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Periodic Characteristics and Implications of Programs and Policies for Brownfield Management in the U.S.A.

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ABSTRACT

Brownfield sites are beginning to be considered as potentially useful areas for landscape design and planning, with post-industrial areas such as water treatment facilities and military training bases being converted into useful landscapes such as parks and recreation areas. These redevelopments bring broad benefits through revitalizing communities and increasing property values, thus, increasing the demand for comprehensive management and planning policies. This study examines changes in U.S. brownfield policies and programs and, identifies their periodic characteristics over the thirty years since the Superfund program was introduced in 1980. A descriptive and interpretive approach was utilized, focusing specifically on a time sequential analysis of the data gathered from the overview of the Environmental Protection Agency's web-based documents and related literature. The primary changes in and characteristics of programs and policies were analyzed and divided into three periods : environmental protection, remediation and reuse, and comprehensive planning. Four major features were identified: relaxation and readjustment of regulation, diversification of support programs, a mix of top-down and bottom-up approaches, and database system building.

The study examines how common brownfield problems such as site identification difficulties and assessment and remediation cost have been dealt with in the regulatory context and has implications for future policies and programs for effective brownfield planning and management in Korea.

Key Words: Post Industrial Sites, Brownfield Redevelopment, U.S. Policies and Programs

국문초록

하수처리시설, 군부대 등의 산업이전적지의 공원화 계획이 늘어나면서 브라운필드 재개발은 조경계획 및 디자인에서 하나의 분야로 자리 잡았다. 특히, 주변 커뮤니티 활성화, 지가 상승 등 동반이익에 대한 기대가 높아지면서 선별된

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부지들의 종합적 계획 및 관리에 대한 필요성이 인식되고 있다. 본 연구는 미국 브라운 필드 관리 정책의 변화양상을 살펴 본 기초적인 사례연구로서, 1980년 수퍼펀드 프로그램 도입 이후, 약 30 여 년간 확장하여 온 브라운필드 프로그램과 정책의 시기별 특성을 파악하는 것을 주 목적으로 한다.

연구 방법으로 서술적, 해석적 방법에 기반한 미국 환경부 산하 기관들의 웹문서 및 관련 문헌 분석을 통해 정책의 특성을 시계열적으로 분석하였다. 본 연구의 결과, 주요한 변화를 기점으로 하여, 환경규제시기, 오염정화 및 재개발 촉진시기, 종합적 계획시기의 세 가지 시기로 구분되었고, 주요 특성은 규제 완화 및 재조정, 지원 프로그램의 다양화, 하향식과 상향식 방식의 조화, 데이터베이스 구축의 네 가지 측면으로 요약되었다.

본 연구는 대상지 선별기준, 이해 당사자 파악 및 책임분쟁 조정, 오염도 평가비용 및 처리 등 브라운필드만이 가진 공통 문제들이 어떻게 다뤄져 왔는지 선례를 살펴봄으로써, 향후 한국의 체계적 브라운 필드 관리 및 계획에 시사점을 제공하는 것에 의의를 두고 있다.

주제어: 산업이전적지, 브라운 필드 재개발, 미국 정책 및 프로그램

Ⅰ. Introduction

1. Research Background

Urban sprawl and deindustrialization have created immense abandoned spaces in city centers and on their outskirts in cities around the world. This unanticipated by-product of industrialization has been accelerated by a dramatic decrease in transportation costs and the trend towards different settlement types. The term "post-industrial," which is often used by landscape architects, architects, and planners to refer to these areas, is generally defined from the perspective that it "narrowly isolates and objectifies the landscape as the by-product of very specific processes no longer operating upon a given site"(Berger, 2006: 200). The perceived environmental hazards associated with many of these so-called brownfields have created barriers to those seeking to reuse post-industrial areas for potential development projects.

Serious efforts to deal with these blighted urban and suburban areas have been made in United States over the last few decades and the evolution of environmental policies has been an important factor shaping the use and perception of post-industrial areas in the U.S(Gorman, 2003). Since 1980, the U.S. Environmental Protection Agency(EPA)[1] has been responsible for enforcing the relevant environmental regulations and has developed various programs to identify, clean-up, and reuse of brownfields. It is estimated that almost 400 brownfield sites are now being successfully reused for alternative energy, commercial, residential, and public and community projects("EPA Superfund Redevelopment Program", 2012 May, retrieved from www.epa.gov/superfund/programs/recycle). According to the EPA, their brownfield support programs have leveraged 90,363 jobs nationwide and increased residential property values in the affected areas by 5.1 to 12.8 percent ("EPA Brownfields and Land Revitalization", 2014 Jan, retrieved from www.epa.gov/ brownfields).

