

URBAN RECYCLING | REVIVING

THE CONTRIBUTION OF BROWNFIELD INTERVENTIONS
TO A MORE SUSTAINABLE URBAN DESIGN

by

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Abstract

The thesis argues brownfield interventions represent a significant opportunity to contribute to sustainability and quality of life in the city, particularly those located in urban areas. It is rooted in the concern about the presence of derelict and underused sites within urban areas together with the current need for more sustainable urban design and planning. The thesis explores the brownfield challenge in the contemporary post-industrial city and its potential to formulate a more sustainable urban design. With this as a basis it develops an evaluative framework based on the physical analysis of the sites before and after intervention. The application of the framework to four brownfield interventions within the city of Bilbao, a European middle size city with a significant amount of brownfield land, suggests that brownfield interventions – a process of urban *recycling* – can effectively contribute to *reviving* the city, with desirable consequences beyond the sites themselves, at a district scale, and to the city as a whole. At the same time, the framework reveals opportunities yet to be achieved in current brownfield intervention practice. The thesis concludes arguing for a new perspective to the brownfield challenge based on the identification of the sites, the evaluation of their potential, and the optimization of the contribution of brownfield interventions to urban sustainability and quality of life. Based on the overall framework, it proposes a series of design recommendations and an evaluation tool to inform design when dealing with interventions on brownfield sites in urban areas.

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1. Introduction

An Opportunity for a more Sustainable Urban Design

When one visits Seattle's Gas Works Park for the first time, the sight of massive industrial remains surrounded by greenery and people is perhaps one of the most striking ways of understanding urban transformations. The site represents a one hundred year old example of urban transformation: from an ideal lakefront [before 1906], to an industrial site [1906–1956], to a popular urban park [1976–today].

What many cities face today is neither one of these three phases, but rather the twenty years *before* the park we see today was opened. The gasification plant that had once powered much of Seattle was closed in 1956 and, for two decades, left abandoned, neglected and contaminated. The 1970s intervention brought the site back to a beneficial use – one of a totally different origin than the former – cleaning it up and adapting it to accommodate diverse recreational activities. But beyond the site scale, the transformed area has contributed to greening the city and has allowed it to reach the water, improving its spatial legibility and integration, and providing a new dialogue between man, technology, and nature.

Gas Works Park illustrates one particular way of how this figurative *recycling* of derelict land can enhance the quality of life of a larger district. Other cities have chosen to do so to accommodate growth, like Vancouver around False Creek, hence building complete communities and mitigating the impact of urbanization by avoiding growing otherwise on natural areas.

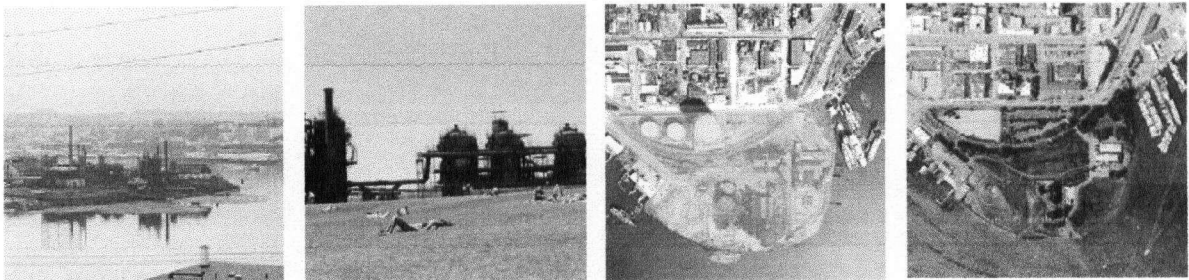


Figure 1.1 Seattle's Gas Works Park: transformation of an abandoned industrial site into an urban park

Nevertheless, although examples worldwide suggest the different ways in which the reintegration of these abandoned sites improves their surrounding areas and ultimately the city as a whole, many cities do not yet know how to approach their own share of these type of sites, what to do with them, or how to do it. And so, just like Gas Works Park during those two decades before being *revived* into an urban park, many sites today remain derelict and neglected, as dormant sites with a great but undervalued potential to contribute to the city.

In this context, the thesis intends to bring clarity to what the reintegration of these derelict sites into the social, economic, and environmental context of a city – what it refers to as *brownfield interventions* – actually mean to the city. The thesis addresses the challenge the interventions represent; recognizes their potential to heal the city, contributing to its sustainability and quality of life; and, ultimately, proposes ways to fulfill this potential and optimize their contribution. To do so, it explores the various concerns that dominate what has come to be called brownfield sites, the opportunities associated with brownfield interventions, and a series of international examples, such as Seattle's Gas Works Park. With this as a basis, it distills the many opportunities identified into six goals and develops a framework to determine a site's potential [based on its capacity to achieve these goals] and, once the brownfield intervention takes place, to evaluate its contribution [based on the actual achievement of the goals]. The framework is then applied to a series of brownfield interventions within the same metropolitan area to reveal, on the one side, the ways in which the sites' potential is achieved, contributing to the city's sustainability and quality of life, and, on the other, those aspects of the sites' potential that have been missed and thus are yet to be fulfilled. The thesis concludes arguing for a new perspective on brownfield sites based on the inherent potential of brownfield interventions to contribute to the city and proposes two complementary ways to fulfill this potential, optimizing their contribution and pushing the practice forward towards a more sustainable urban design - or at least towards a less unsustainable one.

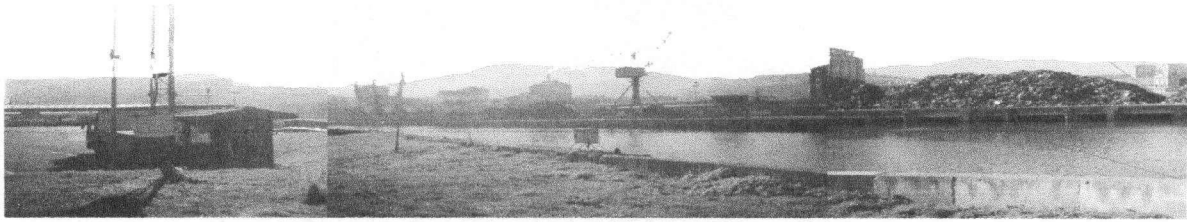


Figure 1.2 Brownfield interventions: opportunity for *urban reviving* through *urban recycling*

1.1 Brownfields: From Challenge to Opportunity

"Brownfield redevelopment is one of the most pressing urban issues of our time - and one of the biggest opportunities to curb urban sprawl, reconnect neighbourhoods, improve public transportation, create meaningful jobs, and restore and protect green space."

Waterfront Regeneration Trust, Canada, 1999¹

1.1.1 The Challenge

Former human activity – particularly industrial activity - has left its trace in many cities in the form of what has come to be addressed as *brownfields*, a single term for a wide variety of sites: abandoned, derelict, or underused; of various sizes and forms; often located in core downtown locations; and frequently presenting the footprint of the site's former use - from real or perceived contamination, to existing structures and infrastructures, to even an existing community within the site. At the site scale, these areas remain neglected and disconnected from the city's social and economic activity. Yet, for the city, these areas represent barriers for the surrounding neighbourhoods, behaving as physical holes or urban voids within its fabric and networks. As a result, the contemporary city of the older industrial countries – often referred to as the *post-industrial city* – faces the challenge of the presence and potential reuse of these abandoned or underused sites, particularly of those within urban areas.

1.1.2 The Opportunity

The concern about the presence of derelict and underused sites within urban areas, together with that about the current need for a more sustainable urban design and planning in an increasingly urbanized world, leads to the focus on the intervention on brownfields located in urban areas as an opportunity to

¹ Waterfront Regeneration Trust, The Nature of Possibility, International Brownfields Exchange 98-99, Canada, 1999

enhance sustainability and quality of life in the city. Similar to the transformation of Gas Works Park in Seattle, numerous existing examples worldwide suggest that, in different ways, the physical reintegration of these abandoned sites into the city has positive consequences beyond the sites themselves and beyond their physical dimension. The idea being that these urban transformations, because of their inherent characteristics that differentiate them from other natural non-urbanized sites – *greenfields* –, have an enormous potential to positively affect their larger social, economic and environmental contexts.

1.1.3 The Response

Towards a more Sustainable Urban Design: Acknowledging Strengths & Addressing Gaps

While intuitively foreseeing the potential of brownfields to enhance or *heal* the city as they are reintegrated into the context of a city – what the thesis refers to as *brownfield interventions* – when these actually take place there seem to be numerous gaps in the achievement of the sites' full potential. In this context, the thesis develops a framework to evaluate the contribution of brownfield interventions to urban sustainability and quality of life based on the extent to which an intervention achieves the identified potential. The thesis acknowledges what is generally achieved in common practice, and at the same time identifies and addresses the gaps. It then proposes two complementary ways of optimizing the contribution and pushing the practice forward towards a more sustainable urban design.

The research is framed within the physical realm, believing that urban design driven by social, economic and environmental rationales can provide the physical capacity to support a more sustainable way of living. It is also focused in brownfields within urban areas, as both the challenges and opportunities beyond the site scale are more intense in these locations. Given the continuous urbanization of the planet, the research is oriented mainly towards the case of growing cities based on the asset of brownfields to accommodate population growth within already urbanized areas – without compromising natural areas. However, it also briefly refers to depopulating or shrinking cities and to those facing an uncertain future, where brownfield interventions may be a means to alleviating the consequences of depopulation or to adapting to uncertain urban change.

Urban Recycling I Reviving

The gerund used in the thesis title Urban Recycling I Reviving intends to reflect the ongoing process of urban design and planning. Considering the city as in constant change and assimilating the generation of brownfields to urban waste or wasteland, the title insinuates a shift within this notion based on turning the challenge into an opportunity. It suggests brownfield interventions as a sort of figurative *urban recycling* that can effectively lead to an urban revival or *reviving* process, with consequences beyond the sites themselves, at a district scale, and to the city as a whole.

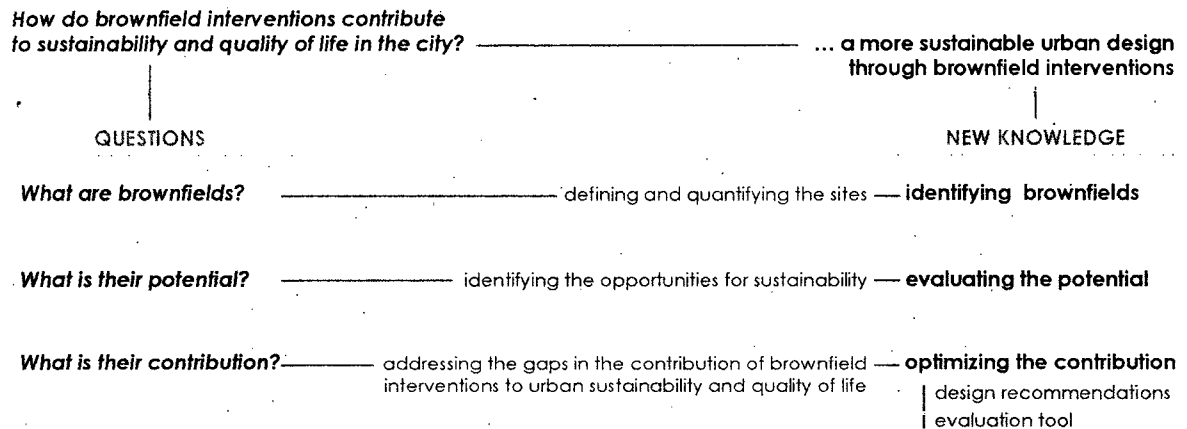


Figure 1.3 Research questions and contribution to the body of knowledge

1.2 Research Objectives and Contribution to the Body of Knowledge

The thesis' driving question is:

How, and in what terms, does the reintegration of derelict land into the social, economic, and environmental context of a city contribute to the reviving of the post-industrial city; to making it a better place to live?

In order to answer the question, the research objectives address in a consecutive way the concept of brownfields, their potential, and their contribution to urban sustainability and quality of life.

1.2.1 Research Objectives

1. To explore the notion of brownfield sites, the major concerns about them, the related concepts, and the associated challenges from the site scale to their significance to the city.
2. To identify the different social, economic, and environmental opportunities associated with brownfield interventions, and to determine their potential to provide the physical capacity to achieve these, contributing to urban sustainability and quality of life.
3. To develop a framework to evaluate the contribution of brownfield interventions to the city through the extent to which it fulfills the identified potential, based on the physical change between the *before* and the *after* intervention.

1.2.2 Contribution to the Body of Knowledge

The thesis concludes arguing for a new perspective to the brownfield challenge based on the identification of the sites, the evaluation of their potential, and the optimization of the contribution of brownfield interventions to urban sustainability and quality of life. The research reveals that, although common practice in brownfield interventions does achieve part of their potential, hence contributing to the city, it does not fulfill it. This indicates there is room for improvement.

Recognizing the strengths and identifying the gaps, the thesis addresses the latter by proposing two ways for fulfilling the potential and pushing forward current practice of urban design on brownfield sites in urban areas. The proposal, which derives from the overall thesis framework, consists, on the one hand, of a series of design recommendations and rules of thumb, and, on the other, of a brownfield intervention sustainability evaluation tool. Both are complementary; while the design recommendations intend to drive the design towards the achievement of the identified opportunities, the tool, which is the evaluative framework used in the case study, is proposed as a means to evaluate the extent to which the design actually meets these opportunities. By identifying the strengths and weaknesses of a specific brownfield intervention, the tool intends to be useful for informing design, as, based on physical measurable parameters, it can assess design before it is actually built.

Together, the overall thesis framework addresses one of the gaps identified by the Concerted Action on Brownfield and Economic Regeneration Network [CABERNET] related to brownfield regeneration: the difficulties in evaluating and incorporating sustainable development of brownfield sites in land use planning and urban design². The thesis framework covers, through physical design, the diverse social, economic, and environmental opportunities associated with brownfield interventions. The idea is that as architects, landscape architects, and urban designers, we may not be able to solve all the environmental, economic and social issues in the city, but that by enabling a more appropriate urban design we can create the physical capacity for sustainability to build upon.

² CABERNET [Concerted Action on Brownfield and Economic Regeneration Network], List of 12 key issues relevant to the regeneration of brownfield sites, Key Issues for Brownfield Regeneration, 2005 www.cabernet.org.uk

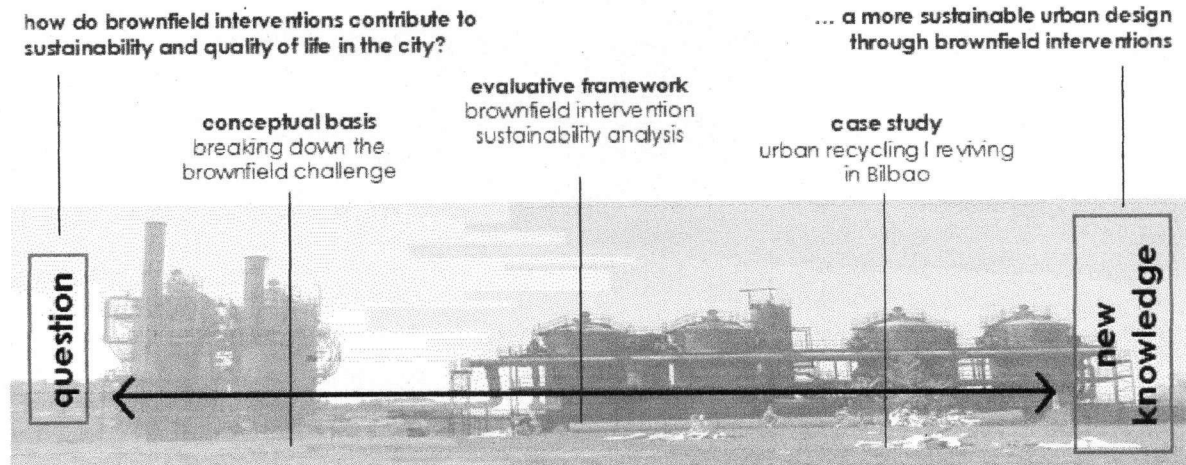


Figure 1.4 Thesis methodology

1.3 Overview to the Methodology and Data Sources

The thesis methodology consists of a preliminary theoretical approach that sets the basis for an evaluative framework, which is tested through a study of a specific city with a series of brownfield interventions. Figure 1.4 illustrates the overall thesis methodology structured in five chapters, and Figure 1.5 provides a more detailed outline of the different pieces that constitute it.

1.3.1 Conceptual Basis Breaking down the brownfield challenge

In order to analyse and understand the brownfield challenge, the conceptual basis addresses the three research questions respectively through three parts: *Concept*, *Vision*, and *Process* [Figure 1.5]. The purpose behind this concept-vision-process break down is to clarify what brownfields are and mean to a city, to identify the opportunities associated with brownfield interventions to contribute to urban sustainability and quality of life, and to do a first round exploration of their contribution based on the process of the *before* and the *after* intervention in a series of international experiences.

The *Concept* introduces the brownfield phenomenon and the different ways it is considered. Topics covered include: the different understandings and concerns when defining brownfields; the magnitude of the brownfield reality; their origin, as the physical expression of the city's shaping forces; their underestimated environmental value; and an overview of related concepts that vary from the sites scale to broader discussions about the city and the urbanized landscape. It concludes with the broad range of sites of what has come to be addressed as *brownfields*, and how these face common challenges.

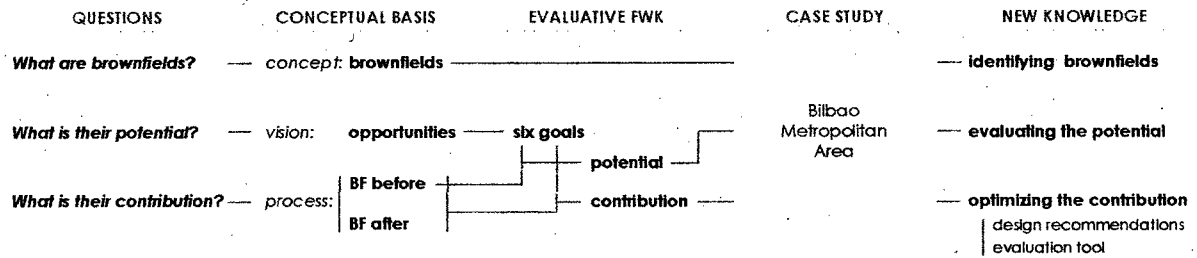


Figure 1.5 Outline of research framework

The *Vision* explores the potential of brownfield sites framing it within the concept of sustainability and quality of life. After defining both inter-related concepts, it provides a summary of the different social, economic, and environmental opportunities associated with brownfield interventions. Although mainly focused as a means to tackle urban growth over natural areas, the *Vision* also covers the opportunity of brownfield interventions for shrinking cities and for cities facing an uncertain future.

The *Process* begins exploring and challenging the economic interests generally faced by brownfield interventions. It then develops a preliminary examination of the contribution of brownfield interventions to urban sustainability and quality of life, based on the change between the *before* and the *after* intervention. A review of well-known international brownfield interventions reveals how certain site circumstances or attributes commonly encountered [*before*] are dealt with in the site's intervention [*after*], and how this change affects the fulfilment of the previously identified opportunities.

1.3.2 Evaluative Framework Brownfield intervention sustainability analysis

Understanding the brownfield problematique and the ways it is related to urban sustainability and quality of life sets the basis for the evaluative framework. The first part introduces the *six goals for brownfield interventions*: the result of distilling to spatial and built form design the diverse opportunities identified in the previous chapter. In other words, each of the six goals covers different social, economic, and environmental opportunities, and at the same time belongs to the spatial and physical realm and can therefore be measured. With this, the potential and the contribution to urban sustainability of a brownfield intervention will be determined the degree of achievement of these goals.

Given the potential to achieve each of the proposed goals may be hindered or favoured by a site's particular conditions, *Determining the Potential* bridges the six goals to the most relevant site attributes *before* intervention identified in Chapter 2 [Figure 1.5]. This provides a way to look at specific sites and, through their key site conditions prior to intervention, determine the site's potential to achieve the goals, and thus to contribute to urban sustainability. The potential is also considered at a metropolitan level, based on a city's overall brownfield scale and its particular circumstances.

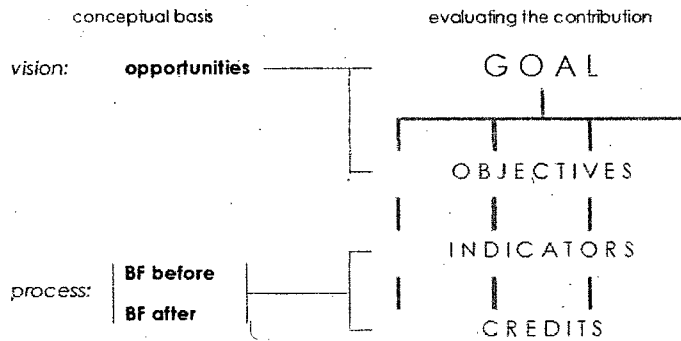


Figure 1.6 Evaluating the contribution

Last, the evaluative framework undertakes the evaluation of the actual contribution of a brownfield intervention to urban sustainability and quality of life based on the extent to which the given intervention achieves the proposed goals [Figures 1.5 and 1.6]. Deriving from the opportunities identified in the conceptual basis, each of the six goals consists of four objectives. These are measured numerically and/or graphically through indicators. Based on the physical change of the sites before and after intervention, a poor/moderate/good credit is acknowledged. The indicators and credits have been determined considering the preliminary brownfield intervention study developed in Chapter 2.

Together, the four objectives determine the overall achievement of a goal. The objectives [and thus, the goals too] cover not only the changes that occur at the site scale before and after intervention, but also how these affect the larger district scale and the city as a whole. When the evaluation of the degree of achievement of all six goals is completed, all six results are represented together in a graphic scale. This visually communicates in a holistic way the evaluated intervention's strengths, but also its gaps and weaknesses, highlighting the areas for improvement.

1.3.3 Case Study Urban recycling I reviving in Bilbao

The evaluative framework proposed is tested through the study of the city of Bilbao, in the Basque Country, Spain. The framework analyses the achievement of the proposed goals and objectives in the four major brownfield interventions that are taking place within its metropolitan area. The selection of the case study city is due to how this European middle size city that has transformed its significant neglected industrial footprint into an asset to revive, largely through a series of brownfield interventions within its metropolitan area. The study provides a holistic view of the extent to which the four brownfield interventions evaluated have, on the whole, contributed to improving the city's sustainability and quality of life, acknowledging the major contributions but also the areas for improvement in future practice.

1.3.4 Data Sources

The data sources for the conceptual basis have been basically bibliographical: books, journals, on-line documents, and site visits [Seattle and Vancouver case studies]. Among many, the most useful sources include: research by the Concerted Action on Brownfield and Economic Regeneration Network - CABERNET; *Drosscapes* [Berger, 2006]; *Manufactured Sites. Rethinking the Post-Industrial Landscape* [Kirkwood, 2001]; *Cities and natural Process* [Hough, 1995]; and *Redeveloping Brownfields: Landscape Architects, Site Planners, Developers* [Russ, 2000].

For the development of the evaluative framework, two documents have been most useful in organizing the different elements: the 2005 draft version of *LEED for Neighborhood Developments Rating System*, and the 2006 *Guide for Sustainable Building in Housing in the Autonomous Community of the Basque Country*.

The data sources for the case study of Bilbao have been primarily the pertinent websites [particularly those from the Basque Government and Bilbao Ria 2000] as well as site visits to all four interventions. Books and on-line articles have also been consulted.

All the data sources are listed in the Bibliography.

2. CONCEPTUAL BASIS

Breaking down the Brownfield Challenge

This chapter explores the brownfield challenge by breaking it into three basic questions: *What is a brownfield? What is its potential to contribute to the city?* And, when a brownfield intervention takes place, *what is its contribution?* The chapter is divided into three parts, *Concept*, *Vision*, and *Process*, addressing each question respectively. The first two and beginning of the third are mostly based on the literature reviewed. The third introduces primary research about existing brownfield interventions.

The *Concept* explores the nature, scale, and different understandings and concerns about what has come to be called brownfields, including an overview of related concepts that vary from the sites scale to broader discussions about the city and the urbanized landscape. The *Vision* addresses the potential within the reuse of the sites to contribute to the city's sustainability and quality of life by identifying the different social, economic, and environmental opportunities associated with brownfield interventions. The *Process* considers and challenges the often exclusive economic interests faced by brownfield interventions, and, through a review of a series of international examples, it preliminarily explores their contribution to urban sustainability and quality of life based on the change between the *before* and the *after* intervention.

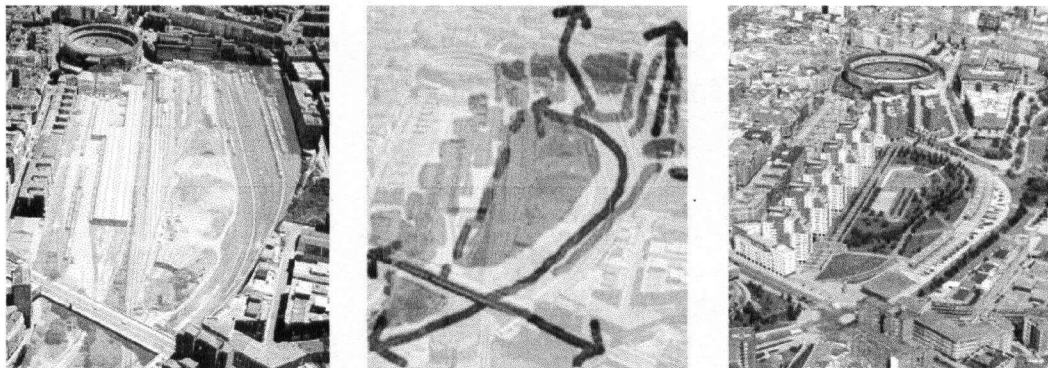


Figure 2.1 Breaking down the brownfield challenge: *What is a brownfield? What is its potential to contribute to the city?* And, when a brownfield intervention takes place *what is its contribution?*

2.1 The Concept: Brownfield Sites

"Virtually every city in the older industrial regions, no matter its size, grapples with the challenge of unused manufacturing facilities and other industrial sites."

Bartsch, C. and Collaton, E. 1997³

2.1.1 Brownfields: Definitions and major concerns

What are brownfields? Many of the older industrial countries have started to address the challenge Bartsch and Collaton refer to above by defining the sites. However, not all countries have developed a specific term and definition for the sites, and, within the ones that have, there seem to be different concerns and understandings of the sites. A look at 18 different definitions in Europe and North America [Figure 2.2 and Appendix I] reveals five basic concerns around this type of sites: their state of abandonment; their state or possible state of contamination; their potential for new use; their former use; and their location. The first three are the major concerns, addressed by most countries. In this line, Niall Kirkwood highlights the remaining contamination on the sites and the motivation to return them to productive use as two important reasons for brownfield redevelopment⁴. However, when focusing on the challenge within the city, the issue of location [within urban areas] is also very relevant, although only referred to in two definitions [Czech Republic and Germany]. As for the former use of the sites, while some definitions are limited to industrial use, many extend this to commercial use, economic activities, or even to any other previous use.

For the purpose of dealing with the physical challenge of brownfields within the city, this thesis considers the most suitable definition for the term *brownfield* as:

The sites that have been affected by the former uses of the site and surrounding land; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban areas; and require intervention to bring them back to beneficial use⁵.

³ Bartsch, C. and Collaton, E. Brownfields. Cleaning and Reusing Contaminated Properties, Praeger, 1997 in Manufactured Sites. Rethinking the Post-Industrial Landscape, Kirkwood, Niall, Ed. Spon Press, 2001

⁴ Kirkwood, Niall, Ed. Manufactured Sites. Rethinking the Post-Industrial Landscape, Spon Press, 2001, Chapter 1

⁵ CABERNET [Concerted Action on Brownfield and Economic Regeneration Network] definition, 2005, based on the original from CLARINET, www.cabernet.org.uk

Figure 2.2

The five major concerns around brownfields extracted from 18 different terms and definitions in 15 countries in Europe and North America

	STATE OF ABANDONMENT	FORMER USE			STATE OF CONTAMINATION		NEW USE		LOCATION
	ABANDONED, VACANT OR UNDERUSED	INDUSTRIAL	INDUSTRIAL & COMMERCIAL (ECONOMIC ACTIVITIES)	ANY USE / PREVIOUSLY DEVELOPED LAND	CONTAMINATED (REAL OR PERCEIVED)	MAY OR MAY NOT BE CONTAMINATED	REQUIRE INTERVENTION	POTENTIAL FOR REDEVELOPMENT	LOCATED IN URBAN AREAS
Austria									
Belgium [Wallonia]									
Belgium [Flanders]									
Canada									
Czech Republic									
Denmark									
Finland									
France									
Germany									
Ireland									
Italy									
Netherlands									
Spain									
Spain [Basque Country]									
Sweden									
United Kingdom [England and Wales]									
United Kingdom [Scotland]									
United States									

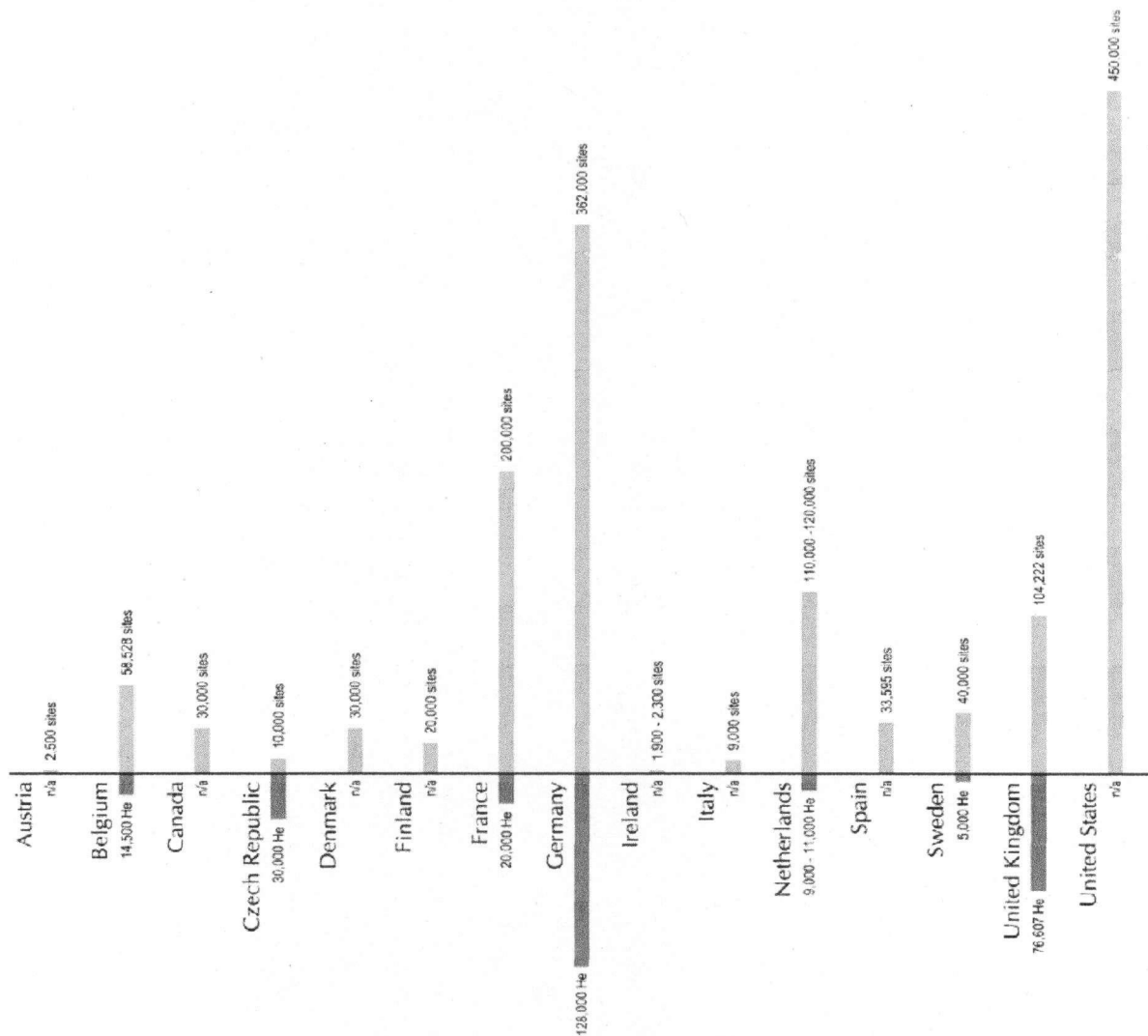


Figure 2.3 Estimated number of brownfield sites [light, above the line], and estimated area of brownfield sites in hectares [dark, below the line]

2.1.2 Scale: [Estimated] magnitude of the brownfield reality

Once defined, many countries are dealing with the challenge by identifying the scale of the brownfield reality. This has also been taking place since the 1990s. Countries measure brownfield scale either by number of sites or by total area, or both [Figure 2.3].

