



Best Practices In Addressing Illegal Dumping Of Durable Waste – A Guide For Policy Makers

Corresponding Author: Dr. Calvin Lakhan

Secondary Author: Nana Adjei

Faculty of Environmental and Urban Change

YORK 



Contents

Forward	3
1.0 Preface	1
2.0 Predictors of Illegal Dumping	1
2.1 Barriers to Legally Disposing of Waste.....	2
2.11 Waste Disposal Fees and Pay As You Throw Programs	3
2.2 Site-Specific Characteristics That Contribute to Illegal Dumping	4
2.21 Communal Maintenance of a Public Space/Area	5
2.3 Socio-Demographic Drivers of Illegal Dumping and Normative Expectations.....	5
2.31 Normative Pressures and Community Expectations Regarding Illegal Dumping	6
2.4 Attitudes and Awareness Toward Illegal Dumping, Sustainability and the Environment	7
3.0 Strategies to Prevent and Deter Illegal Dumping	7
3.1 Data Collection and Reporting	8
3.2 Availability and Access	8
3.3 Promotional, Educational and Awareness Initiatives	9
3.4 Cultivating Community Buy-In	11
3.5 Stakeholder Collaboration and Partnerships.....	11
3.51 The Role of Extended Producer Responsibility (EPR) in Promoting Partnerships	12
3.52 The Importance of Partnerships: A California Case Study	13
3.6 Mitigation vs. Prevention: Opportunity Cost of Infrastructural and Behavioral Intervention Policies	14
3.61 Other Preventive Strategies.....	15
3.7 Effective Enforcement	16
3.71 The Importance of Flexible Penalties: A Harris County, Texas, Case Study.....	16
3.72 Environmental Courts	17
4.0 Conclusion	18
Appendix A: Factors Contributing to Self-Reported Illegal Dumping in Ontario	20
References	23

Forward

On behalf of the Mattress Recycling Council (MRC), I am pleased to present the following report, *“Best Practices in Addressing Illegal Dumping of Durable Waste – A Guide for Policy Makers.”*

When it enacted SB 254 in 2013 to authorize the creation of California’s statewide mattress recycling program, the legislature intended, among other things, that the program develop methods for reducing the number of used mattresses illegally dumped in the state. The California program formally launched in the last days of 2015. In 2016, MRC unveiled its Illegally Dumped Mattress Collection Initiative, which funded efforts by local governments and other entities to collect data on mattress dumping at the local level and to pick up dumped mattresses left in public areas and along public rights of way.

Since the Initiative began, MRC has worked with over 70 different entities located throughout the state to collect over 250,000 illegally dumped mattresses. To put this significant quantity into perspective, the illegally dumped units collected through the Initiative would fill a line of approximately 2,500 53-foot long trailers (assuming each could carry 100 units) that stretches for over 25 miles.

In addition, MRC used the local data that the Initiative’s participants reported to prioritize our efforts for addressing this pressing social problem. For example, we used the information to identify areas where additional mattress collection options are needed and to intensify our communications and outreach efforts with local residents. We met with local elected officials and community leaders. We conducted consumer research to understand how MRC can better serve these communities and increase residents’ awareness of both the importance of proper bulky waste disposal and the most convenient mattress recycling options available to them. These efforts included developing Public Service Announcements and other publicity that we translated into several different languages and targeted at communities affected by this blight.

We have also invited especially hard-hit areas to apply for MRC grants to fund the implementation of innovative ideas for reducing the problem. Finally, to understand whether the prevalence of illegal mattress dumping was related to the level of solid waste services available in a community, MRC commissioned a statewide survey of local curbside bulky waste collection services.

However, illegal dumping is a broader societal problem that involves far more than just mattresses. For that reason, we organized a blue-ribbon panel of professionals from throughout North America and the United Kingdom with experience in addressing illegal dumping to advise MRC, CalRecycle, the legislature and other policy makers as to the root causes of this problem and to recommend changes that governments can implement to address those causes.

On behalf of MRC, I am honored to present this White Paper and to pledge our support and assistance in working with policy makers in California and elsewhere to implement the recommendations that this distinguished panel has proposed.

Ryan Trainer, MRC President
April 2021

1.0 Preface

This report undertakes a comprehensive examination of illegal dumping of durable waste, identifying both the primary drivers of illegal dumping, as well as prevention, abatement and mitigation strategies to address illegal dumping.

For the purposes of this report, we define illegal dumping as the act of disposing of durable waste at a location that is not a permitted solid waste disposal facility. We distinguish illegal dumping as being a separate issue from littering and confine our discussion to include durable waste only (excluding organics, printed paper and packaging materials). Durable waste can refer to materials such as automobile parts, household appliances, mattresses, furniture, construction and home renovation waste, electronics, etc.

The impacts of illegal dumping can be significant and pose numerous environmental, economic and social risks to the surrounding community. While a full examination of these impacts is outside the scope of this report, numerous studies have observed that illegal dumping has been linked to acute health risks, such as increased incidences of acute and chronic health conditions (Comba et al., 2006) and environmental degradation (Critto et al., 2003).

Illegal dumping also results in blight, which lowers real estate values, limits tourism and compromises the safety of communities (Matos et al., 2012; Matsumoto & Takeuchi, 2011; Webb et al., 2006). Illegal dump sites also are difficult to remediate, and they can become a significant financial burden on municipalities (Matsumoto & Takeuchi, 2011). The United Kingdom spends an estimated €100 to €150 million (\$110 million to \$170 million) every year to identify and clean illegal dumping sites (Ichinose & Yamamoto, 2011). A similar study by Glanville and Chang found that illegal dumping remediation costs can consume a substantial percentage of municipal government budgets in the United States (2015).

Given the magnitude of the problem, it is necessary that we identify the key contributors to illegal dumping and the corresponding measures that can be taken to discourage illegal dumping and minimize its impacts.

This report is composed of three sections:

- 1) Predictors of illegal dumping
- 2) Strategies to prevent and deter illegal dumping
- 3) Survey results summarizing household attitudes and self-reported illegal dumping

The findings and recommendations found in this report have been gleaned from the broader literature on illegal dumping in jurisdictions from across North America, as well as interviews with subject area experts.

2.0 Predictors of Illegal Dumping

This section undertakes an examination of factors contributing to illegal dumping, using findings gleaned from the broader literature, as well as feedback from a group of stakeholder experts.

While there are a multitude of factors that potentially can explain illegal dumping, this section uses the theory of planned behavior to better understand the antecedents to illegal dumping.

Theory of planned behavior (TPB): *The TPB explains the rational decision-making process of an individual. Under the TPB, an individual's intention to commit a certain behavior (in this case illegal dumping) is determined by that person's subjective norms, attitude toward the behavior and perceived behavioral control. Subjective norms are the perceived social pressures to conduct a behavior, which is the result of the perceived strength of the approval or disapproval of important reference people (How do family, neighbors and the community feel about illegal dumping?). Attitude toward a behavior refers to an individual's favorable or unfavorable opinion toward the behavior, which results from his or her beliefs about the outcome or consequence of the behavior (Does a person think illegal dumping is wrong? Do they feel guilt for engaging in the behavior?). Perceived behavioral control is a person's perception of the ease or difficulty he or she would have in conducting a specific behavior or engaging in that behavior (Is it easier for a person to illegally dump waste or to have that waste collected through the appropriate municipal channels?).*

In this section, we specifically examine the following:

- 1) Barriers to legally disposing of waste
- 2) Site-specific characteristics that contribute to illegal dumping
- 3) Socio-demographic drivers of illegal dumping and normative expectations
- 4) Attitudes and awareness toward illegal dumping, sustainability and the environment

It is important to note that the drivers of illegal dumping are likely to be a combination of these factors, and not one in particular.

