse Than Some	Worse Than Most	Total Responses to Question
If you ranked the utilities and public services in the area (in terms of outreach, billing and pricing, regularity of service, customer service, etc.), where would waste management be?	20 (26%)	26 (33%)	24 (31%)	4 (5%)	4 (5%)	78 (100%)

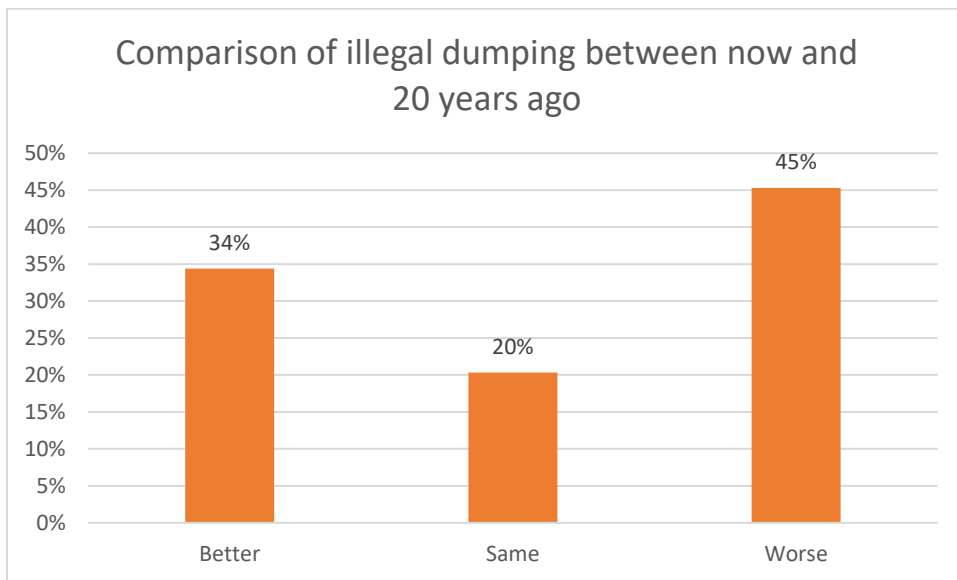
**Finding 3.4:** Satisfaction with waste services has increased over time, except for illegal dumping.

The responses by the 64 long-term residents related to how waste management have changed over time provided useful insights. While 37% of respondents suggest no change in satisfaction in waste management over the past two decades, another 56% indicated that waste management is moving in a somewhat or very positive direction (Figure 3.12).



**Figure 3.12.** Satisfaction with waste management services over time. NOTE: results from “better than most” and “better than some” were compiled in “better,” while results from “worse and some” and “worse and most” were compiled in “worse.”

Participants reported a much more mixed perception of the trajectory of illegal dumping. Figure 3.13 and Table 3.6 below show that about one-third (34%) of respondents think illegal dumping is “better” or “much better” than 20 years ago, whereas 45% of respondents think illegal dumping is “slightly” or “much worse”.



**Figure 3.13.** Respondents’ responses to the question “How would you describe illegal dumping in the region compared to 20 years ago?”

**Table 3.6.** Respondents’ rankings of illegal dumping over the past 20 years.



	Much Better	Slightly Better	No Change	Slightly Worse	Much Worse	Total Responses to Question
How would you describe illegal dumping in the region compared to 20 years ago?	10 (16%)	12 (19%)	13 (20%)	15 (23%)	14 (22%)	64 (100%)

### Recommendations

1. The primary recommendation is **improved communication** regarding **waste management successes and project completions**. Communication regarding basic information, goals, and ongoing projects, such as what to recycle and illegal dumping, all appear to be successful, but the results of goals and projects – such as awards for recycling programs and measurable decreases in illegal dumping – were not communicated effectively to customers and residents.
2. Further, the study recommends that any future funding is **implemented with a comprehensive communication plan** for the duration of the effort. The findings in the first two sections of this project, which involved interviews with area experts and evaluations by academics, provided specialist knowledge that regular residents would not have been privy to. This information highlighted the SCSWA’s successes, and there should always be a plan in place to communicate these successes to those who benefit most directly from them.