Figure 2.3 illustrates the number of sites estimated by different government institutions in 15 countries in Europe and North America [light, above the line]. However, due to the sites' vast range in size, the measurement does not provide a clear picture of the physical dimension of the challenge. For this

purpose, it is more appropriate to identify the total brownfield area, which not even half of the countries provide [dark, below the line]. When brownfield area is available, *brownfield density* [brownfield area as a percentage of total area of country⁶] may be obtained, giving a more consistent idea of the situation in each country. Nevertheless, when dealing with the challenge within the city, and in order to compare the situation within different urbanized areas [i.e. cities, regions, or countries], *brownfield intensity* measured as the *percentage of brownfield area of the total urbanized area* is more adequate. Another useful measure to compare the brownfield scale among urbanized areas is *brownfield area per capita*.

The disparity in the comparison among countries in figure 2.3 is not only due to the lack of data about the total brownfield area, but also due to the disparity in the understandings of the term, with a consequent different identification and quantification of sites.

In all, the lack of a common understanding of brownfields due to the different connotations, which worsens with the absence of a specific term [i.e. Finland; Italy; Spain], added to the general scarcity of data currently available, weaken the possibility to establish effective targets for the reuse of the land. This data is essential to establish indicators of brownfield 'flow' [changes over time, in extent, location and type] and monitor its balance with greenfield development⁷ [development of natural, non-urbanized areas].

2.1.3 Origin: The physical expression of the city's shaping forces

Much of the presence of brownfields, given the industrial or related nature of many, represents the spatial and physical expression of *deindustrialization*. The term, explored by Cowie and Heathcott, involves the de-linking of investment and place, de-urbanization and perhaps even the loosening of the connection between identity and work⁸. Changes in manufacturing and production modes of communication and transportation have resulted in the dispersal and relocation of industrial production to outlying areas and beyond. Deindustrialization creates waste landscape through the attrition of industrial landscapes and buildings in the older parts of the traditional central city⁹.

⁶ 'Brownfield Density' indicator proposed in Oliver, Lee; Ferber, Uwe; Grimski, Detlef; Millar, Kate; Nathanail, Paul; The Scale and Nature of European Brownfields, CABERNET conference paper, University of Nottingham 2005

⁷ Oliver, Lee; Ferber, Uwe; Grimski, Detlef; Millar, Kate; Nathanail, Paul; The Scale and Nature of European Brownfields, CABERNET conference paper, University of Nottingham, 2005

⁸ Cowie, J, Heathcott, J, Eds. Beyond the ruins: The Meanings of Deindustrialization, Cornell University Press, 2003

⁹ Berger, Alan, Drosscape. Wasting Land in Urban America, Princeton Architectural Press, New York, 2006



Figure 2.4 The physical expression of the city's changing forces: from a booming industrial activity, to a derelict and neglected site, to a vibrant neighbourhood

The brownfield phenomenon has been addressed by many as a common feature of the post-industrial city¹⁰, or of the post-industrial landscape¹¹. Alan Berger, on the contrary, understanding *post-industrial* as a term used both spatially and formalistically to describe everything from polluted industrial landscapes to former factory buildings, usually found in older parts of a city, argues there is no break from industrial to post-industrial, but only a shift in industrial based landscapes¹². In any case, the urban voids brownfields embody are one of the many features of the urban landscape created by economic forces. Michael Hough argues these vacant sites, together with uncontained plazas, parking lots, vehicular throughout fares, and highway interchanges, are the resulting landscape created by economic forces; a sterilized landscape by ineffective use, by a lack of co-ordination of various public and private that control it, and, on the city's edges, by restrictive zoning that inhibits human interaction and organic neighbourhood evolution¹³.

When looking at the larger picture, the brownfield phenomenon is not a finite characteristic of the city, but one of the many physical outcomes of the ever-changing urban form – understanding urban form as the consequence of a constant evolutionary process fuelled by economic, political, demographic and social change; of new buildings replacing old and old buildings being adapted for new uses, of shifting

¹⁰ Marshall, Richard, Ed. Waterfronts in Post-Industrial Cities, Spon Press, 2001

¹¹ Kirkwood, Niall, Ed. Manufactured Sites. Rethinking the Post-Industrial Landscape, Spon Press, 2001

¹² Berger, Alan, Drosscape. Wasting Land in Urban America, Princeton Architectural Press, New York, 2006

¹³ Hough, Michael, Cities and Natural Process, Routledge, London and New York, 1995

and changing neighbourhoods, of urban decay and renewal.¹⁴ As a result, brownfield interventions are just another step in the evolution of the city, a process that involves change in both space and time. In this sense, Niall Kirkwood presents his notion of *manufactured sites* as a working paradigm for rethinking the post-industrial landscape, arguing:

It should be noted that this represents another cycle in the reuse and redevelopment of these sites. Land that undergoes radical change today with innovative processes of clean-up and design reuse will themselves be remade in time as the requirements of new forms of program evolve for the workplace, and for living and recreational urban space.¹⁵

The economic shift towards deindustrialization in the industrialized world may be the most obvious cause at the moment for the production of derelict and underused sites, but other socio-economic forces – and/or environmental ones – may in the future drive the natural process of the evolution of the city with the potential generation of abandoned or waste landscapes. Understanding the brownfield challenge as it is today may therefore be helpful for similar situations and for, in the future, avoid the production of derelict sites as the city evolves. Thus, the brownfield challenge may not be an issue exclusive for the so-called *Post-Industrial City*, but inherent to the ever-changing urban form and landscape.

2.1.4 Underestimated environmental value: Biodiversity and hydrological functions

Other than the general degradation described previously, brownfield sites often present an underestimated environmental value. Much unused or abandoned land near waterfronts or in inner-city areas, naturally protected from intrusion by security fences, presents fortuitous colonization. This, combined with poor drainage, has, in many cases, created areas of special botanical, wildlife and heritage interest, representing the vitality of altered but nonetheless functioning natural and social processes at work in the city¹⁶.

At the same time, brownfields may perform, quite unexpectedly, a valuable hydrological function by retaining and storing water. Hough argues this is often the case for abandoned industrial or mining lands, vacant lots, waterfront sites and highway interchanges¹⁷.

¹⁴ Hough, Michael, *Cities and Natural Process*, Routledge, London and New York, 1995

¹⁵ Kirkwood, Niall, Ed. *Manufactured Sites. Rethinking the Post-Industrial Landscape*, Spon Press, 2001, Chapter 1

¹⁶ Hough, Michael, *Cities and natural Process*, Routledge, London and New York, 1995

¹⁷ Hough, Michael, *Cities and natural Process*, Routledge, London and New York, 1995

2.1.5 Related concepts

Contaminated sites include all sites that show levels of contamination or chemical, physical or biological alteration of soils, sub soils and of superficial or underground water in a way to determine danger for public health or for the natural or built environment¹⁸. Addressing brownfields simply as contaminated sites faces the obstacle that the concept involves a wide variety of sites whose characteristics may have to do nothing with other inherent characteristics of brownfields [i.e. state of abandonment or potential for new use]. For instance, waste landfills differ from brownfields because, although involving a contamination, they are in active use and do not need to be redeveloped or reused.

Derelict Land, according to the European Union, refers to "land so damaged by industrial or other developments that it is incapable of beneficial use without treatment". The European Union suggests *Unused Area* as one of the indicators of urban quality of life¹⁹, the concept consisting in the combination of *Derelict Land* [as defined previously] and *Contaminated Land* [defined as "any land that appears to be in such a condition - because of the substances that it contains- that water pollution or significant harm is being, or is likely to be caused"]. The EU indicator is measured as the percentage of the urban area unused and in main land uses. This understanding of Derelict Land may be considered almost a synonym for the notion here of brownfields, as it only misses the concern of location [within urban areas].

Industrial ruins are implicitly described in The International Committee for the Conservation of Industrial Heritage's definition of industrial heritage, as consisting of "the remains of industrial culture, which are of historical, technological, social, architectural or scientific value"²⁰. Due to the lack of a term for brownfields in Spanish, the issue has been addressed in the Basque Country [Spain] as *Industrial Ruins*, defining them as "the sites, built or not, that having participated in an industrial activity are degraded in such way that a new use is not possible but through a thorough work of recovery"²¹. This understanding is the same as the European Union's notion of *Derelict Land*, significantly similar to other brownfield definitions and to this thesis' notion [again, only missing the concern of location].

¹⁸ Italian definition. Italian National LawS 426/98 and 471/99; EEA (1999); Agenzia Nazionale per la Protezione dell'Ambiente (ANPA) (2001) from The Scale and Nature of European Brownfields, CABERNET, 2005

¹⁹ Unused [contaminated or derelict land] area. List of Urban Audit Indicators, IV Environment, 17.Land Use in THE URBAN AUDIT. Towards the Benchmarking of Quality of Life in 58 European Cities. VOLUME III: The Urban Audit Manual, Office for Official Publications of the European Communities, Luxembourg, 2000.

²⁰ The International Committee for the Conservation of the Industrial Heritage [TICCIH] '1 Definition of Industrial Heritage' in The Nizhny Tagil Charter for the Industrial Heritage, TICCIH, July 2003

²¹ Author's translation from Guia Técnica de Criterios Ambientales para la Recuperación de Ruinas Industriales, IHOBE S.A. for the Basque Government, 1998

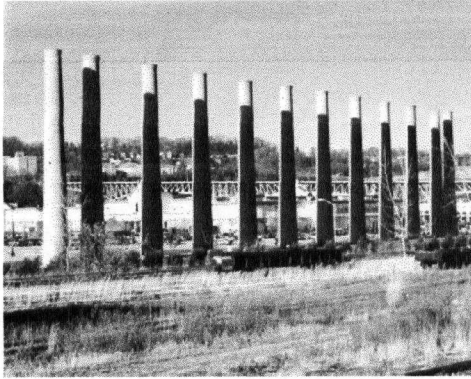


Figure 2.5 Brownfields related to Industrial Ruins and Manufactured Sites. Two examples: chimneys left from Homestead Steel Works, Pennsylvania, and the former steel and iron factory in Bilbao's riverfront in Barakaldo, Spain

Manufactured sites, coined by Niall Kirkwood in 2001, refers to three concepts: *sites of manufacture* - those located in older manufacturing cities and towns, generally with industrial character; *manufacture of sites* - environmentally challenged sites, which need a process and clean-up; and, *manufactured sites as an integrated redevelopment process* - the need for an interdisciplinary approach for reclaiming sites altered by industrial activity²². Kirkwood's approach to the brownfield phenomenon is related to this thesis's, although more focused in the issue of contamination, whereas the intent here is to provide a broader look at the different physical consequences of brownfield interventions in the city; contamination being one of several subjects considered.

Greyfields is a term introduced by the Congress for the New Urbanism to describe retail properties that require significant public and private sector intervention to stem decline; developed sites that are economically and physically ripe for major redevelopment²³. The concept is set in contrast with the CNU's understanding of brownfields, basically as contaminated urban development sites. For the present purpose, this thesis considers no difference between brownfields and greyfields, as the issue of contamination is seen as a 'may be' while the decisive conditions for the focus in the sites is primarily the state of abandonment, vacancy or under use, and the potential for reuse or redevelopment. More specifically within these conditions, the focus relies in those sites located in developed urban areas - a notion that includes greyfields.

²² Kirkwood, Niall, Editor, Manufactured Sites. Rethinking the Post-Industrial Landscape, Spon Press, 2001

²³ Greyfields into Goldfields. From falling shopping centers to great neighborhoods, a study by the Congress for the New Urbanism and Pricewaterhouse Coopers, February 2001, www.cnu.org



Figure 2.6 Greyfield or Brownfield? Abandoned parking lot in the former Greater Pittsburgh International Airport Terminal that 'may' not be contaminated but is a derelict site with potential for reuse, adjacent to an urban area.

Terrain Vague, a French expression from 1970s filmmaking, was introduced in the design world by the Spanish architect and critic Ignasi Sola-Morales as his working theory for designing with urban land that appears to be 'empty, abandoned space'. He saw great potential for understanding the terrains vagues from the metropolis as an architectural opportunity when few others did²⁴. Similarly, *terrain abandonné* is the French term for brownfield, and is defined as "space previously developed; temporarily or definitively abandoned following the cessation of activity; and need to be reclaimed for a future use. Can be partially occupied, derelict, or contaminated"²⁵. Both concepts are tightly related with this thesis's.

Vacant urban land is a parallel concept. In 1999, the Lincoln Institute published a research paper on America's vacant urban land, a concept of little interest in the US until the late 1990's. The document concluded that it is an ever-present issue in American cities, a problem and resource at the same time, and that it increases more rapidly in cities with population growth due to past development practices that consumed more land per capita²⁶. Pagano and Bowman argue vacant land and abandoned structures reflect different situations: In growing cities, vacant land represents a resource – a vast supply of potentially developable land that can be harnessed to pursue the city's vision. To depopulating cities, vacant land represents a red flag – an abundance of boarded-up buildings that signals a neighbourhood in decline and a city in distress²⁷. Although more focused in growing cities, the following chapter argues

²⁴ Sola-Morales Rubio, Ignasi, *Terrain Vague*, Anyplace, ed. Cythia C. Davidson, Cambridge: MIT Press, 1995 in Berger, Alan, *Drosscape. Wasting Land in Urban America*, Princeton Architectural Press, New York, 2006

²⁵ French definition for Brownfield. Ministère de l'Environnement, 2001, in *The Scale and Nature of European Brownfields*, CABERNET, 2005

²⁶ Bowman and Pagano, *Terra incognita*. J. Bonham, Spilka Blaine, Gerri, Darl Rastofer, *Old Cities/Green Cities: Communities Transform Unmanaged Land*, planning Advisory Service Report no.506/507, Chicago, American Planning Association, 2002, in Berger, Alan, *Drosscape. Wasting Land in Urban America*, Princeton Architectural Press, 2006

²⁷ Bowman and Pagano, Vacant Land As Opportunity and Challenge, chapter in *Recycling the City: the Use and Reuse of Urban Land*, Greenstein R and Sungu-Eryilmaz Y Ed., Lincoln Institute of Land Policy, Cambridge, 2004

that, beyond the idea of the red flag suggested by Bowman and Pagano, brownfield interventions present an opportunity in depopulating cities to alleviate the consequences of urban decline and distress.

Drosscapes, coined by Alan Berger in 2006, refers to dross, or waste that is 'scaped' or resurfaced, and reprogrammed for adaptive reuse²⁸. Although wider in focus than this thesis, the concept includes brownfield sites, which are seen as *wasted places*. For Berger, drosscapes or *waste landscapes* involve actual *waste* [municipal solid waste, sewage, scrap metal, etc], *wasted places* [abandoned or contaminated sites], or *wasteful places* [huge parking lots or retail malls]. Figure 2.7 illustrates this notion of waste landscapes within urbanized regions.

Holey Plane is a term introduced by Lars Lerup in 1995. Strongly related to this thesis's approach to the brownfield phenomenon within the city, he refers to the city's vast stretch of urbanized landscape surface as a '*holey plane*' – the holes being voids in the urban plane:

Leapfrogged, these voids are elastic blobs that allow developers to hang into the profit margins. The size and shape of the blob may in fact be a complex reflection of the dynamics of land costs, market forces, building practices, and peculiarities of local conditions... Either way, these voids – a form of unintentional land banking – are restored to a new potential.²⁹

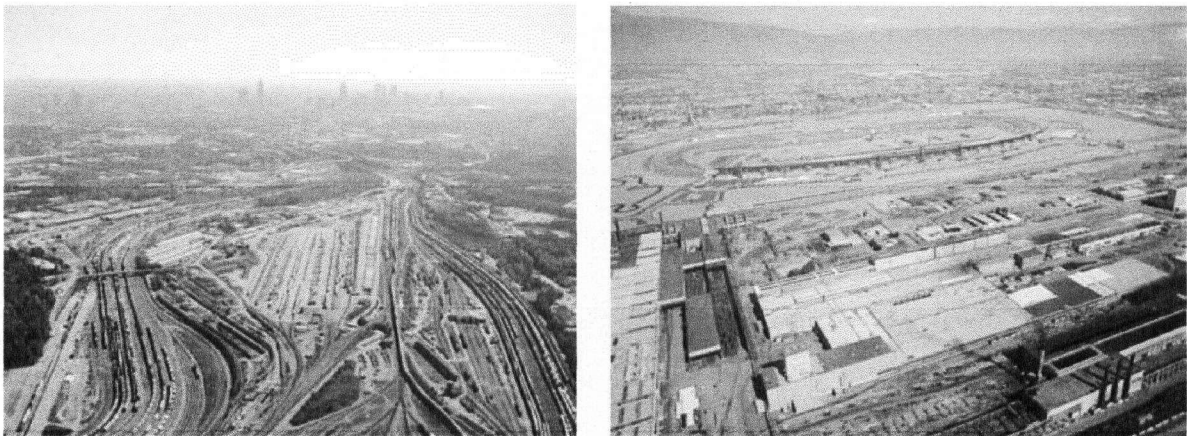


Figure 2.7 Drosscapes or waste landscapes within urbanized regions: Inman Yard, Norfolk Southern Railroad, Atlanta, Georgia; and California Speedway [former steel mill site], Fontana, California, about 45 miles west of Los Angeles – San Bernardino County.

²⁸ Berger, Alan, Drosscape. Wasting Land in Urban America, Princeton Architectural Press, New York, 2006

²⁹ Lars Lerup, After the City, Cambridge, MIT Press, 1995 in Berger, Alan, Drosscape. Wasting Land in Urban America, Princeton Architectural Press, New York, 2006

Zwischenstadt [In-between] has become a common term in the public discussion of urban form and structure in German-speaking countries. Thomas Sieverts, in his book *Cities Without Cities: an interpretation of the Zwischenstadt* explains how the term signifies that today's city is in an 'in-between' state, a state between place and world, space and time, city and country³⁰. The *in-between* is also referred to by Berger, for whom the term describes a state of liminality, something that lives in transition and eludes classification, something that resists new stability and reincorporation. As with the concept of *drosscapes*, the presence and production of brownfields is only a part in the larger discussion about what Sieverts understands as this strange urban-rural landscape as a new form of city.

Landscape Urbanism also relates to this broader discussion about contemporary horizontal urbanization. Edited by Charles Waldheim, *The Landscape Urbanism Reader* presents the concept as a disciplinary realignment currently underway in which landscape replaces architecture as the basic building block of contemporary urbanism. It argues landscape has become both the lens through which the contemporary city is represented and the medium through which it is constructed. Related to this thesis' concern about the presence and potential reuse of abandoned and underused sites within the city, Waldheim makes the following case:

Landscape urbanist tendencies emerge within the discourse of architects in response to the economic, social, and cultural shifts surrounding de-industrialization. Practices of landscape urbanism emerge as a useful framework in these contexts, most appropriately adopted for sites experiencing the abandonment, toxicity, and social pathologies left in the wake of industry as it decamped for more favourable locations.³¹

This overview of concepts related to brownfields uncovers the range in approach to their presence, creation, and potential reuse. It illustrates how it ranges from the concern of the sites themselves to broader discussions about the city and the urbanized landscape; how the challenge the sites represent transcends the site scale.

³⁰ Sieverts, Thomas, *Cities Without Cities: an interpretation of the Zwischenstadt*, Spon Press, 2003

³¹ Waldheim, Charles, Ed. *The Landscape Urbanism Reader*, Princeton Architectural Press, New York, 2006



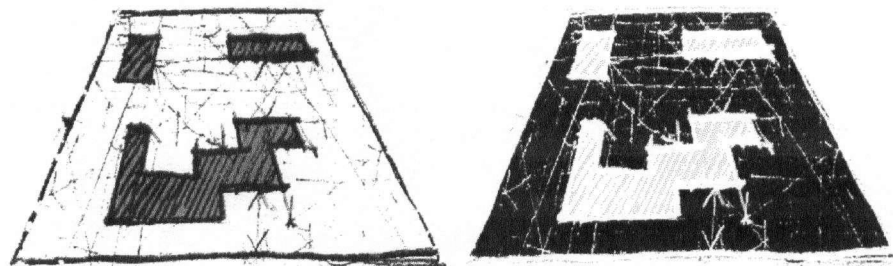
Figure 2.8 Brownfields: A broad range of sites. A few examples: an abandoned gas station, derelict industrial remains, a deserted parking lot and a vast extension of underused railway tracks

2.1.6 Brownfields: A broad range of sites facing common challenges

The literature reviewed reveals the relatively recent concern - since the 1990s - about the 20th century's industrialization legacy of abandoned and underused sites within the cities in the former industrial regions. Commonly known as *brownfields*, these sites embody a vast range in size and nature: abandoned gas stations, derelict railroad properties, underused waterfronts, closed factories, refineries, mines, and military bases are just a few examples. The sites are found both in central urban areas but are also in peripheries, and frequently include built remains from their former use: from single elements [i.e. chimneys, cranes, tanks] to buildings [i.e. workshops, warehouses, mills, factories], to infrastructures [i.e. streets, roads, railroad].

The concern about their presence relates to the sites, its immediate context or surrounding neighbourhoods, and, ultimately to the city. The common challenge of this broad range of sites is the overall degradation of derelict and underused already urbanized land. Although for the most part it is some kind of economic factor that leads to abandonment, the sites are usually also degraded environmentally - with real or perceived contamination- and socially, particularly when there is a community within the site. This poor state of quality of life affects not only the sites themselves, but also the surrounding areas and the city at a larger scale. At the site scale, brownfields remain neglected, detached and disconnected from the city's socio-economic networks. At a larger scale, they behave as physical holes or urban voids; as barriers to the city's spatial understanding and legibility, and to its physical integration and mobility [Figure 2.9].

Figure 2.9
Brownfields: at the site scale, neglected and disconnected. For the city, physical holes or urban voids



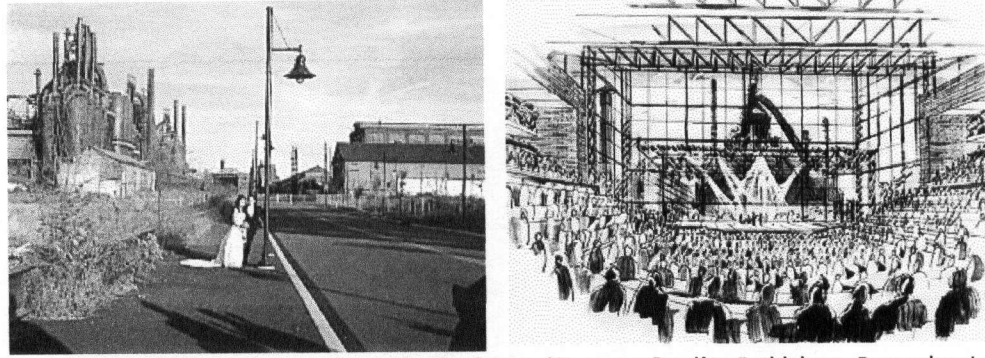


Figure 2.10 One of many visions for the future: 'Save our Steel' in Bethlehem, Pennsylvania

2.2 The Vision: Opportunities for Sustainability and Quality of Life

Canada's Vision: "The transformation of Canada's brownfields into economically productive, environmentally healthy, and socially vibrant centres of community life, through the coordinated efforts of all levels of government, the private sector and community organizations."

National Round Table on the Environment and the Economy, Canada, 2003 ³²

Many questions about what to do with the sites

Once the concept is defined and the sites identified, the new visions for the sites can begin. As Alan Berger suggests, once waste landscapes are identified, the designer proposes a strategy to productively integrate them³³. Before that, however, many questions come up about what to do with the sites: What is the most appropriate new use for a certain site? Which design works best to bring the site back into urban activity? E.O. Moss argues that what is really intriguing about the areas with abandoned infrastructures by the disappearance of manufacturer uses are the questions posed: what to do with the railroad; how to use and reuse, sustain, reinvent the existing buildings, since they continue alive as integral parts of the psychological environment as well as in their appearance of buildings able to continue being productive, reutilized in our culture³⁴. Looking at the larger scale, R. Marshall considers the questions in terms of reconnecting the sites to the city's activity:

³² National Round Table on the Environment and the Economy, Cleaning up the past, building the future: a national Brownfield redevelopment strategy for Canada, National Brownfield Redevelopment Strategy Task Force, Ottawa, 2003

³³ Berger, Alan, Drosscapes in Waldheim, Charles, Ed. The Landscape Urbanism Reader, pp. 210, Princeton Architectural Press, New York, 2006

³⁴ Eric Owen Moss, Chapter "Proyectos urbanos para áreas industriales" [Urban Projects for Industrial Areas], Foro para un Zorrozaurre Sostenible, [Forum for a Sustainable Zorrozaurre: book], pg122, Ed. La H@ceria, Bilbao, 2004

The former industrial areas of many cities now exist as underutilized parcels, separated from the physical, social and economic activity of the rest of the city. In their reconsideration, these sites pose significant issues. How should that redevelopment occur? What is an appropriate form of development? What is an appropriate urban form? How are connections made between the older city and the water through these redevelopment efforts?³⁵

2.2.1 The sustainability vision and its achievement through urban form

The definition for sustainable development established by the Brundtland Commission in 1987 emphasizes meeting human needs in a manner that respects intergenerational responsibility. In a parallel way, the definition from the World Conservation Union [International Union for the Conservation of Nature and Natural Resources, IUCN] emphasizes improving the quality of human life while protecting the Earth's capacity for regeneration. The two definitions together provide a good understanding of the meaning of sustainable development as benefiting both people and ecosystems³⁶. From this, a sustainable urban design can be understood as that which meets current human needs providing quality of life without compromising nature and natural resources; thus without compromising the quality of life of future generations.

In this context, brownfield interventions represent an opportunity to enhance urban sustainability and quality of life through the reuse of derelict urban sites, usually degraded environmentally, economically, and socially. For instance, Edwards suggests the remodelling of former industrial areas not only reduces the pressure on the green corridors, it also offers the possibility to bring residential areas nearer to working, leisure and educational areas, contributing to a regeneration of civic pride and involving an impulse for the restoration of the City, an increasingly important aspect in Post-industrial Reconstruction³⁷.

The following review of the literature on brownfields explores the potential within brownfield interventions both for the improvement of the sites as for contributing to the city's sustainability and quality of life at district and city scales: first through and overview of a few governmental visions and then focusing on the different social, economic and environmental opportunities.

³⁵ Marshall, Richard, Editor, Waterfronts in Post-Industrial Cities, Spon Press, London, USA, Canada, 2001

³⁶ UNESCO, UN Decade for Education for Sustainable Development [2005-2014], portal.unesco.org

³⁷ Edwards, Brian, Guia basica de la sostenibilidad [Barcelona, Ed. Gustavo Gili, 2004], original title: Rough Guide to Sustainability, 2001

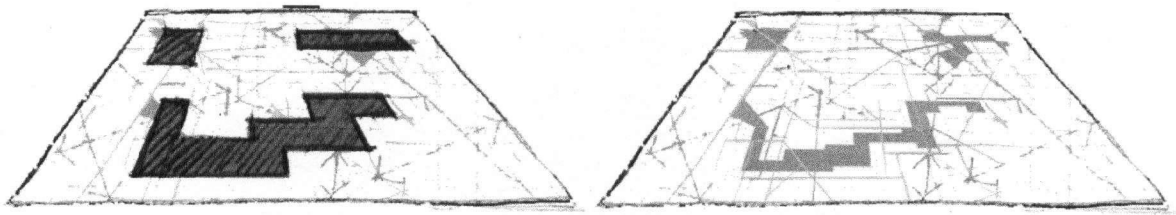


Figure 2.11 Before and after: Reconnecting the sites into the city's social, economic and environmental activity

The review is centred on how this potential is embedded in physical urban form; how interventions on urban brownfields hold an important potential to heal the city by providing a physical background for a more sustainable way of living, by reconnecting neglected and disconnected areas into the city's social, economic and environmental activity - bringing them back into urban life [Figure 2.11].

The following description of Concord Pacific Place in downtown Vancouver illustrates the notion of how, through physical urban form, brownfield interventions can contribute to more sustainable lifestyles and to urban quality of life:

The most remarkable aspect of Concord Pacific Place is what it has done to reinvigorate downtown Vancouver as a compact, vibrant, mixed-use community. When completed, it will have added some fifteen thousand new residents to downtown, and this, combined with many more thousands moving into the other areas undergoing redevelopment on the downtown peninsula, is responsible for Vancouver's becoming a North American model for inner city revitalization. The City's "Living First" strategy for downtown densification is working. There is the sustainable development advantage as well that comes from bringing people and their work places closer together: more and more Vancouverites are walking, cycling or using public transit on the downtown peninsula. And public safety has also improved with many more "eyes on the street".³⁸

A few governmental visions towards sustainable brownfield interventions

Although frequently referred to as brownfield *redevelopment*, a series of countries support – at least in words – a sustainable approach to brownfield interventions, arguing in favour of various environmental, economic, and social opportunities associated with their intervention.

Canada identifies their potential for rejuvenation and for bringing both health and economic benefits to local communities, and envisions the transformation of its brownfields into economically productive,

³⁸ Berelowitz, Lance, Dream City: Vancouver and the Global Imagination, Douglas & McIntyre, 2005

environmentally healthy and socially vibrant centres of community life, through the coordinated efforts of all levels of government, the private sector and community organizations³⁹.

