Residents' Perceptions and Attitudes toward Waste Treatment Facility Sites and their
Possible Conversion: A Literature Review

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Introduction

While the appeal of attractive environmental amenities, such as nature preserves, forests, wetlands, and parks has been studied extensively (Waltert & Schlapfer, 2010), people's reactions to less attractive sites, for instance landfills, brownfields, and waste treatment facilities, has received much less research attention (Jackson, 2001). Despite the lack of research, the presence of these types of manmade disamenity sites can have a substantial influence on local residents and their communities. Thus, it is important for urban planning researchers and professionals to understand residents' perceptions and attitudes toward these sites. Generally, these sites move through a series of distinct life cycle stages, starting with their initial proposal, through development and construction, operation, and at least for some, closure, and possible conversion for other use. Developing a more complete understanding of the complex relationship between these undesirable sites and their host communities, and how this relationship may change over the life of these sites, would greatly benefit future planning and community development practices.

Brownfields represent perhaps the most prevalent type of manmade disamenities in the US. According to the United States Environmental Protection Agency (USEPA), brownfields are defined as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (US Environmental Protection Agency, 2013). The USEPA estimates that there are more than

450,000 brownfield sites in the US alone, while others believe that the number may be as high as one million (Siikamaki & Wernstedt, 2008). The bulk of these sites are located in urban areas with limited land resources.

Landfill sites, on the other hand, are the oldest form of waste treatment. These sites store the by-products of daily living by burying disposed waste materials (Rushton, 2003). Landfills have been the most commonly used methods for waste disposal and remain in operation in many places all over the world. Depending on the materials disposed at the site, landfills may or may not contain hazardous garbage. When a landfill reaches its capacity, the closed landfill site becomes a special type of brownfield. Both brownfield and landfill sites impose substantial impacts on their host communities.

There have been an increasing number of calls for the remediation and redevelopment of brownfield and landfill sites. The primary focus of brownfield redevelopment in US has been pecuniary gain, since the conversion of these sites can create jobs, increase household incomes, expand the local tax base, and create new business (Greenberg & Lewis, 2000; Siikamaki & Wernstedt, 2008; Wernstedt, 2004). More recently, the transformation of brownfield and landfill sites into “green space” settings, such as parks and recreation facilities, has gained increasing attention and interest among planners, authorities and researchers (De Sousa 2003, 2004, 2006; Mowen & Confer, 2003, Siikamaki & Wernstedt, 2008). The complexity of brownfield redevelopment is a consistent theme in the research literature. As stated in a study by Wernstedt and colleagues (Wernstedt, Meyer, Alberini, & Heberle, 2006), brownfield conversion projects combine “elements of the natural, built and social environment and involves concerns related to economic development, smart growth, urban revitalization, environmental justice, housing, local

finance, site planning and design, sustainability, land use, and transportation and infrastructure provision (p. 101).”

Our goal in this paper is to unravel the complicated issues surrounding brownfield and landfill redevelopment by providing an integrated overview of the current literature on attitudes toward these sites and their possible conversion for recreation use. Some sites, such as landfill and incineration facilities, are necessary evils of community growth and development. Often concerns about the siting of these proposed waste treatment facilities parallel those of existing and former facilities. Thus, the paper reviews previous research examining attitudes toward proposed and existing waste treatment facilities as well as the possible conversion of former sites.

Our review focuses on brownfields, landfills, and waste treatment facilities. Other environmental disamenities including energy facilities, detention centers, and homeless shelters may likewise influence their host communities, but are not included in this review. Furthermore, only social impacts are considered here. Studies examining the physical/health impacts (Giusti, 2009; Vrijheid, 2000), economic impacts (e.g., hedonic pricing studies, Palmquist & Smith, 2002; Rosen, 1974; Waltert & Schlapfer, 2010), siting process (Simsek, Elci, Gunduz, & Taskin, 2014), or brownfield redevelopment policies, regulations, screening, monitoring and evaluation practice (Atkinson, Doick, Burningham, & France, 2014; Buzbee, 1997; Chrysochoou et al., 2012; Eisen, 1999; Padiaditi, Doick, & Moffat, 2010) are reviewed elsewhere and are thus beyond the scope of this paper.

The paper begins with a review of prior research on residents’ attitudes toward proposed and existing waste treatment facilities. While many facilities may operate indefinitely, some, such as landfills, typically have a limited operational window. In other cases, efforts to repurpose facilities at other sites may be complicated (due to the presence of pollutants and other

contaminants), resulting in abandoned brownfield sites. Thus, the next section of the paper focuses on research that has examined attitudes toward brownfield and landfill conversion.

While this conversion may occur for both economic redevelopment and recreation use, we focus primarily on the conversion of brownfields to green spaces in transforming “distressed neighborhood into healthier, walkable, more vibrant environments” (Siikamaki & Wernstedt, 2008, p. 588). The final section of the paper summarizes our conclusions and outlines key issues for future research to fill the gaps in our understanding and inform urban policy and planning efforts.

Methods

Prior research on attitudes toward waste treatment facility sites and the conversion of former landfill and brownfield sites was identified via a comprehensive search using the Web of Science Database and Google Scholar. The following combinations of search terms were employed: brownfield, landfill, waste treatment facility, attitudes, perceptions of, impacts, conversion, redevelopment, and remediation. Additional articles were identified through article reference lists. Only peer-reviewed empirical studies in English-language journals published between 1988 and 2014 were included in this review. Other types of papers, for instance literature reviews, book chapters, policy analyses, editorials, and non-peer-reviewed articles were excluded. Only studies that focused primarily on the psychological or social impacts were included in the review; those concentrating on other types of impacts including physical or health impacts, economic impacts (e.g., hedonic pricing studies), energy or environmental impacts, or technical/engineering issues were excluded as well. Finally, papers focusing on the analysis of legislative, regulatory, or policy issues were also not included. A total of twenty-eight studies were identified as a result of our review process. Key features of the twenty-eight studies were

extracted, including primary aims, site type (e.g., proposed, exiting, and former), facility type (e.g., landfill and incinerator), size (in hectares), year established (i.e., operations began), location, study approach and sample, and main findings.

