

**TOWARD LOCAL BROWNFIELD REGENERATION:
RE-CATEGORIZATION BASED ON LANDSCAPE VALUE AND FACTORS
AFFECTING REUSE PLANNING AND RESIDENTS ENGAGEMENT**

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Planning and Residents Engagement**

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ABSTRACT

Planning and design of brownfield landscapes are not straight forward due to invisible, potential contamination. The dilemma occurs to designers in dealing with brownfield landscapes, because they are unknowingly able to deliver deceptive information regarding the site safety. If the designers and planners are given the information about factors affecting people's reaction to different characteristics of brownfield landscapes, this would help them to be better prepared for ethical issues. For this study, visual preference survey for neighborhoods along the rail yard in the City of Roanoke was conducted. A dimensional analysis found six brownfield landscape types. First of all, historical landmark and maintained landscape types received the highest ratings regardless of the participants' characteristics and backgrounds. These types may be viewed less critically and are thus likely to mask potential harms. Second, scruffy vegetation and modest rundown building types that made up the second preferred group revealed more ambivalent feeling. People were highly flexible in switching between change or preservation options in their thinking, thus it would be easy to lead people to focus on certain aspects according to the designer's purposes. Lastly, the two industrial remnant types were the least preferred group. Participants tend to associate these types with toxic pollutants that are likely to adversely affect the health, thus, it would be important to reassure people regarding safety concerns. The expert interviews with brownfield program managers of many localities (Roanoke, VA; Portland, OR; Toledo, OH; Phoenix, AZ; Lewisville, TX; Arlington, TX; and New Bern, NC) were conducted to determine whether the current approaches are effective and develop recommendations. The interviews found that the effectiveness of program is greatly challenged by normative site assessment required by federal government. While the procedure provides necessary

information about site safety, it also attaches a stigma to sites regardless of actual contamination level. Based on the findings, it is recommended to include assessment criteria that reveals reuse potentials of brownfields for balanced approach. The results provide useful information for program managers, planners and designers regarding important factors that should be considered for site prioritizations and preparation and presentation of designs for brownfield reuse.

DEDICATION

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CHAPTER 1: INTRODUCTION

Urban sprawl, deindustrialization, and changing trends in settlement types based on the drastic reduce of transportation cost have created a considerable amount of abandoned land in and around our cities during the last few decades. It is estimated that waste or contaminated land occupies 32.2% of the global lands, with 5 million acres in the U.S. alone (Kirkwood, 2010). Considerable effort has been devoted to dealing with contaminated land in the United States in recent years and the evolution of environmental policies and programs in this area have shaped the use and perception of the nation's abandoned industrial property (Gorman, 2003). The environmental laws passed since the 1960s reflect society's growing realization of the need to protect our environmental health and have played a significant role in stigmatizing the heavy industrial sites that potentially pose the most serious pollution hazards (Russ, 2000). However, since the 1990s, the focus of the regulations has changed and the emphasis is now on programs that facilitate the remediation and reuse of abandoned industrial and commercial areas. The term "brownfield" was coined in this period by practitioners and researchers who had realized that existing policies designed to protect the environment were actually inhibiting the clean-up and reuse of former industrial and commercial sites (Hollander et.al, 2010).

1.1 RESEARCH BACKGROUND

Attitudes to brownfield sites have changed considerably in recent years. In the past, efforts have largely been devoted to the cleanup of large, highly polluted areas. This left many smaller, less polluted sites, often in urban or suburban areas, relatively neglected. These

areas, which typically consist of small abandoned industrial and commercial sites and vacant lots in neighborhoods, are problematic since people living nearby continue to suffer from urban blight and the associated lack of amenities and reduced property values. Now, however, the focus of brownfield policies and programs has shifted from the clean-up of national priority sites to the reuse of local-level brownfields. Although the approaches used to assess and cleanup national priority sites that are highly polluted are well established, there are as yet no clear guidelines for assessing, reusing and designing sites that are less polluted such as local-level brownfields and it is not always obvious how to engage the local community in these projects. This suggests several significant questions regarding dealing with brownfields: Is the current approach or strategy effective for all brownfield classification, management and planning initiatives, including those for sites that are only lightly or non-toxic? If not, how can we assess, plan to reuse and design neglected local brownfield sites? How can the local community become more involved in process?

In this new planning environment, alternative strategies that focus on reuse and design approaches and community engagement have become more important. The major issues regarding brownfield have often been regarded as highly technical problems that can only be solved by a group of experts including scientists and engineers. Design explorations and community involvement are often pushed lower on the priority list. Several scholars including Comp and Arbogast have pointed out the need to seek a balance in dealing with brownfields by reinforcing these aspects. “Degraded environments are cultural artifacts as much as they are problems for science, and we must address these problems with the full range of the arts and humanities, as well as the sciences, if we are to be effective” (Comp,

2008, p. 63). Arbogast argues that “what is needed is the willingness to experiment and see what the world of design and planning has to offer the world of earth science and vice versa ... landscape architects have the methods and tools to create a dialogue between science, [post-industrial areas], and society” (Arbogast, 2008, p. 52; p. 55). Based on those arguments, another overarching question arises: How important is appearance and design in dealing with potentially harmful brownfield sites?

1.2 RESEARCH PROBLEM

Planning and design for brownfield landscapes are not straight forward procedures due to their potential contamination, which is not always immediately visible. The dilemma worries designers dealing with brownfield landscapes, because they may be unknowingly delivering deceptive information to others, including local residents, which can lead to serious ethical issues. Krinke argues, “Aesthetically pleasing and psychologically acceptable solutions such as phytoremediation ... [involve] the risk of losing the public vigilance against future contamination” (Krinke et.al, 2001, p. 50). Erdem and Nassauer (2013) noted that “the appearance of the landscape can influence exposures to residual contamination by cueing the behavior of humans and other organisms” (Erdem and Nassauer, 2013, p. 277). Further, they insist that “brownfield design can be more precautionary by using the power of appearance to affect human and wildlife behavior, ... [but] designers have little guidance for making precautionary design decisions (Erdem and Nassauer, 2013, p. 289). On the contrary, the appearance of brownfield landscapes may also cause fear or negative feelings; brownfield design that preserves industrial remnants can provoke fears of residual contamination even

when the original contamination has been completely removed. The challenge to designers, who must balance an awareness of residual contamination or reducing the stigma and satisfying clients, has been pointed out (Erdem and Nassauer, 2013).

People's reaction to the appearance of a design is based on more than what they see in a design plan; it is also influenced by their past experience and understanding. Thus, their reactions to brownfield landscapes implicitly represent their attitude toward brownfields in general. If designers and planners are able to understand the way people react to brownfield landscapes and are given the information about significant factors affecting people's reactions, they will be far better prepared to deal with the associated ethical issues. This study will provide baseline data that help designers and planners better predict how their designs will influence people's attitudes and behavior.

Research into environmental perceptions can provide valuable insights into the relationship between human behavior and the environment (Maulan, 2006), so identifying people's reactions to different types of environments represents useful research that will provide planners and designers with information that they will be able to apply in their work. The design of local brownfield landscapes in neighborhood settings extends beyond superficial surface changes. Neighborhood satisfaction is closely related to a community's perceptions of the environment in which they live. However, there is very little research on people's attitudes and preferences regarding abandoned and underused land in a neighborhood setting.

1.3 SIGNIFICANCE OF THIS STUDY

“Cities such as St. Louis, Detroit, Buffalo, and New Orleans lost as much as half of their populations from 1950 to 2000 ... [with] the collapse of manufacturing industries and the shift to a service economy” (Hollander, 2011, p. 4). Added to these longstanding concerns, more recently a number of states, including Florida, Nevada, and California, are also experiencing population loss and housing abandonment as a result of the collapse of the real estate market since 2006 (Hollander, 2011). For example, “in Southwestern Atlanta, some neighborhoods have experienced 40 percent abandonment rates due to mortgage fraud and delinquency, ... in 2008, Phoenix’s Maricopa County had 13,000 homes in foreclosure, 600 percent higher than the previous year” (Fletcher, 2008, as cited in Hollander, 2011, p. 5). To bring the jobs and people back, many cities are spending significant amounts of public money and competing with each other to lure new businesses. For example, Orlando recently attracted a major medical research institute to the city, in the process spending \$1.2 million for every job created. This shows how difficult it is to make changes in a city’s fundamental economic structure. For those cities and neighborhoods experiencing the changes described above, repopulation is not going to happen quickly or easily. For some cities, along with trying to grow and develop by attracting new businesses, it is important to focus on improving the quality of life for those who still live there. In this regard, this study examines how to manage abandoned areas in neighborhoods.

1.4 GOAL AND OBJECTIVES OF THE STUDY

The goal of this study is to gain a better understanding of people's reactions to different types of brownfield landscape and the factors that affect those reactions. This will provide important base-line data for those involved in the planning and design process supporting the reuse and management of local brownfields located in neighborhood settings. The study engages people from the local community in neighborhoods alongside the railway in the City of Roanoke, Virginia, where there are approximately sixty brownfield sites scattered across the city.

The six major objectives of this dissertation are:

- 1) Identify the environmental factors that significantly affect people's attitudes and preferences for brownfield landscapes;
- 2) Develop a brownfield typology based on found environmental characteristics;
- 3) Identify people's characteristics and backgrounds that affect their attitudes and preferences for different types of brownfield landscapes;
- 4) Determine whether the current approaches to brownfield management in these localities are effective
- 5) Identify the challenges experienced by local brownfield program managers; and
- 6) Develop recommendations for the management, planning and design for the reuse of local brownfields in neighborhood settings.

1.5 RESEARCH QUESTIONS

Based on the above objectives, a series of research questions were developed to guide the study direction and define the scope of this study.

- 1) What are the significant environmental characteristics of brownfield landscapes that influence people's attitudes and preferences for brownfield landscapes?
- 2) What sort of typology will best describe brownfields based on these environmental characteristics?
- 3) What are people's attitudes and preferences toward each type of brownfield?
- 4) What are people's characteristics and backgrounds significantly influence their attitudes and preferences for each type of brownfield landscape?
- 5) What are the existing procedures used for local brownfield planning and management?
- 6) What are the challenges experienced by brownfield program managers to implement brownfield programs?

1.6 Organization of This Dissertation

This dissertation is organized into five different chapters: an introduction, a review of the literature, a description of the methodological approaches used to design the study, the results of the study, and a discussion of the results. This "Introduction" chapter briefly summarizes the importance of the reuse and design approach and community engagement in dealing with local brownfields in new environment. It also identifies the research problems, the significance of this study and its goals and objectives of study, and the research questions.

The “Literature Review” chapter provides the information needed to understand the background of the study, focusing specifically on aspects such as emerging issues related to post-industrial areas and changing approaches to brownfields. This chapter also provides the theoretical context for the methods used to develop a better understanding of the perceptions of those living alongside brownfield areas based on a review of the relevant literature.

The “Methodology” chapter provides a description of the methods and procedures used in this study and is divided into three sub-sections. The first sub-section revisits the study objectives, research questions, and how they are addressed in the research. The second sub-section describes the study design adopted for the survey and expert interviews. For the resident survey, the survey area and participants, the survey instrument, the survey administration and the data analysis are described. Then, for the brownfield program manager interviews, the participants, protocol, procedure and data analysis follows. The chapter concludes by summarizing the methods used for the study design.

The “Results” chapter provides a description of the findings from the residents’ survey and the interviews with the brownfield program managers. The first three sub-sections describe the findings from the analyses of the residents’ visual preferences survey for a range of brownfield scenes. These findings include the environmental factors affecting residents’ attitudes and perceptions of brownfields, their most and least preferred brownfield types and residents’ background factors that affect their attitudes and perceptions toward brownfields. The fourth section presents the important findings from the interviews with local brownfield

program managers regarding the challenges faced in implementing brownfield programs.

The last sub-section summarizes the study findings

Lastly, the “Conclusions and Implications” chapter includes a summary of the major findings and discusses how they relate to existing theory, as well as their implications for the planning and design of brownfield landscapes. The implications include a number of recommendations, including policy recommendations for local governments, recommendations for planners and designers involved in the preparation and presentation of designs for the reuse of brownfields, and recommendation for the profession (ASLA) and educators (CELA) seeking to better prepare their students for real-world practice. Lastly, the limitations of this study and useful directions for future research are discussed.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews the pertinent literature in this research area, focusing particularly on a wide range of issues regarding post-industrial areas, as well as the theoretical context of the methods used to understand the perceptions of those living in such areas. This chapter is divided into four sections. After reviewing the phenomena leading to the appearance of brownfield sites in our cities and towns, the definitions of brownfield sites based on multiple external and internal factors affecting them and recent changes in approaches to dealing with them will be discussed in the first two sections. The third section of this chapter reviews the legacy of environmental perception research methods used to help develop a better understanding of the perceptions of those living alongside brownfield sites. This review includes a number of different research approaches based on expert and non-expert paradigms, as well as a review of previous studies of people's perceptions of brownfield sites.

2.1 THE EMERGENCE OF POST-INDUSTRIAL AREAS IN OUR CITIES

This section reviews the phenomena leading to the emergence of post-industrial areas in our cities and is divided into two sub-sections. The first sub-section discusses varying definitions of brownfields and the second sub-section reviews related environmental policies in the U.S.

As a result of urban sprawl and deindustrialization, immense abandoned spaces in both city centers and the outskirts of our cities have been created. These huge areas are an unexpected by-product of industrialization, and the phenomenon has been accelerated by a drastic decrease in transportation costs and changing trends in settlement types. As the term

‘post-industrial’ suggests, the existing definition and perspective "narrowly isolates and objectifies the landscape as the by-product of [past] process [es] no longer operating [in sites]" (Berger, 2006, p. 200). Moreover, the negative connotations associated with brownfield sites related to contamination and environmental hazards have created barriers to any consideration of post-industrial areas as a potentially useful space. “The image of a brownfield brings to mind massive sites littered with industrial residue and decaying polluted structures that symbolize urban blight” (Hayek et al., 2010, p. 462).

The U.S. Environmental Protection Agency (EPA) estimates that there are about 450,000 to 1 million waste sites nationwide (Golden et al, 2012). In spite of their expected negative impacts on their surrounding areas, these sites are marginalized by governments due to a lack of monetary resources and economic feasibility. According to the EPA’s estimates, approximately 96% of these sites are neglected due to a lack of assessment and clean-up money (Golden et al., 2012). These lots effectively exist in a city vacuum while generating negative images of rundown city neighborhoods. These brownfield sites have long been regarded as problematic and this neglect could be even more serious when they are located in residential neighborhoods because residents continue to experience a blighted environment, a fear of potential danger, a lack of amenities, and reduced property values. The background presented here provides information about how the research for this dissertation can contribute to make rundown neighborhood conditions better by providing helpful guidelines for the reuse planning and design of these areas that could lead to greater residential satisfaction and area-wide revitalization.

2.1.1 Definitions of Brownfields

This section reviews the various definitions of brownfield sites influenced by multiple external and internal factors. The definitions of “brownfield” shows their diversity, represented in Figure 2.1 by the terms commonly associated with them (Alker et al., 2005) which include “derelict”, “vacant”, “previously developed”, and “contaminated”. There are clear differences in the way brownfield sites are perceived in different parts of the world. For example, while the notion of brownfield sites in European countries emphasizes the vacant status of the land, being driven by the need for more land to be made available for development, in the U.S. more emphasis is placed on the potential contamination of the land due to the ready availability of land and the high priority Americans place on the need for protection from environmental hazards (Oliver et al., 2005; Alker et al., 2000). The most widely used definition of brownfield sites in the U.S. is that espoused by the EPA: “Abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination” (EPA, 1993). The negative connotations associated with

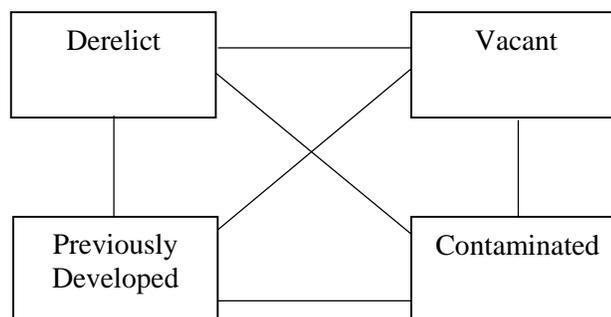


Figure 2.1 Terms Commonly Associated with Brownfield Sites
Reference: Alker et al., 2000: 56

brownfield sites tend to be somewhat exaggerated by the political and social context in the U.S., where the environmental laws passed since the 1960s that have reflected the growing need to protect the nation's environmental health and has thus played a significant role in stigmatizing the brownfield sites as potentially posing the serious pollution hazards (Russ, 2000). The following section will discuss in detail how the successive environmental regulations governing brownfields in the U.S. have played a role in stigmatizing these lands.

2.1.2 Environmental Policies and Brownfields in the U.S.

This section reviews the environmental policies related to brownfields in the U.S. As a result of the greater attention that has been paid to environmental protection since the 1960s, the U.S. EPA has administered the nation's environmental regulations, particularly those related to brownfield sites, and developed various policies and programs to identify and clean up these sites. The types of policies and programs proposed and implemented during this period can be grouped into two general approaches, the first of which imposes heavy liabilities on all the potentially responsible parties. One of the most influential federal regulations governing contaminated sites was the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the so called Superfund Act of 1980. Under this act, the federal government imposed strict liabilities that are retroactively applied to all of the potentially responsible parties for the entire cost of the clean-up, as well as compensation for the damage to natural resources (Bartsch and Collaton, 1997). In addition, the government also collected funds for Superfund project sites by taxing the entire industrial community.

The second approach applied during this period was to identify the hazardous sites

nationwide. Based on a hazard rating system (HRA), a score of 28.5 or higher will lead to a site being designated a Superfund site and earn it a place on a national priority list (ICMA, 2001). While the HRA could serve as a defining element in categorizing brownfield sites, its usefulness falls short in that “the break point of 28.5 was arbitrarily selected to meet [the] requirements of adding at least 400 sites in the NPL dictated by Congress when the superfund law was enacted in 1980” (ICMA, 2001, p. 4). In addition to the national priority list (NPL) and in order to track the different types of risky sites, a range of programs were established according to the type of brownfield that was being focused on. For example, a program established under the Resource Conservation and Recovery Act (RCRA) of 1976 tracks active and potential industrial facilities that pose potential risks through the use of a hazardous waste handler tracking system, while the Underground Storage Tank (UST) program introduced in the mid-1980s focuses on the management of underground tanks containing hazardous chemicals to minimize future leaks. In general, these programs are based on hazard rating or tracking systems and so many smaller, less polluted sites have been relatively neglected. Interestingly, many of these efforts by federal government seem to be a double edged sword. While the policies and programs related to brownfield sites were launched with good intentions to identify, clean up, and manage nation-wide post-industrial areas, they have in many cases created obstacles that set back redevelopment by stigmatizing the sites. This historical background regarding relatively neglected brownfields and the negative connotations attached to them highlights the significance of this study, which is intended to help planning and reuse design of these small, lightly-toxic lands in local areas, thus bringing them back into productive use.

2.2 CHANGING APPROACHES TO BROWNFIELD SITES

As mentioned above, this section reviews the recent changes in approaches to dealing with brownfields. Based on a wider recognition of the problems described above, recent years have seen a huge shift in ways of dealing with brownfield sites. Although brownfield sites have been around for a long time, the actual term “brownfield” originated during the 1990s, when practitioners and researchers saw how existing policies designed to protect the environment were inhibiting the clean-up and reuse of former industrial and commercial sites (Hollander et al., 2010). However, as described above, in recent years the focus of brownfield policies and programs has begun to change from the clean-up of national priority sites to the rehabilitation and reuse of local brownfield sites.

This change is based on the widespread changes in perception of practitioners and researchers, who have begun to see brownfield sites as valuable opportunities and resources for revitalizing cities and neighborhoods, particularly as potential green amenities or community facilities of the types that are so badly needed in the heavily urbanized environments in which many people now live and work. Brownfield sites are now believed to be able to "potentially support the understanding of landscape not just as a product, but as an agency for ecological, cultural, and social change" (Langhorst, 2004, p. 6). In addition, while there has been an apparent widespread reluctance in the U.S. to counter deterioration, derelict landscape are often considered to carry a sense of sadness for what is lost and are also regarded as speaking with evocative power from a sense of mystery (Jakle and Wilson, 1992). Often, the favorite play spaces for children and teenagers are not the playgrounds designed for them, but derelict places such as weed-filled lots, back alleys, junk yards, and

railway corridors (Southworth, 2001). Similarly, artists often feel most creative and stimulated in spaces and neighborhoods that appear to be somewhat neglected or rundown (Southworth, 2001).

Based on those changes, there has been a shift in the focus of brownfield programs from highly polluted post-industrial clean-up to local brownfield reuse. In addition, the programs are now placing a renewed emphasis on bottom-up approaches where the principle agent is no longer a federal agency but the local government. Earlier programs, initiated in the 1980s, have mostly relied on a top-down approach to managing urgent sites in order to protect the public from serious hazards, for example by utilizing CERCLA's hazard ranking system and the hazardous material handler tracking system included in the RCRA program. However, since the 1990s programs have been based on bottom-up approaches, such as the brownfield pilot programs and brownfield area-wide planning programs implemented by many cities and local community programs. Through a national competition, the Brownfield Pilot Program has awarded clean-up grants to more than 50 cities and the most recent phase of this program, the Brownfield Area-Wide Program (BF AWP), provided approximately \$4 million in grant funding for 23 local communities between 2010 and 2012. Each community has received \$175,000 (EPA BF AWP program fact sheet, 2012). Moreover, the program focus has changed to promoting reuse activities and community engagement. For example, the programs are encouraged to include a statement of primary benefits such as improvements in amenity values that lead to a better quality of life for local residents (Jenkins, Kopits & Simpson, 2006).

Based on the above literature review regarding brownfield policies and programs, the priority now seems to be to achieve a balance in policies and programs between those that focus on contamination risks and those that focus on the reuse opportunities of brownfields. While previous policies and programs focused on identifying sites, imposing fines on liable parties and regulating related activities, the focus now has shifted towards promoting reuse activities that will eventually bring broader economic and community benefits.

These recent changes show that the timing of this study is opportune as one of the objectives of this study is to provide helpful guidelines and recommendations for reuse planning and design of brownfields. This study will help to reveal new opportunities for brownfield reuse and thus will support the balanced approach to brownfields that is required in the new environment. This will also provide helpful guidelines for local initiatives.

Community Engagement in the Reuse and Design of Brownfields

As described above, there has been a shift in the focus of brownfield programs from highly polluted post-industrial clean-up to local brownfield reuse. In this new environment, a participatory planning process that engages the community, applied in conjunction with a reuse and design approach, seems to have become more important. This section discusses these issues, along with a review of the research in this area.

In order to achieve democratic planning ideas that correspond to contemporary conditions and take into account a wider range of interest groups, the communicative approach to planning has been suggested as an alternative to the traditional planning process based on a comprehensive plan put together by a few trained professionals. Habermas' communicative action theory provides a useful theoretical foundation for communicative

planning in that it emphasizes a “reasoning process based on diverse interactions among active agents ... planning is understood as an interactive and interpretive process involving communicative work among participants, during which issues, problems, strategies and policy ideas are given form and meaning” (Healey, 2006, p. 91). Without falling prey to extreme post-modernist ideas, such as nihilism¹ or fundamentalism², Habermas maintains the “reasoning” idea of modernism, arguing that the “truth” can be found not solely through reasoning based on scientific rationalism, but in diverse ways including reasoning through mutual interaction. Rather than rejecting the idea of reasoning, narrowed and constrained by scientific rationalism, he expanded the conception of reasoning.

Too often the approach to transforming abandoned or derelict city lots has been driven by economics and litigation (Greenstein & Sungu-Eryilmaz, 2004). Brownfield programs that support brownfield redevelopment typically follow a well-established process, starting with site identification and then moving on through site assessment, and remediation to the final reuse and design stage (ICMA, 2001) (see Figure 2.2). Based on this procedure, brownfield sites represent a knotty issue with inherent problems such as contamination risks that require site assessment and remediation, and potential liabilities that require specialized knowledge. Therefore, it is not hard to assume that trained professionals such as city officials, site engineers, scientists, and planners with expertise in the relevant disciplines will inevitably play a dominant role in planning for brownfield sites to deal with potential site

¹ Originating in Greek philosophy and Sophist ideas, nihilism refers to a certain belief or philosophical doctrine that negates meaningful aspects of life. The term is often used in association with anomie and desperate conditions based on the thought that life is without meaning or intrinsic value

² In contrast to nihilism, fundamentalism is associated with the strict adherence to certain doctrines or beliefs and excludes all others. The term is often used in religion to emphasize ideological purity but is not limited to this.

contamination and liabilities related. Moreover, dealing with brownfield sites with public engagement is complicated due to its double-sided aspects of "contamination risk" and "reuse opportunity." Different framing of brownfield issues can cause a "brownfield disconnect [where] the effectors [such as practitioners in EPA or city government] saw brownfields as an environmental issue of contamination and remediation, whereas the affected [local community] saw brownfields as a neighborhood planning issue dealing with details of the redevelopment" (Solitare, 2011, p. 933). This may be because local people are often not involved in the problem identification and prioritization stage of the process, and hence concentrate primarily on the final redevelopment decisions.

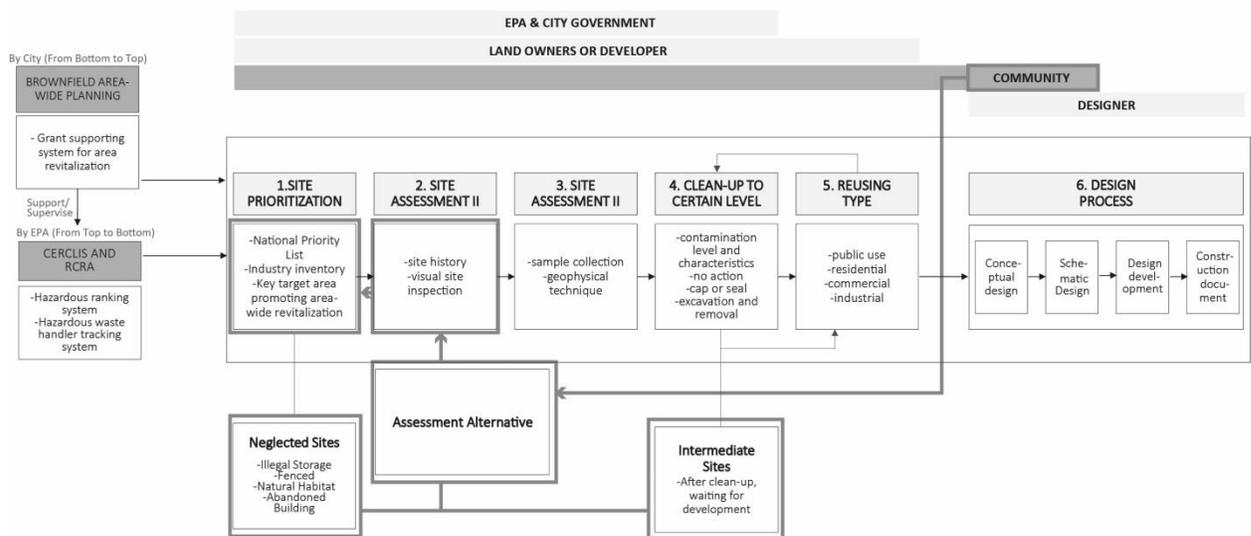


Figure 2.2 Typical Brownfield Management Procedure (ICMA, 2001, Organized by the Author)

In this regard, a participatory planning process that engages the community is expected to help overcome these challenges. First of all, it can be a good instrument for attracting people's attention to neglected brownfield sites. It also can bring multiple

perspectives and issues to the table through the participation of diverse stakeholder groups, as well as supporting more balanced decision-making with multiple objectives rather than a single objective. For example, for site assessments, in addition to the government's hazard rating system based on contamination, other assessments that focus on the visual, ecological, and social aspects of brownfield sites become more relevant when this approach is used. Carlson (2011) maintains that community involvement is even more important in brownfield redevelopment, since it could contribute to changing public perceptions of brownfield sites (Carlson, 2011). The stigma of contamination can be lessened through a better understanding of the risk to health through risk communication and feasible remediation solutions.

In addition to community engagement, a reuse approach to design seems to be becoming increasingly important. Contemporary discourse regarding brownfield reclamation seems to be placing a greater emphasis on the design value and landscape quality aspects of projects. As Comp argues, "Reclaiming any other environmentally damaged area in which communities have a stake, needs more than a technical fix" (Comp, 2008, p. 75). The creation of a higher quality landscape based on creative design ideas is now a significant factor for successful remediation projects. Kirkwood explains that "The logic and needs of a technological task can inspire and shape thinking about conceptual site design in that spatial, experiential and aesthetic clues can be drawn from technologies" (Kirkwood, 2001, p. 7). In the book *Beyond Preservation*, Hurley explores the possibility of "rediscovery", which makes landscape preservation and interpretation such a powerful revitalization and community-building tool (Hurley, 2010). The South Waterfront in Portland, a post-industrial area which was once known for its shipyards and lumber mills, has successfully maintained

its continuity with the past and facilitated historical interpretation because the design called for the incorporation of industrial artifacts into displays of public art (Hurley, 2010).

The above review of the literature reveals a critical research need for a relevant guidelines for a reuse and design approach to local brownfields that can be applied in conjunction with a participatory planning process that engages the community. This is an overarching goal of this dissertation.

2.3 LANDSCAPE ASSESSMENT

As mentioned in the introduction, the second major section of this chapter provides the theoretical context for research methods that can be used to understand people's perceptions of post-industrial and abandoned area landscapes. It includes a review of environmental perception research, which has accumulated a body of knowledge relevant to the perception of natural landscape (Woods, 1995). This section is divided into three subsections. The first sub-section describes five different approaches for landscape assessment, largely based on expert and non-expert paradigms. The second sub-section focuses on one of those approaches that is particularly well-suited to the objectives of this study, the so called psychological approach. It further reviews preceding studies that have used landscape preference methods based on the psychological approach along with the theoretical context. Lastly, the third sub-section reviews perception and preference studies that specifically deal with brownfields.

This section begins by reviewing the landscape assessment studies that directly influence the methods used in this study. Historically, landscape assessment has been an important area of study due to the need to manage scenery along with other resources, such

as timber harvesting and mining. Since the 1960s, there has been a movement to protect the natural scenery as a valuable resource, accompanied by efforts to minimize the visual impact in a development context, enhance landscape quality and increase recreation opportunities (Gobster, 1999). Landscape assessment research has responded to legislative mandates and landscape management, planning and design issues. The theoretical background of landscape assessment, shown in Figure 2.3, is based on a model of shared human and landscape interactions that explains how landscape perception is comprised of these two components.

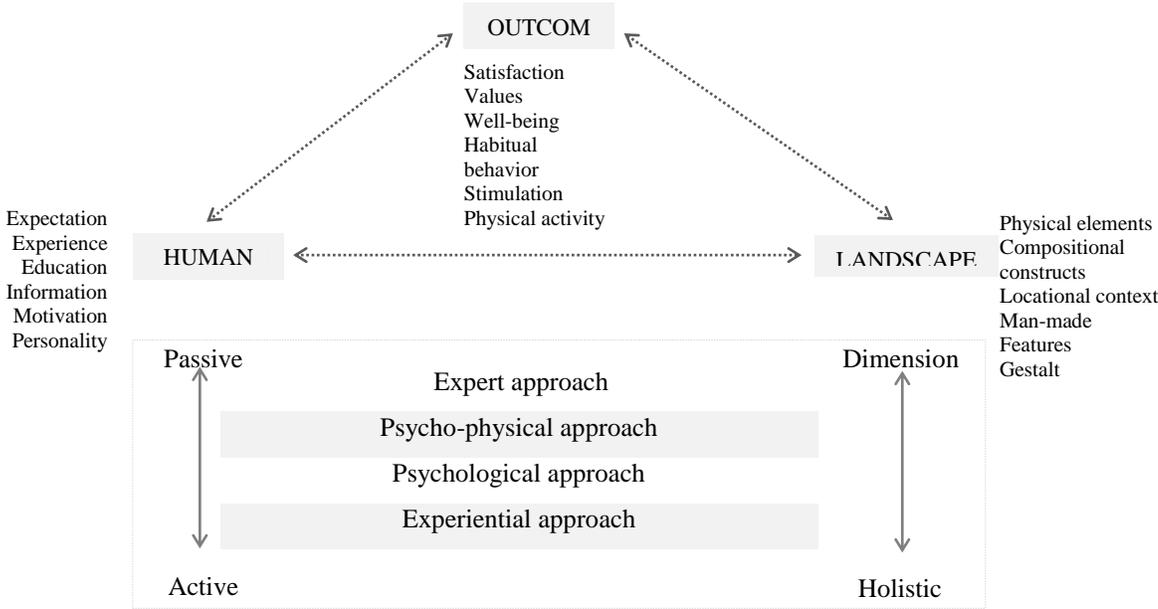


Fig 2.3 Human and landscape interaction model
Reference: Zube et al. (1982)

In this model, landscape perception is considered to be a function of the interaction between human components such as past experience, knowledge, and socio-cultural context and landscape components including various physical properties of the landscape (Zube et al., 1982). According to their relative concentrations on the human, landscape, or interaction

components, scholars have developed a number of very similar classifications for landscape assessment approaches based on expert and non-expert paradigms (Zube et al., 1982; Daniel & Vining, 1983; Lothian, 1999; Daniel, 2001). The following sub-sections discuss each of these landscape assessment approaches in turn.

2.3.1 Legacy of Landscape Assessment Research

A review of the literature in this section reveals two very different approaches to landscape assessment: expert paradigms and non-expert paradigms. The expert paradigms can be divided into ecological and formal aesthetic approaches and the non-expert paradigms can be divided into psychophysical, psychological, and experiential approaches.

2.3.1.1 Expert Paradigms

This section provides an overall description of the expert paradigms, following which two particular approaches based on this paradigm will be discussed in more detail: formal aesthetic and ecological. Expert paradigms assume that only a trained professional is able to judge and analyze the landscape quality objectively. In an expert approach, landscape quality is regarded as the inherent beauty in a physical landscape. Lothian traced the philosophical background of this objectivist paradigm to the period from the ancient Greeks through the early Christian era and the Renaissance in that “beauty was considered to be an objective physical characteristics” (Lothian, 1999, p. 191). Since an expert paradigm mostly relies on objective aspects of a landscape, these approaches put more emphasis on physical landscape attributes than a human viewer’s attributes in landscape perception models (Zube et al., 1982). This type of approach has been criticized in terms of both reliability and validity because

expert assessments are typically conducted by a single person, and the consistency of individual experts has been shown to vary widely. In addition, critics have complained that this approach trivializes the human viewer's role in the landscape assessment procedure (Daniel & Vining, 1983). The expert paradigm can be further divided into formal aesthetic and ecological approach, discussed in more detail below.

Formal aesthetic approaches

Formal aesthetic approaches evaluate landscape quality based on inherent qualities such as basic forms, lines, colors, textures, and their interrelationship. In this approach, “expert judgments of the variety, harmony, unity, and contrast among the basic landscape elements are the principal determinants of aesthetic value” (Daniel & Vining, 1983, p. 49). Litton's (1968) work, considered the classic text for this approach, argues that the formal quality or properties of a forest should be used as a basis for land planning and design (Maulan, 2006). Another study by Laurie (1975) developed a visual qualities assessment checklist that records landscape qualities as positive (+), neutral (0), or negative (-) in proportion, scale, outline in plan, profile in elevation and so on. Laurie argued that “[an] evaluation technique would need to be prepared by a team of observers of high perceptual capacities and a high degree of acquired skill” (Laurie, 1975, p. 117).

However, this formal aesthetic approach has been criticized with regard to both reliability and sensitivity. For example, a study by Feimer and colleagues (1981) found a low reliability among independent experts. In terms of its validity, it has also been criticized by questioning “whether the analysis of the landscape into a set of abstract formal elements

captures all of the aesthetically relevant aspects of the landscape” (Daniel & Vining, 1983, p. 53). In addition, as this approach relies solely on expert judgment, it fails to address non-expert perspectives (Maulan, 2006).

Ecological approaches

Unlike formal aesthetic approaches that evaluate landscapes based on their inherent quality based on physical form-related factors, the proponents of the ecological approach believe that landscape quality relies on the pure ecosystem, with its naturalness and ecological integrity undisturbed by human activities. Since many landscape scenic beauty assessment methods have grown out of the intention to protect and preserve the environment, while “naturalness” is often regarded as an important “evaluative dimension”, “human influence” is typically considered as an “external, disruptive element” (Daniel & Vining, 1983, p. 44). In particular, the ecological approach places a great deal of emphasis on naturalness and “treats any evidence of human influence as a negative aesthetic factor” (Daniel & Vining, 1983, p. 44). In this approach, complexity and diversity are considered as two major variables under the assumption that “there is a linear relationship between naturalness and ecological integrity with landscape complexity and diversity” (Maulan, 2006, p. 14). Nassauer argues that “a neat, orderly landscape seldom enhances the ecological function of the landscape” (Nassauer, 1995). Another factor based on ecological measure is uniqueness. For example, Leopold (1969) studied aesthetic factors along the Idaho River based on a “uniqueness ratio”. The underlying assumption here is that “landscape which is unique, that is, different from others or uncommon, has more significance to society than that

which is common” (Leopold, 1969, p. 5). In sum, the ecological approach clings to the idea that the lesser the human influence and the greater the complexity, diversity, and uniqueness, the more highly valuable the landscape.

Criticism of the ecological approach comes from its implicit assumption regarding the positive and linear correlation between a landscape’s aesthetic value and its complexity, diversity, and degree of naturalness (Maulan, 2006). Nassauer criticized the linear combination because “viewing landscape is like viewing anything in that the combination of parts can have a meaning or value different from the simple sum of the parts’ meanings or values” (Nassauer, 1980, p. 29). This lack of sensitivity arises because it primarily distinguishes natural environments from human-influenced environments rather than discriminating landscape qualities within either category. This also negatively influences the applicability of this approach to design and management since it fails to suggest any alternatives for intervening and manipulating land. As with the formal aesthetic approach, the ecological approach is based on the judgments of a few experts and so suffers from poor reliability.

2.3.1.2 Non-Expert Paradigms

This section provides an overall description of non-expert paradigms, following which three particular approaches based on these paradigms will be discussed: psychophysical, psychological, and experiential. In contrast to expert paradigms, which emphasize the importance of a trained professional’s ability to judge landscape quality, non-expert paradigms underline the role of human viewers, generally a group of non-experts

(Daniel, 2001). In the non-expert paradigm, landscape quality is regarded as “a product of the mind- eye of the beholder” (Lothian, 1999, p. 177). The underlying philosophy of this subjectivist paradigm can be traced back to the ideas of philosopher Immanuel Kant, who identified beauty as lying in the eye of beholder (Lothian, 1999). This perception-based method places the focus on human viewers in the landscape in that the public are considered to be “responders to environmental stimuli or thinkers imposing their value structures or ideals of artistic composition on their assessments of landscapes” (Zube et al., 1982, p. 5). Unlike the expert paradigms, research based on a non-expert paradigm generally presents a high reliability, but a lack of consensus in terms of validity (Daniel, 2001). Non-expert paradigms can be divided into psychophysical, psychological, and experiential approaches.