2. Related Research Trend and the Purpose of This Research

There has been a great deal of research related to environmental policies for polluted land in the U.S. For example, a number of researchers assessed the benefits and limitations of the Small Business Liability Relief and Brownfield Revitalization Act[2] of 2002(Collins, 2002; Dull and Wernstedt, 2010; Eisen, 2007; Levine, 2002; McMorrow, 2003; Mintz, 2002; Robertson, 1999), while others compared brownfield management related regulation in the U.S. with that in countries such as Japan and Canada(Adams *et al.*, 2009; Sakai *et al.*, 2011). Of particular relevance for the current study, a few have focused specifically on how characteristics of brownfield regulations have changed over time(Hula, 2001; Reisch, 2002).

Korea's Soil Environment Conservation Act[3] of in 1998 initially focused on regulating pollution induced industries but was revised to include detailed provisions for the cleanup and restoration of contaminated soil in 2001 and 2004. In addition to studies evaluating this policy(Choi, 2008; Park, 2010; 2014) several comparative studies have compared brownfield regulations in Korea with those in other countries, including the U.S. and Germany(Kim, 2002; Park *et al.*, 2004). Reuse guidelines for polluted sites have also been proposed(Kim *et al.*, 2013), along with a comprehensive assessment framework that incorpo-

rates ecological factors(Kim and Lee, 2011).

However, research on polluted land-related regulations in the U.S. has generally been limited to a critique of specific laws or programs and there is a dearth of comprehensive studies on the evolution of environmental legislation over time. There have been no reports as yet of studies on recent changes such as the 2010 shift in emphasis to a localized, reuse-based approach, for example. Korea policies have to a certain extent mirrored the early stages of U.S. legislation in that they are generally aimed at controlling and regulating pollution-induced activities. One of the recent research studies have revealed a similar trend in Korea in terms of changing attitudes towards the clean-up and reuse of polluted lands (Kim *et al.*, 2013).

The study focus on conducting a time sequential analysis from the enactment of a law to its most recent consequences differentiates this research from its predecessors due to the macroscopic viewpoint adopted. It is expected to provide useful insights into brownfield planning and management in Korea due to the parallels and similarities with the early stages of U.S. legislation. Furthermore, given that landscape architects tend to be marginalized to a certain extent due to the wide-spread perception that polluted land management requires technical rather than design solutions, this research highlights the potential contribution of landscape architects in today's new regulatory environment.

II. Research Method

This study utilizes a descriptive and interpretive approach. Rather than focusing on causal relationships or developing a framework, this study is based on observations of specific phenomena and the various factors involved, identified through a comprehensive literature review designed to reveal general patterns and common characteristics inductively from individual policy and program reviews. The U.S. legal system requires that government agencies seeking to enact environmental policies and programs at both the federal and state levels go through a public hearing and comments period as a necessary step(Innes and Booher, 2004). All the relevant information must be made available to members of the public so they can easily examine the materials; these readily accessible online documents provided a valuable resource for the current study.

For the purposes of this study, brownfield-related policies and programs in the U.S. from 1980 to the present were divided into distinct periods and the major characteristics of each defined, with the objective being to examine how the complexities and difficulties related to brownfield management have been dealt with in the American regulatory context. Over the past forty years, a variety of programs and policies for polluted land management, including the Resource Conservation and Recovery Act(RCRA)[4] of 1976, the Underground Storage Tank(UST) provisions in the Energy Policy Act of 2005, and the ongoing Brownfield Pilot Program, have been implemented and the procedures used recorded in online databases and documents.

III. Periodic Divide of Brownfield Policies and Programs

The review of the published literature and online databases revealed that the timeline for the brownfield policies and programs fell neatly into three periods: the environmental protection period, the clean-up and reuse promotion period, and the comprehensive planning period. These are discussed in turn below.

1. Environmental Protection Period(1976-1990): The Comprehensive Environmental Response Compensation and Liability(CERCLA) Act of 1980

The earliest of the three stages is the environmental protection period. The conceptualization of brownfield sites, represented in Figure 1, is illustrated by the terms commonly associated with them such as "contaminated", "derelict", "vacant", or "previously developed". In particular, the term "contaminated" focuses specifically on the effect of contamination on future land use and the potential harm to health and the environment. This is a fluid definition, relying primarily on the end use of the site; for example, if a site, despite heavy contamination, is not a hazard in the context of its current use it does not meet the definition. The terms "vacant" and "previously developed" are catch-all terms associated with the "economic and development status of such land"(Alker *et al.*, 2000: 59) and closely related to land ownership, which affects the definition and reuse of brownfield sites and hints at

managerial difficulties with site consolidation. The term "derelict" lies in between these two terms and is applied to land that may be damaged by chemical contamination or simply neglected or dilapidated in appearance.