Prior Research on Attitudes toward Proposed and/or Existing Sites

While solid waste treatment facilities are vital elements of community growth and development, it is increasingly common for planners involved in locating and developing such facilities to face opposition from those living nearby. Such opposition is generally referred to as the “not in my backyard” (or NIMBY) phenomena. This negative social response to a proposed waste treatment facility site occurs because residents perceive “the cost they will bear from the facility will exceed the benefits” (Lober & Green, 1994, p. 43). It should be noted that a variety of similar forms of opposition (and acronyms) have been advanced including NIABY (not in anybody’s backyard), NIMTOO (not in my term of office), NOPE (not on planet Earth), CAVE (citizens against virtually everything) and, more generally, LULU (locally unwanted land uses) (Schively, 2007). While a variety of facilities have been associated with NIMBY and LULU concerns (e.g. affordable housing developments, drug treatment facilities, homeless shelters, animal/livestock operations, energy facilities, and hazardous waste facilities), this section reviews prior studies focusing on residents’ perceptions of and attitudes toward proposed and/or existing landfills and solid waste treatment facilities. These facilities have received the greatest amount of research attention and are the most germane to the present paper.

Host communities and nearby residents may view the impacts of such sites from a variety of perspectives. These impacts include environmental and health risks as well as social and economic problems. Specific concerns relating to brownfield and landfill sites include contaminated air, soil, and groundwater which expose people, plants, wildlife and the natural

environment to environmental threats, decrease residential property values, and raise anxiety and perceptions of health risk (Eiser, Stafford, Henneberry, & Catney, 2007). A subsequent loss of trust of the management ability of local authorities may also occur (Owusu, Oteng-Ababio, & Afutu-Kotey, 2012).

Although residents' perceptions of and attitudes toward existing sites do not depend on whether they opposed or supported the proposal to site the facility (Okeke & Armour, 2000), concerns about existing waste treatment facility sites often parallel those of proposed ones. Thus, this section reviews previous research examining residents' perceptions of and attitudes toward both proposed and existing waste treatment facility sites.

Eighteen empirical studies were identified and reviewed in this section (see Table 1). The eighteen studies varied in terms of the types of site and facility, study location, and study approach. As shown in Table 1, eight out of eighteen studies examined proposed sites and ten examined existing sites. Landfills were examined the most frequently among these papers (44.4%); followed by waste treatment facilities (33.3%) which according to Lober (1993) typically include landfills, recycling centers, and/or transfer stations; and incinerator facilities (22.2%). The majority of the reviewed studies involved sites in North America (6 in US and 6 in Canada); others examined sites located in Europe (Germany and Portugal) and the more developed parts of Asia (Japan and Shanghai). In-person interviews were the most frequently used approach (n=9) and two studies used both interviews and surveys (n=2). A total of seven studies administered mail or telephone surveys of local residents (n=7).

Table 1. Empirical studies examining perceptions of and attitudes toward waste treatment facility sites

Author(s) (date)		Type of site and facility; location	Study approach and sample
1	Furuseth & Johnson (1988)	Existing landfill (61 ha, established 1975); Charlotte, North Carolina, US	Interviews with local residents (n=100)
2	Furuseth (1990)	Existing landfill (61 ha, established 1975); Charlotte, North Carolina, US	Interviews with local residents (n=100)
3	Furuseth & O'Callaghan (1991)	Proposed waste incinerator; Charlotte, North Carolina, US	Interviews with local residents (n=168)
4	Wiedemann, Schutz, & Peters, (1991)	Proposed waste incinerator, West Germany	Telephone survey of local residents (n=165)
5	Elliott et al. (1993)	Existing landfills (162 ha, est'd 1983 and 126 ha est'd 1992) and incinerator (est'd early 1970's); Ontario, Canada	Telephone survey of local residents (n=696)
6	Eyles et al. (1993)	Existing landfills (162 ha, est'd 1983 and 126 ha est'd 1992 and incinerator (est'd early 1970's); Ontario, Canada	Interviews with local residents (n=39)
7	Lober (1993)	Proposed waste treatment facilities (recycling center, garbage-burning plant, ash landfill, and transfer station); Connecticut, US	Mail survey of local residents (n=257)
8	Lober & Green (1994)	Proposed waste treatment facilities (recycling center, waste-to-energy plant, ash landfill, and transfer station); New Haven, Connecticut, US	Interviews with local residents (n=82)
9	Elliott et al. (1997)	Existing landfill (126 ha, est'd 1992); Ontario, Canada	Telephone survey of local residents (n=187 in 1990; n=108 in 1992-93; n=87 in 1995)
10	Okeke & Armour (2000)	Existing landfill (126 ha, est'd 1992); Ontario, Canada	Mail survey of local residents (n=72)
11	Wakefield & Elliot (2000)	Proposed landfills; Ontario, Canada	Interviews with stakeholders (n=36)
12	Ishizaka & Tanaka (2003)	Proposed waste treatment facilities (incinerator, landfill, and recycling plant); Okayama, Japan	Mail survey of municipal officials (n=55); interviews with local resident groups (n=12)

13	Lima (2004)	Existing incinerator (est'd 2000); Oporto, Portugal	Interviews with local residents (n=906 in 1997, 1998, 1999, 2000, 2001, and 2002)
14	Rahardyan et al. (2004)	Proposed waste treatment facilities (incinerator, landfill, and recycling facility); Sapporo, Kutchan, and Hinode, Japan	Mail survey of local residents (n=51)
15	Lima (2006)	Proposed incinerators; Lisbon and Oporto, Portugal	Interviews with local residents in Lisbon (n=451) and Oporto (n=298)
16	Elliot & McClure (2009)	Existing landfill (est'd 1996); Ontario, Canada	Telephone survey of local residents (n=328 in 1996; n=178 in 2002); interviews with local residents (n=18 in 2005)
17	Johnson & Scicchitano (2012)	Proposed landfills; Florida, US	Telephone survey of local residents (n=1004)
18	Che et al. (2013)	Existing landfill (697 ha); Shanghai, China	Interviews with local residents (n=845)

The studies also varied in whether they examined the perceived impacts of proposed/existing sites or the determinants or factors influencing the perceived impacts associated with these sites. Both of these lines of research are reviewed in the remainder of this section.