### Conclusions

Perhaps the best evaluators of the SCSWA’s success as a waste management utility are the residents who are directly served by the utility. The survey reported here indicates that, by and large, the SCSWA’s performance is satisfactory and that quality of life for residents (in aspects that are or could be affected by solid waste management) has improved over the past two decades, or remained the same. Although there are some positive changes that could be made, such as communicating successes of waste management programs more effectively, the SCSWA appears to have improved the quality of life for residents of Las Cruces and Doña Ana County.

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## Chapter 2

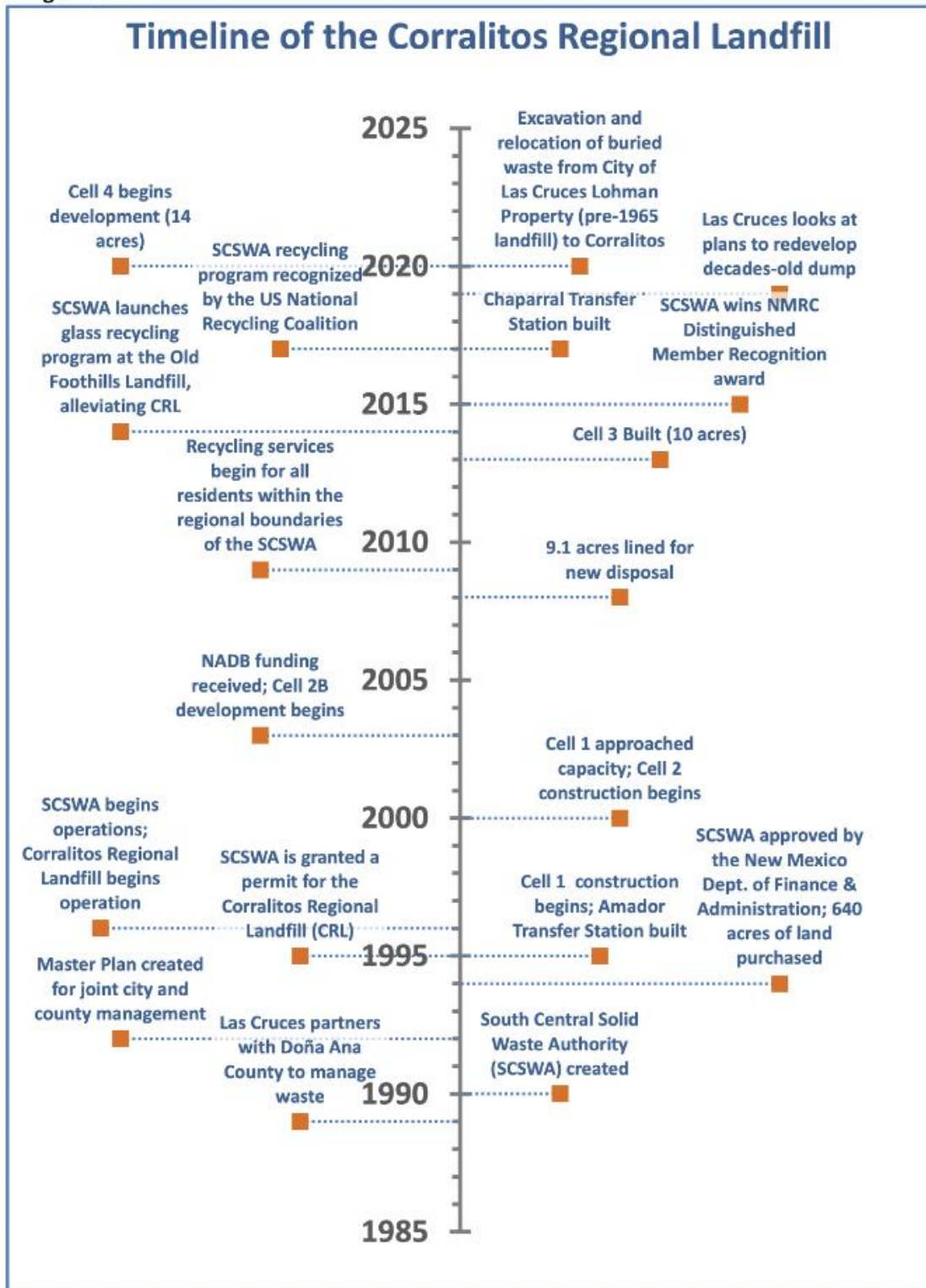
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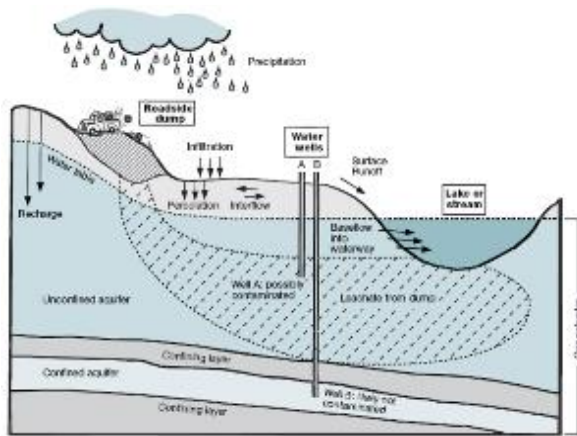
## Appendix A - Timeline