While the notion of brownfield sites in European countries emphasizes the vacant status of the land, driven by the need for more land to be made available for development, in the U.S. more importance is placed on the contamination of the land(Alker *et al.*, 2000; Oliver *et al.*, 2005) due to public concern regarding the need for protection from environmental hazards. In fact, the negative connotations associated with brownfield sites tend to be somewhat exaggerated by the political and social context in the U.S. The environmental laws passed since the 1960s all reflect the growing realization of the need to protect the nation's environmental health and have played a significant role in stigmatizing the heavy industrial sites that could potentially pose the most serious pollution hazards(Russ, 2000).

In this period, the types of policies and programs being implemented can be grouped into two general approaches. The first imposes heavy liabilities on all the potentially responsible parties(PRP)[5]. One of the most influential federal regulations governing contaminated sites is the Comprehensive Environmental Response Compensation and Liability Act(CERCLA), better known as the Superfund Act. This legislation was inspired by public indignation over the notorious case of Love Canal, where a residential complex was built on an industrial landfill. The canal was used as a dumping area for 21,800 tons of hazardous waste from 1942 to 1953, after which it was capped and sold to the city for housing. Shortly after moving in, residents began to suffer from serious diseases such as birth defects and leukemia as a result of leakages from the site. This accident gained national attention and in 1978 President Jimmy Carter issued a disaster declaration and "the first emergency funds ever to be approved for something other than a natural disaster"("The Love Canal Tragedy", 2014 Dec, retrieved from http://www.epa.gov/aboutepa/love-canal-tragedy). The government evacuated 221 families, compensated 900 families, and initiated remediation action. The Superfund Act imposes strict liabilities that are retroactively applied to all the PRP for the entire cost of the clean-up, as well as compensation for the damage to natural resources (Bartsch and Collaton, 1997). Superfund project sites are also funded through taxes imposed on the entire industrial community(Kirkwood, 2001).

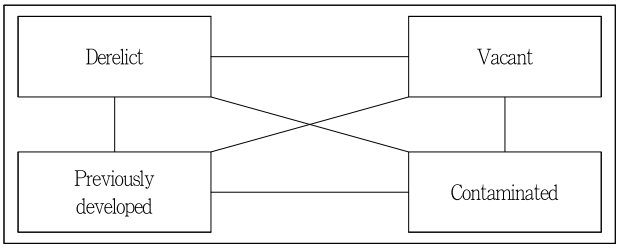

Figure 1. Terms commonly associated with brownfield sites
Source: Alker, Joy, Roberts and Smith, 2000: 56

A second approach used during this period is to identify hazardous sites nationwide and track the different types of risky sites by establishing a range of programs. For example, programs under the Resource Conservation and Recovery Act (RCRA) of 1976 track active and private industrial facilities that pose potential risks through their use of hazardous materials, while the Federal Facilities Restoration and Reuse Office(FFRRO) focuses on identifying facilities that the government operates(Refer to Table 1). Both abandoned mines and municipal industrial landfills are managed through these programs, with the government actively supporting soil and surface water contamination removal. Military training bases such as the 22,000-acre Massachusetts Military Reservation, which is located over a drinking water source supplying a population of 500,000 people, must also periodically undergo the EPA's environment assessment process. Aquifer contamination due to oil spills and earlier military training activities at the site was detected in 1997 and the cleanup process is ongoing.

Interestingly, the efforts made in this early period were to some extent a double edged sword. The brownfield policies and programs were originally launched to manage hazardous sites across the nation, but they have also had an adverse effect that has set back the redevelopment of those lands by stigmatizing them. The federal government therefore took steps to address this issue, described below.

2. Clean-up and Reuse Promotion Period(1990-2010): The Small Business Liability Relief and Brownfields Revitalization Act of 2001

In the second phase, the focus shifts to remediation and reuse. Although brownfield sites have been around for a long time, the term "brownfield" entered the lexicon when existing

environmental regulations were proved to inhibit the reuse of previous industrial areas(Hollander *et al.*, 2010). Since the late 1990s, the government has introduced new regulations and initiated programs to facilitate the remediation and reuse of brownfields, including the Brownfields Revitalization and Environmental Restoration Act of 2001 and the Small Business Liability Protection Act of 2002. Examining the relevant documents[6], these changes can be divided into two categories: limiting liability and supporting local projects.

First, and possibly most importantly, the liability barrier has been substantially reduced. Those purchasing contaminated sites are now excluded from liability if they ensure that the site is remediated to an agreed standard and were not responsible for the original contamination. The EPA also encourages better coordination between the federal government and state agencies via Memoranda of Agreement(MOA) to reduce dual accountability fears regarding a prospective developer's liability(Kirkwood, 2001); a lender who was not involved in the contaminated site's management is now protected from responsibility.