Perceptions of impacts from proposed and/or existing sites

Past research has examined residents' perceptions of the impacts of living near a proposed or an existing (i.e., currently operating) solid waste treatment facility, such as a landfill or incinerator. Although residents' perceptions and attitudes may change or be tempered after experiencing the operation of the facility, certain general themes occur across the literature regarding proposed or existing waste treatment facility sites. These perceived impacts range from those involving public health and well-being, to environmental degradation, to social and economic welfare. The potential physical health impacts (e.g. cancer, birth defects, and

respiratory diseases) of living near existing facilities have received considerable research attention and have been reviewed elsewhere (for example, see Giusti, 2009 and Vrijheid, 2000). Similarly, hedonic analyses examining the economic impacts on real estate values of living near landfills and related facilities have also been reported (Deaton & Heohn, 2004; Eshet, Ayalon, & Shechter, 2006; Palmquist & Smith, 2002; Rosen, 1974). Here we concentrate on studies that have examined the psychological and social impacts associated with the siting of proposed or operation of existing waste treatment facility sites.

Having a landfill in its midst, the host community may have many concerns which would result in opposition to proposed facilities or negative attitudes toward the existing facilities, especially when these concerns have not been effectively addressed by local authorities. A total of eight studies explored residents' concerns toward these sites. These concerns can be grouped into six categories: operational impacts, traffic impacts, environmental impacts, economic impacts, psychological impacts, and physical impacts (see Table 2.).

Table 2. Studies examining residents' perceptions of impacts from proposed or existing sites

Type of impact(s) examined		Studies involving existing sites ^[references]	Studies involving proposed sites ^[references]
Operational impacts			
	Odor from the site	6 ^[1, 2, 10, 13, 17, 18]	2 ^[11, 12]
	Site's appearance to passers-by	3 ^[1, 2, 10]	2 ^[12, 14]
	Noise from the site	3 ^[1, 2, 10]	2 ^[11, 14]
	Dust from the site	3 ^[1, 2, 10]	1 ^[11]
	Litter from the site	3 ^[1, 2, 10]	
	Paper blowing out of the site	1 ^[10]	
	Cost of the siting process		2 ^[11, 14]
	Length of the siting process		1 ^[11]
Traffic impacts			
	Site-related traffic	5 ^[1, 2, 6, 10, 17]	3 ^[11, 12, 14]
	Traffic noise	4 ^[1, 2, 9, 13]	2 ^[12, 14]
	Litter from the site trucks	4 ^[1, 2, 9, 10]	
	Odor from the site trucks	1 ^[10]	1 ^[12]
Environmental impact			
	Groundwater impacts	8 ^[1, 2, 5, 6, 9, 10, 17, 18]	1 ^[14]
	Pollution	4 ^[5, 13, 17, 18]	3 ^[4, 12, 14]
	Insect attraction	3 ^[6, 9, 18]	
	Rodents, seagulls etc.	2 ^[10, 17]	1 ^[14]
Psychological impact			
	Stress and anxiety	3 ^[9, 10, 13]	1 ^[11]
	Uncertainty	1 ^[16]	1 ^[11]
Economic impact			
	Property devaluation	5 ^[1, 2, 6, 10, 17]	1 ^[14]
	Employment opportunities	1 ^[17]	1 ^[4]
	Uninterrupted waste disposal	1 ^[17]	
	Revenues from landfill operations	1 ^[17]	
Physical impact			
	Health hazards	5 ^[5, 9, 16, 17, 18]	3 ^[4, 11, 14]

The numbers refer to the studies listed in Table 1.

With respect to operational impacts, odor from the site was reported in eight studies, followed by the site appearance to passers-by and noise from the site, reported in five studies respectively. For example, odor annoyance was ranked highest (73.84%) among the impacts associated with living close to the Shanghai Laogang Landfill by the local residents (Che et al., 2013). Also, Okeke and Armour (2000) found that 72% of respondents were a little concerned or very concerned about the noise from the landfill in Ontario, Canada, and 70% were concerned about odors. Four studies found the residents concerned about the dust from the site. In particular,

Wakefield and Elliott (2000) found that many of the concerns identified by their respondents regarding the proposed landfill in southern Ontario, Canada, hinged on nuisance aspects, specifically increased traffic, dust, odor, and noise. In addition, three studies reported the litter from the site concerned the residents and other concerns included paper blowing out of the site, the high cost of the siting process, and the extended length of the siting process.

Regarding traffic impacts, eight studies reported the increase of site-related traffic was a concern to residents; six studies reported traffic noise was a concern; four studies reported litter from transporting trucks as a concern; and two studies reported odor from transporting trucks as a concern. Interestingly, Furuseth (1990) found that the traffic related to the landfill in North Carolina, US, was rated the most serious impact by the participants, with 19.2% viewing it as a minor problem and 16.2% as a major problem.

As for environmental impacts, nine studies reported groundwater contamination was a concern to residents; seven studies found pollution in general was a concern; three studies noted concerns about rodents, seagulls, other animals, and insects attracted to site. For example, Ishizaka and Tanaka (2003) indicated that the residents thought the solid waste treatment and disposal facility in Okayama, Japan increased the possibility of environmental pollution. Also, pollution received the highest rating in comparison to other concerns of respondents in the Rahardyan et al. (2004) study in Japan. Okeke and Armour (2000) found that “operational, traffic and psychological impacts posed the least concerns to the residents, while environmental and economic impacts posed the highest concerns” (p. 137).

In terms of psychological impacts, two aspects that emerged from the reviewed studies were stress and uncertainty. For example, Wakefield and Elliott (2000) reported their respondents had expressed psychological symptoms related to uncertainty, stress and anxiety,

arising from the proposed landfill in Ontario, Canada; noting that “some respondents felt that dealing with a long period of uncertainty was more difficult than coping with an actual landfill” (p. 1149). Concerns about economic impacts, specifically, perceived property devaluation associated with a nearby waste treatment facility site was reported in six studies. In Okeke and Armour (2000) study, the majority of the participants (86%) were concerned or very concerned about property devaluation due to the site. While most impacts focused on negative aspects, perceived economic benefits were reported as well. These included employment opportunities (reported in two studies), uninterrupted waste disposal, and revenue derived from landfill operations. Finally, perceived physical impacts, specifically increased health risks were recorded in eight studies. For instance, Che et al. (2013) found that 82.5% of the residents that lived close to a landfill in Shanghai, China, considered physical health effects as their most important concern.