The timeline is available interactively at <https://bit.ly/3wzdash>, and non-interactively in the images below.



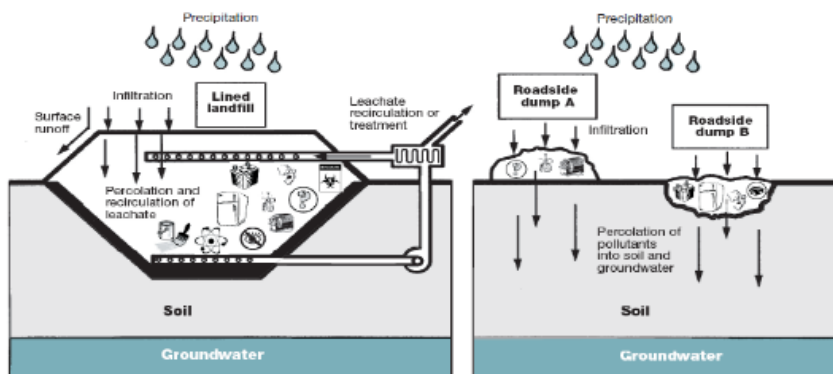
## APPENDIX B-1: Supporting images for Finding 2.2 - No observable adverse impact on ground and surface water quality

The main risks posed by a landfill site to water quality is toxic chemicals in leachate. When precipitation, surface runoff, or a high groundwater table, infiltrates into a landfill leachate is created. Water percolating through the waste causes chemical compounds to be dissolved or suspended in the leachate. Factors such as location, climate, weather, topography, soils, bedrock type, and landfill design, largely determine the risk of leachate migrating from a landfill, contaminating water bodies. Water quality can be impacted by a landfill operation at two levels: a) at the site - due to operations at the landfill; and b) at the watershed level - based on improperly disposed solid waste polluting water bodies (see Figures A.1).



**Figure A.1.** Improper waste disposal can impact water quality in many ways.

Apart from contamination of groundwater and surface water bodies, improper waste disposal poses health related exposure risk from contaminated drinking and flood water. Drinking water supplies near dumps can be influenced by a wide variety of pollutants (Figure A.2). Improperly disposed solid waste can lead to flooding caused by debris/wastes clogging drainage, ditches, and waterways. Illegal dumping has long been problematic in Doña Ana County and statewide.