Second, in addition to the top-down approach typical of state and federal government operations, a bottom-up approach in which the city or local community takes the lead became a viable option. The literature shows considerable evidence for this shift, including for example, the EPA's Brownfield Pilot Project, where grants are awarded to selected cities or communities(Refer to Table 1). Initiated in 1991, the program expanded rapidly from the original ten city projects to fifty in just four years(Bartsch and Collaton, 1997). To address the financial difficulties involved in clean-up and reuse, the government has also used existing funding programs such as Community Development Block Grants(CDBG) from the Department of Housing and Urban Development(HUD)[7](Bartsch and Collaton, 1997). The Economic Development Administration (EDA)[8] also awards grants to promote public economic development projects and private business and investment activity

Table 1. Periodic characteristics of brownfield policies and programs in the U.S. from 1975 to 2010

Phase	Year	Programs/policies	Role	Branch of government
Environmental protection period	1976	Resource Conservation and Recovery Act (RCRA)	Focuses on active and future industrial facilities, ensures that wastes are managed in an environmentally-sound manner, and utilizes a hazardous waste handler tracking system.	Federal
	1980	Comprehensive Environmental Response, Compensation, and Liability Act(CERCLA)	Responds directly to releases or threatened releases of hazardous substances that may endanger public health and the environment, and generates National Priority Lists, imposes liabilities on potentially responsible parties retroactively, imposes taxation on industrial communities, provides hazard ranting system.	Federal
	1984	Underground Storage Tanks(USTs)	Regulates USTs containing petroleum and hazardous chemicals to limit corrosion and structural defects and thus minimizes the risk of future tank leaks.	Federal
Clean-up and reuse promotion period	1990	Voluntary Cleanup Programs(VCP)/Memoranda of Agreement(MOA)	Regulates agreement between a developer and a state that the state will not require additional clean-up in the future once a site completed clean-up/Promotes coordination by agreements between EPA regional authorities and state environmental programs.	Federal and local
	1991	Brownfields Program	Empowers states, communities, and other stakeholders to be involved in economic redevelopment, launches hundreds of two-year brownfield "pilot" projects, facilitating brownfield redevelopment and clean-up as working models to leverage financing, demonstrates the environmental and economic benefits of clean-up, provides brownfield assessment grants, brownfield revolving loan fund grants, brownfield job training grants, and brownfield cleanup grants.	Local
	1999	Superfund Redevelopment Program	Provides assistance to return sites to productive uses, encourages a partnership approach among local governments, communities, developers, and other stakeholders.	Federal
	2001	Federal Facilities Restoration and Reuse Office(FFRRO)	Focuses on providing effective, efficient, and timely clean-up and reuse of facilities that government operates ranging from nuclear weapons plants and military bases to landfills and fuel distribution stations.	Federal
	2002	Small Business Liability Relief and Brownfield Restoration Act	Exempts from liability, excludes new purchasers of contaminated sites from liability and redevelopers from further clean-up costs.	Federal
Comprehensive planning period	2010	Brownfield Area-Wide Planning(BF AWP)	Provides fund to localities to conduct research and basic assessment that will result in area-wide planning and implementation strategies for key brownfield sites.	Local

Source: Web database of each organization, 2010 May, retrieved from www.epa.gov, reorganized by author

in distressed areas(Bartsch and Collaton, 1997).

Local brownfields are often small-scale and only lightly toxic and have begun to be used in landscape projects such as neighborhood parks and outdoor community areas(Refer to Table 2). For example, the Steel Yard, a brownfield renewal awarded project in Providence, RI, successfully converted a 3.5 acre steel fabrication facility to a non-profit industrial arts education center; land that was contaminated with lead and chromium was capped on-site with clean fill. The project received $400,000 in funding from an EPA Brownfield Clean-up Grant and $199,000 from Rhode Island Economic Development Corporation-managed EPA funds("The Steel Yard", 2014 Dec, retrieved from http://www.brownfieldrenewal.com).

In this period, policies and programs sought to balance the contamination risk and reuse opportunities of brownfield sites. While the earlier emphasis had been on identifying sites, imposing fines on the liable parties and regulating the related activities, now the focus had shifted towards promoting voluntary clean up and reuse activities as the broader economic and community benefits of brownfield redevelopment began to be recognized.

3. Comprehensive Planning Period(2010-present): Brownfield Area-wide Planning Grants, 2010

The third and most recent phase can be characterized as the comprehensive planning period. Since 2010, the federal Brownfield Area-wide Planning(BF AWP) program has been used to assist selected communities to prepare comprehensive area-wide revitalization plans for brownfield sites. These projects include river, industrial, commercial and railway corridors, as well as downtown areas. Unlike earlier phases, brownfield redevelopment is now seen as a catalyst for larger visions rather than a quick fix of an individual brownfield site. The new perspectives can be summarized in terms of four main categories.

First of all, the physical planning areas covered by the proposals are all designated as sections of the city rather than as individual plots. For example, waterfront and river corridor areas are considered in their entirety, as are the neighborhoods alongside the railway, and downtown districts, where dozens of brownfield sites may be located within the project boundary.