Residents may witness both the development and operation stages of the waste treatment facilities. Thus, an important question is whether and how resident’s perceptions and attitudes might have changed or evolved over time. Three longitudinal studies specifically examined residents’ attitudinal shifts and impacts of living near waste treatment facilities (Elliott et al., 1997; Elliot & McClure, 2009; Lima, 2004). A positive change over time in attitudes toward the nearby landfill or incinerator was found in two of these studies (Elliott et al., 1997; Lima, 2004). In one study, Elliott and her colleagues (Elliott et al., 1997) followed residents who lived close to a landfill in Ontario, Canada, for five years (1990-1995) and found a positive change in landfill perceptions, concerns and actions, indicating many respondents “had adapted to the facility or at least had become resigned to it” (p. 229). A similar habituation effect was found in the participants in Lima’s (2004) study, who investigated the effects of risk perception on

psychological well-being of residents who were adjacent to an incinerator in Portugal. Over the five-year period of the study, less extreme attitudes and lower levels of perceived risk were reported. Wiedemann, Schutz, and Peters (1991) pointed out that “it is psychologically plausible that those who see no chance to influence the decision-making process tend to diminish the personal relevance of the waste incineration issue” (p. 235).

In contrast to these habituation effects, other research by Elliott and McClure (2009) has shown that negative perceptions and concerns do not fade over time for all. In their study involving telephone interviews conducted with residents of Ontario, Canada, they showed little change regarding residents’ concerns with the landfill over time from 1996 to 2002, but found that health concerns shifted from short-term concerns to long-term concerns.

Determinants of residents’ perceptions and attitudes toward waste treatment facility sites

In addition to identifying the perceived impacts of waste treatment facility sites, several studies explored the determinants or factors that influence resident perceptions or attitudes toward these sites. The factors examined in past research can be organized in terms of three categories: resident characteristics, psychosocial factors, and site-related planning and management factors. Table 3, which presents these factors also summarizes whether the relationship observed between the variables examined in a particular study was positive, neutral, or negative.

Table 3. Studies examining determinants of residents' perceptions/attitudes toward proposed or existing waste treatment facility sites

Resident characteristics		Psychosocial factors		Site-related planning/management factors	
Distance from home to site	+ [1,3,5,8,10,13,15,18] ^a 0 [16,17]	Trust in decision-makers	+ [11, 12, 15] 0 [7, 17]	Site preferences	* [3,8,18]
Age	+ [7, 14, 17] 0 [3, 5, 15, 16] - [13]	Perceived risk	- [4, 7, 11, 15]	Social network (membership, satisfaction, support and involvement)	* [5, 9]
Gender	* [3, 7, 13] 0 [5, 14, 15, 16]	Perceived benefits (employment opportunities)	+ [4, 17] 0 [8]	Environmental decision-making process	+ [11, 12]
Education	+ [9] 0 [3, 5, 7] - [13]	Perceived costs	0 [4, 8] - [17]	Information disclosure	+ [12]
Home ownership	* [16] 0 [5, 7, 17]	Perceived environmental equity	+ [8, 15] 0 [7]	Adequate communication to public	+ [12]
Years at current address	+ [5] 0 [7, 16] - [14]	Perceived need for building new facilities	+ [7, 8]	Knowledge of risk and waste management	+ [12]
Employment status	* [5, 16]	Perceived control on landfill siting process	+ [11]	Site-related environmental annoyance	- [13]
Income	* [16] 0 [7, 17]	Positive expectancies about the project	+ [15]	Credible information sources	+ [12]
General health status	* [5, 16]	Perceived power to influence the risk	+ [11]		
Residents with children at home	0 [16] - [3]	Fear	- [1]		
Previous site visitation	+ [14]				

^aEach entry gives the relationship (+, 0, -) found between the variable and residents' attitude toward proposed or existing waste treatment facility sites; the numbers refer to the studies listed in Table 1. "+" Means a positive relationship was observed, "0" a neutral relationship and "-" a negative relationship. "*" Means the variable was a significant factor in the study, but no direction was indicated.

The relationship between resident characteristics and attitudes toward proposed or existing waste treatment facility sites were examined in twelve studies. Distance from residents' home to site was positively associated with residents' attitudes in eight studies, but had a neutral impact in two studies. The proximity of local residents to a proposed or existing site has been reported as the most influential factor shaping residents' perceptions and concerns. Furuseth and Johnson (1988) reported that the closer residents lived near the Harrisburg Landfill, the more likely they were to be impacted by sensory factors including landfill noise, landfill odor, landfill litter, traffic noise, and dust. In another study, Lima (2006) noted that opposition to an incinerator was stronger among respondents living closest to the proposed site. She found that residents living closest to the proposed site tend to perceive a higher degree of site-related annoyances (i.e., site-related odor, noise, litter, and dust), resulting in deeper concerns and more negative attitudes (Lima, 2006). In a recent study incorporating GIS analyses, Che et al. (2013) demonstrated that residents who lived closer to Laogang Landfill were more annoyed by the odors emitted from the landfill facilities. While 100% respondents living within 3 km reported odor annoyance, only 60% living at a distance of 7 km reported odor annoyance, and less than 40% at a distance of 9 km complained about the odor (Che et al., 2013).