Psychophysical approaches

Psychophysical approaches are rooted in the stimulus-response theory of experimental psychology, which sees the environment as a stimulus to which human beings respond (Zube et al., 1982). The goal of this approach is to identify mathematical relationships between physical attributes of landscape (e.g. topography, vegetation, water) and human psychological responses (preference, aesthetic value, evidence of human disturbance, fittingness of a development to its surrounding) that provide reliable predictions of individual perceptions of physical landscape features (Daniel & Vining, 1983). The feature that distinguishes psychophysical approaches from psychological and experiential approaches is that they treat landscape properties as external stimuli that are separate from

the human viewer and consider that the value of landscape quality can be perceived without invoking human cognitive processes (Zube et al., 1982).

Of all these approaches, the psychophysical approach is the most rigorous and specific in that it deduces formal equations to describe the relationships between specific landscape forms and people's perceptions and preferences. The reliability of this approach has been proven empirically through several studies, and its sensitivity has been found to be high, as shown by its ability to discern reactions to subtle landscape variations (Daniel & Vining, 1983). However, the disadvantage of this approach is that as yet it has been used to test only one aspect or a specific element of landscape at a time and so further research is needed to determine whether this method is capable of measuring overall landscape quality (Daniel & Vining, 1983).

Psychological approaches

A psychological approach "views scenery as a construct that is built up in the mind [based on] visual modes of information gathering" (Zube et al. 1982, p. 7). Psychological models focus on the "feelings and perceptions of people who inhabit, visit, or view the landscape" and emphasize the holistic "cognitive and affective reactions evoked by various landscapes" (Daniel & Vining, 1983, p. 65). To measure people's responses, this approach relies on holistic judgment criteria such as preference and utilizes dimensional analysis methods to explore the environmental characteristics affecting those judgments (Maulan, 2006). In research based on this type of approach, photographs or simulated images are shown to people and their reactions to the scenes are measured based on single preference dimension or multiple dimensions such as complexity, coherence, mystery and so on. The

main goal of this approach is to reveal the psychological basis, for example environmental or human attributes factors, that affect landscape preferences, so this is often applied as a useful way to select between different landscape modification alternatives by predicting preferences. Studies based on the psychological approach were conducted by Ulrich (1977), Kaplan et al. (1972), R. Kaplan (1985), and Herzog (1995), all of whom provided empirical evidence for the impact of various environmental and human attribute factors on people's reactions to different environments. This approach has achieved several theoretical breakthroughs, including evolutionary theories as well as cultural difference theories. This will be discussed in more detail later in this chapter.

Both the reliability and sensitivity of the psychological approach can be precisely determined because these methods use multiple observers and quantitative scale values (Daniel & Vining, 1983). However, in terms of utility, the method has been criticized regarding whether psychological dimensions can be related to identifiable, measurable, and manipulatable physical features of the landscape (Daniel & Vining, 1983). For example, compared to psycho-physical studies that deduce formal equations to describe the relationships between specific landscape forms and preferences, a psychological approach does not provide the type of data that will lead to specific design implications. This can be reduced by applying a Content Identifying Method (CIM), which extracts physical landscape dimensions that are responsive to people's reaction (Maulan, 2006).

Experiential approaches

Unlike the previous two approaches, which tend to focus on either the physical qualities of landscapes or the meaning or understanding of the landscape for human observers, the experiential approach is centered on the experience of the human-landscape interaction (Zube et al., 1982). The experiential approach considers that individuals cannot be separated from their surrounding environment or the context of a particular situation and “the aesthetic is difficult to separate from other emotional experiences” (Zube et al., 1982, p. 7). The major goals of this type of approach are to explore “the understanding of the experience of interacting with the landscape and its importance to people” (Zube et al., 1982, p. 8) as well as “determining the meaning and significance of various aspects of the environment to the particular person” (Daniel & Vining, 1983, p. 72). To build a deeper understanding of these interactions, most experiential approaches are based on qualitative, unstructured, and phenomenological methods such as interviews, observations, and place descriptions. Human geographers, including J.B. Jackson (1970) and Tuan Yi Fu (1977), have implemented this approach in an attempt to understand complex human-landscape interactions based on the experiential quality of the landscape, placing the emphasis on both the landscape itself and how it is experienced by viewers (Maulan, 2006).

The experiential approach has been criticized as idiosyncratic to the individual experience of the landscape and thus not reliable and useful for landscape management and design. Since the method is frequently used for in-depth studies of the phenomenology based on the relationship between a specific context and a particular observer within it, the

differences in landscape assessment based on experiential approaches arise through the relationship between observers and context, not from generalized dimensions or characteristics of the landscape. Thus, it would be relatively hard to apply this type of approach to derive useful implications for landscape management and design compared to others (Daniel & Vining, 1983).

The preceding discussion of research approaches, from formal aesthetic to experiential, presented a range of different research designs that could potentially be applied to study people's perceptions of post-industrial and abandoned area landscapes. Among these, landscape perception and preference studies based on the psychological approach seem to have most relevancy for the purpose of this research because they provide an opportunity to encourage the public to participate in the process as well as generating useful implications that will make a practical contribution to planning and designing brownfield landscapes. This approach usually engages the public through a landscape scene preference survey, and identifies influential design-related factors in the form of contents and spatial organization, while at the same time allowing researchers to explore the inherent perceptions behind the preferences expressed in the survey. The following section discusses the theoretical and methodological basis for the landscape perception and preference study conducted for this research in detail.

2.3.2 Landscape Perceptions and Preferences

2.3.2.1 Evolutionary Theories

As previously mentioned, the psychological approach focuses on measuring human responses based on holistic evaluation criteria such as preference, a familiar daily judgment of like or dislike. The psychological perspective “supports several theoretical approaches, ranging from evolutionary conceptualization to [an] emphasis on the effects of culture and personality” (Zube et al., 1982, p. 7). As a theoretical basis for this approach, evolutionary explanations help to understand landscape preferences as an important component of humanity’s instinctive adapt and survive tactics. Based on evidence from empirical research, the evolutionary approach has achieved several theoretical breakthroughs by demonstrating common aspects shared by most human beings in perceiving and recognizing different aspects of their environment. These theoretical achievements include prospect and refuge theory (Appleton, 1975), affordance theory (Gibson, 1979), information processing theory (Kaplan & Kaplan, 1982), visual complexity (Vitz et al., 1966; Ulrich, 1977), and arousal theory (Wohlwill, 1968). Each of these will be discussed in turn below.

Refuge and prospect theory

Appleton (1975) developed “Refuge and Prospect Theory” to explain how landscape preferences favoring those that include the potential for prospect (openness) and refuge (security) originated with early hominids’ need to “see without being seen” and are thus closely related to human evolution, serving as a vital element in hunting, escaping, shelter-seeking and exploring. Appleton’s theory was criticized due to its lack of reliability. Since

most of his arguments are based on the study of landscape paintings and are related to the question of why those paintings are great, this is not supported by empirical research (Maulan, 2006). However, several researchers (Herzog, 1984; Hofmann et al., 2012) have discussed their findings in the context of Appleton's theory to explain their often apparently contradictory results, for example when the extremes of large open lawns and dense forests were preferred the most. This theory provides an explanation by suggesting that they represent two contrasting basic human tactics: attack and defense. The general preference for scenes showing both open lawns and thick forests may be the product of these dual purposes.

Another theory based on evolutionary perspective is Gibson's "Environmental Affordance Theory" (1979). Gibson states that the world is perceived in respect to the possibilities of action as well as in terms of shapes and spatial relationships. In other words, he maintains that people's perception and preference of certain types of landscape are largely influenced by their ability to support human activities such as hiding, searching, way-finding, walking and so on.

Information processing theory

Another theoretical breakthrough was made by the Kaplans (1982). Their "Information Processing Theory" provides a meaningful explanation for people's preference for certain environments based on evolutionary reasons, thus adopting an evolutionary perspective. They found that landscape perception is closely related to a human's adaptive need to make sense of his or her environment as well as to be stimulated by it as a way of enhancing their ability to survive. For example, they established a useful framework that

explains the rationale for preference based on the two basic human needs of “making sense” and “involvement” (see Table 2.1). As people cognitively process the information that they take in visually there are four types of information: coherence, complexity, legibility and mystery. Coherence and complexity have to do with making sense (coherence) and involvement (complexity) with what can be readily seen. Legibility and mystery have to do with making sense (i.e. a cognitive map – legibility) and involvement (the promise of more information if one proceeds into the landscape – mystery). (Table 2.1). For example, landscape scenes that present appropriate levels of these four factors have been identified as important factors that influence people’s preferences (Herzog, 1984; 1989; 1992; Kaplan, S., Kaplan, R). It is theorized that these four factors are important for human preferences for evolutionary reasons that support human survival. In order for the ancestors of humans to survive, they had to make sense of their environment (i.e. find food and shelter) and pay attention or be involved (i.e. avoid danger and find food). These four spatial organizations are discussed in more detail later in this chapter.

Table 2.1 Preference Framework (Kaplan & Kaplan, 1982)

	MAKING SENSE	INVOLVEMENT
Present or immediate	Coherence	Complexity
Future or promised	Legibility	Mystery

Visual complexity and arousal theory

Two other theories, Visual Complexity (Vitz, 1964) and Arousal Theory (Wohlwill, 1968), have also been proposed in an attempt to identify the optimal level of visual

complexity in the context of diverse environments. Vitz (1966) examined participant's preferences toward eight different degrees of stimulus complexity using black line drawings. A similar visual complexity study by Wohlwill (1968) was conducted to discover the stimulus configurations in landscapes related to optimal levels of arousal. Both studies found a similar reversed curvilinear shape in the relationship graph between complexity and preference. These findings also fit well with an evolutionary perspective. People probably prefer visual stimuli or information that satisfy the conditions in which they are able to quickly understand what the landscape holds for them without being overwhelmed.

2.3.2.2 Preference Method: Measuring Preference with a Photograph

Landscape preference is a common research method for perceptual studies based on the psychological approach. According to S.Kaplan and R. Kaplan (1982), preference is not just an individual's taste, but "a result of perception, acquired knowledge, innate reaction, and cognitive processing" (as cited in Maulan, 2006). It is also easy enough for non-experts to participate in the assessment because "people make preference judgments every day to the extent that making preference judgments is almost second nature" (Kaplan & Kaplan, 1989, as cite in Maulan, 2006). As a methodological basis for landscape preferences, visual preference studies that measure people's preferences for images as an actual landscape substitute have often been utilized. In a visual preference study, photographs and simulated images are shown to participants and their preference levels for each scene rated or ranked with either a single dimension of preference scale or multiple dimensions. This method is based on the idea that "much of the way humans experience the environment is visual,"

(Kaplan & Kaplan, 1989, p. 207) as well as the contention that photographs are an adequate surrogate for an actual environment (Pitt & Zube, 1987; Shuttleworth, 1980). The results of preference research need to be analyzed to identify the underlying factors that influence people's reactions to different landscape scenes. This analysis involves Content Identifying Methods (CID) or factor analysis in order to extract landscape dimensions that represent patterns of preferences (Maulan, 2006).

Based on the information revealed by this literature review, there are two types of findings produced by visual preference studies. The first type involves the revelation of some kind of underlying cause for landscape preferences that provides a better explanation of and understanding about human cognitive processes in the environment. The second identifies those factors that influence preferences for environments containing a specific content or spatial organization, in which the factors themselves provide implications for designers and planners seeking to take into account people's preferences. Regarding the causes and influential factors found through landscape preference methods, there are two main streams based on whether the emphasis is placed on the similarities or differences between people. The similarities among people are the focus of the above discussion on evolutionary theories, but while there are similarities there are also differences among sub-groups of people with different backgrounds, such as ethnicity, age, gender, and so on. Both streams provide useful guidelines for this research in exploring potential factors that could influence perceptions and preferences for the brownfield landscapes to be used in the study design. Potential factors that have been identified in past perception and preference studies are described in the next section.

2.3.2.3 Potential Factors Related to Landscape Perception and Preference

A review of the landscape preference literature provides a list of potential factors that could have an impact on landscape preferences. By and large, this list can be divided into two categories: environmental factors and individuals' characteristic factors. In the first section below, environmental factors identified as being influential are reviewed. These include the presence of nature, coherent or complex spatial qualities, level of maintenance, visual accessibility and so on. This is followed by a review of the individual characteristic factors that have been identified as potentially influential, including age, gender, education level and personal interest.

Environmental factors

Environmental factors can be divided into two categories: scene content and spatial organization. These categories are based on the idea that “humans respond not only to the things, but also to their arrangement, and not merely to the arrangement, but also to the inference of what such arrangement makes possible” (Kaplan, 1985, p. 162). Each component is explained in detail below.

Scene contents. Among scene contents, the first environmental attribute to be discussed is the presence of nature, which has long been recognized as a significant factor for landscape preference in both urban and non-urban settings. In general, scenes with natural elements are preferred over scenes taken from urban areas for both settings (Kaplan et al., 1972). Among the urban scenes, a scene showing a plaza containing a few small trees received the highest preference ratings. Another study compared participants' preferences

for scenes of narrow canyons and urban alleys, confirming that non-urban scenes were preferred over urban scenes, particularly if the scenes contain land with topographical changes (Herzog & Smith, 1988). Herzog (1989) proved that the presence of nature was a significant factor for preference in urban nature. In particular, tended nature scenes were best liked in his study (Herzog, 1989). Another study by Herzog and Chernik (2000) revealed a clear positive relationship between nature and tranquility in urban scenes. Meanwhile, Kuo and colleagues (1998) conducted a preference study with neighborhood scenes and found that the scenes depicting densely planted trees and open views were significantly preferred by residents due to the resulting sense of safety, particularly in poor and low-income neighborhoods. These results imply that “the presence of trees and well-maintained grass sends a positive signal, indicating to residents and possible offenders that this is a nice place, a civilized, cared-for place with civilized standards of behavior” (Kuo et al., 1998, p. 55). Another preference study in a neighborhood area by Hanyu (2000) identified a positive relationship between several evaluative dimensions (i.e. pleasant-unpleasant, exciting-boring, relaxing-distressing) and natural dimensions (Hanyu, 2000).

Along with the presence of nature, ground texture has also been shown to be an important factor for landscape preference. Based on a series of preference studies, Herzog reported that “blocked views, receiving low preference, often involve a very coarse-grained texture such as tall grass and rough foliage while well-structured scenes, receiving high preference, tend to have a more fine-grained ground surface” (Herzog, 1984, p. 10). Herzog quoted S. Kaplan in his study, pointing out that “texture may contribute to the spatial structuring that seems to affect preference” and arguing that the smoothness of ground texture

is a factor which “cut across both the making-sense and involvement processes” (Herzog, 1984, p. 10). Another study by Yang and Brown (1992) found that soft landscape materials such as water or vegetation were preferred over hard landscape materials such as rocks, regardless of any cultural differences.

Spatial organization. In addition to what a scene contains, spatial organization has been recognized as another important factor. One example demonstrating the importance of spatial organization comes from a study by Yang and Brown (1992), who discovered that water and vegetation are highly preferred landscape scene content, although this preference depends on the form, type, and relationship of one element to others. The combination and relationship of elements have also been shown to be one of the most powerful factors influencing preference; the juxtaposition of water and vegetation was consistently preferred by participants (Yang and Brown, 1992).

A set of classic and representative factors related to scene organization is provided by the Kaplans’ preference framework, which is composed of four main categories of arrangement style: coherence, complexity, mystery, and legibility. Of these, coherence is related to “the extent to which the scene hang together or contains repeated elements, textures, and structural factors” (Herzog, S. Kaplan and R. Kaplan, R., 1982, p. 46). The coherence present in scenes generally seems to increase an individual’s preference for those scenes. For example, Herzog’s studies of both natural and urban settings (1984; 1989) found a positive relationship between coherence and preference (Herzog, 1984; Herzog, 1989). However, R. Kaplan (1975;1977) found the reverse to be true, contending that “coherence has shown little

empirical relationship to preference for natural scenes” although it may contribute positively to the preference for rivers and riverside environments (as cited in Herzog, 1984, p.10).

Another spatial organization category to be considered is complexity, which is related to concerns regarding whether there are enough elements to keep an individual involved based on visual richness or diversity. Although Herzog (1992) reported that coherence and complexity were positively related to preference in urban scenes, a negative correlation between those was found in an earlier study by S, Kaplan., R, Kaplan and Wendt (1972). Given this lack of agreement, it has been argued that complexity presents “an uneven track record as a predictor of preference for natural environments” (R. Kaplan, 1975, as cited in Herzog, 1984, p. 10).

The third category is mystery, which is related to concerns over whether scenes provide inferences that one could explore deeper and learn more. It has been suggested that “the notion of mystery emerged as a compelling force in preference, and especially in preference for nature scenes” (Kaplan, 1989). However, like complexity, mystery also shows some inconsistencies as a positive factor because while it shows high preference in nature scenes, it shows low preference in urban scenes (Herzog, 1989). This may be due to the potential lack of safety and perceived danger implied in the scenes (Herzog, 1992). For example, Herzog and Smith’s study comparing narrow canyon and urban alley scenes confirmed the generally positive relationship between mystery and preference, as well as the negative relationship between danger and mystery (Herzog and Smith, 1988). However, an agrarian landscape scene preference study by Strumse (1996) revealed that while respondents

preferred scenes with old structures, which might promote exploration, some respondents were less enthusiastic about scenes showing a spruce plantation with dense vegetation, which suggests that “mystery seems to have an opposite, perhaps even fear-inducing effect” (Strumse, 1996, p. 27).

The last category is legibility, which is related to concerns over whether people can explore the environment without getting lost (Kaplan, S and Kaplan, R., 1982). A similar concept of the imagability of the city was developed by Lynch (1960), who considered that imagability means the ability to be visually grasped as a related pattern of recognizable symbols, which seems to have some similarity to the concept of “coherence” proposed by the Kaplans. A distinctive and legible environment that contains both sufficient openness and landmark elements provides a sense of safety as well as increasing the depth and intensity of an experience (Lynch, 1960; Kaplan, S and Kaplan, R., 1982).

Another potential factor related to spatial organization is the level of maintenance. Herzog reported that well-maintained nature scenes were best liked because “tended nature focuses on neatness and order in the configuration of natural elements, which should enhance coherence” (Herzog, 1989, p. 38). Another study by Herzog and Chernik (2000) identified predictors for tranquility and danger and found a positive relationship between setting care level and tranquility, as well as a negative relationship between setting care level and danger. Nassauer looked at the question of why people prefer “neatness” and “order”. In a series of studies, she revealed that people tend to associate the appearance of “neatness and order” with cues for “care and maintenance”, identifying these cues as including mowing, trimmed

plants in a neat row, fences and architectural details as preferred environmental factors (Nassauer, 1995).

Visual accessibility and foreground openness are other factors revealed as being important related to spatial organization. Herzog (1992) found that well-structured scenes with visual penetration or access were highly preferred in urban scenes. Another study revealed that the scenes allowing visual access were preferred over those in which “visual access was lacking, blocked, or unclear” (Yang and Brown, 1992, p. 503). Herzog and Chernik (2000) measured perceived danger in natural and urban scenes and found that openness had a negative relationship with danger, which could mean that low openness is assumed to have low visibility and may thus signal the possibility of entrapment. Along with visual accessibility and foreground openness, spaciousness has also been shown to influence preference. As cited in Herzog’s study (1984), S. Kaplan (1979) reported well-structured spacious scene received high preference ratings. This could mean that well-structured larger areas can support the sense-making process due to their coherent characteristics.

Individual’s characteristic factors

In addition to environment factors, personal characteristic factors that potentially influence landscape preference were examined through a review of previous studies. These factors include familiarity, training and knowledge, motivation and interest, and cultural background. These are discussed in turn below.

The first factor to be considered is familiarity, which is specifically related to a perceived home location and living period. In a study with riparian scenes, Ryan proved that

the residents generally preferred the scenes resembling the landscapes surrounding their home locations (Ryan, 1998). For example, residents who indicated farmland as their home preferred the domestic landscape scenes more than those who indicated a natural wetland and grassland type as a home. This study also found that the length of residence was a significant factor for scene preference. While relative newcomers presented a higher preference for natural scenes, long-term residents presented a higher preference for domestic landscapes. Another preference study by Dearden (1984) revealed a positive correlation between familiarity with certain landscape types and landscape preference. In this study, those respondents who have lived in natural and low density environments for most of their adult life presented a higher preference for rural and wilderness scenes than those who came from high-density housing environments.

Training and knowledge are additional factors that are related to landscape preference. The difference in preferences between expert and non-expert groups has been demonstrated in several perception and preference studies. A classic study by Kaplan (1973) revealed significant differences among architecture, landscape architecture, and psychology students at different training levels. These results highlighted the difference between those trained in design skills and those who are not. For example, while closed woody natural scenes were strongly preferred by the untrained group, trained landscape architecture students clearly preferred buildings with unspoiled natural elements, probably due to the training they had received about “the appreciation for the juxtaposition of buildings and their settings” (Kaplan, 1973, p. 273). Another study by Herzog et al. (2000) found that landscape architecture students preferred structural remnants in a natural settings more than other students. In

addition, they found that staff members in a Department of Environmental and Natural Resources tended to prefer natural landscapes more than other adults. In contrast, Yu's cross-cultural study comparing a Chinese group and a Western group (1995) found that while general education level was an influential factor for preferences, the influence of expertise and education in landscape architecture was unexpectedly weak.

Further important personal characteristic factors that need to be taken into account are motivation and interest, which are closely related to the ability of a landscape to support certain types of use or to match people's interests. This idea is based on the supposition that people might prefer scenes that contain or present essential things that meet people's needs from a utilitarian perspective. A study by Maulan (2006) revealed that motivation to use urban open space significantly influenced preferences for different types of wetlands. For example, in his study, participants motivated by passive activities (i.e. walking, sitting and relaxing) preferred park-like landscapes, while those motivated by more active pastimes (i.e. roller skating, playing ball) preferred all types of landscape. Participants who enjoyed natural exploration preferred natural wetland landscape more than other scenes. Yu (1995) agreed, reporting that utilitarian interest can strongly bias landscape preference. In his study, farmers presented negative responses to water-dominated and misty rocky scenes in bad weather, probably due to their interest in agricultural production and daily farm work (Yu, 1995).

The fourth characteristic factor to be discussed here is cultural background. Kaplan and Herbert (1987) found cross-cultural as well as sub-cultural differences in their preference study of American and Australian student groups. Large preference differences were found

not only between American and Australian student groups, but also between Australian students and Australian Wildflower Society members. This suggests that “while preference is affected by familiarity, people do not necessarily prefer what they are familiar with” (Kaplan and Herbert, 1987, p. 291). There are other factors to be considered such as interest and expertise that may be “potent in defining sub-cultures” (Kaplan and Herbert, 1987, p. 292). Yang and Brown (1992) found that Korean people prefer a western landscape style over a Korean one, and suggested that cultural influences could affect preferences for different landscape styles. This result is not consistent, however; several studies have reported that cultural difference is not significant in landscape perception and preference. For example, a cross-cultural study by Yang and Kaplan (1990) found a striking similarity between Korean and Western groups in perceptual categorization reflecting landscape style and content (in this case, Korean, Japanese, and Western landscapes). Similarly, another cross-cultural study by Yu found only a very weak influence of macro-cultural differences between Chinese and Westerners except “some specific types of landscapes which contained specific cultural meanings” (Yu, 1995, p. 124).

Lastly, among the demographic factors, age and gender were found to be potential factors affecting preferences in several studies. Herzog et al. (2000) found the age difference in groups of adults presented a “lower correlation with other age groups and greater variability in the mean preferences across the scene categories”. The reason was assumed to “the end result of a developmental sequence in which increasing maturity ultimately leads to a distinctive pattern of preferences” (Herzog et al., 2000, p. 343). With regard to gender, as cited by Maulan (2006), the Kaplans (1989) reported that one of their students identified

gender differences, noting that while male participants tend to prefer open and spacious scenes, female participants tend to prefer enclosed scenes offering refuges. Based on the evolutionary theory, the reason for this observation was assumed to be based on prehistoric humans' hunting and gathering activities, where males needed to see for hunting, but females preferred to hide in enclosed spaces while gathering.

2.3.3 Review of Perception Studies in Brownfields

This section reviews previous perceptual studies of brownfields. These reviews include information related to the goals of each study and the study design used for accomplishing these goals, including the methods, variables, and data analysis applied. By and large, the most recent research evidence regarding public perceptions of brownfields has been provided by two types of research. The first section explores previous research conducted into the general perceptions toward brownfield remediation and reuse based on text-oriented surveys, while the second section reviews other types of research that have utilized visual preference studies based on scenes or simulated image-oriented surveys.

2.3.3.1 General Perception Studies

These general perception studies are reviewed based on five factors: the categories of their research goals, type of brownfield studied, participants, methods, variables, and data analyses. This review is summarized in Table 2.2.

The major research goal of general perception studies is to understand public perceptions regarding various reuse options including community facilities, amenities, housing, and commercial or industrial development, as well as reuse impact in terms of social,

environmental and cultural aspects. For potentially influential variables, background information including working conditions and living distance from the brownfield site as well as demographic information including age, income and gender were generally gathered for correlation analysis. Exceptionally, one study (Greenberg & Lewis, 2000) examined public perceptions toward participation in the brownfield redevelopment process. Data collection for most of these studies was conducted through resident surveys in industrial and surrounding areas of the city concerned. People were recruited through advertisements or at key access points such as churches, education centers, and public parks. Both computer-based and meeting-based surveys were used for the research.

The results obtained from these general perception research studies can be summarized into two categories. The first of these focuses on preferred reuse options, while the other looks at the main effect and value of the reuse process. For example, recreational, cultural, and community facilities were commonly preferred reuse options in two studies (Turvani, 2007; Greenberg and Lewis, 2000). In the second type, which consider the effects and values of reuse, public good aspects such as environmental, public health and aesthetics were deemed to be more important than economic impact (Turvani, 2007; Ramos & Panagopoulos, 2007). Two types of implication were discussed in general perception research. Both relate to the perceived difference between city government and the public. The first of these consisted of the need to reconsider the main goals and objectives of most current brownfield projects. For example, although economic revitalization can create job opportunities and increase property values, and is therefore often the main goal of city government, the highest reuse benefit and value by public was actually assigned to

Table 2.2 Research Evidence Regarding Public Perception of Brownfield Sites
(Turvani et al., 2007; Greenberg & Lewis, 2000; Ramos & Panagopoulos, 2007)

Research Goal	Brownfield type	Participants	Method	Variables	Data analysis
Public perception of contaminated land regarding reuse options and effects	Industrial area in city	Residents (n=400)	-Computer-based survey with questionnaires set	1) Awareness, familiarity, knowledge about contaminated land issues and reuse plans, perceived risk 2) Preference for reuse options 3) Perception for reuse effects 4) Personal background	Factor analysis, ANCOVA
Public perception of brownfield redevelopment and participation	Major industrial center in city	Residents (n=204)	-Meeting-based survey at community access points with questionnaire sets	1) Preference for reuse options 2) Desire to be involved in planning 3) Personal background	Discriminant analysis
Local people perception of values and aesthetic in rehabilitation process	Underutilized property in downtown area	Local people (n=40)	-Meeting-based survey at public park with questionnaire sets	1) The importance of value in rehabilitation process (aesthetic, social, cultural, budget, microclimate, ecological) 2) type of material and plants to be used 3) Visual quality of the site and surrounding area (the amount of mystery, complexity, coherence, or legibility) 4) Personal background	Descriptive analysis

environmental, public health and aesthetic aspects (Turvani et al., 2007; Greenberg & Lewis, 2000). The second implication is the need to reconsider reuse programs that relate to rezoning and the adjustment of remediation levels. For example, community and cultural facilities are often considered the most important even though the government may plan industrial and commercial development to support the area's economic vitality. Overall, this suggests a need for early communication between government planning bodies and local people. In

general, communication with local people at a very early stage was found to generate support for government plans.

The findings from these general perception studies provide a useful starting point for this dissertation research. Based on the findings on perceived difference between public and city government, they emphasize the need to engage local people in the process to minimize future disputes and to consider the local community's planning interests such as public health and community facilities. However, the implications of those studies tend to concentrate on providing general advice for reconsidering existing program objectives or strategies for government, and while useful for policy makers and city officers involved in brownfield projects, they are of little use for planners and designers. The following sections review the earlier visual preference studies for brownfields that are more relevant to the current study and provide implications for the design and planning of brownfield landscapes, as well as contributing to the design of the residents' visual preference survey that was conducted for this dissertation.

2.3.3.2 Visual Preference Studies

In this section, visual preference studies regarding brownfield landscapes are reviewed based on five factors: the research goals, types of brownfield studied, methods, variables, and data analyses. The design of each is summarized in Table 2.3.

Unlike general perception studies, the major research goal for visual preference studies is to identify factors that influence public preference for various types of brownfield sites, including large scale mining areas, industrial areas and neighborhoods, as well as for

different stages of the brownfield recovery process such as pre-reclamation, post-reclamation including underused sites, and those currently undergoing remediation. With regard to the survey methods utilized, a wide range of participants, including residents, non-residents, employees of industries, and landscape planners were recruited for the different studies. Web and phone-based surveys (employees and planners), as well as meeting-based surveys (residents) are included in these earlier studies.

Participant sampling is important to ensure internal validity within a particular group and setting. Major issues in sampling include the sample's representativeness of that particular study group and ensuring an adequate sample size. Among probability sampling methods (i.e. simple random, systematic, stratified, or cluster), a systematic sampling approach has advantages when there are appropriate lists of participants available such as household addresses within certain neighborhood boundaries. For example, door-to-door visits that systematically select every third household can be conducted under the assumption that the location of households has the quality of randomness. Non-probability sampling methods (i.e. convenience, volunteer, or purposive) can also be utilized due to recruitment convenience, a particular survey setting, and the study purpose; sidewalk sampling has an advantage for resident surveys due to the ease of recruitment.

For measuring preferences, various methods of photo-rating, photo-ranking, and sorting were used. Based on this review of these studies, this dissertation research adopted a meeting-based survey for residents as this appears to be an effective way to supervise the survey process and increase the response rate. In addition, photo-rating was selected for

measuring preference since it is convenient when using a large number of scenes (66 scenes were used for this study).

Table 2.3 Research Evidence Regarding Visual Preference for Brownfield Landscapes (Hofmann et al., 2012; Svobodova et al., 2012; Laforteza et al., 2008; Ruelle et al., 2013; Sklenicka & Molnarova, 2010)

Stage	Research Goal	Brownfield type	Participants	Method	Variables	Data analysis
Pre reclamation	Visual preference for urban derelict land (Hofmann et al., 2012)	Urban derelict land	Residents and Landscape planners (n=82)	-Phone and meeting-based survey -Photo-sorting and ranking (n=24)	Degree of canopy and enclosure, artificiality vs naturalness, degree of accessibility	Hierarchical cluster, Multidimensional scaling, Multiple regression
Pre and post reclamation	Visual preference for mining and post-mining landscapes	Large scale mining site	Residents (n=1050)	-Web-based survey -Photo-rating (n=84)	Topography, mining elements, mature woody vegetation, built-up areas, water features, wilderness Personal background	Linear mixed-effect model
During reclamation	Visual Preference for designed alternatives of brownfield remediation	Major industrial area in city	Employees and stakeholders of local industries (n=127)	-Phone-based Survey -Photo-rating (n=25)	Vegetation patterns during clean-up Personal background: Employee or stakeholders	ANOVA
Post reclamation	Visual preference for different landscape style in brownfield regeneration	Six post-industrial neighborhoods	Residents (n=460)	-Meeting-based survey -Photo-rating (including simulated image)	Different landscape style: existing vs conservationist vs interventionist Personal background	Chi-squared test Correlation
Post reclamation	Visual preference for natural habitat types used in land reclamation	Large scale mining site	Residents and non-residents (n=363)	-Meeting-based survey -Photo-rating (n=20)	Habitat styles: managed coniferous forest, wild deciduous forest, managed mixed forest, managed grassland Personal background	Chi-squared test, ANOVA

In most of the earlier studies, data analysis occurred with two stages. Dimensional analysis was used first to identify potentially influential environmental attributes variables from the scenes such as topography, water features, built-up areas, physical accessibility, and different habitat types, as well as different landscape reclamation styles, that could then be used for further correlation analysis (Hofmann et al., 2012; Sklenicka & Molnarova, 2010; Laforteza et al., 2008; Ruelle et al., 2013). Correlation analyses such as ANOVA and multiple regression were generally conducted after the dimensional analysis (Hofmann et al., 2012) or when the potential factors had already been decided (Sklenicka & Molnarova, 2012; Ruelle et al., 2013; Laforteza et al., 2008). Here, the other variables that primarily referred to human viewer components, including gender, age, education, income, residence, birth place, and occupation, were used to identify influential participants' background factors for preference ratings. This was typical for most of the visual preference studies and the current study also adopted similar analysis procedures.

In addition to the study design, the results, discussions, and implications for the previous studies are summarized and included in Table 2.4. Most of these studies began by producing lists of significant factors based on environmental attributes (i.e. naturalness, built-up areas, industrial elements, vegetation patterns and types, degree of enclosure, accessibility) and human attributes (i.e. gender, income, education, profession). For example, one study found high artificiality and both extremes of canopy closure and prospects to be important positive factors for resident's preferences (Hofmann et al., 2012).

Table 2.4 Research Evidence Regarding Visual Preference for Brownfield Landscapes
(Hofmann et al., 2012; Svobodova et al., 2012; Laforteza et al., 2008; Ruelle et al., 2013; Sklenicka & Molnarova, 2010)

Environmental Attributes	Personal Attributes	Discussion	Implications
Artificiality vs Naturalness (maintenance or stewardship)	-Profession -Relationship to place -Familiarity to certain type of environment	1) The preference difference regarding artificiality between planner and resident groups due to usability concept: while planners see structure and beauty in wildy grown vegetation, residents see as weeds and chaos 2) Residents prefer managed landscape due to long-term disorder caused by mining and unkempt character of wilderness 3) People from villages and towns appear to be more attracted to complex vegetation patterns	-Derelict land management with a minimum level of maintenance and accessibility is recommended
Vegetation patterns and types	-Relation to industry -Age, Education level	1) Stakeholders' and employees' different perspectives regarding vegetation density were maybe due to establishment and management cost 2) Managed grassland of agricultural type was preferred by older people due to more productivity-based attitude based on their education level 3) Native deciduous forest was preferred by the young with a higher education level and awareness of ecological issues	-Significant portions of post-mining landscape are recommended to be left to natural succession, leading to the establishment of stable habitats of high natural and aesthetic value -Rapid reclamation with a high proportion of mature woody vegetation is recommended
Landscape quality and Industrial heritage	-Neighborhood conditions	1) The need and sensitivity to landscape quality can be different among neighborhoods according to economic vitality 2) Context dependency of landscape preference such as neighborhood effect should be investigated at local level 3) Among different reclamation design styles, a conservationist approach was preferred due to the presence of green and industrial heritage	-A wide range of issues with green amenities, visual attractiveness, cultural heritage-should be considered -Temporary uses or more extensive greening for underused sites after remediation are recommended

They then went on to develop a deeper understanding, for example by exploring how a high level of artificiality is related to a positive view of human influence in the form of maintenance. Similarly, the preference for an extreme degree of canopy closure was explained related to prospect and refuge theory, which states that human survival requires the ability to see without being seen. Lastly, the identified environmental characteristics were discussed in terms of other influential human or context factors. For example, one study found that significant differences between stakeholders and employees emerged in alternative remediation options, where scenes containing large groups of trees may limit the visibility of industry and possibly be seen as requiring a higher cost for establishment, and were thus less preferred by stakeholders than employees (Lafortezza et al., 2008). The results and discussions of these studies are summarized in Table 2.4 above.

The review of the previous work in this area presented in this chapter provides helpful guidelines that will help interpret the results and provide implications for the current study. In addition, these earlier studies provide important list of factors that can potentially influence people's perceptions of brownfield landscapes and should thus be included in the survey design for this study. These include environmental attributes such as artificiality, naturalness, vegetation patterns and types, landscape quality and industrial heritage, as well as other attributes such as familiarity and relationship to place and neighborhood conditions such as economic vitality.

Although these earlier studies have contributed to our knowledge regarding perceptions and preferences for brownfield landscapes to some extent, their findings do suffer

from some constraints. First of all, the research evidence specifically related to brownfield landscapes do not differ markedly from those from numerous past studies conducted on urban or natural landscapes, probably due to the lack of appropriate landscape scenes used for the surveys as these need to contain certain attributes that are particularly seen on brownfield sites such as industrial remnants or leftover structures. In addition, as mentioned in connection with the limitations of visual preference research in the previous section, these studies tend to lack design specificity when providing useful design solutions for brownfield landscapes. For example, environmental attributes presented in the scenes such as artificiality, naturalness, and vegetation species and patterns are somewhat abstract concepts if they are to be directly applied to planning and design.

2.3.3.3 Conclusion for the Review of Previous Studies

Although there have been a number of interesting perceptual studies of brownfields recently, both perception and visual preference studies suffer from limitations. Most importantly, the implications from general perception studies tend to concentrate on providing advice related to reconsidering existing program objectives or strategies for government, and thus are of little use for planners and designers. Although visual preference studies seem to provide more useful guidelines that include design-related environmental characteristic factors, the research evidence for brownfield landscapes are not very different from those from past studies conducted for other types of landscapes, probably due to the surveys' lack of suitable landscape scenes that include elements typically seen in brownfield sites. They also tend to lack design specificity or to provide useful guideline or solutions for

planning and design of brownfield landscapes. As described in the discussion of the psychological approach earlier in this chapter, compared with psycho-physical studies that deduce formal equations to describe the relationships between specific landscape forms and preferences, visual preference studies based on the psychological approach do not provide the type of data that will lead to specific design solutions. For example, as the review of previous studies revealed, influential environmental attributes identified in the scenes such as artificiality, naturalness, and vegetation species and patterns are somewhat abstract concepts if they are to be directly applied to planning and design.

For this dissertation research, this review of earlier work in this area has provided a helpful list of potential factors, including both environmental and human attributes, that will be used in the study design. The limitations of the earlier studies have also contributed to the design this study, for example by ensuring that visual stimuli presenting exclusively brownfield site characteristics are included in the survey scenes. Lastly, the results of this research will be discussed alongside those from the past studies reviewed here; some of the factors previously thought to be influential were not found to be so here, but others are more strongly supported by the new evidence that has been collected.

2.4 SUMMARY

The literature review presented in this chapter has described the issues regarding post-industrial and abandoned areas, the so called brownfield sites, as well as the theoretical context for the research methods that will be used to help develop a better understanding of how people's perceptions of these landscapes are formed. First of all, the historical context

describing how the brownfields came into being and the subsequent conceptualization of these areas were described, with a particular emphasis on the related environmental policies and programs in the U.S. More importantly, recent changes in the approaches to these areas were reviewed, highlighting the crucial turning point that has revolutionized our thinking about the importance of adopting a reuse design approach and engaging local communities' support at an early stage.

Next, the research methods relevant to understanding the perception of brownfield landscape were reviewed. The legacy of landscape assessment research with five different types of approaches and methods was reviewed: aesthetical and ecological approaches based on expert paradigms and psycho-physical, psychological, and experiential approaches based on non-expert paradigms. The advantages and disadvantages of each of those types were summarized. Among these, the landscape perception and preference method rooted in the psychological approach was singled out for further review. In particular, its theoretical basis (evolutionary perspective) and methodological basis (scene preference method) were described to provide an understanding and the rationale behind the method. In addition, a wide range of potential factors that might influence landscape preference were reviewed based on previous preference research, including the dimensions of both environmental and individual characteristics. Lastly, previous perception and preference studies on brownfield sites and the limitations of each were reviewed. Chapter 3: "Methodology" will articulate how the implications from the previous work reviewed in this chapter were utilized and structured for this research. The study design focused on investigating the factors relevant to the residents' perceptions and preferences for brownfield landscapes, developing a landscape

typology for brownfield sites and revealing the challenges experienced by brownfield project managers in changing their approach to brownfields.