The United States Environmental protection Agency [USEPA] argues the nature, context, and perspective of the challenges confronting brownfields practitioners demand a new approach based on an ecologically, economically, and socially sustainable brownfield redevelopment. An important point in their argument is that brownfields redevelopers can avoid re-creating Brownfields and continuing their legacy. The EPA suggests this can be achieved by integrating the concepts of sustainable development, community involvement, risk management, and collaborative project teams with brownfields redevelopment⁴⁰.

Working in both Canada and in the US, the National Brownfield Association states in its guiding principles that the responsible redevelopment and productive reuse of brownfields properties are in the best interests of society for a number of environmental, economic, and social reasons⁴¹.

The United Kingdom takes the vision to action through a policy that seeks to encourage a regeneration of brownfield sites / previously developed land in order to promote: 1- the economic and social regeneration of the surrounding areas; 2- the environmental improvement of the sites themselves; and, 3- the reduction in 'development pressure' on greenfield sites. These aims are reflected in the headline land-use policy objective for the national Government in the UK, which is *to promote a sustainable pattern of physical development and land and property use in cities, towns and the countryside*. This objective is backed up by specific Public Service Agreement [PSA] targets for: 60% of new housing to be provided on previously developed land or through conversion of existing buildings; and, brownfield land to be reclaimed at a rate of over 1,100 hectares per annum by 2004, reclaiming 5% of current brownfield land by 2004 and 17% by 2010. This land use objective is also specifically linked to a further objective *to enhance sustainable economic development and social cohesion through integrated regional and local action, including the promotion of an urban renaissance*. The UK Government target by which 60% of all new houses be built on brownfield sites by 2008, was designed to relieve the pressure on greenfield sites and preserve the countryside. Data released by the DTLR in May 2002 indicate the target is currently being exceeded with 61% of new housing being built on brownfield sites⁴².

³⁹ National Round Table on the Environment and the Economy, Cleaning up the past, building the future: a national Brownfield redevelopment strategy for Canada, National Brownfield Redevelopment Strategy Task Force, Ottawa, 2003

⁴⁰ United States Environmental Protection Agency, A Sustainable Brownfields Model Framework, EPA, 1999, www.epa.gov/brownfields

⁴¹ The National Brownfield Association, www.brownfieldassociation.org

⁴² EUGRIS, Portal for Soil and water management in Europe, United Kingdom Brownfields, further description, www.eugris.info

2.2.2 Social opportunities

Social integration, needs and concerns

An early example of a brownfield site transformed to generate social interaction and meet community needs of public open space is Seattle's Gas Works Park. Opened in 1975, this 8-hectare site, once a gasification plant, later closed and abandoned, became a successful urban park. At a larger scale, another early example is Parc de la Villette in Paris. Over a 50-hectare site, once the site of Paris's largest slaughterhouse, the 1982 competition proposed an "Urban Park for the 21st Century". According to Charles Waldheim, the demolition of the Parisian *abattoir* and its replacement with intensively programmed public activities is precisely the kind of project increasingly undertaken in post-industrial cities across the globe, and among the first projects to orchestrate urban program as a landscape⁴³.

Other than the common concerns about health, safety, and environmental issues, the community in and around the sites may have economic driven concerns to the extent an intervention impacts local property values, offers prospects for local employment, and provides opportunities for existing and new local businesses⁴⁴. Regarding the effect on property values, it is important not to generate a gentrification process, where low-income residents are forced to move due to the increase in property values and rental payments resulting from the physical renovation of physically deteriorated neighbourhoods.

Industrial ruins and social reconciliation

Reclaiming brownfields - specifically those resulting from a currently decayed but once booming activity - offers the opportunity to deal with an often neglected past, to open a door towards reconciliation and the regeneration of civic pride. However, it is a complex social issue as the feelings towards brownfields and industrial ruins are quite diverse and varied: to some, they symbolize renewal and reconstruction⁴⁵; to others they are about remembering people and their struggle⁴⁶. The affected community's view is of great relevance in the steering of this complex reconciliation between past and future. Figure 2.10, from "Save Our Steel", a grassroots effort currently taking place in Bethlehem, Pennsylvania, illustrates the importance the community gives to their industrial heritage, and the way they would like to preserve it as part of their everyday activities. On the other side, for the public in general, less closely related to the sites, the preservation of industrial heritage might not be a popular issue. This is closely related to how

⁴³ Waldheim, Charles, Ed. The Landscape Urbanism Reader, pp.40, Princeton Architectural Press, New York, 2006

⁴⁴ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁴⁵ Bordage, Fazette, The Factories: Conversions for Urban Culture / TransEuropeHalles, Birkhauser, Publishers for Architecture, Basel, Boston, Berlin, 2002

⁴⁶ Shackel, Paul A., Remembering the American Industrial Landscape. Paper presented in the Plenary Session of the Annual Meetings of the Society for Historical Archaeology Providence, Rhode Island, 2003.

cultures often *choose* what their past should look like, by the way history is written, or by which elements of the past are preserved and which ones are forgotten. Kevin Lynch illustrates this notion clearly:

Our perceptions guide what we choose to preserve. Old bridges are bold and elegant, they leap up against the force of gravity. Whatever their hidden human costs may have been, they were useful to, and used by, everyone. Old factories, on the other hand, sit heavily on the ground. They were places of noise, stress and hard labour. They visibly remind us of what it cost this country to achieve its wealth and who paid. Little wonder that few protest the loss of an old factory building.⁴⁷

Looking at brownfields as the ruins of industrialization, they follow a pattern common to ruins in general. As described by both Lynch and Jackson, in different ways, the pattern involves an initial successful time – *environments rich in historic remains* [Lynch] or *a preliminary golden age* [Jackson] – that inevitably leads to a decline, and thus to neglect, and abandonment. This is directly applicable to the brownfield phenomenon: the prosperous past – generally industrialization – followed by decline and dereliction – deindustrialization. But, as Jackson qualifies as the '*necessity for ruins*', it is only after this phase of neglect that the time of renewal can emerge.

But there has to be an interval of neglect, there has to be discontinuity; it is religiously and artistically essential. That is what I mean as the necessity for ruins: ruins provide the incentive for restoration, and for a return to origins. There has to be [in our new way of history] an interim of death or rejection before there can be renewal and reform. The old order has to die before there can be a born-again landscape. That is how we reproduce the cosmic scheme and correct history.⁴⁸

Thus, the reclamation of brownfields offers the possibility for a better understanding of the past, the present and the future; of the role of technology as well as the role of labour; for a better understanding of the so-called industrialized culture on the whole. The design of public open space is a critical element for this, and should capitalize on the strong historic, social, and technological values often found in industrial – nature brownfields to generate a powerful sense of place. As James Corner suggests, public space in the city must be more than mere token compensation or vessels for this generic activity called "recreation", as public spaces are firstly the containers of collective memory and desire, and secondly they are the places for geographical and social imagination to extend new relationships and sets of possibility⁴⁹. The design of these public spaces can provide a new dialogue between man and technology as well as between nature and technology [Figure 2.12].

⁴⁷ Lynch, Kevin, *What time is this Place?* Ch.2 The Presence of the Past, Cambridge, Massachusetts, MIT Press, 1972

⁴⁸ Jackson, John B. *The necessity for ruins and other topics*, Amherst, University of Massachusetts Press, 1980

⁴⁹ Corner, James, *Terra Fluxus*, pp.32, in Waldheim, Charles, Ed. *The Landscape Urbanism Reader*, Princeton Architectural Press, New York, 2006

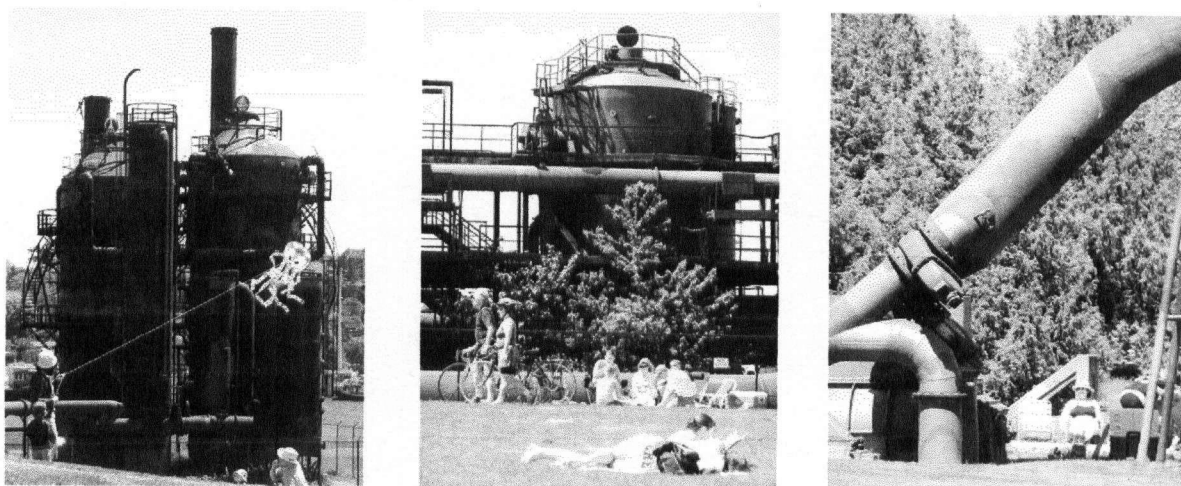


Figure 2.12 Gas Works Park: new dialogues between man and technology and between nature and technology

The design solution must find its way without falling into rejection and neglect [tabula rasa], nostalgia, or a museum-like approach - the disneyfication of the industrial past. Peter Latz elaborates on this:

The tasks of dealing with run-down industrial areas and open cast mines require a new method – one that accepts their physical qualities but also their destroyed nature and topography. This new vision should not be one of “re-cultivation”, for this approach negates the qualities that they currently possess and destroys them for a second time. The vision for a new landscape should seek its justification exactly within the existing forms of demolition and exhaustion. We have to ask ourselves which spaces from among the dilapidated and redundant places we want to use and occupy, and which of those have to be changed by the mark of a cultural intervention or the remediation of historical contamination.⁵⁰

Community support and engagement

Due to the usual high community concern around brownfield Interventions, these offer an enormous opportunity to involve and engage the community in the decision making process. A strong communication of the process and the use of public participation tools, such as workshops and charrettes, are therefore a significant key in brownfield interventions. Charrettes are time-limited design events in which a diverse group of people strive to produce a mutually agreeable answer to a complex community design problem⁵¹. Facilitated by skilled designers but stakeholder driven, charrettes represent a valuable tool to reach community consensus and acquire public support in challenging planning

⁵⁰ Latz, Peter, Chapter 11 Landscape Park Duisburg-Nord: the metamorphosis of an industrial site, in Kirkwood, Niall, Ed. Manufactured Sites. Rethinking the Post-Industrial Landscape, Spon Press, 2001

⁵¹ Condon, P., Proft, J., Teed, J., Muir, S., Sustainable Urban Landscapes: Site Design Manual for B.C. Communities, James Taylor Chair in Landscape and Liveable Environments, University of British Columbia, Canada, 2002

processes such as brownfield interventions. For instance, the design charrette in South East False Creek [SEFC], Vancouver [Figure 2.13] was a visioning charrette initiated to clarify the vision for a sustainable neighbourhood within the context of existing policy for the area.

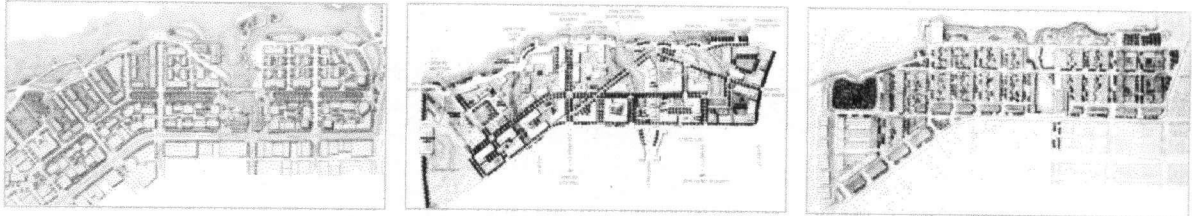


Figure 2.13 Public participation in a brownfield intervention: Charrette results for Southeast False Creek, Vancouver

Summary of social opportunities

The literature has revealed how brownfield interventions provide a specific opportunity to enhance social integration and cohesion between the existing community [on and around the site] and new residents coming from other parts of the city. There are also a variety of opportunities to contribute to the social regeneration of these derelict areas by alleviating issues that may concern the community, such as particular needs of open space, housing, and amenities and services; unemployment and the opportunity to create new jobs; health risks due to the environmental state of the site; or the future identity of the site linked to the culture or historical heritage of its former land use. The importance of public involvement and engagement in the process is crucial for the satisfaction of the different community needs, and, although this should be intrinsic to any urban development process, it is of special importance in this type of sites.

Table 2.1 compiles the different social opportunities and includes the scale each of these involves: site, district, or city. This illustrates how most of the identified social opportunities are primarily related to the site and surrounding district scales [black dot], and, to less extent, to the city at a larger scale [grey dot].

Social Opportunities		site	district	city
s1	To enhance social diversity, integration and interaction, achieving a higher sense of community and social equity	•	•	[•]
s2	To satisfy the needs for open space, housing, amenities and services	•	•	[•]
s3	To alleviate unemployment by creating and retaining jobs	•	•	[•]
s4	To ease the concern about real or perceived contamination and reduce potential risks for human health	•	[•]	[•]
s5	To contribute to a collective reconciliation with a decayed and neglected past	•	•	[•]
s6	To promote community involvement and engagement in the decision-making process	•	•	[•]

Table 2.1 Social opportunities in brownfield interventions

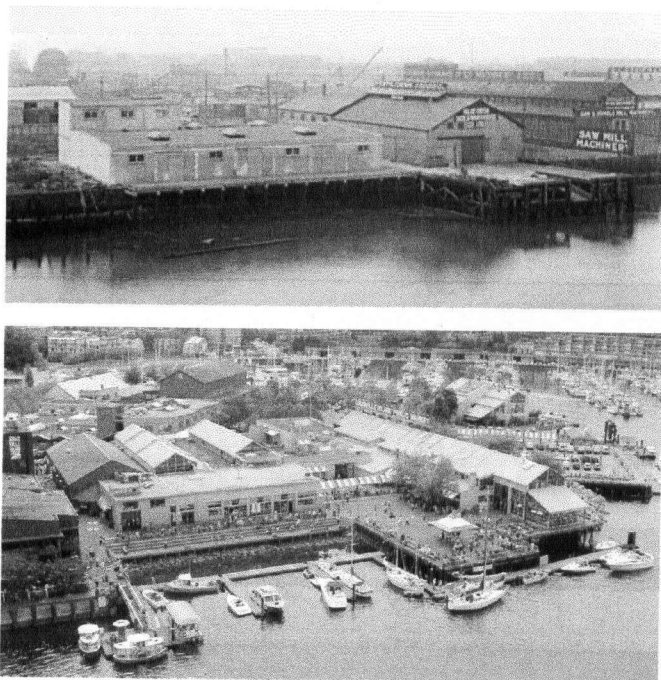


Figure 2.14 Economic opportunities in Granville Island, Vancouver: images of 1922 and 2005 show two very different but at the same time economically viable uses within the same site and structures

2.2.3 Economic opportunities

Often addressed with an economic connotation – brownfield *redevelopment* - the overarching economic opportunity in brownfield interventions is to transform the sites to economically productive sites contributing to economic revitalisation and regeneration. The following conclusions from an international symposium held in Toronto in 1998 optimistically illustrate this:

Long dormant sites are being revitalized as owners, investors and regulators find new ways to regenerate old industrial areas. The result is a new “can-do” attitude that is improving the investment climate and establishing the partnerships needed to ensure the environmental and economic health of cities around the world.⁵²

The Canadian National Brownfield Redevelopment Strategy⁵³ identifies four major economic benefits in brownfield redevelopment: the creation and retention of employment opportunities; an increased competitiveness for cities; an increased potential export for Canada cleanup technologies; and, an

⁵² Waterfront Regeneration Trust, Redeveloping Brownfields: A Different Conversation, Proceedings of an International Symposium [April 7-8, 1998], Canada 1998

⁵³ National Round Table on the Environment and the Economy, Cleaning up the past, building the future: a national Brownfield redevelopment strategy for Canada, National Brownfield Redevelopment Strategy Task Force, Ottawa, 2003

increased tax level for all three levels of government. The redevelopment of the sites into economically productive uses [i.e. industrial, commercial, and office] not only increases economic competitiveness at a city scale, but also at a smaller neighbourhood scale.

Brownfield interventions also contribute to develop an efficient risk-management system. According to Canada's Waterfront Regeneration Trust, a growing number of communities in Europe, Canada and the United States have been successful in employing innovative ways to redevelop brownfield sites using risk based approaches. However, public perceptions about the risks posed by site conditions, implications concerning "who pays" and long term care, as well as difficulties in securing brownfield financing have presented deterrents to effective revitalization of many derelict sites, particularly within North America⁵⁴.

Brownfields with existing structures or infrastructures in sufficient good state to be reused also offer the possibility to reduce development costs related to demolition, transportation to wasteland, and construction. In this sense, Granville Island is an example of *innovative adaptive reuse of existing buildings and spaces*⁵⁵, where former warehouses have been reused for retail uses.

Summary of economic opportunities

In all, although the production of brownfields is the consequence of a decayed economic activity, there are many economic opportunities in their intervention. Table 2.2 summarizes these, together with the scale they more directly relate to [site, district, and city].

Economic Opportunities		site	district	city
ec1	To increase economic productivity and complement existing economic activities	•	•	•
ec2	To create and retain jobs	•	•	[•]
ec3	To provide economic benefits through tax revenues and real estate	[•]	[•]	•
ec4	To increase accessibility to economic activity to the public as customers, consumers, and employees	•	•	[•]
ec5	To reduce development costs by the potential reuse of existing structures and infrastructures	•		
ec6	To reduce development costs through the use of permeable surfaces and soil remediation practices	•	[•]	[•]

Table 2.2 Economic opportunities in brownfield interventions

⁵⁴ Waterfront Regeneration Trust, The Nature of Possibility: Experiences in Risk-Based Decision Making, International Brownfields Exchange [2000-2002], Canada 2002

⁵⁵ Design Centre for Sustainability, Greater Vancouver Green Guide, Design Centre for Sustainability, School of Architecture and Landscape Architecture, University of British Columbia, Canada, 2006

2.2.4 Environmental opportunities

Contamination I Remediation

The remediation of contaminated brownfield sites can affect just the site and its immediate surroundings or the city as a whole. There are six major groups of contaminants: metals; volatile organic compounds [VOCs]; semi volatile organic compounds [SVOCs]; polychlorinated biphenyls [PCBs]; polycyclic aromatic hydrocarbons [PAHs], and pesticides⁵⁶. There are basically three ways of dealing with contamination on a site: one, to leave the material where it is; two, excavation and disposal; and three, treatment on site, where the soil being restored is left in place⁵⁷.

Leaving the soils in place and capping the site to restrict exposure reduces the initial expenses, but the liability for the on-site condition may remain, with risks of cap failure and the future use of the site limited. The maintenance of the cap will be required forever. The option of excavation and disposal may be *economically* adequate for the site, but only shifts the problem somewhere else, with the risk of the disposal site becoming a hazardous waste facility⁵⁸. On-site treatments, where the soil being restored is left in place by biological systems, are relevant where contaminants can be broken down organically through microorganisms⁵⁹. An emerging area of practice is phytoremediation, the use of living planted material to clean environmental hazards⁶⁰. Approaches to remediation vary in response to site, types of industrial pollution and environmental, legal, jurisdictional and political agendas, and reveal a need to develop an integrated ecosystem-based, rather than a piecemeal, approach⁶¹.

Duisburg Nord Park, in Germany, is a well-known example of dealing with contamination on the site, rather than taking the problem somewhere else. Contamination for the former Thyssen factory has been entirely dealt within the 230-hectare site through a landscape design that includes biological systems as well as using existing structures to bury and seal those materials unable to be restored through natural processes. A 3.5-metre diameter underground main, sealed by a layer of clay, collects run off from the buildings, bunkers and former cooling ponds. A wind power installation set up in the mill tower of the former sintering plant ensures the cleaning and the transport of the water. Above the ground, the open

⁵⁶ ATSDR/EPA, 1997 in Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁵⁷ Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995

⁵⁸ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁵⁹ Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995

⁶⁰ Rock, Steven, Phytoremediation: integrating art and engineering through planting in Kirkwood, Niall, Ed. Manufactured Sites. Rethinking the Post-Industrial Landscape, Spon Press, 2001

⁶¹ Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995

wastewater canal that crosses the park from east to west was transformed into a clear water canal with bridges and footpaths, exclusively fed by the clear rainwater. Peter Latz, Duisburg Nord Park's landscape architect, describes the process:

The water channel and the whole water system are an artefact, which aims to restore natural processes in an environment of devastation and distortion. These processes are governed by the rules of ecology, but initiated and maintained by means of technology. Man uses this artefact as a symbol for nature, but remains in charge of the process. The system is at one and the same time entirely natural and entirely artificial.⁶²

Regarding those materials so highly contaminated, which could only remain on the site as long they were not accessible, the option was to have slender grasses over the course of several generations with a corresponding reduction of contamination and limited utilization, such as walking or cycling. This alternative was chosen in contrast to the other way of dealing with contamination hot spots on the site: layers of clay and the total loss of vegetation, an "eternal grave" of contaminated material. By using "vegetation fields" covering isolated areas with different forms and colours, many vegetation typologies have been returned to the Rhine area, with lots of species [approximately 200]⁶³. The design includes birches growing on a former coal wash spoil, contamination kept in sealed bags and covered by roof gardens, and contamination enclosed in "secret gardens"; walls that formerly were filled with ore, coal, lime and ashes. Old pollutants in sealed containers, excavated materials, water, or gardens form a great variety and abundance of places of retreat and contemplation, so important in a large public park⁶⁴.

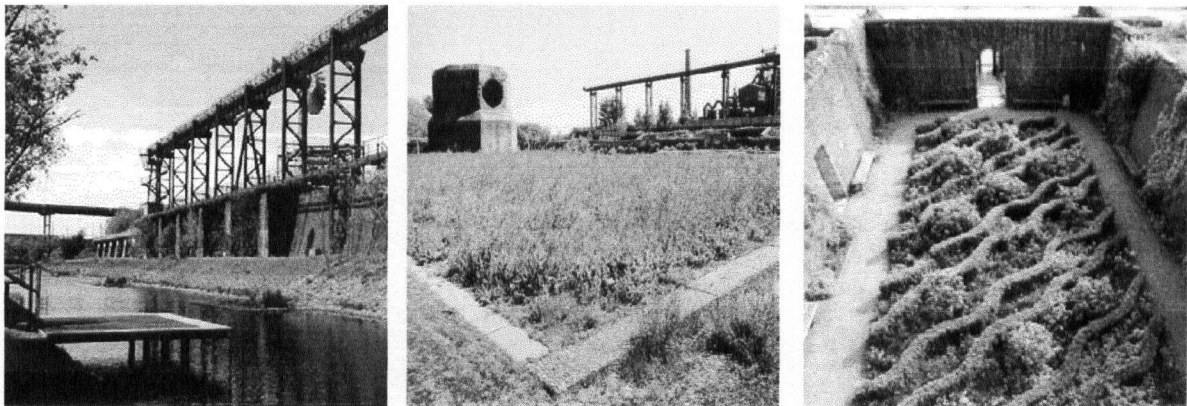


Figure 2.15 On-site remediation in Duisburg Nord park, Germany: water channel, roof gardens and secret gardens

⁶² Latz and Partner, Landscape Park Duisburg-Nord, www.latzundpartner.de/L3/eng/e-4-du.htm

⁶³ Latz, Peter, Chapter 11 *Landscape Park Duisburg-Nord: the metamorphosis of an industrial site*, in Kirkwood, Niall, Ed. *Manufactured Sites. Rethinking the Post-Industrial Landscape*, Spon Press, 2001

⁶⁴ Latz and Partner, Landscape Park Duisburg-Nord, www.latzundpartner.de/L3/eng/e-4-du.htm

Remediation and restoring the hydrological balance

Brownfield interventions offer the opportunity to restore or alleviate the hydrological balance by, for instance, reducing the amount of impervious surface on the sites. But, as explained previously, projects must consider the site's existing hydrological role. If there are no existing stormwater management facilities on the site, they should seek the best design to least alter its environment [i.e. risk of floods]. At the same time, conditions on brownfields may suggest that stormwater infiltration should be avoided or detained for treatment before release⁶⁵. Design solutions must consider these circumstances.

One of the most challenging limitations when designing the stormwater management on a brownfield site is the presence of an impervious cap on the site. Impervious caps are constructed to seal the surface of a site, to prevent infiltration of water through the cap and the contaminated soils, and to contain or isolate the contamination from accessibility and contact with humans or the environment⁶⁶. The correct role of the cap is vital for the environmental health inside and outside the site. Although the most common types of caps are clay based systems, bituminous and geotextile caps are also used. The rooftop and secret gardens in Dusiburg Nord Park illustrate different creative possibilities when capping is required [Figure 2.15]. Although less common, pervious caps are sometimes used when the type and degree of contamination allow infiltration but not exposure; they are a means of containing or isolating contaminants without restricting infiltration.

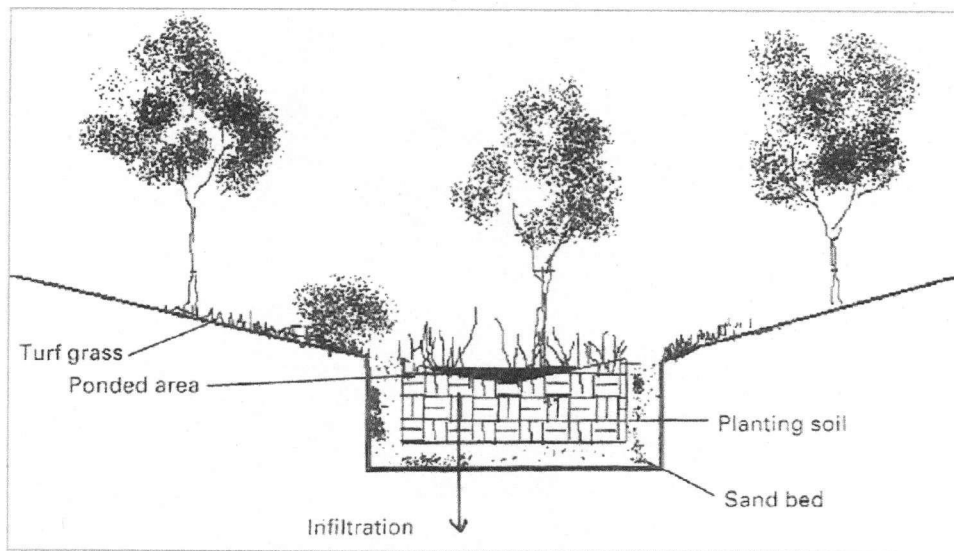


Figure 2.16 Bioswale with sand filter for a contaminated site⁶⁷

⁶⁵ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁶⁶ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁶⁷ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

Where the type and degree of contamination as well as the soil's drainage characteristics allow, there are a variety of infiltration solutions: from sand filters, vegetative filter strips, infiltration trenches, and swale infiltrators; to bioswales, bioretention swales, and detention and retention ponds; to more complex solutions of bioremediation in ponds and wetlands. Depending on the contamination or desired treatment, there are different filter media that can be used: although stone is the most common medium for storm water infiltration, other materials such as sand may be used instead of or in conjunction⁶⁸. Maintenance on some systems will increase, as the medium used is able to trap more particles. Differing from non-contaminated sites, the filter medium may require special handling when it is removed.

A system with high contamination removal efficiency is the bioswale [Figure 2.16]. It increases the treatment capability of retention adding the biological elements of the vegetative filter strip to the infiltration trench, using a medium of sand or other material with topsoil cover to further filter the runoff and as a medium for microbial growth and rooting medium for swale plantings. Similarly, bioretention swales convey stormwater, but their longitudinal grade [1-2%] allow water to be retained much longer permitting settlement and bioretreatment⁶⁹.

Likewise but at a larger scale, bioremediation in ponds and wetlands offers many advantages: by combining the two functions, site disruption and delays are minimized; the cost of removing material off site is eliminated; and, the cost of bioremediation is less than active or mechanized treatment processes. Bioremediation acts to eventually eliminate the contamination to reduce it to a level where liability is eliminated, and once remediated, the contamination is gone. The disadvantage is often the length of time necessary for the bioremediation to be completed⁷⁰.

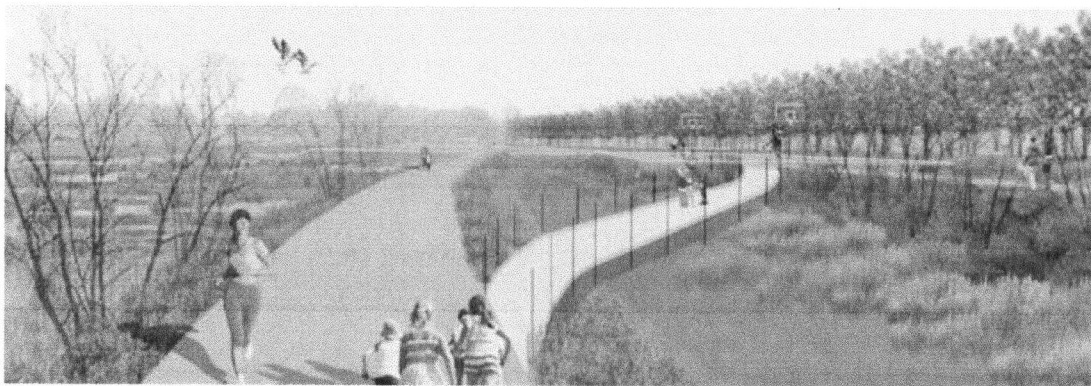


Figure 2.17 Bioremediation terraces in Silresim Superfund Redevelopment Study, Lowell, MA by StoSS, 2004

⁶⁸ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁶⁹ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁷⁰ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

Remediation and biodiversity

Apart from the hazardous risks of contamination, many authors agree contaminated sites often have an underestimated level of biodiversity, with more diverse ecological environments in contaminated sites than in native landscapes that surround them. Brownfield intervention must consider this existing value and seek to enrich it. Alan Berger argues that because of their contamination, industrial contexts, and secured perimeters, brownfield sites offer a viable platform from which to study urban ecology while performing reclamation techniques. This potential relies in the accommodation of new landscape design practices that concurrently clean up contamination during redevelopment, or more notably where reclamation becomes integral to the final design process and form⁷¹.

In this line of including natural processes in the design to rehabilitate contaminated sites, Michael Hough suggests both the use of the naturalized plant community and aquatic plants as a filter, as alternatives to technology-only based methods. Regarding the first, Hough cites a survey of metal-related mine wastes in Britain that suggests that with high concentration of toxic metals, rehabilitation is more effectively achieved with naturally occurring grasses than with commercial varieties.

The naturalized plant community becomes a valued resource for establishing vegetation on poor soils and sterile soils. Plants may be seen as constantly evolving communities rather than individual phenomena. Colonizing plants adapted to urban soils can enhance and modify them and provide alternatives to importing fertility to the city. Landscape maintenance can become a process of integrated management, based on ecological parameters, and give us the practical tools for maintaining productive and self-sustaining landscapes.⁷²

As for remediation by aquatic systems, they suspend solids by aeration and use solar energy, bacteria, plants and animals to enhance natural responses which bio-chemically change or remove contaminants from sewage. Hough cites US researches that show 0.4ha of water hyacinths absorb annually 1,600kg of nitrogen, 360kg of phosphorous, 12,300kg of phenols and 43kg of highly toxic metals⁷³.