2.1 Barriers to Legally Disposing of Waste

Most past studies have noted that a lack of adequate and accessible waste collection infrastructure is the primary determinant of illegal dumping. In areas with mature waste management systems and readily accessible collection points (waste depots, transfer stations, etc.), significantly lower rates of illegal dumping are reported. Most research has found a direct inverse relationship between the density of waste collection sites and incidents of illegal dumping — illegal dumping increases as the density of waste collection sites decreases (Lakhan, 2014).

This is fairly consistent with observations made about waste behavior in general, as convenience is one of the most significant predictors of behavior. While people generally are supportive of activities such as recycling, reuse, etc., they are not willing to incur a significant cost (measured in terms of effort or resources) to engage in the behavior (Lee, 2017). As an example, in a 2020 survey on illegal dumping conducted by York University in Toronto, Ontario (Appendix A), rural respondents characterized a lack of approved collection points as being the primary driver of illegal dumping, with a majority of respondents indicating they would not be willing to travel more than 15 minutes to dispose of waste at a depot/transfer station. Urban respondents characterized the problem slightly differently, as survey participants defined a lack of access as a lack of

curbside collection. (In most urban communities in the greater Toronto area, households receive weekly/biweekly curbside collection of recyclables/organics and garbage). Inconsistent provision of waste management services was found to indirectly incent illegal dumping among urban households, as they become accustomed to baseline level of service and collection frequency (Palermo, 2020). Unlike rural households, the behavioral precedent of taking waste to a depot or transfer station is not something that normally is expected of urban households. As a result, the perceived inconvenience of doing so for a waste stream that is not serviced by municipal collection programs is enough to encourage illegal dumping (Palermo, 2020) .

In a comprehensive meta-analysis of the factors contributing to illegal dumping conducted by Ichinose et al. (2015), it was observed that increasing the number of designated waste collection points had the most measurable impact on decreasing the frequency of illegal dumping. Their findings are supported by the vast majority of studies on illegal dumping, which have found that illegal dumping cannot be addressed adequately until there is sufficient collection infrastructure in place. Generally speaking, even when attitudes toward the desired behavior (in this case, disposing of waste at approved collection points) are positive, any impediments to carrying out the behavior (lack of access, lack of opportunity, lack of awareness, cost of disposal, etc.) can act as a deterrent. Awareness regarding where waste should go and what programs are available to households also has been noted as a key cause of illegal dumping. As an example, a Eunomia Research and Consulting report on illegal dumping prepared for Sacramento, California, found that households did not utilize the waste collection programs made available to them by the city. Residents simply were not aware of the types of waste collection services offered by the city and were unable/unwilling to find out for themselves.

A lack of awareness regarding where to correctly dispose of waste has been noted in several studies and often is cited as one of the primary barriers to having waste collected through the appropriate (and legal) channels (Jutta, 2016). With that being said, the efficacy of behavioral intervention, promotion, education and even punitive measures to discourage illegal dumping diminishes if adequate infrastructure is not in place.

In the York University survey, respondents reported feeling frustration when faced with barriers to illegal dumping, often rationalizing the act by saying that they felt forced into dumping waste. Both self-reported measures of guilt/remorse and perceived personal responsibility for illegal dumping were observed to be lower among respondents who felt there was a lack of adequate collection infrastructure. Rural residents, in particular, felt that their communities were being neglected and felt that inordinate resources were spent focusing on the needs of urban communities. (This is a situation that is exacerbated by the fact that most rural areas do not receive curbside waste/recycling service.) This latter finding is of particular interest, as it speaks to how relative access to waste management services can affect illegal dumping — the perceived inequity and fairness in the provision of waste collection among rural residents was used to rationalize dumping behavior (Lakhan, 2020).

2.11 Waste Disposal Fees and Pay As You Throw Programs

In addition to the physical barriers to participation due to a lack of collection infrastructure, waste disposal fees also have been identified as a primary driver of illegal dumping. Numerous studies have observed a direct relationship between increased disposal rates and incidents of illegal dumping in a community (Ichinose & Yamamoto, 2011). Disposal fees act as a disincentive for properly disposing of waste, which in turn, encourages illegal dumping as a means to avoid an

economic penalty for disposal. Communities that implement unit pricing on waste disposal (also known as pay as you throw (PAYT) or variable-rate pricing) also have been observed as having significantly higher rates of illegal dumping. (Note: In communities with PAYT programs, residents are charged for the collection of municipal solid waste — ordinary household trash — based on the amount they throw away. The theory behind the approach is that it creates a direct economic incentive to generate less waste and to recycle more by increasing the relative cost of disposal vs. diversion). While PAYT programs are effective in diverting waste from landfills, they indirectly encourage illegal dumping, as the increase in the cost of disposal can be sufficient to encourage illegal dumping as a means to avoid disposal costs (Hamilton et al., 2013).

2.2 Site-Specific Characteristics That Contribute to Illegal Dumping

Findings from the broader literature, as well as input provided by stakeholder experts, have shown that the geospatial characteristics of an area can contribute to illegal dumping. Site-specific and situation-specific characteristics also can promote/discourage the occurrence of illegal dumping. Geospatial characteristics include access to roads, adequate lighting, population densities, mixed land use, foot/vehicle traffic and site visibility.

These characteristics all have been identified as potentially important drivers when attempting to understand illegal dumping. In many ways, illegal dumping has been characterized as a “crime of opportunity.” Despite most research finding that households overwhelmingly are opposed to illegal dumping and characterize the behavior as abhorrent, illegal dumping is quite common and very often is a function of how easy it is for a person to engage in the activity — and get away with it. As an example, researchers have found that areas with mixed land use (where residential and commercial land use coexist – e.g., homes, apartments, retail shops and industrial sites) may provide more opportunity for illegal dumping if there are unoccupied areas or areas that lack traffic and lighting. Mixed-use land also increases nonresidents’ familiarity with and easy access to places offering the opportunity to dump items.

Many studies have emphasized that geospatial features, such as the position of road networks (Matos et al., 2012), proximity to roads (Tasaki et al., 2007) and distance to residential areas (Jordá-Borrell et al., 2014), play important roles in predicting illegal dumping sites or landfills. Illegal dumping in public spaces is more common in areas that are easy to access but have low visibility, for example, rural areas with road access and low population density.

Locality in particular has been seen to play a significant role in affecting both the instances of and willingness to dump material illegally. Both findings from the broader literature and results of the York University survey indicate that urban households are less likely to dispose of waste illegally when compared with rural communities. (The frequency of self-reported illegal dumping in urban areas was approximately 24% lower relative to suburban communities and 44% lower relative to rural communities.) Self-reported measures of guilt/remorse for illegal dumping also varied widely across community types — 80% of urban respondents who admitted to illegal dumping agreed or strongly agreed with the statement “I feel guilty when I dump waste in places where I know it doesn’t belong.” This is in stark contrast to rural communities, where only 24% of respondents indicated some measure of guilt for illegal dumping. It should be noted that the increase in illegal dumping among rural residents is rooted in a lack of infrastructural access that makes legal disposal of waste prohibitively difficult or costly.

2.21 Communal Maintenance of a Public Space/Area

A particularly interesting observation is that the willingness to illegally dump waste also is a function of whether a public space is being maintained and whether that space is perceived to be a communal space.

As noted by Brunton-Smith et al., the aesthetics or cleanliness of a site is inversely related to rates of illegal dumping — the cleaner or better maintained an area, the less likely people are to illegally dump waste (2014). By contrast, if an area is perceived to be poorly maintained (litter, overflowing waste bins, other illegal dumping), people will be more inclined to dump waste. The characteristics of a site send signals to people about the collective lack of control and concern about the space, and the values and intentions of others who share the space. In simpler terms, people will rationalize and justify the behavior — “If other people don’t care, why should I?” This effect is exacerbated in instances where enforcement is perceived as low.