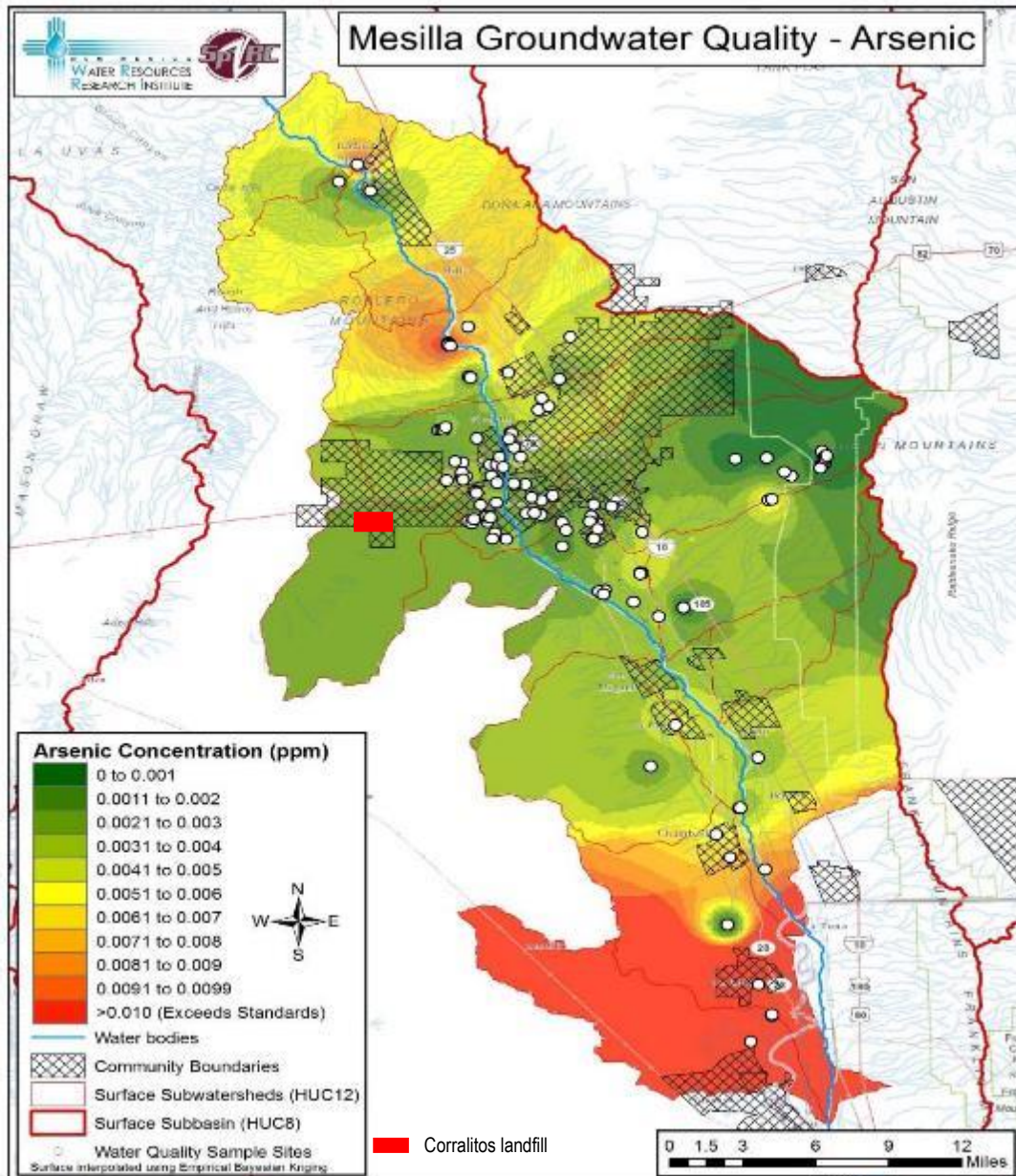


**Figure A.2.** Schematic of leachate formation and fate in relation to groundwater underlying a lined sanitary landfill versus an unlined dump.