Phytoremediation treatments are an emerging science in landscape architecture. Hybrid poplars, Poplars, Alfalfa, Juniper, Fescue, and Clover are among plants with known phytoremediation applications⁷⁴.

⁷¹ Berger, Alan, Drosscapes in Waldheim, Charles, Ed. The Landscape Urbanism Reader, pp. 210, Princeton Architectural Press, New York, 2006

⁷² Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995

⁷³ Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995

⁷⁴ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

Environmental quality

In all, dealing with contamination to transform the sites to environmentally healthy sites embraces four major opportunities: to preserve and rehabilitate soil as a major component of the urban physical environment together with water and air; to improve water quality by restoring or alleviating the hydrological balance where possible [i.e. reducing the amount of impervious surface on the sites]; to improve air quality by increasing quantity and diversity of green open space, reducing carbon emissions [which is improved when interventions favour non-motorized modes of transportation]; and to enhance urban biodiversity by connecting new green open spaces to the broader habitat network of the city.

Quantity and accessibility to green open space

In terms of the opportunity to improve the quantity and accessibility to green open space in the city, there has been a growing recognition among community groups and environmental organizations that brownfields hold enormous potential for "greening" city environments, through the implementation of parks, playgrounds, trails, greenways, and other open spaces, and that these green spaces benefit the community and culture⁷⁵.

Michael Hough considers the vision of these former industrial places as the parks of the twenty-first century as entirely appropriate for the future of our cities and the direction that must be taken⁷⁶. Figure 1.1 and 2.12 of Seattle's Gas Works Park before and after intervention, illustrate this opportunity for greening the city and providing accessibility to green public open space.

Connectivity

To improve the connectivity between green open spaces is another important potential of brownfield sites. This is especially patent in abandoned railway lines, as they provide physical and potential biological links through the city to the surrounding countryside. Michael Hough argues these communication links, often regarded as wastelands, constitute significant natural corridors with environmental and social value for the migration of plants, wildlife and people, with rich and naturally regenerated habitat⁷⁷.

Figure 2.18 shows abandoned railway tracks along 6th Street in Vancouver illustrating the opportunity for connectivity; a corridor for plants, wildlife and human activity, as well as a space for urban agriculture.

⁷⁵ De Sousa, Christopher, Turning Brownfields into Green Space in the City of Toronto, Landscape and Urban Planning, Volume 62, Number 4, 25 February 2003, pp. 181-198(18). Document Type: Research article

⁷⁶ Hough Michael, Foreword of Manufactured Sites. Rethinking the Post-Industrial Landscape, Kirkwood, Niall, Ed. Spon Press, 2001

⁷⁷ Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995



Figure 2.18 Improving connectivity of plants, wildlife and people: railway tracks along 6th St. in Vancouver

Reducing consumption of natural resources: land, energy, materials

Also relevant in the larger discussion about city and urbanization is the potential of brownfield interventions to reduce consumption of natural resources, particularly land consumption [by alleviating 'development pressure' on greenfield sites], but also energy consumption [by providing urban forms less reliant on the automobile and energy efficient buildings]. Reusing existing structures and infrastructures is also a way of reducing material consumption in general.

The reuse of already urbanized land to accommodate a seemingly inevitable population growth is a means of using land more efficiently and increasing development and activity in existing cities – a process of intensification –, which is potentially one way of achieving more sustainable urban forms⁷⁸. This optimizing of the use of urban land contributes to minimising urban sprawl and its impacts on infrastructures efficiency, traffic congestion, air pollution and resource depletion, and to taking full advantage of existing infrastructures through a better integration of transport and land use planning⁷⁹. Looking at the larger picture, this urban land efficiency embodies a way of relieving 'development pressure' on greenfield sites, therefore preserving the countryside⁸⁰. In favour of this potential Niall Kirkwood argues:

⁷⁸ Jenks M.; Gerhardt W.; Urban intensification: the potential of decision support for assessing brownfield sites, Urban Design International, Volume 5, Numbers 3-4, 1 December 2000, pp. 233-243(11), Palgrave Macmillan.

⁷⁹ Favrel Vincent, Brownfield redevelopment and research in Europe – Community Challenges, EU Key Action 4 "City of Tomorrow and Cultural Heritage", RESCUE-MASURIN International Conference, Katowice, Poland, 19-20 November, 2003

⁸⁰ EUGRIS, Portal for Soil and water management in Europe, United Kingdom Brownfields, further description, www.eugris.info



Figure 2.19 Transformation of vacant lot for urban agriculture in Grant Park, downtown Chicago

Others have disagreed, however, pointing out the insignificance of these manufactured sites in relationship to more pressing concerns in the environment such as the continuing effects of over-development, particularly sprawl. These commentators and critics ignore the fact that recycling and reuse of these sites is an old activity, and one that is likely to continue to influence sprawl through the rebuilding of the urban core and reducing further encroachments into "greenfield" sites.⁸¹

Reducing waste and improving food security: recycling, composting & urban agriculture

As illustrated in Figures 2.18 and 2.19, brownfield interventions also offer the possibility to introduce alternative uses to the city's inner cores, such as recycling, composting or urban agriculture. Although seemingly site-specific, these types of initiatives, if widely replicated, could have an overall impact on waste reduction [recycling and composting] and improving food security [urban agriculture].

Based on a study from Friends of the Earth that estimates idle land may yield 50 tonnes of food per hectare, Michael Hough claims the availability of urban land is potentially enormous in almost all major western cities, with railway, public works and public utility properties, vacant lots, cemeteries and industrial lands forming a major proportion of unbuilt-on land that has been, and remains, sterilized or ineffectively used⁸².

Downtown Chicago's Grant Park urban farm illustrates the potential for urban agriculture within the city. This initiative is lead by the non-profit organization "Growing Power", who believes the over 60,000 vacant lots in Chicago could be restored to productive land. The urban farm at Grant Park is a 1,858-m2

⁸¹ Kirkwood, Niall, Ed. Manufactured Sites. Rethinking the Post-Industrial Landscape, pp. 7-8, Spon Press, 2001

⁸² Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995

site [20,000 sq. feet] that has produced, since its beginning, over 6 thousand pounds of food with a market value of \$US 15,000. It currently grows and distributes over 150 varieties of heirloom vegetables, herbs and edible flowers to area food pantries and soup kitchens. Growing Power organizes workshops to learn how to self-assess brownfields, develop appropriate soil testing techniques, and create project plans for soil remediation of different types of contaminants⁸³. Beyond their environmental value, these types of initiatives hold a great social value, with educational and health benefits for the community.

Summary of environmental opportunities

The various environmental opportunities in brownfield interventions range from improving the environmental quality of a specific site to broader environmental benefits at a larger metropolitan scale. Table 2.3 lists these and the scale they affect [site, district, city]. For instance, the remediation a site [opportunity env1] improves the environmental quality of a site, but if the contamination is simply excavated from the site and disposed somewhere else, the benefit only relates to the site and its surroundings, as the problem has been moved somewhere else. On the other hand, an example of a city scale environmental benefit is how the reuse of brownfield land improves the city's land efficiency, reducing the development pressure on natural areas or greenfield land [opportunity env8].

Environmental Opportunities	site	district	city
env1 To remediate contaminated soil	•	•	[•]
env2 To restore the hydrological balance	•	•	•
env3 To improve air quality by reducing carbon emissions	•	•	
env4 To enrich urban biodiversity	•	•	•
env5 To increase the quantity of green space	•	•	[•]
env6 To improve accessibility to green open space	•	•	[•]
env7 To improve the connectivity between green open spaces	•	•	•
env8 To improve land efficiency by reducing 'development pressure' on natural areas [greenfield sites]			•
env9 To reduce energy consumption	•	•	[•]
env10 To reduce the resource consumption by the potential reuse of existing structures and infrastructures	•		[•]
env11 To reduce waste by introducing recycling and composting	•		[•]
env12 To improve food security by introducing urban agriculture	•	•	[•]

Table 2.3 Environmental opportunities in brownfield interventions

⁸³ Growing Power Inc., Grant Park - Urban Agriculture Potager, Chicago www.growingpower.org

2.2.5 Summary of opportunities in brownfield interventions

Table 2.4 provides a summary of the different opportunities for sustainability associated with brownfield interventions and the scale they involve [site, district, city]. This illustrates how the opportunities in brownfield interventions transcend the site scale, affecting the surrounding districts and, although in a less direct way, the city as a whole.

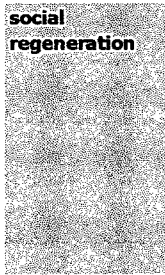
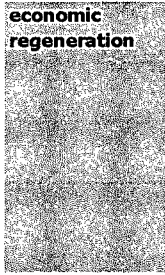
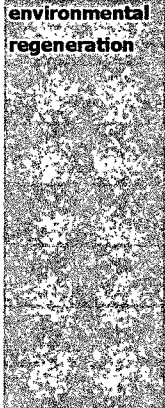
Opportunities in Brownfield Interventions		site	district	city
 social regeneration	sa1 To enhance social diversity, integration and interaction, achieving a higher sense of community and social equity	•	•	[•]
	sa2 To satisfy the needs for open space, housing, amenities and services	•	•	[•]
	sa3 To alleviate unemployment by creating and retaining jobs	•	•	[•]
	sa4 To ease the concern about real or perceived contamination and reduce potential risks for human health	•	[•]	[•]
	sa5 To contribute to a collective reconciliation with a decayed and neglected past	•	•	[•]
	sa6 To promote community involvement and engagement in the decision-making process	•	•	[•]
 economic regeneration	ea1 To increase economic productivity and complement existing economic activities	•	•	•
	ea2 To create and retain jobs	•	•	[•]
	ea3 To provide economic benefits through tax revenues and real estate	[•]	[•]	•
	ea4 To increase accessibility to economic activity to the public as customers, consumers, and employees	•	•	[•]
	ea5 To reduce development costs by the potential reuse of existing structures and infrastructures	•		
	ea6 To reduce development costs through the use of permeable surfaces and soil remediation practices	•	[•]	[•]
 environmental regeneration	env1 To remediate contaminated soil	•	•	[•]
	env2 To restore the hydrological balance	•	•	•
	env3 To improve air quality by reducing carbon emissions	•	•	
	env4 To enrich urban biodiversity	•	•	•
	env5 To increase the quantity of green space	•	•	[•]
	env6 To improve accessibility to green open space	•	•	[•]
	env7 To improve the connectivity between green open spaces	•	•	•
	env8 To improve land efficiency by reducing 'development pressure' on natural areas [greenfield sites]			•
	env9 To reduce energy consumption	•	•	[•]
	env10 To reduce the resource consumption by the potential reuse of existing structures and infrastructures	•		[•]
	env11 To reduce waste by introducing recycling and composting	•		[•]
	env12 To improve food security by introducing urban agriculture	•	•	[•]

Table 2.4 Summary of opportunities for sustainability in brownfield interventions. On the right, the scale they mostly affect [site, district, city] with black dots indicating a direct influence and grey dots in brackets a less direct influence.

2.2.6 Adapting to urban change: Opportunities for shrinking cities and uncertain futures

At the same time as the worldwide phenomenon of an increasingly urban population, there is a parallel phenomenon of cities facing decline of urban population and economic activity. The German project "Shrinking Cities" lead by Philipp Oswalt argues that not only is this a global phenomenon that presents a social challenge, but that despite their diminished utilization, shrinking cities continue to sprawl beyond their borders and thereby undergo a twofold thinning out: less activity is spread out over a greater space⁸⁴. It is within Shrinking Cities' idea of moving from crisis to innovation, where this thesis proposes the potential of brownfield land in depopulating cities: transforming the creation of excess spaces, buildings, and obsolete properties - what Oswalt calls 'growth in the process of shrinkage' - as an impulse to create new concepts, models, and dialogues to alleviate the consequences of depopulation.

At a larger scale and longer timeframe, brownfield interventions offer the possibility for the city to adapt to its ever-changing shaping forces; for growing cities, for depopulating cities, and for those whose future in terms of growth is uncertain. At this scale, landscape is seen by many as a key element: a kind of urban infrastructure with the ability to shift scales, to locate urban fabrics in their regional and biotic contexts, and to design relationships between dynamic environmental processes and urban form⁸⁵; landscape as an efficient remediating practice - a salve for the wounds of the industrial age -, evident in the work of many landscape architects [i.e. Duisburg Nord; Gasworks Park]⁸⁶.

In terms of how a brownfield intervention can face the flexibility required by the changing city shaping forces, two examples in France are worth mentioning: Lyon Confluence, Lyon, and Site Unimetal, in Caen. Lyon Confluence, a project over industrial land under the process of abandonment between the Saone and the Rhone rivers in Lyon, is structured by a "dispersed and mobile" system of parks, allowing flexible occupation as parcels become available for new programs. During the envisioned 30 year transformation process, all exterior land will at one time or another be parkland, either provisionally or for more the long term. Michel Desvigne, landscape architect of Lyon Confluence, describes the idea of a flexible landscape that adapts to urban change:

We are not envisaging a hypothetical, definitive state but a succession of states that correspond to the different stages of the metamorphosis. Exterior areas will be born, disappear, shift, according

⁸⁴ Oswalt, Philipp, Shrinking Cities. Volume 1. International Research, Introduction, HatjeCantzVerlag, Germany 2005

⁸⁵ Corner, James, Terra Fluxus, in Waldheim, Charles, Ed. The Landscape Urbanism Reader, Princeton Architectural Press, New York, 2006

⁸⁶ Waldheim, Charles, Ed. The Landscape Urbanism Reader, Princeton Architectural Press, New York, 2006

to the evolution of the building and the rhythm of the liberation of land, to make up a sort of moving map, like that of crop rotation⁸⁷.

In Site Unimetal [Figure 2.20], a 220-hectare site on a former steel and iron plant in Caen, the program is still uncertain and planned to evolve over time. The site, strategic for the development of the city along the river Orle, has a series of priorities - the recovery of the banks and the link between the city, the river and the peripheral farm fields - but is mostly conceived as a 'pre-landscape' for future development. This concept illustrates the relevance of time on the site; the current landscape design sets a 100m by 100m grid [1hectare] that will gradually accept urban growth when needed, but meanwhile providing a vast relevant open space as an urban park. The most relevant industrial ruins on the site have been preserved as part of the past, as part of the present pre-landscape, and as part of the future development: a large refrigeration tower dominating the 300x900 central field, a series of smaller towers as a park on the river bank and over the hill rise that served as the factory base, and a series of preserved buildings perceived as pieces of a museum of industrial archaeology.

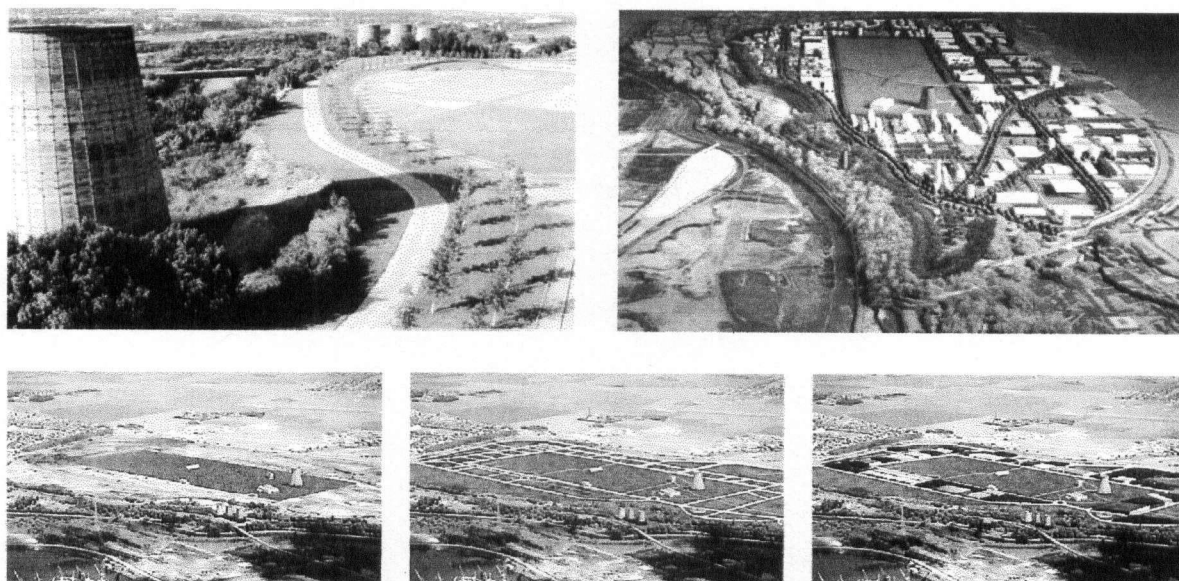


Figure 2.20 The concept of a 'pre-landscape' in site Unimetal, Caen, France: the park as it is today [top left]; its possibility to accommodate future growth [top right]; and the process by which this could take place [bottom]

⁸⁷ Desvigne, Michel, Landscape Architect of Lyon Confluence, in Shannon, Kelly, From Theory to Resistance: Landscape Urbanism in Europe, in Waldheim, Charles, Ed. The Landscape Urbanism Reader, Princeton Architectural Press, New York, 2006

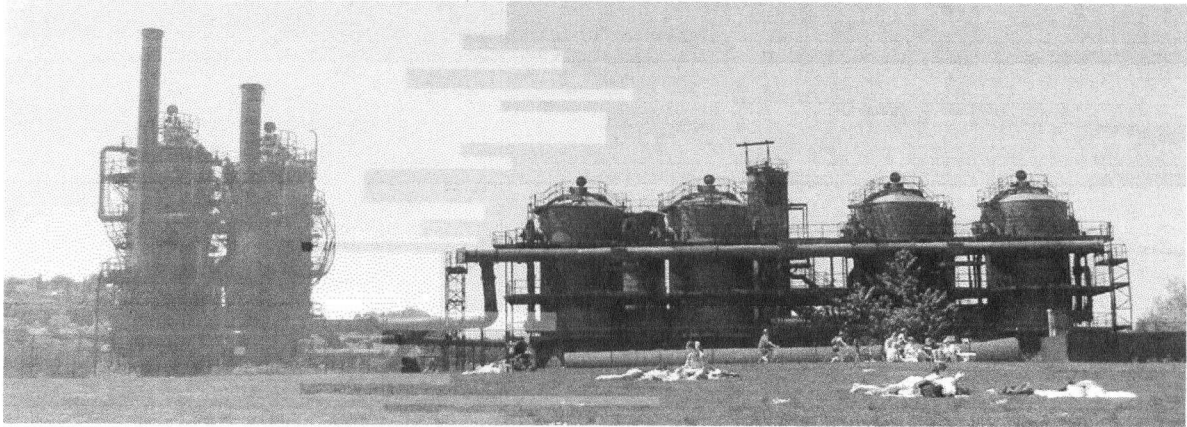


Figure 2.21 The Process: Gas Works Park, Seattle from *before* to *after*

2.3 The Process: Brownfields Before | Brownfields After

"The projection of new possibilities for future urbanisms must derive less from an understanding of form and more from an understanding of process – how things work in space *and* time."

James Corner, 2006⁸⁸

An emerging area of practice

Until the 1990s the challenge to redevelop contaminated properties was restrained by problematic public policy, reluctant lenders, and significant financial risks. Since then, however, the opportunities for redevelopment have improved considerably. According to Niall Kirkwood, initiatives and legislation on the clean-up of these urban sites, their critical location within regional transportation centres, and the diminishing number of "greenfield" sites available for development, have all acted to focus research, engineering and design efforts on their redevelopment and reuse⁸⁹. In the design profession, dealing with brownfield sites is an emerging field. Russ argues they present a wide range of unfamiliar site restrictions and conditions for the designer, together with the opportunity to actually improve environmental conditions, and highlights the importance of collaboration among professionals⁹⁰.

⁸⁸ Corner, James, *Terra Fluxus*, pp.28-29, in Waldheim, Charles, Ed. *The Landscape Urbanism Reader*, Princeton Architectural Press, New York, 2006

⁸⁹ Kirkwood, Niall, Editor, *Manufactured Sites. Rethinking the Post-Industrial Landscape*, London, USA and Canada, Spon Press, an imprint of the Taylor & Francis Group, 2001

⁹⁰ Russ, Thomas H. *Redeveloping Brownfields: Landscape Architects, Site Planners, Developers*, McGraw Hill, 2000

Important Questions in a Risk-Based Approach to a Brownfield Intervention

- 1 What are the real risks associated with existing environmental conditions?
 - 2 What risks would be associated with a new land use?
 - 3 How clean is clean enough? What are the costs of site remediation?
 - 4 What are the viable site restoration methods?
 - 5 Is that new land use consistent with community objectives?
 - 6 What are the regulatory requirements and how long does it take for review and approval?
 - 7 Can financing be secured if environmental monitoring and control measures are required?
-

Table 2.5 Important questions in a risk-based approach to a brownfield intervention

[Source: Waterfront Regeneration Trust, Canada, 2002]

2.3.1 Economic obstacles and incentives

Economic obstacles

Brownfield interventions face several obstacles. These vary from those current land use policies that follow the spirit explained above, to the potential state of contamination of the site and the environmental hazard it may embody. Contamination is not seen as an environmental issue, but rather as a major economic liability due to the cost of environmental restoration and the possible decline in the surrounding land values. Multiple ownership and the existence of a community concerned over the site are also seen as economic liabilities, as they may lead to a delay in the redevelopment process. Regarding the environmental implications, Thomas H. Russ notes:

The redevelopment of environmentally impacted sites is rarely undertaken with an expressed purpose of effecting an environmental cleanup. Environmental issues are of concern in the project only to the extent that they limit or impact the development program either physically or economically.⁹¹

The Waterfront Regeneration Trust [Canada] from their experience in risk-based decision-making has identified several important questions that are common to many redevelopment initiatives⁹² [Table 2.5]. Thomas H. Russ explains how the costs of remediation should be viewed as both initial costs and life-cycle costs. While the cost of excavating and removing contaminated soils may be high, once the soil is removed, the on-site liability may end and the use of the site could proceed without restriction. Leaving the soils in place and capping the site to restrict exposure greatly reduces the initial cost, but the project is committed to maintaining the cap, and the liability for the on-site condition may remain. The choice to

⁹¹ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁹² Waterfront Regeneration Trust, The Nature of Possibility: Experiences in Risk-Based Decision Making, International Brownfields Exchange [2000-2002], Canada 2002

manage a condition on site may mean restricting what the site may be used for. The restriction of use means, of course, limiting the marketplace for the redeveloped project⁹³. Table 2.6 compares the costs, times to complete, liability, maintenance and use restrictions for three remediation techniques.

The concern about short-term economic benefits following the general rule of thumb "the more short term and expensive the remediation, the greater liability reduction it offers"⁹⁴, often lead to the conventional "dig and dump" approach, where, as Table 2.6 illustrates, the problem is shifted elsewhere, with the risk of the disposal site becoming a hazardous waste facility. Generally, overall conditions as to economic risk and liabilities make it more *economically* beneficial to develop greenfield land, consequently expanding the city and leaving abandoned and potentially reusable land behind.

Comparison of Remedy Types for 8,000 Tons of Gasoline-Contaminated Soil					
Factor	Cost	Time to complete	Liability	Maintenance	Use Restrictions
Permanent onsite by ex situ bioremediation and vacuum extraction	\$1,400,000 US	2 years	None	None	None
Excavation with transport, offsite recycling, backfill with clean fill	\$640,000 US	120 days	Risk of disposal site becoming a hazardous waste facility	None	None
Remove hot-spots, cap site, building restriction	\$120,000 US	60 days	Cap failure, future use limited	Maintenance required forever	Site use limited

Table 2.6 Comparison of remedy types for 8,000 tons of gasoline-contaminated Soil

[Source: Thomas H. Russ, 2000, adapted from Whitman, 1997]

Economic incentives

In order to overcome the economic obstacles, a range of incentives has been developed to promote brownfield redevelopment. On the one hand, there has been a considerable shift in many planning regimes throughout the 1990s at different administrative scales [national, regional or municipal] to incentive urban development over brownfield sites [i.e. UK, at a national scale; Bilbao, Spain, at a municipal scale]. On the other, many countries have developed governmental programs to provide economic funds to overcome the liabilities.

⁹³ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

⁹⁴ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

Following the notion of a responsible redevelopment and productive reuse of brownfields properties, The National Brownfields Association argues in favour of processes with stakeholder participation and government incentives, by which all levels of government should offer and appropriately fund, as conditions warrant, a wide range of flexible incentives that promote the investigation, cleanup, transfer, and reuse of brownfields. Regarding risk assessment and cleanup approaches, it suggests all levels of government should investigate, and as appropriate adopt, flexible yet protective and scientifically sound risk assessment and cleanup approaches that are consistent with current and reasonably anticipated land and resource uses. At the same time, the public and private sectors should address liability issues, such as the concerns of buyers and sellers regarding liability for site conditions, and "finality" of cleanup decisions [at all levels of government] and devise workable mechanisms, such as viable institutional controls, to ensure the long-term effectiveness of cleanups⁹⁵.

In the United States, the Environmental Protection Agency's [EPA] 1995 Brownfields Program has changed the way contaminated property is perceived, addressed, and managed. The program is designed to empower states, communities, and other stakeholders in economic redevelopment to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse brownfields. Initially, EPA provided small amounts of seed money to local governments that launched hundreds of two-year brownfield "pilot" projects. Through passage of the Small Business Liability Relief and Brownfields Redevelopment Act, effective policies that EPA had developed over the years were passed into law. The Brownfields Law expanded EPA's assistance by providing new tools for the public and private sectors to promote sustainable brownfields cleanup and reuse⁹⁶.

In Canada, at a provincial level, the Crown Contaminated Sites Program in British Columbia is intended to provide action and public accountability on the management of contaminated sites for which the province is responsible in BC. It provides cross-government policy development and management of specific projects. It is also responsible for supplying information on contaminated sites, including projects that are underway, progress that has been made and upcoming priorities⁹⁷.

Alan Berger summarizes the shift in the economic perception of brownfields [from the private sector] due to the different incentives [coming from the public sector]:

⁹⁵ The National Brownfield Association, www.brownfieldassociation.org

⁹⁶ United States Environmental Protection Agency, A Sustainable Brownfields Model Framework, EPA, 1999, www.epa.gov/brownfields

⁹⁷ Crown Contaminated Sites Program, Crown Contaminated Sites Biennial Report 2006, Crown Contaminated Sites Branch, Ministry of Agriculture and Lands, Government of British Columbia, BC, 2006

Since the 1990s, brownfields have received much attention from the federal government. In 2003 more than \$73 million in grants were dispersed to thirty-seven states to promote the redevelopment of contaminated landscapes. Most were former urban industrial - production sites. Today developers seek out contaminated sites instead of clean ones; a former director of the National Brownfield Association noted that developers generate a higher rate of return from contaminated properties than from non-contaminated properties. New federal subsidies make this possible.⁹⁸

Pursuing the social – economic – environmental balance

A common term for brownfield interventions is *brownfield redevelopment*, with an intrinsic economic connotation. Although perceived as a key-element in an overall strategy for urban sustainability, a review of the literature concerning the brownfield challenge suggests that the economic concern is generally the major driver in the overall process. Brownfield interventions today face several and different interests and obstacles, often addressed from an exclusive economic point of view, with issues such as contamination or an existing community on the site often referred to as "economic liabilities" rather than as environmental or social issues. Although the reuse of the land and the reintegration of the properties into the economic cycle is a major objective, successful brownfield redevelopment policies and strategies particularly need the combination of environmental approaches with spatial and urban planning approaches to be integrated into policy approaches and vice versa⁹⁹.

It appears that the legal frameworks in many countries have not yet sufficiently integrated the needs arising from the viewpoint of environmental protection/restoration with the viewpoint of spatial and urban planning. In many countries, there is still no specific emphasis on the reuse of brownfields in the urban and spatial planning regimes.¹⁰⁰ There is a need to consider, beyond an exclusive economic view, the environmental and social consequences of leaving this potentially reusable land that, when left underused and abandoned, creates barriers to urban activity and impoverishes urban quality of life. Not only is there a need to rebuild the city *within* the city and alleviate the deficiencies from former urban growth or simply from the changing forces that shape the city, but also there are lessons to be learned to guide planners and designers to avoid the creation and generation of this type of sites in the future.

⁹⁸ Berger, Alan, Drosscaples in Waldheim, Charles, Ed. The Landscape Urbanism Reader, pp. 210, Princeton Architectural Press, New York, 2006

⁹⁹ Ferber, Uwe; Grimski, Detlef; Brownfields and Redevelopment of Urban Areas, CLARINET, Contaminated Land Rehabilitation Network for Environmental Technologies, 2002 www.clarinet.at

¹⁰⁰ Ferber, Uwe; Grimski, Detlef; Brownfields and Redevelopment of Urban Areas, CLARINET, Contaminated Land Rehabilitation Network for Environmental Technologies, 2002 www.clarinet.at

Brownfield sites are considered an immensely valuable resource for the city's changing future. However, their complexity and the fact that they represent an emerging field, requires a collaborative and integrative search for solutions, not exclusive of just one discipline. Environmental, economic, legal, policy, and site and urban design expertise are needed, if the sites are to be restored to environmental health and integrated into the economic and social life of the city¹⁰¹.

Even as we begin to define the principles of sustainable urban design, we find that some brownfield sites may, in time, heal and that, with planning and nurturing, the contamination will be biologically diminished. Research into the function of landscapes as systems is raising new design possibilities. The advancement of bioremediation and phytoremediation into practical design tools will provide landscape architects with the ability to design important remediation functions into landscapes as well as beauty. If we are to make the built environment work sustainably, we must find ways to make cities function environmentally. In some ways, impacted sites are among the most important design challenges.¹⁰²

2.3.2 Brownfields before & after: Preliminary study of their contribution to the city

As a preliminary examination of the process of how the different social, economic and environmental opportunities identified in the *Vision* play out in brownfield interventions, the following is a case study of sixteen international brownfield interventions. The study represents a first round assessment of how brownfield interventions contribute to urban sustainability and quality of life. This preliminary consideration is based in the process and change between the *before* and the *after* intervention.

To do this, the study looks at how certain site circumstances or attributes commonly encountered [related to the brownfield *before*] are dealt with in the site's intervention [brownfield *after*]. The change in these reflects the degree of accomplishment of the opportunities, and thus its contribution to the city. The overall results from the case study start to inform an initial value system based on *poor*, *moderate* and *good* assessments that serve as a basis for the evaluative framework later developed.

For instance, looking at how a brownfield intervention increases the amount of green open space within the site reasonably covers opportunities env1 to env7 [remediate contaminated soil; restore the hydrological balance; improve air quality; enhance urban biodiversity; increase quantity of green open space; improve accessibility to green open space; and improve connectivity between green open spaces].