Results regarding age, education, and years at current address yielded mixed findings. For example, in a study that examined attitudinal and demographic determinants of public opinion to solid waste facilities in US, Lober (1993) found that older adults were more likely to support such facilities. Rahardyan and colleagues (2004) examined people's attitudes towards solid waste facilities in Japan found the same relationship that older residents tended to have more favorable attitudes toward these facilities. However, Lima (2004) investigated the influence

of risk perception on mental health among people who lived near an incinerator in Portugal. She found that older individuals showed higher levels of psychological symptoms, such as anxiety, depression, and stress. Age was not found as a significant factor in other studies (Elliot & McClure, 2009; Lima, 2006). The results have also been inconsistent in terms of gender, home ownership, income, and presence of children at home. These characteristics are significant in some studies, but not in others. For example, respondents whose household income were higher than \$30,000 were more likely to report site-related and health concern and coping responses (Elliot & McClure, 2009), while there was no significant effects found in both Lober (1993) and Johnson and Scicchitano (2012) studies. Employment status, general health status, and whether or not residents have ever visited the site were all found significant in predicting residents' attitude toward waste treatment facility sites. In Rahardyan et al. (2004) study, respondents' opposition toward the waste management facility decreased if they had visited such facilities in the past; although the decrease in opposition was slight for those that had only noticed or seen such facilities from outside.

The impact of psychosocial factors on attitudes toward these sites was examined in seven studies. In general, the relationship among these variables tended to be relatively consistent. For example, perceived risk was negatively associated with residents' attitudes in four studies. In one study, Lober (1993) found that respondents perceiving higher risk were more likely to have negative attitudes toward a proposed incinerator and landfill project. Trust in the decision-makers involved, perceived benefits, and perceived environmental equity were found to be positively associated with residents' attitudes in some studies, but not associated in others. In the Wakefield and Elliott (2000) study, participants who had less trust in the government were more concerned and had negative attitudes toward the proposed landfill, while participants who felt

that public hearings provided greater opportunity to voice their views resulted in a positive attitude change toward the proposed landfill. In addition, Rahardyan et al. (2004) found that people who were opposed to waste treatment facilities did not participate in planning process of the proposed projects. In other studies, beliefs about the perceived need for building new facilities, positive expectancies about the project, and perceived power to influence risks were positively related to residents' attitudes, while perceived costs were negatively related.

Factors regarding site-related planning and management that impact resident's attitudes toward proposed or existing waste treatment facility sites were examined in six studies. One interesting finding, reported in three studies, was that public support tends to be stronger for the siting of incinerators compared to landfills (Che et al., 2013; Furuseth & O'Callaghan, 1991; Lober & Green, 1994). Furuseth and O'Callaghan (1991) found that respondents have a more positive reaction to incineration than landfilling. Factors related to social networking, such as membership, support, and involvement, were found to be significant in two studies. For instance, residents who perceive the environmental decision making process as fair, that sufficient information has been disclosed, that communication has been adequate, and that information sources are credible, are more likely to have more positive attitudes toward these sites. With regard to the design of a risk communication program in the area of waste management, Wiedemann et al. (1991) concluded that the kind of information given to the public should be guided by information demands expressed by the public; an information policy should be tailored to the motivational and cognitive conditions of the target audience to improve the reception of risk information.

Previous Research on Attitudes toward Former Sites

When industrial or commercial facilities reach the end of their life operating and are shut down, the sites effectively become brownfields properties. Due to the proliferation of brownfield sites, policies and regulations have been advanced to promote the remediation of these abandoned or derelict lands. While the conversion of brownfields provides potential opportunities, the question of how to make the right decision that would benefit the local community, the economy, and the city in a bigger scope, deserves thoughtful investigation. Nine empirical studies were identified and reviewed in this section (see Table 4.). The two main types of brownfield redevelopments examined here include brownfield conversion for economic redevelopment and for recreation use.

Table 4. Empirical studies examining redevelopment of brownfield and landfill sites

Author(s) (date)		Type of conversion; location	Study approach and sample
19	Yount & Meyer (1999)	Brownfield conversion for economic redevelopment; US	Interviews with developers and lenders (n=38) and brownfield redevelopment projects (20 small scale and 28 large scale)
20	Schoenbaum (2002)	Brownfield conversion for economic redevelopment; Maryland, US	Primary data analysis of Baltimore City deeds and tax assessment records
21	De Sousa (2003)	Brownfield conversion for recreation use; Toronto, Canada	Brownfield-to-green space projects (n=10) and interviews with primary stakeholders (n=12)
22	Howland (2003)	Brownfield conversion for economic redevelopment; Maryland, US	Case studies (n=3)
23	Mowen & Confer (2003)	Brownfield conversion for recreation use; Ohio, US	Mail survey of park visitors (n=500)
24	De Sousa (2004)	Brownfield conversion for recreation use; US	Mail survey of project coordinators/managers (n=20)
25	De Sousa (2006)	Brownfield conversion for recreation use; Illinois and Minnesota, US	Interviews with park visitors (n=479)
26	Wernstedt et al. (2006)	Brownfield conversion for economic redevelopment; US	Mail survey of private developers (n= 313)
27	Siikamaki & Wernstedt (2008)	Brownfield conversion for recreation use; US	Online survey of officials (n=446) and interviews with stakeholders (n=10)
28	Johnson et al. (2009)	Landfill conversion for recreation use, Ontario, Canada	Interviews with stakeholders (n=4), residents' comment cards (n=20), newspaper articles, and the master plan of the site

Brownfield conversion for economic redevelopment

For the last twenty years, the focus of brownfields redevelopment in the US has been on immediate economic gains. This has been accomplished through stimulating and promoting

industrial, residential and commercial conversion, and spurring investment from private developers. Brownfield redevelopment projects have resulted in increased economic opportunities, business development, and increased tax receipts (De Sousa, 2004; Siikamaki & Wernstedt, 2008). Of the studies reviewed in this section, one investigated differences between large-scale and small-scale brownfield redevelopments projects. Another examined the relationship between environmental contamination and land use and development, and the final two examined the impact of incentives designed to attract private developers to invest in brownfield redevelopment projects.

Yount and Meyer (1999), in the initial study in this area, conducted interviews with redevelopment project participants including developers, lenders, environmental site assessors, state environmental agency personnel, etc. Their results showed that large-scale brownfield redevelopments were more likely to be funded by government programs and receive attention and support from the public and community organizations. In contrast, small-scale projects, were less likely to be funded via government subsidies, had greater difficulty attracting private capital, and lacked detailed information on the steps involved in the remediation process.