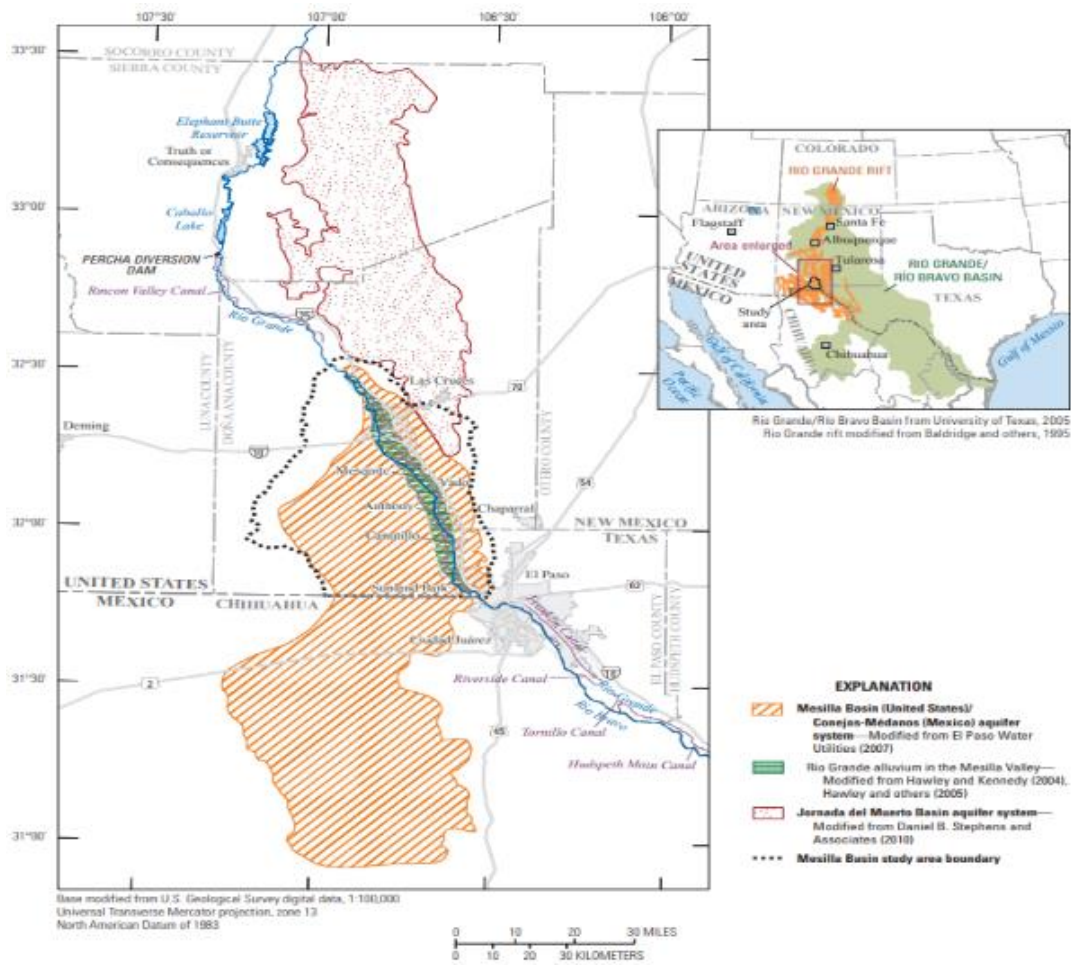
**Site location, weather/climate, and hydrogeology.** Precipitation is scarce at the Corralitos landfill. Climate within the area and the wider Doña Ana County is arid continental; characterized by low levels of



precipitation and humidity. Average annual precipitation is about 8 to 10 inches (State of New Mexico, 2017); mostly (54%) restricted to rainfall during the monsoon months of July, August, and September, in the form of heavy storm events. Loss of surface water and soil moisture via annual evaporation is high (about 94 inches). Characteristics of the groundwater and surface water systems near the landfill, such as groundwater aquifer thickness, direction and rate of water movement, contribute to the risk of contaminants from landfills polluting water bodies.



**Figure A.3.** Map showing Arsenic levels in groundwater in the Hueca-Mesilla Bolsons Aquifer. Arsenic is one of the heavy metals commonly found in landfill leachate. The map shows that groundwater below the Corralitos Landfill has some of the lowest levels of arsenic within the Mesilla basin. Source: NMWRRI (2017).



**Figure A.4.** Map of groundwater aquifers and surface water bodies in Doña Ana County, NM, showing the relative location of the Corralitos sanitary landfill.

## APPENDIX B-2: Methods and extended documentation for Finding 2.3

To evaluate the extent of environmental and human health risks associated with Corralitos, the process included the steps from the Environmental Protection Agency (EPA) guidelines on the information to be contained in Environmental Impact Assessments and a modification of the methodology EVIAVE (*Evaluacion del Impacto Ambiental en Vertederos*). The methodology balances known risks at large within the landfill and waste management sector with the probability of those risks occurring at a specific site (Zamorano, Calvo, Moreno, & Ramos , 2006). Elements analyzed for Corralitos include **air pollution, water quality (surface & ground); waste handling and disposal; exposure to unknown materials; and general worker safety** at different spatial and exposure scales: **individuals on site; occasional visitors; nearby population centers; and wildlife**. For example, an occasional visitor is given a different risk score than wildlife or even those who work on site multiple days a week.