It should be noted that both the willingness to illegally dump and observed instances of illegal dumping decrease significantly in areas that are perceived to be communal spaces/amenities. As an example, public parks often are thought to be one of the types of sites most likely to attract illegal dumping — however, when members of the community utilize such a space and feel a collective responsibility for its maintenance, illegal dumping is discouraged. The concept of “ownership” has been observed to have a significant influence on waste disposal behavior, particularly with respect to adherence to rules and regulations. In multiresidential buildings where residents own their units (vs. renting) or belong to a cooperative, participation in source separation initiatives is significantly higher, while contamination rates of the organics/recycling stream are lower, when compared with rental units. This also may explain, in part, why some people choose to illegally dump material outside of their communities. Not only is there a reduced risk of being recognized, but people also are able to avoid harming areas they may use and perceive to be part of their neighborhood.

2.3 Socio-Demographic Drivers of Illegal Dumping and Normative Expectations

While it often is difficult to establish correlation or causality between socio-demographic factors (age, income, education, etc.) and frequency of illegal dumping, the following has been discussed in the broader literature surrounding drivers of dumping behavior. It should be noted that there is a significant degree of collinearity among both demographic variables (income is a function of age and education, etc.) and infrastructural variables (a greater proportion of lower income households are in multifamily residential buildings, etc.). As such, the reader must be cautioned from drawing any definitive conclusions regarding the role of socio-demographic factors and illegal dumping. While there is evidence to suggest that relationships between these variables and dumping behavior exist, they must be considered within the broader context of infrastructural access, enforcement and other aggravating factors that contribute to illegal dumping frequency.

Illegal dumping has been linked to social factors such as population density (Jordá-Borrell et al., 2014), percentage of renters in an area (Brandt, 2017), unemployment (Matsumoto & Takeuchi, 2011) and income (Brandt, 2017; Jordá-Borrell et al., 2014).

Areas with greater population density or higher population mobility tend to generate more waste for disposal, either because there are more households that generate waste or there are more people moving (rental properties tend to have much higher rates of turnover, and these groups may need to discard durable waste more frequently). Brandt noted that rates of illegal dumping

are highest when households move out of a building (the same also is observed for single-family residences) (2017). Households not only generate more durable waste during this time, they also are less likely to subscribe to community expectations and social norms regarding the maintenance of a public space. Households no longer feel as though they are part of that particular community, and there are fewer perceived risks and consequences if they are observed illegally dumping waste. In high mobility areas, both formal and informal sources of social control (the process in which familiarity creates a shared system of social norms and social pressure to conform to order) may be weakened (Brunton-Smith et al., 2014; Stark, 1987). Transience in these areas not only reduces levels of community surveillance, but also makes it less likely that households within that community feel a collective responsibility to maintain and manage common spaces. The notion of “community” is difficult to cultivate in areas with high population turnover.

Tasaki et al. (2007) found that urban areas with a population density of 1,000 people per square kilometer had fewer illegal dump sites than rural areas with a density of 100 people per square kilometer. Jordá-Borrell et al. (2014) found more illegal dumping within municipalities with high populations, but that illegal dump sites were more closely concentrated in rural areas with low visibility.

2.31 Normative Pressures and Community Expectations Regarding Illegal Dumping

A consistent theme emerging from the literature is that surveillance by neighbors or other members of the community acts as a deterrent to illegal dumping — not only do offenders not want to be noticed, but they have a particular aversion to being noticed by people who are part of their extended kinship or social network (friends, neighbors, coworkers, etc.).

As noted in the survey conducted by York University, individuals who participate in illegal dumping recognize the act as “wrong” and expressed shame or guilt for doing so (where guilt/shame is moderated by perceived access to designated waste collection sites). Respondents also expressed a decreased willingness to engage in illegal dumping if they felt there was a risk of their extended kinship network finding out.

It should be noted that the strength of normative influences with respect to illegal dumping are reinforced by municipal enforcement. In areas where the perceived level of enforcement is low, there is a greater risk of illegal dumping, even in instances where households recognize that illegal dumping is an undesirable activity. In the absence of a threat of penalty for illegal dumping, individuals not only are inclined to do it because of the lack of consequences, but they also perceive a lack of interest/concern on the part of the municipality. As noted in the York University survey, a lack of enforcement also was seen as a lack of interest on the part of the municipality (more than 60% of respondents disagreed or strongly disagreed with the statement “My municipality does enough to prevent illegal dumping”), which ultimately manifested in increased rates of illegal dumping by members of the community. Conversely, credible and consistent enforcement on the part of the municipality was seen as a deterrent to illegal dumping, with more than half of respondents indicating that they would not illegally dump if faced with a penalty.

The York University report did not consider research that explores whether illegal dumping can be linked to education, income or employment levels.

2.4 Attitudes and Awareness Toward Illegal Dumping, Sustainability and the Environment

While a full discussion of survey findings can be found in Appendix A of this report, emerging themes based on participants' responses suggest that most households agree illegal dumping is wrong and should be avoided when possible. The vast majority of respondents expressed some measure of guilt/remorse for illegal dumping, but often would rationalize the behavior due to perceived lack of access to designated waste collection points. This disconnect between intent and outcome points to explanatory factors beyond individual attitudes and preferences and highlights that desirable behaviors must be accompanied by the right enabling conditions (availability of infrastructure and access).

It is clear that locality significantly affects both the frequency and nature (types of materials and places of disposal) of illegal dumping. Of note, stated preferences for the environment and desire to participate in environmentally sustainable behavior are consistent across localities (urban/rural), income groups and education levels. While these factors do ultimately influence rates of participation in activities such as illegal dumping, the underlying reasons are less likely to be explained by fundamental behavioral or attitudinal differences (in most instances). Differences in rates of illegal dumping most are often explained by the availability of infrastructure (or lack thereof) and the density of authorized waste collection points. Numerous studies have found that convenience is the most significant predictor of behavior, highlighting the importance of local governments providing sufficient points of collection and, depending on the type of waste, multiple methods of collection, e.g., waste depots, return-to-retail, curbside, donation bins, etc.

3.0 Strategies to Prevent and Deter Illegal Dumping

With a better understanding of the causes of illegal dumping, what measures can be implemented to address them as a means to discourage illegal dumping? This section undertakes a comprehensive analysis of potential solutions to illegal dumping from the perspectives of:

- Supporting policies and legislation
- Community engagement and awareness
- Stakeholder collaboration
- Prevention vs. mitigation
- Effective enforcement measures

The following recommendations are based on input from a panel of industry experts, each with a particular area of knowledge as it pertains to illegal dumping. Their contributions and insights were integral in developing the content in this section. The experts include:

- Sarah Edwards, Eunomia Research and Consulting, North America
- Dr. Wesley Schultz, California State University San Marcos
- Duncan Jones, Hertfordshire Waste Partnership, United Kingdom
- Roger Haseman, former assistant district attorney, Harris County, Texas

A comprehensive literature review also was conducted to identify best practices from other jurisdictions and to supplement suggestions made by the expert panel.

One of the foremost challenges in developing effective policy for preventing illegal dumping is a lack of coordinated and consistent policy approaches across communities. At present, approaches toward illegal dumping involve a patchwork of solutions and strategies that vary across jurisdictions, which makes addressing the root causes of the problem difficult. Numerous studies, as well as input provided by industry experts, have highlighted the importance of local governments taking uniform action — providing harmonized standards, enforcement approaches, education and awareness initiatives, etc., where possible.

The following are policy recommendations that can help standardize and operationalize approaches toward illegal dumping as a means to discourage and ameliorate dumping behavior:

3.1 Data Collection and Reporting

The development of effective policy is fundamentally premised on the availability of “good data,” which provides insights into the size, scale and scope of the problem. With specific reference to illegal dumping, it is critical that there be statewide/regionwide data collection and reporting requirements that track instances/frequency of illegal dumping, the types and quantities of material being illegally dumped, and areas where material is being dumped.

For the sake of consistency, a central agency/organization should, if possible, be responsible for collecting and serving as a steward of this data statewide, requiring that relevant stakeholders (municipalities, waste collectors, etc.) submit information at regularly scheduled intervals (monthly, quarterly, etc.). This information is required to track instances of illegal dumping over time and to identify hot spots where immediate action is needed, and should be used to set actionable targets, including evaluating the efficacy of programmatic and policy changes over time. In the absence of this data, it is not only difficult to understand what strategies may or may not be working, it also compromises a region’s ability to effectively allocate resources to ensure optimal outcomes. In short, a comprehensive data collection strategy is a prerequisite to preventing illegal dumping and should not be seen as optional.