Based on the assumption that pollution and brownfield redevelopment were systematically related, many states have passed brownfield legislation to exempt redevelopers from environmental liability. Schoenbaum (2002), in a study involving the brownfields in an industrial area of Baltimore, Maryland, tested this assumption. The study findings, however, failed to show that pollution systematically affects land use and development; and suggested that other unknown factors may be at work. One conclusion from this study is that brownfield legislation alone will not automatically lead to brownfield remediation and reclamation. Other factors such as public services, transportation and labor force access, or crime rates might

account for variation in land use, land value, and development and other economic incentives may be required to spur redevelopment.

The impact of incentives on brownfield redevelopment was first explored by Howland (2003), who investigated three case studies in Baltimore, Maryland. Her results showed that the private sector was more likely to invest in brownfield conversion projects when the market conditions were strong, contamination of the land remained relatively minor, and the future land use was for industrial purpose. Another study used a conjoint choice experiment to examine the relative importance of incentives that attract private investors to residential brownfield redevelopment (Wernstedt et al., 2006, see Table 5). The results of this study showed that private developers valued “protection from third party liability” the most, with “protection from cleanup liability” and “relief from public hearing requirements” also being important (p. 101).

Table 5. Incentives available in choice experiments (Wernstedt et al., 2006, p. 108)

Factor (incentive)	Factor levels (options presented)
Funds for assessing site contamination	\$0, \$100,000
Public hearing requirements	Required, not required
Relief from liability for cleanups	Available, not available
Relief from third party liability claims for environmental damages	Available, not available
Direct financial subsidies for site redevelopment	\$0, \$125,000, \$250,000, \$500,000

Brownfield conversion for recreation use

Another goal of brownfield conversion is to convert these former undesirable sites into parks and other types of recreational facilities. The benefits of converting sites for recreation use have been increasingly recognized among planners, communities, and environmental organizations (De Sousa, 2003). It is especially important to note that communities with residential areas adjacent to brownfield sites often occur in urban areas that suffer from a

shortage of green open space, such as parks, outdoor sports facilities, natural habitats, trails, and playgrounds. Increasing the number of parks and recreation areas in these settings would add much to the urban experience, enhancing livability and residents' quality of life (Harnik, 2000).

This section of the paper summarizes previous research that has examined the benefits, barriers, and facilitators associated with the conversion of brownfield to green space. Six empirical studies were identified. Of these studies, two investigated the public's perception of, attitudes toward and usage of parks that were transformed from brownfields; while the other four explored the primary issues, concerns, and processes involved in brownfield conversion for recreation use projects.

The benefits associated with brownfield/landfill-to-park projects can be viewed in terms of four categories: environmental benefits, social benefits, economic benefits, and technical benefits (see Table 6). The environmental benefits include ecological habitat creation, environmental renewal (e.g. soil and ground water quality), improvement of neighborhood aesthetics, scenic beauty, flood control, trail development and access to trails/water, and unique topographical features that enrich the inventory of open spaces and activities (De Sousa, 2003, 2004, and 2006). The social benefits consist of increasing areas for public recreation and leisure use, connecting places and spaces, enhancing public and community collaboration and involvement, providing models for future brownfield redevelopment, preserving historically significant sites, promoting health and wellness, and educating residents about habitat and environmental restoration (De Sousa, 2003, 2004, and 2006). As pointed out by De Sousa (2003), these projects "act as 'flagship' or 'marquee' demonstration 'experiments' that serve as models for future greening endeavors" (p. 194). The economic benefits include economic revitalization of neighborhoods and economic stimulation (De Sousa, 2003, 2004, and 2006). Finally, the

technical benefits from these types of conversion projects involve providing an opportunity to test and promote remediation technology and assess physical construction outcomes (De Sousa, 2003).

Table 6. Studies examining the benefits of brownfield/landfill-to-park projects

	# of studies that cite as benefit ^[references]
Environmental	
Ecological habitat creation	3 ^[21, 24, 25]
Environmental renewal (e.g. soil and ground water quality)	2 ^[21, 24]
Improvement of neighborhood appeal	2 ^[24, 25]
Scenic beauty	1 ^[25]
Trail development and access to trails/water	1 ^[24]
Flood control	1 ^[21]
Social	
Recreational opportunity enhancement	3 ^[21, 24, 25]
Connecting places and spaces	2 ^[24, 25]
Public collaboration and involvement	1 ^[21]
Serve as a model for future brownfield redevelopment	1 ^[21]
Preservation of historically-significant sites	1 ^[21]
Promoting health and wellness	1 ^[25]
Habitat education and environmental restoration	1 ^[21]
Economic	
Economic revitalization of neighborhoods	3 ^[21, 24, 25]
Technical	
Testing and promoting remediation technology	1 ^[21]

The numbers in brackets refer to the studies listed in Table 4.

Despite the many benefits associated with converting brownfields/landfills to green spaces, these projects are neither inexpensive nor easy to carry out in terms of cost, governmental support, public acceptance and other social aspects (De Sousa, 2004). Facilitators and barriers associated with brownfield/landfill-to-park projects are summarized in Table 7. These factors fall into the following four categories: policy-related, environmental, social, and managerial. Policies and regulations in relation to brownfields redevelopment emerged as the

most frequently cited factor as both a facilitator and a barrier. Specifically, while the presence of government funding will facilitate the implementation of greening conversion projects, the absence of government financial support will impede such projects. Other policy-related facilitators include political leadership, private funding and partnership opportunities, encouraging such projects in current city plans, and existing public ownership of the site. At the federal level, the Small Business Liability Relief and Brownfield Revitalization Act was passed in 2002, which authorizes up to \$250 million per year to support brownfield redevelopment for state and local clean-up programs (De Sousa, 2004; Siikamaki & Wernstedt, 2008). Other policy-related barriers include development of the site not being considered a top priority, the long duration of the redevelopment process and slow regulatory review, and high liability concerns. Environmental factors include brownfield location, availability of technology to remediate the site, open space needs, and accessibility of the site to the public. For example, De Sousa (2004) examined 20 brownfield redevelopment projects in US and found 13 out of 20 respondents identified the primary objective of the project was to provide recreational and open space to residents, particularly in under-served communities. Social factors include community involvement and collaboration, socio-cultural meanings associated with the site, trust in government, and perceived health impacts. A study examining local residents' reactions to a brownfield redevelopment project and found that residents opposed to the project because planners did not take into account the social-culture meanings of the site (Johnson et al., 2009). Finally, managerial factors include having clearly defined roles for each partner, availability of previous successful models, perceived economic benefits, long-term maintenance concerns, and having staff members experienced with such projects. For example, in a study examining the issues, obstacles and processes involved in brownfield redevelopment into green spaces projects

in Toronto, Canada (De Sousa, 2003), the author found that the second most-mentioned factor was the perception of debatable economic benefits. A lack of similar greening models to replicate was also concerned as key barrier to the greening of brownfield sites.