Operationalizing the methodology is a two-stage process. First, a Risk Index (RI) score is created for each element. An assessor starts with a list of risk factors – based in scientific literature and applicable regulations - for each element. The assessor then uses information about the known design and purpose of the system to state what proportion of the factors are of *potential concern at Corralitos which becomes the Risk Index (RI)*.

Once potential concerns are associate with RI are documented, the second stage is to create an Environmental Landfill Index (ELI). An **ELI uses information gained from extensive document review and interviews to assess the extent to which there is evidence of actual or high probability impact**. For analysis of Corralitos, multiple (3 or more) evaluation team members indicated which, if any, factors had surfaced during data collection. The ELI, like the RI, is expressed in a ratio.

For simplicity's sake, both the RI and the ELI are normed to 25 to compare across different elements or pathways to risk. From an interpretation standpoint, this means that each index is on a scale as follows:

- 0-5 Very Low
- 6-10 Low
- 11-15 Average
- 16-20 High
- 21-25 Very High

The relationship between the RI and the ELI is such that if they are equal, the Corralitos Landfill is performing as can be expected given the risks inherent in waste management. If the RI is greater than ELI, then Corralitos Landfill is performing above expectations. If the RI is less than ELI, is not performing above expectations.

Below are the RI and ELI for air pollution, water quality, waste handling & disposal, exposure to unknown materials, and general worker safety. The risk factors considered and a brief description of the rationale behind those factors are also provided.

**Finding 2.1** No significant concern about exposure to air pollution

Scale affected	Risk Index	Environmental Landfill Index
<i>Individuals on site</i>	<b>25.0 - Very High</b>	<b>3.57 - Low</b>
<i>Wildlife</i>	<b>14.29 - Average</b>	<b>0.0 - None</b>
<i>Occasional visitors</i>	<b>10.71 - Average</b>	<b>0.0 - None</b>

**\*\*The risk indices here have been normalized to a scale of 0 to 25 where 0-5=Very Low; 6-10=Low; 11-15=Average; 16-20=High; and 21-25=Very High.**

- Risk factors:**
1. Waste and organic matter precursors of Methane
  2. Incineration (not applicable)
  3. Presence of Industrial waste (if any)
  4. Presence of heavy metals (if any)
  5. Polycyclic Aromatic Hydrocarbons (PAH)
  6. Smell/inhalation
  7. Wind conditions

**Rationale**

Solid waste landfills are large contributors of precursors to methane. This plus dust in the presence of industrial waste, heavy metals, other potential contaminants (PAHs and VOCs), and smells can result in health impacts. However, pollution can only travel so far and siting a landfill away from population centers can alleviate much of this risk. Corralitos’ design and site location away from population centers minimizes much of this risk.

**Finding 2.2** Water Quality Assurance

Scale affected	Risk Index	Environmental Landfill Index
<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>0.0 None</b>
<i>Wildlife</i>	<b>25.0 Very High</b>	<b>0.0 None</b>
<i>Occasional visitors</i>	<b>25.0 Very High</b>	<b>0.0 None</b>
<i>Closest town or city</i>	<b>25.0 Very High</b>	<b>0.0 None</b>

**\*\*The risk indices here have been normalized to a scale of 0 to 25 where 0-5=Very Low; 6-10=Low; 11-15=Average; 16-20=High; and 21-25=Very High.**

- Risk factors:**
1. Control of liquid leachate
  2. Pluviometry
  3. Aquifer characteristics
  4. Surface drainage systems
  5. Waterproofing pipping, pumping and storage of storm water

**Rationale**

The main risks posed by a landfill site to water quality is toxic chemicals in leachate. When precipitation, surface runoff, or a high groundwater table, infiltrates into a landfill leachate are created. Water percolating through the waste causes chemical compounds to be dissolved or suspended in the leachate. Factors such as location, climate, weather, topography, soils, bedrock type, and landfill design, largely determine the risk of leachate migrating from a landfill and contaminating water bodies. Water quality can be impacted by a landfill operation at two levels: 1) at the site - due to operations at the landfill



including the leachate management system; and 2) at the watershed level - based on improperly disposed solid waste polluting water bodies. Corralitos' improved site location and design specification ensures that the sanitary landfill program funded by the NAD Bank is unlikely to negatively affect water quality.