Second, a major objective is to create comprehensive plans that consider existing brownfields within the larger context of city conditions and future plans. For example, more than half of the proposals, including the Newark, San Diego and Kansas City projects, include an overall analysis of environmental and market conditions in addition to infrastructure and community needs("BF AWP Pilot Project Fact Sheet", 2010 May, retrieved from www.epa.gov/brownfields/areawide_grants). Selected project objectives show that priorities are assigned based on a comprehensive analysis and assessment of existing conditions in relation to the larger context, thus enabling key areas to play a more effective role as catalysts to improve the wider community.

Third, the proposed plans all consider the potential area-wide influence of the target brownfield sites(Refer to Table 2). The Cleveland, Chicopee, and Sanford projects all indicate that the proposed brownfield reuse will play a role in the larger sustainable development context, for instance by creating green infrastructure and introducing alternative energy sources ("BF AWP Pilot Project Fact Sheet", 2010 May, retrieved from www.epa.gov/brownfields/areawide_grants).

Fourth, community engagement is an important aspect in larger and more complex projects. Of the 23 projects listed in Table 2 under this third phase, 17 state that they will facilitate community involvement throughout the brownfield redevelopment process. This typically consists of conducting community needs analyses, enhancing participation with monetary support, and creating amenity spaces for communities. Project goals are clearly shifting towards more community-oriented planning and design, probably as a reflection of the new awareness of the disconnection of perspectives between the effector and the affected. It has been suggested that while the experts from the federal government and EPA tend to regard brownfields as an environmental and technical problem involving contamination and clean-up, the local residents see brownfields as a neighborhood planning issue and thus focus on details of the redevelopment(Solitare, 2005).

Ⅳ. Major Characteristics of Brownfield Programs and Policies

The major characteristics of policies and programs that have developed over the last thirty years, especially how they deal with difficulties, are presented in this section. In particular,

Table 2. Examples of major landscape projects in each period

	Project type	Project description	Similar projects
Environmental protection period (1976-1990)	Water way/ canal(Love Canal, Niagara Falls, NY)	· Inspiration for Superfund law to clean-up nation's hazardous sites · Residential complex built on former industrial dumping site · Leaching accident causing to birth defects and leukemia · $230 million clean-up for capping with liner and topsoil	Gowanus Canal, NY Portland, Harbor, OR Tar Creek, OK Hudson River, NY Chisman Creek, VA
	Landfill/miining (Gulch Site, Leadville, Colorado)	· The largest mine 16.5 square-miles closed · Clean-up of soil and surface water contaminated with lead · Creation of 12.5 mile Mineral Belt Trail loops with mining heritage · Cooperation among responsible parties, community, and EPA	Lipari Landfill, NJ Copper Smelter, MT
	Industrial site (Gasworks Park, Seattle, WA)	· 19-acre former gas light company transformed into city park · Reclamation using natural processes of bio-remediation · Threatened to be on NPL after environmental assessment · Temporary closures in 1998, 2000	Murray Smelter, UT IndustriPlex, MA Maywood Riverfront, CA
	Military facilities (Cape Cod, MA Military)	· 22,000-acre military training base · Sole aquifer source for 500,000 seasonal residents contaminated by fuel spills and past military activities · Environmental clean-up programs for ground water contamination	Pearl Harbor Naval Complex, Hawaii
Clean-up and reuse promotion period (1990-2010)	The Steel Yard, Providence, RI	· 3.5-acre former steel fabrication facility · Clean-up of lead and chromium contamination · Community-based non-profit industrial arts education center with recycled material, bio-swale, infiltration for stormwater management · $400,000 EPA Brownfield Clean-up Grant	Guthrie Green Community Gathering Place, Tulsa, OK
	Riverfront Edge, Wausau, WI	· 33-acre waterfront industries with mill, rail road, and gas station contaminated with petroleum and chlorinated solvent · Clean-up using excavation and capping · Commercial redevelopment, public green and recreational reuses · Tax incremental financing, EPA brownfield cleanup grants and area-wide planning grant, CDBG funding	Riverwalk Complex, Rock Hill, SC
	Historic Fourth Ward Park, Atlanta, GA	· 17-acre light industrial site · Contamination with leaky UST, asbestos construction debris and lead · Contaminated soil and water removed and replaced with clean fill · Public natural area, detention pond, discharge pipes and engineered features with artistic design · $26.7 million city grant	American Tannery Street, Philadelphia, PA
Comprehensive planning period (2010-present)	River corridor	· Vision preparation for riverfront · Identification and prioritization of sites for clean-up, reuse plans for target area · Evaluation of sites' potential for public access to river	Denver, Monaca, San Francisco, Ogdensburg
	Commercial/ industrial corridor	· Coordination of community involvement · Support of redevelopment and converting to other land uses · Prioritization of sites for redevelopment	Atlanta, Desarrollo Integral del Sur PR, Goshen, Ranson
	Railway corridor	· Research about market, infrastructure improvement and community needs · Clean-up and reuse of core area · Consideration of park and trail reuse	Roanoke, Kalispell
	Downtown area/ street corridor	· Prioritization of reuse area as part of a larger planning vision · Plan of reuse based on environmental data, community input, infrastructure needs · Plan of sustainable approach such as alternative energy · Plan of reuse of existing infrastructure and creating green space	Kalispell, Lowell, New Bern, Chicopee, Sanford, Tulsa
	Neighborhood/ local community	· Site assessment and preparation of clean-up goals based on reuse type · Plan of land use for community needs · Plan sustainable recreational and mixed-use development · Determination of target area close to transit and existing infrastructure · Plan of reconnecting community to commercial and recreational area	Aurora, Cleveland, Newark, San Diego, Kansas City, Pheonix