CHAPTER 3: METHODOLOGY

As stated in the first chapter of this dissertation, the goal of this study is to gain an understanding of people's reactions to different types of brownfield landscape and the factors affecting those reactions in order to provide helpful information for those involved in reuse planning and design of local brownfields. Based on this goal, six study objectives were developed and were described in Chapter 1. This "Methodology" chapter discusses the methods used to accomplish these research objectives. This discussion is divided into two sections. The first section revisits the study objectives and research questions that were described in Chapter 1. The second section describes the study design, including a discussion of the methods used for the survey and expert interviews. This section consists of two sub-sections, the first of which discusses the survey method, looking at the survey area and participants, survey instrument, survey administration, and data analysis, and also discusses the rationale for the survey location and participant sampling, the methods used to measure participants' preferences for diverse brownfield landscapes, as well as examining the factors that could potentially affect their preferences. The second focuses on the interview method, including the interview participants, protocol, and procedure and data analysis utilized.

3.1 STUDY OBJECTIVES AND RESEARCH QUESTIONS

In this section, the study objectives and research questions that were stated in Chapter 1, are revisited. The study objectives of this dissertation are: 1. Identify the environmental factors influencing people's attitude and preference of brownfield landscape;

2. Develop brownfield landscape typology based on identified environmental characteristics; 3. Identify the people's characteristics and backgrounds influencing their attitude and preference of different types of brownfield landscape; 4. Determine whether the current approaches to brownfield in localities are effective; 5. Identify the challenges experienced by local brownfield program managers; 6. Develop recommendation for the management, planning and reuse design of local brownfield in neighborhood setting. To fulfill these study objectives, the following research questions were developed to guide the study design:

- 1) What are the significant environmental characteristics of brownfield landscapes that influence people's attitude and preference of brownfield landscapes?
- 2) What is a typology of brownfield based on these environmental characteristics?
- 3) What are people's attitudes and preference toward each type of brownfield?
- 4) What are the people's characteristics and backgrounds that significantly influence on their attitudes and preference of each type of brownfield landscapes?
- 5) What are the existing procedures used for local brownfield planning and management?
- 6) What are the challenges experienced by program managers in working with communities to implement brownfield programs?

The next section describes the methods used to address the above research questions and provides the rationale linking them to the specific research objectives.

3.2 STUDY DESIGN

This study is composed of two major parts: people's attitude and preference survey and expert interviews. The people's attitude and preference survey was conducted with the assistance of residents living near brownfield sites in the City of Roanoke in Virginia, U.S.A. The interview was conducted with brownfield program managers in different localities in Eastern, Central and Western parts of the United States. This section first describes the design of the survey study, including the survey area and participants, instrument, administration, and data analysis, after which the design of the interview study is described, including the participants, protocol, procedures, and data analysis.

3.2.1 People's Attitude and Preference Survey

This section describes the survey method used for the first part of the research. As discussed in the Literature Review Chapter, a survey method involving a large participant group is a good tool for quantitatively revealing patterns in participant responses for a given setting. This section is divided into four parts, the first of which describes the survey area and participants. This includes a discussion of the rationale for choosing the study area as well as the participant sampling. This is followed by a description of the survey instrument, which includes scene rating, scene description, people characteristics and backgrounds, and scene selection. The third part presents the procedure followed for the development and administration of the survey, including the pre-test conducted for the survey instrument, the general survey procedure, obtaining the necessary approvals for the human subjects review process. The final part describes the survey data analysis performed, consisting of mean

ratings and frequency analysis, dimensional analysis, content analysis, and analysis of variance.

3.2.1.1 Survey Area and Participants

Location: Railway Corridor Revitalization Project in the City of Roanoke

The Railway Corridor Revitalization Project area in the City of Roanoke in the Commonwealth of Virginia was selected as the location for the survey for several reasons:

1) the city's industrial history, which is based on its role as a railway depot, 2) local brownfield programs have been operating for a while and continued up until very recently, 3) fairly typical brownfield types scattered across a number of different neighborhoods throughout the city, 4) its geographic location, passing between the northeast and southwest areas of the city, and 5) the city's convenience and its easy access for the researcher.

Roanoke has well-known industrial history. The presence of the railroad, which was completed in 1882, made the city attractive to manufacturers so Roanoke's economy developed around the railroad, with a strong emphasis on manufacturing industries. However, transportation modes have now changed and many of the industries have closed, leaving workers unemployed. Roanoke's rates of economic and population growth have both been below the state and national averages ever since the 1960s. Based on these changes, numerous brownfields, including post-manufacturing sites and vacant commercial and housing lots near the old railway lines, have emerged.

Second, Roanoke is already an EPA brownfield grant funding recipient for several assessment and community engagement projects. One of those projects, the Railway

Corridor Revitalization Project, has been funded by the EPA's Brownfield Area-wide Planning Program since 2010. This program assists local communities responding to the challenges from local brownfield sites that are not included in the national priority list to successfully complete brownfield site cleanup and reuse projects. In particular, the objectives of this program include collecting site information, identifying community priorities, evaluating existing environmental conditions and identifying potential opportunities for cleanup and reuse. The brownfield program in the City of Roanoke is recognized as one of the most successful in Virginia and has been held up as a role model for other cities. In spite of the improvement to date, the environmental blight along the rail corridor and surrounding areas in the City of Roanoke remains obvious. As discussed in the "Literature Review" chapter, the type of planning and management procedure implemented, which is based on the associated contamination hazard, is thought to be one reason that these secondary sites might need a different assessment instrument that places more emphasis on the non-hazardous aspects of brownfields. Based on a pilot survey conducted by the author to examine people's attitudes and issues related to brownfield sites, local residents do not seem to be aware of the problem and of the efforts of government agencies at both the state and national level to address it, even though several funded projects have already been implemented. A lack of effective community engagement in the procedure may be the reason for this lack of awareness and attention to brownfield issues and the government's efforts. Since secondary brownfield reclamation projects are more likely to succeed if they receive support from members of the local community, this lack of awareness on the part of local people is an important problem.

Third, the rail corridor area in the City of Roanoke is located about 1.5 miles west from the city downtown. The corridor area includes approximately sixty brownfield sites and there are several neighborhoods located in the surrounding areas (Figure 3.1). The residents in these neighborhoods are significantly affected by the environmental blight problems caused by these brownfield sites. The brownfield types located in these neighborhoods are fairly typical and largely consist of the remnants of small to medium size industries, including manufacturing industries (steel manufacturing, pharmaceutical manufacturing, automobile manufacturing, and chemical manufacturing), light industries (text mills, tannery factory, utility substation, corner gas station), and small vacant commercial and housing lots.

In addition, the geographic location extends between the Northeast and Southwest areas of the city. This encompasses neighborhoods whose residents are reasonably balanced in terms of their education and income level and should thus minimize potential bias. The population in the northeastern part of the city is predominantly non-white, with comparatively low incomes and education levels, while those living in the southwestern section of the city are mainly white, with comparatively high incomes and education levels. This area was also selected due to its convenient access for the researcher.

Survey Participants

The residents in the eight neighborhoods of Loudon-Melrose, Harrison, Gilmer, Gainsboro, Hurt Park, Old Southwest, West End, and Mountainview were chosen as the survey population since they live close to brownfield sites and are exposed to the blighted

environments. All live near the Railway Corridor Revitalization Project area that is currently underway and the information gathered regarding people's attitude and preferences is expected to provide useful input for effective brownfield planning and design. They represent the populations most likely to be affected by any changes in the brownfield sites located along the rail corridor area. For this study, based on household addresses within certain neighborhood boundary, a systematic sampling method was used. Every household was visited on a door-to-door basis. Households who did not answer the door or declined to participate were excluded.

A sample size of 200 participants was deemed acceptable. The most important factor determining the sample size in this study was whether the size would be large enough to permit a statistical analysis. For dimensional analysis, it has been argued that a sample three to five times the number of variables being considered is adequate (MacCallum et.al, 1999; Hatcher, 2005). This study looked at 60 scene variables for the dimensional analysis. Thus, a sample of 200 satisfies the required number for factor analysis, namely more than three times the number of scene variables.

In total, 200 people participated in the interviews. The participants' background were reasonably balanced for most of categories: gender, ethnicity (white and non-white), age (10~30, 30~50, above 50yrs), income and education level, and living period. The income level was fairly evenly divided into two groups (those earning less than \$25,000 and more than \$25,000), and the education level divided into two major groups (high school graduate, college graduate) and some residents held postgraduate level degrees. The

length of time they had been living in their neighborhood was fairly evenly divided between two major groups (1~10 yrs and more than 10yrs), although a few were categorized as less than 1yr. With regard to home ownership, there were twice as many renters as owners. The survey participant profiles are shown in Table 3.1.

Table 3.1 Survey Participants

Participants	Number	Percent	
Total participants	200	100.0	
Sub-category			
Gender	Male	89	44.5
	Female	111	55.5
Ethnicity	Black	95	47.5
	White	81	40.5
	Mix	7	3.5
	Other	8	4.0
Age	10~30	58	29.0
	30~50	84	42.0
	Above 50 years	57	28.6
Income level	Less than \$25,000	97	48.5
	\$25,000~50,000	46	23.0
	More than \$50,000	33	16.5
Education level	High school	80	40.0
	College	70	35.0
	More than graduate	47	23.5
Living period	Less than 1yr	52	26.0
	1~10yr	70	35.0
	More than 10yr	71	35.5
Neighborhood meeting attendance	Never	121	60.5
	More than once every 6 months	42	21.0
Home	Owner	67	33.5
	Renter	125	62.5

3.2.1.2 Survey Instrument

This subsection describes the survey instrument, which is divided into three components: the first involves the rating of brownfield scenes for preference; the second is

the description of representative scenes, where participants are asked to freely write comments for selected scenes from the whole set; and the third consists of a series of questions about characteristics and backgrounds of the participants. These components comprise the survey instrument and will be described in turn in the following sections, followed by a discussion of the scene collection, selection and presentation. The survey form used in this study is included in Appendix A.

Scene Rating Survey

As mentioned above, the survey was administered to residents living along the rail yard area in Roanoke, Virginia. Participants were asked to rate a set of scenes presented in a 8.5”x 11” booklet, with two scenes per page. The scenes were of diverse brownfield sites in the neighborhood. Sixty-six brownfield scenes were shown to the participants, who were asked to rate their preferences for each scene. The scenes were randomly ordered and two scenes were presented per page of the 8.5’x 11’ survey booklet. In the second booklet, the order in which the scenes were presented was reversed. They rated the scenes using a 7 point Likert scale (-3=dislike very much, -2=quite dislike, -1=dislike, 0=neutral, 1=somewhat like, 2=quite like, 3=like very much). A 7 point Likert scale was used since it provides sufficient choice to express a wide range of preferences. There is also research to suggest that people are usually able to immediately remember 7 different things based on a normal memory span, which limits their ability to digest a great deal of information at once (Miller, 1956).

Scenes Collection, Selection, Presentation

The participants rated a set of 66 brownfield scenes for their preference for each scene. The discussion in the following section presents the three major procedures used for scene preparation: scene collection, scene selection and scene presentation.

Scene collection. More than 300 photographs were taken of neighborhood areas in the City of Roanoke. Since one of the research objectives was to identify brownfield typology, it was deemed important to include as wide a range of brownfield as possible. If photographs of brownfields containing certain characteristics were not included, the importance of those characteristics could not be determined. Therefore, it was considered important to include, as far as possible, the full range of brownfield content and spatial organization that exists in the study area.

Brownfield target areas designated in area-wide planning map of the City of Roanoke were used as basic information to decide where to take photographs. In addition, the scenes were collected in the adjacent target areas where show full or partial abandonment. Several scenes of grey fields including industrial facilities currently in use were also included since the areas have high possibilities to become brownfield sites in the future.

To ensure a diverse selection, 15 initial scene categories were identified based on the content of the scenes. Additional photographs were taken to remedy gaps identified in the content. In total, fourteen scene categories were created that showed enclosed wild nature areas, open wild fields, wild natural areas with topographical changes and coarse

ground texture, wild natural areas with leftover structures, neat and enclosed green areas, neat medium sized open spaces with clear access, neat open fields, natural areas with fences, historical commercial and industrial buildings, brick historical buildings with natural vegetation, brick buildings in industrial complexes, modern type buildings, abandoned buildings surrounded by wild nature, and industrial facilities and automobiles. Each scene category contained four to fifteen scenes. Scenes were photographed under different weather conditions to reduce the effect of weather upon preference ratings and the scenes with people or objects not common to brownfields were eliminated so they would not influence the preference ratings. To ensure that the scenes do indeed represent typical views from the people's perspective, they were photographed from viewpoints that might be commonly seen from streets and sidewalks. The scenes were photographed using a digital camera with 16.2 mega pixels and optical zoom lens.

Scene selection. The brownfield scenes were screened by two landscape designers, including the author and a total of 60 scenes were selected based on a standard sample selection technique. It is important in the scene selection to make sure there is a sufficient repetition of scenes types of content. If there is only one or two scenes containing potential brownfield type or content that may be important to participants, the statistical analysis will not reveal that type of content as a pattern of preference. Instead of using simple random sampling that can exclude important but infrequently occurring types of brownfield, a stratified random sampling method was used. This method partitions the scenes into subsets called strata and selects a simple random sample from each stratum (Pedhazur & Schmelkin, 2013). As mentioned above, the scenes collected were categorized into 14 groups

representing a range of conditions such as enclosure wild nature, open wild nature, wild nature with topography and rough ground texture, wild nature with remnant structure, enclosure green space next to building, green space with access, large open field, fenced green space, small historical commercial or industrial buildings, small historical building with green space, historical buildings in industrial complex, modern-looking building, abandoned buildings with wild nature, and abandoned industrial facilities and automobiles. Then, four to five scenes from each category were selected by using a random number generator. As a result, a set of 66 scenes was created for the survey. In addition, for the scene description survey 14 brownfield scenes, one representing each category, were randomly selected from each category.

Scene presentation. Scene booklets were created to be used by participants in rating the scenes. The scenes were randomly ordered and two scenes were presented per page of the 8.5”x 11” survey booklet. The layout of the booklet used in this study is included in Appendix B. In order to adequately locate the scenes and to avoid bias, a random number table was used to assign the order in which the pictures were presented, although to reduce the effect of neighboring scenes, no more than two consecutive scenes from the same categories or conditions were placed adjacent to each other. Once the presentation order of the scenes had been decided, an additional three scenes that would not be included in the data analysis were added at the beginning of the scene presentation booklet to enable participants to become familiar with the scene rating procedure. Similarly, to reduce the “end effect”, an extra three scenes were added at the end of the scene presentation booklet to prevent participants anticipating the imminent completion of the

survey. To reduce “order effect,” two variants of the scene booklet were created, one is based on the original order (scene booklet A) and the other with the order reversed (scene booklet B). Approximately half the participants were shown each version of the booklet. Lastly, to facilitate effective scene rating, with high quality photographs, each page in the 8.5”x 11” booklet contained only two high resolution scenes. The scenes were printed with a color laser jet printer and bound as booklets.

Scene Key Word Descriptors

Survey participants were asked to provide a word or two that best described a subset of 14 scenes. This was done to aid in the interpretation of the environmental characteristics of the scenes as perceived by the participants. These verbal labels are intended to reveal environmental stimuli in different scenes that the participants reacted to when they rated the scenes. This will be used to triangulate the findings from the content analysis of the scenes. Scene description was used because this method reduces bias of the researcher by guiding their interpretation process (Jain and Etgar, 1976, as cited in Wood, 1995).

Participant Characteristics and Backgrounds

Participants were also asked to answer the questions regarding their attitudes and backgrounds. Characteristics and the background factors were divided into five categories: attitude toward brownfield sites, interest in planning issues, trust in the experts involved and the need for community engagement, health concerns, and participants’ backgrounds. In total, 5 survey questions related to these sub-items were included in survey, along with

11 questions related to the respondent's personal background. Each of these questions will be discussed in detail below.

Sixteen items related to *attitude toward brownfield sites* were included in the survey.

These questions asked participants whether they considered brownfield sites:

- were dangerous places,
- lowered local property values,
- were opportunities waiting to happen,
- looked like interesting places to explore,
- were a source of water pollution,
- discouraged community pride,
- were a provider of needed greenery,
- were neighborhood eye-sores
- were part of the local industrial heritage,
- were places containing toxic materials and sources of disease,
- were difficult to maintain,
- were places for unsavory individuals to hang out,
- improved property values if cleaned up,
- often contained objects that were dangerous for children,
- were a provider of habitat for wildlife, and
- encouraged vandalism.

These factors could all influence people's attitudes toward brownfields. For example, some people may tend to prefer brownfields if they believe brownfield sites are interesting places to explore, while others may view brownfields less favorably if they believe brownfield sites are dangerous and problematic places. To identify and measure the participants' attitude toward brownfields, the participants were asked to what extent they

agreed with a series of statements about brownfield sites. For example, they were asked to respond to statements such as “Brownfields are not safe places to go,” “Brownfields pollute our water supply,” “Brownfields are opportunities waiting to happen,” and “Brownfields are interesting places to explore.” As explained earlier, a 7 point Likert scale was used for this rating (-3=strongly disagree, -2= disagree, -1= somewhat disagree, 0=neutral, 1=somewhat agree, 2=agree 3=strongly agree). The full list of items is included in Appendix A.

Eleven items related to the participants’ *interest in planning matters* were included in the survey. These included aspects of planning including: historical building preservation, dangerous structure removal, development for productive use, wild vegetation preservation, industrial history preservation, toxic material isolation with protective layer, toxic material removal, building and structure renovation with local characteristics, open space maintenance by removing weeds and trash, removal of visually unpleasing remnants, and blocking off dangerous areas and provide warning signs for children’s safety. These may influence the participants’ preference rating decisions. For example, if they are interested in securing a safe environment or visual enhancement, they might prefer a brownfields that look neat and clean, without dangerous objects. However, if they are interested in preservation, they prefer a brownfields that includes buildings or objects with some historical significance. To identify and measure the participants’ interest in planning for the rehabilitation of brownfield sites, the participants were asked for their perceived importance regarding different brownfield planning actions. They were asked to indicate how important they believed different actions to be. The actions they were asked about

were: “Preserving historically important buildings,” “removing potentially dangerous objects,” “developing them for productive use,” “preserving naturally growing wild vegetation,” “preserving interesting industrial history,” “isolating or capping existing toxic materials with a protective layer,” “removal of existing toxic materials,” “renovating buildings and structures representing local characteristics,” “maintaining open space by removing overgrown weeds and industrial trash,” “removing visually unpleasing remnants,” “blocking dangerous area for children safety or providing warning sign.” A 7 point Likert scale was again used for the rating (-3=very unimportant, -2=unimportant, -1=somewhat unimportant, 0=neutral, 1=somewhat important, 2=important 3=very important).

Seven questions were asked related to their *trust regarding the experts involved and community engagement* were included in the survey. The participants were asked the extent to which they trust the experts such as scientists, planners, and representatives of local and state government involved in brownfield reclamation. In addition, participants were asked belief in the need for community engagement. These items may influence participants’ attitudes toward brownfields and brownfield planning. For example, people who are likely to trust government and the experts involved in the brownfield planning may be able to persevere with their existing surroundings and be more amenable to brownfield reclamation. However, those who do not trust that the government and experts will act with the participants’ best interests at heart might couch complaints for their surrounding environments and may be less accepting of brownfield planning recommendations. To identify and measure participants’ trust in the experts involved, the participants were asked to indicate the extent to which they agreed with the statements about the experts involved.

They were asked to respond to statements such as “Redeveloping brownfield sites should be left to scientists and specialists,” “I believe that my local and state government are doing an adequate job of planning and managing brownfields sites,” “If I am told by a planner or landscape architect that appropriate actions have been taken to make a brownfield site safe for humans for a new use I am likely to believe it,” “I am confident that my local and state government will provide me with what I need to know about brownfields for protection from potential hazards,” and “I believe that local and state government understand neighborhood situation well enough to fully achieve community benefits from reusing brownfields.” Participants were also asked to what extent they agreed with statements such as “Local area residents should be involved in planning and management decisions regarding local brownfield sites” and “Local area residents should be involved from an earlier stage to discuss diverse brownfield issues, before the specific management and design plan options are found.” A 7 point Likert scale was also used for this rating (-3=strongly disagree, -2= disagree, -1= somewhat disagree, 0=neutral, 1=somewhat agree, 2=agree 3=strongly agree).

To identify and measure participants’ health concerns regarding brownfields, the participants were asked two types of questions. The first set, consisting of 9 questions, examined their belief in the existence of pollution in brownfield sites. The other set, consisting of 7 questions, examined their concern regarding the impact of brownfield sites on health. It is reasonable to think that if people have a high level of concern about health issues, they may be less amenable to brownfield reuse. However, if people are less concerned about health issues they may be more receptive to brownfield reuse. With regard

to their beliefs in the likely presence of pollution on a brownfield site, participants were asked the degree to which they believe that land uses they were asked about included: gas stations, dry cleaners, housing, grocery stores, hardware stores, commercial offices, farming operations, steel manufactures, and chemical manufacturing plants. This was followed by a series of questions that asked to what extent the participants believed that someone living next to a brownfield site should be concerned about different types of health-related problems, including: asthma, birth defects, cancer, chemicals in drinking water, lead-poisoning, eye and skin diseases, and physical hazards to children. A 7 point Likert scale was used for rating both sets of items (-3= not at all concerned, -2= very low concern, -1= slightly concerned, 0= neutral, 1= moderately concerned, 2= very concerned, 3= extremely concerned).

Participants were asked to provide their ethnicity, gender, age, yearly income and education level. Different personal backgrounds, including socio-economic and cultural backgrounds, may influence the participants' attitudes toward brownfields. The study area includes neighborhoods that present two very different sets of population characteristics: the population in the northeastern part of the city is predominantly non-white, with comparatively low incomes and education levels, while those living in the southwestern section of the city are mainly white, with comparatively high incomes and education levels. Participants' gender was measured using a categorical scale, while their gross family income and highest education level completed was recorded using interval scales. For family income, the following scale was used: less than \$25,000, \$25,000-50,000, \$50,000-75,000, \$75,000 – 100,000, 100,000 – 250,000, and more than \$250,000. For education, the

following interval scale was used: middle or elementary school, high school, some college, graduate, post-graduate.

3.2.1.3 Survey Administration

This section describes the survey administration procedure. The procedure is divided into three sub-sections: the pre-test procedure for the survey instrument, the general survey procedure and the process involved in gaining Institutional Review Board (IRB) approval regarding human subject. The IRB approval document is included in Appendix C.

Pre-Test of the Survey Instrument

Before the neighborhood survey was conducted, the survey instrument was pre-tested by administering the scene booklet and survey questionnaire to students at Virginia Tech (n=5). The pre-test participants reported a few typographical errors but no major problems.

Pilot Survey

Before conducting this survey, a pilot survey using similar photo-rating questionnaires in the one of neighborhoods was conducted during June 2013. The pilot study involved only 30 participants. For the first step, the author contacted neighborhood association leaders via e-mail and asked if it would be possible to make a brief presentation on the brownfield research at a neighborhood. The recruitment e-mail is included in Appendix D. With their agreement, the researcher made a presentation introducing the city's brownfield program, case studies and the purpose of the pilot survey at a

neighborhood meeting. The author provided survey materials and a consent form, and asked attendees if they would be willing to participate in the survey and then helped those who agreed to complete the survey. During the neighborhood meeting, a total of 10 residents from the Hurt Park neighborhood participated in the survey.

After the neighborhood meeting presentation and survey, door-to-door visits were conducted for another 20 residents in Hurt park neighborhood. Before visiting residents' houses, a flyer advertising the research and the upcoming door-to door visits were distributed in key community locations such as neighborhood parks. The advertisement material is included in Appendix E. During the door-to-door visits, the researcher knocked on the door or rang the bell three times. If there was a resident at home, the author introduced herself as a student at Virginia Tech who was conducting a survey for a research project and asked the resident if he or she would be willing to participate in the survey. If the resident agreed to participate, the author asked them to sign a consent form and then informed them of the survey procedure and provided survey materials, including scene booklets, a questionnaire, pen, and writing pad. The survey consent form is included in Appendix F. For participants who were more than 16 years old but not yet 18, verbal parent permissions were also required. The verbal parent permission script is included in Appendix G.

The pilot survey revealed whether people are aware of the term "brownfield" and the related issues in their neighborhood. These findings were reflected in the design of the survey questionnaire used for the main survey. For example, a question asking what they

understood a brownfield to be was added because most of the people who participated in the pilot study were not familiar with the term “brownfield”. Those questions that the participants found confusing or difficult wordings were also revised. The number of scenes per page was reduced to 2 and the scene numbering adjusted to reduce confusion since some people missed the scenes or redundantly checked. The length of the questionnaire was adjusted based on the time taken by each person to complete the questionnaire in the pilot survey. The survey form and the scene booklet are included in Appendix H and Appendix I.

Main Survey

The main survey was conducted over the 3 week period from 14 May to 4 Jun, 2014. The researcher followed a similar procedure to that used in the pilot study for the door-to-door visits, knocking or ringing the bell of the house. If nobody came to the door after three knocks, the author moved on to the next house. When a resident opened the door, the author introduced herself as a student at Virginia Tech who was conducting a survey regarding brownfield sites in the neighborhood. The author then asked the resident if they would be willing to participate in the survey. If they indicated their willingness to participate and signed the informed consent, the author informed them of the survey procedure and provided survey materials. The residents in the neighborhoods were surveyed either inside their homes or on their front porches. While the residents were completing survey, the surveyor remained next to them and answered any questions they might have and assisted them with any difficulties. For example, when some participants were illiterate, the researcher should have explained the questions verbally. Participants

often made mistakes in rating the scenes. The researcher hold the booklet and help them rate the scenes without missing the scenes or checking redundantly. After the participants completed the survey form, the surveyor expressed her appreciation for their help and contribution to her research. As a reward, five dollars in cash were provided for each participant to thank them for their time after they had completed all of the questions in the survey.

Approvals and Human Subjects Review

Before starting the pilot and main survey, the study had first to gain approval for research involving human subjects from the Institutional Review Board (IRB) Office of Research Compliance of Virginia Tech. The documents submitted to the IRB and the final approval form is included in Appendix C.

3.2.1.4 Analysis of Data

As noted earlier in this chapter, five different types of data analysis procedures were used in this research: mean rating and frequency analysis (the most and least preferred scenes), dimensional analysis, content analysis, analysis of variance (MANOVA and ANOVA), and analysis of relationships (correlation and multiple regression). All the collected data were entered into a Microsoft Excel database, after which the Statistical Program for Social Scientists (SPSS) software program version 21 was used for further data analysis. The license for the SPSS program was acquired through the Student Software Distribution Office at Virginia Tech. All the statistical analyses were tested at the 95%

significance level. Each of the five types of analysis will be described in turn in the following sub-sections.

Mean Ratings Analysis

Mean preference ratings were calculated for each of the 60 scenes for all 200 participants. Based on the calculated mean ratings, the scenes were then ranked from the highest score to the lowest score and the 8 scenes with the highest and lowest ratings identified. The common environmental characteristics in the most preferred group and the least preferred group were then subjected to content analysis.

Dimensional Analysis

As the first step in identifying those environmental factors affecting preference ratings, an analysis of the 8 most and the 8 least preferred scenes was conducted and their common environmental characteristics identified through content analysis. A dimensional analysis was then conducted to determine whether useful scene categories could be identified based on preference rating patterns. This is in accordance with the purpose of this study, which aims to find a brownfield landscape typology. As a dimensional analysis, factor analysis is useful statistical tool for grouping the scenes because it is able to find common patterns of preference among the participants. This is not simply agreement on the magnitude of preference, but consistent patterns of rating across the participants. These patterns represent a stimuli that the participants are reaction to. The researcher examines each grouping to determine the underlying stimuli. The factor analysis followed a specific set of guidelines:

1. The eigenvalue of the factor analysis was set to be at least 1.0. As the eigenvalue increases, the sensitivity of the grouping rationale decreases. For this study, the factor analysis was conducted twice with two eigenvalues (1.0 and 1.5) and the results compared;
2. Verimax was used for the rotation procedure;
3. The scenes with a loading factor under 3.0 were excluded from the dimension groups;
4. Each dimension had to have at least three scenes. If not, the dimensions were excluded.

Factor analysis is often used for reducing the number of variables by grouping them based on participants' response patterns. While scene dimensional analysis was used to identify scene categories based on the participants' preferences, it was also used for grouping other survey items. For example, 16 items under the variable *attitude toward brownfield* were collapsed into three items. This analysis helps to reveal the umbrella meaning of several items that were asked of participants.

Content Identifying Analysis

A content identifying method was conducted for each of the identified scene groups. The author, a trained landscape designer, examined the scenes to identify common environmental factors that were shared among scenes in the same group. The examination of scenes was based on two different environmental characteristics: scene content and spatial organization. Based on the identified characteristics, different descriptive labels

were given to each scene grouping. Since the content identifying method is based on the researcher's judgment, it was important to confirm these results. During the survey, the participants were asked to provide one or two words that best described 14 representative scenes. The content analysis of the participants' verbal descriptions ensured the author's interpretations were acceptable. The result of the content analysis triangulated, clarified, and expanded the researcher's interpretation of scenes. After the content analysis was complete, a mean preference rating was calculated using the scenes in each dimension and then was ranked based on its mean rating. This is a useful way to highlight which types of brownfield landscapes or environmental characteristics are more or less preferred by participants. Overall, the dimensional and content analyses used to examine the brownfield typology revealed the commonality shared among participants. Therefore, these results provided useful base-line data for those seeking to understand participants' generalized reaction to different types of brownfield landscapes.

Analysis of Variance

Unlike the dimensional analysis, which identifies commonalities, analysis of variance (ANOVA) finds differences among participants. This type of analysis is an effective way to examine whether preference ratings differ significantly among sub-groups based on their personal characteristics and backgrounds. This fits well with the purpose of this study, which aims to identify characteristic factors that affect preference ratings. This section also includes the analysis of relationships that further reveals the predicting ability of sub-group characteristics.

MANOVA and ANOVA analyses to find significant differences. For this research, the statistical analyses used for examining these differences include multivariate analysis of variance (MANOVA) and analysis of variance (ANOVA). MANOVA is one of the general linear model procedures and its use is appropriate when there is more than one dependent variable to test and some correlation among the dependent variables is expected. For this research, correlations were found among dependent variables (preference dimensions). The MANOVA analysis was conducted with all the dependent variables (preference dimensions), and independent variables (participants' characteristics and backgrounds) involved to determine if mean preference ratings in any dimension differ significantly among the various sub-groups. If the MANOVA analysis is statistically significant, this means that independent variables can be factors affecting preference ratings in at least one preference dimension. Based on the MANOVA results, an ANOVA analysis was conducted to examine each particular preference dimension to determine whether mean preference ratings differ significantly among the sub-groups. Lastly, if the ANOVA analysis did reveal significant differences among sub-groups in a particular dimension, a multiple comparison analysis was conducted to compare how the various sub-group differed from one another.

3.2.2 Brownfield Program Manager Interviews

The second section of this study design covers the interview method used for this research. This section is divided into four parts. The first part describes the interview participants, including the recruitment criteria and participant profiles. The second part

briefly describes the interview procedure and lists the steps of the interview procedure. The third part describes the design of the interview protocol. The final part describes the interview data analysis, including the transcription procedure and coding procedure used.

3.2.2.1 Interview Participants

In order to fully understand the full range of highly localized approaches under different local conditions, the localities were intended to be fairly distributed across as many regions as possible of the U.S.A., covering municipalities with populations ranging from small (30,000) to large (1,500,000). To gain a more comprehensive understanding of the programs, localities with diverse program durations and different operation types were included wherever possible. The following criteria were used to recruit participants;

- Brownfield program managers in localities receiving brownfield funding from the EPA to develop and operate their own brownfield program and projects
- Brownfield program managers in localities under diverse physical and demographic conditions in terms of city location and population
- Brownfield program managers in localities with diverse program durations and operation types
- Brownfield program managers at different government levels, including federal and state

In total, eleven brownfield program managers from areas across the United States participated in the interviews (Table 3.2). All but two were program managers in local

government agencies (representing eight cities in seven states). Two additional interviewees who were program managers in the EPA and State DEQ also agreed to participate. Unlike the sites supervised by the EPA under the Superfund Act, those responsible for dealing with local brownfield sites enjoy much more flexibility in their decision-making. In order to understand the differences between federal and local programs, a program manager in EPA was also interviewed, and the two procedures were compared.

Table 3.2 Interview Participants

Government Body or Location/ Population	Position	Program Duration	Interview Type
EPA	Brownfield program manager	-	Phone
State DEQ	Brownfield program manager	-	Phone
City in Virginia/ 100,000	City planner and GIS Analyst	Since 2006/ 8yrs.	Face-to-Face
City in Virginia/ 100,000	Environmental administrator	Since 2006/ 8yrs.	Face-to-Face
City in Ohio/ 300,000	Brownfield project manager	Since 1998/ 16yrs.	Phone
City in Arizona/ 1,500,000	Brownfield program manager	Since 1998/ 16yrs.	Phone
City in Texas/ 100,000	Planning manager	Since 2009/ 5yrs.	Phone
City in Texas/ 350,000	Strategic planning assistant director	Since 2006/ 8yrs.	Phone
City in North Carolina/ 30,000	Community development coordinator	Since 2010/ 4yrs.	Phone
City in North Carolina/ 30,000	Development service director	Since 2010/ 4yrs.	Phone
City in Oregon/ 600,000	Brownfield program manager	Since 1997/ 17yrs.	Phone
City in Oregon/ 600,000	Brownfield program manager	Since 1997/ 17yrs.	Phone
City in Michigan/ 700,000	Brownfield redevelopment authority staff	Since 1998/ 16yrs.	E-mail

The localities whose representatives participated in the interviews were reasonably balanced for population, location (Eastern, Central, and Western) and program durations.

There was a broad range of city population sizes, from 30,000 to 1,500,000, and the program durations ranged from four to seventeen years. Operation types varied from independent permanent programs to temporary teams within departments. Seven of the interviewees were brownfield program managers, with the remainder working in planning departments, community development departments, development service departments or environmental administration.

3.2.2.2 Interview Protocol

To ensure consistency in the broad areas covered, as well as to obtain greater depth and insights, the author conducted semi-structured interviews based on interview protocols. The interview protocol was not rigidly structured but was instead composed of several open-ended questions grouped under main topics, accompanied by prompts for sub-questions. There were three major topics considered based on the study objectives: 1) Interview participants were asked to describe their brownfield program characteristics in general followed as needed with questions such as the reason for initiating the program, the type of program operation, the program focus and the approaches used. 2) If they did not cover the specific procedure used in their description of the program they were asked about specific procedures used to deal with brownfields including site assessment and community engagement 3) Lastly, they were asked about the challenges they encountered, for example, about overcoming specific problems and resource shortages to gather information and suggestions that could contribute to future recommendations regarding the procedure. They were also asked about their background, for example their academic training, as well as

their work experience and duration, and current role. These will be discussed in the following sections. The interview protocol, including the list of interview questions, and demographic questionnaire are provided in Appendix J and Appendix K.

Brownfield program general characteristics and procedure used

The interview participants were asked about how they run their brownfield program by asking questions such as the motivation for initiating the program, the program operation type, the program focus and the approaches used. In addition, the interviewees were asked about the specific procedure used in dealing with brownfields in their program including any assessment and community engagement as these issues were of particular interest for this study. Interviewees were also asked to describe specific programs and projects, if any, they are involved. Those working on particular brownfield projects were asked to describe their procedures in detail to help develop a better understanding of the process including assessment and engagement implemented. Unlike Superfund sites supervised by EPA under Superfund Act, those responsible for dealing with local brownfield sites enjoy much more flexibility in their decision-making. Therefore, it is important to see if there is a typical procedure including assessment and community engagement shared among the different localities represented by the interviewees. In addition, in order to understand the differences in the procedure between federal programs and local programs, a federal brownfield program manager in EPA was also interviewed, and the two procedures compared.

Challenges experienced

To determine whether the same difficulties were experienced in different localities, the participants were asked about the challenges they encountered during implementing the procedure. In addition, program managers were asked their opinions about overcoming specific problems and resource shortages and to suggest things that they would find helpful for the future planning and management of local brownfields.

3.2.2.3 Interview Procedures

The interview participants were recruited via e-mail. The recruitment e-mail is included in Appendix L. The interviews were conducted either face-to-face or by phone and lasted for approximately 45~60 minutes. Follow-up interviews were conducted for some participants when the additional questions are needed to clarify the procedure used in program. Before any interviews were conducted, the interviewees received the interview protocols and a consent form that informed them of purpose and specific procedures for the interview. The consent form is included in Appendix M. They were informed that:

1. The purpose and content of study
2. The interview participation was voluntary and that they could refuse to answer any of the questions
3. Their personal information would be handled in such a way as to protect confidentiality, particularly by using pseudonyms and storing the data in a safe place having limited access

4. The interview would be audio-recorded and when the results are published or discussed in conference, every effort would be made to exclude personal information
5. The interview procedure had been approved by the Institutional Review Board (IRB) Office of Research Compliance of Virginia Tech to conduct research involving human subjects. The IRB approval document is included in Appendix N.

3.2.2.4 Interview Data Analysis

The interview data analysis can be divided into two parts: the transcription and the content analysis. For the transcription, all the audio-recorded interviews were transcribed using the free download version of the InqScribe software to facilitate the transcription process. After the transcriptions were completed, all the transcripts were saved into Microsoft Word.

For the transcripts, a supervised content analysis was employed. An iterative process was followed to identify themes for which there was some repetition among the interviewees. Each phase refined the results further. All the interviews were coded using categories related to what the program managers overtly or implicitly stated as the focus of program, the procedure used for managing brownfields including assessment and community engagement, as well as the challenges experienced during these procedures. The first round of the analysis was conducted by highlighting important sentences with different colors, according to various themes, adding interpretation of these sentences as

comments. The second round of analysis was conducted through revisiting the highlighted sentences, adding more comments and combining the quotes into “sub-themes”. The third and final analysis was conducted by reanalyzing the sub- themes and re-grouping them beneath overarching “themes” once again.

3.3 SUMMARY

This chapter discussed the research methods used to accomplish the objectives of this dissertation. The first section briefly revisited the study objectives and research questions addressed in this dissertation. The second section discussed the two different types of methods chosen for the study. The survey section was composed of four major parts, namely a discussion of the rationale for the survey location and participant sampling; the survey materials, in particular the methods used to measure preference for different brownfield scenes as well as how the characteristic factors selected for inclusion that could affect their preferences; the survey administration procedure including the pre-test, main survey, and IRB approval; and the survey data analysis procedure. The expert interviews section was consisted of four major parts covering the interview participants, protocol, procedure, and data analysis. Chapter 4: “Results” will describe the findings from these survey and interview studies, which include participants’ generalized reaction to brownfield landscapes, important environmental and characteristics factors affecting their attitude and preference of brownfield landscapes, and procedure used and challenges experienced in local brownfield program.