3.2 Availability and Access

As noted in Section 2, the primary driver of illegal dumping is a lack of infrastructural access to designated waste collection points. Due to the perceived inconvenience or cost of disposing of waste, households are more inclined to participate in illegal dumping. This behavior is exacerbated in communities with low levels of enforcement or a perceived lack of interest on the part of the community to encourage proper disposal.

It is critical that communities offer a minimum level of service with respect to waste management collection and extend that service to include the collection of durable waste. As noted in the York University study, municipalities that did not offer a formal program for mattress/white good/furniture collection experienced higher rates of illegal dumping. Survey participants rationalized their illegal dumping by saying they did not have any other options, as the municipality neither collected the materials being dumped nor communicated where those materials could go.

Generally speaking, curbside collection yields the highest rates of household participation with respect to the diversion of all waste streams. It is seen as the most convenient option and also is the most familiar method to residents who live in urban areas. In communities with curbside collection of residential organics, printed paper and packaging, there is an expectation that all waste should be serviced via curbside pickup. However, the costs of curbside waste collection, particularly for durable goods, is prohibitive for many municipalities. The cost effectiveness of curbside collection is premised on having a critical mass of material being collected within a

certain geographic boundary and at scheduled intervals (weekly, biweekly, etc.). Given the nature by which durable goods are disposed, curbside collection may not be an affordable option for many communities. A potential option is to offer curbside pickup on special days when residents are instructed to set out durable waste for pickup (e.g., monthly or seasonal collections, etc.).

Local authorities also need to consider how easy it is to access proper disposal locations. For example, if the nearest waste and recycling center is a significant distance away and in an area with low rates of car ownership, then there is a higher likelihood that people will illegally dump. In such scenarios, local authorities need to be responsive and think about initiatives, such as local amnesties on specified dates, or setting up temporary collections for bulk waste in municipal car parks or parking garbage collection vehicles at convenient spots on weekends to act as mobile waste collection sites. Increasing access to and utilization of free collection services, increasing the number of free bulky collections and providing access to temporary waste collection points during periods of high waste generation are demonstrably effective strategies to encourage community buy-in and cultivate awareness regarding the waste disposal options available to the public.

Designated drop-off sites (waste depots, transfer stations, material recycling facilities, participating retailers, etc.) should be used to either complement curbside waste collection in urban communities or serve as the primary form of collection in communities where curbside collection is not possible for financial or infrastructural reasons. Local governments need to ensure that there are sufficient designated drop-off/collection points relative to the distribution of households. While there is little guidance in the broader literature regarding the optimal number of collection points given the size of the community, the York University study found that most households were unwilling to travel more than 15 minutes to dispose of waste. This finding once again reinforces the notion that legally disposing of durable waste needs to be made as convenient as possible for households, which requires that local authorities set minimum targets with respect to household access and service coverage.

For context, Recycle BC, the stewardship program responsible for managing British Columbia's residential recycling program, requires that all communities with more than 1,000 residents be provided access to either curbside or transfer station collection, which translates into more than 97% of households being able to participate in residential recycling programs. Accessibility standards and service coverage areas will depend on site-specific and situation-specific factors of a community, including available infrastructural and staffing resources.

3.3 Promotional, Educational and Awareness Initiatives

One of the challenges identified in the illegal dumping survey conducted by York University is that most communities do not take a coordinated approach when developing promotional and educational initiatives to encourage proper disposal and discourage illegal dumping. This, in part, is explained by the differences in waste management services and programming that exist across communities — some municipalities offer residential curbside collection of bulky and white goods, while others do not. Some municipalities offer curbside collection to both single-family and multifamily residences, while others rely exclusively on depot-based drop-off systems. Regional differences in the services offered and the expectations of households with respect to waste disposal make it difficult to develop a harmonized approach to promotion and education.

While there is rarely a one-size-fits-all approach to promotion and education, it is important that communities provide clear and consistent messaging with respect to illegal dumping, highlighting the “who, what, when, where, why and how?” of a program.

- Households should understand “why” illegal dumping is a critical issue, including the problems it causes with respect to health, the environment, quality of life and community aesthetics.
- A promotional and educational campaign also should clearly communicate “where” waste should be taken, including designated drop-off sites and collection points that are available in a community.
- Households should clearly understand “what” items are permissible for disposal as part of a residential waste program. This needs to be as prescriptive as possible, as not all waste (including durable waste such as white goods and mattresses) is accepted, depending on the collection point (i.e., a refrigerator must be taken to a hazardous waste depot, while electronics can be taken to a participating retailer for e-cycling).
- A promotional and educational campaign also should clearly specify “when” households should dispose of waste (particularly durable waste), communicating hours of operation for designated drop-off sites, collection schedules for curbside pickup, and dates of special waste amnesty days and community cleanup events where households can dispose of bulky waste at no cost with a municipality or partner group.

Cultivating awareness regarding where waste materials should be disposed and what programs are offered also is considered a key component of garnering community support. Communications should focus on promoting the desired behavior, aim to reduce the burden on the resident to decipher the program (where waste goes), and occur at a time and place relevant to the disposal behavior. This last point is particularly important because communications that occur in a time and place proximal to the behavior are more likely to have an impact.

Legislators and policymakers need to consider that illegal dumping is an activity based on a series of decision points that follow a line of least resistance — from the point of waste generation (when the item no longer has any value to a household) all the way through to the moment at which the illegal dumping occurs.

Therefore, the chain of decisions that leads to illegal dumping also represents multiple opportunities for behavioral intervention, diverting the decision-making chain onto a path that results in the legal disposal of waste through appropriate collection channels.

Typical decision points will be represented and influenced by dynamics that normally are subject to legislative control, e.g., the location of public waste and recycling centers, the availability of and access to waste collection services, the cost of using such services, and knowledge and awareness of such services.

As a result, a resident who does not know what options are available for the safe and proper disposal of waste is more likely to illegally dump than one who does. The propensity to do this also will be influenced by the degree to which the resident believes that illegal dumping will result in enforcement action, which in turn, is influenced by how normalized illegal dumping is.

3.4 Cultivating Community Buy-In

As noted in the discussion on accessibility, it is imperative that communities are offered a consistent level of service, with a sufficient number of designated collection points to ensure adequate accessibility for households. Support for initiatives intended to curb illegal dumping is fundamentally predicated on ensuring adequate collection infrastructure that is accessible to the entire community. Community support and buy-in is difficult to achieve when not all households within a community have access to the same services.

Community buy-in is most likely to be achieved when disposing of waste at designated collection points is as easy (or easier) than illegally dumping waste. As noted, illegal dumping is largely a crime of opportunity that follows the path of least resistance. People will illegally dump waste when it is easier than taking it to an approved collection point, further highlighting the need to increase the number of designated collection points.

Residents want to feel that governments (both local and municipal) are listening to and acting upon their concerns. Within the context of illegal dumping, residents want to see the number and severity of incidents noticeably reduced and hot spots/problem areas reclaimed, particularly in instances where illegal dumping is harming a local amenity, such as a park, trail or other public space.

Therefore, the scale of the problem in an affected community needs to be quantified. Affected communities also need to be consulted to gauge what they think are contributing factors to illegal dumping and to solicit feedback for suggestions/ideas to help fix the problem. Key messages from the data and community consultation then need to be reflected in behavioral change campaigns. Campaigns themselves need to be multichannel (digital and print), as well as culturally appropriate and relevant. (Depending on locality, urban areas and multiresidential households may be comprised of non-native English speakers.)