¹⁰¹ Hough, Michael, Foreword of Manufactured Sites. Rethinking the Post-Industrial Landscape, Ed. Niall Kirkwood, London, USA and Canada, Spon Press, 2001

¹⁰² Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

As a result, the study looks at the site's green open space before and after intervention. A larger change between these indicates a high achievement of the opportunities, with a consequent high contribution, obtaining a *good* assessment. Smaller changes indicate a minor achievement of the opportunities, and are therefore considered either as *moderately* or *poorly* contributing to the city.

The site attributes considered as most relevant in the achievement of the identified opportunities and analysed throughout the brownfield interventions in relation to their contribution to the city are explained as follows. Table 2.7 summarizes these, and also serves as a legend for Tables 2.8 and 2.9, which compile the study's results.

The selection criteria were that the brownfield interventions appeared throughout the literature reviewed as "good examples". There are also four examples from Vancouver, due to the usefulness of studying interventions that can be experience here first hand. The sixteen case studies are included in Appendix II International Brownfield Interventions.

International brownfield interventions studied:

1. Arbutus walk, Vancouver, Canada
2. Battersea Power Station, London, UK
3. Brandt's Creek Crossing, Kelowna, BC, Canada
4. Duisburg Nord Park, Duisburg, Germany
5. False Creek North, Vancouver, Canada
6. False Creek South, Vancouver, Canada
7. Fresh Kills Park, New York, US
8. Gas Works Park, Seattle, US
9. Granville Island, Vancouver, Canada
10. Lyon Confluence, Lyon, France
11. Menominee Valley West End, Milwaukee, US
12. Northside Park, Denver, US
13. Site Unimetal, Caen, France
14. Southeast False Creek Vancouver, Canada
15. Westergasfabriek Culture Park, Amsterdam, Netherlands
16. Western Harbour – bo01, Malmö, Sweden

Scale, Location, and Shape

[Tables 2.8 and 2.9, bars and rows 1 and 2]

The larger, the more urban, the more in a relevant site, the larger the perimeter the sites have, the more they affect the surrounding areas as barriers and urban voids, and therefore the more potential to contribute to the city.

The case study [Tables 2.8 and 2.9] illustrates the vast range in sites, from Arbutus Walk with 6ha to Duisburg Nord Park with 230ha [and Fresh Kills Park off the charts with 890ha]. In terms of location, the majority of the interventions studied are urban [vs. suburban or non urban], which supports the thesis' focus on brownfields in urban areas. At the same time, the majority of sites are located on waterfronts - oceanfronts, riverfronts, or lakefronts - allowing the cities and communities to reach formerly inaccessible shores. There is also a tendency of more compact than longitudinal sites.

Former use – New use

[Tables 2.8 and 2.9, row 3]

The case study suggests the main origin or former use of the sites is industrial related [generally served by infrastructures]. There are also a few cases from exclusively infrastructure. What all sites have in common is that they were either abandoned or underused before the interventions took place, which, added to the general urban and waterfront location, resulted in urban voids impeding cities and communities to reach the water.

When bringing the sites back into urban life [brownfields *after* intervention], there seem to be two main tendencies: mostly open space-based interventions [urban parks]; and, mostly built form-based interventions, all of which include a mix of uses to some extent [2 or more]. Both types of intervention cover many of the opportunities identified previously; with urban parks especially to those related to green open space. Mixed-use interventions have provided a variety of uses to the surrounding areas, including housing, space for economic activities, and open space. Table 2.9 suggests a correlation between scale and the proportion of built form in the new use, where beyond a certain scale the new use is either an urban park or a flexible, temporary landscape, with smaller parts of mixed use built form and temporary parks to adapt to future needs [i.e. Lyon and Caen].

Existing and reused structures and infrastructures

[Tables 2.8 and 2.9, rows 4 and 5]

Many of the sites studied had existing structures within the sites prior to intervention [cranes, warehouses and buildings, some with heritage value]. Most were also, to some extent, served by infrastructures [i.e. streets, bridges, rail tracks]. The *Vision* has revealed the potential of reusing, restoring and integrating these existing elements to contribute to a collective reconciliation with a decayed and neglected past, to reduce development costs, and to reduce consumption of natural resources [opportunities s5, ec5, env9, and env10].



Figure 2.22 Reusing existing structures and infrastructures: railroad tracks informing circulation in Granville Island, and reused structures for cultural and recreational activities in Westergasfabriek and Duisburg Nord parks.

Regarding existing infrastructures, there is a general reuse, particularly of streets and bridges. The railroad, if not reused, is frequently left as a trace of the sites history informing circulation patterns [i.e. Granville Island, Fig.2.22 left]. As for reusing and integrating existing structures, urban parks have been more successful than mixed-use interventions. Gas Works, Duisburg Nord and Westergasfabriek parks [Fig. 2.22 middle and right] are celebrated examples of this. In mixed – use interventions the restoration is generally more selective [i.e. Battersea Power Station; the Roundhouse, False Creek North].

Contamination – Remediation

[Tables 2.8 and 2.9, row 6]

Contamination to some degree [high, low, very low] is a common factor faced by most interventions, although not all referred to it as a relevant issue [a few not mentioning it at all]. This supports the major focus on state of abandonment and potential for reuse of the sites [and contamination, real or perceived, as something the sites *may or may not* contain] versus the focus on merely “contaminated sites”.

In the remediation, urban parks have for the most part provided innovative landscape practices towards dealing with contamination on the sites [i.e. Duisburg Nord; Westergasfabriek]. Mostly built form-based interventions have either recognized conventional “dig and dump” processes or not provided information other than that contamination was dealt with prior to intervention. As remediating the contamination on the site is better, there is a need to learn from current practices in urban parks and adopt them to built form-based interventions. As for contamination at a metropolitan scale, when on-site remediation is not possible, off-site practices should avoid merely shifting the contamination somewhere else.

Biodiversity and green open space

[Tables 2.8 and 2.9, rows 7 and 8]

In contrast with the value of existing biodiversity in brownfield sites identified in the *Concept*, the case study shows very few [with the exception of Fresh Kills] refer to this. In general, the aerial images before intervention revealed that most sites once included at least some existing green open space, presumably supporting some level of biodiversity. This supports Hough’s suggestion that the usual practice is that

redevelopment ignores the rich natural heritage that it replaces¹⁰³. On the other side, many of the cases studied claim an improvement in the areas' biodiversity after intervention, which differs from Hough's idea that frequently the reclamation of derelict areas, where a cultivated landscape replaces the native and cultural one, involves reducing diversity, rather than enhancing it¹⁰⁴.

The case study acknowledges the contribution of brownfield interventions to the city in terms of quantity for green open space [Table 2.9, row 8], which covers many of the identified opportunities in the *Vision* [s2, ec6, env2, env3, env4, env5, env6, env7]. This contribution is evident when the sites are turned into urban parks, and, to less extent, in built-form interventions, with at minimum of 20% of the sites dedicated to green open space. 60% of the mostly built form-based interventions provided over 30% of the sites to green open space [with Menomenee Valley and Western Harbour up to 50%] and 40% provided between 20 and 30% [i.e. Battersea Power Station; False Creek North]. In this sense, Figure 2.23 is the first attempt to establish a series of ranges to show the brownfield interventions that better contribute to the city [good range], as those that contribute more moderately or poorly.

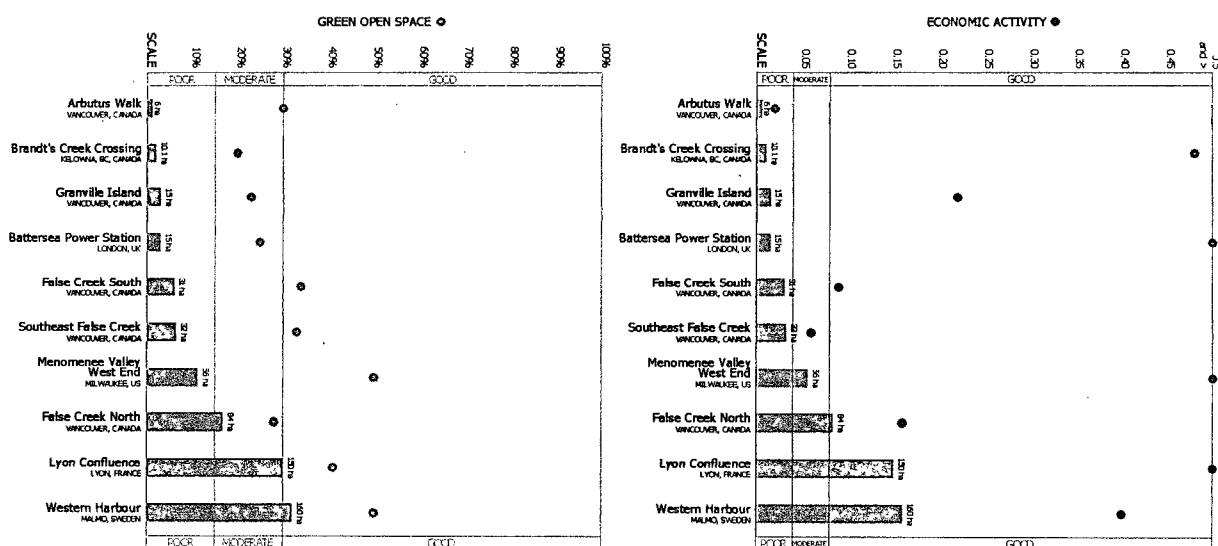


Figure 2.23 Change in green open space and economic activity on the sites. The chart includes only the mostly built form-based interventions. The dots represent the numerical value of the change in percentage of the sites dedicated to green open space [left] and the change in intensity of economic activity [right], measured as ratio of total floor area of economic activity to total site area. This informs an initial consideration of their contribution, indicated in three ranges: *poor*, *moderate*, and *good*.

¹⁰³ Hough, Michael, *Cities and natural Process*, Routledge, London and New York, 1995

¹⁰⁴ Hough, Michael, *Cities and natural Process*, Routledge, London and New York, 1995

Economic Activity

[Tables 2.8 and 2.9, row 9]

A common denominator of the cases studied is low economic activity – all sites being derelict or underused before intervention. Not applicable for parks, where there is generally none or little economic activity proposed, all of the built form interventions provide area for economic activities, most with ratios over 0.08 of area for economic activities to total site area. This contribution increases economic productivity and complements existing economic activities, creates new jobs, provides economic benefits through tax revenues and real estate, and increases accessibility to economic activity to the public as customers, consumers, and employees [opportunities s3, ec1, ec2, ec3, and ec4].

Community concern – Community involvement

[Tables 2.8 and 2.9, row 10]

Although community involvement and participation [opportunity s6] is an important element in any planning process, it is crucial in brownfield intervention, as the majority of sites studied present high levels of community concern. According to Russ, although a brownfield intervention may remediate existing contamination, neighbours have legitimate concerns over the general change in character that will occur with the intervention, or the conditions during construction. Russ argues in most cases neighbourhoods do not have professional assistance in evaluating the new proposal and the technical terminology that describes contamination and redevelopment strategies¹⁰⁵. Community concerns can lead to a strong social opposition to a project, which in turn becomes an economic liability. When neighbours are given the opportunity to participate in the process, consensus is more likely to occur and smooth the process. On average, the cases studied claim to have had high community engagement in the process.

There was a long history of neighbourhood opposition to the project. [...] Local residents were very involved and had many concerns - and expectations - about traffic, density, height and the scale of change in a well-established neighbourhood. Concert [the developer] spent a great deal of time putting together high-quality plans for open space [especially the greenway] and worked closely with the neighbourhood association through an extensive public process to ensure that the interests of the local residents were properly addressed. While initially this took far longer than the developer had anticipated, it did result in a very livable neighbourhood and later approvals were more rapid as trust developed.¹⁰⁶

Land ownership – Developer

[Tables 2.8 and 2.9, row 11]

Although out of the physical domain, land ownership and the developer have been included for their critical relevance due to the many economic obstacles faced by brownfield interventions. In this sense,

¹⁰⁵ Russ, Thomas H. Redeveloping Brownfields: Landscape Architects, Site Planners, Developers, McGraw Hill, 2000

¹⁰⁶ Canada Mortgage and Housing Corporation CMHC, The Carlings at Arbutus Walk, Vancouver, BC, Residential Intensification Case Studies, www.cmhc.ca

the case study highlights the figure of the public sector as developers. When the new use is an urban park [public use], the developer is always public; but when it is a built form-based intervention including private uses [housing, economic activities], the public sector appears in either public-private or fully public developments, with only a few fully private interventions. The relation between the land ownership and developer in some of the cases illustrates how the public sector steps on privately owned land to re-develop the sites [i.e. Gas Works Park, Dusiburg Nord Park, as fully publicly developed; Western Harbour, Arbutus Walk, as public-private partnerships].

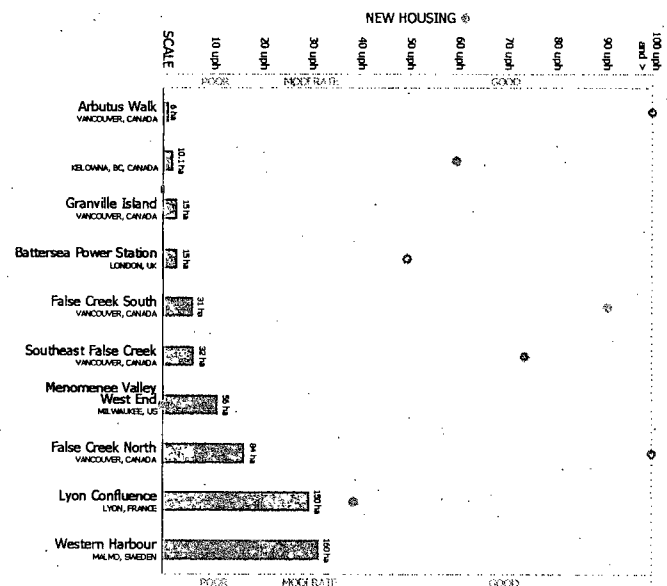
New housing, affordable housing and green building standards

[Table 2.9, row 12]

The *Vision* highlights the potential of brownfield interventions to reduce development pressure on greenfield sites by introducing new housing [opportunity env8]. The majority of the built form-based interventions generally met this potential, as many provided residential densities over 40 units per hectare [gross density; number of units over total brownfield site]. These compact developments also contribute to enhance social integration, satisfy the needs of housing and provide economic benefits through tax revenues and real estate [opportunities s1, s2 and ec3]. Opportunities s1 and s2 are furthermore achieved when the percentage of affordable housing is considered [i.e. False Creek South 37%; Lyon Confluence 33%]. The interventions of Western Harbour, Lyon Confluence and Southeast False Creek [the two latter in planning process] introduce green building standards for the new buildings, contributing, among others, to reduce energy consumption and carbon emissions. These initiatives, yet few, represent an inspiring step further for brownfield interventions to enhance urban sustainability.

Figure 2.24 New housing in brownfield interventions.

The chart includes only the mostly built form-based interventions. The dots represent the numerical value of the gross dwelling density, measured as number of dwelling units over total site area [units per hectare]. This informs an initial consideration of their contribution to the city, indicated in three ranges: *poor*, *moderate*, and *good*. The value in increasing the dwelling density housing is based on the series of opportunities associated with it explained above.



Summary

The case study of sixteen international brownfield interventions represents a preliminary examination of the extent to which brownfield interventions achieve different social, economic and environmental opportunities identified in the *Vision*, contributing better, moderately, or poorly to urban sustainability and quality of life. The review has been based on the process and change between the *before* and the *after* intervention, by looking at how certain site circumstances or attributes commonly encountered [related to the brownfield *before*] are dealt with in the brownfield intervention [brownfield *after*].

Table 2.7 summarizes the site attributes analysed throughout the brownfield interventions in relation to their contribution to the city. It also serves as a legend for Tables 2.8 and 2.9, which compile the results from the sixteen case studies. Appendix II International Brownfield Interventions includes the full analysis of the sixteen case studies.























































































LEGEND		
LOCATION	  	Urban / Suburban / Non-urban; Waterfront  / Railway 
SHAPE	  	Compact [regular/ irregular] / Longitudinal [regular/ irregular]
NATURE	  	Industrial / Infrastructure / Landfill
STRUCTURES	   	H Many / Few / None; Heritage
INFRASTRUCTURES	   	Many / Few / None
CONTAMINATION	   	High / Moderate / Low [default: moderate]
BIODIVERSITY	   	High / Low / Very Low
GREEN OPEN SPACE	   	High / Low / Very Low
ECONOMIC ACTIVITY	   	Underused [partial activity] / Derelict [no activity]
COMMUNITY / CONCERN	   	High / Low / Very Low
LAND OWNERSHIP	   	Public / Private / Public + Private; Single / Multiple
NEW USE	  	F Mixed-Use / Eco-Industrial / Urban Park; Flexible
REUSED STRUCTURES	   	H Many / Few / None; Heritage
REUSED INFRASTRUCTURES	   	Many / Few / None
REMEDICATION	   	Most on-site / Both on-site and off-site / Most or all off-site
BIODIVERSITY	   	High / Low / Very Low
GREEN OPEN SPACE	   	High [>30%] / Moderate [15-30%] / Low [<15%]
ECONOMIC ACTIVITY	   	High [> 0.08] / Moderate [0.04-0.08] / Low [<0.04]
COMMUNITY INVOLVEMENT	   	High / Low / Very Low
DEVELOPER	   	Public / Private / Public + Private; Single / Multiple
NEW HOUSING	   	High [> 40 uph] / Moderate [20-40 uph] / Low [<20 uph]
GREEN BUILDING PRACTICES	   	Many; GB Standards / Few GB Practices / None

Table 2.7 Key site attributes studied and legend for Tables 2.8 and 2.9

16 International Brownfield Interventions before

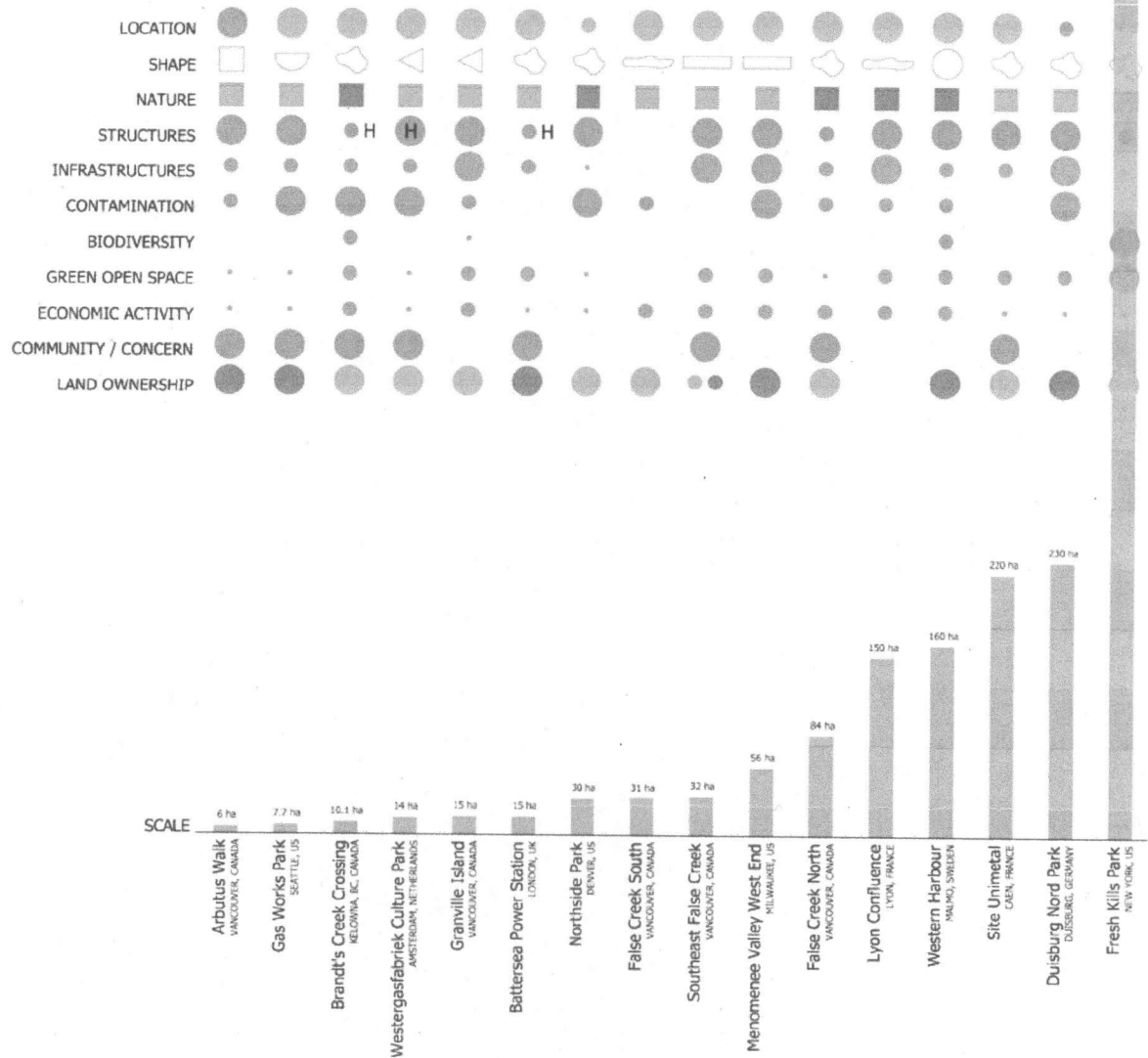


Table 2.8 International Brownfield interventions: *before*

16 International Brownfield Interventions after

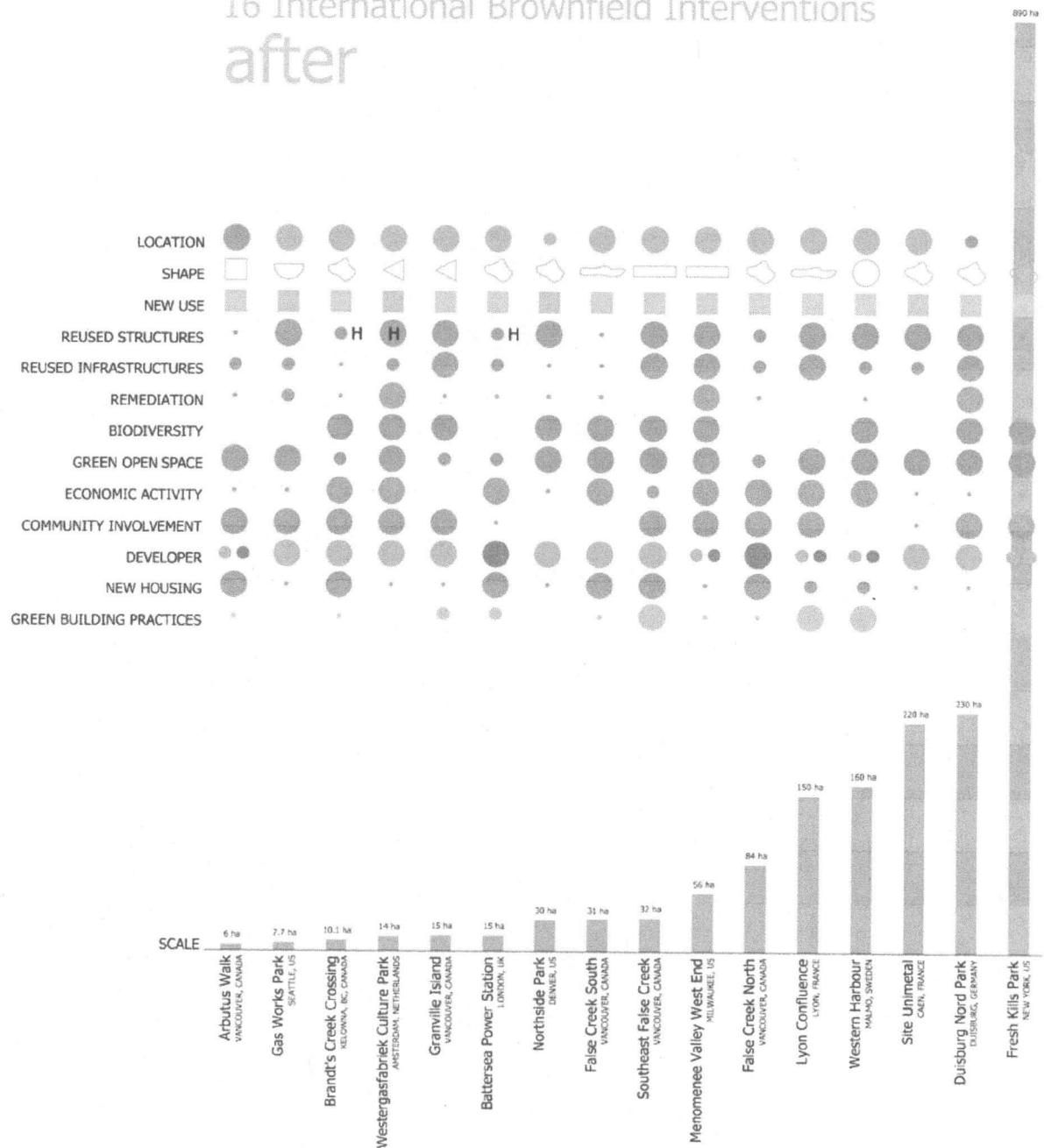


Table 2.9 International Brownfield interventions: *after*

3. EVALUATIVE FRAMEWORK

Brownfield Intervention Sustainability Analysis

Understanding the brownfield challenge and how it is related to urban sustainability and quality of life [covered in Chapter 2] sets the basis for the evaluative framework, which proposes six goals for brownfield interventions, and, based on the degree of achievement of these, how to determine a brownfield site's potential, and how to evaluate its intervention's contribution [Figure 3.1].

Six Goals for Brownfield Interventions condense into spatial and built form parameters the opportunities in brownfield interventions to contribute to urban sustainability identified in Chapter 2.

Since the potential to achieve each of the proposed goals may depend on particular site circumstances, *Determining the Potential* considers the key site conditions *before* intervention to clarify a specific site's potential to achieve the goals, and thus to contribute to urban sustainability. At a metropolitan level, it looks at a city's overall brownfield potential based on its brownfield scale and its particular circumstances.

Evaluating the Contribution considers the actual contribution of a brownfield intervention to urban sustainability based on the extent to which it achieves the goals. The method basically consists in the six goals, each consisting of four objectives, measured through indicators, and recognized a specific credit. The indicators and credits are based on the physical change of the sites *before* and *after* intervention, and have been determined by the preliminary brownfield intervention study developed in Chapter 2.

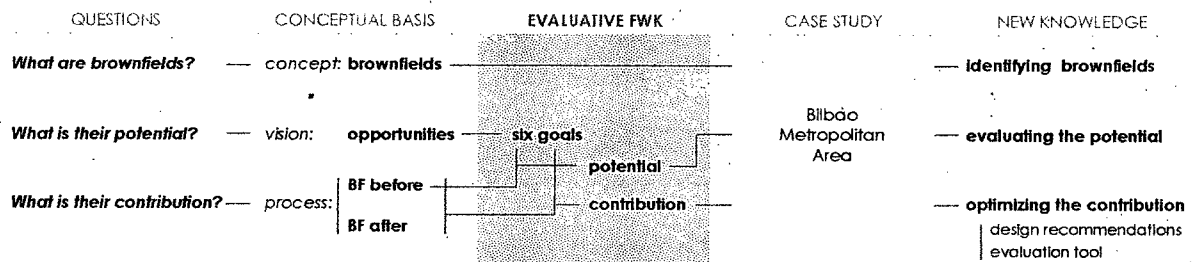


Figure 3.1 Evaluative framework: six goals, potential of brownfield sites, and contribution of brownfield interventions

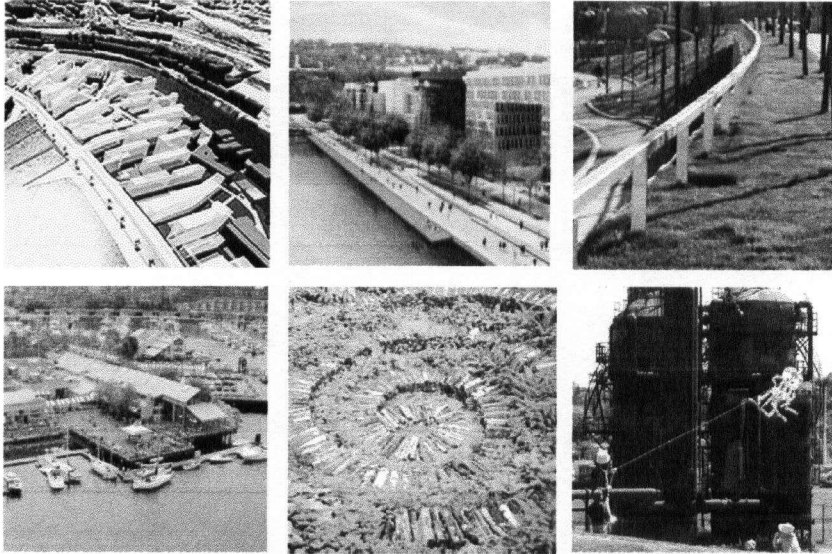


Figure 3.2 Six Goals for Brownfield Interventions: Improve the legibility of the city; Improve urban integration and mobility; Green the city; Build complete communities; Mitigate the impact of urbanization; Deal with the pre-existing

3.1 Six Goals for Brownfield Interventions

The six goals proposed distil into physical parameters the multiple social, economic, and environmental opportunities for brownfield interventions to contribute to urban sustainability and quality of life [identified in Chapter 2]. The goals, listed below, are described in this section together with their rationales and objectives. Each goal responds to an area related to urban design [below] and covers different opportunities [Table 3.1, and in brackets throughout the goals' rationales]. At the same time each goal has a spatial and physical consistence articulated in a set of measurable objectives. The focus on the physicality of the goals responds to the belief that urban design driven by social, economic and environmental rationales provides a physical capacity to support a more sustainable way of living. The focus on the measurability of the goals lies in the intent to evaluate the contribution to urban sustainability by the degree of achievement of these goals.