CHAPTER 4: RESULTS

The results for the research questions described in the “Methodology” chapter are addressed in this chapter. The first section describes the results from the interviews conducted with the brownfield program managers. Of particular interest are the procedures used for local brownfield planning and management, as well as the difficulties experienced by the brownfield program managers. The second to fourth sections of the chapter focus on the results obtained from the survey that examined the reactions of members of the local community to their surrounding brownfield environments. In particular, the second section includes a descriptive analysis of the scene preference ratings and reports the generalized result of the participants’ preference for the various brownfield scenes depicted. The third section deals with the environmental factors affecting participants’ reactions to the various brownfield landscapes that eventually led to the development of a brownfield landscape typology, along with an examination of participants’ preferences regarding different types of brownfield landscape. Building on the environmental factors analyzed in the third section, the fourth section examines participants’ backgrounds and the characteristics likely to affect their reaction to brownfield landscapes, including their preconception of different aspects of brownfield sites, any health concerns related to brownfield sites that they may have, and their socio-economic and cultural background.

4.1 CURRENT PLANNING APPROACH TO LOCAL BROWNFIELD AND THE CHALLENGES EXPERIENCED

As discussed in the “Methodology” chapter, the fifth and sixth research questions investigate the existing procedures used for local brownfield planning and management and the difficulties experienced during implementation. To address these questions, interviews with thirteen professional brownfield program managers from across the country were conducted. This section includes the information gathered in the course of these interviews and is divided into two

sub-sections. The first section provides a descriptive picture of general program characteristics, while the second section describes the four themes that emerged as a result of the content analysis; these will be explored in turn. These four themes are particularly related to the program focus, the procedure used, challenges program managers experience during implementing the procedure and overcoming experiences.

4.1.1 General Characteristics of Local Brownfield Programs

Unlike the Superfund program, which falls under the federal government, brownfield programs in local communities are expected to show some flexibility in the way they run programs. Since each locality has its own way to deal with brownfields, it is important to understand the general characteristics of local brownfield programs and to examine whether they share common characteristics. By and large, for this research two aspects of local program characteristics were analyzed: how they start the program (motivation) and how they run it (operation type).

4.1.1.1 Motivation to Start

During the content analysis, five different types of motivations for initiating brownfield reclamation programs were identified. First of all, programs were often motivated by existing city condition and problems such as a history of heavy industry, a lack of buildable areas and development opportunities, or residents' complaints about urban blight. Alternatively, programs might be motivated by a specific person's awareness, for example in one case a particular director wrote an initial grant proposal and headed the process. In other cases the federal government played a role in motivating local governments to start programs through action agendas, tax incentives, publications, and various funds for assessment, clean-up, job training, and area-wide planning. Professional networks also provided the motivation for starting some programs; for

example city officers were recommended to participate in brownfield conferences or apply for brownfield cleanup funds by environmental consulting firms and other partners. Last but not least, the majority of the cities were motivated by their previous experience with restoration projects and past grant benefits. These results are summarized in Table 4.1.

Table 4.1 Motivation for Starting Program

Existing city conditions and problems	-Heavy industrial history -Lack of buildable areas and economic development opportunities -Citizen complaints about neighborhood
Specific personal awareness	-Director writing the initial grant proposal and leading the process
Federal government agenda, incentives, grant funding, and publicizing efforts	-Environmental justice action agenda -Tax incentives under the Act -Various EPA funds for assessment, clean-up, area-wide planning, job training -EPA's wide publicizing and advertisement
Professional networking	-Brownfield conference -Suggestions from consulting firm
Previous experience	-Significant restoration project experience -Past grant benefits experience -Direct calls from EPA

4.1.1.2 Types of Operation

In addition to the above motivations for starting programs, three different program operation types were revealed during the content analysis: independent programs, temporary teams within existing departments, and interdisciplinary task-force teams. The first of these types is based on independent brownfield programs in which people work closely with other local government departments such as the economic development department, neighborhood services department, and planning department. The temporary teams in the second type are usually located in a particular department, for example team members from the planning department may be temporarily assigned to work on a local brownfield project for a certain period of time. The last

type, an interdisciplinary task-force team, consists of selected individuals from different departments who are brought together to work on brownfield projects. The city governments where the 11 interviewees who work in local government were based were evenly distributed in terms of these three types of program operations. The results of the content analysis indicated that one third of the cities represented have independent, permanent brownfield programs, while the remaining two thirds have temporary brownfield programs or interdisciplinary task-force teams.

4.1.2 Four Themes

The content analysis procedure revealed four overarching themes, namely *program focus*, *approaches used*, *challenges experienced*, and *overcoming experiences* (See Figure 4.1).

Coding Map

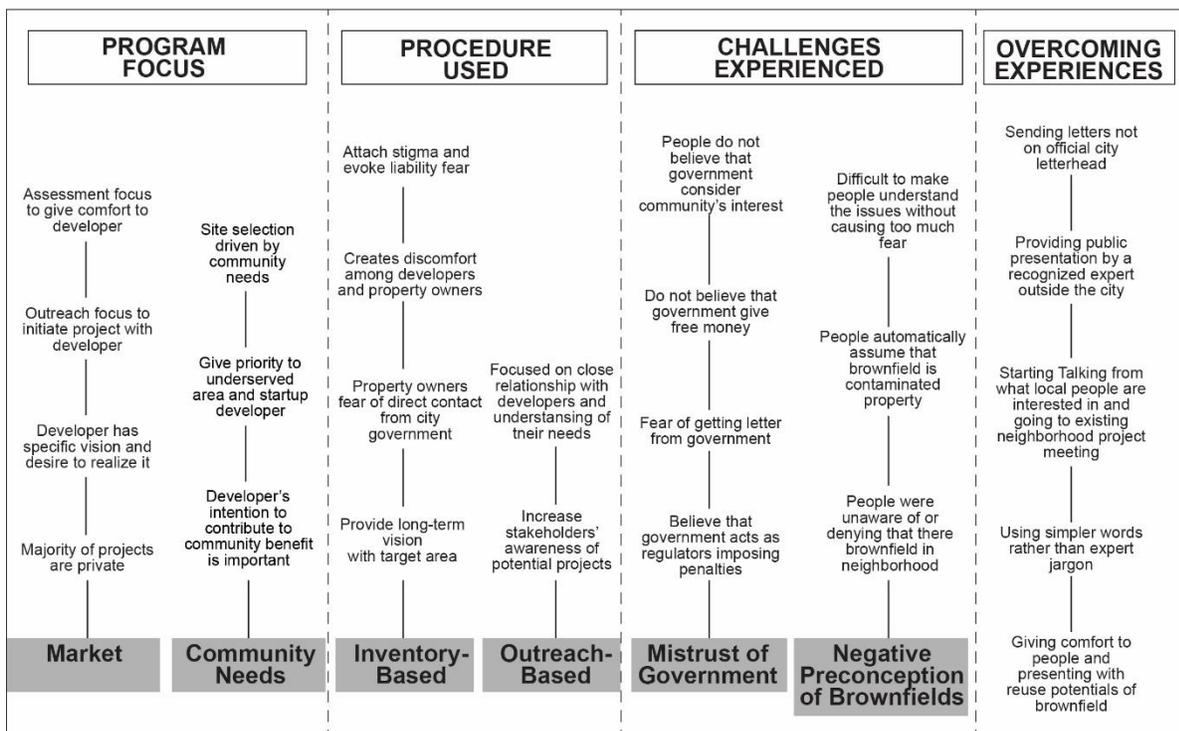


Figure 4.1 Map of Content Analysis. Essential themes identified.

4.1.2.1 Focus of Program: Market and Community

The responses related to program focus were primarily associated with two types of driving forces for brownfield redevelopment: market and community needs. Eight program managers in seven localities described several aspects of market-oriented characteristics in their program. First of all, brownfield management in localities were said to be mainly driven by prospective developers or property owners. For example, two of the interviewees openly stated that the process can be initiated when there is a developer showing interest in the property.

“Again it's all driven by [the] market - if people are interested in those properties and they come in, they want to clean that up, then it's going to become less contaminated....”

“We are driven by economy, so if there is no one interested in developing which has been the case of the past two years since we have the recession. You know, there is not too much that we can do with our brownfield site”

Another two interviewees mentioned that they generally regard the first and second phases of site assessment, which investigate safety through historical records of previous uses of brownfields and physical soil samplings, as a normative procedure for allaying the concerns of developers and giving comfort to them. The result of this site assessment is often being used in outreach materials for groups of developers:

“We will do phase 1 and phase 2 [site assessment] for developers and owners. Most of the time the way we start our process is if somebody is interested in the piece of property, they will contact us just like this current project that I'm working on. The purchaser is interested in the property, but he wants to make sure that the property is clean and if there are any contaminants before he buys the property because that takes a liability off from him. That's where we come in

with our brownfield grants and our assessment funds we can do those assessments with no cost for a purchaser, no cost on owner”

“Our role here at the city is to kind of help projects going and give perspective purchasers and those who might be interested in the property a level of comfort [Through site assessment procedures], we have a pretty good understanding of sites from our environmental standpoint as well as contamination potential. What we can do is speaking knowledgeably to anybody that might be developing the sites regardless of what their interests are. We have some pretty good data, for example, there is some hot spot here or the site’s relatively clean except for this one area over here.”

Another interviewee remarked that in order to start the second phase of site assessment, which includes a physical sampling process on someone’s property, they need agreement from the property owner or the potential purchaser:

“[For second phase assessment], you have to own the property so that's where the market comes in. We can't touch private property unless the owner or the potential purchaser is interested in doing so.....if we know some sites are potentially contaminated and that is under private ownership, we can't do anything. That's where it's tough because we have to not rule out in the market. If the market is great, private developers will be there and we can give them all free money if they want to do an assessment”

One interviewee noted that current practices rely on developers because they usually have a specific vision and the desire (capacity) to realize it, which might marginalize the local community’s participation in decision-making:

“For most of our sites, the reason that things finally [begin] moving forward is that somebody has [a] specific vision for the property that they are trying to carry out. So, there's usually not an opportunity for the neighbors to determine what the end use is going to be”

Similarly, one of the interviewees emphasized the importance of a developer who has the desire to realize a specific vision, which will then be able to attract the attention of the local community.

“If you got a developer coming in already -I might want to put this in there, what can I do with this? - Then, you got something to talk to the people [about]. Now with that set, there is a lot of important work to be done at the community outreach level”

In other cases, community benefits were also found to be an important program focus in comments by two interviewees, who noted that site selection was mainly driven by community needs such as existing blight, contamination concerns, and the lack of amenities. One interviewee stated that they are interested in supporting public projects such as those run by non-profit organizations. For private projects, they also give priority to local developers who are just starting up and appear to have good intentions regarding contributing to community benefits:

“We work with smaller developers that are building mixed use -apartment on the top floors, commercial and retail spaces in bottom floor-. They've been smaller, sort of start-up developers who has been working in the city. Typically, [they are] not developers that have millions and millions dollars for their own. Because there is a financial need criteria as a part of our program, for large private developers, especially these big ones that are coming into our city and building these mixed use project, they don't have financial needs. They can certainly pay for their own

environmental site assessment. But for smaller local start-up developers, we are willing to help them for their assessment, if we feel their project has community benefits.”

One of the interviewees highlighted the importance of the developer’s intentions to contribute to community benefits when they chose who to support with government funds, as noted here:

“We really are not interested in just providing assessments for someone who wants to sell their property and make [a] profit. Intention means a lot for the program. What your intentions are, [do] you plan [on] just turning around [the] site and sell[ing] it or are you trying to bring needed community benefits to the neighborhood?”

She also emphasized their interest in helping underserved neighborhoods and resolving gentrification issues:

“We had a property owner. African American man living there for 40 years with a small construction and home remodeling business on [the] street. It is one of the fastest gentrifying streets in [the] North East. He doesn’t want to sell [his property] to the developer even though he knows how much that will be. He wants to develop his own property and expand his business, and actually bring amenities to the neighborhood that [will be] still here after 40 years. So, for those, we did phase 1 environmental site assessment, we paid 100% for them”

Commenting on the success of this approach, she went on to talk about their major target areas located in underserved, low-income neighborhoods:

“I also like to think that our big success is that the areas we’ve been trying to work in, we call our target area. Every time we apply for money from the EPA for assessment, we have to say what our target area will be in the city, and why that’s important. Most of our assessment has been

in North-east area where a lot of suspected brownfields are. There are low income neighborhoods, so, it is [related to] environmental justice issues happening. Majority of our sites have been addressing small commercial properties that might cause health issues, you know, the communities are typically underserved, like I said, that was a large African American district.”

In short, although the goals of most local brownfield programs are both for community benefit and economic revitalization, the majority of local brownfield programs seem to present market-oriented characteristics that were detected in the utterances of the interviewees. This is demonstrated by their outreach focus on potential developers and the site assessment focus, which supports and encourages developers. The interviewees noted that the site assessment and clean-up processes are considered marketing tools that show that the land is clean and good for reuse, which eventually facilitates development but could marginalize community benefits. In addition, the importance of the developer’s role was noted due to their ability to suggest a specific vision for a site. The lack of a specific vision based on the local community’s perspective could be another reason that community benefits become marginalized. This portion of the results is summarized in Table 4.2.

Table 4.2 Program Focuses of “Market” and “Community Benefit”

Market-Oriented	Community Benefit-Oriented
<ul style="list-style-type: none"> - Market-driven site selection when property owners or prospective developers want to start - Outreach focused to private property owners and perspective developer group - Site assessment to give comfort to developers - Grant funds as starting tool to help economic development 	<ul style="list-style-type: none"> - Need-driven target area selection to address a lack of amenities, existing blight, or contamination concerns - Support for public projects by non-profit organizations - Fund priority for good developers with intention to contribute to neighborhood - Fund priority for small, start-up, local developers

Private Projects and Limited Community Engagement

Further evidence that indicates a market-oriented characteristic comes from the brownfield project types. The content analysis identified three types of brownfield projects: private, city-private partnership and public. Private projects happen when property owners want to change land to other uses or developers are interested and step into the process. The majority of the interviewees mentioned that most brownfield sites are small private commercial and industrial locations that had been gas stations, dry cleaners, and warehouses in the past. The interviewees said that most of the brownfield projects in their cities are driven by private property owners and prospective developers, and the sites have been converted into offices, small retail outlets, housing and mixed-use developments. Another type is a city-private partnership that happens when the city assumes ownership of a site and then works with a private firm by leasing the land to them. For example, one of localities interviewed has been quite active in taking ownership of brownfield sites, keeping them in a land bank, changing them into community gardens or leasing them to private firms. Most public types are driven by project champions such as non-profit organizations and neighborhood

Table 4.3 Brownfield Project Types Identified

	Private project	Public-Private Partnership	Public project
Project Type	<ul style="list-style-type: none"> -When property owners want to convert the land to other uses -When developers are interested in and step in to the process 	<ul style="list-style-type: none"> -When the city takes ownership and works with a private firm or leases land to them 	<ul style="list-style-type: none"> -When there is project champion such as a non-profit organization or neighborhood association -When a partner entity such as a housing authority owns land and donates it to the city
Community Engagement	<ul style="list-style-type: none"> <Condition> - Limited to some big projects - Proposed by a developer, supported by the city <Type> - Advisory committee - Application process including expected community benefits - Public meetings, publicly available information, public comment period 		<ul style="list-style-type: none"> <Condition> -Controversial key sites -Active neighborhood residents -Key person leading the process <Type> - Neighborhood steering committee, neighborhood meeting, design charettes

associations. This may also occur when a partner entity such as a housing authority owns land that it then donates to the city. One of the challenges that public type projects often face is the complex rezoning process and higher clean-up level required. This portion of the results is summarized in Table 4.3.

According to the interviewees, for private projects, community engagement is often very limited and is only attempted when requested by the developer. In this limited case, city government could support community engagement by attending community meetings to support the developer and bringing experts in to provide information to local residents. Typically, such an engagement effort involves an advisory committee that includes only a few neighborhood representatives. Another option is to ask developers or property owners to write about the community benefits and potential opposition arguments expected in the original application documents. Other efforts to engage the community include public meetings to inform people of the proposed project, a public comment period, and making publicly available information via sign boards or websites. For public projects, community engagement appears to be limited, only becoming involved when a project site is located in a controversial area or there are active neighborhood residents, with a key person who leads and coordinates the process. Here, typical engagement efforts will consist of a neighborhood steering committee, neighborhood meetings, and design charettes.

During the content analysis, three types of community engagement efforts were identified based on the timing: getting people to participate in the early planning stages, during planning-related decision-making, and after planning-related decision-making. Most of the engagement efforts described by interviewees concentrated on advertising programs and fostering participation, the so called initiation phase. In particular, this was conducted through formal meetings, face-to-

face small group meetings, and electronic media or publication materials. However, these efforts appeared to diminish somewhat after the initiation phase. Only a few efforts to engage the public at large during or after the decision-making phase were mentioned by interviewees, although advisory committees, including neighborhood representatives, were typically involved at the decision-making stage. Design charettes were limited to a very few public type projects. This result again reveals that the focus of most engagement endeavors is on the potential developers in the early stages of a project. Also, it further implies that there is a lack of platforms or instruments that might help community people step into the decision-making procedure. The results for this portion of the study are summarized in Table 4.4.

Table 4.4 Types of Community Engagement Efforts

	<p>Public hearings (Formal presentations) (Follow-up discussions with developers) (Open discussions)</p>
	<p>Informal group meetings (with community leaders, who already know the key players in the city, to encourage them to spread the word) (with stakeholder groups such as non-profits, business organizations, developers, realtors, and bankers)</p>
	<p>Partnering with existing organizations (with neighborhood organizations, business organizations, non-profit organizations, local colleges) (with key people who can assist with brownfield networking such as environmental consultants who can bring clients, real estate offices, and law firms who might experience some delay in their transaction process)</p>
For Initiation	<p>Go to existing meetings (neighborhood association meetings, business association meetings, As well as church, community development and community groups) (Attending existing project meetings) (Tables at various events in town such as business fairs) (Brownbag presentations at real estate offices or environmental law firms) (Presentations at local schools and colleges)</p>
	<p>Informal word out (When people come to the city for other purposes) (Among people involved in the initial assessment)</p>
	<p>Passing out outreach materials (Brochure to show past success stories) (Education kits)</p>
	<p>Advertise in Existing Publications (Local newspapers)</p>
	<p>Creating Newsletters (to business community)</p>
	<p>Sending Letters (direct contact with inventory property owners)</p>

	(direct contact with property owners after window survey) (to stakeholders such as developers, realtors, bankers, anyone with any connection to the site) (to community groups in the project area)
	Website (update regularly, fresh modern look, upload and refresh outreach material, easy to use and include fun media like video, language accommodation)
	City Blog (upload successful community projects, check feedback, share info about community events visits or results)
	Public Database (Publicly open and available information about ongoing project process)
	Easy Application (Keep application process simple)
	Full-Time Outreach Staff (Full time funded position for outreach)
During Making decision	Advisory Committee (To help make decisions; include realtors, business owners, neighborhood representatives)
	Design Charettes (To obtain more specific input like community priorities)
After decision-making	Public Notice and Comment Period (One- way presentation with map) (Sign board about project and contact information)

4.1.2.2 Procedures Used in Program: Inventory-Based and Outreach-Based

The responses related to the procedure used in brownfield program were primarily concentrated on two different types of activities for managing area-wide brownfields. The first of these is inventory-based in that localities create a brownfield inventory based on the land use history or their own field research, while the other is outreach-based in that they do outreach activities to try and recruit potential interest groups to help raise additional brownfield funding.

According to the interviewees, four localities use both types of approaches together in that they not only create inventory by determining target areas and assigning priorities to them, but they also reach out to potential interest groups such as local businesses, realtors, and property owners. The interviewees pointed out several advantages of both approaches. The inventory-based approach provides a long-term vision by supplying a list of brownfield sites and highlighting possible links, while an outreach-based approach increases stakeholders' and developers' awareness of the potential of individual projects. Interviewees emphasized the importance of close

relationships with developers and an understanding of their needs (i.e. clean-up costs, duration, historic preservation), but a specific vision of a site's potential (i.e. closeness to natural amenities, accessibility) and viability (i.e. flooding issues) are also considered important. For example, when asked about the important conditions for brownfield redevelopment, both potential developers and a vision for the site came up frequently during the interviews. As one of the interviewees noted:

“If we don't have a developer there already, I would say probably the most important thing is having some kind of vision about what we like to see there and also understanding the viability of the land for development”

Four localities used only an outreach-based approach, focusing on advertising their fund and waiting for someone to express an interest in a brownfield project. Although both approaches have advantages, three program managers in two localities with longer program histories have had bad experiences with the inventory-making approach because they found that individual property owners were very often intimidated by a direct contact from city government. Despite the strength of the inventory-based approach, it is often avoided due to the discomfort it creates among developers and property owners. For this reason, a more outreach-based approach tends to be implemented instead. In particular, three interviewees clearly indicated that inventory-making is a challenge to them because it stigmatizes the land and causes liability fears:

“We don't keep an inventory for the reason that nobody wants their properties to be labeled brownfields; that could depreciate the value of their property.....Part of the reason we don't create an inventory is that it is very complicated to take a property that nobody has labeled as brownfield and come in as the city with tax payer dollars and call that site a brownfield because you potentially devalue some personal properties.”

“We didn't do an inventory and we still have not done one because most of the sites are privately-owned and we have never been able to get private property owners comfortable with being included in any kind of list. So, we offer assistance directly to the private sector.”

“In [the] past, we had tried things like we did number of years ago. We tried doing a bit of windshield survey in a target area and we tried direct mailing, so we look at the properties that seem to be vacant and [may] be the sites that you want to do environmental site assessment. We sent letters that said, you have a site and we have some services that would be useful here. We got a very low response.....My feeling is that no one wants to get the letter from government agency about the contamination on their property..... So, we shifted our approach to a more robust education campaign.....What we really rely on is very robust outreach program. We are always connecting with neighbors, neighborhood organizations, business organizations, and non-profits to let them know about our services..... So, they [are] aware of issues and the reasons why they might want to make use of some of [the] assistance we can offer.”

Unlike the wide-spread perception that there will be contamination left on a site where assessment processes are going on, another interviewee emphasized that the site assessment activity (the first phase, that is the examination of historical documents, as well as the second phase, the physical sampling used for an in-depth site investigation) does not have anything to do with any actual contamination on the site:

“That site assessment process doesn't have anything to do with the concentration of contamination or the magnitude of it. It's there regardless and there's a perhaps intuitive association that people have -if there's other regulatory work, the site must be really dirty. Well, not necessarily. It could be fairly benign, but [if] you don't do all of these things, then whoever [is] coming in has no liability protection”

The interviewee from the EPA Brownfield program noted that most of the sites in localities that were considered to have environmental concerns were eventually revealed to have only very light contamination or no contamination:

“9 times out of 10, the amount of contamination doesn't meet [the] threshold that would [make] you spend money like [a] Superfund site. We never see a brownfield site that has come back with the level that meets the threshold, when there has to be some kind of higher action beyond [what] the local community can take care of.”

In addition to inventory-making, based on the interviewees’ comments the stigmatization problem seems to arise as a result of the site assessment procedure typically implemented for brownfield sites. This normative procedure, which is required by the federal government, is a necessary step for liability protection. The assessment procedure focuses on a site’s contamination level in order to determine whether the site should be classed as a Superfund site or a brownfield site and to provide full site information to potential developers to encourage them to step into the process. However, the current site assessment procedure seems to unintentionally cause anxiety to both local residents and potential developers, regardless of the actual contamination or public health risk. This portion of the results is summarized in Table 4.5.

Table 4.5 Two Types of Approaches to Brownfields

Inventory-based	Outreach-based
-Develop brownfield inventory or city-wide conceptual plan	-Get the word out about funding opportunities to perspective developers
-Set up target area, assign priorities to target areas	-Get the word out to other city departments or at meetings for on-going projects
-Send information to property owners in target areas	

4.1.2.3 The Challenges Experienced

The responses regarding the challenges interviewees experienced were primarily associated with their outreach activities. Although they often devote a great deal of time and effort to outreach, the majority of the interviewees found it hard to get people, particularly the property owners and developers, to participate. The results revealed that these challenges were exacerbated by people's mistrust of government, as well as their negative preconceptions regarding brownfields.

Mistrust of Government as Regulator

First of all, six interviewees considered that the greatest challenges came from people's fear of the potential liabilities or penalties associated with brownfield sites, as well as their skepticism of government as a genuine supporter based on their long-standing experiences with city government. They mentioned that property owners were not cooperative or responsive, because of their belief that city government acts primarily as a regulator. For example, people's fear of direct contact from local government representatives generally arose due to their expectation that it would incur obligations, such as regulatory controls or prosecution. One interviewee said that many people fear getting a letter from a government agency about contamination on their property, even when accompanied by information about a related grant fund. People also find it hard to distinguish between support programs and regulatory programs. The comments below are typical:

“No one wants to get the letter from [a] government agency about the contamination on their property. It's frightening and it's hard for people to distinguish between a program that's there for providing assistance and a program that's regulatory.”

“We send individual letters. Out of the 100 letters, I had two people call. So, is it really effective? I'm not sure, well, that can certainly be one of the challenges. Departments of government might not be trusted all the time. I think the city brownfield program, which is under the Bureau of Environmental Services, is sometimes looked at as a regulatory agency, sort of like, the State DEQ”

One of the interviewees commented that people do not believe that government will support them by giving them “free money” to help with the costs involved in a brownfield project:

“There is a huge distrust about that we are giving free money (air quotes gesture). The most difficult thing for us was in the beginning, getting the word out, getting people to trust that it was free government money and it was really sort of [the] purpose of redevelopment.”

Adding to the fear of regulatory controls and the distrust of free money for property owners or developers, two interviewees pointed out the skepticism and distrust of the local community as a whole in government agencies at every level. They explained that people believe that the community's interests and benefits are not uppermost in their mind and often consider city employees as outsiders with no genuine understanding of neighborhood conditions who are likely to be partners with developers:

“Well, I think that it's probably inherent skepticism. Maybe they have concerns that the city is partnering with developers or someone else and we don't have [the] neighborhood's best interests in mind (air quotes gesture). If the city is partnering with a developer, then it may be for helping the neighborhood to give [that] developer a level of comfort. It's not big brother coming in and taking up your neighborhood”

“There is a real challenge to make sure that brownfield redevelopment serves the existing neighborhood and community members and that it does not contribute to displacing them”

Another interviewee noted that this distrust had been caused by a long history of failure to carry out promises made to people, as well as people’s lack of experience in working with the city to find solutions. One of the interviewees noted:

“Public perception probably was the biggest difficulty that we have to [face] every step of the way. This is an older, very historic area of town and has a lot of people that lived there for long time and there have been a lot of promises made in the past on good things that are going to happen [that] never materialized”

Negative Preconceptions of Brownfield

Another major challenge was associated with the laypeople’s negative preconceptions of brownfields. Half of the interviewees explicitly mentioned that the greatest challenges come from the negative preconceptions of brownfield related to the potential liabilities and contamination risk incurred by the people involved. The previous section regarding the procedures used included the concerns related to the stigma generated based on the inventory-based approach associated with the negative perceptions of property owners or developers; this section focuses instead on the challenges related to those of people in the local community.

Many localities where the interviewees worked did not have active community outreach or participation programs apart from regular advisory committee meetings that included one or two neighborhood association leaders or the letters of support that the EPA requires as evidence of support from existing neighborhood organizations. Only one locality was actively trying to get local people involved by encouraging them to participate in brownfield tours and education

sessions. One interviewee who teaches a brownfield class and leads brownfield tours noted that people were generally unaware of or denying that brownfield sites exist in their neighborhoods. In one case, although people do not think there were brownfields in their neighborhood, they seemed to have preconceived ideas about what brownfields are. The interviewee described this problem as follows:

“Certainly, people do not believe there are brownfields in their neighborhoods....We do teach classes and give brownfield tours..... I go to a meeting and say [that] I'm here from brownfield program. People look at me and say that oh, we don't have those problems out there. So, I start asking questions like can you think of vacant lots, parking lots? How about a gas station [that] hasn't been open for long time? They start to kind of understand, oh, maybe we do have brownfields, but people automatically assume that brownfields are contaminated property. We are trying to change that perception. [Not] that it is not necessarily contaminated, but there is just a perception of something wrong with it”

She continued by describing what is effectively a communication problem. In some cases, people had no idea what brownfields are, and thus had no preconceptions regarding them. However, once people are informed about them by city representatives, they often become very fearful of contamination. The concern for experts is how best to make people understand without causing an excessively fearful reaction, which is challenging. She noted:

“I think another challenge is making it relevant like what the issues.....You don't want people [being] freaked out or afraid [that] they might get cancers..... You just should think about [the] health of communities and health of kids and if you are going to have a garden on a vacant lot, you should know [about potential contamination] from the soil; [instead] you just assume [there is] nothing there..... Getting people to understand why it is important and why it is relevant

[is challenging]. The challenges are really [about] presenting the information without [causing] them a lot of fear. It's just something that you should be aware of. It's not just because your mom died of cancer"

4.1.2.4 Overcoming Experiences

The interviewees spoke of the need to overcome people's previous experiences regarding mistrust of government and negative preconceptions of brownfield. Some interviewees recommended sending letters not on official city letterheads, so they are not immediately discarded, and also stressing to residents that they were there not in a regulatory capacity, but as supporters of the local community:

"When I send letters, I send them anonymously, [for example] there isn't the city stamp on the envelope, hoping that property owners at least open it, and then it's more official, I mean inside. But it's really [telling them that] we have funds available, we help you with the property, we are not a regulatory agency.....a lot of the materials that I bring with me really reflect the projects we [have already] worked on. We have site biographies [to encourage] people [to] apply for the funds. There's also assessments [about] what happened and how successful their projects were"

Providing a public hearing meeting featuring a recognized expert from outside the city was another successful approach tried in several localities. One of the interviewees described her experience:

"The other thing that we found really important, especially with brownfields, is that you should do some education even before you start talking about a specific project. You need to [make people] understand what brownfields are, what environmental issues are with phase 1 and phase 2 remediation, and what that all means. We often found that's really important that you've got to

bring some experts in from outside of the city. So, people realize it's not just the city is saying this, but there's some recognized experts who are coming in to talk about this. We have brought in environmental consultants and we also brought in folks from universities. That is always a good choice.”

In addition, to overcoming the challenges of negative preconceptions, the interviewees noted the need to give comfort to people and present them with positive visions of brownfield reuse options. In particular, communicating with people by focusing on community interests such as community health, amenity benefits, or future reuse has been a successful strategy:

“When you talk about use and community health, those things keep people interested. Also, if you can talk about redevelopment on a community benefit level, like why you would be taking care of this, and if you can make it relevant, then I think people listen too.”

Another interviewee, whose major job is doing community outreach activities, noted that rather than just focusing on advertising the brownfield program, starting by talking about what local people are interested in has been successful. She recommended going to existing neighborhood project meetings and assisting those projects that local people are already interested in and feel comfortable with if the projects are eligible for financial assistance from brownfield program funds:

“Going where the community is and framing things in a way that's useful and important to them [is important]. So, when I mean by that, don't hold the meeting downtown to talk about brownfields because nobody will come. It seems so obvious to me after doing this work for five years..... Find out what people [are] already working on with their community, and it is probably not going to be called [a] brownfield. People are working on affordable housing or working on

trying to get a park, go to the meeting they've created about that topic and then phrase thing as to why this is a piece of that project.”

In addition, when they talk with local people, it is better to use simpler words rather than expert jargon, as the interviewees agree that this also helps people understand the specific information needed and overcome their preconceived fears of brownfields. As one interviewee explained below:

“Brownfield has its own language and has a particular set of law, policy, and funding. We live in this world and we forget [others are] outside this world. People aren't familiar with that.”

4.1.3 Summary

The interviews with brownfield program managers revealed that the effectiveness of local brownfield programs is greatly challenged by the existing site assessment procedures required by the federal government. While the site assessment provides necessary information about site safety, it also attaches a stigma to the sites regardless of actual contamination level. Based on this stigma, the biggest challenges expressed were associated with getting people participated in. This is often accompanied by a mistrust of government as a regulator and negative preconceptions related to brownfields.

The insights from the interviews set the stage for the resident survey. The interview results indicate a need to investigate additional assessment criteria that might reveal opportunistic aspects of brownfields and provide helpful guideline for reuse planning and design. The results also suggest important factors in dealing with brownfields such as people's preconception of

brownfields and mistrust of government. Next section discusses the analysis of resident attitude and preference survey using different types of brownfield images.

4.2 RESIDENT GENERAL REACTION TO BROWNFIELD LANDSCAPES

This section includes the analysis of resident attitude and preference survey. As mentioned in the Methodology chapter, a total of 200 residents participated in the survey and 60 local brownfield scenes were shown to them for the scene ratings. These preference ratings were based on a 7 Likert scale ranging from -3 to +3, with -3 representing the lowest rating (“dislike very much”), zero representing neutral, and +3 representing the highest rating (“like very much”). This section includes a brief description of the scene preference ratings and a summary table presenting the overall mean preference rating descriptive statistics is shown below (Table 4.6).

Mean preference ratings for the scenes ranged from the highest point of 2.08 to the lowest point of -2.18. The overall mean preference rating for all scenes was -0.63. The standard deviation for each scene mean ranged from 1.07 to 1.88. Most of the scene ratings included participant ratings of both -3 points for a minimum score and +3 points for a maximum score, which means the survey participants rated the scenes over the full range of the 7 point Likert scale. Appendix O provides descriptive information about each individual scene. Preference ratings are assumed to be continuous and normally distributed.

Table 4.6 Descriptive Statistics for Preference Ratings of Scenes

Scene Number	N	Mean	Standard Deviation	Minimum	Maximum
Scene 01	200	-.5150	1.74211	-3.00	3.00
Scene 02	200	1.5100	1.25610	-3.00	3.00
Scene 03	200	-1.3200	1.67979	-3.00	3.00
Scene 04	200	.3600	1.85407	-3.00	3.00
Scene 05	200	2.0750	1.06539	-2.00	3.00
Scene 06	200	.2650	1.67295	-3.00	3.00
Scene 07	200	-1.8300	1.49408	-3.00	3.00
Scene 08	200	-.4100	1.84088	-3.00	3.00

Scene 09	200	-1.4100	1.56015	-3.00	3.00
Scene 10	200	-.5150	1.70715	-3.00	3.00
Scene 11	200	-1.1450	1.62393	-3.00	3.00
Scene 12	200	-1.5550	1.40243	-3.00	2.00
Scene 13	200	.0750	1.78474	-3.00	3.00
Scene 14	200	-1.1800	1.81496	-3.00	3.00
Scene 15	200	.7400	1.59534	-3.00	3.00
Scene 16	200	-.4900	1.70424	-3.00	3.00
Scene 17	200	-1.2700	1.57145	-3.00	3.00
Scene 18	200	-.1000	1.63811	-3.00	3.00
Scene 19	200	-.6850	1.69118	-3.00	3.00
Scene 20	200	-1.5100	1.44233	-3.00	3.00
Scene 21	200	-1.6550	1.44791	-3.00	3.00
Scene 22	200	-1.2250	1.58015	-3.00	3.00
Scene 23	200	1.4250	1.52512	-3.00	3.00
Scene 24	200	-1.7150	1.44715	-3.00	3.00
Scene 25	200	-2.1750	1.21729	-3.00	3.00
Scene 26	200	-2.1200	1.24634	-3.00	3.00
Scene 27	200	-.2850	1.75762	-3.00	3.00
Scene 28	200	-1.0200	1.80719	-3.00	3.00
Scene 29	200	-.8850	1.56011	-3.00	3.00
Scene 30	200	-.7250	1.59124	-3.00	3.00
Scene 31	200	-.1450	1.55113	-3.00	3.00
Scene 32	200	-1.2400	1.60790	-3.00	3.00
Scene 33	200	-.6050	1.90450	-3.00	3.00
Scene 34	200	-.2000	1.79894	-3.00	3.00
Scene 35	200	-1.4000	1.50042	-3.00	3.00
Scene 36	200	-1.1400	1.60727	-3.00	3.00
Scene 37	200	-.2100	1.85827	-3.00	3.00
Scene 38	200	-.6950	1.75710	-3.00	3.00
Scene 39	200	.0700	1.57400	-3.00	3.00
Scene 40	200	-.0700	1.78072	-3.00	3.00
Scene 41	200	-1.6300	1.44344	-3.00	2.00
Scene 42	200	.0400	1.51322	-3.00	3.00
Scene 43	200	-1.7250	1.38527	-3.00	3.00
Scene 44	200	.2000	1.87820	-3.00	3.00
Scene 45	200	1.2550	1.52367	-3.00	3.00
Scene 46	200	-2.1150	1.18270	-3.00	3.00
Scene 47	200	-1.1550	1.45311	-3.00	3.00
Scene 48	200	1.7100	1.18020	-3.00	3.00
Scene 49	200	1.6000	1.23190	-3.00	3.00
Scene 50	200	-1.8800	1.40552	-3.00	3.00
Scene 51	200	-.7150	1.77752	-3.00	3.00
Scene 52	200	-1.5950	1.45311	-3.00	2.00
Scene 53	200	-.1500	1.64347	-3.00	3.00
Scene 54	200	-1.8250	1.51189	-3.00	3.00
Scene 55	200	.0050	1.67601	-3.00	3.00
Scene 56	200	.3950	1.59427	-3.00	3.00
Scene 57	200	-1.0750	1.61007	-3.00	3.00
Scene 58	200	-.9850	1.60864	-3.00	3.00
Scene 59	200	-1.4050	1.40386	-3.00	3.00
Scene 60	200	-1.5900	1.50774	-3.00	3.00

4.3 ENVIRONMENTAL FACTORS AFFECTING RESIDENTS REACTION TO BROWNFIELD LANDSCAPES

The first three research questions deal with the identification of environmental factors affecting the participants' reaction to brownfield landscapes and the data gathered will eventually lead to the identification of a brownfield landscape typology, as addressed in the second research question. This will be addressed by identifying patterns in the participants' scene preference ratings. The study results related to these research questions are organized into two parts: first, based on the mean preference ratings, the environmental factors presented in the scenes that were preferred the most and least will be discussed. Next, the results of the dimensional analysis of the rated scenes to identify brownfield landscape types will be described, followed by a discussion of the environmental characteristics of each type in detail.

4.3.1 Content of the Most Preferred Scenes

The eight most preferred scenes were identified by ranking the mean preferences of all the rated scenes, which ranged from 2.08 to 0.40. All the top eight scenes presented the appearance of a high level of maintenance, meaning that the areas are well cared for, and easily accessible. Overall, the scenes include neat and tamed nature or landmark type buildings involving historical style and interesting exterior features.