A particularly effective strategy for cultivating collective responsibility for maintaining public spaces is when local authorities organize and lead community cleanups that address illegal dumping hot spots. Such events also should incorporate beautification measures. For example, if a hot spot for illegal dumping is in a park or along a trail, it may be worthwhile to install benches or picnic areas that make the spot popular for positive reasons, thereby acting as a deterrent.

Data collection and analysis needs to continue to gauge the impact of such measures, and failures need to be addressed through changes in approach. Perhaps of greater importance, successes need to be celebrated and communicated back to communities. As an example, community groups that would welcome recognition (e.g., churches, school clubs, scouts, etc.) can be engaged to help with cleaning up public spaces and fostering a sense of community pride. A significant body of behavioral research shows that individuals are more likely to participate in a desired activity if there is a “halo effect,” i.e., participants are recognized for promoting a social good, such as recycling. With respect to encouraging desirable behavior, celebrating wins is as important as highlighting problems.

3.5 Stakeholder Collaboration and Partnerships

Based on experiences from other jurisdictions, as well as insights provided by industry experts, it is clear that promoting effective collaboration and forging partnerships among multiple stakeholders is required in order to effectively address illegal dumping.

Given the size and scale of the problem, no one entity can “go it alone” and attempt to tackle illegal dumping. As noted, a harmonized approach across multiple jurisdictions and agencies is likely to be the most effective approach, particularly with respect to data collection/management and effective promotion and education. The challenge, however, is how to bring a diverse group of stakeholders together, particularly when they may have competing interests.

In light of these challenges, it is recommended that consideration be given to forming specialized partnerships to address illegal dumping. These would involve all relevant stakeholders, including local and regional government, law enforcement and regulatory agencies, service providers, and community representatives, working collaboratively to address illegal dumping from both a policy and operational perspective. To be effective, such groups would need to be facilitated by dedicated management professionals, with the costs shared between affected stakeholders.

Such partnerships should review what existing resources are being spent on illegal dumping and what cost savings and efficiencies could be achieved by pooling budgetary resources. Such cost/resource sharing reduces the burden on individual stakeholders, allowing a coordinated approach to addressing issues surrounding illegal dumping. Pooled resource sharing also can reduce budgetary commitments over time, as efficiencies and costs savings are realized.

All operational responses to illegal dumping should be channeled through whichever organization is deemed to be nearest to the main centers of population — likely municipalities or other local governments. These organizations should be collectively responsible for financing all cleanup operations, with stakeholder budgets redirected to support local governments’ effort to combat illegal dumping. Thus, by pooling budgetary resources, local governments would be better equipped to address and remediate illegal dumping by increasing the number of free collections available to all households, funding more temporary collection points, sponsoring promotional and educational campaigns, etc.

In order to overcome some of the administrative challenges associated with stakeholder collaboration and partnerships (a likely inevitability given the number of actors involved and the sectors that they represent), it is strongly recommended that a framework be developed that sets out commonly agreed upon principles, roles, responsibilities and desired outcomes. This framework also would specify benchmarks regarding the frequency of illegal dumping, service coverage, cost of remediation/cleanup, and appropriate penalties and enforcement. If appropriate, formal bylaws and legislation could be used to codify the guiding principles of stakeholders in a given jurisdiction — this approach was adopted by the province of Ontario for managing printed paper and packaging waste from the residential sector.

3.51 The Role of Extended Producer Responsibility (EPR) in Promoting Partnerships

Extended producer responsibility (EPR) refers to when the manufacturers of a particular product are physically and financially responsible for managing that product at its end of life. EPR has been widely adopted (both within the United States and internationally) for a number of waste streams and can take different forms depending on site-specific and situation-specific circumstances, as well as the type of waste being managed. The primary purpose of EPR is for manufacturers to take an appropriate level of responsibility for managing the products they make at end of their useful life. In the absence of EPR programs, local governments often bear the financial burden of managing waste, which in turn, is passed on to residents in the form of higher property taxes or waste levies.

While it is outside the scope of this report to discuss the appropriateness of EPR legislation as a whole, within the context of illegal dumping, policymakers could consider whether it would be efficient and logical for producers of durable goods (e.g., appliances, furniture, textiles, etc.) to have a physical and/or financial responsibility to either prevent illegal dumping or manage waste materials that have been dumped.

Previous studies from California show that the majority of illegal dumping comes from single and multifamily households and involves waste materials that readily lend themselves to management through a well-designed EPR system. While EPR often is accompanied by administrative and legislative complexities that can be met with resistance from some stakeholders, it is critical that jurisdictions take a coordinated approach to implementing EPR to ensure that adequate investments are made in reverse logistics networks and end-of-life management systems.

A well-designed EPR program for durable goods would include a range of options that would make it convenient for an individual to legally dispose of an item (e.g., in-store take back (if appropriate), dedicated collections as part of the delivery of new products, etc.), encouraging participation and ultimately removing the motive to illegally dump waste in the first place (where the incentive to illegally dump waste is driven by a lack of convenience and cost). EPR programs that emphasize the convenience of including the appropriate and legal disposal of durable goods would offer “a path of least resistance” for a household at the point the waste arises.

3.52 The Importance of Partnerships: A California Case Study

Forming partnerships with key stakeholders should be seen as a tangible, realistic first step in lieu of legislative intervention. Unlike EPR programs, their formation does not require structural reform, additional funding or legislative changes. The foremost challenge to forming partnerships often involves relationship management — affected stakeholders may have competing interests, different priorities or disagreements regarding what each member should contribute. While overcoming these issues may be a challenge, it is one worth embracing, as a coordinated effort is integral to minimizing illegal dumping, particularly in communities that already have hot spots.

Such partnerships need dedicated full-time resources. For example, a study conducted by Eunomia Research and Consulting in Sacramento, California, found that funding could be obtained through existing budgets on a “spend to save” basis shared among stakeholders. As an interim solution in that case, the state of California formed a regional task force that convened a technical committee on illegal dumping. The purpose of the committee was to provide guidance and recommendations to policymakers regarding appropriate responses (both preventive and reactionary) to illegal dumping.

The technical committee recommended to the California Department of Resources Recycling and Recovery (CalRecycle) various legislative, outreach, public education, enforcement, coordination (including regional coordination summits), human resources, and budgetary and financial options for consideration. The technical advisory committee also assessed the extent and cost of the illegal dumping problem and developed content for an Illegal Dumping Resources Toolbox, a resource for both households and government to better understand illegal dumping and what can be done to address it.

In general, technical committees can be used to gather data about illegal dumping, analyze the amount and type of durable waste collected, and quantify collection and disposal costs as a proportion of overall government budgets. In addition, technical committees can help governments better understand the size and scope of the illegal dumping problem, quantifying

the direct costs attributable to illegal dumping, as well as the costs associated with remediation and prevention.

Technical committees also can work with stakeholders to develop appropriate educational and awareness campaigns, serving as the liaison between government officials and affected communities where illegal dumping is prevalent. The ultimate goal of a technical committee is to provide evidence-based and scientifically sound recommendations to local (and state) government, so that effective illegal dumping policy can be developed.

3.6 Mitigation vs. Prevention: Opportunity Cost of Infrastructural and Behavioral Intervention Policies

Governments often are faced with the dilemma of deciding whether to be proactive (developing programs, policies and infrastructure to prevent illegal dumping from occurring) or reactive (cleaning up sites after illegal dumping and punishing/prosecuting offenders). Both approaches are resource intensive, and there is an opportunity cost to choosing one path over another.

While there is a relative paucity of literature that specifically compares the cost of prevention vs. mitigation, a 2018 study conducted by Eunomia Research and Consulting for the city of Sacramento, provides meaningful insights into this topic.