Source: "BF AWP Pilot Project Fact Sheets", 2010 May, retrieved from www.epa.gov/brownfields/areawide_grants; "The Renewal Awards", 2014 Dec, retrieved from http://www.brownfieldrenewal.com; "10 Superfund Sites: Where are they now?", 2014 Dec, retrieved from http://www.mnn.com, reorganized by author

the study identified four major characteristics of U.S. brownfield policies and programs: relaxation and readjustment of regulation, support for program diversification, a combination of top-down and bottom-up approaches, and database system building.

1. Relaxation and Readjustment of Regulation

First, to overcome the stagnant redevelopment situation, the U.S. government sought to address the issue by identifying the regulatory problems and readjusting those governing brownfield redevelopment. The excessive environmental regulations that have been imposed since 1960[9] were regarded as the main factor inhibiting the remediation and reuse of brownfield sites. The Gasworks Park project in Seattle, WA, a highly popular post-industrial park design using natural remediation, struggled under the strict regulation imposed by the Superfund Act, which threatened with inclusion on the National Priority List after the park opened in 1975. The park experienced temporary closures in 1998 and 2000 because the EPA assessed site as unsafe and local businesses near the park suffered greatly, leading the Seattle City Government and local citizens to complain of excessive regulation.

As the critical issues moved from the need to protect from contamination risk and blaming the responsible party to a greater focus on fostering redevelopment and lessening burdens, the federal government actively revised the regulations in order to reduce liabilities for remediation costs and taxation (Bartsch and Collaton, 1997).

2. Support for Programs Diversification

As a result of changes in the regulations, a series of programs have been initiated to deal with the clean-up and reuse of different types of brownfield sites. The CERCLA program still requires the most hazardous sites to be included in the National Priority List(NPL)[10], but sites with comparatively low levels of contamination and non-urgent sites are now covered by the less rigorous brownfield program as shown in Table 1.

Along with the rules governing the treatment of different types of brownfield sites, these programs support brownfield redevelopment through a well-established process that starts with site identification and moves through site assessment and remediation to the final reuse and design stage(Refer to Figure 2). For example, a riverfront revitalization project in downtown Wausau, WI, has benefited from access to diverse funding sources for the identification to reuse stages. The project's primary funding of over $25 million was provided through tax incremental financing[11], supplemented by $200,000 from an area-wide planning and community-wide assessment pilot grant for consolidating 32 parcels of land, $200,000 from two clean-up grants and a CDBG grant for the public plaza redevelopment. This process demonstrates how the U.S. government approaches the complex set of brownfield concerns by distributing and specifying different responsibilities.

Involving planners and designers through established process can be a good way of dealing with specific concerns such as site potential assessment and clean-up. For instance, the Historic Fourth Ward Park project in Atlanta, GA, which is located in an area once plagued by industrial waste and subject to flooding and combined sewer overflows, was a success largely because landscape architects were involved from an