The preferred scene that came top in the rankings (scene 05) has a comparatively higher mean score (2.08) and lower standard deviation (1.07) than any of the others. This indicates that the participants undoubtedly prefer this scene, which contains architectural features involving historical style and is thus highly recognizable. The exterior of the brick building shown is intensely designed, with a pitched roof and three dimensional relief details in the façade, window

and doorframes, as well as different materials in the foundation. The building shown in the scene was an old fire station located in the downtown area of Roanoke and was recognized by the

Figure 4.2 The Scenes Most Preferred by Participants



Scene 05
 Mean=2.08
 Stand
 Dev.=1.07



Scene 23
 Mean=1.43
 Stand Dev.=1.53



Scene 48
 Mean=1.71
 Stand
 Dev.=1.18



Scene 45
 Mean=1.26
 Stand Dev.=1.52



Scene 49
 Mean=1.60
 Stand
 Dev.=1.23



Scene 15
 Mean=0.74
 Stand Dev.=1.60



Scene 02
 Mean=1.51
 Stand
 Dev.=1.26



Scene 56
 Mean=0.40
 Stand Dev.=1.59

majority of the participants. These scenes rarely contain visible plantings that might hide the architectural features from the pedestrians' view. The group of scenes that were the second most preferred (scenes 48, 49 and 02) include tamed and managed green space with well textured groundcover and a good-looking background, such as well-maintained houses and fully-grown trees. The scenes in the second group have expansive green spaces at the front without any plantings to block the view. Lastly, the group of scenes that were third most preferred all contain modern type buildings with interesting facades. The exteriors of these buildings are designed with interesting outside stairs, different sizes of windows, projecting window frames, and dark-colored material (scenes 45 and 15). These scenes also rarely have visible plantings. The scenes are shown in Figure 4.2.

4.3.2 Content of the Least Preferred Scenes

The eight least preferred scenes had mean preference ratings ranging from -2.18 to -1.72. In contrast to the most preferred scenes, all the scenes commonly presented a low level of maintenance, meaning that the areas are not well looked after and are not easily accessible. Overall, the scenes include abandoned industrial remnants, overgrown and scruffy vegetation, and blockades like fences. In the scenes, there are no clear edges that define the space and its use besides the fence. Outworn, cold blue-colored industrial machines and containers encroached upon by thick, wild vegetation are found in the majority of the scenes. No human traces such as access paths, structures or buildings are visible in the scenes.

Among the eight scenes, the group of scenes that were least preferred (scenes 25, 26 and 46) presented comparatively lower mean ratings (-2.18, -2.12, -2.12) and lower standard deviations

(1.22, 1.25, 1.18) than the others. This suggests that the participants much less preferred the scenes that included outworn industrial facilities, piles of trash and overgrown and scruffy vegetation.

Figure 4.3 The Scenes Least Preferred by Participants



Scene 25
 Mean=-2.18
 Stand
 Dev.=1.22



Scene 07
 Mean=-1.83
 Stand
 Dev.=1.49



Scene 26
 Mean=-2.12
 Stand
 Dev.=1.25



Scene 54
 Mean=-1.83
 Stand
 Dev.=1.51



Scene 46
 Mean=-2.12
 Stand
 Dev.=1.18



Scene 43
 Mean=-1.73
 Stand
 Dev.=1.39



Scene 50
 Mean=-1.88
 Stand
 Dev.=1.41



Scene 24
 Mean=-1.72
 Stand
 Dev.=1.45

The scenes also contain uneven and rough ground texture with weeds and fragments of hard materials. Overall, the scenes look abandoned. The second least preferred scenes group (scenes 50,

7, 54, and 24) present comparatively less complexity than the first group in terms of the number of scene items. These scenes include either overgrown and scruffy vegetation or a stack of derelict industrial facilities.

4.3.3 Analysis of Preference Dimensions

As described earlier, dimensional analysis (factor analysis) offers a useful way to identify specific environmental factors that affect participant reactions by grouping the scenes based on rating patterns of the survey participants. When applied to these results, the analysis yielded six significant categories of brownfield landscapes that will be helpful in terms of insights into brownfield assessment, planning and design. This section provides the results of the factor analysis and a descriptive discussion of each type. The descriptive name for each type is determined based on the results of major scene content and spatial characteristics interpreted by the researcher and verbally described by participants. In particular, the contents and spatial characteristics of the six types are delineated, along with verbal descriptions provided by the participants that confirm the researcher’s descriptions.

4.3.3.1 Factor Analysis and Ranking of Dimensions

Factor analysis was used to group the scenes based on participant reaction patterns. The analysis produced six different types. The number of scenes belonging to each type varies from three to seventeen. Table 4.7 depicts the factor loading for each scene.

Table 4.7 Factor Loading Values (Rotated Component Matrix)

	Component					
	1	2	3	4	5	6
SCE35	.745					
SCE25	.725					
SCE36	.713					
SCE20	.693					

SCE41	.674					
SCE26	.638					
SCE21	.635					
SCE33	.625					
SCE24	.624					
SCE43	.597					
SCE09	.525					
SCE03	.515					
SCE38	.493					
SCE54	.476					
SCE57	.474					
SCE31	.466					
SCE47	.443					
SCE08		.783				
SCE19		.760				
SCE16		.713				
SCE22		.656				
SCE40		.656				
SCE14		.649				
SCE06		.630				
SCE11		.623				
SCE37		.619				
SCE56		.585				
SCE13		.556				
SCE27		.540				
SCE34		.531				
SCE07		.426				
SCE01			.595			
SCE58			.570			
SCE04			.565			
SCE29			.540			
SCE55			.536			
SCE12			.504			
SCE17			.466			
SCE10			.458			
SCE32			.454			
SCE18			.423			
SCE44			.416			
SCE30			.410			
SCE28			.372			
SCE49				.795		
SCE48				.694		
SCE45				.681		
SCE02				.568		
SCE42				.536		
SCE53				.477		
SCE50					.682	
SCE59					.538	
SCE52					.529	
SCE60					.495	
SCE51					.479	
SCE46					.465	
SCE39					.386	
SCE05						.759
SCE15						.654
SCE23						.651

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 8 iterations.

According to the mean ratings for each type, six types were ranked from the highest (1.41) to the lowest (-1.55). The types were named based on their common characteristics identified in scenes.

- Type 1- Historical Landmarks
- Type 2- Maintained Landscapes with Scattered Structures
- Type 3- Scruffy Vegetation
- Type 4- Plain Modest Rundown Structures
- Type 5- Industrial Remnants
- Type 6- Crumbling Industrial Remnants

The highest mean rating was historical landmarks (mean=1.41), followed by maintained landscapes with scattered structures (mean=0.99), scruffy vegetation (mean=-0.50), plain modest rundown structures (mean=-0.60), industrial remnants (mean=-1.37), and crumbling industrial remnants (mean=-1.55). These mean score rankings suggest that participants prefer scenes that contain historically significant landmark type buildings and maintain landscape, and this was validated by the findings of the most preferred scenes analysis. This result also indicates that participants were neutral or slightly disliked scenes containing scruffy vegetation and plain modest rundown structures and that they strongly disliked most of the scenes that included industrial remnants. The results of this portion of the analysis are summarized in Table 4.8 and Figure 4.4.

Table 4.8 Rank of Preference Means

Rank	Type name (number of scenes)	Mean	S.D	Alpha
1	Historical landmarks (3)	1.41	1.13	0.71
2	Maintained Landscapes with Scattered Structures (6)	0.99	0.96	0.78
3	Scruffy Vegetation (14)	-0.50	1.26	0.93
4	Plain Modest Rundown Structures (12)	-0.60	1.10	0.89
5	Industrial remnants (17)	-1.37	1.09	0.94
6	Crumbling Industrial remnants (6)	-1.55	1.09	0.84

To identify internal consistency among items in each dimension, a reliability test was conducted. The result shows moderate to high internal consistency using Cronbach's Alpha values among items (Table 4.8). The Alpha value ranges from 0.71 to 0.94. This proves that the scenes in each dimension are highly correlated and reliable.

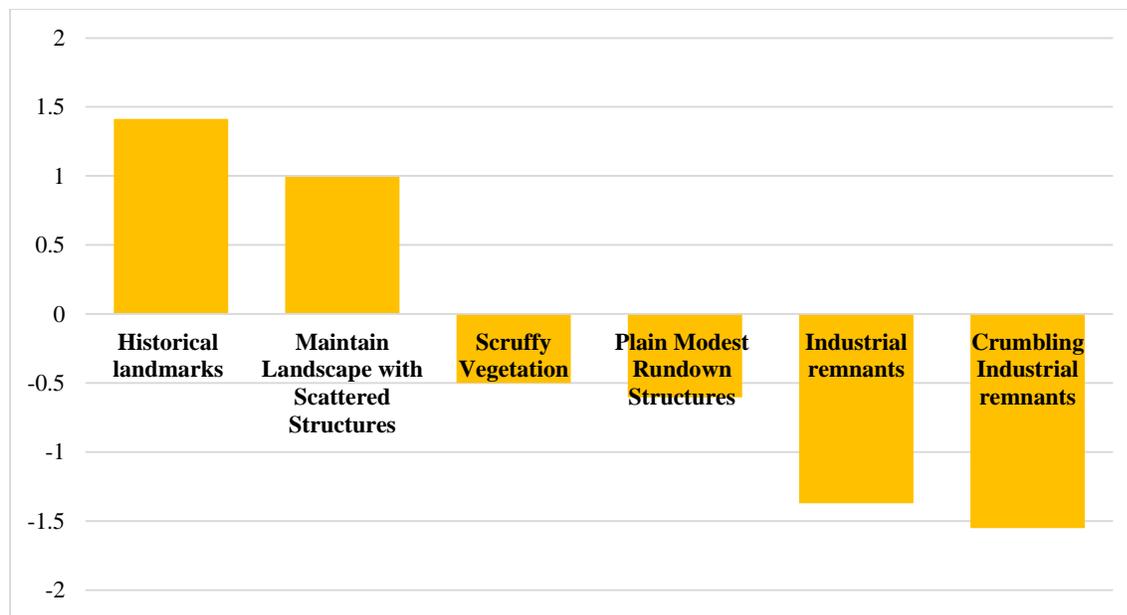


Figure 4.4 Histogram of Rankings of Preference Means

The six types of brownfield landscape along with preference magnitude of each type provide helpful information for site categorization and prioritization based on visual aspects. This may be able to complement existing site assessment procedure described in interview study and lead to more balanced approach.

For this dissertation, the six types of brownfield site defined for the brownfield typology can largely be divided into three major groups, each of which would benefit from a specific type of planning and management. These are the commonly preferred group (historical landmarks,

maintain landscape and scattered structures), the ambivalent group (scruffy vegetation, plain modest rundown buildings) and the commonly less preferred group (industrial remnants, crumbling industrial remnants). This will be discussed in next chapter in detail.

Second, identified preferred design-related factors will provide design guideline for different types of brownfield reuse. Further, by revealing factors that affect the stereotypes of pollution and danger or safety or reuse opportunity, it may help planners and designers be prepared for ethical issues as well as utilize design elements for warning or reassuring people.

4.3.3.2 Preference Dimension 1: Historical Landmarks

The first dimension identified consists of three scenes of clean-looking buildings involving a historical style (Fig 4.5). These scenes are commonly characterized by landmark type buildings with interesting exterior design and good accessibility. The dominant façade color is dark-brown or black, creating a stately atmosphere. Another important characteristic is the high level of maintenance shown in these scenes, meaning that the areas are well cared for. The mean preference for all scenes in this group is 1.41, which is considerably higher than the overall average preference rating of -0.63. All the scenes in this dimension are included in the eight most preferred scenes.

Two scenes that include brick buildings involving a historical style (scene 05, 23) were highly preferred by participants. The exteriors of these brick buildings are intensely designed with a pitched roof, three dimensional relief details in the façade, window and door frames, and different materials for the foundation. The buildings in the scenes were both old fire stations located in the downtown area and were recognized by the majority of the participants. Another scene (scene 15) contains new, modern type buildings with an interesting façade design. The exterior of these buildings has been designed with visually interesting outside stairs, different sizes of windows, window frames, and dark-colored materials. The clear focus of these scenes is a single building

and the scenes rarely contain visible plantings that might hide the architectural features from the pedestrians' view, except for scene 23 which contains a tall tree and open lawn right next to the building.



Scene 05
Mean = 2.08
Loading
=0.76



Scene 23
Mean = 1.43
Loading
=0.65



Scene 15
Mean = 0.74
Loading
=0.65

Figure 4.5 Preference Dimension 1: Historical Landmarks

In terms of spatial characteristics, the scenes in this group commonly present a moderate level of complexity. In particular, the visually interesting architectural features incorporated in the building exteriors keep people involved in the scene. At the same time, the balanced color-use in a building's exterior design, for example unified brown tone material in scenes (scene 05, 23) and grey tone material (scene 15), seems to provide an adequate level of coherence that makes people feel comfortable. The use of natural materials such as bricks (scenes 05 and 23) adds an old, stately atmosphere to the locations. Lastly, good accessibility shown in the scene seems to contribute to a feeling of safety.

Verbal Description for Dimension 1 (Historical Landmarks)

Verbal descriptions and frequency related to “Historical Landmarks” type are summarized in Table 4.9. Scene (scene 23) was included among the representative scenes that were used for the scene description questions. Participants’ comments about the scene were generally positive. The great majority of participants considered the scene to be in nice condition and related to reusable and potential. Positive comments were also received for the building in that participants frequently referred to it as “beautiful” and “nice” and remarked that it reminded them of some kind of history. The comments based on eight categories were identified as relevant to the interpretation of environmental factors affecting people’s reaction to brownfield landscape. This result was used to cross-check with the author’s interpretation of the scenes.

Table 4.9 Verbal Descriptions and Frequency for Scene 23 in Historical Landmarks Type

	Positive Comments						Negative Comments	
Scene 23	Nice and OK condition	Beautiful and Nice building	History	Reusable and Potential	Clean and Maintained	Safe	Need to Clean and Repair	Abandon ed and Rundown
Frequency	69	43	34	15	9	2	8	5

4.3.3.3 Preference Dimension 2: Maintained Landscapes with Scattered Structures

The second dimension consists of six scenes of tamed and managed green spaces resembling a small neighborhood park (Fig 4.6). These scenes are commonly characterized by maintain landscape with well-textured groundcover and a good-looking background such as well-maintained houses and fully-grown trees. The dominant feature is a flat, expansive open lawn at the front without any plantings to block the view. Clean-cut edges such as sidewalk edges define the space and use in the scenes. The high level of maintenance indicates that the areas are well cared for, and good accessibility is another characteristic of this group. The mean preference for

this group is 0.99, which is again higher than the average preference rating of -0.63. Four scenes in this dimension are included in the eight most preferred scenes.



Scene 49
Mean = 1.60
Loading =0.80



Scene 02
Mean = 1.51
Loading =0.57



Scene 48
Mean = 1.71
Loading =0.69



Scene 42
Mean = 0.04
Loading =0.54



Scene 45
Mean = 1.26
Loading =0.68



Scene 53
Mean = -0.15
Loading =0.48

Figure 4.6 Preference Dimension 2: Maintained Landscapes with Scattered Structures

Five scenes (scenes 49, 48, 02, 42 and 53) contain residential buildings in the background, which seem to provide a feeling of safety and human care. In addition to housing, three scenes (scenes 49, 48 and 02) include a high density of full-grown trees in the background that support the prospect and refuge theory, which will be discussed later. Five scenes (scenes 49, 45, 02, 42 and 53) present clear accesses including sidewalks and roads with clean edges. The clear focus of

these scenes is a well-maintained front open lawn without any conspicuous objects, except for scene 45 which focuses on a modern-type building. All scenes have visible plantings.

In terms of spatial characteristics, the scenes in this group present a high level of coherence with open, expansive green areas. There are few conspicuous objects or buildings, thus they present a low level of complexity. The scenes also seem to make people feel secure; the good accessibility shown by the sidewalks and roads with clean edges reinforce a safe, comfortable feeling. This idea reflects a prospect-refuge theory in that human-beings instinctively seek a secure and safe place for survival, thus preferring an environment where they can see potential enemies without being seen. The dense planted area in the background strengthens the link to the prospect-refuge theory (Appleton, 1975). However, these scenes do not include enough things that engage the interest or curiosity of viewers because of the comparatively plain and banal residential landscape shown.

Verbal Descriptions for Dimension 2 (Maintained Landscapes with Scattered Structures)

Verbal descriptions and frequency related to the “Maintained Landscapes with Scattered Structures” type are summarized in Table 4.10. As for the historical landmarks type, only one scene (scene 42) in this dimension was included among the representative scenes. The comments about the scene were also generally positive: the scene was generally perceived as “nice” and “ok”, and related to the potential for various uses. Comments about the scene such as “nice yard” and the potential it presented for green amenities were also high. Most of the negative comments were related to abandonment, vacancy, and upgrade needs. Comments based on eight categories were identified as relevant to the interpretation of environmental factors. This result was used to cross-check the author’s interpretation of the scenes.

Table 4.10 Verbal Descriptions and Frequency for Scene 42 in Maintain Landscape and Scattered Structures Type

	Positive Comments				Negative Comments			
Scene 42	Nice and OK	Need Building or Potential to Use	Nice Yard and Potential Green	Plain and Ordinary	Abandoned and Vacant	Need Work and Upgrade	Clean up or Tear down	Eyesore and Ugly
Frequency	67	24	21	8	34	19	8	6

4.3.3.4 Preference Dimension 3: Scruffy Vegetation

The third dimension consists of fourteen scenes of highly natural green areas with diverse planting species resembling natural landscape (Fig 4.7). These scenes are commonly characterized by overgrown, tangled vegetation with rough ground texture and topographical changes. The dominant features are natural, overgrown vegetation and a dynamic mix of species. The scenes rarely contain visible paths or buildings, however, there is some visual penetration. This indicates that these places are less accessible and have not been actively managed for a long time. The mean preference for this group is -0.50, which is close to the overall average preference rating of -0.63. One scene in this type is included in the eight least preferred scenes.

All the scenes contain more than one plant species. In particular, the mix of trees, shrubs, and ground species in the scenes presents a highly natural landscape. In addition to the diverse vegetation, eight scenes (scenes 08, 19, 16, 40, 14, 06, 11 and 07) show topographical changes. Although a high degree of vegetation cover dominates these scenes, at least some human influence is also visible in all scenes, such as leftover structures, buildings, traces of stairways and paths, as well as the distant residential buildings that are partially shown. However, it is not visually dominant. Moderate visible accesses exist in most of scenes, however three scenes contain remaining stairway and, sidewalks (scenes 37, 40 and 13), and subtle pathways (scenes 19 and 11).



Scene 08
Mean = -0.41
Loading = 0.78



Scene 14
Mean = -1.18
Loading = 0.65



Scene 19
Mean = -0.69
Loading = 0.76



Scene 06
Mean = 0.27
Loading = 0.63



Scene 16
Mean = -0.49
Loading = 0.71



Scene 11
Mean = -1.15
Loading = 0.62



Scene 22
Mean = -1.23
Loading = 0.66



Scene 37
Mean = -0.21
Loading = 0.62



Scene 40
Mean = -0.07
Loading = 0.66



Scene 56
Mean = 0.40
Loading = 0.59



Scene 13
Mean = 0.08
Loading = 0.56



Scene 34
Mean = -0.20
Loading = 0.53



Scene 27
Mean = -0.29
Loading = 0.54



Scene 07
Mean = -1.83
Loading = 0.43

Figure 4.7 Preference Dimension 3: Scruffy Vegetation

In terms of spatial characteristics, this group includes both types of scenes: those that are highly enclosed and those that are very open. Here the enclosed type is a small wild habitat created within existing residential areas (scenes 40, 06, 37, 56, 13, 27 and 34), and the open type consists of comparatively large open fields located on the outskirts of the neighborhood (scenes 08, 19, 16, 22, 14 and 11). The enclosure type is full of thick vegetation covering a small lot, while the open type has a weedy, rough open field at the front and dense full grown trees at the back. The topographical changes also create a changing and relatively unstable landscape compared to the scenes without topographical changes. These topographical changes, along with the thick

vegetation, provide a sense of mystery. People might be curious when they are walking in the scenes as they are not able to see the landscape at times. Instead of clear accesses, two scenes (scenes 19 and 11) contain very subtle footpaths, hinting at human traces. When these paths are combined with topographical changes and open field, the paths in these scenes look as if they expand endlessly beyond the hills. This might strengthen a feeling of mystery.

The scenes in this group present high complexity in terms of the number of vegetation species and the presence of topographical changes, leading to a low level of coherence. This natural complexity seems to contribute to keeping people involved, but also to make people feel less stable and secure. In particular, the lack of human care seems to influence the lower rating the scenes received. For example, some scenes with clean-looking, managed open spaces (scenes 06, 56 and 13) undoubtedly received positive ratings and those scenes showing clean sidewalks also received good ratings, although they include overgrown and tangled vegetation. This results suggests that people prefer to be involved in highly complex natural areas only when they have a feeling of sufficient safety. Therefore, high mystery seems to function well only when safety is secured.

Verbal Descriptions for Dimension 3 (Scruffy Vegetation)

Verbal descriptions and frequency related to “Scruffy Vegetation” type are summarized in the Table 4.11. Three scenes (scenes 22, 13 and 40) in this type were included among the representative scenes used for the verbal descriptions. Interestingly, the comments about the scenes were almost evenly distributed between positive or negative. Although the scenes were highly perceived as related to potential sites for green amenities or other uses, as well as being “good” or “ok”, the comments related to “abandonment”, “depressing”, and “needs clean-up” were also high. Comments based on ten categories were identified as relevant to the interpretation of

environmental factors. This result was again used to cross-check the author’s interpretation of the scenes.

Table 4.11 Verbal Descriptions and Frequency for Scene 22, 13, 40 in Scruffy Vegetation Type

	Positive Comments				Negative Comments					
	Potential for Green Amenity or Other Use	Good, OK, Nice	Plain and Barren	Well-Maintained	Abandoned, Empty, and Depressing	Clean up or Remove	Need Work and Lack of Maintenance	Bad and Ugly	Trash and Junk	Unsafe and Dangerous
Scene 22 (frequency)	27	8	5		46	34	16	31	24	5
Scene 13	77	45	2	4	39	14	9	9		
Scene 40	18	25	1	1	16	43	42	14		2

4.3.3.5 Preference Dimension 4: Plain Modest Rundown Structures

The fourth dimension consists of twelve scenes of old, plain buildings that were previously used for commercial, residential, and industrial purposes (Fig 4.8). The dominant feature here is a series of non-industrial purpose buildings, plainly designed. Most of the buildings have outworn parts, for example peeling paint, broken windows and entry doors, and old or empty signboards. The scenes present clear evidence of the lack of human care, with battered buildings.

Ten of the twelve scenes contain usable buildings. Of the two exceptions (scenes 12 and 30), one includes disused industrial machines and the other a fenced-off green area. Among the ten building-focused scenes, seven contain non-industrial type buildings (scenes 01, 04, 29, 55, 10, 32 and 18), typically with color schemes that utilize warm colors based on brown and yellow, and



Scene 01
Mean = -0.52
Loading =0.60



Scene 12
Mean = -1.56
Loading =0.50



Scene 58
Mean = -0.99
Loading =0.57



Scene 17
Mean = -1.27
Loading =0.47



Scene 04
Mean = 0.36
Loading =0.57



Scene 10
Mean = -0.52
Loading =0.46



Scene 29
Mean = -0.89
Loading =0.54



Scene 32
Mean = -1.24
Loading =0.45



Scene 55
Mean = 0.00
Loading =0.54



Scene 18
Mean = -0.10
Loading =0.42



Scene 44
Mean = 0.20
Loading = 0.42



Scene 30
Mean = -0.73
Loading = 0.41

Figure 4.8 Preference Dimension 4: Plain Modest Rundown Structures

well-textured building materials such as brick, tiles, and wood. Two scenes containing industrial type buildings (scenes 58 and 17) showed buildings with color schemes that utilize cold colors based on bluish grey, with light temporary-looking materials such as panels. Participants tended to prefer the industrial type buildings less than the non-industrial type buildings. An exception was found among the industrial type buildings, where a scene including a tall, clean chimney-shaped structure made of red brick material received the second highest preference rating in this group (scene 44). Among the non-industrial type buildings, the scenes including extremely battered buildings were less preferred than the others (scene 32).

Some scenes include visible vertical plantings and many have small lawns next to the buildings. Five scenes (scenes 01, 58, 29, 17 and 18) include tall trees or medium-size shrubs with a lawn. Although the buildings in the scenes are battered, most of the building areas have good accessibility with the presence of sidewalks and roads. The mean preference for this group is -0.60, which is very close to the average preference rating of -0.63. No scenes in this type are included in either the eight most preferred or least preferred scenes.

In terms of spatial characteristics, the scenes in this group commonly present a high level of complexity. In particular, the partially outworn features of building exteriors such as peeling paint, broken windows and doors, as well as overgrown weeds in the green spaces next to buildings,

increase the complexity of the scenes but decrease the level of coherence. These spatial qualities eventually influence the negative ratings awarded by participants. However, the existing buildings and access paths provide a sense of the potential for improvements. For example, three scenes including relatively fine-looking buildings compared to other buildings, and these received higher ratings from the participants (scenes 04, 55 and 44).

Verbal Descriptions for Dimension 4 (Plain Modest Rundown Structures)

Verbal descriptions and frequency related to “Plain Modest Rundown Structures” type are summarized in Table 4.12. Three scenes (scenes 01, 17 and 32) in this type were included among the representative scenes. As with scruffy vegetation type, the comments about these scenes were fairly evenly split between both positive and negative descriptions. The scenes were frequently referred to as usable or buildable area, but the comments were also highly related to abandonment, rundown and trash, and it was noted that maintenance needs were also high. The comments based on ten categories were identified as relevant to the interpretation of environmental factors. This result was also used to cross-check the author’s interpretation of the scenes.

Table 4.12 Verbal Descriptions and Frequency for Scene 01, 17, 32 in Plain Modest Rundown Structures Type

	Positive Comments				Negative Comments					
	Build or Potential for Other uses	Good, OK, Nice	Plain and Barren	Well-Maintained	Abandoned and Rundown	Trash, Clean up or Remove, Tear down	Need work and Lack of Maintenance, Rebuild, Restore	Bad and Ugly	Old, History	Unsafe and Dangerous
Scene 01	26	32	5	2	57	17	19	27	7	1
Scene 17	16	11			33	28	22	34	26	5
Scene 32	18	11			44	37	23	36	29	4

4.3.3.6 Preference Dimension 5: Industrial Remnants

The fifth dimension consists of seventeen scenes presenting strong industrial characteristics with evidence of industrial operations (Fig 4.9). The dominant features of the scenes in this category are unique, noticeable industrial facilities such as factories, machines, and containers. Some scenes include overgrown, tangled vegetation. The scenes contain both partially active industrial areas with high accessibility and closed industrial areas or junk yards that no longer operate and rarely contain visible access points. However, both areas commonly contain unique industrial objects, structures, and buildings that remind people of the area's industrial history. The mean preference for this group is -1.37, which is substantially lower than the average preference rating of -0.63. Four scenes in this type are included in the eight least preferred scenes.

For this group, around half the scenes clearly show that these places are no longer accessible and have not been taken care of for some time (scenes 35, 25, 41, 26, 21, 24, 43 and 09). This group frequently includes unkempt, scruffy vegetation and these scenes received relatively lower ratings than the scenes that include only structures or buildings without the presence of vegetation. The scenes depicting areas that are still at least partly still operating for various purposes, with visible accesses and neat, clean facilities and buildings (scenes 36, 20, 33, 3, 38, 57, 31 and 47) were more preferred by participants. Three scenes including brick buildings with a sloped roof or an interesting façade design that suggests a historical style received better rating scores than the others (scenes 33, 38 and 31). The architectural features and brick material in these scenes seem to make people notice the unique design of these industrial buildings and remind them of the area's history to some extent. The dominant colors used in the scenes are blue, brown and white, mostly shown in the industrial remnants. The scenes including industrial remnants with warm colors based on brown brick materials were preferred by people the most,

followed by the scenes with white colored structure remnants. The scenes with blue colored containers and machines were least preferred.



Scene 35
Mean = -1.40
Loading = 0.75



Scene 26
Mean = -2.12
Loading = 0.64



Scene 25
Mean = -2.18
Loading = 0.73



Scene 21
Mean = -1.66
Loading = 0.64



Scene 36
Mean = -1.14
Loading = 0.71



Scene 33
Mean = -0.61
Loading = 0.63



Scene 20
Mean = -1.51
Loading = 0.69



Scene 24
Mean = -1.72
Loading = 0.62



Scene 41
Mean = -1.63
Loading = 0.67



Scene 43
Mean = -1.73
Loading = 0.60



Scene 09
Mean = -1.41
Loading = 0.53



Scene 57
Mean = -1.08
Loading = 0.47



Scene 03
Mean = -1.32
Loading = 0.52



Scene 31
Mean = -0.15
Loading = 0.47



Scene 38
Mean = -0.70
Loading = 0.49



Scene 47
Mean = -1.16
Loading = 0.44



Scene 54
Mean = -1.83
Loading = 0.48

Figure 4.9 Preference Dimension 5: Industrial Remnants

In terms of spatial characteristics, in general, the scenes in this group present a low level of coherence and a high complexity as a result of the outworn features of the industrial remnants and overgrown, tangled vegetation. Exceptionally, three scenes mentioned in the above present a high level of coherence and a moderate level of complexity (scenes 33, 38 and 31). These scenes commonly contain clean brick buildings with interesting exterior designs of sloped roofs, chimneys, and cylinders. Their brown coloration and clean textures based on brick materials provide coherence and the exterior design involving different architectural features adds a moderate amount of complexity to the scenes. Overall, these spatial qualities seem to provoke unique heritage feelings in viewers that eventually influence their slightly higher preference ratings for these scenes.

Verbal Descriptions for Dimension 5 (Industrial Remnants)

Verbal descriptions and frequency related to “industrial remnants” type are summarized in Table 4.13. Three scenes (scenes 24, 25 and 31) in this type were included among the representative scenes. In general, the comments about the scenes were negative. The majority of the scenes were frequently referred to using terms such as “trash”, “clean-up”, “removal”, “bad”, “ugly”, “needs maintenance”, “unsafe”, and “dangerous”. One exception was found in the scene depicting a clean-looking brick factory (scene 31). Comments based on ten categories were identified as relevant to the interpretation of environmental factors. This result was used to cross-check the author’s interpretation of the scenes.

Table 4.13 Verbal Descriptions and Frequency for Scene 24, 25, 31 in Industrial Remnants Type

	Positive Comments				Negative Comments					
	Good, OK, Nice, Interesting	Build, Potential for Green space or Other use	Well-Maintained	Plain and Barren	Trash, Clean up or Remove, Tear down	Bad and Ugly Dirty	Need Work and Lack of Maintenance	Abandoned, Depressing, Rundown	Unsafe and Dangerous	Old, History
Scene 24 (frequency)	6	17		2	44	41	29	22	23	6
Scene 25	8	6			70	39	19	11	18	5
Scene 31	68	25	9	3	12	15	11	4	1	24

4.3.3.7 Preference Dimension 6: Crumbling Industrial Remnants

The sixth dimension consists of six scenes of industrial remnants that are being encroached upon by overgrown, tangled plant species (Fig 4.10). Like industrial remnant type I, the scenes in this group are commonly characterized by industrial leftover facilities. However, unlike industrial remnants type, in which the clear focus was unique industrial features, the dominant features of this group are overgrown weeds covering buildings, paved surfaces, containers and fences. These scenes contain either no clear access paths or broken paths that are encroached upon by overgrown weeds. The scenes present clear evidence of a lack of human care, with weeds, broken windows, outworn building exteriors, and trashed containers. The mean preference score for this group is -1.55, which is markedly lower than the average preference rating of -0.63. Two scenes in this dimension are included in the eight least preferred scenes.

Like the scenes in industrial remnants type, the scenes in this group present a low level of coherence and high complexity. These spatial qualities, influenced by unkempt, scruffy vegetation and extremely battered industrial facilities, eventually resulted in lower preference ratings from

participants. No scenes in this type were included among the representative scenes for verbal description.



Scene 50
Mean = -1.88
Loading = 0.68



Scene 60
Mean = -1.59
Loading = 0.50



Scene 59
Mean = -1.41
Loading = 0.54



Scene 51
Mean = -0.72
Loading = 0.48



Scene 52
Mean = -1.60
Loading = 0.53



Scene 46
Mean = -2.12
Loading = 0.47

Figure 4.10 Preference Dimension 6: Crumbling Industrial Remnants

4.3.4 Summary of Preference Dimensions

One of the major objectives of this research is to identify a brownfield typology based on participants' scene rating pattern. Through factor analysis and Content Identifying Method, the six types of brownfield landscape and environmental factors in each type were identified in response to the second and third research questions. To identify the magnitude of participants' preference, six types were ranked using mean ratings of the scenes in each type. The highest rated type was

“Historical Landmarks”, followed by “Maintained Landscapes with Scattered Structures”, “Scruffy Vegetation”, “Plain Modest Rundown Structures”, “Industrial Remnants” and, lastly, “Crumbling Industrial Remnants.” The contents and spatial organizations shared among the scenes in each type are summarized in Table 4.14 in below.

Table 4.14 Summary of the Content and Spatial Characteristics of Preference Dimensions

Dimension (mean)	Analysis	Contents	Spatial organization
1. Historical landmarks (1.41)	Content and spatial organization	Clean and neat brick building, distinct features: historic decoration, dark color building	Highly accessible, high coherence, low complexity
	Participants description	Ok condition, beautiful and nice building	
2. Maintained Landscapes with Scattered Structures (0.99)	Content and spatial organization	Clean and neat green, tame nature, clean building or house, fully-grown tree	Open and high coherence, low complexity, low mystery, highly accessible and clean edge
	Participants description	Nice, need Building or potential to use, nice yard and potential green space, vacant, abandoned	
3. Scruffy Vegetation (-0.50)	Content and spatial organization	Scruffy and tangled vegetation, fully-grown tree, rough ground texture, unkempt structures	Not or less accessible, enclosure, high mystery, low coherence, high complexity
	Participants description	Good, build or potential for green space, abandoned, trash, remove, clean up, need work	
4. Plain Modest Rundown Structures (-0.60)	Content and spatial organization	Non-industrial and ok or good condition building, less vegetation	Accessible, low coherence, high complexity
	Participants description	Build, potential for uses, ok, need work, ugly, abandoned, rundown, clean up	
5. Industrial Remnants (-1.37)	Content and spatial organization	High industrial character remnants (factory, fence, trash), rough ground texture, overgrown and untamed vegetation	Not or less accessible, low coherence, high complexity
	Participants description	Trash, clean up, remove, bad, need work, abandoned, depressing, unsafe, dangerous, old	
6. Crumbling Industrial Remnants (-1.55)	Content and spatial organization	Outworn buildings and structure, overgrown and untamed vegetation,	Not or less accessible, low coherence, high complexity
	Participants description	N/A	

In terms of the scene contents, in general participants tended to like clean and well-maintained landmark type buildings or landscape and to dislike dirty and unmaintained landscapes with industrial remnants or natural vegetation. The analysis suggests that participants clearly

preferred the scenes containing landmark type brick buildings with a historical style such as a decorated façade as shown in Type 1: historical landmarks. In particular, among brick buildings, non-industrial purpose buildings were preferred over industrial purpose buildings. Another type of scene content affecting preference ratings was the condition of the vegetation. Participants clearly preferred the scenes containing tamed and neat vegetation, for example well-managed open lawns with fully-grown trees in the background. This was demonstrated in the ratings for Type 2: maintain landscape and scattered structures. However, participants were much less enthusiastic about scenes containing natural and overgrown vegetation, as shown by their response to scenes in Type 3: scruffy vegetation, and Type 6: crumbling industrial remnants. In terms of species diversity, participants prefer the presence of a few species more than a diverse mix of species. Maintenance and cleanliness that implies human care or stewardship were other factors affecting participants' preference ratings. Participants clearly liked the scenes containing clean lawns, shaped trees and neat buildings, as proven in Type 1: historical landmarks and Type 2: maintain landscape and scattered structures. On the other hand, they clearly disliked the scenes containing battered buildings with broken windows or entrances, industrial trash, and litter. Lastly, evidence of industrial operations also affected residents' preference ratings, as they clearly disliked the scenes containing industrial factories, machines, containers, and cylinders; and liked them even less if they were covered with overgrown vegetation.

In terms of spatial organization, coherence, complexity, mystery, openness, and accessibility were identified as important factors affecting preference ratings. Most of all, participants seem to clearly prefer the scenes that are highly coherent with a moderate level of complexity, as proven by the high ratings given to Type 1: historical landmarks. Scenes that are highly coherent with a low level of complexity were less preferred by residents, as shown by the

scores given for Type 2: maintain landscape and scattered structures. This may indicate that people are a little bored by these scenes and thus prefer opportunities to explore and become involved to some extent. The least preferred case was the scenes that are highly complex with a low level of coherence, for example Preference Dimensions 3, 4, 5 and 6. This suggests that people need at least some amount of comfort to enable them to relax and make sense of their surroundings. Openness is closely related to natural settings. The most preferred scenes contain open, expansive lawns at the front and dense forest at the back. This can be seen in Type 2: maintain landscape and scattered structures, and some of the scenes in Type 3: scruffy vegetation. Lastly, accessibility also appears to be an important factor affecting preference ratings. Most of the highly preferred scenes appear to have good accessibility, such as maintained sidewalks and road, but the less preferred scenes rarely contain accessible or maintained paths and include areas where access is blocked with fences, overgrown and tangled weeds and trees, or have broken sidewalk paving.

4.4 ATTITUDE AND BACKGROUND FACTORS AFFECTING PREFERENCE

The fourth research question deals with how participant attitude and backgrounds affect their reactions to brownfield landscapes. Knowing these factors will help program managers, planners and designers to anticipate how their design can influence on the particular group of people and be prepared for better communication with people involved and careful presentation of their planning and design to them. The section is divided into three sections: socio-economic backgrounds and preferences, preconception of brownfields and preference, health concern and preference.

4.4.1 Socio-Economic Backgrounds and Preferences

In this section, the relationship between the factors related to the socio-economic background of the participants and their reaction to different types of brownfield landscape (scene preference) were analyzed. Background variables included are ethnicity, gender, age, education and income level. For each variable, a MANOVA was performed to identify relationships between the dimensions of preference and participants' backgrounds. If the MANOVA results were significant, the analysis continued with ANOVA tests to identify existing differences between sub-categories and the dimensions of preference. Finally, if the results from the ANOVA tests were significant, post-hoc multiple comparisons were used to identify which sub-categories differed from each of the dimensions of preference. However, for variables that had only two categories, an Independent T-test was used instead of an ANOVA.

Based on MANOVA tests, ethnicity (F18.140, $p < 0.000$), education level (F8.048, $p < 0.000$), income level (F3.152, $p < 0.006$), gender (F18.140, $p < 0.000$), and age group (F4.027, $p < 0.001$), were found to be statistically significant variables among the socio-economic variables that influence participants' preference for different types of brownfield landscapes. The following section presents the significant results from the analysis.

4.4.1.1 Ethnicity, Education and Income Level

For ethnicity, further analysis using independent T-tests revealed that preference for Dimension 1 (Historical landmark), Dimension 2 (Small park-like), and Dimension 3 (Natural Habitat) are significantly different for two ethnicity groups, African American and Caucasian ($p < 0.05$). Results from multiple comparison analysis indicated, for dimension 1, Caucasian participants ($m = 1.70$) preferred this type significantly more than African American participants ($m = 1.28$). One

possible explanation may be that this difference comes from their cultural backgrounds, which may place a different importance on history or local identity. However, this explanation seems to indicate the need for further research to understand the phenomenon better. For Dimension 2, Maintained Landscapes with Scattered Structures, African American participants had a higher preference (m=1.28) compare to Caucasian participants (m=0.74). In addition, for Dimension 3, Scruffy Vegetation, African American participants had a significantly lower preference (-0.74) compare to Caucasian participants (-0.14). These results were interpreted together with participant education and income level in below.