The Eunomia study found that the cost of cleaning up illegally dumped waste was significantly higher than collecting waste through scheduled curbside services. The table below summarizes various cost scenarios:

	City			County		
	<i>Reactive Illegal Dumping Service and Enforcement</i>	<i>Proactive Scheduled Service</i>	<i>Difference</i>	<i>Reactive Illegal Dumping Service and Enforcement</i>	<i>Proactive Scheduled Service</i>	<i>Difference</i>
Cost Per Incident	\$ 79.65	\$ 65.01	22.50%	\$ 112.51	\$ 66.91	68.00%

The cost of preventing illegal dumping was significantly lower than the cost of remediation in both urban and nonurban environments. (It is worth noting that there is a significant disparity in waste management costs when comparing types of communities.) The Eunomia study found that from a per incident perspective, it was 22.5% more expensive to address illegal dumping in the city when compared with providing preventive scheduled services, and 68% more expensive in the county. The Texans for Clean Water study, “The Cost of Litter and Illegal Dumping in Texas: A Study of Nine Cities Across the State,” (2017) reached similar conclusions. The Texas study found that municipalities that adopted a preventive approach ultimately incurred lower expenses when compared with municipalities that addressed illegal dumping reactively.

These findings, in part, are explained by the lack of coordinated efforts and approaches to proactive illegal dumping service. As noted in the Eunomia study, there are multiple agencies involved in clearing illegally dumped waste, but there is no single organization overseeing activities or supporting the delivery of collaborative coordinated programs.

California Penal Code 374.3 makes illegal dumping on public and private property punishable by a fine of up to \$10,000. The city of Sacramento uses an administrative process, while the county employs a criminal process to enforce this legislation. Existing levels of fines within the city and

county, even for multiple offenses, were insufficient to act as an effective deterrent and meaningfully discourage illegal dumping. In addition to this, the amount of evidence required to demonstrate burden of proof was too high a threshold for the city and county to reach. This resulted in fewer prosecutions and fines, ultimately undermining the credibility of enforcement.

The Sacramento case study illustrates that unless there is a coordinated effort to manage illegal dumping among various levels of government and affected stakeholders, reacting to illegal dumping is often more costly than preventing illegal dumping. In many ways, the colloquial expression “An ounce of prevention is worth a pound of cure” aptly summarizes how local governments should approach illegal dumping. While the upfront costs of providing the necessary infrastructure, training and education may be high, in the long run, preventive approaches are less costly than uncoordinated reactive approaches — in some instances, nearly half as expensive.

It should be noted that preventive approaches are effective only if they are being adequately utilized. The Eunomia report found that less than 20% of residents in Sacramento use the services provided and illegal dumping has increased over time in spite of preventive measures. This highlights how important education, awareness and clear communication are to preventing illegal dumping. Providing adequate infrastructure and waste collection services must be accompanied by promotional and educational initiatives that communicate the “who, what, when, where, why and how” of proper waste disposal.

While the reader should be cautioned from assuming illegal dumping prevention always will be less expensive than treatment, it reinforces the need to gather data regarding the size and scale of illegal dumping (e.g., quantifying the frequency of illegal dumping incidents, locality, waste type, etc.). Without that knowledge, it is difficult for local governments to develop appropriate infrastructure or design appropriate policies and programs to address the specific needs of a community.

3.61 Other Preventive Strategies

Modifications of the physical environment that aim to directly affect offenders’ perceptions of increased risks and effort have been shown to deter illegal dumping (Welsh et al., 2015). As an example, in Australia, authorities have installed fences to prevent access to dumping hot spots in public spaces and have engaged in education and outreach using social media to ensure rapid removal of dumped materials (Government of South Australia, 2015). The results of this approach have been effective at reducing illegal dumping in problem areas, with a 40% reduction in the frequency of illegal dumping incidents in public spaces.

Increasing surveillance also can discourage instances of illegal dumping. For example, installing street lighting and CCTV cameras in areas characterized as illegal dumping hot spots has been shown to reduce rates of illegal dumping by almost 50% (Welsh et al., 2015). The use of infrared cameras to capture the license plates of illegal dumping offenders also has improved rates of identification and prosecution by local authorities. A secondary benefit of this approach is that it increases the perceived threat and likelihood of enforcement among the public and discourages illegal dumping over time.

Police patrols, drone surveillance and community surveillance also are options for decreasing the frequency of illegal dumping. Police presence generally deters illegal activity in general, and some cities enhance community surveillance by paying residents a monetary reward for reporting illegal

dumpers to law enforcement. The cities of Los Angeles, Oakland and Sacramento have similar reporting programs. Some jurisdictions have set up websites, developed mobile applications and created centralized hotlines where residents can report illegal dumping incidents anonymously.

Cities also can implement periodic compliance campaigns, which involve randomly conducted crackdowns by law enforcement. Increased police patrols, antidumping signage posted in known illegal disposal sites, random inspections of property, and publicity regarding convicted illegal dumpers and the use of surveillance can deter illegal dumping.

More recently, some communities have implemented “smart monitoring” technologies — automated services that notify authorities of illegal dumping as it occurs, as well as where it occurs (Begur et al., 2017). Examples of communities that have implemented this type of technology include the city of San Jose, California; city of Houston, Texas; city of Markham, Ontario; and York region, Ontario. Using technology to better understand what is being dumped, at what times and at which locations provides meaningful insights, as it enables a more targeted approach to illegal dumping prevention and enforcement. It should be noted that these technol

Such technologies still are in their relative infancy. The long-term effectiveness of these approaches in discouraging illegal dumping, when compared with the cost of implementation, has yet to be established, necessitating further investigation.

3.7 Effective Enforcement

Historically, enforcement measures regarding illegal dumping have been defined poorly, with limited harmonization across jurisdictions. This particularly is true for the illegal dumping of nonhazardous durable waste, which oftentimes is understood poorly by both law enforcement and policymakers. As noted by Haseman (2020), this was (and to a degree, remains) one of the foremost challenges associated with illegal dumping — insufficient knowledge regarding how to identify illegal dumping, what appropriate enforcement measures should be and how it should be prosecuted. Given this, one of the first steps to improving illegal dumping laws and enforcement is to provide the necessary training to law enforcement and local government staff so that effective deterrents can be developed and implemented. Members of the justice system need be trained to fully understand the consequences of illegal dumping to ensure that judgments are sufficient to act as deterrents, while also encouraging further positive enforcement activity.

Once relevant local government staff have received training, the next step is to review the efficacy of existing laws regarding illegal dumping (if any), and to evaluate what changes could be made to make them more effective, e.g., looking at the burden of proof needed.

Regulatory and enforcement approaches also need to be aligned within jurisdictions. This could either take the form of a straightforward alignment between various enforcement and regulatory agencies or be structured as a collaborative model through which various jurisdictions work together to develop consistent regulatory and enforcement approaches.

3.71 The Importance of Flexible Penalties: A Harris County, Texas, Case Study

One approach to improving the effectiveness of illegal dumping enforcement is to develop nonprescriptive penalties. Law enforcement agencies and judges should have the latitude and flexibility to develop punishments that capture contextual factors: Who is the illegal dumper and what did he or she dump? What were the impacts attributable to the dumping? What will be the costs of remediation? What will act as the biggest deterrent to illegal dumping?

One of the foremost issues with prescriptive penalties is that, oftentimes, the punishment does not fit the crime and does not address the specific causes and consequences of illegal dumping. In Harris County, Texas, former Assistant District Attorney Roger Haseman successfully prosecuted thousands of illegal dumping cases over the course of 20 years and developed an approach that was intended to maximize environmental and economic outcomes, while acting as a deterrent to future behavior.

The approach developed by Haseman (and later replicated in other jurisdictions) was predicated on ensuring that staff at all levels and across jurisdictions (local law enforcement, municipal officials, district attorney's office, etc.) received adequate training regarding illegal dumping. This was identified as a critical first step in developing a successful enforcement strategy, as buy-in from public sector stakeholders was the linchpin of the approach.

The second step was to understand who was engaging in illegal dumping (individual or company) and why. In cases of business entities that illegally dumped waste, companies faced criminal prosecution. If convicted, the businesses could have faced catastrophic impacts on their reputation and ability to conduct business. Given the gravity of the potential punishment, Haseman observed that most companies were willing to incur significant financial penalties and assume the costs (and even the responsibility) of remediating the dump site.