Table 7. Studies examining facilitators and barriers of converting brownfield sites for recreation use

	# of studies that cite as a facilitator ^[references]	# of studies that cite as a barrier ^[references]
Policy		
Political leadership	2 ^[21, 24]	1 ^[21]
Government funding	2 ^[21, 27]	3 ^[21, 24, 27]
Private funding and partnership	2 ^[21, 27]	
Component of a city plan	1 ^[24]	
Existing public ownership of the site	1 ^[27]	1 ^[24]
Not considered as an internal priority		2 ^[24, 27]
Duration of redevelopment and slow regulatory review		1 ^[24]
Liability concerns		1 ^[24]
Environmental		
Brownfield location (near floodplain or greenway)	3 ^[21, 24, 27]	
Environmental technology	1 ^[21]	1 ^[27]
Open space was needed	1 ^[24]	
Public access to the site	1 ^[28]	
Social		
Community involvement and collaboration	3 ^[21, 24, 28]	
Socio-cultural meanings	1 ^[28]	1 ^[28]
Lack of trust between public and private-sector stakeholders		2 ^[21, 24]
Uncertainty of health impacts		2 ^[21, 24]
Managerial		
Clearly defined roles for each partner	1 ^[24]	
Lack of previous successful models		2 ^[21, 24]
Low perceived economic benefits		1 ^[21]
Long-term maintenance issues		1 ^[24]
Lack of experienced staff members		1 ^[24]

The numbers in brackets refer to the studies listed in Table 4.

One conclusion from this body of research is that in order to implement a conversion project successfully, officials and planners need to account for a variety of possible influences. In particular, Johnson and her colleagues (2009) found that residents would not support a brownfield-to-park conversion project if the planners did not take into account the social and cultural meanings of such sites. In their study, respondents who lived close to a former landfill believed in the necessity of conversion; however, they opposed the proposed private park development because they perceived the conversion would threaten their access to the site and decrease the sense of place attributed to the area. Further, it was concluded that sense of place and privatization of public space were the two key concepts that contributed to support or opposition of the brownfield redevelopment plans. The results suggested that even though residents prefer parks and recreational facilities compared to other types of brownfield conversion projects, a successful brownfield redevelopment project also relies on the consideration of resident perceptions and other social impacts (Johnson et al., 2009).

To our knowledge, only two empirical studies have investigated public perceptions of and attitudes toward parks converted from brownfields (see Table 8). In one study that assessed public perceptions and use of an urban park transformed from a brownfield, Mowen and Confer (2003) surveyed 500 park users in Ohio, US. The results of a regression analysis demonstrated that intentions to visit this park were significantly related to perceived accessibility, convenience, compatibility, and relative advantage over existing neighborhood parks. The respondents who lived farther away from the park were less likely to visit the park regularly. Also, this study suggested that the creation of a park or green space that has been transformed from a previous brownfields does not guarantee widespread public acceptance and use. Some people who live close to a converted park may appreciate the changes, because they have witnessed and may

have participated in the process of such a transformation. Therefore, these people may hold positive attitudes toward the park and are willing to visit it once the park has been completed. However, “another viewpoint is that nearby residents are aware of previous land uses involving significant environmental degradation (i.e., illegal dumping of toxic material) and may be wary about venturing into these settings for recreational pursuits” (Mowen & Confer, 2003, p. 62). De Sousa (2006) targeted users of three parks in the Midwest US and found that the respondents had partaken in various activities regularly within all three parks that were transformed from brownfields. Additionally, 90% of the respondents preferred green space as the optimal redevelopment for brownfields and found that the transformation projects had positively influenced both individual and community quality of life.

Table 8. Empirical studies examining park users' perception of and attitudes toward brownfield-to-park projects

Author(s) (date)	Type of sites; location	Study approach and sample	Salient finding(s)
Mowen & Confer (2003)	Brownfields redevelopment for recreation use; Ohio, US	Mail survey of park visitors (n=500)	1. Future park visitation intentions were significantly related to perceived accessibility, convenience, compatibility, and relative advantage over existing neighborhood parks; 2. Residential proximity is also an important predictor for future park visit.
De Sousa (2006)	Brownfields redevelopment for recreation use; Illinois and Minnesota, US	In-person survey of park visitors (n=479)	1. Respondents had partaken in a variety of activities in parks converted from brownfields; 2. 90% of participants “felt that green space was a good use for brownfields”, which had enhanced their quality of life; 3. Respondents preferred projects designed to highlight site history (e.g., preserving previous structure and including educational signs).

Conclusions

Our goal in this paper was to provide an integrated overview of the current literature on attitudes toward waste treatment sites and their possible conversion for recreation use. Our review of prior work examining perceptions/attitudes toward proposed and existing waste treatment facilities highlighted the major impacts and key determinants that have been typically examined in this line of research. The impacts examined included those related to site operations (odors, trash/litter visible at the site), traffic at/near the site, concerns with groundwater contamination and other forms of pollution, psychological impacts including stress and uncertainty from living near the site, as well as concerns about property devaluation and perceived health hazards. It is important to note that the impacts identified were primarily negative (except for economic benefits associated with jobs, waste disposal efficiencies and revenue generation). As one reviewer noted, this is likely the result of our focus on residents' attitudes toward the siting of proposed and operation of existing facilities. In practice the siting and operation of these facilities cannot be fully separated from the broader issue of policy making about re-use/ recycling and residual waste treatment. Future research employing a broader scope of analysis and the viewpoints of additional stakeholders, would likely increase the number of positive impacts seen as relevant.