Table 4.15 MANOVA and T-Test for Ethnicity

Categories	MANOVA		T-Test		Multiple Comparison	
	F	Sig	F	Sig	African American	Caucasian
Ethnicity	18.140	0.000				
1.Historical Landmark			6.402	0.012	1.28	1.70
2.Maintained Landscapes with Scattered Structures			15.848	0.000	1.28	0.74
3.Scruffy Vegetation			10.526	0.001	-0.74	-0.14
4.Plain Modest Rundown Structures				not sig.		
5.Industrial remnant				not sig.		
6.Crumbling Industrial Remnant				not sig.		

Meanwhile, ANOVA and T-Tests revealed that only one Dimension, Maintained Landscapes with Scattered Structures, is statistically significantly different for education and income level groups ($p < 0.05$). For education level, based on multiple comparison analysis, preference among the High School Graduate was significantly higher (m=1.20) than among the Graduate or Post-Graduate participants (m=0.56). Also, preference among the College Graduate

Table 4.16 MANOVA and T-Test for Education Level

Categories	MANOVA		T-Test	Multiple Comparison			
	F	Sig		High school graduate	College graduate	Graduate or Post-graduate	
Education level	8.048	0.000					
1.Historical Landmark						not sig.	
2.Maintained Landscapes with Scattered Structures			6.934	0.001	1.20	1.03	0.56
3.Scruffy Vegetation						not sig.	
4.Plain Modest Rundown Structures						not sig.	
5.Industrial remnant						not sig.	
6.Crumbling Industrial Remnant						not sig.	

was significantly higher (m=1.03) than among the Graduate or Post-Graduate participants (m=0.56). For income level, the group of less than 25,000 rated significantly higher (m=1.19) than more than 25,000 group (m=0.76).

Table 4.17 MANOVA and T-Test for Income Level

Categories	MANOVA		T-Test	Multiple Comparison		
	F	Sig		Less than 25,000	More than 25,000	
Income	3.152	0.006				
1.Historical Landmark					not sig.	
2.Maintained Landscapes with Scattered Structures			8.835	0.003	1.19	0.76
3.Scruffy Vegetation					not sig.	
4.Plain Modest Rundown Structures					not sig.	
5.Industrial remnant					not sig.	
6.Crumbling Industrial Remnant					not sig.	

Based on demographic characteristics of the neighborhood, above results suggest the preference difference between two major participants groups. African American participants with lower incomes (less than \$25,000) and lower education levels (less than high school) had a

significantly higher preference for “Maintained Landscapes with Scattered Structures type” compare to Caucasian participants with higher incomes (more than \$25,000) and higher education levels (some college or above). One possible explanation may be that the economically disadvantaged participants are more accepting of environmental appearance such as maintained green area than those with more advantaged. In other words, in low income neighborhood, these may look good to people who live there, but these may not good to people from more affluent neighborhood. This may suggest that enhancing brownfield appearance with maintained green space could be an effective way to boost the satisfaction of disadvantaged residents. However, this also indicates the need for adequate information to be delivered to the disadvantaged group regarding the potential for remaining pollution. It also suggests that those in the advantaged group will not be satisfied simply by changes in appearance, possibly due to their higher expectations such as reuse opportunities.

4.4.1.2 Gender

For gender, independent T-tests revealed that only Dimension 3, Scruffy Vegetation, is significantly different in terms of gender preference ($p < 0.05$). Results from multiple comparison analysis indicated that female participants had a significantly lower preference ($m = -0.66$) than did the male participants ($m = -0.30$). One possible explanation may be that female participants are less tolerant of ugly and scruffy vegetation that may evoke a sense of danger compare to male participants. It is also possible that male participants may be less sensitive to aesthetic quality of green space. However, this explanation indicates the need for further research to understand the phenomenon better.

Table 4.18 MANOVA and T-Test for Gender

Categories	MANOVA		T-Test	Multiple Comparison	
	F	Sig		Male	Female
	18.140	0.000			
1. Historical Landmark					not sig.
2. Maintained Landscapes with Scattered Structures					not sig.
3. Scruffy Vegetation			4.089	0.044	-0.30 -0.66
4. Plain Modest Rundown Structures					not sig.
5. Industrial remnant					not sig.
6. Crumbling Industrial Remnant					not sig.

4.4.1.3 Age

Meanwhile, ANOVA shows that only one Dimension, Industrial Remnant, are statistically significantly different for the age group variable ($p < 0.05$). Based on multiple comparison analysis, one age group was found statistically significant. Preference among the age group of 10~20 was significantly higher ($m = -1.05$) than among the age group of 30~50 or More than 50 (-1.75). One possible reason may be that younger participants (teenagers) tend to be less sensitive to or less

Table 4.19 MANOVA and T-Test for Age

Categories	MANOVA		T-Test	Multiple Comparison		
	F	Sig		10~20	30~50	More than 50
	4.027	0.001				
1. Historical Landmark						
2. Maintained Landscapes with Scattered Structures						not sig.
3. Scruffy Vegetation						not sig.
4. Plain Modest Rundown Structures						not sig.
5. Industrial remnant						not sig.
6. Crumbling Industrial Remnant			9.027	0.000	-1.05 -1.75 -1.75	

influenced by unmaintained, crumbling industrial characteristics in their neighborhood than older participants. Another possible explanation is they maybe more adventuresome and willing to explore something that may be dangerous. However, this explanation seems to indicate the need for further research to understand the phenomenon better.

4.4.2 Preconception of Brownfield

As identified in interview study, people's preconception of brownfields is one of challenges experienced by program managers in their community outreach and engagement activities. Participants with different preconceptions of brownfield may react differently to certain type of brownfield landscapes. In this section, the possible relationship between people's preconception and how it may influence their preference towards different types of brownfield landscape is analyzed.

4.4.2.1 Agreement on Problems and Opportunities

For people's preconception of brownfield, the level of participants' agreement with a range of problems and opportunities associated with brownfield sites was measured. A list of 16 different types of statements were used in the study. The results for this portion of the survey are presented in Table 4.20 below.

Based on a 7-point Likert scale (-3=strongly disagree, -2= disagree, -1= somewhat disagree, 0=neutral, 1=somewhat agree, 2=agree 3=strongly agree), the mean analysis revealed that while the participants in general tended to agree with problems of brownfield sites, they were more skeptical about the potential opportunities associated with brownfield sites, including industrial heritage and greenery benefits. In particular, the results indicate that the participants strongly

Table 4.20 Agreement Regarding the Problems and Benefits of Brownfield Sites

Statements	n	Mean	Std. Deviation
Often contain dangerous objects for children	189	2.15	1.29
Can improve property values if cleaned up	189	2.00	1.40
Lower property values	185	1.77	1.64
Provide places for unsavory individuals to hang out	183	1.69	1.71
Encourage vandalism	185	1.68	1.79
Are eye-sores in the neighborhood	188	1.53	1.75
Can provide habitat for wildlife	187	1.43	1.80
Discourage community pride	178	1.43	1.92
Are opportunities waiting to happen	186	1.40	1.74
Often contain toxic materials and are sources of disease	170	1.27	1.71
Are difficult to maintain	184	1.13	1.67
Pollute our water supply	164	1.09	1.79
Are not safe places to go	189	0.96	1.88
Are important parts of our industrial heritage	184	0.46	1.94
Provide needed trees and greenery	188	0.45	2.02
Are interesting places to explore	187	-0.07	2.15

agreed that brownfield sites “often contain dangerous objects for children” (mean=2.15). They also agreed or somewhat agreed that brownfield sites “can improve property values if cleaned up” (mean=2.00), “lower property values” (mean=1.77), “provide places for unsavory individuals to hang out” (mean=1.69), “encourage vandalism” (mean=1.68), and “are eye-sores in the neighborhood” (mean=1.53). However, the participants were either neutral to or disagreed that brownfield sites “are important parts of our industrial heritage” (mean=0.46), “provide needed trees and greenery” (mean=0.45), and “are interesting places to explore” (mean=-0.07).

As discussed with interview results, this survey results strengthen the fact that people tend to have negative preconception (denying that they have brownfields in their neighborhood and fear of danger regardless of actual contamination risk). There is a clear lack of people’s awareness of possible benefits that brownfields can provide. To overcome these, it is recommended to engage people in developing design alternatives. As mentioned in interview result discussion, it is also important to prepare additional assessment criteria that reveals potentials of brownfield reuse.

Three Types of Preconception

Using Factor analysis, the statements are grouped into three categories, one set of positive statements and two negative groups, one related to broad-based problems with brownfield sites and the other to site specific problems. The results of this dimensional analysis portion are shown in Table 4.10. Based on contents of individual statements, each category was named as follows: (a) *broad-based problem*, (b) *site specific problem* and (c) *Development opportunities, natural and cultural assets*. Further understanding of participants’ preconceptions was achieved through ranking these categories (Table 4.21). The sections below discuss the results in detail.

Broad-based problem

This type consists of seven statements that describe broad-based problems of brownfields. The statements grouped into this type relate to negative influences of brownfields on property value, community pride, and appearance of neighborhood, water pollution and community safety. This was named “broad-based problem.”

Table 4.21 Three Types of Preconception

Statements	Factor			Categories
	1	2	3	
Lower property values	0.88			Broad-based problem
Discourage community pride	0.73			
Are eye-sores in the neighborhood	0.65			
Are not safe places to go	0.61			
Pollute our water supply	0.60			
Encourage vandalism	0.60			
Provide places for unsavory individuals to hang out	0.50			
Often contain dangerous objects for children		0.75		Maintenance difficulties and dangerous objects
Are difficult to maintain		0.74		
Are interesting places to explore			0.80	Development opportunities/natural and cultural assets
Are important parts of our industrial heritage			0.69	
Are opportunities waiting to happen			0.58	
Provide needed trees and greenery			0.53	

Maintenance difficulties and dangerous objects

This type include two statements associated with site specific problems of brownfields. Compare to the first type, this focuses more on unmanaged physical characteristics of individual brownfield sites. The statements grouped into this type relate to maintenance difficulties and dangerous objects found in brownfield sites and was named “maintenance difficulties and dangerous objects”

Development opportunities, natural and cultural assets

The last type consists of four statements associated with potential benefits that brownfields can provide. The statements groups into this type are regarding the opportunities including industrial heritage, future development, and source of needed greenery. This was named “development opportunities and natural and cultural assets”

Rank of Three Types

To identify participants’ general preconception towards brownfield sites, the mean agreement ratings of all three type were compared. The results revealed that the study participants tend to have a negative preconception toward brownfields in terms of their broader harmful influence on the local community, including decreasing property values, discouraging community pride, water pollution and creating neighborhood eyesores (category mean=1.46). The participants also tend to be negative toward brownfield sites with respect to site specific problems such as the presence of dangerous objects and maintenance difficulties (category mean=1.18). However, they generally hesitate to agree with the suggested benefits of brownfield sites, such as providing places to explore, their potential contribution to the area’s industrial heritage, and as providers of greenery (category mean=0.57).

Table 4.22 Rank of Preconception Types

	Types	Mean	Alpha
<i>1</i>	Broad-based problems (7 items)	1.46	0.82
<i>2</i>	Maintenance difficulties and dangerous objects (2 items)	1.18	0.51
<i>3</i>	Development opportunities, cultural and natural assets (4 items)	0.57	0.60

4.4.2.2 Preconception and Scene Preference

To identify meaningful relationships among participants' preconception of brownfield and their reactions to brownfield landscapes, each type of preconception was divided into three categories based on their mean percentile values. This approach allows a statistical comparison between the level of participant agreement (independent categorical variables) and the preference for a certain brownfield landscape type (independent scale variables). To equally divide the aspects into less agreed, agreed, and strongly agreed categories, two different percentiles values were used (33rd percentile and 66th percentile). The analysis involves the same statistical procedures, including MANOVA, ANOVA, and Multiple Comparison Analysis, used in the previous section.

Maintenance Difficulties and Dangerous Objects

Table 4.23 shows that participants' preconception of site specific problem of brownfields (agreement level on maintenance difficulties and dangerous objects in brownfield sites) significantly influenced in their preference toward certain types brownfield landscape ($F_{2,704}$, $p < 0.016$). In particular, the results from the ANOVA test show that there are significant preference rating differences among three agreement level groups for dimension 4 (Plain Modest Rundown Structures), 5 (Industrial Remnant), 6 (Crumbling Industrial Remnant).

Results from multiple comparison analysis indicates that preference means for three dimensions decrease significantly when participants' agreement level (maintenance difficulties

and dangerous objects) increase. This may indicate that participants with strong preconceived idea that brownfields are difficult to maintain and contain dangers might more focus on those aspects

Table 4.23 MANOVA and ANOVA for Agreement on Maintenance Difficulties and Dangerous Objects

Categories	MANOVA		ANOVA	Multiple Comparison			
	F	Sig		Slightly Agreed	Agreed	Strongly Agreed	
Maintenance Difficulties and Dangerous Objects	2.704	0.016					
1. Historical Landmark			not sig.				
2. Maintained Landscapes with Scattered Structures			not sig.				
3. Scruffy Vegetation			not sig.				
4. Plain Modest Rundown Structures			4.304	0.015	-0.27	-0.73	-0.82
5. Industrial remnant			4.458	0.013	-1.02	-1.49	-1.56
6. Crumbling Industrial Remnant			3.183	0.044	-1.31	-1.47	-1.79

in the above three brownfield landscape types than the other participants, thus less preferred the scenes. In addition, based on the scene contents and spatial organization, these also suggest that people might remind of maintenance difficulties and dangers from leftover building structures, industrial remnants, scruffy vegetation that are presented in the scenes (dimension 4, 5, 6).

Development Opportunities, industrial heritage, and greenery provider

As shown in table 4.24, participants' preconceived idea of potential benefits of brownfields (agreement level on development opportunities, industrial heritage, and greenery provider) significantly influenced in their preference toward certain types brownfield landscape (F3.221, $p < 0.005$). In particular, the results from the ANOVA test show that there are significant preference rating differences among three agreement level groups for all dimensions except dimension 2.

Results from multiple comparison analysis also indicated that preference means for all dimensions except dimension 2 increase significantly when participants' agreement level (development opportunities, industrial heritage, and greenery provider) increase. This possibly means that participants with strong preconceived idea that brownfields provide opportunities for development, industrial heritage and greenery may more focus those aspects from brownfield landscape scenes than the other participants, thus more preferred the scenes. In addition, based on the scene contents and spatial organization, this also suggests that these participants might be more likely to expect the reuse or development opportunities from the usable buildings represented in these scenes. They may also see interesting potential uses of brownfield such as places to explore and industrial heritage from industrial remnants such as the factory buildings and structures represented in the scenes. Also, they may see potential uses of brownfield sites such as wild life habitats from outworn buildings and structures covered with natural vegetation in the scenes. However, since dimension 5 and 6 was one of the least preferred types, the number of participants who take this view may be small.

Table 4.24 MANOVA and ANOVA for Agreement on Opportunities of Brownfield

Categories	MANOVA		ANOVA		Multiple Comparison		
	F	Sig			Slightly Agreed	Agreed	Strongly Agreed
Development Opportunities, Cultural and Natural Assets	3.221	0.005					
1. Historical Landmark			4.269	0.016	1.10	1.59	1.59
2. Maintained Landscapes with Scattered Structures				not sig.			
3. Scruffy Vegetation			3.105	0.047	-0.80	-0.48	-0.24
4. Plain Modest Rundown Structures			7.734	0.001	-1.05	-0.55	-0.30
5. Industrial remnant			5.739	0.004	-1.74	-1.20	-1.13
6. Crumbling Industrial Remnant			6.200	0.003	-1.91	-1.31	-1.29

4.4.3 Health Concern related to Brownfields

Among preconceptions of brownfields, people's health concern may be one of the most important. Participants with different levels of health concern may react differently to brownfield landscape scenes. This section discusses the possible relationship between health concern and how it may influence their reaction to brownfield landscapes. The analysis involves procedures described in the previous section, including MANOVA, ANOVA and Multiple Comparison Analysis.

4.4.3.1 Belief in the Effect to Health

Concern level of participants related to the effect of brownfield sites to health of those who living nearby was measured. The participants were asked to response to a list of 7 different types of illness or health problems. The results for this portion of the survey are presented in Table 4.25 below.

Table 4.25 Health Problem Types

Types	n	Mean	Std. Deviation
Physical hazard to children	195	2.46	0.94
Chemicals in drinking water	195	2.27	1.23
Lead-poisoning	195	2.26	1.17
Asthma	195	1.91	1.48
Cancer	194	1.84	1.44
Eye and skin disease	195	1.78	1.50
Birth defects (i.e. premature birth, infant mortality)	195	1.49	1.66

Based on a 7-point Likert scale (-3= not at all concerned, -2= very low concern, -1= slightly concerned, 0= neutral, 1 = moderately concerned, 2= very concerned, 3= extremely concerned), the mean analysis revealed that the participants were moderately to extremely concern about

brownfield sites' potential for adversely affecting nearby residents' health in various ways. For example, the participants were extremely concerned about “physical hazard to children” (mean=2.46), “chemicals in drinking water” (mean=2.27), “lead-poisoning” (mean=2.26), and moderately concerned about “birth defects” (mean=1.49).

4.4.3.2 Health Concern and Scene Preference

To identify meaningful relationships among participants' health concern and their reactions to brownfield landscapes, each type of health concern was divided into three categories based on their mean percentile values. This approach allows a statistical comparison between the level of participant belief or concern (independent categorical variables) and the preference for a certain brownfield landscape type (independent scale variables). To equally divide the aspects into less belief or less concern, belief or concern, and strong belief or strong concern categories, two different percentiles values were used (33rd percentile and 66th percentile). The analysis involves the same statistical procedures, including MANOVA, ANOVA, and Multiple Comparison Analysis, used in the previous section.

Table 4.26 MANOVA and ANOVA for Belief in Effect to Health

Categories	MANOVA		ANOVA	Multiple Comparison			
	F	Sig		Less Concern	Concern	Strong Concern	
Effect to Health	2.996	0.008					
1. Historical Landmark			not sig.				
2. Maintained Landscapes with Scattered Structures			not sig.				
3. Scruffy Vegetation			3.302	0.039	-0.23	-0.53	-0.78
4. Plain Modest Rundown Structures			5.171	0.007	-0.27	-0.62	-0.91
5. Industrial remnant			6.902	0.001	-1.05	-1.40	-1.72
6. Crumbling Industrial Remnant			5.613	0.004	-1.25	-1.58	-1.86

Table 4.26 shows that participants' health concerns associated with brownfields (concern level on health problems of those living nearby brownfield sites) significantly influenced in their preference toward certain types brownfield landscape ($F_{2,996}$, $p < 0.008$). In particular, the results from the ANOVA test show that there are significant preference rating differences among three concern level groups for dimension 3 (Scruffy Vegetation), 4 (Plain Modest Rundown Structures), 5 (Industrial Remnant), 6 (Crumbling Industrial Remnant).

Results from multiple comparison analysis indicates that preference means for four dimensions decrease significantly when participants' health concern level increase. This may indicate that participants who strongly concern about health problems related to brownfields possibly more focus on those aspects in the above four brownfield landscape types than the other participants, thus less preferred the scenes. In addition, based on the scene contents and spatial organization, these also suggest that people may remind of harmful substances from leftover rundown structures, industrial facilities, and scruffy vegetation that are presented in the scenes (dimension 3, 4, 5, 6). For example, regardless of the actual pollution level in brownfield sites, a highly natural appearance (dimension 3), leftover building structures (dimension 4), the most evidence of industrial operations (dimension 5), outworn industrial facilities crumbled with vegetation (dimension 6) in a brownfield might be thought to indicate the presence of toxic materials and thus evoke a feeling of unsafety in health conscious participants.

4.4.4 Interest in Planning Matters

As identified in interview results, there was a clear lack of efforts to engage community in local brownfield program. This could marginalize a community's opportunity to participate in decision-making regarding reuse options. In order to assist consensus planning and design output,

the part of survey include questions about people’s interest in different types of planning actions in brownfield.

The participants were asked to use a 7 point Likert scale (-3=very unimportant, -2=unimportant, -1=somewhat unimportant, 0=neutral, 1=somewhat important, 2=important 3=very important) to indicate how important they believed each of the eleven statements related to planning aspects of brownfields to be. The result to this portion of survey are presented in Table 4.27.

The participants placed great importance on “blocking dangerous areas for children’s safety or providing warning signs” (mean=2.66), “removal of existing toxic materials” (mean=2.43), “removing visually unpleasing remnants” (mean=2.39), “removing potentially dangerous structures” (mean=2.38), and “maintaining open space by removing overgrown weeds

Table 4.27 Perceived Importance of Different Planning Actions

Items	n	Mean	Std. Deviation
Blocking dangerous areas for children’s safety or providing warning signs	191	2.66	0.88
Removal of existing toxic materials	191	2.43	1.29
Removing visually unpleasing remnants	192	2.39	1.04
Removing potentially dangerous structures	192	2.38	1.22
Maintaining open space by removing overgrown weeds and industrial trash	193	2.36	1.29
Developing them for productive use	191	2.21	1.28
Renovating buildings and structures representing local characteristics	188	2.21	1.34
Preserving historically important buildings	189	1.99	1.40
Isolating or capping existing toxic materials with a protective layer	185	1.83	1.78
Preserving interesting industrial history	189	1.44	1.72
Preserving naturally growing wild vegetation	186	1.20	1.94

and industrial trash” (mean=2.36). However, the participants placed moderate importance on “preserving historically important buildings” (mean=1.99) and “Isolating or capping existing toxic materials with a protective layer” (mean=1.83). Lastly, the participants put some importance on

“preserving interesting industrial history” (mean=1.44), and “preserving naturally growing wild vegetation” (mean=1.20).

As shown in table 4.28, factor analysis grouped the statements into two categories. Each category was named based on statements assigned to them: “Maintain landscape, remove visually unpleasing remnants, and protect from danger” and “Preserve historical buildings, industrial history, local identity, natural vegetation.” The mean importance ratings for the two categories were compared. The participants tend to place a greater importance on making changes that secure the safety of the sites, especially for children, and visually enhance their appearance, for example by removing dangerous structures and visually unpleasing remnants (category mean=2.45). However, they appear to be relatively uninterested in preserving existing historical and natural characteristics, including evidence of past industrial operations and growing wild vegetation (category mean=1.73).

Table 4.28 Categories for Planning Actions for Brownfields

	Dimension and Items	Mean	Loading	Alpha
1	Maintain landscape, remove visually unpleasing remnants, and protect from danger	2.45		0.78
	Maintaining open space by removing overgrown weeds and industrial trash		0.82	
	Removing visually unpleasing remnants		0.82	
	Blocking dangerous areas for children’s safety or providing warning signs		0.82	
	Removing potentially dangerous structures		0.56	
2	Preserve historical buildings, industrial history, local identity, natural vegetation	1.73		0.67
	Preserving interesting industrial history		0.85	
	Preserving historically important buildings		0.69	
	Preserving naturally growing wild vegetation		0.64	
	Renovating buildings and structures representing local characteristics		0.59	

As previously mentioned, this collected information about local people’s interest in brownfield planning matter will provide helpful base-line data for preparing design alternatives and developing consensus output for planning and design of local brownfields.

4.5 OTHER FACTORS

One of the most important objectives of local brownfield programs lies in community engagement. It is important to identify how much people believe in the need for community engagement in decision-making process for brownfield planning and design. In addition, it is important to identify people’s level of trust toward expert involved. These results will provide information about real feeling of people, thus, will help localities justify and develop agenda for outreach and engagement activities.

4.5.1 Belief in the Need of Community Engagement

First of all, participant level of belief in the need for community engagement was measured. The participants were asked to use a 7 point Likert scale (-3=strongly disagree, -2= disagree, -1= somewhat disagree, 0=neutral, 1=somewhat agree, 2=agree, 3=strongly agree) to indicate their level of agreement with two statements. The results for this portion of the survey are presented in Table 4.29.

Table 4.29 Belief in the Need of Community Engagement

Items		n	Mean	Std. Deviation
Belief in the Need for	Local area residents should be involved in planning and management decisions regarding local brownfield sites.	191	2.14	1.04
Community Engagement	Local area residents should be involved from an earlier stage to discuss diverse brownfield issues before the specific management and design plan options are found.	192	2.03	1.08

Regarding the brownfield planning and management decision-making, the participants strongly agree that “local area residents should be involved in planning and management decisions regarding local brownfield sites” (mean=2.14), and “local area residents should be involved from an earlier stage to discuss diverse brownfield issues before the specific management and design plan options are found” (mean=2.03).

4.5.2 Trust toward Experts Involved

To measure participant level of trust, they were asked to use a 7 point Likert scale (-3=strongly disagree, -2= disagree, -1= somewhat disagree, 0=neutral, 1=somewhat agree, 2=agree, 3=strongly agree) to indicate their level of agreement with five statements. The results for this portion of the survey are presented in Table 4.30.

Participants tend to disagree that “redeveloping brownfield sites should be left to scientists and specialists” (mean=-0.06), “I am confident that my local and state government will provide me with what I need to know about brownfields for protection from potential hazards” (mean=-0.08), “I believe that local and state government understand the neighborhood situation well

Table 4.30 Trust toward Experts Involved

Items		n	Mean	Std. Deviation
Trust toward Experts Involved	If I am told by a planner or landscape architect that appropriate actions have been taken to make a brownfield site safe for humans for a new use I am likely to believe it.	184	0.52	1.69
	Redeveloping brownfield sites should be left to scientists and specialists.	185	-0.06	2.04
	I am confident that my local and state government will provide me with what I need to know about brownfields for protection from potential hazard.	189	-0.08	1.91
	I believe that local and state government understand neighborhood situation well enough to fully achieve community benefits from reusing brownfields.	190	-0.09	2.05
	I believe that my local and state government are doing an adequate job of planning and managing brownfields sites.	171	-0.48	1.95

enough to fully achieve community benefits from reusing brownfields” (mean=-0.09), and “I believe that my local and state government are doing an adequate job of planning and managing brownfields sites” (mean=-0.48).

The mean agreement ratings of these two categories are compared. The results show that the participants tend to strongly believe that community should be engaged at every stage of the decision-making for brownfield planning and management (category mean=2.09). However, they tend not to trust the experts involved, including government, scientists, specialists, planners and landscape architects regarding their ability and ethics (category mean=-0.15).

Along with the interview results that revealed the lack of efforts for community engagement in local brownfield programs, the above results also suggest that there is an urgent need for developing planning for better engagement for every stage of decision-making. In particular, the agenda may need to include the strategy how to restore trust of people to government and experts involved through the engagement procedure.

4.6 SUMMARY

Based on the interviews with those charged with managing the local brownfield programs, the program focus, procedure used, challenges experienced, and overcoming experiences were identified. Inventory-making based on existing assessment procedure represent the challenge because it stigmatizes the land and causes liability fears. The program managers interviewed for this study also occasionally encountered difficulties in their outreach activities due to the mistrust of government as regulator and negative preconception of brownfields. Based on the result, it is recommended that brownfield program managers and policy makers include assessment criteria that reveal more than contamination risks and highlight reuse benefits and potentials.

Based on the survey undertaken with the assistance of the local residents living along the rail corridor area in the City of Roanoke, Virginia, the brownfield environment can be divided into six major brownfield landscape types: historical landmarks, maintained landscapes and scattered structures, scruffy vegetation, plain modest rundown structures, industrial remnants and crumbling industrial remnants. Among these, the historical landmarks type, which includes landmark type buildings with historical styles and interesting exterior features, and maintain landscape and scattered structures, including tamed nature, were found to be the most preferred by participants, while those scenes with evidence of past industrial operations were the least preferred. Interestingly, the participants were ambivalent about the plain modest rundown structures type, including the remaining nonindustrial-purpose buildings, and the scruffy vegetation type, including highly natural vegetation. The brownfield landscape types identified in this study and the participants' preferences for each type have implications for different reuse planning and design styles of brownfields, which will be discussed in the next chapter.

Along with the brownfield landscape types, participants' characteristics and backgrounds that affected their preference ratings for different types of brownfield landscapes were also identified. These included their preconception of brownfield sites, health concerns, gender, ethnicity, age, and income and education level. This result suggests that particular brownfield landscapes could convey information or messages regarding potential risks or opportunities to certain group of people. This will also be discussed in detail in the next chapter. The "Conclusions and Implications" chapter will offer a more detailed discussion of results and the implications of them. The next chapter will also include a series of recommendations for the design professions, including landscape architects and planners, as well as policy recommendations for those responsible for dealing with local brownfield sites.

CHAPTER 5: CONCLUSIONS AND IMPLICATIONS

This chapter sums up the important findings of this dissertation and discusses their implications and then goes on to provide a series of recommendations for federal policy makers, local program managers, design professionals and educators involved in the assessment, planning and design of brownfield sites. The chapter concludes by discussing the limitations of the study and suggestions for future research.

5.1 SUMMARY OF THE MAJOR FINDINGS AND IMPLICATIONS

This section summarizes the study's major findings and discusses their implications. The findings and implications are divided into two parts: the procedures used to plan and manage local brownfield sites and the challenges encountered, and a description of the six brownfield landscapes types identified and survey respondents' expressed preferences.

5.1.1 The Procedure Used To Plan and Manage Local Brownfields and the Challenges Experienced

One of the research question for this dissertation research relates to the identification of the procedure used to plan and manage local brownfields and the challenges encountered during the process. This section discusses the major findings from the interviews with brownfield program managers in order to provide helpful recommendations for the planners, designers, and policy makers undertaking brownfield redevelopment projects.

5.1.1.1 Assessment as a Double-edged Sword

The interviews with brownfield program managers revealed that the effectiveness of local brownfield programs is greatly challenged by the existing site assessment procedures required by the federal government. Although the localities are able to freely decide their own way to manage

brownfields, the normative site assessment procedure needed for securing liability protection from the federal government seems to greatly influence all the localities. While the site assessment provides necessary information about site safety, it also attaches a stigma to the sites regardless of their actual contamination levels. For the same reason, several localities had begun to avoid creating a brownfield inventory. Given that the stated goal of local brownfield assessments, namely “reusing brownfields,” is not the same as the federal superfund assessment goal of “clean-up brownfields,” these interview results imply that the legislation that was set up to eliminate brownfield contamination is actually hurting reuse efforts on local sites.

The professionals involved in the planning and management of brownfields should first recognize the stigma attached to and negative preconceptions of brownfields. It is important to help stakeholders and local citizens to see not only the threat, but also the possible benefits that could come from the reuse of these sites in a more balanced way. Therefore, it may be helpful if brownfield program managers and policy makers include assessment criteria that reveal more than contamination risks and highlight reuse benefits and potentials. Further, such approaches should lead to richer definitions of brownfield sites based on factors such as natural resources and community assets.

5.1.1.2 Mistrust of Government and Negative Preconceptions Related to Brownfields

The biggest challenges expressed were associated with their outreach activities, particularly related to property owners and developers who are reluctant to step into the process. This is often accompanied by a mistrust of government as a regulator that exacerbates fears of being involved, thus slowing the reuse process. It is not surprising that people regard government as a regulating body rather than a supporting agency, however, the fear of penalties and liabilities seems to be much greater in brownfield projects, because of the influence of the Superfund law in

the past. For the few localities who did engage in active broad community outreach, the challenges were also primarily related to negative preconceptions of brownfields. The typical responses of lay people described by the interviewees largely consisted of denials of the brownfields in their neighborhood or fear of those they were aware of. This is probably largely influenced by what they have read or seen in the past about the pollution of superfund sites.

5.1.1.3 Lack of Efforts for Community Outreach and Perceived Need

When describing outreach activities, the interviewees generally did not differentiate between property owners or developers and community residents, but simply lumped all the local people together. It was very natural for them to focus on developers or property owners. After devoting additional time to explore this question further, the interviewees finally mentioned community outreach efforts that are largely limited to a few advisory committee meetings and letters of support, which could marginalize a community's opportunity to participate in decision-making regarding reuse options. Given that one of the most important objectives of local brownfield programs lies in community engagement, as described in their grant proposals, this is a clear lack of effort.

Added to interview results that revealed the clear lack of efforts for community engagement in local brownfield programs, the part of the survey results indicate that the participants tend to strongly believe that community should be engaged at every stage of the decision-making for brownfield planning and management. They tend not to trust the experts involved, including government, scientists, specialists, planners and landscape architects regarding their ability and ethics. These results provide information about the real feelings of people, thus, helping localities justify and develop agenda for outreach and engagement activities.

5.1.2 Six Brownfield Landscapes Types and Preference

One of the important research questions that has guided this dissertation research relates to the identification of a brownfield landscape typology and influential factors affecting preference for different types of brownfield landscape. The result of the survey revealed six different brownfield landscape types based on scene preference patterns of participant: historical landmarks, maintained landscapes and scattered structures, scruffy vegetation, plain modest rundown structures, industrial remnants, and crumbling industrial remnants. This typology, along with the degree of preference for each type, has implications for planning and design of brownfields and public engagement process.

5.1.2.1 Three Major Groups involving Different Level of Planning Challenges

Based on the results of the comparison among the magnitudes of the preferences for the six brownfield landscape types identified, three major groups that involved different levels of planning and management difficulties were revealed. First of all, the “Historical Landmarks” and “Maintained Landscape and Scattered Structures” received easily the highest preference scores overall, and these types were the most preferred regardless of participant characteristics and backgrounds. This result implies that these types of brownfield landscape may be viewed less critically and are thus more likely to mask potential harms. They may be more easily accepted by the community for redevelopment, but this does not mean they should not be made safe if necessary.

Table 5.1 Brownfield Landscape Typology and Implications

FINDINGS	Historical Landmarks	Maintained Landscapes and Scattered Structures	Scruffy Vegetation	Plain Modest Rundown Structures	Industrial Remnants	Crumbling Industrial Remnants
	Built-environment, historical characteristics, high level of maintenance and care, highly preferred by most participants	Natural environment, high level of maintenance and care, highly preferred by most participants	Natural vegetation, low level of maintenance and care	built-environment, non-industrial type, plain buildings	Evidence of industrial operations, less preferred by most participants	Evidence of industrial operations, less preferred by most participants
IMPLICATIONS OF FINDINGS	Commonly Preferred Group		Mixed Feeling Group		Commonly Less-Preferred Group	
	-Easily accepted by the community for redevelopment -High chance of being likely to mask potential harms		-High flexibility for change or preservation - Relatively easy to propose redevelopment in these types if they demonstrate that safety concerns are met		-Challenges for planners seeking to redevelop -Need to reassure people about safety concern	

The “Scruffy Vegetation” and “Plain Modest Rundown Structures” types that made up the second preferred group produced more mixed feelings among the survey participants. Based on people’s preconception, those who focused on the potential uses of these brownfield sites, such as development opportunities, natural resources, and industrial heritage, gave higher rating scores to these landscapes, while those who mostly perceived the negative influences of brownfield sites such as toxic pollutants, dangerous structures, and places for vandalism, gave lower rating scores to these landscapes. This indicates that people were able to recognize both the positive and negative sides of brownfield sites in these types. As a result, people may be more easily influenced by arguments that either “this industrial remnant should be preserved as part of our industrial heritage” or “better to change this due to safety problems.” Based on participant rating patterns, these types seem to suggest greater potential for switching between change or preservation options in their

thinking. This highlights the importance of the position taken by planners or landscape designers as they decide to give salience to a certain aspect, as it would be easy to lead people to focus on certain aspects rather than others, according to the designer's purposes. It is likely to be more successful in proposing redevelopment in these types if they demonstrate that safety concerns are met.

Lastly, the two industrial remnant types were the least preferred group. These types were less preferred by all the participants, although some characteristics and backgrounds factors that affected the preference ratings were found. While the majority of participants disliked these landscapes, the participants who were more sensitive to health issues disliked them significantly more. This indicates that participants in general tend to associate industrial remnants with the type of toxic pollutants that are likely to adversely affect the health of themselves and their families. Therefore, it is important that landscape architects and planners seeking to redevelop industrial remnants recognize the challenge in doing so and the need to reassure community residents regarding safety concerns.

Meanwhile, interesting differences in preference ratings were found between the two types. "Industrial Remnant," which consists of scenes depicting clean and neat industrial facilities, received slightly higher rating scores than "Crumbling Industrial Remnants," which includes outworn facilities covered with overgrown vegetation. Based on this result, participants seem to be influenced by a clean and neat landscape even where there is clear evidence of industrial operations. In other words, the clean and neat appearance of industrial sites, which could in fact have toxic pollutants, are perceived slightly more positive by community residents. In contrast, the unkempt appearance of outworn industrial sites or the presence of industrial trash such as machines and vehicles will tend to be perceived as toxic regardless of whether they contain toxic pollutants.

This suggests removing industrial junk and improving the appearance of a site would be an important part of gaining community acceptance for redevelopment of a site if it was safe. These findings and implications are summarized in Table 5.1.

5.1.2.2 Stereotypes Identified and Ethical Issues

As discussed in the “Introduction” chapter, dealing with the appearance of brownfield sites is complex due to invisible, potential contamination. The survey results suggest that the brownfield environment delivers different messages or information about the associated risks. There is not just a need to create a pleasing landscape, but information regarding the risks within the environment must be considered, which can lead to ethical issues for all the planners and designers involved. Therefore, it is important to understand the factors that relate to presenting or delivering this information. This can help designers understand the messages they might be delivering to people unconsciously, thus better preparing them to deal with ethical issues.

Regarding preferred stereotypes, for example, tamed green space or clean brick industrial buildings could be regarded as safe places by local residents even though they suffer from serious underground contamination. Stereotypes of danger or pollution are also identified, for example, dirty, cold-colored, scattered industrial objects covered with vegetation could be regarded as dangerous places regardless of their actual contamination level. Interestingly, there seems to be preference for certain type of industrial remnants such as old unique brick buildings and structures compared to others. This is identified as stereotype of industrial heritage. If a designer intends to utilize industrial remnants outside this stereotype boundary as design elements, they should recognize there might be some challenges in satisfying people and be prepared to address these perceived issues.

It is important for designers to understand that it may be necessary to prepare different strategies to either make sure people are aware of hazards if they exist or help them overcome preconceptions if they do not exist. In some situations designers may need to do more to make sure people understand the acceptable level of pollution for a proposed reuse and in others designers may have to provide more vision and clear information on pollution to overcome an unjustified preconception.

5.2 RECOMMENDATIONS REGARDING ASSESSMENT, PLANNING AND DESIGN OF BROWNFIELD AND PEOPLE ENGAGEMENT PROCESS

This section provides recommendations for federal policy makers, local brownfield program managers, design professions and educators regarding assessment, the planning and design of brownfields and ways to engage local people in the process.

5.2.1 Revision of the Definition of Brownfields and Multiple Site Assessment Criteria

It is recommended that the federal government reconsider the existing EPA definition of brownfields in a way that highlights the potential assets in brownfields such as natural resources and aesthetic quality. Instead of the definition of “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,” the government could possibly revise this definition to instead read: “real property, the expansion, redevelopment, or reuse of which may be [benefited by the presence of existing structures, natural resources and cultural assets] and may also be complicated by the potential presence of a hazardous substance, pollutant, or contaminant”.

In addition, for local-level brownfields, it is recommended that the federal government rescind its current requirement to apply the same normative site assessment as that used for extremely polluted sites. Instead, the government could adjust its standard site assessment protocol



Figure 5.1 Example of Multiple Assessment Criteria

to include multiple criteria. The new rating criteria could be expanded to include aesthetic quality (e.g. landforms, views), natural resources (e.g. native species, tree structure and capacity), historical significance (e.g. building style, previous uses), and industrial heritage and community assets (e.g. key gathering areas, memorable places). The results of this type of site assessment can be especially beneficial for outreach resources when sending mail to property owners or recruiting prospective developers to sign up for the process, thus greatly facilitating further site investigation, clean-up, and redevelopment.