Harris County took this a step further and was able to impose penalties/punishments that were not confined to the illegal dumping act itself. Offenders could be asked to clean up other dump sites or perform additional in-kind services for both Harris County and surrounding communities. As an example, a company that specialized in painting/finishing shipping containers and hulls was accused of discharging residual paint into a local waterway. To avoid criminal prosecution, the company was required to pay a fine and the costs of site remediation, and also was asked to refurbish a fleet of the county's vehicles. The purpose of the punishment was not just to act as a deterrent to future illegal dumping, but to address additional needs of the county and surrounding communities.

Haseman observed that successful enforcement required adequate training, buy-in from the district attorney and courts, and nonprescriptive approaches to developing punishments that both deterred illegal dumping and addressed other government needs.

3.72 Environmental Courts

The Eunomia report on illegal dumping identified environmental courts as being a potential enforcement option to address illegal dumping. At present, there are more than 1,200 environmental court tribunals in more than 44 countries worldwide. As per the report:

Environmental courts (EC) and tribunals are a type of specialized court system that adjudicates cases that have to do with violation of environmental laws only and are used to adjudicate administrative rule violations. They are typically established in communities experiencing an escalation in environmental crimes/code enforcement violations. The courts focus on education, awareness and remediation of such crimes."

While ECs do have several benefits (e.g., the judge has greater understanding of environmental issues, outcomes may be more consistent, there is greater latitude to develop creative solutions focusing on remediation instead of punishment), there also are practical and administrative challenges. Fragmentation (some illegal dumping cases include multiple infractions, including nonenvironmental crimes) and administrative startup costs may discourage ECs from being implemented in some localities.

4.0 Conclusion

This report is intended to provide insights into the factors that contribute to illegal dumping and offer potential preventive strategies to discourage illegal dumping of durable waste. While there are a multitude of drivers that contribute to illegal dumping, the primary issue can be distilled to a lack of access to appropriate disposal methods. Households overwhelmingly recognize that illegal dumping is an abhorrent activity that poses both environmental and economic harm and should be avoided when possible. However, a lack of perceived behavioral control (measured in terms of accessibility and convenience) is ultimately what results in illegal dumping, highlighting the importance of providing communities with readily accessible waste collection points (through curbside collection, designated drop-off points or a combination of measures). The most effective strategy for dealing with illegal dumping is to make legal disposal of waste at approved collection points as convenient as possible.

While providing infrastructural access is a prerequisite to discouraging illegal dumping, it also is important that there is clear and consistent messaging regarding the “who, what, when, where, why and how” of disposing of waste — households need to know where they can go and what materials they can take, as well as the importance of avoiding illegal dumping because of its economic, environmental and health risks. Harmonization across jurisdictions is critical in promoting desired behavior, as differences in levels of service, access and operations among neighboring communities can result in confusion for households. This report found that the confusion and uncertainty resulting from a lack of harmonization also contributes to illegal dumping, as households report receiving mixed messaging, that in turn leads to illegal dumping.

One of the key takeaways from this report is that addressing the drivers of illegal dumping (lack of access, lack of awareness, etc.) requires a concerted and coordinated effort of multiple stakeholders from a range of sectors. It is not sufficient for any one actor to “go it alone” when addressing illegal dumping, as it requires the resources, expertise and input of multiple actors that represent state and local governments, manufacturers of durable goods, waste management operators and the community. It is important that the roles and responsibilities of involved stakeholders are defined clearly, with consensus regarding the most effective and economically practical ways to address illegal dumping and prevent it from occurring in the first place.

This report found that preventive strategies are likely the most effective method for addressing illegal dumping, as on aggregate, site remediation and cleanup are significantly more expensive than providing the enabling conditions to discourage illegal dumping (e.g., accessible infrastructure, clear and consistent communication to residents, monitoring and surveillance technologies in public spaces, etc.). However, the upfront costs of providing these enabling conditions may discourage these investments, necessitating that communities find ways to pool and leverage resources to share the financial burden across a wider range of stakeholders so that no one organization or community is paying a disproportionate share. Resource pooling can be accomplished by informal technical committees with voluntary participation or be written into bylaws and legislation that require stakeholders to participate. EPR legislation also may be seen as a potential vehicle for creating the process and marshalling the resources needed to implement accessible collection methods that can result in reduced illegal dumping.

Discouraging illegal dumping also can be achieved through behavioral intervention strategies that emphasize punitive measures for noncompliance. Results of a survey that accompanied this study showed there was an inverse relationship between illegal dumping and enforcement. In communities that were more likely to enforce ticketing/fining individuals for illegal dumping, there was a reduced willingness to partake in illegal dumping. In short, enforcement has to be both credible and severe enough to actually deter an individual from illegal dumping. Where possible though, punishment should be seen as a line of last resort — the emphasis of policy ideally should

be placed on preventing illegal dumping. Furthermore, while punishment may achieve the desired behavioral outcome, it is of greater value to educate households about the impacts of illegal dumping and create a shared sense of stewardship in maintaining the cleanliness and safety of public spaces.

Illegal dumping is an incredibly complex issue that is driven by a multitude of factors. In turn, the solutions to addressing illegal dumping also must be nuanced and multifaceted – it is a shared problem that affects multiple stakeholders and only can be meaningfully addressed when a collaborative and inclusive approach is utilized.

Appendix A: Factors Contributing to Self-Reported Illegal Dumping in Ontario

Illegal dumping often is difficult to isolate, as most people who participate in illegal dumping actually have favorable attitudes toward the environment and recognize the activity as wrong. To better understand household attitudes toward illegal dumping, York University in Toronto, Ontario, conducted a survey in the summer of 2020 that gathered self-reported behaviors on illegal dumping in nine communities across southern Ontario.

The following is a summary of the salient findings gleaned from the survey as they pertain to attitudes toward illegal dumping, self-reported illegal dumping and perceived availability of waste collection infrastructure.

Survey methodology

Three geographical regions were targeted to complete a combination of structured surveys and open-ended survey statements pertaining to respondents' attitudes toward illegal dumping, self-reported measures of illegal dumping, assessments surrounding the efficacy and consistency of enforcement, and perceived infrastructural availability.

These communities were chosen on the basis of representing large urban, suburban and rural communities, as a means to achieve a representative approximation for the province as a whole. Of note, previous research on the topic has identified locality as being a significant predictor/modifier of illegal dumping findings.

Geographic regions are defined by population density, geographic location and collection type (curbside collection vs. depot systems).

These groups include:

- Large urban (Toronto, Brampton, Mississauga, York region)
- Urban regional/suburban (Ajax)
- Medium urban (Barrie)
- Rural/northern

Questionnaires were pre-tested and refined prior to conducting the official survey in collaboration with the Tri-Council Ethics Committee. The pre-test allowed for wording refinements and changes to the ordering of the questions. The finalized survey was conducted over a six-week period beginning in the second week of May 2020 and running through June 2020. Teams of two enumerators and one site supervisor were sent to each municipality for a period of four days each, spending six hours at each survey site.

Questionnaire "booths" were set up in spaces with high foot traffic (namely malls, arenas and public commons areas). Enumerators were asked to approach members of the public, explain who they were and the purpose of the study, and requested approximately 10–15 minutes of the participant's time to complete the survey. A \$5 Tim Hortons café and bake shop gift card was used to incent participation.

While concerns surrounding the COVID-19 pandemic resulted in fewer interactions between enumerators and potential survey participants, the total number of samples obtained (612) is

statistically significant and representative of the broader population of Ontario (at the 95% confidence interval).

A mix of convenience and quota sampling was employed to ensure that survey participants reflect the relative proportions of Ontario's population. Survey responses were recorded by hand and by tape recorder by the enumerator, and later electronically archived and analyzed using Provalis Word Stat, Microsoft Excel and Microsoft Word.

Distribution of samples were as follows: (Note: Municipal classification is in accordance with RPRA guidelines.)