**Finding 2.3** Adequate handling and disposal of waste

Scale affected	Risk Index	Environmental Landfill Index
<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>9.21 Low</b>
<i>Wildlife</i>	<b>21.05 Very High</b>	<b>11.84 Average</b>
<i>Occasional visitors</i>	<b>21.05 Very High</b>	<b>9.21 Low</b>
<i>Closest town or city</i>	<b>6.58 Low</b>	<b>1.32 Very Low</b>

**\*\*The risk indices here have been normalized to a scale of 0 to 25 where 0-5=Very Low; 6-10=Low; 11-15=Average; 16-20=High; and 21-25=Very High.**

- Risk factors:**
1. Modes of transportation of waste
  2. Inadequate confinements of waste
  3. Handling and disposal of waste
  4. Drive through, to and from the facility including State of roads in the landfill
  5. Distance to-from the facility
  6. Morphology
  7. Visibility
  8. Final covering
  9. Landfill age
  10. State of roads in the landfill
  11. Presence of micro and macro plastics
  12. Unknown content of the local waste
  13. Unknown content of the out-state waste
  14. Noise/hearing
  15. Sight/view
  16. Settling of waste

**Rationale**

Landfill operation requires vast areas of land and a well-functioning transportation system to safely manage the waste. Landfills, if not managed well, can result in elevated temperatures in surface and subsurface environments, which can produce random fire events leading to additional air quality concerns. Litter or loose trash can impact wildlife and commuters. Visibility to and from the landfill is a concern for safety, storm water management, runoff prevention, visitors, and local community for its aesthetical and safety values. The good design and management minimize most of these risks at Corralitos. Siting the landfill away from population centers also helps, although coyotes, birds and rattlesnakes around the site could still be exposed to some waste.

**Finding 2.4** Inevitable exposure to unknown content in waste streams

Scale affected	Risk Index	Environmental Landfill Index
<i>Individuals on site</i>	<b>25.0 Very High</b>	<b>10.0 Average</b>
<i>Wildlife</i>	<b>17.5 High</b>	<b>10.0 Average</b>
<i>Occasional visitors</i>	<b>20.0 High</b>	<b>2.5 Very Low</b>

**\*\*The risk indices here have been normalized to a scale of 0 to 25 where 0-5=Very Low; 6-10=Low; 11-15=Average; 16-20=High; and 21-25=Very High.**

- Risk factors:**
1. Presence of micro and macro plastics
  2. Presence of asbestos
  3. Unknown content of the out-state waste
  4. Presence of other wastes
  5. Waste and organic matter types (if any)
  6. Presence of Industrial waste (if any)
  7. Presence of heavy metals (if any)
  8. Presence of Polycyclic Aromatic Hydrocarbons (PAH)
  9. Presence of Biosolids (sewage and sludge) (if any)

#### **Rationale**

A landfill receives household and nonhazardous wastes, such as commercial solid waste, nonhazardous sludge, and industrial nonhazardous solid waste. Accidental and sporadic urban and farm solid waste can add increased risk of workers encountering unknown materials. This is a known risk to landfilling and is generally managed best earlier in the waste stream.

#### **Finding 2.5 Worker safety and operations**

Scale affected	Risk Index	Environmental Landfill Index
<i>Individuals on site</i>	<b>25 Very High</b>	<b>6.25 Low</b>

**\*\*The risk indices here have been normalized to a scale of 0 to 25 where 0-5=Very Low; 6-10=Low; 11-15=Average; 16-20=High; and 21-25=Very High.**

- Risk factors:**
1. Accidental Intake/ingestion
  2. Physical Illness
  3. Skin contact/dermal contact
  4. Erosion

#### **Rationale**

In 2016, there were 32 fatal injuries and 10,900 estimated nonfatal injuries and illnesses across the US among Waste Management and Remediation Service workers in NAICS Codes 562111 Solid Waste Collection, 562212 Solid Waste Landfill, and 562920 Materials Recovery Facilities (U.S. Bureau of Labor Statistics). However, most fatalities are on the collection rather than the landfill side. Daily management decisions can make a big difference in managing the risks for waste management workers. SCSWA's continued commitment to bring more the waste collection under their control combined with good daily management practices minimizes this risk.