5.2.2 Brownfield Assets Inventory based on the Six Types

The author recommends that local governments consider using the six types of brownfield landscape identified in this research for categorizing and prioritizing brownfield target areas in order to develop area-wide planning. Local governments could consider utilizing these six categories of brownfield landscape or the environmental characteristics identified when creating a local brownfield inventory. The findings from the interviews indicate that although brownfield inventory-making supports a city-wide vision, it is currently often avoided since the inventory attaches a stigma to sites. Along with the information on the inventory regarding a site's industrial history or previous uses, it is recommended that a brownfield assets inventory based on landscape

characteristics be used for site categorization and prioritization (target areas); for example, a brownfield assets inventory mapping process could be utilized.

5.2.3 Active Engagement Plan for the Mixed-Feeling and Least Preferred Groups

Based on the survey results, the six types of brownfield site defined for the brownfield typology can largely be divided into three major groups. Regardless of whether pollution is present or not, designers and planners will face different levels of challenges depending on the group assigned. People find it easy to see that sites in the first group (“historical landmarks” and “maintained landscape and scattered structures”) have redevelopment potential, and these sites are also less likely to carry the stigma of being polluted. At the other extreme lies the third group (the two types of “industrial remnants”), which will be the most difficult to redevelop because of their stigma of being polluted and unsafe. Lastly, there is the second, in-between group (“scruffy vegetation” and “plain modest rundown structures”) that carry some stigma, but may have greater potential to overcome it with good community engagement and a clear vision.



Figure 5.2 Example of Before and After Image

It is strongly recommended that for sites in the in-between and third groups, reuse simulations be utilized to help people overcome the stigma and see a site’s potential. It is important to help people believe that good changes can happen, for example by using before and after images

such as the ones shown in Figure 5.3 above or by describing successful cases of similar sites that have already been completed, thus enabling people to see these sites through fresh eyes as potential target areas for redevelopment.

For the in-between types, since people have different preferences it is important to prepare a number of alternative designs including different options such as either utilizing or removing leftover structures and vegetation. For example, when planning to redevelop in-between type brownfields, it can be helpful to prepare a series of design alternatives such as the ones shown in Figure 5.4 to stimulate debate and engage people’s attention to build a consensus planning output.

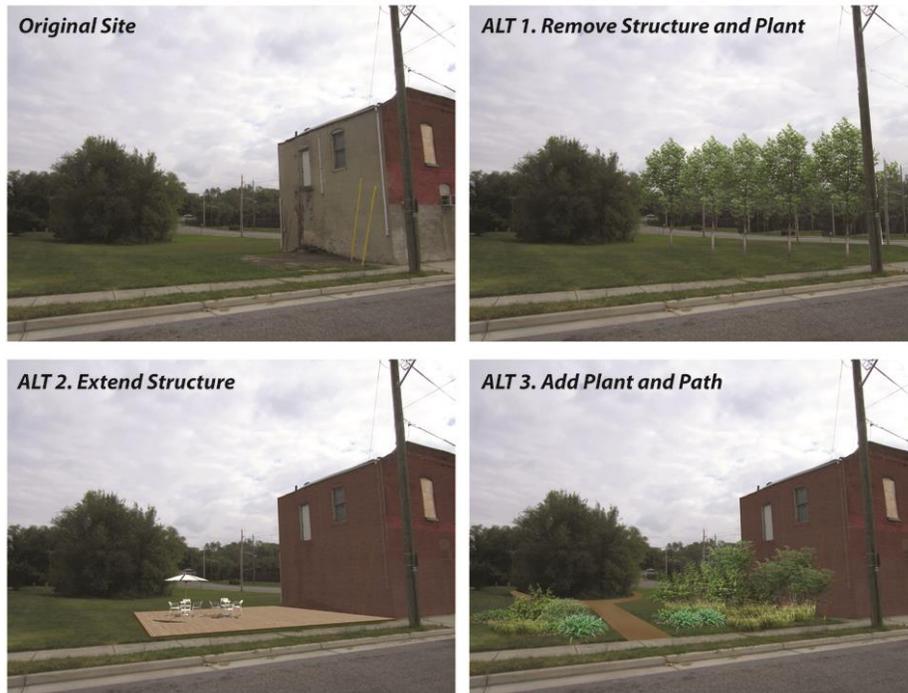


Figure 5.3 Example of Design Alternatives

5.2.4 Separate Warning or Reassuring Plan

Based on the findings related to stereotypes, it is strongly recommended that warning signs or physical barriers should be installed on clean and neat looking industrial facilities or green

spaces such as phytoremediation areas if the site suffers from contamination or is undergoing a slow decontamination process. It is also strongly recommended that reassuring signs be placed on sites involving crumbling industrial characteristics if the site is actually clean and safe from pollution.

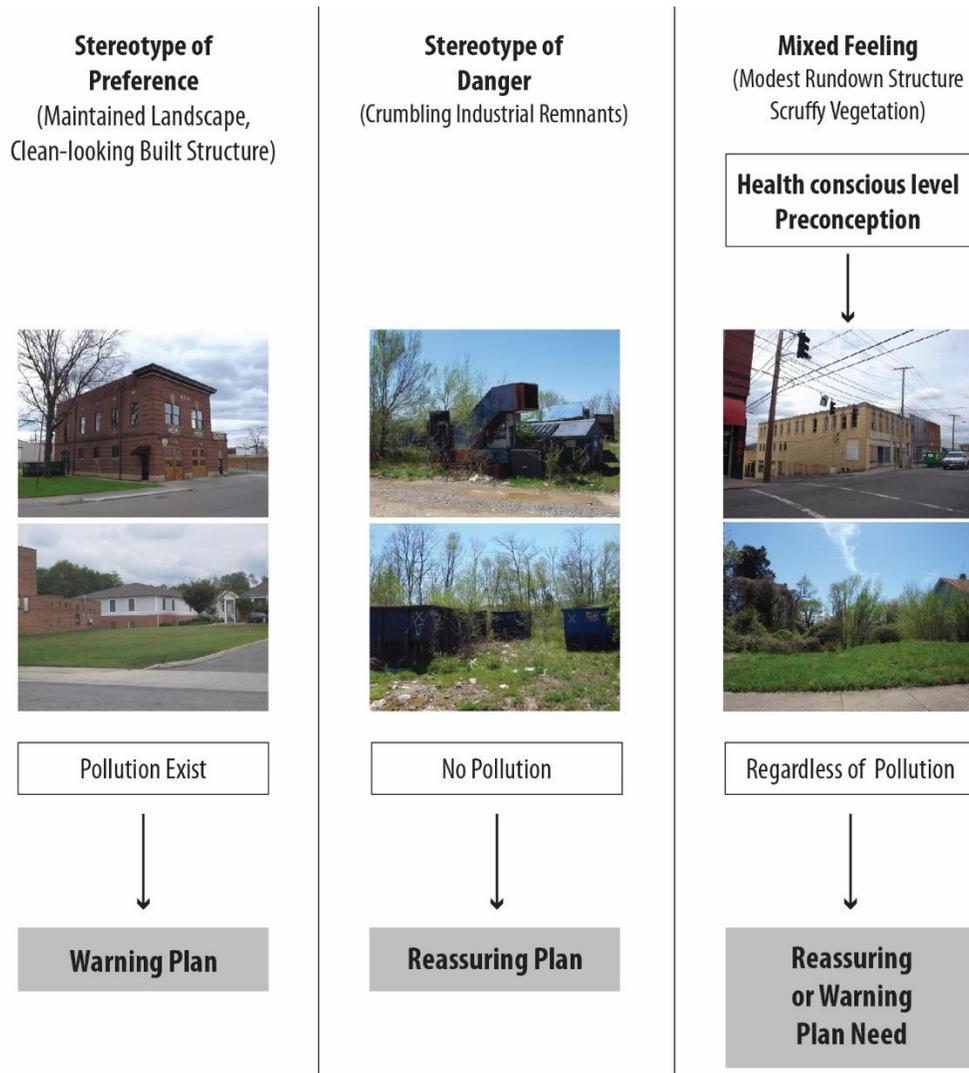


Figure 5.4 Warning or Reassuring Plan Need based on Different Types

Another important finding related to sites in the mixed feelings group was that people see different things from the same scenes based on their preconceptions, health concerns, and backgrounds. Therefore, it is recommended that a separate “warning or reassurance” plan be developed that informs people of the exact pollution levels on a site, such as a pollution area map or an on-site signboard.

Some people with strong preconceived ideas that brownfields provide opportunities for development, industrial heritage and greenery may focus more on those aspects and thus be less sensitive to unmaintained, crumbling industrial characteristics. Teenaged participants tended to be less sensitive to or less influenced by those characteristics in their neighborhood than older participants. They may be more adventurous and willing to explore something that may be quite dangerous. For these groups, it is important to inform them of potential danger or pollution in brownfield sites if there is a particular contamination risk associated with a site. It is recommended that separate warning plans, for example a warning sign board or site design with barriers (e.g. fence, level changes) be implemented in such cases.

In contrast, some people with strong preconceived ideas that brownfields contain dangers will focus more on those aspects when looking at sites containing leftover structures, industrial remnants, and scruffy vegetation. Some health conscious people associate brownfields with harmful substances regardless of their actual pollution level. In this case, it is recommended that a “reassuring” plan be developed for this group, for example by installing a sign board indicating the site’s safety or a clean area map.

5.2.5 Specialized Brownfield Education and Certification Program for Design Professions

Unlike most other planning processes, brownfield planning and design involves particular concerns related to the potential contamination risk. In particular, since there is increasing interest in public health and community engagement has become one of the most important objectives of local brownfield programs, there is a need for special training for those involved in public engagement initiatives to help them learn how to build trust and communicate risk effectively. It is recommended that professionals are made aware of the wide-spread negative preconceptions held by lay people related to brownfields.

There is also a need for specialized education program for design professionals involved in brownfield planning projects regarding the integration of remediation technology and design, acceptable risk levels based on the projected land use type, risk-based decision-making and the preparation of design alternatives with separate warning and reassurance plans, and collaboration skills to coordinate the efforts of those involved in the process who have different types of expertise, including scientists and engineers. Since there are an increasing number of post-industrial and commercial redevelopment projects, specialized education or certification programs for brownfield planning and design are rapidly becoming a critical need. It is therefore recommended that state and city governments prepare education certification and training programs for planners and designers involved in brownfield projects. Professional bodies also need to consider how to address this issue, for example by modifying the Landscape Architect Registration Examination (LARE) to include a separate section that focuses specifically on brownfield planning and design.

5.2.6 Basic Courses Related to Ethical Issues in Design for Undergraduate Student

Basic courses related to the ethical issues involved in landscape design are currently rare but are becoming increasingly necessary. For example, the survey results show that while teenagers tended to be less sensitive to potential dangers and consequently more willing to explore environments that include industrial remnants compared to older groups, females and health conscious people tended to be more sensitive to environments including scruffy vegetation or industrial remnants compared to others. Since landscape designers deal with outdoor space that will be used by a wide range of different individuals, students should be trained to consider the broad influences of their design for different groups of people. In particular, for brownfield design, students should be aware of and understand how their design could possibly influence people's perception of safety since some sites are likely to suffer from invisible contamination. Information about stereotypes of safety or danger, as well as the way people's different characteristics or backgrounds affect their perception of danger, may help students become more prepared to deal with the ethical issues that may be involved in design projects.

5.2.7 Brownfield Design Technical Courses for Senior Undergraduate or Graduate Students

The technical knowledge needed to deal with brownfields could be included in both the undergraduate and graduate curriculum. Most Landscape Architecture program curricula in both colleges and graduate schools include design studios and students necessarily become exposed to more complex, larger urban and suburban conditions as they advance through their academic programs. Brownfields are an important area that they should consider when looking at area-wide or city-wide planning and design. Students should learn about soil and water contamination issues, various types of remediation technology (e.g. physical, chemical, natural attenuation solutions)

and be encouraged to explore creative ways to integrate technologies to deal with these into their site designs.

5.3 LIMITATIONS OF THE STUDY AND IMPLICATIONS FOR FUTURE RESEARCH

The study findings shed light on people's attitude and preference toward different types of brownfield landscapes and the implications for brownfield reuse planning and public engagement. However, the study limitations exist and these indicate the area for future research. Below are limitations of this study and implications for future research.

5.3.1 Design Alternatives for Each Type and Site Specific Research

The environmental factors identified through the scene preference study suffer from limitations in providing practical implications for the planning and design of brownfield landscapes. Although the influential environmental characteristics identified help designers understand implications of their design and provide useful guidelines for improving brownfield landscapes, they tend to lack design specificity. For example, as previously mentioned in "Literature Review" chapter, while psycho-physical studies deduce formal equations describing the relationships between specific landscape forms (i.e. lengths, widths, and heights) and preferences, visual preference studies do not provide the type of data that will lead to specific design solutions. This is because visual preference studies holistically judge human responses to an overall landscape scene or image and are more interested in understanding the implications of the design and appearance of a landscape. Moreover, the factors related to content and spatial organization identified here, such as tamed nature, landmark type buildings, coherence with moderate complexity, foreground openness, and good accessibility, are somewhat abstract and generic concepts if they are to be directly applied to site design and layout.

This limitation of the study suggests several potential areas for future research. One area that could provide useful results is a more specific examination of the design alternatives with the factors identified. To find more specific design solutions, many of the environmental characteristic factors need to be explored in more detail for each type of brownfield landscape. The survey scenes for this research were selected as a way of encompassing as diverse a range of brownfield environments as possible. For example, the scenes include examples of both built environments and natural environments in the same set. This might make it difficult to identify specific design-related factors for certain types of brownfield environment. More specifically purposed scene selection for each type could help researchers to narrow the scope. Alternatively, to cope with the design specificity problem, image simulations based on more delicate variations might help to provide specific design recommendations for each type of brownfield site. Future research into site specific brownfield redevelopment using visual simulations of proposed redevelopment and post-construction evaluation could be possible.

5.3.2 Engagement Strategy Differentiation

The interview study identified the need to adjust outreach activities according to different stakeholder groups. Moreover, the survey results indicated that participants strongly agreed with the need for community engagement at every stage of the brownfield redevelopment process. Therefore, future research needs to be conducted to gain useful information that will enable program managers, planners and designers to develop differentiated engagement strategies based on different redevelopment stages and stakeholder groups.

5.3.2.1 Engagement During the Site Remediation

The results also suggest that there is an urgent need to develop better community engagement throughout the decision-making process. In addition, given that the interviewees identified mistrust of government as one of their major challenges, the engagement agenda may need to include a strategy for restoring people's trust in the government bodies and experts involved through the engagement procedure.

The results from the visual preference survey provide helpful insights and base-line data for early-stage engagement that will help alleviate the broad stigma attached to brownfields and support the redevelopment process. However, there is a general lack of information regarding ways to develop specific engagement strategies for other stages, especially those that may be more contentious such as the site remediation phase. For example, there is a clear need for a differentiated engagement strategy for disseminating the results of the second phase site assessment or decision-making for site remediation options. During these phases, designers might need guidelines for how they should communicate with people about any risks identified (e.g. contamination types, potential effect on health) without causing unnecessary fear and approaches that they should consider to effectively engage people in making remediation technology decisions. Future research is needed to gain information regarding people's acceptance level for different types of remediation technology and the importance level they assign to different characteristics of remediation technology such as duration, cost, and aesthetic quality.

5.3.2.2 Engagement for Property Owners, Developers and the Broader Community

One of the interview study findings points to the need to tailor outreach activities for specific types of stakeholder groups, including property owners, developers, and local residents.

This result suggests that it is important for property owners and developers to be helped to understand the role of the government as a supporter. While targeting the developer and property owner group is taken for granted, especially in the early stages of the process, it is also important to solicit support from the community as a whole to prevent future disputes. The interview findings generally suggest that for local communities, it is important to help them become more aware of brownfields in their neighborhood, not by way of causing fear, but to help them understand both the risks and opportunities involved in brownfield redevelopment. However, the study findings are limited to a general suggestion regarding the need for a differentiated engagement approach for different groups of stakeholders. Further research is needed to identify the information relevant to specified engagement strategies, for example, how the perspectives of these three groups (the local community, property owners, and prospective developers) are different regarding brownfield prioritization, remediation and reuse options.

5.3.3 Generalizability of This Study

It is expected that the survey results would be similar in other neighborhood areas to the extent that the populations are similar and the brownfield landscape types and issues are similar. Previous visual preference studies for brownfield landscapes in urban and neighborhood areas (Hofmann et al., 2012; Laforzezza et al., 2008; Ruelle et al., 2013) identified similar influential environmental and human factors as those found in this study such as naturalness, maintenance, accessibility, industrial elements, gender, income, education level.

However, there is clear boundary between this visual preference research and other types of studies related to engineering and legal liability aspects in brownfields. The use of these research results should be limited, for example, for the early-stage of site prioritization and preparation, the visual assessment results should be considered with other types of assessment results such as

ecological value and site accessibility. For the site-specific reclamation, the visual aspects of sites should be considered with the site pollution level and types, therefore, the results should not be used to hide or disguise the level of pollution or liability.

5.4 CONCLUSION

This research provides helpful insights regarding brownfields planning, design and public engagement process and base-line data that can be used to enhance policy makers' and design professionals' understanding of people's attitude and preference for different brownfield types. Many cities suffering from economic decline and population loss are urgently seeking to better management of abandoned areas to improve the quality of life for people who still live there. The results of this study will assist in solving this important urban problems in these cities.

First of all, the preceding sections discussed the many important findings revealed by this research. The interviews with planners found that the majority of local brownfield programs are using normative site assessment procedures and the effectiveness of local brownfield programs is greatly challenged by this procedure due to the stigma that are consequently associated with brownfield sites. These results imply that to overcome this stigma, it is important to have a balanced approach for local-level brownfield management that reveals more than just simple contamination risks and includes possible reuse potentials.

The results of the attitude and preference survey were used to develop a brownfield landscape typology and identify three major groups that would suggest different level of challenges in public engagement. The results suggest that historical landmarks and maintain landscape types may be more easily accepted by the community for redevelopment, however, this does not mean they should not be made safe if necessary. It is likely to be more successful in proposing

redevelopment in modest rundown buildings and scruffy vegetation types if they demonstrate that safety concerns are met. Lastly, it is important for landscape architects and planners seeking to redevelop industrial remnants type recognize the challenge in persuading people and the need to reassure community residents regarding safety concerns.

In addition, important stereotypes of brownfield landscape that might involve ethical issues were identified. While tamed green space or clean looking buildings could be regarded as safe places, the areas with cold-colored industrial objects covered with vegetation seems be regarded as dangerous places regardless of actual contamination level. The results suggest that designers are able to prepare different strategies such as either warning or reassuring people based on this stereotype information and actual contamination level.

Second, the sections provide recommendations for federal policy makers, local brownfield program managers, design professionals and educators regarding assessment, planning and design of brownfield and engagement process. The recommendations include revision of definition of brownfield, multiple site assessment criteria, brownfield assets inventory making, active engagement plan for mixed-feeling and least preferred groups, separate warning or reassuring plan, specialized brownfield education and certification program, basic course related ethical issues in design, and graduate level course for brownfield design technical learning.

Lastly, the chapter concludes with the suggestions of future research area based on the limitation of this study. Suggested research area includes design alternatives studies for each brownfield landscape type, site specific research such as redevelopment alternatives and post-construction evaluation, engagement strategy during site remediation phase, and engagement strategy for different stakeholder groups.

Unlike other professionals such as the environmental engineers and scientists who deal with the technical aspects of brownfield sites, if design professionals are to remain relevant to brownfield reuse initiatives, designers must develop their own strategy. It is therefore important to find new ways of dealing with brownfield sites to reveal the opportunities they offer and to enable us to engage more effectively with citizen's and residents' interests. This will eventually benefit both residential developers and city governments, major client groups for landscape architects. The appearance and design of local brownfield landscapes in neighborhood settings extends beyond superficial surface changes. Residential satisfaction is closely related to residents' perceptions of the environment in which they live. Prospective and current residents make decisions about where to live based on their perceptions of the surrounding environment. Assisting the residential industry (generally private developers) in creating competent residential environments on brownfield sites as well as supporting city government (public works) in improving neighborhood environments through brownfield reuse projects are both excellent participation opportunities for design professionals. Particularly, assisting government through engaging communities in brownfield reuse projects will eventually help local governments gain the trust of their citizens. The results of this and future research in this area should be disseminated to the decision-makers involved in private and public projects regarding brownfield reuse and design.

REFERENCES

- Alker, S., Joy, V., Roberts, P., & Smith, N. (2000). The definition of brownfield. *Journal of Environmental Planning and Management*, 43(1), 49-69.
- Appleton, J. (1975). *The experience of landscape*. London: Wiley and Sons.
- Arbogast, B. (2007). Interrogating a landscape design agenda in the scientifically based mining world. *Designing the Reclaimed Landscape*, 52.
- Bartsch, C., & Collaton, E. (1997). *Brownfields: Cleaning and reusing contaminated properties*. Praeger Publishers.
- Berger, A. (2007). *Drosscape: wasting land urban America*. Princeton Architectural Press.
- Carlson, S. Green Building on Brownfields: Creating a green education and health center on a brownfield in East Tampa. *From Brown to Green: Opportunities for Sustainable Brownfield Development in East Tampa*, 3.
- Carman, Eric. "From laboratory to landscape: a case history and possible future direction for phyto-enhanced soil bioremediation." *Manufactured Sites, Rethinking the Post-Industrial Landscape* (2001).
- Comp, T. A. (2007). Science, art an environmental reclamation: Three projects and a few thoughts. In A. Berger (Ed.), *Designing the reclaimed landscape* (pp. 63-76). London: Routledge.
- Daniel, T. C. (2001). Whither scenic beauty? Visual landscape quality assessment in the 21st century. *Landscape and urban planning*, 54(1), 267-281.
- Daniel, T. C., & Vining, J. (1983). Methodological issues in the assessment of landscape quality. In *Behavior and the natural environment* (pp. 39-84). Springer US.
- Dearden, P. (1984). Factors influencing landscape preferences: an empirical investigation. *Landscape planning*, 11(4), 293-306.
- Erdem, M., & Nassauer, J. I. (2013). Design of brownfield landscapes under different contaminant remediation policies in Europe and the United States. *Landscape Journal*, 32(2), 277-292.
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston, MA: Houghton-Mifflin.
- Gobster, P. H. (1999). An ecological aesthetic for forest landscape management. *Landscape journal*, 18(1), 54-64.
- Gorman, H. S. (2003). Brownfields in historical context. *Environmental Practice*, 5(01): 21-

24.

- Greenberg, M., & Lewis, M. J. (2000). Brownfields redevelopment, preferences and public involvement: a case study of an ethnically mixed neighborhood. *Urban Studies*, 37(13), 2501-2514.
- Greenstein, R., & Sungu-Eryilmaz, Y. (Eds.). (2004). *Recycling the city: the use and reuse of urban land*. Lincoln Inst of Land Policy.
- Hanyu, K. (2000). Visual properties and affective appraisals in residential areas in daylight. *Journal of Environmental Psychology*, 20(3), 273-284.
- Hatcher, L. (2005). *A step-by-step approach to using the SAS system for factor analysis and structural equation modeling*. SAS Institute.
- Hayek, M., Novak, M., Arku, G., & Gilliland, J. (2010). Mapping industrial legacies: Building a comprehensive brownfield database in geographic information systems. *Planning, Practice & Research*, 25(4), 461-475.
- Healey, P. (2006). *Collaborative planning: Shaping places in fragmented societies*. London: Macmillan.
- Herzog, T. R. (1984). A cognitive analysis of preference for field-and-forest environments. *Landscape Research*, 9(1), 10-16.
- Herzog, T. R. (1989). A cognitive analysis of preference for urban nature. *Journal of environmental Psychology*, 9(1), 27-43.
- Herzog, T. R. (1992). A cognitive analysis of preference for urban spaces. *Journal of environmental psychology*, 12(3), 237-248.
- Herzog, T. R. (1995). A cognitive analysis of preference for urban nature. In A. Sinha (Ed.), *Landscape Perception* (pp. 65-82). New York: Academic Press.
- Herzog, T. R., & Chernick, K. K. (2000). Tranquility and danger in urban and natural settings. *Journal of Environmental Psychology*, 20(1), 29-39.
- Herzog, T. R., Herbert, E. J., Kaplan, R., & Crooks, C. L. (2000). Cultural and developmental comparisons of landscape perceptions and preferences. *Environment and Behavior*, 32(3), 323-346.
- Herzog, T. R., Kaplan, S., & Kaplan, R. (1982). The prediction of preference for unfamiliar urban places. *Population and Environment*, 5(1), 43-59.
- Herzog, T. R., & Smith, G. A. (1988). Danger, mystery, and environmental preference. *Environment and Behavior*, 20(3), 320-344.
- Hofmann, M., Westermann, J. R., Kowarik, I., & van der Meer, E. (2012). Perceptions of

- parks and urban derelict land by landscape planners and residents. *Urban Forestry & Urban Greening*, 11(3), 303-312.
- Hollander, J. B. (2011). *Sunburnt cities: The great recession, depopulation and urban planning in the American sunbelt*. Routledge.
- Hollander, J. B., Kirkwood, N., & Gold, J. (2010). *Principles of brownfield regeneration: cleanup, design, and reuse of derelict land*. Island Press.
- Hurley, A. (2010). *Beyond preservation: using public history to revitalize inner cities*. Temple University Press.
- ICMA: International City/ County Management Association (2001). *Brownfields Redevelopment: A Guidebook for Local Governments and Communities*.
- Jackson, J. B. (1970). The imitation of nature. In E. H. Zube (Ed.), *Landscapes: Selected Writings of J.B. Jackson* (pp. 76-87). Amherst, MA: University of Massachusetts.
- Jakle, J. A., & Wilson, D. (1992). *Derelict landscapes: The wasting of America's built environment*. Rowman & Littlefield Publishers.
- Jenkins, R., Kopits, E., & Simpson, D. (2006). Measuring the social benefits of epa land cleanup and reuse programs. *US EPA National Center for Environmental Economics, Working Paper*, 06-03.
- Kaplan, R. (1973). Predictors of environmental preferences: designers and clients. In W. F. E. Peiser (Ed.), *Environmental Design Research*. Stroudsburg, PA: Dowden, Hutchinson and Ross.
- Kaplan, R. (1985). The analysis of perception via preference: a strategy for studying how the environment is experienced. *Landscape planning*, 12(2), 161-176.
- Kaplan, R. (1990). The perception of landscape style: a cross-cultural comparison. *Landscape and Urban Planning*, 19(3), 251-262.
- Kaplan, R., & Herbert, E. J. (1987). Cultural and sub-cultural comparisons in preferences for natural settings. *Landscape and urban planning*, 14, 281-293.
- Kaplan, S. (1979). *Perception and landscape: Conceptions and misconceptions*. Paper presented at the Our National Landscape Conferences, Berkeley, CA.
- Kaplan, S., & Kaplan, R. (1982). *Cognition and environment: Functioning in an uncertain world*. New York: Praeger Publisher.
- Kaplan, S., Kaplan, R., & Wendt, E. (1972). Related preferences and complexity for natural and urban visual material. *Perception and Psychophysics*, 12, 354-355.
- Kaplan, R. (1977). Patterns of environmental preference. *Environment and Behavior*, 9(2), 195-216.

- Kaplan, R. (1977). Preferences and everyday nature: Method and application. In D. Stokols (Ed.), *Perspective on Environment and Behavior: Theory, Research and Applications*. New York: Plenum Press.
- Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. New York: Cambridge University Press.
- Kuo, F. E., Bacaicoa, M., & Sullivan, W. C. (1998). Transforming inner-city landscapes trees, sense of safety, and preference. *Environment and behavior*, 30(1), 28-59.
- Lafortezza, R., Corry, R. C., Sanesi, G., & Brown, R. D. (2008). Visual preference and ecological assessments for designed alternative brownfield rehabilitations. *Journal of environmental management*, 89(3), 257-269.
- Langhorst, J. (2004, October). Rising from ruins: Postindustrial sites between abandonment and engagement. In *Proceedings of the OpenSpace: PeopleSpace Conference. October* (pp. 27-29).
- Laurie, I. C. (1975). Aesthetic factor in visual evaluation. In E. H. Zube (Ed.), *Landscape Assessment: Values, Perceptions and Resources* (pp. 102-117). Stroudsburg, PA: Dowden, Hutchinson and Ross.
- Leopold, L. (1969). Quantitative comparison of some aesthetic features among rivers. *US Geological Service Circular*(620).
- Lothian, A. (1999). Landscape and the philosophy of aesthetics: is landscape quality inherent in the landscape or in the eye of the beholder?. *Landscape and urban planning*, 44(4), 177-198.
- Lynch, K. (1960). *The image of the city*. Cambridge, MA: MIT Press.
- MacCallum, R. C., Widaman, K. F., Preacher, K. J., & Hong, S. (2001). Sample size in factor analysis: The role of model error. *Multivariate Behavioral Research*, 36(4), 611-637.
- Maulan, S. (2006). *A perceptual study of wetlands: Implications for wetland restoration in the urban areas in Malaysia* (Doctoral dissertation, Virginia Polytechnic Institute and State University).
- Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological review*, 63(2), 81.
- Nassauer, J. (1980). A non-linear model of visual quality. *Landscape research*, 5(3), 29-30.
- Nassauer, J. I. (1995). Messy ecosystems, orderly frames. *Landscape journal*, 14(2), 161-170.
- Oliver, L., Ferber, U., Grimski, D., Millar, K., & Nathanail, P. (2005). The scale and nature

- of European brownfields. In *CABERNET 2005-International Conference on Managing Urban Land LQM Ltd, Nottingham, UK, Belfast, Northern Ireland, UK*.
- Pedhazur, E. J., & Schmelkin, L. P. (2013). *Measurement, design, and analysis: An integrated approach*. Psychology Press.
- Pitt, D. G., & Zube, E. H. (1987). Management of natural environments. In D. Stokols & I. Altman (Eds.), *Handbook of Environmental Psychology* (Vol. 2, pp. 1009-1042). New York: Chuck Wiley and Sons.
- Ramos, B., & Panagopoulos, T. Informing the Rehabilitation Process in Urban Landscapes. In *3rd WSEAS International Conference on Urban Rehabilitation and Sustainability* (pp. 3-5).
- Ruelle, C., Halleux, J. M., & Teller, J. (2013). Landscape Quality and Brownfield Regeneration: A Community Investigation Approach Inspired by Landscape Preference Studies. *Landscape Research*, 38(1), 75-99.
- Russ, T. H. (2000). *Redeveloping Brownfields: Landscape Architects, Planners, Developers*. New York: McGraw-Hill.
- Ryan, R. L. (1998). Local perceptions and values for a mid-western river corridor. *Landscape and Urban Planning*, 42(2), 225-237.
- Shuttleworth, S. (1980). The use of photographs as an environment presentation medium in landscape studies. *Journal of Environmental Management*, 11, 61-76.
- Sklenicka, P., & Molnarova, K. (2010). Visual perception of habitats adopted for post-mining landscape rehabilitation. *Environmental management*, 46(3), 424-435.
- Solitare, L. (2005). Prerequisite conditions for meaningful participation in brownfields redevelopment. *Journal of Environmental Planning and Management*, 48(6), 917-935.
- Southworth, M. (2001). Wastelands in the evolving metropolis. *Institute of Urban & Regional Development*.
- Strumse, E. (1996). Demographic differences in the visual preferences for agrarian landscapes in western Norway. *Journal of Environmental Psychology*, 16(1), 17-31.
- Svobodova, K., Sklenicka, P., Molnarova, K., & Salek, M. (2012). Visual preferences for physical attributes of mining and post-mining landscapes with respect to the sociodemographic characteristics of respondents. *Ecological Engineering*, 43, 34-44.
- Tuan, Y. F. (1977). *Topophilia: A study of environmental perception, attitudes and values*. Englewoods Cliffs, NJ.: Prentice Hall.

- Turvani, M., Paccagnan, V., & Tonin, S. Population preferences towards risk and alternative reuse policies for derelict and contaminated sites: Results from a survey of the Italian public.
- Ulrich, R. S. (1977). Visual landscape preferences: A model and application. *Man-Environmental System*, 7, 279-283.
- Vitz, P. C. (1966). Preference for different amounts of visual complexity. *Behavioral Science*, 11(2), 105-114.
- Wohlwill, J. F. (1968). Amount of stimulus exploration and preference as differential functions of stimulus complexity. *Perception & Psychophysics*, 4(5), 307-312.
- Woods, J. (1995). *Environmental factors that influence preference and price perceptions of commercial landscapes and storefronts* (Doctoral dissertation, Virginia Polytechnic Institute and State University).
- Yang, B. E., & Brown, T. J. (1992). A cross-cultural comparison of preferences for landscape styles and landscape elements. *Environment and behavior*, 24(4), 471-507.
- Yu, K. (1995). Cultural variations in landscape preference: comparisons among Chinese sub-groups and Western design experts. *Landscape and Urban Planning*, 32(2), 107-126.
- Zube, E. H., Sell, J. L., & Taylor, J. G. (1982). Landscape perception: research, application and theory. *Landscape planning*, 9(1), 1-33.

APPENDIX A: Survey form (main survey)

Survey id#: _____ Booklet: A or B

PART 1 – Image Preference and Description

1. How much do you like or prefer each of the scenes in Section-1 of the scene booklet?

-3= dislike very much -2= quite dislike -1=dislike 0= neutral 1 = somewhat like 2= quite like
3= like very much

Scene	Dislike	Very Much	-----	Like	Very Much	Scene	Dislike	Very Much	-----	Like	Very Much				
1	-3	-2	-1	0	1	2	3	31	-3	-2	-1	0	1	2	3
2	-3	-2	-1	0	1	2	3	32	-3	-2	-1	0	1	2	3
3	-3	-2	-1	0	1	2	3	33	-3	-2	-1	0	1	2	3
4	-3	-2	-1	0	1	2	3	34	-3	-2	-1	0	1	2	3
5	-3	-2	-1	0	1	2	3	35	-3	-2	-1	0	1	2	3
6	-3	-2	-1	0	1	2	3	36	-3	-2	-1	0	1	2	3
7	-3	-2	-1	0	1	2	3	37	-3	-2	-1	0	1	2	3
8	-3	-2	-1	0	1	2	3	38	-3	-2	-1	0	1	2	3
9	-3	-2	-1	0	1	2	3	39	-3	-2	-1	0	1	2	3
10	-3	-2	-1	0	1	2	3	40	-3	-2	-1	0	1	2	3
11	-3	-2	-1	0	1	2	3	41	-3	-2	-1	0	1	2	3
12	-3	-2	-1	0	1	2	3	42	-3	-2	-1	0	1	2	3
13	-3	-2	-1	0	1	2	3	43	-3	-2	-1	0	1	2	3
14	-3	-2	-1	0	1	2	3	44	-3	-2	-1	0	1	2	3
15	-3	-2	-1	0	1	2	3	45	-3	-2	-1	0	1	2	3
16	-3	-2	-1	0	1	2	3	46	-3	-2	-1	0	1	2	3
17	-3	-2	-1	0	1	2	3	47	-3	-2	-1	0	1	2	3
18	-3	-2	-1	0	1	2	3	48	-3	-2	-1	0	1	2	3
19	-3	-2	-1	0	1	2	3	49	-3	-2	-1	0	1	2	3
20	-3	-2	-1	0	1	2	3	50	-3	-2	-1	0	1	2	3
21	-3	-2	-1	0	1	2	3	51	-3	-2	-1	0	1	2	3
22	-3	-2	-1	0	1	2	3	52	-3	-2	-1	0	1	2	3
23	-3	-2	-1	0	1	2	3	53	-3	-2	-1	0	1	2	3
24	-3	-2	-1	0	1	2	3	54	-3	-2	-1	0	1	2	3
25	-3	-2	-1	0	1	2	3	55	-3	-2	-1	0	1	2	3
26	-3	-2	-1	0	1	2	3	56	-3	-2	-1	0	1	2	3
27	-3	-2	-1	0	1	2	3	57	-3	-2	-1	0	1	2	3
28	-3	-2	-1	0	1	2	3	58	-3	-2	-1	0	1	2	3
29	-3	-2	-1	0	1	2	3	59	-3	-2	-1	0	1	2	3
30	-3	-2	-1	0	1	2	3	60	-3	-2	-1	0	1	2	3

61	-3	-2	-1	0	1	2	3	64	-3	-2	-1	0	1	2	3
62	-3	-2	-1	0	1	2	3	65	-3	-2	-1	0	1	2	3
63	-3	-2	-1	0	1	2	3	66	-3	-2	-1	0	1	2	3

2. Scene Descriptions: Please provide a word or two that best describes each of the scenes in **Section-2** of the scene booklet).

- Scene 1: _____
- Scene 2: _____
- Scene 3: _____
- Scene 4: _____
- Scene 5: _____
- Scene 6: _____
- Scene 7: _____
- Scene 8: _____
- Scene 9: _____
- Scene 10: _____
- Scene 11: _____
- Scene 12: _____
- Scene 13: _____
- Scene 14: _____

3. Some vacant land contains pollution from past use of the land. Without knowing the level of pollution present and based on appearance, how concerned would you be to have vacant lots in Section-2 of the scene booklet located in your neighborhood?

-3= not at all concerned -2= very low concern -1= slightly concerned 0= neutral 1 = moderately concerned 2= very concerned 3= extremely concerned

Scene	Not at all concerned---Extremely Concerned							Scene	Not at all concerned---Extremely Concerned						
1	-3	-2	-1	0	1	2	3	8	-3	-2	-1	0	1	2	3
2	-3	-2	-1	0	1	2	3	9	-3	-2	-1	0	1	2	3
3	-3	-2	-1	0	1	2	3	10	-3	-2	-1	0	1	2	3
4	-3	-2	-1	0	1	2	3	11	-3	-2	-1	0	1	2	3
5	-3	-2	-1	0	1	2	3	12	-3	-2	-1	0	1	2	3
6	-3	-2	-1	0	1	2	3	13	-3	-2	-1	0	1	2	3
7	-3	-2	-1	0	1	2	3	14	-3	-2	-1	0	1	2	3

PART 2 –Brownfields and What We Know About Them

1. Have you heard the term “brownfield” before? _____ Yes _____ No

2. To what extent does each of the following terms apply to your understanding of a “brownfield”?

1= Does not apply to brownfields 2= applies to a few brownfields 3= applies to some brownfields 4= applies to most brownfields 5 = applies to all brownfields

Terms	1 does not apply to brownfields	2 applies to a few brownfields	3 applies to some brownfields	4 applies to most brownfields	5 applies to all brownfields
<i>a. Abandoned or Derelict</i>					
<i>b. Vacant or Underused</i>					
<i>c. Opportunity for Reuse</i>					
<i>d. Land in Intermediate Stage</i>					
<i>e. Industrial History</i>					
<i>f. Contaminated or Polluted</i>					
<i>g. Visually Unpleasing</i>					
<i>h. Previously Developed</i>					

All the scenes you rated in Part 1 were taken from potential brownfields in your neighborhood. Brownfields can be broadly defined as lands that have been previously used for diverse purposes, however, are currently vacant or underused. Former gas stations and dry cleaners, abandoned offices and restaurants, former public buildings and houses are usual examples of brownfields.