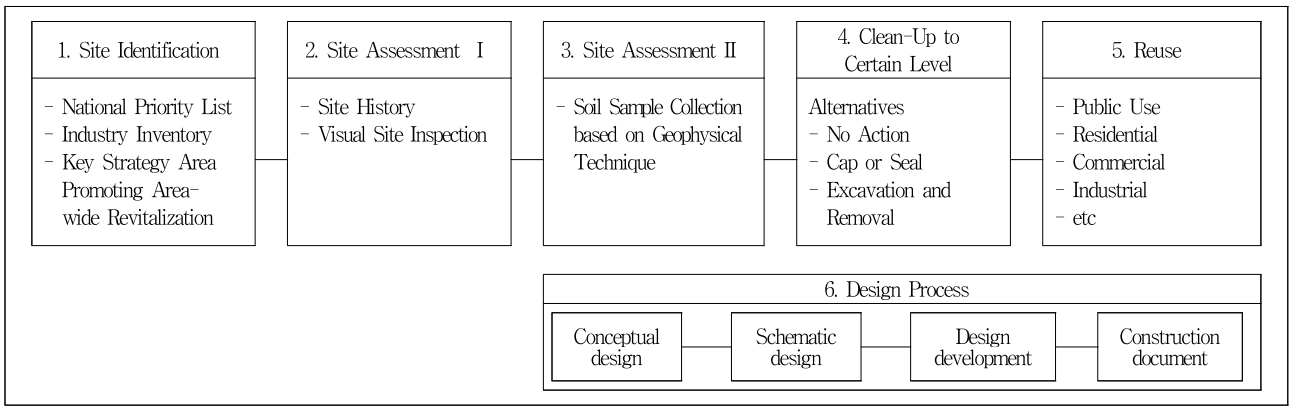

Figure 2. Typical Brownfield Management Process
Source: ICMA, 2001, reorganized by author

early stage. Storm water management facilities such as discharge pipes and detention ponds and contaminated land remediation were integrated into the artistic design process, showing how soil remediation and water management can be transformed into visually pleasing park elements.

3. Mix of Top-down and Bottom-up Approach

The government utilizes both top-down and bottom-up approaches for brownfield clean-up and redevelopment. In the early days, a top-down approach was adopted for managing urgent sites to protect the public from the risk of contamination. However, since the 1990s, programs based on bottom-up approaches to manage neglected, lightly toxic areas in localities have become more common.

Brownfield management, planning and design often require consideration at different scales, either national, regional, city or neighborhood. In particular, the two different approaches of top-down and bottom-up suggest that there are different factors that can only be dealt with at either a federal or local level. This is particularly true for a bottom-up approach that involves local brownfields, which are often located within residential and downtown areas and have a direct impact on the local community's quality of life. For instance, American Tannery Street in Philadelphia, PA, adopted a bottom-up approach where the local community played a significant role in transforming an abandoned tannery operation site into neighborhood park named after the North Liberty Neighborhood Association(NLNA). After a thorough clean-up of spilled chemicals, the 1.5-acre area became one of the city's most visited neighborhood parks, with a playground, community garden and open multi-purpose lawn. The park and NLNA have been a major catalyst for wider area regeneration, including affordable housing and commercial redevelopment.

4. Database System Building

Web-based information, particularly the extensive online database maintained by the EPA, has continued to expand. The two main purposes of the database for each brownfield program is to facilitate site identification and reuse monitoring. For site identification, the database first plays a role in tracking risky sites, but as Superfund sites complete the clean-up process and are prepared for reuse, the general focus shifts to redevelopment. The EPA's Superfund Redevelopment Program has systematically collected brownfield reuse data such as prior uses, contamination characteristics, surrounding land use, community involvement, and reuse types("EPA Superfund Redevelopment Program", 2012 May, retrieved from www.epa.gov/superfund/programs/recycle). This database provides an outstanding resource for brownfield research, one example of which is a study published by the National Center for Environmental Economics, part of the EPA, which compared Superfund Redevelopment program data for a large number of brownfield non-reuse sites and reuse sites to identify the factors that influenced decision-making(Vitulli *et al.*, 2004). This database shows the strength of the program in terms of its ability to monitor the project process and to reveal clean-up and reuse patterns. However, it also reveals the deficiencies in the agency's ability to guide the planning and design process for brownfields.

V. Conclusion

There has been increasing interest in brownfield redevelopment projects in Korea and future plans to transform post-industrial sites into public parks have received a great deal of public attention. Most recently, Yongsan Park, a former military training base, went through a design competition and Seoul's city government recently completed a design competition for a post thermal power generation plant facility. Issues such as polluted water from closed coal mines and the widespread soil contamination found in several military training bases has led to calls for these problems to be fully investigated and measures taken to correct them. This indicates an urgent need for comprehensive policies and programs that deal specifically with brownfield sites, where the findings of the current study of the history of U.S. brownfield policies and programs may be helpful.

First, the creation of an atmosphere supporting brownfield redevelopment through existing policy review and readjustment in the U.S. may have interesting implications for the development of an appropriate brownfield policy in Korea. The U.S. EPA identified a need to modify the existing CERCLA regulations since these had been found to inhibit the reuse activities for brownfield sites. These changes in brownfield regulation suggest how policies enacted for national-level brownfield management, no matter how well-intentioned, can actually discourage brownfield redevelopment at the regional

and local level. This implies the importance of maintaining a balanced perspective between risk and opportunity when initiating regulatory works. While it is natural to focus initially on the potentially harmful effects of pollution and liability concerns, a largely regulatory approach does not encourage redesign nor give local governments and citizens a voice in what happens. If Korean governmental agencies and landscape architects are interested in soundly based future redevelopment of brownfield sites, they should consider adopting the practices used in the later stages of the process in the U.S.