## APPENDIX B-3: Supporting images demonstrating no impact of Corralitos on nearby areas.

**Figure 8.** Bird-eye images comparing the site 1999 Vs. 2020



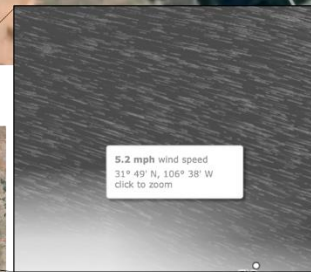
**Figure 9.** Rationale for descanting air quality concerns for near by population



**Location:** The SCSWA is in Dona Ana County in the State of New Mexico (around 35 miles north of the U.S./Mexico border). 11.4 miles away from the **Recycled Roadrunner Sculpture**. This is a landmark that also coincide with the first populated area on the west side of Las Cruces, N.M.

**Current population (2020):** Dona Ana County, including the City of Las Cruces, is approximately 245,000.

Health is at risk for those who live within 3.11 miles of a landfill site, according to the International Journal of Epidemiology. Longer distances and high winds makes it unlikely to affect residents' health. Therefore, **Corralitos is beyond the minimum distance to becoming a health concert to the population.**



The potential contamination of air (if any) from the facility may spread into the southeast region which may be **out of the limits of Dona Ana County, New Mexico and the US.**

Source: <http://hint.fm/wind/>

## APPENDIX C: Printed Version of Survey

1. Please indicate how satisfied you are with waste collection by the South Central Solid Waste Authority.

	Very dissatisfied	Slightly dissatisfied	Neither dissatisfied nor satisfied	Slightly satisfied	Very satisfied
How satisfied are you with <b>solid waste management</b> ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How satisfied are you with <b>recycling services</b> ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How satisfied are you with the <b>handling of illegal dumping</b> ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How satisfied with you are with <b>communications</b> from the utility?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Please indicate your level of familiarity (schedule, how to dispose) with disposal of the following types of waste.

	Very unfamiliar	Slightly unfamiliar	Neither unfamiliar nor familiar	Slightly familiar	Very familiar
Regular, curbside <b>solid waste</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Regular, curbside <b>recycling</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Glass</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Batteries and other <b>electronic waste</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mattresses and other <b>large, bulky items</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Tires</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Green/compostable waste</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. If you ranked the utilities and public services in the area (in terms of **outreach, billing and pricing, regularity of service, customer service**, etc.), where would waste management be? Please check your choice

- Worse than most
- Worse than some
- Exactly in the middle
- Better than some
- Better than most

4. Have you lived in the region since 2003? If you lived in the region prior to 2003, moved away, and then returned, please answer YES to this question and answer questions 5 and 6. Please circle your choice.

- Yes
- No

5. Please indicate how each of the following have changed over the past 20 years. For this question, please check only one option for each question, and please only answer this question if you circled YES in response to #4.

	Very negatively	Somewhat negatively	No change	Somewhat positively	Very positively
How has your <b>quality of life</b> changed over the last 20 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How has your <b>satisfaction with solid waste management</b> changed over the last 20 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How has your <b>satisfaction with recycling</b> changed over the last 20 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How has your <b>neighborhood's cleanliness</b> changed over the last 20 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How has the <b>air quality</b> in your area changed over the last 20 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How has the <b>water quality</b> in your area changed over the last 20 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How much have <b>bad odors from waste</b> changed over the last 20 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. How would you describe illegal dumping in the region compared to 20 years ago? Please only answer this question if you circled YES in response to #4.

- Much worse
- Slightly worse
- No change
- Slightly better
- Much better

7. Is there anything else that you would like to share about changes in waste management or services in your area?

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8. What is your age? Please check one option.

- 18 to 35
- 36 to 55
- 56 to 75
- 76 or older

9. What is your gender? Please check one option.

- Male
- Female
- Non-binary
- Prefer not to say

10. Which of the following best describes you? Please check all that apply.

- Asian or Pacific Islander
- Black or African American
- Hispanic or Latino/a/x
- Native American or Alaskan Native
- White or Caucasian
- Biracial or Multiracial
- Not listed

11. What is your household income? Please check one option.

- Below \$30,000
- Between \$30,000 - \$59,999
- Between \$60,000 - \$90,000
- Above \$90,000