3. Based on this definition, to what extent are brownfields located near, within several blocks (approximately 200 yards), of where you live?

1 none 2 one or two 3 a few 4 quite few 5 a lot 6 [don't know]

4. How much do you agree with the following statements about brownfields in general?

-1=strongly disagree -2= disagree -1= somewhat disagree 0=neutral 1=somewhat agree 2=agree 3=strongly agree

	Strongly Disagree ----- Strongly Agree							[don't know]
	-3	-2	-1	0	1	2	3	4
<i>a. Are not safe places to go</i>								
<i>b. Lower property values</i>								
<i>c. Are opportunities waiting to happen</i>								
<i>d. Are interesting places to explore</i>								
<i>e. Pollute our water supply</i>								
<i>f. Discourage community pride</i>								

	Strongly Disagree ----- Strongly Agree							[don't know]
<i>g. Provide needed trees and greenery</i>	-3	-2	-1	0	1	2	3	4
<i>h. Are eye-sores in the neighborhood</i>	-3	-2	-1	0	1	2	3	4
<i>i. Are important parts of our industrial heritage</i>	-3	-2	-1	0	1	2	3	4
<i>j. Often contain toxic materials and are sources of disease</i>	-3	-2	-1	0	1	2	3	4
<i>k. Are difficult to maintain</i>	-3	-2	-1	0	1	2	3	4
<i>l. Provide places for unsavory individuals to hang out</i>	-3	-2	-1	0	1	2	3	4
<i>m. Can improve property values if cleaned up</i>	-3	-2	-1	0	1	2	3	4
<i>n. Often contain dangerous objects for children</i>	-3	-2	-1	0	1	2	3	4
<i>o. Can provide habitat for wildlife</i>	-3	-2	-1	0	1	2	3	4
<i>p. Encourage vandalism</i>	-3	-2	-1	0	1	2	3	4

PART 3 – Participants Interest and Belief in Brownfield Planning and Management

1. In planning and managing brownfields in your neighborhood, how important are each of the following?

-1=very unimportant -2= unimportant -1= somewhat unimportant 0= neutral 1=somewhat important 2=important 3=very important

	Very Unimportant -----Very Important							[don't know]
<i>a. Preserving historically important buildings</i>	-3	-2	-1	0	1	2	3	4
<i>b. Removing potentially dangerous structures</i>	-3	-2	-1	0	1	2	3	4
<i>c. developing them for productive use</i>	-3	-2	-1	0	1	2	3	4
<i>d. Preserving naturally growing wild vegetation</i>	-3	-2	-1	0	1	2	3	4
<i>e. Preserving interesting industrial history</i>	-3	-2	-1	0	1	2	3	4
<i>f. Isolating or capping existing toxic materials with a protective layer</i>	-3	-2	-1	0	1	2	3	4
<i>g. Removal of existing toxic materials</i>	-3	-2	-1	0	1	2	3	4
<i>h. Renovating buildings and structures representing local characteristics</i>	-3	-2	-1	0	1	2	3	4
<i>i. Maintaining open space by removing overgrown weeds and industrial trash</i>	-3	-2	-1	0	1	2	3	4
<i>j. Removing visually unpleasing remnants</i>	-3	-2	-1	0	1	2	3	4
<i>k. Blocking dangerous area for children safety or providing warning sign</i>	-3	-2	-1	0	1	2	3	4

2. Based on the above, what are top three important things for you in planning and managing brownfield?

1) _____ 2) _____ 3) _____

3. How much do you agree with the following statements about brownfield planning and management?

-1=strongly disagree -2= disagree -1= somewhat disagree 0=neutral 1=somewhat agree 2=agree
3=strongly agree

	Strongly Disagree	-2	-1	0	1	2	3	Strongly Agree	[don't know]
<i>a. Redeveloping brownfield sites should be left to scientists and specialists.</i>	-3	-2	-1	0	1	2	3	4	
<i>b. Local area residents should be involved in planning and management decisions regarding local brownfield sites.</i>	-3	-2	-1	0	1	2	3	4	
<i>c. Local area residents should be involved from earlier stage to discuss diverse brownfield issues before the specific management and design plan options are found.</i>	-3	-2	-1	0	1	2	3	4	
<i>d. I believe that my local and state government are doing an adequate job of planning and managing brownfields sites.</i>	-3	-2	-1	0	1	2	3	4	
<i>e. If I am told by a planner or landscape architect that appropriate actions have been taken to make a brownfield site safe for humans for a new use I am likely to believe it.</i>	-3	-2	-1	0	1	2	3	4	
<i>f. I am confident that my local and state government will provide me with what I need to know about brownfields for protection from potential hazard.</i>	-3	-2	-1	0	1	2	3	4	
<i>g. I believe that local and state government understand neighborhood situation well enough to fully achieve community benefits from reusing brownfields.</i>	-3	-2	-1	0	1	2	3	4	

PART 4 –Health Concern and Personal Background

1. To what extent, do you believe that each of the following previous uses of a brownfield site would be likely to leave toxic pollutants on the site?

-1=very unlikely -2= unlikely -1= somewhat unlikely 0= neutral 1=somewhat likely 2=likely
3=very likely

	Very Unlikely	-2	-1	0	1	2	3	Very Likely	[don't know]
<i>a. Gas Station</i>	-3	-2	-1	0	1	2	3	4	
<i>b. Dry Cleaner</i>	-3	-2	-1	0	1	2	3	4	
<i>c. Housing</i>	-3	-2	-1	0	1	2	3	4	

	Very Unlikely	-----	Very	Likely	[don't know]			
<i>d. Grocery or Restaurant</i>	-3	-2	-1	0	1	2	3	4
<i>e. Hardware Store or Automotive Garage</i>	-3	-2	-1	0	1	2	3	4
<i>f. Commercial Offices</i>	-3	-2	-1	0	1	2	3	4
<i>g. Farming Operations</i>	-3	-2	-1	0	1	2	3	4
<i>h. Steel Manufactures</i>	-3	-2	-1	0	1	2	3	4
<i>i. Chemical Manufacturing</i>	-3	-2	-1	0	1	2	3	4

2. To what extent do you believe someone living next to a brownfield site should potentially be concerned about each of the following health issues?

-3= not at all concerned -2= very low concern -1= slightly concerned 0= neutral 1 = moderately concerned 2= very concerned 3= extremely concerned

	Not at all Concerned	-----	Extremely Concerned				
<i>a. Asthma</i>	-3	-2	-1	0	1	2	3
<i>b. Birth defects</i> (i.e. premature birth, infant mortality)	-3	-2	-1	0	1	2	3
<i>c. Cancer</i>	-3	-2	-1	0	1	2	3
<i>d. Chemicals in drinking water</i>	-3	-2	-1	0	1	2	3
<i>e. Lead-Poisoning</i>	-3	-2	-1	0	1	2	3
<i>f. Eye and skin disease</i>	-3	-2	-1	0	1	2	3
<i>g. Physical hazards to children</i>	-3	-2	-1	0	1	2	3

3. Please check the response that best describe you.

a. Ethnicity: _____ (optional)

b. Age: _____

c. Gender: ___ Male, ___ Female

d. Highest education level completed?

___ Middle/Elementary school, ___ High school, ___ Some College, ___ Graduate, ___ Post-Graduate

e. What is your gross family income?

___ Less than \$25,000, ___ \$25,000-50,000, ___ \$50,000-75,000, ___ \$75,000 – 100,000

___ 100,000 – 250,000 ___ More than \$250,000 ___ Prefer not to answer

f. What is the name of your neighborhood? _____

g. Does your neighborhood have meetings regularly? ___ Yes ___ No ___ [I don't know]

h. If yes, do they have meetings about planning and land use issues? ___ Yes ___ No ___ [I don't know]

i. If yes, how often do you attend to meetings?

___ Never, ___ Once every 6 months, ___ Once every 3 months, ___ Once a month, ___ Several times a month

j. How long have you lived in this neighborhood (roughly)? _____

k. Home: ___ Own, ___ Rent

APPENDIX B: Scene booklet (main survey)

Scene Booklet A

Section 1



Scene 1



Scene 2



Scene 3



Scene 5



Scene 4



Scene 6

Scene Booklet A

Section 2



Scene 1



Scene 2



Scene 3



Scene 5



Scene 4



Scene 6

APPENDIX C: IRB approval for survey



Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website <http://www.irb.vt.edu>

MEMORANDUM

DATE: June 26, 2013
TO: Eujin Julia Kim, Patrick Miller
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE: Public Perception toward Brownfield and Potential Reuse: A Study of the City of Roanoke, Virginia
IRB NUMBER: 13-438

Effective June 26, 2013, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Exempt, under 45 CFR 46.110 category(ies) 2**
Protocol Approval Date: **June 26, 2013**
Protocol Expiration Date: **N/A**
Continuing Review Due Date*: **N/A**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

**Appendix D: Recruitment material for neighborhood association leaders
(pilot survey)**



Dear President of [NEIGHBORHOOD NAME] Neighborhood Organization,

I am a PhD student in the Landscape Architecture Program at the Virginia Tech conducting research under the supervision of Professor Patrick Miller. I am studying about the resident's perception of brownfield (i.e. abandoned industries) and potential reuse in neighborhood settings.

During the research, I am looking for the opportunity to meet and talk with people living in and around brownfields. [NEIGHBORHOOD NAME] neighborhood is one of the nearest neighborhoods to brownfield target areas funded by EPA's brownfield area-wide planning project.

If I could have opportunity to give a short presentation about my research, share the idea with people, and take survey for voluntary participants during the neighborhood meeting, that will be valuable exploration for research. I believe that it also could give residents an opportunity to think and discuss about brownfields in and around their neighborhood.

If you have any questions regarding the research, please feel free to contact
Julia Kim (jkim7@vt.edu/ 540-838-5092)
Prof. Patrick Miller (pmiller@vt.edu/540-231-0611)

Thank you for your consideration in advance. I look forward to hearing from you.
I would like to assure you that this study has been reviewed and received ethics clearance through the Institutional Review Board at the Virginia Polytechnic Institute and State University.

Yours sincerely,

Eujin Julia Kim
Virginia Polytechnic Institute and State University

APPENDIX E: Advertisement material for residents (pilot and main survey)



Dear Residents in [NEIGJBORHOOD NAME] Neighborhood,

I am a PhD student in the Landscape Architecture Program at the Virginia Polytechnic Institute and State University conducting research under the supervision of Professor Patrick Miller on the public perception of brownfields (i.e. abandoned industries) and potential reuse in neighborhood settings. This study intends to better understand about people's perception of existing brownfields in neighborhood settings and the preferences for clean-up and reuse options, and explore the ways to manage brownfields with current resident's engagement. The result of this survey will help to make decision about the future planning and management of brownfields in neighborhood settings with resident's engagement by providing base line data.

As stakeholders, your opinions may be important to this study. I would appreciate the opportunity to speak with you about your experience on this topic. Your involvement in this survey is entirely voluntary and there are no known or anticipated risks to participation in this study. If you agree to participate, the survey should not take more than about 30 minutes. Further, you will not be identified by name in any thesis, report or publication resulting from this study. All information you provide will be considered confidential and will be grouped with responses from other participants.

The door-to-door visits for survey will be made for a minimum of two days on weekends from 12pm to 6pm through [DATE] [MONTH], 2013 ~ [DATE] [MONTH], 2013.

If you have any questions about this study or would like to have additional information to assist you in reaching a decision about participation, please feel free to contact Eujin Julia Kim (jkim7@vt.edu/540-838-5092) and Prof. Patrick Miller (pmiller@vt.edu/540-231-0611). I would like to assure you that this study has been reviewed and received ethics clearance through the Institutional Review Board at the Virginia Polytechnic Institute and State University.

Thank you in advance for your interest in this project.

Yours sincerely,

Eujin Julia Kim
Virginia Polytechnic Institute and State University

APPENDIX F: Consent form for survey (pilot and main survey)

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Informed Consent for Participants in Research Projects

Title of Project

Public Perception Survey of Brownfields in Neighbourhood Settings

Investigator(s)

Patrick A. Miller, PhD (Principal Investigator).

Eujin Julia Kim, PhD Candidate (Co- Investigator)

I. Purpose of this Research/Project

The purpose of this survey is to gain information about people's response to brownfields and potential reuse in neighborhood setting. In particular, we are interested in understanding the resident's attitude to existing brownfields and the preferences towards management and reuse options of brownfields, and understanding how the information about potential risk and reuse opportunities in brownfield can be delivered to residents and further managed with people's engagement.

II. Procedures

The questionnaire and scene booklet survey will be conducted at the neighborhood meeting or door-to-door visits. If you agree to participate in this study, you will be given two sets of instruments - a questionnaire and scenes booklet. Using the scenes booklet, you will rate series of scenes based on 1-5 Likert scales according to your feelings, describe your opinions about the scenes and answer related questions in the questionnaire's answer sheet. After finishing the questionnaire, you will hand over both instruments to the researcher and receive your compensation. There will be no further contact with you after the survey session. Each survey will take 30 minutes. For children and minor between 16 and 18 years old, verbal consent are required from their legal guardian/parent to participate in both survey. Please be aware that minor under age of 16 are not allowed to participate.

III. Risks

The emotional risks are minimal. The survey was designed to inform you that the given hazard conditions in brownfields are not real, but only suppositions for the study purpose.

IV. Benefits

There is no immediate, direct, or indirect benefit to you for participating in this study. No promises of benefits have been made to encourage you to participate. However, we hope that the results of this project can help in designing future research to benefit students and faculty members at universities. On a broader scale, we also hope that this study will have implications for decision makers regarding the management and reuse of brownfields in neighborhood setting including the participant's neighborhood.

APPENDIX G: Verbal parent permission script (pilot and main survey)

Verbal Parent Permission Script

Hello,

I am a PhD student in the Landscape Architecture Program at the Virginia Polytechnic Institute and State University conducting research under the supervision of Professor Patrick Miller. This study intends to better understand about people's perceptions of brownfields in neighborhood settings and their preferences for different clean-up and reuse options as well as identify the best practices for managing brownfields in a manner consistent with residents' desires.

I would like to request your permission to interview your son or daughter, who is more than 16 years old, but not yet 18. This study has been reviewed and received ethics clearance from the Institutional Review Board at the Virginia Polytechnic Institute and State University. The research team can only survey minors, those between 16 and 18 years old, when there is verbal consent from their legal guardian/parent. No one under 16 will be surveyed.

To help with your decision, I will briefly explain the survey procedures. If you allow your son or daughter to participate in this study, he/she will be given a questionnaire and a booklet of pictures. The pictures are of different types of brownfields and brownfields that have been cleaned up. Using the photo booklet, he/she will rate each photo in terms of how much they like it, provide opinions about the scenes and answer related questions about their understanding of brownfields. After finishing the questionnaire, he/she will return both the questionnaire and photo booklet to the researcher and receive 5\$ as a compensation. There will be no further contact with him/her after the survey session. The survey will take about 30 minutes.

There is a minimal risk that some participants might experience some anxiety after hearing information about possible contamination in brownfields in their neighborhood. The survey was designed to inform participants that hazardous conditions might be present in brownfields, but these conditions have not been confirmed. They are suppositions for study purposes only.

Your son's or daughter's identity will remain confidential and the answers will only be described in ways that cannot be traced back to reveal the identity of any individual survey participant. The data obtained from this survey will be stored in a locked drawer in the investigator's office and on a personal computer with password required.

Thank you for your consideration and feel free to ask any questions before making a decision. If you decide, you can provide a verbal consent to the researcher.

APPENDIX H: Survey form (pilot survey)

Survey id#: _____ Booklet: A or B

A Study to Better Understand the Public Perception toward Brownfield and Potential Reuse

"Brownfields" means real property, the reuse of which may be complicated by potential presence of pollutant or contaminant. **Abandoned/ leftover industries and commercials (i.e. chemical factory, steel manufacture, gas station)** are usually considered brownfields. Vacant lots or abandoned buildings could have potential contamination and be classified as brownfields.



PART 1 » The purpose of this section is to learn more about how the public perceives the general issues of quality of life in their neighborhoods

A. **To what extent, do you agree** with the following statements about your neighborhood?

1=strongly disagree 2= disagree 3=neither agree nor disagree 4=agree 5=strongly agree

1. I feel safe in my neighborhood	1	2	3	4	5
2. Health services are sufficient and the quality is satisfactory	1	2	3	4	5
3. Environmental quality(i.e. air, water) is good	1	2	3	4	5
4. Public transportation is accessible and affordable	1	2	3	4	5
5. Relationships with my neighbors are good	1	2	3	4	5
6. Social and cultural facilities(i.e. museum, library) are sufficient	1	2	3	4	5
7. Green areas (i.e. parks and community gardens) are sufficient	1	2	3	4	5
8. Appearance of buildings and streets are fine	1	2	3	4	5
9. Education facilities are accessible and sufficient	1	2	3	4	5
10. Housing cost is appropriate	1	2	3	4	5
11. All things considered, my neighborhood is a good and healthy place to live	1	2	3	4	5
12. I think of the neighborhood as my home I choose to live, not just a place I happen to live in	1	2	3	4	5

PART 2 » The purpose of this section is to learn more about public attitudes toward the characteristics of brownfields.

B. **To what extent, do you agree** with the following statements about brownfields in a neighborhood setting?

1=strongly disagree 2= disagree 3=neither agree nor disagree 4=agree 5=strongly agree

1. Are not safe places to go	1	2	3	4	5
2. Are interesting places to explore	1	2	3	4	5
3. Are an important part of our industrial heritage	1	2	3	4	5
4. Often contain toxic materials	1	2	3	4	5
5. Often contain dangerous objects for children	1	2	3	4	5
6. Can provide habitat for wildlife	1	2	3	4	5

C. If a brownfield was located in a neighborhood in which you live, **how concerned would you be with each of the following?**

1= not at all 2=not much 3=neutral 4=somewhat 5=very much

Safety:

1. Leftover built-structures	1	2	3	4	5
2. Industrial objects	1	2	3	4	5
3. Contact with remaining contamination	1	2	3	4	5

Health Risk:

4. Asthma	1	2	3	4	5
5. Birth defects or birth outcomes (i.e.premature birth, infant mortality)	1	2	3	4	5
6. Cancer	1	2	3	4	5
7. Childhood lead poisoning	1	2	3	4	5
8. Physical hazards to children	1	2	3	4	5
9. Eye and skin disease	1	2	3	4	5

Appearance:

10. Unrepaired street near brownfield	1	2	3	4	5
11. Visual blight caused by abandoned structures	1	2	3	4	5

Social & Economic:

12. Vandalism	1	2	3	4	5
13. Crime	1	2	3	4	5
14. Reduced property values					
15. Unfriendly Neighbors	1	2	3	4	5
16. Reduced social services as a result of reduced tax base	1	2	3	4	5

Environmental:

17. Soil contamination	1	2	3	4	5
18. Groundwater contamination	1	2	3	4	5
19. Spread of contaminants	1	2	3	4	5

D. **To what extent, do you believe** the presence of brownfields **can provide opportunities to enhance the following?**

1= not at all 2=not much 3=neutral 4=somewhat 5=very much

Cultural Heritage

20. Industrial machinery and objects	1	2	3	4	5
21. Leftover buildings	1	2	3	4	5
22. Aesthetic character	1	2	3	4	5

Wild Life Habitat

23. Naturally growing plants	1	2	3	4	5
24. Source of food and refuge for animals	1	2	3	4	5

PART 3 » The purpose of this section is to learn more about public attitudes toward the different types of brownfields.

E. This question requires you to refer to the scenes in the attached booklet. For this question, Please refer to Section I & II in the booklet.

1. **How much do you like or prefer** each of the following scenes? (Section I)

1= not at all	2=not much	3=neutral	4=somewhat	5=very much
---------------	------------	-----------	------------	-------------

Scene 1)	1	2	3	4	5	Scene 21)	1	2	3	4	5
Scene 2)	1	2	3	4	5	Scene 22)	1	2	3	4	5
Scene 3)	1	2	3	4	5	Scene 23)	1	2	3	4	5
Scene 4)	1	2	3	4	5	Scene 24)	1	2	3	4	5
Scene 5)	1	2	3	4	5	Scene 25)	1	2	3	4	5
Scene 6)	1	2	3	4	5	Scene 26)	1	2	3	4	5
Scene 7)	1	2	3	4	5	Scene 27)	1	2	3	4	5
Scene 8)	1	2	3	4	5	Scene 28)	1	2	3	4	5
Scene 9)	1	2	3	4	5	Scene 29)	1	2	3	4	5
Scene 10)	1	2	3	4	5	Scene 30)	1	2	3	4	5
Scene 11)	1	2	3	4	5	Scene 31)	1	2	3	4	5
Scene 12)	1	2	3	4	5	Scene 32)	1	2	3	4	5
Scene 13)	1	2	3	4	5	Scene 33)	1	2	3	4	5
Scene 14)	1	2	3	4	5	Scene 34)	1	2	3	4	5
Scene 15)	1	2	3	4	5	Scene 35)	1	2	3	4	5
Scene 16)	1	2	3	4	5	Scene 36)	1	2	3	4	5
Scene 17)	1	2	3	4	5	Scene 37)	1	2	3	4	5
Scene 18)	1	2	3	4	5	Scene 38)	1	2	3	4	5
Scene 19)	1	2	3	4	5	Scene 39)	1	2	3	4	5
Scene 20)	1	2	3	4	5	Scene 40)	1	2	3	4	5

2. For your least preferred scenes, what was the primary reason for that rating?

3. For your most preferred scenes, what was the primary reason for that rating?

4. Scenes Description: Please provide a word or two (i.e. unpleasant, eyesore, pretty, recovering / fence, trees, concrete cover, buildings) that best describes each of the following scenes (Section II)

Scene 1: _____

Scene 2: _____

Scene 3: _____

Scene 4: _____

Scene 5: _____

Scene 6: _____

Scene 7: _____

Scene 8: _____

Scene 9: _____

Scene 10: _____

Scene 11: _____

Scene 12: _____

PART 4 » One purpose of this survey is to learn more about how the public recognizes the need for enhancing brownfields in neighborhood settings

- F. How knowledgeable are you about the health risks of contamination in brownfields?

1= not at all	2=not much	3=neutral	4=somewhat	5=very much
---------------	------------	-----------	------------	-------------

1 2 3 4 5

- G. How knowledgeable are you about the city government efforts to clean up and reuse brownfields (i.e. superfund project, brownfield area-wide planning project by EPA)?

1= not at all	2=not much	3=neutral	4=somewhat	5=very much
---------------	------------	-----------	------------	-------------

1 2 3 4 5

- H. To what extent, do you believe that there is a need to clean up and reuse brownfields in the neighborhood in which you are currently living?

1= not at all	2=not much	3=neutral	4=somewhat	5=very much
---------------	------------	-----------	------------	-------------

1 2 3 4 5

PART 5 » One purpose of this survey is to learn more about public preferences toward the clean-up and reuse options of brownfields in neighborhood settings

Step 1. Brownfields presents different level of health risk and **can be cleaned-up in different ways: 1) remove 2) cap or seal 3) natural attenuation.**
 Step 2. Please carefully see and read the **FOUR clean-up options in Section III in Booklet.**
 Step 3. Did you see and read all? Please feel free to ask any question to surveyor.
 Step 4. Please answer the following questions.

Please **consider the different public health hazard levels in the site (Q1~Q5)**, please circle the number indicating **how acceptable you find each of the FOUR options in booklet.**

WARNING: The given conditions or contamination hazards in following questions are not real or proven fact, but only suppositions by the researcher.

I. **Unknown Hazard:**

[there are **no conclusions** about public health hazard on the site because **data are lacking**]

1= very unacceptable ----- 5=very acceptable

Option 1)	1	2	3	4	5	Option 3)	1	2	3	4	5
Option 2)	1	2	3	4	5	Option 4)	1	2	3	4	5

J. **Urgent Hazard:**

[the site poses **a serious risk to the public health as the result of short-term exposures** to hazardous substances]

1= very unacceptable ----- 5=very acceptable

Option 1)	1	2	3	4	5	Option 3)	1	2	3	4	5
Option 2)	1	2	3	4	5	Option 4)	1	2	3	4	5

K. **No Hazard:** [data indicates no current or past exposure or no potential for exposure and therefore **no health hazard**]

1= very unacceptable ----- 5=very acceptable

Option 1)	1	2	3	4	5	Option 3)	1	2	3	4	5
Option 2)	1	2	3	4	5	Option 4)	1	2	3	4	5

L. Usual Hazard:

[the site **poses a public health hazard as the result of long-term exposures** to hazardous substances]

1= very unacceptable ----- 5=very acceptable
--

Option 1)	1	2	3	4	5	Option 3)	1	2	3	4	5
Option 2)	1	2	3	4	5	Option 4)	1	2	3	4	5

M. No Apparent Hazard: [sites where **contaminated media exists, but the exposure is below a level** considered to be a health hazard]

1= very unacceptable ----- 5=very acceptable
--

Option 1)	1	2	3	4	5	Option 3)	1	2	3	4	5
Option 2)	1	2	3	4	5	Option 4)	1	2	3	4	5

N. To what extent, do you prefer each of the following as **reuse opportunities for brownfields?**

1= the least ----- 5=the most

1. New commercial use	1	2	3	4	5
2. Nature park (i.e. trails, wildlife observation)	1	2	3	4	5
3. Outdoor meeting place (i.e. farmer's market, square)	1	2	3	4	5
4. Community garden	1	2	3	4	5
5. Active recreation park (i.e. athletic fields)	1	2	3	4	5
6. Community center	1	2	3	4	5
7. Passive Recreation park (i.e. picnic, sitting, walking)	1	2	3	4	5
8. New housing development	1	2	3	4	5
9. Parking lots	1	2	3	4	5
10. New industrial use	1	2	3	4	5

11. Any other opinions?

O. How important are each of the following for cleaning-up and reuse brownfields?

1= not at all 2=not much 3=neutral 4=somewhat 5=very much

1. Reduces crime	1	2	3	4	5
2. Improves property value	1	2	3	4	5
3. Attract new business investors	1	2	3	4	5
4. Clean-up contaminated soil and improve soil quality	1	2	3	4	5
5. Improve groundwater quality	1	2	3	4	5
6. Reduce spread of contaminants	1	2	3	4	5

PART 6 » We would like to know about your personal concerns and involvement with brownfields in neighborhood setting?

- P. About how far are brownfields from your home?
Less than 0.1mile __, *0.1-0.5mile* __, *0.5-1mile* __, *1-1.5mile* __, *more than 1.5mile* __
- Q. Have you ever lived in neighborhood with brownfields or working industrial area?
 (i.e. landfills, chemical factory)? *Yes* __, *No* __ *If Yes, how long (roughly)* ____

PART 7 » Finally, we would like to ask some questions about yourself to help understand and interpret the results

- R. Ethnicity? _____
- S. Age: _____
- T. Gender: ___ Male, ___ Female
- U. Highest education level completed?
 ___ Middle/Elementary school, ___ High school, ___ Colleges, ___ Graduate,
 ___ Post-Graduate
- V. What is your gross family income? (optional)
 ___ Less than \$25,000, ___ \$25,000-50,000, ___ \$50,000-75,000, ___ \$75,000 – 100,000,
 ___ More than \$100,000
- W. How long have you lived in this neighborhood (roughly)? _____
- X. Home: ___ Own, ___ Rent

-----THANK YOU! -----

APPENDIX I: Scene booklet (pilot survey)

Public's Perception Survey of Brownfields and Potential reuse

Scenes Booklet A
(section I, II, III)

Section I

How much do you like or prefer each of the following scenes?

- 1= not at all
- 2= not much
- 3= neutral
- 4= somewhat
- 5= very much



scene 1



scene 2



scene 5



scene 6



scene 3



scene 4



scene 7



scene 8

Section II

Scene descriptions:
Please provide a word or two that best describes each of the following scenes



scene 1



scene 2



scene 3



scene 4

Section III

Please carefully see and read following **FOUR options** and please answer the Q1-Q5.



APPENDIX J: Interview protocol

Interview Protocol

Before the phone interview, the interviewer will review the study and consent, answer any of the participants' questions, and collect the demographic questionnaire via e-mail.

1. Can you please tell me something about yourself?(who?)

Prompts: Academic training, working experience, current roles in city brownfield program, working period

2. Can you tell me about your city's brownfield programs and projects?(what?)

Prompts: how old, type of programs, how many brownfields, successes and failures, why?

2. Can you tell me about the your experiences and roles in working with city brownfield projects and in brownfield programs?(how)

Prompts: Main accomplishments (neighborhood enhancement, database building), main difficulties (site identification, prioritization, assessment)

3. Can you describe the programs and projects if any involve community input or engagement? What was done? (how) Were programs and projects more successful than others?(result) Why? And Who did what?

Prompts: Any large stakeholder group meeting including local community in site assessment or prioritization process, risk communication efforts, any community involvement in choosing remediation technology and clean-up type, design charrette or focus group meeting in redevelopment stage

4. What are some of the challenges you have encountered when working with local community? Why do you think they are challenges? How do you overcome these challenges? Who are the key players?

Prompts: Why do you think these challenges or bad experiences have occurred?

5. Are there key elements of successful community input and engagement and what are they? Why are they important? Whose responsible for that? What do you need to make it work?

Prompts: do you think the existing efforts (i.e. public hearing, comment period, design charrette, focus group) does enough to help local community understand the process and participate in decision-making, what additional resources do you think the city government can make available to facilitate the process of community participation, how do you think about visual assessment as a tool that can be added to existing brownfield assessment?

6. Is there anything else you would like to tell me about your experiences with brownfield projects and in brownfield programs and working with people in the community?

Thank you so much for your participation

APPENDIX K: Demographic questionnaire

Demographic Questionnaire

Thank you very much for your interest in this study. Please respond to the following questions.

- 1) In what department are you employed? _____
- 2) What is your official title? _____
- 3) In what month and year did you begin your current position? (mm/yyyy)
_____/____
- 4) How would you describe yourself with regard to the following characteristics?
Gender: _____
Race: _____
Ethnicity: _____
- 5) Approximately, how long have you been working for brownfield-related program/project?

- 6) Please describe below your major role in brownfield-related program/project.

APPENDIX L: Interview recruitment letter

72-Hour Request for City Brownfield Project/Program Managers Participation in Research Project

Dear <CITY NAME> Brownfield Project/Program Manager,

I am a PhD student in the Landscape Architecture Program at the Virginia Polytechnic Institute and State University conducting research under the supervision of Professor Patrick Miller on the meaningful citizen input in the city's brownfield projects and programs. This study intends to better understand about brownfield management and planning process in city's brownfield projects or programs and the current efforts for community engagement.

I am seeking city brownfield project/program manager to participate in this research project. I am inviting you to participate in a 45-60 minute recorded phone interview regarding your experiences in working with brownfield projects or in brownfield program. Please let me know if you are interested in participating by <INSERT DATE AND TIME 72 HOURS FROM E-MAIL DATE AND TIME>. If you let me know that you are interested, I will promptly e-mail you the consent form, with more in-depth information about the project, for your review, and I can schedule an interview at your convenience. Your participation will be valuable for the research project, which can help others in the planning and design of future brownfield projects and programs.

If you have any questions about this study or would like to have additional information to assist you in reaching a decision about participation, please feel free to contact Eujin Julia Kim (jkim7@vt.edu/540-838-5092) and Prof. Patrick Miller (pmiller@vt.edu/540-231-0611). I would like to assure you that this study has been reviewed and received ethics clearance through the Institutional Review Board at the Virginia Polytechnic Institute and State University.

Thank you in advance for your interest in this project.

Yours sincerely,

Eujin Julia Kim Ph.D Candidate
Virginia Polytechnic Institute and State University

48-Hour Reminder E-mail to City Brownfield Project/Program Managers to Request Participation

Reminder: Request for City Brownfield Project/Program Managers Participation in Research Project

Dear <CITY NAME> Brownfield Project/Program Manager,

I am a PhD student in the Landscape Architecture Program at the Virginia Polytechnic Institute and State University conducting research under the supervision of Professor Patrick Miller on the meaningful citizen input in the city's brownfield projects and programs. This study intends to better understand about brownfield management and planning process in city's brownfield projects or programs and the current efforts for community engagement.

I am seeking city brownfield project/program manager to participate in this research project. I am inviting you to participate in a 45-60 minute recorded phone interview regarding your experiences in working with brownfield projects or in brownfield program. Please let me know if you are interested in participating by <INSERT DATE AND TIME 72 HOURS FROM E-MAIL DATE AND TIME>. **This is your final reminder.** If you let me know that you are interested, I will promptly e-mail you the consent form, with more in-depth information about the project, for your review, and I can schedule an interview at your convenience. Your participation will be valuable for the research project, which can help others in the planning and design of future brownfield projects and programs.

If you have any questions about this study or would like to have additional information to assist you in reaching a decision about participation, please feel free to contact Eujin Julia Kim (jkim7@vt.edu/540-838-5092) and Prof. Patrick Miller (pmiller@vt.edu/540-231-0611). I would like to assure you that this study has been reviewed and received ethics clearance through the Institutional Review Board at the Virginia Polytechnic Institute and State University.

Thank you in advance for your interest in this project.

Yours sincerely,

Eujin Julia Kim
Ph.D Candidate
Virginia Polytechnic Institute and State University

APPENDIX M: Consent form for interview

Informed Consent for Participants in Research Projects

Title of Project

City Brownfield Project/Program Manager Interview Focusing on Their Experiences Regarding Local Brownfield Management and Community Engagement

Investigator(s)

Patrick A. Miller, PhD (Principal Investigator).
Eujin Julia Kim, PhD Candidate (Co- Investigator)

I. Purpose of this Research/Project

The purpose of this survey is to get better understanding of local brownfield management and planning processes in city brownfield projects and programs, focusing on current efforts for community engagement. In particular, we are interested in understanding the brownfield site assessment process for deciding planning priorities and finding ways for meaningful citizen input in the city's brownfield management and planning.

II. Procedures

If you choose to participate in this research study, you will participate in a 45 to 60 minute telephone interview. During this interview, you will first discuss this consent form and asked if you have any questions. Once all your questions have been answered, you will be asked to sign the consent form if you wish to continue. Upon signing the consent form, you will be asked to complete a background questionnaire that will be sent to you via e-mail. You will then complete the phone interview related to your experience regarding city brownfield management and community engagement, which will be recorded. Following the interview, we will send you a transcript of your answers and you will have an opportunity to read and make comments on it in order to insure that the transcript accurately reflects the meaning that you intended to convey.

III. Risks and Benefits

One possible minimal risk is experiencing slight discomfort in answering the interview questions. A second risk is related to confidentiality. We have procedures in place to strive to protect your confidentiality and personal information (see below), but we cannot guarantee confidentiality. If you feel the answer to any question is too sensitive you can tell the researchers that you would rather not answer.

There is no immediate, direct, or indirect benefit to you for participating in this study. No promises of benefits have been made to encourage you to participate. However, we hope that results of this project can help others in the planning and design of future brownfield projects and programs.

V. Extent of Anonymity and Confidentiality

We will make every effort to protect your confidentiality. Each person who participates in this study will be assigned a unique pseudonym. This pseudonym will be used to identify all research data collected. The master list, which will contain your name and the unique pseudonym, will be kept separate from all other data. Only the investigators of the study will have access to this master list. All audio recordings will be kept separately from identifying information, in a secure

locked filing cabinet. Only the investigators will have access to these recordings. When the results of the research are published or discussed in conferences, will we make every effort not to include information that would reveal your identity.

VI. Compensation

You will be offered no compensation for your participation.

VII. Freedom to Withdraw

You do not have to participate in this study. If you do participate, you can stop at any time and without penalty, by telling the researchers that you want to stop the study.

VIII. Subject's Responsibilities

As a participant in this study, you voluntarily agree to participate in this study. You have the following responsibilities:

1. Ask any questions you have about the study and the consent process.
2. Complete the audio-recorded phone interview.
3. Read and provide comments on the interview transcript.

You are encouraged to ask any questions at any time during the procedure. Please feel free to ask about anything you do not understand. In addition, consider this research and the consent form carefully – as long as you feel is necessary – before you make a decision.

IX. Subject's Permission

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent.

_____ Subject signature	_____ Date	_____ Subject name (printed)
_____ Investigator Signature	_____ Date	<u>Eujin Julia Kim</u> Study Investigator Name

Should I have any pertinent questions about this research or its conduct, and research subjects' rights, and whom to contact in the event of a research-related injury to the subject, I may contact:

Investigators

Patrick A. Miller, (pmiller@vt.edu/ 540-231-0611)

Eujin Julia Kim (jkim7@vt.edu/ 540-838-5092)

Chair, Virginia Tech Institutional Review Board for the Protection of Human Subjects

David M. Moore, 540-231-4991

moored@vt.edu

APPENDIX N: IRB approval for interview



Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website <http://www.irb.vt.edu>

MEMORANDUM

DATE: February 11, 2014
TO: Patrick Miller, Eujin Julia Kim
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE: City Brownfield Project/Program Manager Interview Focusing on Their Experiences Regarding Local Brownfield Management and Community Engagement
IRB NUMBER: 14-159

Effective February 11, 2014, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: Expedited, under 45 CFR 46.110 category(ies) 6,7
Protocol Approval Date: February 11, 2014
Protocol Expiration Date: February 10, 2015
Continuing Review Due Date*: January 27, 2015

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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APPENDIX O: List of scenes with mean scores



Scene 1: mean = -0.5150



Scene 2: mean = 1.5100



Scene 3: mean = -1.3200



Scene 4: mean = 0.3600



Scene 5: mean = 2.0750



Scene 6: mean = 0.2650



Scene 7: mean = -1.8300



Scene 8: mean = -0.4100



Scene 9: mean = -1.4100



Scene 20: mean = -0.5150



Scene 31: mean = -1.1450



Scene 42: mean = -1.5550



Scene 53: mean = 0.0750



Scene 64: mean = -1.1800



Scene 75: mean = 0.7400



Scene 86: mean = -0.4900



Scene 97: mean = -1.2700



Scene 108: mean = -0.1000



Scene 119: mean = -0.6850



Scene 20: mean = -1.5100



Scene 212: mean = -1.6550



Scene 22: mean = -1.2250



Scene 23: mean = 1.4250



Scene 24: mean = -1.7150



Scene 25: mean = -2.1750



Scene 26: mean = -2.1200



Scene 27: mean = -0.2850



Scene 28: mean = -1.0200



Scene 29: mean = -0.8850



Scene 30: mean = -0.7250



Scene 313: mean = -0.1450



Scene 32: mean = -1.2400



Scene 33: mean = -0.6050



Scene 34: mean = -0.2000



Scene 35: mean = -1.4000



Scene 36: mean = -1.1400



Scene 37: mean = -0.2100



Scene 38: mean = -0.6950



Scene 39: mean = 0.0700



Scene 40: mean = -0.0700



Scene 414: mean = -1.6300



Scene 42: mean = 0.0400



Scene 43: mean = -1.7250



Scene 44: mean = 0.2000



Scene 45: mean = 1.2550



Scene 46: mean = -2.1150



Scene 47: mean = -1.1550



Scene 48: mean = 1.7100



Scene 49: mean = 1.6000



Scene 50: mean = -1.8800



Scene 515: mean = -0.7150



Scene 52: mean = -1.5950



Scene 53: mean = -0.1500



Scene 54: mean = -1.8250



Scene 55: mean = 0.0050



Scene 56: mean = 0.3950



Scene 57: mean = -1.0750



Scene 58: mean = -0.9850



Scene 59: mean = -1.4050



Scene 60: mean = -1.5900