Second, our findings highlight the importance of supporting diverse programs. In the U.S., efforts are no longer concentrated in a single program, but are instead distributed over several programs that deal with brownfields at different stages as well as different types of sites. Since 1980, no less than nine major programs have been introduced for site identification, assessment, clean-up and reuse. More importantly, landscape architects are now becoming involved at an earlier stage in the process rather than being limited to the final design stage. This early involvement of designers when assessing spatial quality and choosing cleanup options makes a major contribution to project success.

Third, the differentiation between the key roles played by local and central government has important implications for brownfield management and the field of landscape architecture in Korea. The U.S. EPA runs a mix of top-down and bottom-up approaches simultaneously, with the top-down programs being applied to national priority sites where urgent action is required, and the bottom-up programs being deemed more appropriate for local sites where comparatively low levels of contamination exist. Since landscape architects may be involved in both types of brownfield projects, an awareness of the different design approach required in each case is critical. Particularly for local sites, landscape architects need to take a design approach that engages local communities, taking into account residents' perceptions and preferences to achieve the best design outcome as well as long-term regeneration benefits.

Lastly, it is also important to build a good database to support brownfield reclamation efforts to provide useful resources and guidance for planners and designers. Our findings reveal the critical need for additional information that planners and designers can utilize such as, for instance, information on the visual and spatial qualities of brownfields. Research into the visual assessment of existing brownfields may be helpful, for example, the development of a brownfield typology based on visual characteristics, and determining local residents' attitudes and preferences for brownfields at different stages.

The benefits of reusing brownfields have already been demonstrated in several successful redevelopment projects in Korea. However, the design outcomes and additional benefits from brownfield projects could be enhanced by the existence of a comprehensive suite of policies and programs to support the effective planning and management of brownfields. The conditions in Korea may be different in terms of the degree of the strictness of environmental regulation, since the general awareness of environmental issues in Korea is relatively recent, and the direct implementation of U.S. brownfield policies and programs may not be appropriate due to the different social and cultural norms and city structures in the two countries. However, the challenges that the U.S. has experienced on the way to developing their regulatory framework may provide useful insight for those working to develop appropriate brownfield management programs in Korea, where there are currently interesting parallels with the early stages in the U.S., and also indicate the need for further research on potentially relevant systems in Korea.

Note 1. EPA is an Agency of the U.S. Federal Government in charge of writing and implementing regulations to protect human health and environment. It also conducts environmental assessment, research, and education(www.epa.gov/aboutepa).

Note 2. In 2002, President Bush signed an Act "to provide relief for small businesses from liability under Comprehensive Environmental Response, Compensation, and Liability Act of 1980". The purpose of law is "to promote the cleanup and reuse of brownfields" and "provide financial assistance"(www.epa.gov/brownfields/laws).

Note 3. Soil Environment Conservation Act of 1995 is enacted to protect public health and environmental hazard from soil contamination and for soil conservation and management in Korea(www.law.go.kr).

Note 4. Resource Conservation and Recovery Act(RCRA) of 1976 is "to control hazardous waste from the cradle to grave" which includes "the generation, transportation, treatment, storage, and disposal of hazardous waste"(www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act).

Note 5. The Superfund Act enforces cleanup of sites by "finding the companies or people responsible for contamination" and advising them to do voluntary cleanup or to pay for the cleanup cost(www.epa.gov/enforcement/superfund-enforcement).

Note 6. Four books reviewed here documented the legal issues of brownfield well as a separated chapter(Bartsch and Collaton, 1997; Russ, 2000; Hollander *et al.*, 2010; Kirkwood, 2001).

Note 7. CDBG grant, a major funding source for local brownfield projects, has been one of the longest funding programs at U.S. Department of Housing and Urban Development(HUD) to assist community development needs such as affordable housing, anti-poverty programs and infrastructure development since 1974. HUD is a

cabinet department in the executive branch of federal government to develop and execute policies on housing and metropolises(www.hud.gov/cdbg).

Note 8. EDA is an agency in the U.S. Department of Commerce that provides grants to economically distressed communities to generate new employment and stimulate industrial and commercial growth(www.eda.gov).

Note 9. Since 1960, environmental laws to protect air, water, soil, and ecosystem became important U.S., Europe, Australia, and New Zealand. This is based on the idea that biosphere is fragile system that could be negatively influenced by human activities.

Note 10. Hazard Rating System is a screening system that estimates the site's hazard potential to human and environment with numeric points to place the sites into the National Priority List. To be included in NPL, the site should reach to 28.5 points(ICMA, 2001).

Note 11. Tax Increment Financing is a public financing tool utilizing anticipated gains in taxes after development. This is often used in distressed, underdeveloped area improvement when a certain improvement project are projected to gain above the typical yearly tax increase.

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