Six Goals for Brownfield Interventions

1. **Improve the Legibility of the City**
2. **Improve Urban Integration and Mobility**
3. **Green the City**
4. **Build Complete Communities**
5. **Mitigate the Impact of Urbanization**
6. **Deal with the Pre-Existing**

Area the goals relate to:

Built Form: Urban Fabric

Built Form: Urban Networks

Natural resources: Nature, Air & Water

Built Form: Mixed Use

Natural Resources: Land & Energy

Pre – Existing

Goals & Opportunities in Brownfield Interventions

Goals	social opportunities						economic opportunities						environmental opportunities											
	s1	s2	s3	s4	s5	s6	ec1	ec2	ec3	ec4	ec5	ec6	env1	env2	env3	env4	env5	env6	env7	env8	env9	env10	env11	env12
1 Improve the Legibility of the City																								
2 Improve Urban Integration and Mobility																								
3 Green the City																								
4 Build Complete Communities																								
5 Mitigate the Impact of Urbanization																								
6 Dealing with the Pre-Existing																								

- s1 To enhance social diversity, integration and interaction, achieving a higher sense of community and social equity
- s2 To satisfy the needs for open space, housing, amenities and services
- s3 To alleviate unemployment by creating and retaining jobs
- s4 To ease the concern about real or perceived contamination and reduce potential risks for human health
- s5 To contribute to a collective reconciliation with a decayed and neglected past
- s6 To promote community involvement and engagement in the decision-making process

- ec1 To increase economic productivity and complement existing economic activities
- ec2 To create and retain jobs
- ec3 To provide economic benefits through tax revenues and real estate
- ec4 To increase accessibility to economic activity to the public as customers, consumers, and employees
- ec5 To reduce development costs by the potential reuse of existing structures and infrastructures
- ec6 To reduce development costs through the use of permeable surfaces and soil remediation practices

- env1 To remediate contaminated soil
- env2 To restore the hydrological balance
- env3 To improve air quality by reducing carbon emissions
- env4 To enrich urban biodiversity
- env5 To increase the quantity of green space
- env6 To improve accessibility to green open space
- env7 To improve the connectivity between green open spaces
- env8 To improve land efficiency by reducing 'development pressure' on natural areas [greenfield sites]
- env9 To reduce energy consumption
- env10 To reduce the resource consumption by the potential reuse of existing structures and infrastructures
- env11 To reduce waste by introducing recycling and composting
- env12 To improve food security by introducing urban agriculture

Table 3.1 Goals and opportunities in brownfield interventions

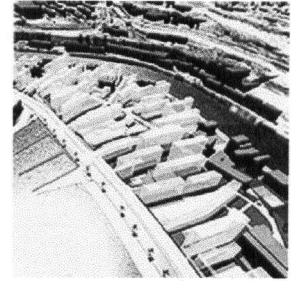


Figure 3.3 Goal 1

3.1.1 Goal 1: Improve the Legibility of the City

The landscape of the contemporary city is no longer a place making or a condensing medium. Instead it is fragmented and chaotically spread, escaping wholeness, objectivity, and public consciousness – terra incognita.¹⁰⁷

Description: Improve the city's spatial understanding by enhancing the existing and surrounding urban fabric, increasing its compactness and diversity, and revealing its site-specific physical features.

Rationale: As urban voids in the city fabric, brownfields prevent a clear spatial understanding of the city. Intervention can repair a fragmented urban fabric, and, by increasing its compactness and diversity, enhance social diversity, integration and interaction [s1]. New uses can satisfy the community needs of open space, housing, and jobs [s2, s3]. Economically, these can increase productivity, complement existing economic activities, and provide benefits through the creation of jobs and tax revenues, contributing to economic regeneration. Environmentally, increasing the compactness of the urban fabric discourages the use of the private vehicle, reducing CO2 emissions and fossil fuel consumption [env3, env9], as the relationship between gasoline consumption and urban densities in major cities around the world demonstrates more compact urban forms involve a general reduction in gasoline consumption¹⁰⁸. At the same time, the reuse of these sites to accommodate urban development reduces pressure on greenfield sites [env8]. In all, this goal intends to repair what Berger explains in the quote above.

Objectives:

1. Enhance the existing and surrounding urban fabric.
2. Increase the compactness of the urban fabric.
3. Increase the diversity of the urban fabric.
4. Reveal the area's site specific natural features.

¹⁰⁷ Berger, Alan, *Drosscapes* in Waldheim, Charles, Ed. *The Landscape Urbanism Reader*, pp. 209, Princeton Architectural Press, New York, 2006; Berger uses the term "Terra Incognita" from Bowman and Pagano

¹⁰⁸ Hough, Michael, *Cities and natural Process*, pp.267, 268, Routledge, London and New York, 1995; data from Paehlke, 1991 and Newman and Kenworthy, 1989

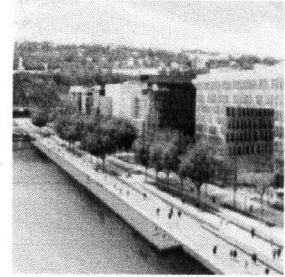


Figure 3.4 Goal 2

3.1.2 Goal 2: Improve Urban Mobility and Integration

The overlaying of ecological and urban strategies offers a means by which projects create new systems of interconnected networks that complement the existing structures.¹⁰⁹

Description: Enhance the existing and surrounding urban networks favouring transit and non-motorized modes of transportation.

Rationale: Behaving as physical holes in the urban fabric, brownfields interfere with the city networks, hindering mobility of people and goods, and the integration of activities. By repairing these networks, brownfield interventions hold the capacity to enhance social integration and interaction [s1] and to improve accessibility to different social needs, such as open spaces, services and amenities [s2]. Economically, it favours the integration of new economic activities with those in the surrounding neighbourhoods, increasing accessibility to the public as customers, consumers, or employees [ec4]. Environmentally, it reduces distances, discouraging the use of the private vehicle, thus reducing CO2 emissions and fossil fuel consumption [env3, env9].

Objectives:

1. Enhance the existing and surrounding street network.
2. Enhance the existing and surrounding pedestrian network.
3. Enhance the existing and surrounding transit network.
4. Promote other non-motorized modes of transportation.

¹⁰⁹ Shannon, Kelly, *From Theory to Resistance: Landscape Urbanism in Europe* in Waldheim, Charles, Ed. *The Landscape Urbanism Reader*, pp. 147, Princeton Architectural Press, New York, 2006

3.1.3 Goal 3: Green the City

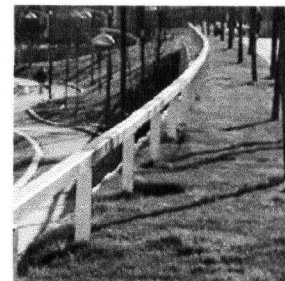


Figure 3.5 Goal 3

These industrial places have been called the parks of the twenty-first century. This vision is entirely appropriate to the future of our cities and the direction that must be taken¹¹⁰.

Description: Improve the quality, quantity, and accessibility to green public open space. For contaminated sites [real or perceived], restore the sites and any potential environmental hazards.

Rationale: The reuse of vacant and abandoned urban land to green the city alleviates the lack of green open space and the concern on real or perceived contamination [s2, s4]. Together with programmed activities, these new public open spaces contribute to the social regeneration of the sites and surrounding areas. The increase in permeable surfaces reduces construction and maintenance costs of open spaces [ec6]. The remediation of contaminated soil and the increase in permeable surfaces improves soil and water quality [env1, env2], and thus the environmental health of the sites and their surroundings. Although its effectiveness depends on the plant species, the increase in vegetation significantly improves air quality¹¹¹ [env3], as plants filter dust and absorb gases [i.e. CO₂, NO₂, SO₂, ozone] lowering city temperatures. Vegetation also collects heavy metals, but plant damage may occur if pollutants are excessive [env1]. As the sites usually contain little green open space, by increasing the quantity of green open space [env5], the sites can improve accessibility to and connectivity among green open spaces [env4, env6, env7], providing settings that enhance urban biodiversity. Last, introducing recycling facilities, composting and urban agriculture also reduces waste and favours food security [env11, env12].

Objectives:

1. Improve the environmental quality of public open space.
2. Increase the quantity of green open space.
3. Improve the accessibility to green public open space.
4. Include other environmental features [i.e. recycling facilities, composting, urban agriculture].

¹¹⁰ Hough, M. in Manufactured Sites. Rethinking the Post-Industrial Landscape, Kirkwood, N. Ed. Spon Press, 2001

¹¹¹ Hough, Michael, Cities and natural Process, Routledge, London and New York, 1995

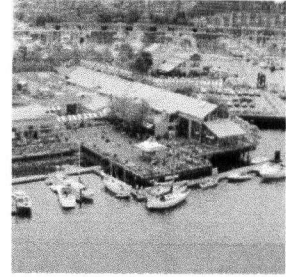


Figure 3.6 Goal 4

3.1.4 Goal 4: Build Complete Communities

Description: Improve housing affordability, social integration, and accessibility to goods and services, and encourage economic revitalization.

Rationale: As socially and economically derelict or underused, these sites negatively affect the surrounding neighbourhoods. However, their reuse provides space to alleviate existing needs within the surrounding neighbourhoods, contributing to build a more complete community by complementing existing urban activities with new ones. The needs may be related to housing, economic activities, amenities, open spaces, or most commonly a mix of all to some degree [s2]. Socially, this can promote housing affordability, social diversity, integration and interaction, transforming the sites into socially vibrant centres of community life [s1]. Economically, providing space for economic activities to take place improves economic productivity, generates economic benefits through the creation of jobs and tax revenues, and improves the accessibility to economic activities [ec1, ec2, ec3]. All this contributes to the economic revitalisation and regeneration of the site and its surrounding communities. Environmentally, introducing new uses in these sites reduces development pressure on greenfield sites [env8], and, by improving accessibility to community needs [s2] and economic activities [ec4], the use of the private vehicle is discouraged, reducing CO2 emissions and fossil fuel consumption [env3, env9].

Objectives:

1. Increase housing availability.
2. Increase housing affordability and social integration.
3. Improve accessibility to services and amenities.
4. Encourage economic revitalization.

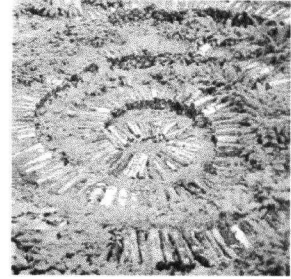


Figure 3.7 Goal 5

3.1.5 Goal 5: Mitigate the Impact of Urbanization

Description: Reduce the city's overall resource consumption and waste generation, with a particular focus on land as a natural resource and soil, water, and air contamination as waste.

Rationale: Referred to as *waste landscapes*¹¹² in their state prior to intervention, these sites offer a series of ways for mitigating the negative impacts of urbanization in the environment. When the sites are used to accommodate urban growth, the optimization of the use of the land reduces the development pressure on greenfield sites [env8]. This contributes to preserve the countryside and minimise urban sprawl and its impacts on infrastructures efficiency, traffic congestion, air pollution and resource depletion [env3, env9]. As many sites often present some kind of contamination, real or perceived, their remediation reduces contaminated soil [env1] – and consequently water [env2] –, and alleviates the social concern of a real or perceived contaminated environment [s4]. Often referred to as an off-site treatment, excavation and disposal - the conventional "dig and dump" – does not reduce the overall contamination in the metropolitan area, as it only shifts the problem somewhere else. On-site soil remediation practices, such as those in Duisburg Nord and Westergasfabriek parks, also result in a reduction of economic costs from transportation and off-site treatment of contaminated soils [ec6]. The inclusion of green building practices, or preferably standards as those set in Malmo's Western Harbour, Lyon Confluence and Southeast False Creek, reduce the overall environmental impact of the building sector, particularly in terms of energy consumption and carbon emissions.

Objectives:

1. Reduce brownfield land in the metropolitan area.
2. Reduce pressure on greenfield development.
3. Reduce contaminated soil in the metropolitan area.
4. Include green building practices.

¹¹² Berger, Alan, Drosscape. Wasting Land in Urban America, Princeton Architectural Press, New York, 2006

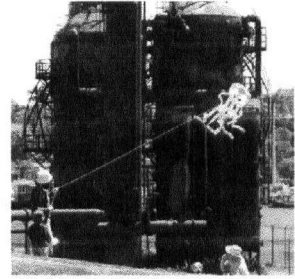


Figure 3.8 Goal6

3.1.6 Goal 6: Deal with the Pre-Existing

Even motorways or industrial wastelands can be filled with a new spirit and can be made worth living by keeping visible the spirit of the existing site.¹¹³

Description: Consider, value, and enhance the site's social, cultural, historical, and environmental pre-intervention conditions. These may vary from remaining structures and infrastructures, to existing biodiversity, to a community within the site or to a larger community concerned about the site.

Rationale: The reuse, restoration and integration of the existing buildings, structures and infrastructures – opposed to its demolition or mere preservation – provides the possibility for reconciliation with an often neglected past, through what Hough suggests as *the opportunity to celebrate past heritage*¹¹⁴ [s5]. This potential reuse of existing structures and infrastructures, economically, reduces demolition, building and developing costs [ec5]. Environmentally, it reduces waste production and resource consumption of construction materials [env10]. Due to the usual high community concern around brownfield interventions, they represent the opportunity to promote community involvement in the decision-making process [s6], which becomes crucial when there is an existing community within the site or risk of gentrification in or around the site. As for the site's pre-intervention environmental conditions, the preservation and increase of green open spaces holds the potential to enrich existing biodiversity [env4], and restore the natural hydrological balance [env2], improving water quality and minimizing the risk of floods, and reducing development costs [ec5].

Objectives:

1. Reuse, restore and integrate existing structures and infrastructures.
2. Engage the community in the decision making process.
3. Preserve and enhance existing biodiversity and green open space.
4. Address the site's former use[s] through design.

¹¹³ Latz+ Partner Landscape Architects, www.latzundpartner.de

¹¹⁴ Hough, Michael, *Cities and natural Process*, Routledge, London and New York, 1995

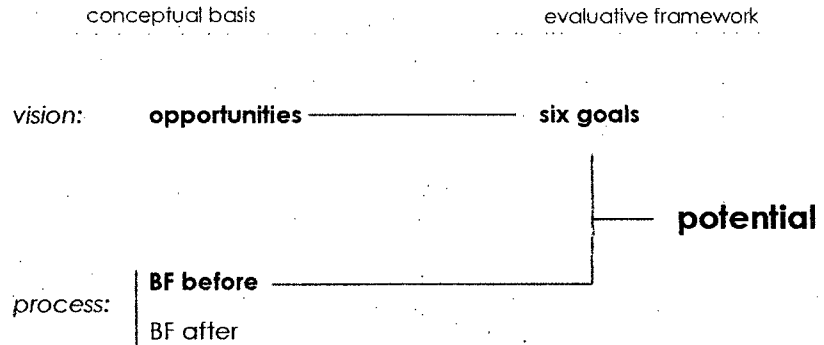


Figure 3.9 Diagram of determining the potential at site scale: bridging a sites' key circumstances before intervention [BF before] to its capacity to fulfill the six goals

3.2 Determining the Potential

3.2.1 Brownfield potential at site and district scales

Before setting out to meet the proposed goals, it seems reasonable to think that, given the vast range of sites, not all brownfields hold the same capacity to accomplish them; that the potential to achieve each of the goals may be hindered or favoured by a site's particular circumstances. The intent behind this section is to address as specifically as possible the potential of brownfield sites to contribute to the city's urban sustainability and quality of life based on their capacity to achieve the goals.

Table 3.2 relates the key site attributes identified in chapter 2 to the proposed six goals, illustrating which conditions are relevant and which are not for the accomplishment of the goals. The connections are based on the findings from the literature and the international brownfield interventions reviewed in Chapter 2 [Figure 3.9]. Further more, within the twelve key site attributes, the table distinguishes the different capacities to fulfill the goals. For instance, within the relevance of location for the achievement of most goals, the table indicates how this potential varies among urban, suburban, and non-urban sites.

With this, Table 3.2 recognizes, beyond the almost exclusive economic point of view revealed in Chapter 2, the potential of certain sites to achieve different opportunities for sustainability articulated through the six goals. It intends to clarify the designer and other stakeholders involved in a brownfield intervention which site attributes or conditions are more relevant to the achievement of the goals. In other words, highlight those aspects of the site where most of its potential to contribute to the city relies.

		Goal 1 LC	Goal2 UI&M	Goal 3 GC	Goal 4 BCC	Goal 5 MIU	Goal6 DwPE
1 Scale	Small [< 10 ha]						
	Medium [10-29 ha]						
	Large [30 ha or >]						
2 Location	Urban						
	Suburban						
	Non-urban						
	Waterfront						
	Railway						
3 Shape	Compact						
	Longitudinal						
4 Former use	Industrial						
	Infrastructure						
5 Structures	Many						
	Few						
	None						
	Heritage						
6 Infrastructures	Many						
	Few						
	None						
7 Contamination	High						
	Low						
	Very low						
8 Biodiversity	High						
	Low						
	Very low						
9 Green open space	High						
	Low						
	Very low						
10 Economic activity	Underused						
	Derelict						
11 Community concern	High						
	Low						
	Very low						
12 Land ownership	Public						
	Private						
	Public & private						

Table 3.2 Determining the potential of brownfield sites.

The potential to achieve each of the six goals may be favoured or hindered by the site's attributes or conditions. The grey lines indicate the relevance of a site's key attributes [left] to its potential to achieve the six goals [above]. The differences in length in the grey lines specify the magnitude of the potential [shorter, less potential; larger, higher potential].

3.2.2 Brownfield potential at metropolitan scale

At a metropolitan scale, in order to set the context of the brownfield reality - in order to approach the challenge and its potential - it is necessary to determine the overall brownfield scale. This requires the sites to be defined, identified, and their area quantified. With the data of a city's total brownfield area, a series of indicators of the brownfield scale can be obtained [Table 3.3]. These are preliminary in that they only refer to brownfield scale, but are useful to define the potential at a metropolitan scale. The first three provide an initial quantification, suggesting the notion of brownfield land as a type of *reserve* land - to accommodate growth, alleviate shrink, or adapt to future uses. The indicators *Brownfield Intensity* and *Brownfield Area per Capita* also allow the comparison of the brownfield situation within different urbanized areas [i.e. cities, regions, or countries].

Mostly for growing cities, the indicator *Greenfield Saving Capacity* illustrates the capacity to accommodate population growth without expanding the city's urbanized footprint over natural areas. The indicator provides a hypothetical area: the area that suburban residential development would occupy with an equivalent residential development to the brownfield area if this were fully developed at an urban density. The hypothetical greenfield area is obtained by first applying the gross residential density of the metropolitan area to the brownfield area, which gives the brownfield area's residential development capacity [in number of dwelling units]. The *Greenfield Saving Capacity* is then obtained by applying a suburban density of 15 uph to the number of dwelling units [equivalent residential development].

While the first four indicators quantify the potential of the reserve land, the fifth one introduces the relation to the rest of urban land uses. The potential of brownfield land depends on the city's particular conditions, such as population trends and social, economic, and environmental circumstances and needs.

Indicators of the Brownfield Scale in a Metropolitan Area

Indicator	Description	Measure
Brownfield Area	Total brownfield area in the metropolitan area	ha
Brownfield Intensity	Percentage of brownfield area over the city's urbanized area	%
Brownfield Area per Capita	Ratio of brownfield area to population, of the metropolitan area	m2
Greenfield Saving Capacity	Area that suburban residential development would occupy with an equivalent residential development to the brownfield area if fully developed at an urban density	ha
Brownfield Area related to Urban Land Uses	Brownfield area related to the urban land uses, such as residential, commercial, industrial, institutional, and transportation.	ha, %

Table 3.3 Metropolitan scale brownfield indicators

For instance, a city may be lacking open spaces, space for economic activities, or, quite commonly, space to accommodate a growing population. Many cities are currently facing urban growth, typically in the form of low density in cities' peripheries. In these cases, brownfield land can be used to accommodate population growth with higher densities in central urban areas, and provide any lacking urban uses complementing existing ones. On the other side, a city may be suffering from depopulation and facing various challenges. The creation of derelict and abandoned land with no money to redevelop it requires innovative concepts, models, and dialogues to alleviate the negative consequences of depopulation. Last, a few examples in Chapter 2 revealed the capacity of this reserve of brownfield land as a means to adapt to urban change, quite valuable for those areas whose future in terms of growth is uncertain, such as the two French examples of Caen's Site Unimetal and Lyon Confluence.

The indicators of the brownfield scale for a specific metropolitan area and its relation to the existing urban land uses, together with an analysis of the city's precise social, economic and environmental circumstances and needs allow to elaborate different scenarios about the potential of brownfield land as reserve land. Following MVRDV's Regionmaker¹¹⁵ planning method of exploring the possibilities of a region by setting four extreme scenarios [Park, Archipelago, Campus, and Network], the scenarios proposed to analyse the types of reuse of brownfield land are three: *Spontaneous*, *Mixed-Use*, and *Park*. The most suitable of the three as for the contribution of the brownfield *reserve* land to the rest of urban land uses to meet its needs, determines the potential of brownfield land in a specific metropolitan area.

Spontaneous scenario

The area is left as it is, in its state of abandonment. This does not require intervention, but the area is left to decay and neglect, and may hopefully but uncertainly self heal naturally over time.

Mixed-Use scenario

The land is reused to accommodate urban growth, including space for residential use, economic activities, amenities and open spaces. The degree of the mixture of uses depends on the city's needs at the moment [i.e. more oriented towards residential use or more towards economic activities].

Park scenario

The land is reused mainly for open space, either as permanent urban parks or as temporary landscapes to adapt to future urban evolution.

Fig. 3.10 illustrates the method in the example of brownfields in downtown Vancouver in the late 1970s.

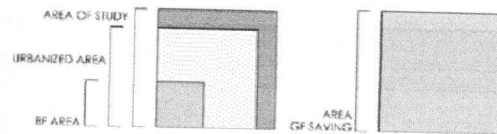
¹¹⁵ MVRDV, The REGIONMAKER / RheinRuhrCity: The Hidden Metropolis, Hatje Cantz, Germany 2002

SETTING THE CONTEXT: HOW MUCH OF AN OPPORTUNITY? DOWNTOWN VANCOUVER CASE STUDY

AREA OF STUDY: 1435 Ha URBANIZED AREA: 1021 Ha

EXISTING 1981 BROWNFIELD SITUATION

BROWNFIELD AREA: 222 Ha
BROWNFIELD INTENSITY: 20%
BROWNFIELD AREA PER CAPITA: 40 m²
GREENFIELD SAVING CAPACITY: 1483 Ha

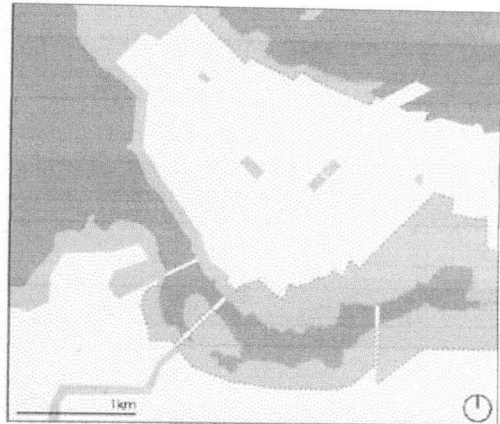


scenario #1:

SPONTANEOUS

The area is left abandoned. Does not require intervention. It is left to decay and neglect, and may self heal naturally over time.

1981	2010
47%	47%
9%	9%
15%	15%
29%	29%

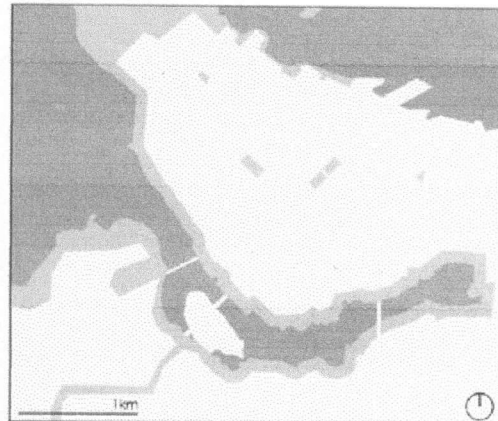


scenario #2:

MIXED-USE

The area is used to accommodate urban growth. The degree of mixture of uses depends on the current urban needs and complements existing uses.

1981	2010
47%	57%
9%	
15%	14%
29%	29%



scenario #3:

PARK

The area is assigned for public open space, either as a permanent urban park or as temporary landscapes to adapt to future urban evolution.

1981	2010
47%	47%
9%	
15%	24%
29%	29%



Figure 3.10 Setting the context: Downtown Vancouver Case Study

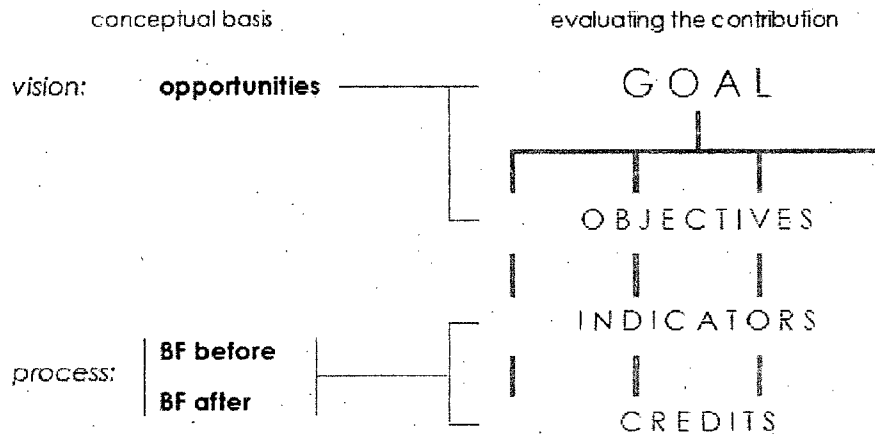


Figure 3.11 Goals, Objectives, Indicators, and Credits diagram

3.3 Evaluating the Contribution: Goals, Objectives, Indicators, and Credits

Shifting the focus from the site to the intervention, the evaluation framework proposed is based on the extent to which the intervention achieves the six goals. With this, it acknowledges its contribution to sustainability and quality of life, and at the same time shows where it could have done better – a valuable lesson for future interventions. For this purpose, each goal, as a broad intention, consists in four more accomplishable objectives, each of which is measured by an indicator and given a poor, moderate, or good credit [Figure 3.11]. Once the four objectives are individually assessed, together, they determine the overall achievement for a goal. Tables 3.4 to 3.9 contain the objectives for each goal, with their respective indicator and credit. When completed, all six results are represented together in a graphic scale that visually communicates the evaluated intervention's strengths, but also its gaps and weaknesses, highlighting the areas for improvement.

Figure 3.11 illustrates how the conceptual basis has informed the development of the evaluation method: While the opportunities identified have led to the goals and their respective objectives, the preliminary brownfield intervention study has determined the indicators and credits, which are based on the physical change of the sites *before* and *after* intervention.

This component of the evaluative framework embodies the core basis for the proposed Brownfield Intervention Sustainability Evaluation Tool. In its development, a series of documents have been consulted about ways to evaluate urban design from a sustainability perspective. The notion of setting a series of goals followed by more specific and measurable objectives was inspired from the document

prepared by the Sheltair Group for the City of Vancouver in 1999, *Visions, Tools and Targets: Environmentally Sustainable Development Guidelines for Southeast False Creek*. The process of establishing some kind of description, indicator or measure, and credit for each objective is related to those in the 2005 draft version of the upcoming *LEED for Neighborhood Developments Rating System (LEED-ND)* and in the *Guide for Sustainable Building in Housing in the Autonomous Community of the Basque Country* published by the Basque Government in 2006.

However, the indicators proposed have been developed specifically for brownfield interventions, addressing the key findings in Chapter 2. The vast majority of indicators are based in the physical analysis of the sites *before* and *after* intervention, evaluating the contribution based on the change they provide. In all, the indicators, and thus the objectives and goals, cover not only the changes that occur at the site scale but also how these affect the larger district scale and ultimately to the city.

The evaluative framework is mainly oriented towards brownfields within urban areas, as both the challenges as the opportunities beyond the site scale are more intense in these locations, and towards mostly built form based interventions. This is due to the intent to respond to the rapid and continuous urbanization of the planet, capitalizing on the capacity of brownfields to accommodate urban growth within already urbanized areas, hence protecting natural areas.