Of the factors examined as determinants of residents' perceptions/attitudes toward existing or proposed sites, distance from the site to residents' homes was examined most frequently; and had a consistently positive relationship with attitudes toward the site. Other determinants that emerged as consistently significant include measures of trust, involving the public during the decision-making stage, and perceived benefits/need for building the site, which tended to be positively related to attitudes; and measures of perceived risk, which tended to be

negatively related; and perceptions that the environmental decision making process was fair, that sufficient information had been disclosed, that communication had been adequate, and that information sources were credible, were more likely to have more positive site attitudes.

Demographic factors such as age, gender, education, income, and years at current address tended to yield mixed findings, with some characteristics significant in some studies, but not in others.

A possible explanation is that confounding may occur when particular demographics are grouped with other factors, such as distance from home to site, trust, and perceived risk, etc. This possibility suggests that attitudinal positions, rather than demographic characteristics, may be better predictors for understanding resident support or opposition toward these types of disamenity sites.

One additional conclusion from our review of prior research on existing waste treatment facilities is that prior studies have generally focused only on the impact of the particular facility (i.e., the incinerator or landfill) in question. However, as suggested by Deaton and Heohn (2004), waste treatment facilities are often sited close to other urban disamenities such as railroad lines, storage tanks, noisy industrial operations, and other sources of odors or air pollution. It is quite possible that resident perceptions of the impacts of a particular waste treatment facility might be driven in part by their perception of the other sites or disamenities located nearby. These “co-mingled” effects should be taken into account in future investigations.

In the context of proposed sites, local residents generally express opposition (in the form of NIMBY concerns) in response to proposals to site undesirable facilities in their community. In general, previous studies have shown that while the local residents often acknowledge the necessity of waste treatment facilities, these residents perceive that the costs incurred would exceed the benefits received (Elliot & McClure, 2009; Lober & Green, 1994; Rahardyan et al.,

2004). Residents' reactions to proposed sites, however, are likely to focus solely on the immediate use of the site for waste treatment. However, as noted earlier, landfills and certain other waste treatment facilities often have limited operational windows. Thus it is possible that incorporating an after-use plan in the initial waste facility project proposal, i.e., a plan for converting the site for future recreation use in a specified number of years (in essence improving the long-term benefits obtained from the project), might help garner support, or at least alleviate opposition, for the proposed project. Future research could be conducted to explore this possibility.

Our review of the studies that have been conducted to understand the general issue of brownfield conversion for economic redevelopment focused on the context of large-scale versus small-scale projects, different degrees of environmental contamination, and the potential impact of selected economic incentives. And our review of the few studies that have examined brownfield conversion for recreation use summarized the major environmental, social, economic, and technical benefits as well as the key facilitators and barriers associated with these projects. An important conclusion from this analysis was that in order to be successful, government officials and conservation planners and leaders will need to consider the potential impact of multiple policy, environmental, social and managerial influences on the redevelopment projects. We found only two studies that have examined public perceptions of parks that have been transformed from former landfill or brownfield sites. While attitudes toward these projects were generally positive, both studies investigated only current park visitors; and thus ignored the perceptions and attitudes of other community residents that have not or will not visit the park. Future research is needed to better understand the full range of attitudes toward visiting park/recreation facilities converted from prior landfill or brownfield sites.

Former brownfield/landfill sites represent great potential, especially for those interested in landscape change and sustainable development in urban settings. Sustainable development is an increasingly important concept that refers to “establishing long-term strategies and a global ethic in regard to how efficiently our advancing society is going to utilize and manage the natural resources we harness and the synthetic resources we create” (Dorsey, 2003, p. 70).

Redevelopment of brownfields and the creation of parks and green space are especially important in promoting sustainable development in urban settings (De Sousa, 2006; Doick et al., 2009). A key issue centers on how to gain support from the different stakeholders that might be involved in a brownfield-to-park project. Based on the studies reviewed in this article, funding to cover the project costs is the foremost factor that can keep brownfield-to-park projects from happening (DeSausa, 2004). However, DeSausa (2006) pointed out the brownfield-to-park projects potentially have multiple types of economic benefits. The conversion of a brownfield or landfill site to a park or green space may well increase property values in the area, attract additional residential development, promote business investment, and expand tax revenues. Additional research is needed to examine the potential of these multiple economic impacts in initiating and sustaining these types of redevelopment projects.

Another area that needs additional research is how to promote park visitation at existing converted sites, especially among people that may hold negative attitudes toward such parks. One possible direction is to examine options for persuasive communication and messaging strategies. Prior recreation research has used this approach to promote park visitation in more traditional park settings (Brown, Ham, & Hughes, 2010; Taff et al., 2014) and examine the acceptability of park user fees (Steckenreuter & Wolf, 2013).

In addition, the review identified only three longitudinal studies have examined the attitudes of local residents living near waste treatment facilities (Elliott et al., 1997; Elliot & McClure, 2009; Lima, 2004). None of these studies, however, was conducted in the context of a facility that was closed and transformed into a park or other recreation area. Future research is needed to examine how attitudes toward parks converted from former landfills and brownfields change over time.

Finally, it should be noted that the studies considered in this were literature review involved facilities in North America, Europe and in the more developed parts of Asia. As one reviewer noted, the issues and problems of land-fills in developing countries such as Africa, Asia and Latin America are often very different. In addition, the approach used in this paper to examine the factors and determinants impacting resident perceptions/attitudes toward waste treatment sites emphasized those that emerged across the particular studies included in this review. It is possible, however, that certain factors or determinants may play a more prominent role in particular contexts and circumstances and may vary across the integrated process of pre-project planning and decision making, project realization, and post-project monitoring and evaluation. A key issue for both future practice and research is how to combine the insights provided by this review with the conditions and concerns that are unique to a particular setting or case study.

This review provides a synthesis of prior work on waste treatment facilities and their potential conversion for recreation use and thus represents an important point of reference for future research on landfill/brownfield redevelopment. Continuing to explore the dynamics of these sites and their possible conversion for recreation use remains a significant opportunity for public authorities and an important topic for landscape/urban scholars and research scientists.

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