- 310 samples taken from large urban municipalities
- 161 samples taken from medium urban/suburban municipalities
- 141 samples taken from rural municipalities

Salient findings:

- 1) In urban communities, the frequency of self-reported illegal dumping was approximately 24% lower relative to suburban communities and 44% lower relative to rural communities
- 2) Multifamily residential buildings reported higher rates of illegal dumping relative to single-family dwellings
- 3) 64% of respondents admitted to illegally dumping durable waste at least once within the past year (51% urban, 48% suburban and 89% rural)
- 4) 91% of respondents reported seeing neighbors and households from the broader community illegally dispose of waste at least once in the past year
- 5) 88% of respondents agreed or strongly agreed, with the statement "I think illegal dumping is wrong"
- 6) 80% of urban respondents (who admitted to illegally dumping) agreed or strongly agreed with the statement "I feel guilty when I dump waste in places where I know it doesn't belong," in stark contrast to rural communities where only 24% of respondents indicated some measure of guilt for illegal dumping
- 7) 55% of respondents agreed or strongly agreed with the statement "I think illegal dumping should be fined or face a penalty"
- 8) 44% of respondents indicated that they would avoid illegal dumping if faced with a financial penalty
- 9) 37% of respondents agreed or strongly agreed with the statement "Illegal dumping is a problem in my community" (28% urban, 31% suburban and 55% rural)
- 10) 21% of respondents agreed or strongly agreed with the statement "My municipality does enough to prevent illegal dumping"
- 11) 34% of respondents agreed or strongly agreed with the statement "I know where to take my waste that is not collected as part of my city's recycling or garbage service" (Note: Wording of survey question was changed to specify that the question was not referring to either the Blue Bin or Green Bin program)
- 12) Impeded access to approved collection points was the primary determinant of illegal dumping across all three municipal groups (Note: What constitutes infrastructural inadequacies differed between urban/suburban and rural communities)
- 13) Rural respondents characterized a lack of approved collection points as being the primary issue, with majority of those respondents indicating that they would not be willing to travel more than 15 minutes to dispose of waste at a depot/transfer station

- 14) Urban/suburban respondents characterized a lack of formal municipal programs for durable goods (e.g., furniture, mattresses, etc.) as being the main behavioral impediment, with lack of collection points following closely behind. Many respondents indicated that it is the municipality's responsibility to collect and manage waste from households
- 15) Participants across all three municipal groups felt that bylaws barring the illegal dumping of waste were ineffectual due to a lack of enforcement
- 16) Lack of awareness regarding where to safely dispose of waste contributed to illegal dumping, with more than 70% of respondents indicating that they did not know where to properly dispose of one or more waste streams
- 17) Normative pressures were a significant predictor of willingness to illegally dump material, with 74% of respondents reporting that they would be deterred from illegal dumping if they were noticed by neighbors, loved ones or the broader community
- 18) Self-reported willingness to illegally dump is significantly correlated with perceived environmental harm of a particular waste stream, with respondents indicating that they were more likely to illegally dump items that they felt were not "dangerous" or "bad for the environment" (e.g., household hazardous waste, oil, paint, etc.)
- 19) The types of items that are illegally dumped vary based on locality, with urban respondents more likely to dump construction/renovation waste, electronics and small appliances, and engage in "garbage switching" (putting waste in neighbors' garbage/recycling carts)
- 20) Rural respondents were more likely to dispose of a broader range of materials, including large durable goods such as mattresses, furniture and appliances, with the differences in self-reported disposal between urban and rural communities being likely explained by program availability (the urban municipalities sampled offer a wider range of waste collection services) and opportunity (there are more opportunities to dump large items in rural communities without being noticed)
- 21) Where respondents illegally disposed of waste also is a function of locality, with urban respondents being most likely to dump waste in nondesignated carts (Note: Most urban municipalities in Ontario use 360L opaque carts to collect recyclables, household waste and organics with a side loading vehicle)
- 22) Respondents from rural communities were more likely to dump waste in areas that were characterized by low foot traffic and low visibility, including ravines, wooded spaces, culverts, etc.

References

- Alessio D'Amato, Massimiliano Mazzanti, Francesco Nicolli, Mariangela Zoli. Illegal waste disposal: Enforcement actions and decentralized environmental policy Socio-Economic Planning Sciences, Volume 64, 2018, pp. 56-65
- Barrett, Martyn & Brunton-Smith, Ian. (2014). Political and Civic Engagement and Participation: Towards an Integrative Perspective. *Journal of Civil Society*. 10. 10.1080/17448689.2013.871911.
- Brunton-Smith, Ian & Jackson, Jonathan & Sutherland, Alex. (2014). Bridging Structure and Perception on the Neighbourhood Ecology of Beliefs and Worries About Violent Crime. *British Journal of Criminology*. 54. 10.1093/bjc/azu020.
- Comba, P., Bianchi, F., Fazzo, L., Martina, L., Menegozzo, M., Minichilli, F., Martuzzi, S. T. (2006). Cancer mortality in an area of Campania (Italy) characterized by multiple toxic dumping sites. *Annals New York Academy of Sciences*, 1076, 449- 461. doi 0.1196/annals.1371.067
- Critto, A., Carlon, C., & Marcomini, A. (2003). Characterization of contaminated soil and groundwater surrounding an illegal landfill by principal component analysis and kriging. *Environmental Pollution*, 122, 235-244.
- Crofts, P., Morris, T., Wells, K., & Powell, A. (2010). Illegal dumping and crime prevention: a case study of Ash road, Liverpool Council. *Public Space: The Journal of Law and Social Justice*, 5, 1-23.
- Glanville, K., & Chang, H.-C. (2015). Remote sensing analysis techniques and sensor requirements to support the mapping of illegal domestic waste disposal sites in Queensland, Australia. *Remote Sensing*, 17, 13053-13069. doi:10.3390/rs71013053
- Ichinose, D., & Yamamoto, M. (2011). On the relationship between the provision of waste management service and illegal dumping. *Resource and Energy Economics*, 33, 79- 93. doi:10.1016/j.reseneeco.2010.01.002
- Jordá-Borrell, R., Ruiz-Rodriguez, F., & Lucendo-Monedero, A. L. (2014). Factor analysis and geographic information system for determining probability areas of presence of illegal landfills. *Ecological Indicators*, 37, 151- 160. <http://dx.doi.org/10.1016/j.ecolind.2013.10.001>
- Lakhan, C. (2015) "Evaluating the effects of unit-based waste disposal schemes on the collection of household recyclables in Ontario, Canada" *Resources Conservation and Recycling*. 2015a, 95(2): 38-45
- Matos, J., & Kristof Ostir, J. K. (2012). Attractiveness of roads for illegal dumping with regard to regional differences in Slovenia. *Acta Geographica Slovenica*, 52(2), 431- 451. doi: 103986/AGS52207
- Matsumoto, S., & Takeuchi, K. (2011). The effect of community characteristics on the frequency of illegal dumping. *Environmental Economics and Policy Studies*, 13, 177-193. doi: 10.1007/s10018-011-0011-5
- H. Begur et al., "An edge-based smart mobile service system for illegal dumping detection and monitoring in San Jose," 2017 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computed, Scalable Computing & Communications, Cloud & Big Data

Computing, Internet of People and Smart City Innovation
(SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI), San Francisco, CA, 2017, pp. 1-6, doi:
10.1109/UIC-ATC.2017.8397575.

Tasaki, Tomohiro & Kawahata, Takatsune & Osako, Masahiro & Matsui, Yasuhiro & Takagishi, Susumu & Morita, Akihiro & Akishima, Shigeki. (2007). A GIS-based zoning of illegal dumping potential for efficient surveillance. *Waste management* (New York, N.Y.). 27. 256-67.
10.1016/j.wasman.2006.01.018.

Taylor, S. "Area-wide illegal dumping analysis for City of Sacramento and County of Sacramento" Eunomia Consulting (2018) Accessed from: <https://www.eunomia.co.uk/report-category/topic/waste-recycling/illegal-dumping/>