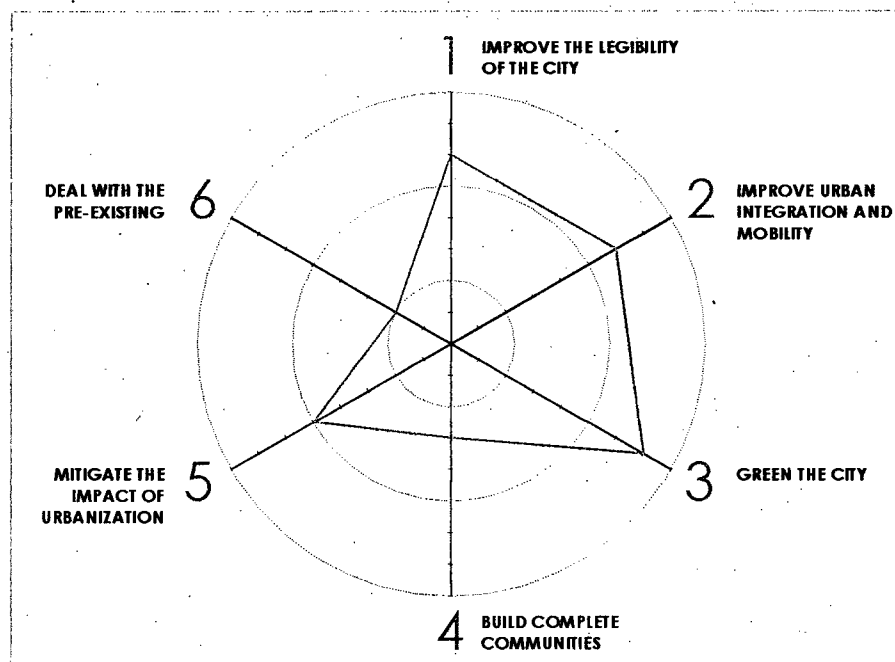


Figure 3.12 Graphic scale for the Six Goals for Brownfield Interventions

Goal 1: Improve the Legibility of the City

1	Objective:	Enhance the existing and surrounding urban fabric	
	Indicator:	Description before and after intervention at neighbourhood scale	
	Credit:	0- Accomplishes the objective poorly; 1-moderately; 2-well	map
2	Objective:	Increase the compactness of the urban fabric	
	Indicator:	Change in gross residential density on the brownfield site in units per hectare [uph]	
	Credit:	0- < 20uph; 1- 20-39uph; 2- ≥ 40uph	map
3	Objective:	Increase the diversity of the urban fabric	
	Indicator:	Change in number of uses within the brownfield site	
	Credit:	0- 0 new uses; 1- 1 or 2 new uses; 2- 3 or more new uses	map
4	Objective:	Reveal the area's site specific natural features	
	Indicator:	Description before and after intervention at neighbourhood scale	
	Credit:	0- Accomplishes the objective poorly; 1-moderately; 2-well	map

Table 3.4 Goal 1: Objectives, Indicators, and Credits

Goal 2: Improve Urban Integration and Mobility

1	Objective:	Enhance the existing and surrounding street network	
	Indicator:	Description before and after intervention at neighbourhood scale	
	Credit:	0- Accomplishes the objective poorly; 1-moderately; 2-well	map
2	Objective:	Enhance the existing and surrounding pedestrian network	
	Indicator:	Description before and after intervention at neighbourhood scale	
	Credit:	0- Accomplishes the objective poorly; 1-moderately; 2-well	map
3	Objective:	Enhance the existing and surrounding transit network	
	Indicator:	Change in transit affecting the site and the surrounding area within 400m	
	Credit:	0- no change; 1- bus / more frequency; 2- train, tram, subway / more frequency	map
4	Objective:	Promote other non-motorized modes of transportation	
	Indicator:	Existence of bikeways	
	Credit:	0- no; 1- yes, but only on the site; 2- yes, and connected to a broader network	map

Table 3.5 Goal 2: Objectives, Indicators, and Credits

Goal 3: Green the City

- 1 **Objective:** **Improve the environmental quality of public open space**
Indicator: Description of state of contamination and use for public open space [POS] or green POS
Credit: 0- contamination remediated; 1- 0+ use for POS; 2- 0+ use for GPOS [urban park] map
- 2 **Objective:** **Increase the quantity of green open space**
Indicator: Change in percentage of BF site destined to green public open space
Credit: 0- < 15%; 1- 15-29%; 2- ≥30% map
- 3 **Objective:** **Improve the accessibility to green public open space**
Indicator: Change in percentage of dwelling units within 5 min. walking distance [400m] to GOS ≥1ha at a neighbourhood scale [on the BF site and the surrounding area within 500m]
Credit: 0- < 0% [negative value]; 1- 0-19%; 2- ≥20% map
- 4 **Objective:** **Include other environmental features**
Indicator: Number of features and description [i.e. recycling facilities, composting, urban agriculture]
Credit: 0- none; 1- 1 feature; 2- >1 feature map/site image

Table 3.6 Goal 3: Objectives, Indicators, and Credits

Goal 4: Build Complete Communities

- 1 **Objective:** **Increase housing availability**
Indicator: Percentage of change in number of dwelling units at a neighbourhood scale [on the brownfield site and the surrounding area within 400m]
Credit: 0- <10%; 1- 10-19%; 2- ≥20% map
- 2 **Objective:** **Increase housing affordability and social integration**
Indicator: Change in percentage of social/affordable housing on the brownfield site
Credit: 0- <15%; 1- 15-49%; 2- ≥50% map
- 3 **Objective:** **Improve accessibility to services and amenities**
Indicator: Number of new services and amenities at neighbourhood scale [on the brownfield site and the surrounding area within 400m]
Credit: 0- 0; 1- 1; 2- >1 map
- 4 **Objective:** **Encourage economic revitalization**
Indicator: Change in gross intensity of economic activity as ratio of floor area to brownfield site area
Credit: 0- <0.04; 1- 0.04-0.07; 2- ≥0.08 map

Table 3.7 Goal 4: Objectives, Indicators, and Credits

Goal 5: Mitigate the Impact of Urbanization

1	Objective:	Reduce brownfield land in the metropolitan area	
	Indicator:	Percentage of change in brownfield land in the metropolitan area	
	Credit:	0- <1%; 1- 1-9%; 2- ≥10%	map/chart
2	Objective:	Reduce pressure on greenfield development; "greenfield saving"	
	Indicator:	Ratio of "Greenfield [GF] Saving" to area of brownfield site ["GF Saving" obtained by applying a suburban density of 15uph to the number of new dwelling units]	
	Credit:	0- <2; 1- 2-4; 2- ≥5	chart
3	Objective:	Reduce contaminated soil in the metropolitan area	
	Indicator:	Percentage of on-site remediation of the brownfield site's contaminated soil	
	Credit:	0- <20%; 1- 20-80%; 2- ≥80%	chart
4	Objective:	Include green building practices	
	Indicator:	Existence of Green Building Practices or Standards	
	Credit:	0- none; 1- in specific buildings; 2- Green Building Standards for all intervention	images

Table 3.8 Goal 5: Objectives, Indicators, and Credits

Goal 6: Deal with the Pre-Existing

1	Objective:	Reuse and integrate existing structures and infrastructures	
	Indicator:	Number of existing buildings, structures, and infrastructures reused/restored	
	Credit:	0- none; 1- 1,2; 2- ≥3	map, images
2	Objective:	Engage the community in the decision-making process	
	Indicator:	Type of public participation events [i.e. charrettes, workshops, forums]	
	Credit:	0- conventional process; 1- participatory events but not to be implemented; 2- participatory events to be implemented	chart, drawings from events
3	Objective:	Preserve and enhance existing biodiversity and green open space	
	Indicator:	Same credit as 3.2 [Change in percentage of BF site destined to green open space] as long as the new green open space includes the existing	
	Credit:	0- < 15%, or green open space not including the existing; 1- 15-29%; 2- ≥30%	map
4	Objective:	Address the site's former use[s] through design	
	Indicator:	Description/Number of references to the former use[s] in site and building designs	
	Credit:	0- Accomplishes the objective poorly/no references; 1- moderately/few; 2- well/many	site images

Table 3.9 Goal 6: Objectives, Indicators, and Credits

4. CASE STUDY

Urban Recycling I Reviving in Bilbao

This chapter presents the city of Bilbao, in the Basque Country, Spain, as a case study of a European middle size city with a significant industrial footprint that has experienced urban revitalization – that has *revived* - largely due to a series of brownfield interventions over the last decade. Using the evaluative framework developed in Chapter 3, it studies four major brownfield interventions in the metropolitan area. The physical analysis of the sites before and after intervention illustrates how the reclamation of brownfields for urban activity – a figurative *urban recycling* - plays an important role in enhancing the sustainability and quality of life of the city, both at the site scale as well as to the city as a whole.



Figure 4.1 Urban Recycling I Reviving in Bilbao: Abandoibarra, Galindo, Ametzola, Zorrotzaurre before and after

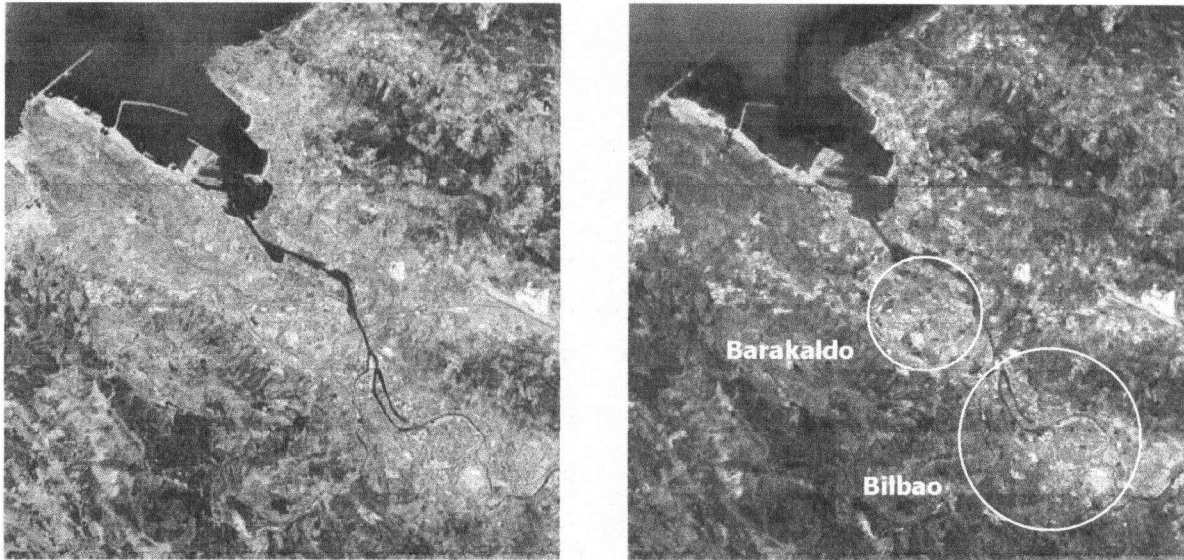


Figure 4.2 Bilbao Metropolitan Area

4.1 Context: Brownfields in the Bilbao Metropolitan Area

Situated in the Basque Country, in northern Spain, the Bilbao metropolitan area holds a population of 900,000 people in an area of 50,000 ha. This represents more than 40% of the total population of the Basque Country in 7% of its total area¹¹⁶. As the aerial images in Figure 4.2 illustrate, it is a geographically constrained area tightly linked to its river, the Nervion. As a result, urban development has taken place along the river shores, in the valley, in a relatively dense form, especially when compared to North American standards. The overall gross dwelling density for the metropolitan area is 64 units per hectare. However, the municipalities of Bilbao and Barakaldo, where the major brownfield interventions are taking place, present higher gross densities of over 100 uph, of 117 and 106 uph respectively.

The city's urban development throughout history, since its foundation in the year 1300, has been linked to the Nervion River and the economic activity it has provided ever since. Following the industrial revolution, shipbuilding and steel and iron industries along the riverbanks linked to the nearby mines generated intense economic activity, a dense railroad system, and enormous population growth. Due to its specialization in heavy industry, the European industrial crisis in the 70s and 80s was especially acute in Bilbao, facing a situation of used-up mines and abandoned industries and railroad layouts [Fig. 4.3].

¹¹⁶ UDALPLAN 2005, Información de la Zonificación General del Suelo residencial, Actividades económicas y Sistemas Generales, Departamento de Ordenación del Territorio y Medio Ambiente, Eusko Jaularitza - Gobierno Vasco, 2005

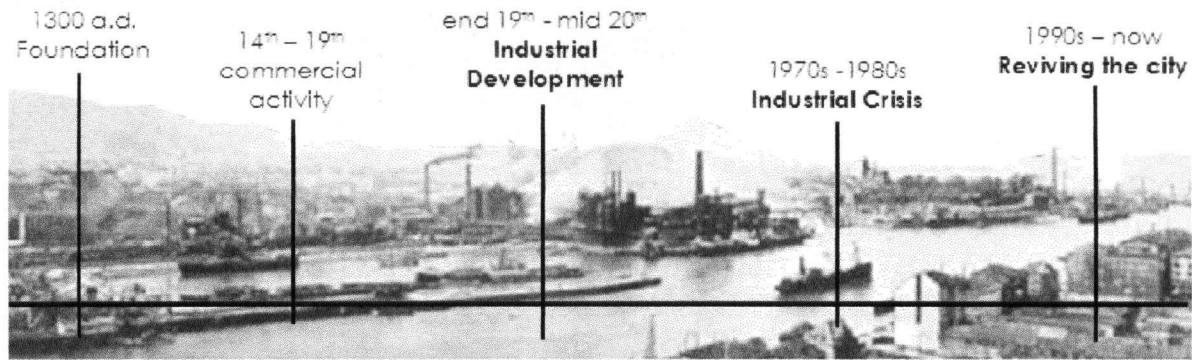


Figure 4.3 Bilbao Metropolitan Area historical timeline

Over the last decade, the city has experienced an enormous urban transformation through the reuse of the former industrial and railroad sites and the transfer of harbour activities to the outer bay. It has reclaimed its waterfront and consequently the river, once the expression of strong industrial success followed by neglect and decay, now represents the city's new identity, providing public open spaces and new neighbourhoods and business areas.

The Planning Approach: Brownfields as Opportunity

There are two planning initiatives towards the new urban model that were highly relevant in the city's transformation. Both took place in the industrial crisis context of the 1980s. At a municipal level, a new City Plan [Plan General de Ordenación Urbana] was developed between 1985 and 1995. Pursuing the shift from the industrial-based model in crisis to a service- mixed-use one, its main and most relevant proposal was the understanding of the existing large obsolete sites as an opportunity rather than an obstacle¹¹⁷. The sites would be used to restructure the city and its uses to alleviate the deficiencies from the former period. At the same time and at a metropolitan scale, between 1989 and 1992 the Revitalisation Plan for Metropolitan Bilbao was developed, and the Association Bilbao Metropoli 30 was formed in 1991 to launch and drive the revitalization process. It presently carries out planning, research and promotion projects through public-private partnerships¹¹⁸.

But perhaps the most innovative decision at this point in time was the creation of the fully public company Bilbao Ria 2000 in 1992 to undertake and execute the process. Funded fifty-fifty by the central Spanish and Basque regional authorities, with support from the European Union, the company is composed of national, regional, provincial and municipal authorities, which is not a conventional model for Spain. The organization has no jurisdictional power but is powerful because its Board of Trustees

¹¹⁷ Madrazo, Julia, Bilbao City Hall, *La península de Zorrozaurre: Previsión y objetivos, conexiones con otros barrios, in Foro para un Zorrozaurre Sostenible* [Forum for a Sustainable Zorrozaurre: book] Ed. La Haceria, Bilbao, 2004

¹¹⁸ Bilbao Metropoli 30, Association for the Revitalisation of Metropolitan Bilbao, 2006

includes local politicians committed to the implementation plan¹¹⁹. Since 1992 and up to date, the company coordinates and executes projects in relation to town planning, transportation and the environment, focusing on the urban directives drawn up by the planning authorities¹²⁰. It is in charge of the recovery of former industrial spaces around the city, of the transformation and recovery of the city's industrial sites for urban use. With a strategy rooted in environment, infrastructure, culture and employment, the initial idea was to start with significant public investment so that the new Bilbao would be presented to private investors¹²¹. According to the company, a key part of the process has been demonstration projects¹²² related to infrastructures [i.e. subway, harbour, airport and new bridges] and cultural amenities [i.e. Guggenheim Museum and Euskalduna Convention Centre].

Defining and Identifying the Brownfield Reality

As part of the strong public compromise, a regional agency was set up to deal with the soil and water contamination. The Basque Government set up a brownfield reclamation program [Programa de Demolición de Ruinas Industriales], and the first study-inventory was developed by IHOBE, the Public Society for Environmental Management, in 1998. As the term *brownfield* does not exist *per se* in Spanish, the study addressed the sites resulting from the industrial crisis as *Industrial Ruins*. Differentiating them from other contaminated sites such as wastelands, Industrial Ruins have been defined as *'the sites, built or not, that having participated in an industrial activity are degraded in such way that a new use is not possible but through a thorough work of recovery'*¹²³. The study-inventory identified 331 hectares of Industrial Ruins in 159 sites in the Bilbao Metropolitan Area in 1998. This consisted in 72% of the total Industrial Ruin area of the Basque Country. By 2005, 36 of the sites in the Bilbao Metropolitan Area have been intervened, liberating 128,67 ha of industrial ruins, over a third of the area identified in 1998 for the metropolitan area¹²⁴.

¹¹⁹ Waterfront Regeneration Trust, Bilbao's waterfront Redevelopment Strategy in The Nature of Possibility, International Brownfields Exchange (1998-1999), pp. 48-49, Waterfront Regeneration Trust, Canada, 1999

¹²⁰ BILBAO Ria 2000, Public Company Responsible for the Urban Regeneration of Metropolitan Bilbao, 2006

¹²¹ Otaola Ubieta Pablo, Director General of Bilbao Ria 2000 from 1993 to 2000, Reconnecting Ecology, Economy and Community in Redeveloping Brownfields: A Different Conversation, Proceedings of an International Symposium (April 7-8, 1998) pp.32-33, Waterfront Regeneration Trust, Canada, 1998

¹²² Waterfront Regeneration Trust, Bilbao's waterfront Redevelopment Strategy in The Nature of Possibility, International Brownfields Exchange (1998-1999), pp. 48-49, Waterfront Regeneration Trust, Canada, 1999

¹²³ Author's translation of the definition of *Industrial Ruin* in Estudio-Inventario de las Ruinas Industriales en la Comunidad Autónoma Vasca [Study-Inventory of Industrial Ruins in the Basque Autonomous Community], in Guía Técnica de Criterios Ambientales para la Recuperación de Ruinas Industriales [Technical Guide of Environmental Criteria for the Reclaiming of Industrial Ruins], document prepared by IHOBE Public Society for Environmental Management for the Basque Government, 1998

¹²⁴ Gobierno Vasco, Departamento de Ordenación del Territorio y Medio Ambiente [Basque Government, Department of Land Use Planning and the Environment], Ruinas Industriales [Industrial Ruins], 2005

Bilbao Metropolitan Area Indicators of Brownfield Scale

The indicators of brownfield scale have been applied to explore the potential at a metropolitan scale. Using the data for the total metropolitan area as from when the sites were identified, in 1998, the indicators of brownfield scale and the three scenarios give a preliminary idea about the quantity and potential for the future of the city at the time, in terms of reducing pressure on greenfield sites and possible contribution to the rest of urban land uses [Figure 4.4]. As the sites are generally urban, in high-density contexts, their reuse to accommodate urban development instead of at lower densities in the cities periphery, would result in a greenfield saving capacity of over four times more land. As for the contribution to the rest of urban land uses through the scenario-based model, the framework, at this scale, does not reflect the full potential of the sites, as it does not consider the location of the sites or the geography of the region. These are two critical factors in the determination of the potential of brownfields in this particular metropolitan area, where most sites are located along the riverfront and/or in core urban areas, and where urban growth is not permitted in most of its natural area.

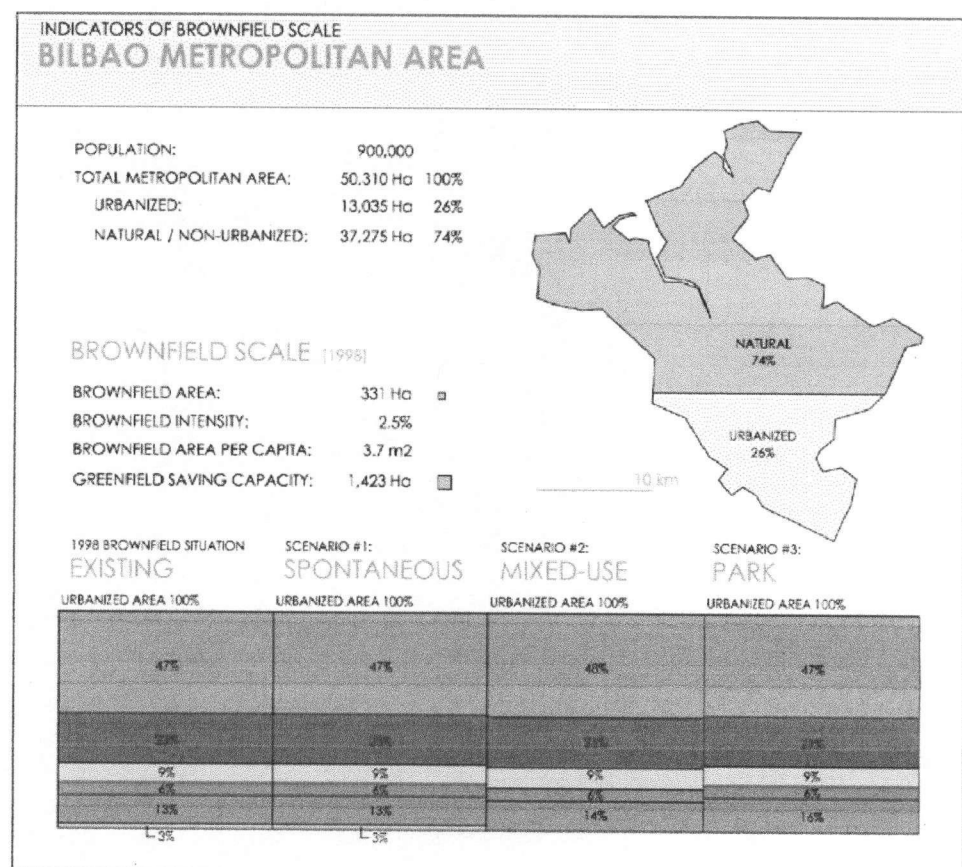


Figure 4.4 Bilbao Metropolitan Area 1998 indicators of brownfield scale. Urban Land Uses Legend: Orange: Residential; Red: Economic Activities [Commercial, Office, Industrial]; Light Blue: Amenities, Institutions, and Public Services; Dark Blue: Transport and Communication; Green: Open Spaces; Grey: Brownfields [Industrial Ruins]

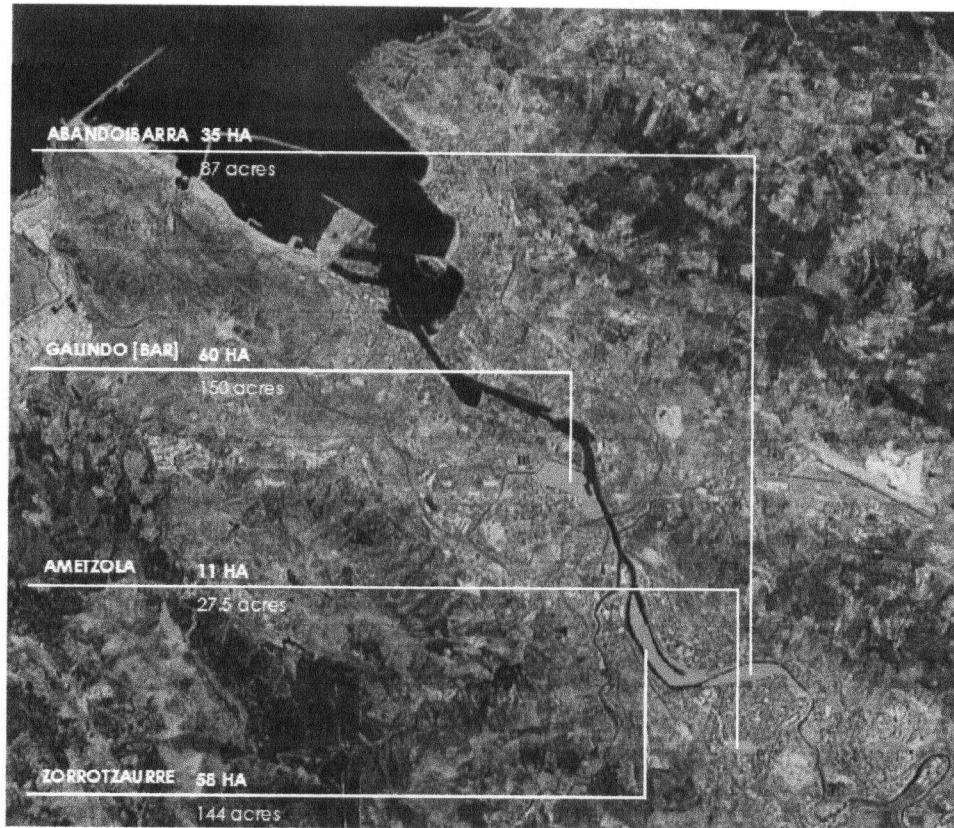


Figure 4.5 Four major brownfield interventions in the Bilbao Metropolitan Area

4.2 Case Studies: Abandoibarra, Galindo, Ametzola, Zorrotzaurre

The major brownfield interventions that have taken place since the revitalization process started are four mixed-use neighbourhoods, yet distinct in scale and character: Abandoibarra, the most famous one, due the Guggenheim Museum, an example of *waterfront reclaimed and image remade*; Galindo, in the municipality of Barakaldo, *overcoming the deficiencies from the past*; Ametzola, the smallest of the four, a case of *connecting and greening at a district scale*; and, last, Zorrotzaurre, still in the planning process, *future intervention in an inhabited site*.

This section explores each of the interventions looking at the sites before and after intervention, and evaluating the contribution to urban sustainability and quality of life according to the evaluation framework proposed. Appendix III includes the evaluation sheets for all four interventions.

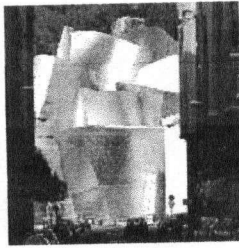


Figure 4.6 Abandoibarra brownfield intervention

4.2.1 Abandoibarra: Waterfront Reclaimed & Image Remade

Abandoibarra before: The area of Abandoibarra, in basque “the shore of Abando” [the city’s central district], is located along the southern bank of the Nervion River, right in the city core. It was once home of a strong shipbuilding industry in the region and of harbour activities linked to the railroad. As access to the river had been exclusively for former industrial activity, the city fabric had consequently developed as physically detached from the river, with no relation to it except through a series of bridges [Fig. 4.7].

Abandoibarra After: Due to its central location and scale, the area is now intended to become the new city centre that integrates the city core with the riverfront. This long-term process began in 1998 and continues presently, but the city is already able to reach the riverfront through a new street network, bikeways, tramline, and new bridges and pedestrian walkways connecting the two shores. Including the Guggenheim Museum, which has become the city’s international icon, Abandoibarra represents a compact, diverse and open expansion of the city through a mix of uses consisting in institutional / public buildings [two museums, a convention centre and two University buildings], office and residential buildings, a hotel, a shopping mall, and a large amount of reclaimed public open space [Fig. 4.7].

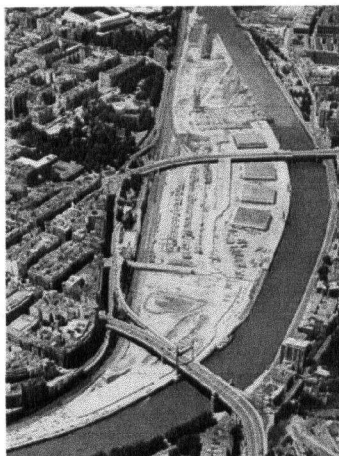


Figure 4.7 Aerial images of Abandoibarra *before* and *after*

		Goal 1 LC	Goal2 UI&M	Goal 3 GC	Goal 4 BCC	Goal 5 MIU	Goal6 DwPE
1 Scale	35 ha						
2 Location	urban; waterfront						
3 Shape	longitudinal						
4 Former use	industrial						
5 Structures	many						
6 Infrastructures	few						
7 Contamination	high						
8 Biodiversity	very low						
9 Green open space	very low						
10 Economic activity	derelict						
11 Comm. concern	high						
12 Land ownership	public						

Table 4.1 Abandoibarra *before* brownfield potential

Potential and contribution to urban sustainability and quality of life

The framework developed in Chapter 3 has been applied to Abandoibarra to determine the site's potential and evaluate the brownfield intervention's contribution to the city. In terms of the potential, the site's scale, shape, and strategic location [in terms of being right in the city core and on the waterfront] were the major challenge for the city, denying its access to the river. At the same time, these were its most significant potential to enhance the surrounding areas [Table 4.1].

In terms of the actual contribution of Abandoibarra to urban sustainability and quality of life, as for the plan for the complete intervention, the following is a summary of the evaluation based on the extent to which it achieves the six goals. Appendix III includes the full evaluation using the goals, objectives, indicators, and credits developed in the previous chapter, supported with maps, diagrams, and images.

Goal 1: Improve the Legibility of the City [1 LC]

Abandoibarra completes the surrounding urban fabric, revealing the waterfront through a variety of open spaces [Figure 4.9]. It increases the diversity of the urban fabric providing new uses to the surrounding neighbourhoods [Figure 4.10].

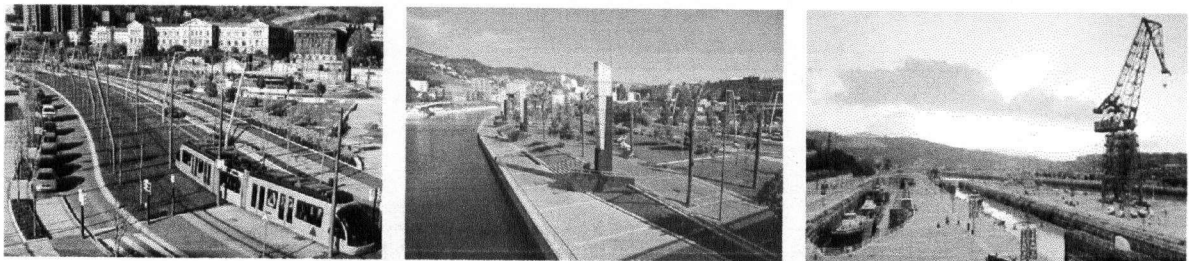


Figure 4.8 Transit networks, reclaimed public open spaces, and integration of the past

Goal 2: Improve Urban Integration and Mobility [2 UI&M]

The intervention has favoured alternative modes of transportation to the car by enhancing the pedestrian networks both with the city core as with the shore in front through three new bridges [two pedestrian only]. Although the whole area is within walking distance to the subway, it has introduced a new tram service throughout the site, as well as bike lanes along the river shore [Fig. 4.8, diagrams in Appendix III].

Goal 3: Green the City [3 GC]

Through a waterfront park [Figure 4.8], two smaller parks, and the extension of an existing one, the intervention provides a third of the site for green public open space [33%, 115,714m²], improving the quantity and accessibility to it to the whole district.

Goal 4: Build Complete Communities [4 BCC]

Abandoibarra has significantly increased accessibility to new amenities and services such as museums, convention centre, and university facilities [Fig. 4.10, in blue]. By providing a total of 115,000m² for economic activities it has strongly encouraged the economic revitalisation of the area [Figure 4.10, commercial use in red and office use in purple]. The new uses introduced affect not just the site but

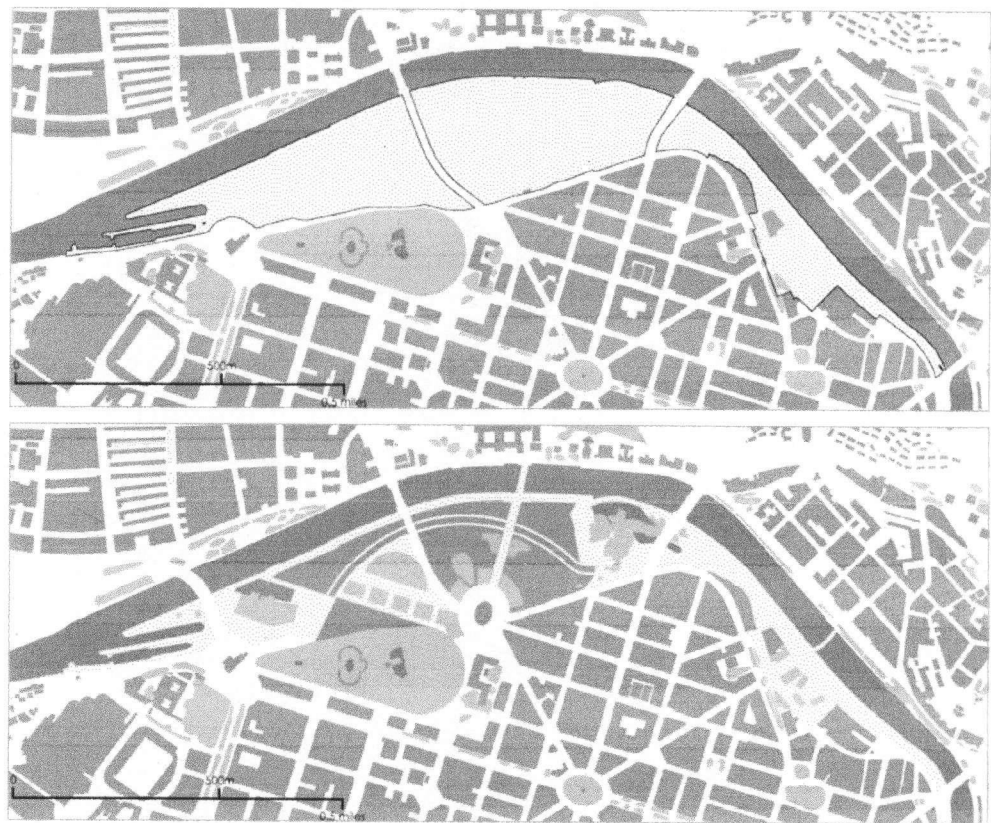


Figure 4.9 Plan of Abandoibarra *before* and *after*: completing the urban fabric and revealing the waterfront

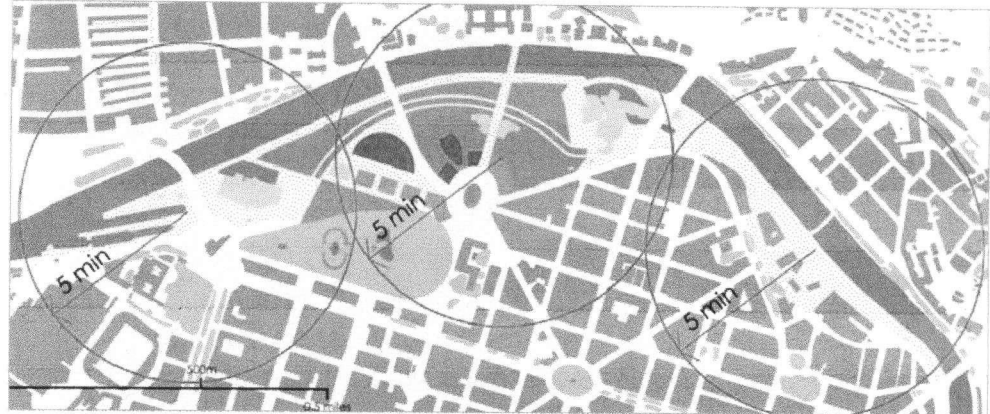


Figure 4.10 Abandoibarra *after*: new uses and walking distances

beyond it, to the existing areas within walking distance to the site [Fig. 4.10]. However, the few housing proposed [600 units, gross density 17uph] and none affordable units hinders its achievement of this goal.

Goal 5: Mitigate the Impact of Urbanization [5 MIU]

Mitigating the impact of urbanization seems to be Abandoibarra's weakest point. This is due to the low number of housing, which hinders its ability to reduce pressure on greenfield development, and to the absence of specific information on soil remediation or green building practices.

Goal 6: Deal with the Pre-Existing [6 DwPE]

The wharves once used for shipbuilding have been reclaimed for public use, and, of the many pre-existing structures, one crane has been preserved and integrated in the public realm [Fig. 4.8, right]. Other than these, the facades of both the new Convention Centre and the Guggenheim Museum somewhat allude to the site's former industrial use.

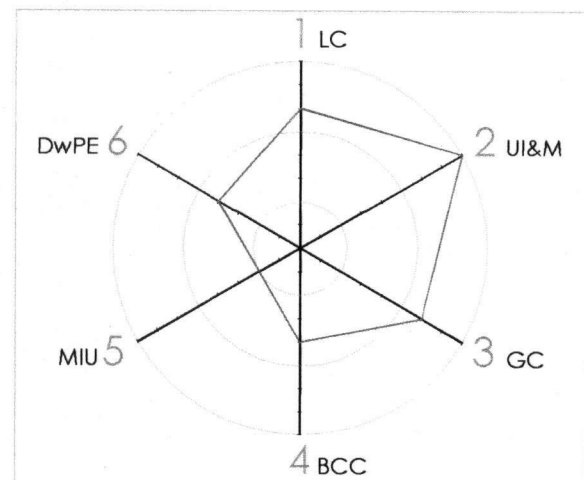


Figure 4.8 Abandoibarra evaluation diagram

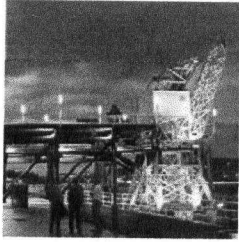


Figure 4.12 Galindo [Barakaldo] brownfield intervention

4.2.2 Galindo [Barakaldo]: Overcoming the Deficiencies from the Past

Galindo before: Further north down the river, in the municipality of Barakaldo, the 60-hectare site is named for its location, where the Galindo River meets the Nervion River. Once home of a highly relevant iron and steel industry in the Basque Country, Altos Hornos de Vizcaya [AHV], the site represented the 'boom to bust – and neglect', so common in many brownfield sites. Also and as in Abandoibarra, the site denied the city access to the riverfront, first by industrial activity and later by its remains.

Galindo after: The intervention process began in 1998, seeking to bring Barakaldo to the waterfront and provide a series of amenities and services to the city that the former rapid growth period had not been able to supply. The intervention, partially completed, consists in a mix of uses including 2,200 new dwelling units, amenities and civic uses, office and commercial space, and a variety of parks and open spaces. It has provided lacking and needed amenities, integrated city and waterfront, and shows interesting examples of integrating past and present.

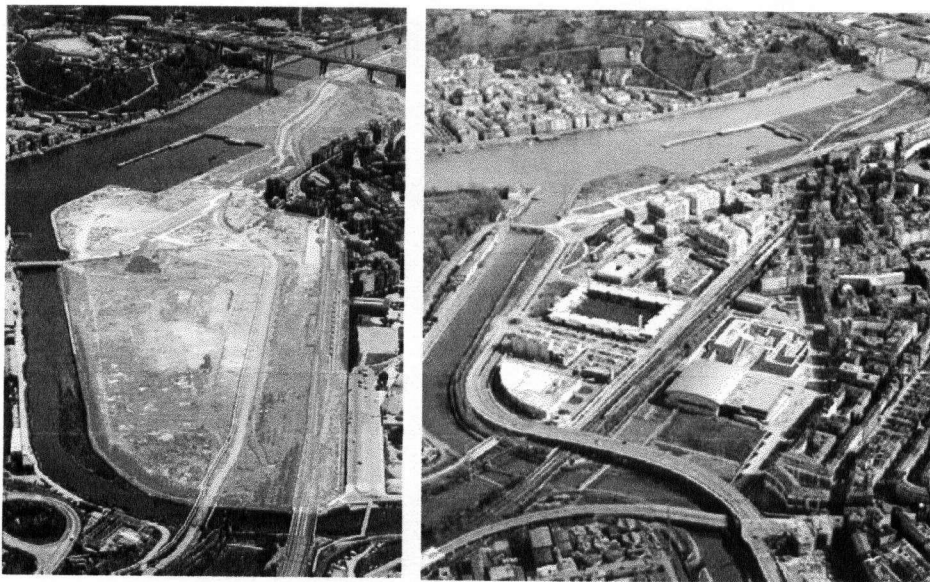


Figure 4.13 Aerial images of Galindo [Barakaldo] *before* and *after*

		Goal 1 LC	Goal2 UI&M	Goal 3 GC	Goal 4 BCC	Goal 5 MIU	Goal6 DwPE
1 Scale	60 ha						
2 Location	urban; waterfront						
3 Shape	compact						
4 Former use	industrial						
5 Structures	few						
6 Infrastructures	many						
7 Contamination	high						
8 Biodiversity	very low						
9 Green open space	very low						
10 Economic activity	derelict						
11 Comm. concern	high						
12 Land ownership	public						

Table 4.2 Galindo [Barakaldo] *before* brownfield potential

Potential and contribution to urban sustainability and quality of life

Similar to Abandoibarra in that it is right between a city core and the waterfront, but almost twice as large, the site's scale and location were once its major challenge, and at the same time, as Table 4.2 shows, its major potential to contribute to the surrounding area. Having been home of a once highly significant industry in the region's industrial boom and containing a few structures related to it, the site presented the opportunity to deal with the pre-existing and provide a reconciliation with a decayed past. As for the contribution, explained below is Galindo intervention's achievement of the six goals. The full evaluation is included in Appendix III and is based on the plan for the complete intervention.

Goal 1: Improve the Legibility of the City [1 LC]

The images and plans of the site *before* and *after* intervention [Figures 4.13, 4.14] show Galindo's contribution to the existing urban fabric. It extends the dense city fabric to both river shores in a relatively less dense form that introduces lacking open spaces and services.

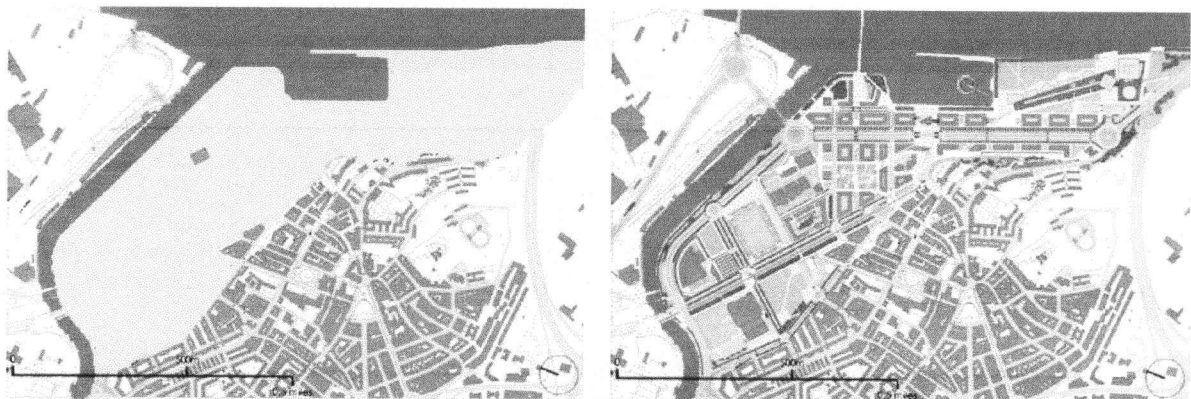


Figure 4.14 Plan of Galindo *before* and *after*: reaching the water through the extension of the urban fabric



Figure 4.15 Variety of green open spaces in Galindo [Barakaldo]

Goal2: Improve Urban Integration and Mobility [2 UI&M]

New streets already continue and complete the existing, and a new train station will improve transit mobility and increase transportation options to both Galindo and Barakaldo's city core [Fig.4.16, blue]. A new bikeway connects Barakaldo's existing network to a broader 30km long one along the Nervion River's south shore [Fig.4.16, red].

Goal 3: Green the City [3 GC]

Galindo provides 200,000m² of green public open space through a variety of parks and open spaces [33% of the site]. These include two riverfront parks along the Galindo and Nervion Rivers and a more recreational one close to the sports complex [Fig. 4.15 left to right]. Figure 4.17 [right] shows a detail of the smaller and more enclosed park of Plaza Desierto. With these, Galindo has provided accessibility to green open space within walking distance to over 4,000 existing homes [Fig. 4.16 and Appendix III].

Goal 4: Build Complete Communities [4 BCC]

Responding to the city's needs, Galindo provides a mix of residential, civic, commercial, and office use, alleviating the larger area's deficiencies derived from the past rapid growth. Although with a density lower than its context's [37 uph versus 107 uph of gross residential density], the new neighbourhood provides 2,200 new dwelling units, 525 of these assigned for affordable housing. New amenities [Figure

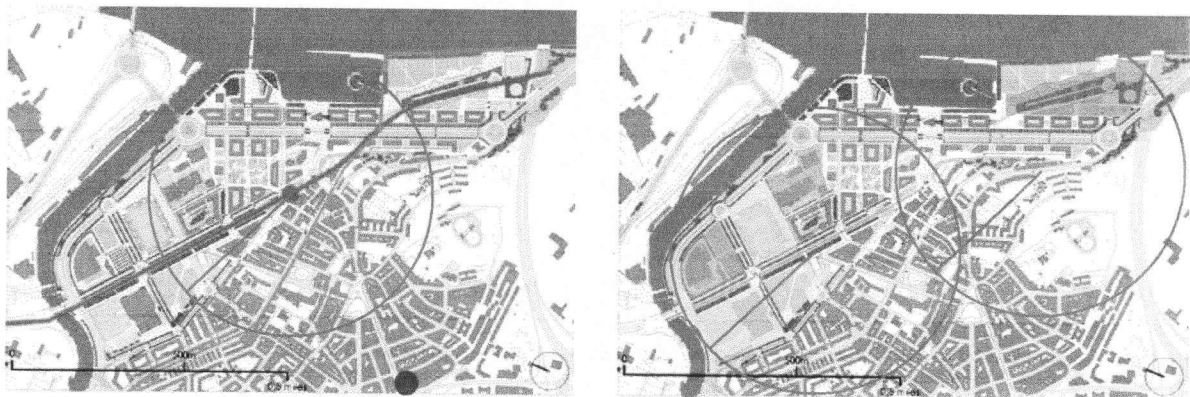


Figure 4.16 Galindo [Barakaldo] *after*: integration and mobility [left] and new uses [right] within walking distances

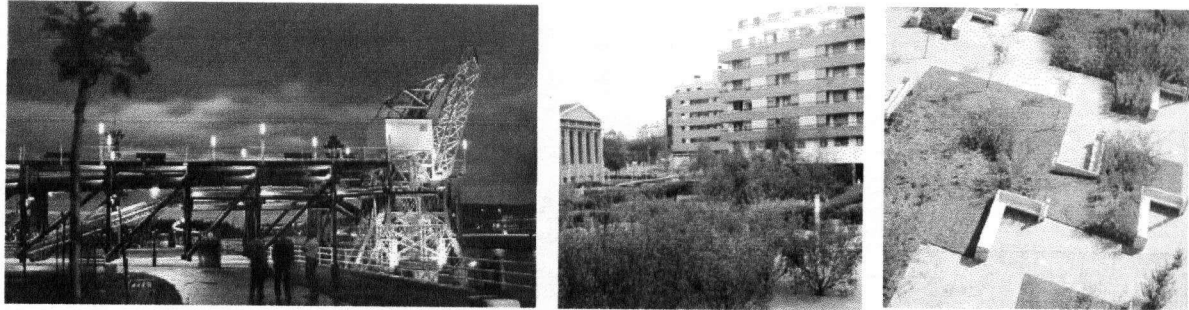


Figure 4.17 Galindo [Barakaldo]: Dealing with the Pre-Existing by integrating past and present

4.16, blue] include a new soccer field, a sports centre, a community centre and an institutional building. A business area and a shopping and leisure area by the riverbank provide space for economic activities [Fig. 4.16, commercial use in red and office use in purple].

Goal 5: Mitigate the Impact of Urbanization [5 MIU]

Although Galindo reclaims 60 hectares of brownfield land, similarly to Abandoibarra, the lack of on-site soil remediation practices and green building standards result in this goal as its weakest point.

Goal 6: Deal with the Pre-Existing [6 DwPE]

Several industrial structures have been restored as monuments to the region's industrial past: a former AHV building is now the headquarters of a public business development initiative [Fig. 4.17, middle]; the riverside promenades host the Portu Wharf, formerly the AHV dock-side [Fig.4.15, middle]; and a restored ore loading facility is a homage to decades of local mining and at the same time a lookout over the river [Fig. 4.17, left]. Plaza Desierto [Fig. 4.17, right] integrates materials referring to the site's former industrial activity with others referring to the site's new residential use.

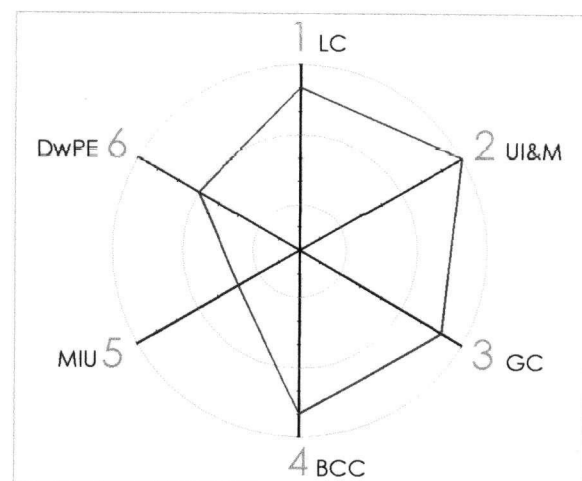


Figure 4.18 Galindo [Barakaldo] evaluation diagram

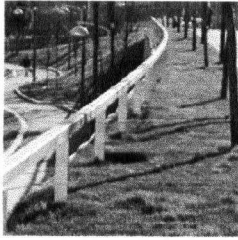


Figure 4.19 Ametzola brownfield intervention

4.2.3 Ametzola: Connecting and Greening at a District Scale

Ametzola before: The smallest of the three, this 11-hectare site was previously used by the railroad system, hosting three rail-freight stations. Located on the southern edge of the city core, the site represented a physical barrier between the surrounding neighbourhoods.

Ametzola after: As Abandoibarra and Galindo, the intervention started in 1998. Due to its smaller scale it is almost fully completed, currently covering the last remaining visible sections of railroad tracks. the intervention has transformed the site into a residential area that has brought the adjacent districts together through a 36,000m² urban park, a connected street system, and a new transit network.

Potential and contribution to urban sustainability and quality of life

A series of this site's features, such as its smaller scale, compact shape, few structures, basically only rail infrastructures, etc. suggest the potential to contribute to the city's sustainability and quality of life is somewhat lower than in the other three [Table 4.3]. Nevertheless, Ametzola represents a fine case of connecting and greening at a district scale. Appendix III includes the full evaluation.

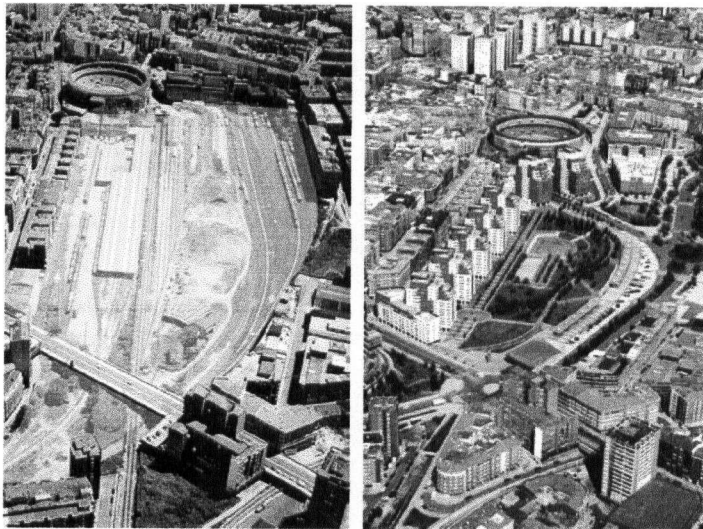


Figure 4.20 Aerial images of Ametzola *before* and *after*

		Goal 1 LC	Goal2 UI&M	Goal 3 GC	Goal 4 BCC	Goal 5 MIU	Goal6 DwPE
1 Scale	11 ha						
2 Location	urban						
3 Shape	compact						
4 Former use	infrastructure						
5 Structures	few						
6 Infrastructures	few						
7 Contamination	low						
8 Biodiversity	very low						
9 Green open space	very low						
10 Economic activity	underused						
11 Comm. concern	low						
12 Land ownership	public						

Table 4.3 Ametzola *before* brownfield potential

Goal 1: Improve the Legibility of the City [1 LC]

Through a compact residential development, Ametzola has provided a large accessible open space that grants a spatial understanding of the site's larger context through a break in the urban fabric and views to the surrounding mountains [Figures 4.21 and 4.22].

Goal 2: Improve Urban Integration and Mobility [2 UI&M]

Ametzola's major strength in this goal relates to how the railroad tracks have been covered and adapted for passenger use, with a new railway station that guarantees efficient transit connection with the rest of city and enhances the reclamation of the use of the train.

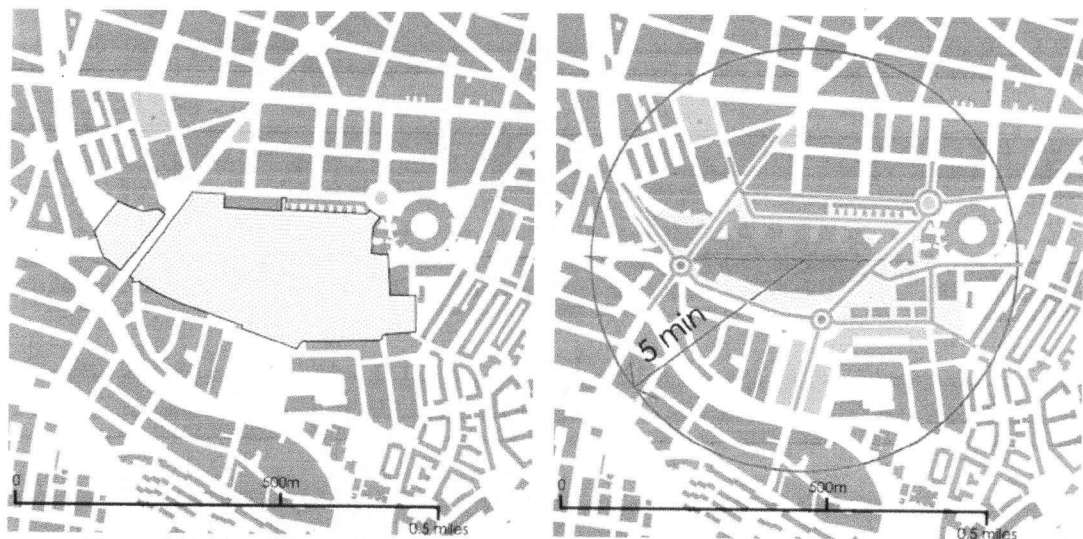


Figure 4.21 Plan of Ametzola *before* and *after*: new uses, street connections, and walking distance



Figure 4.22 Ametzola park, housing, and passenger train station

Goal 3: Green the City [3 GC]

The plans of the area before and after intervention [Fig. 4.21] highlight Ametzola's contribution to green the city, as this was a major need for the whole district. The 36,000m² urban park has provided accessibility within walking distance to a large green public open space to 4,500 existing dwelling units.

Goal 4: Build Complete Communities [4 BCC]

Basically residential, Ametzola is planned to house 900 new dwelling units in high-density residential buildings overlooking the park. Although all new housing is located within walking distance to existing commercial and office space in the area, its single use character hinders its achievement of this goal.

Goal 5: Mitigate the Impact of Urbanization [5 MIU]

Despite its moderate performance, Ametzola's major contribution in this goal relates to reducing pressure on greenfield land. Through a high-density development of 82uph it has "saved" five times as much greenfield land compared to the same housing development in the periphery at lower densities of 15uph.

Goal 6: Deal with the Pre-Existing [6 DwPE]

Likewise, Ametzola's major strength in this goal is the reclamation of the train for passenger use.

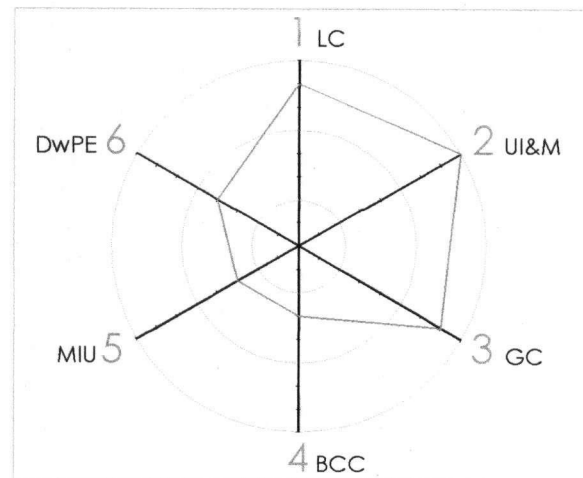


Figure 4.23 Ametzola evaluation diagram

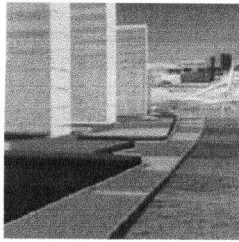


Figure 4.24 Zorrotzaurre brownfield intervention

4.2.4 Zorrotzaurre: Future Intervention in an Inhabited Site

Zorrotzaurre before: With a distinct geographical location – a peninsula in the Nervion River almost adjacent to the city's central district - the particularity of this site is that it contains a small community of 462 people together with little active industrial activity, and many buildings. With 60% of the land belonging to the Bilbao Port, the area was left underused when the port moved to the outer bay. As a result, the site today is an isolated neighbourhood with lacking services.

Zorrotzaurre after: The area is presently at the beginning of the urban planning approval process of the project. A Management Commission representing the landowners [70% public, 30% private] is driving the development process, while the existing community, concerned about the future of their neighbourhood, has organized a series of public events for a sustainable urban transformation. As from the 2004 Master Plan developed by Zaha Hadid, the program for the area was the refurbishment and construction of housing, new industries, tertiary uses, and urban and recreational spaces.

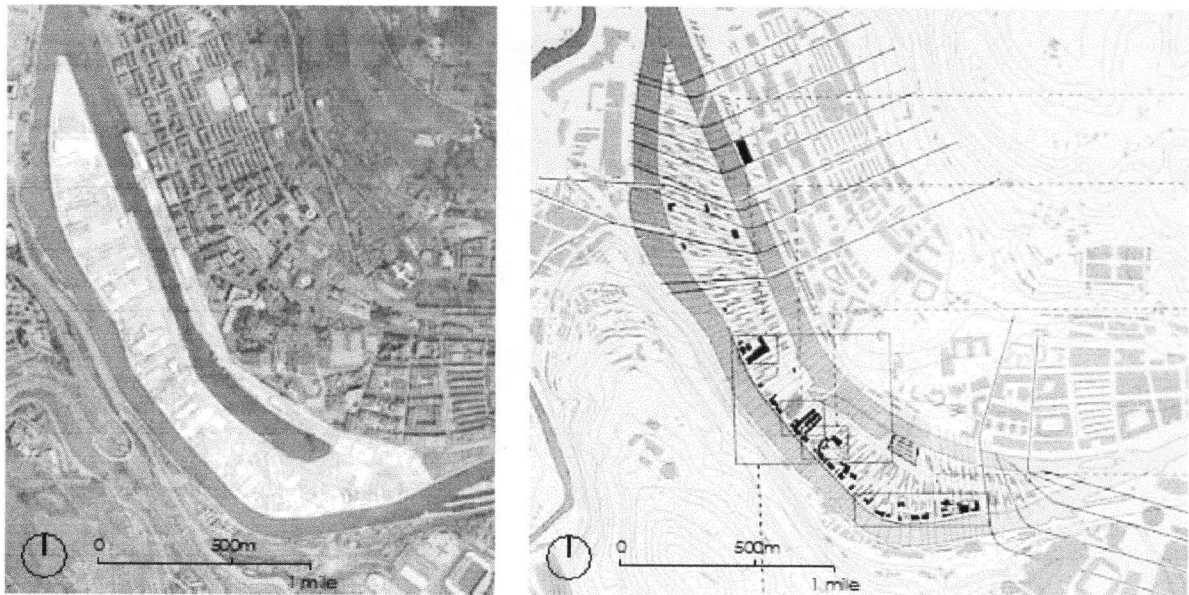


Figure 4.25 Aerial image of Zorrotzaurre *before* and plan of Zorrotzaurre *after*

		Goal 1 LC	Goal2 UI&M	Goal 3 GC	Goal 4 BCC	Goal 5 MIU	Goal6 DwPE
1 Scale	58 ha						
2 Location	urban; waterfront						
3 Shape	longitudinal						
4 Former use	industrial, infrastructure and residential						
5 Structures	many						
6 Infrastructures	few						
7 Contamination	low						
8 Biodiversity	high						
9 Green open space	low						
10 Economic activity	underused						
11 Comm. concern	high						
12 Land ownership	public and private						

Table 4.4 Zorrotzaurre *before* brownfield potential

Potential and contribution to urban sustainability and quality of life

Many site features suggest a significant potential to contribute to the city's sustainability of life: from its large scale [58 ha], distinct geographical location, and longitudinal shape, to its pre-existing structures, community, and biodiversity [Table 4.4]. Perhaps because it is the latest of the four interventions, or maybe it is due to its evocative geographical location and social context, or perhaps because it is still in the planning process - with many good intentions that might be later modified - but the overall performance of Zorrotzaurre's intervention, summarized below, is, on average, quite positive [Fig. 4.29]. The full evaluation, based on the 2004 Master Plan, is included in Appendix III.

Goal 1: Improve the Legibility of the City [1 LC]

The proposed urban fabric fluently and simultaneously responds to both the curving of the river and the existing urban fabric in the adjacent neighbourhood on the other shore, creating a spatial connection and transition between the two [Figures 4.25 and 4.26].

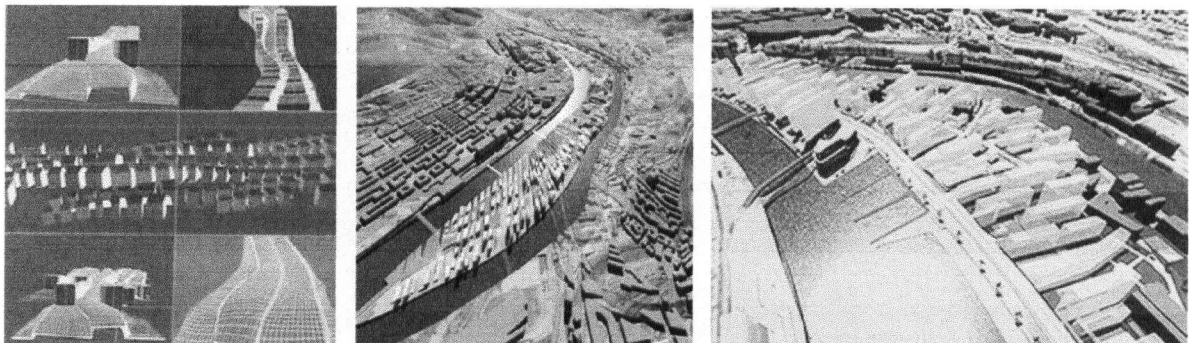


Figure 4.26 Digital images of Zorrotzaurre *after*

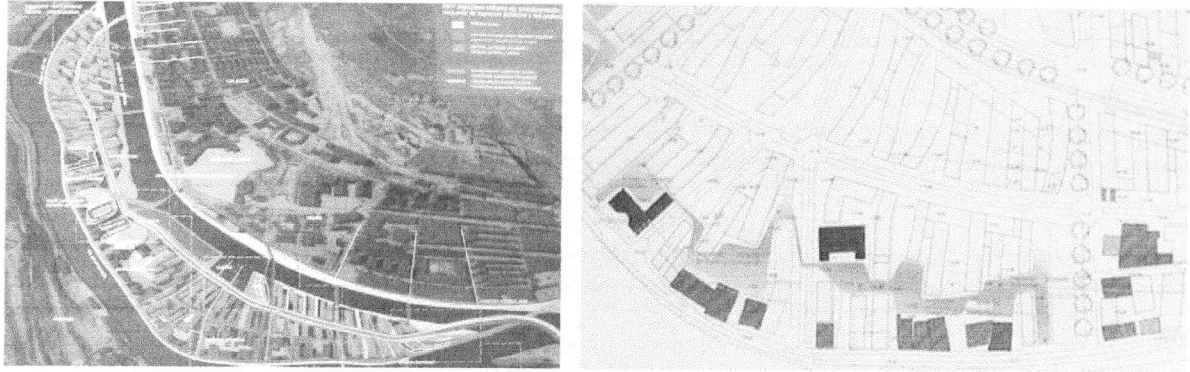


Figure 4.27 Plans of Zorrotzaurre *after*: urban connections and green open space

Goal 2: Improve Urban Integration and Mobility [2 UI&M]

An important element in both the program and the design are to provide new connections to link the peninsula with the city and surrounding areas. These consist in new streets and bridges, pedestrian walkways, improved transit connections [bus and tram], and bikeways along the river shores.

Goal 3: Green the City [3 GC]

The plan proposes a variety of green public open spaces, with the overarching intention to bring reclaim the shores as part of the public realm. The criteria for the plant and building material respond to principles of sustainability, permeability, and maintenance, including water as a design element particularly to reduce the risk of floods, of high concern in the area.

Goal 4: Build Complete Communities [4 BCC]

The intervention is mainly residential, proposing 5,300 new dwelling units, with 28% affordable housing. It also provides amenities and civic uses, as well as 156,000m² for economic activity [office/commercial]. The master plan proposes three distinct districts in character: North, mostly residential; Central, the amenities and larger open spaces hub, with many restored buildings reused for civic uses; and, South, a mixed-use district with most of the economic activity.

Goal 5: Mitigate the Impact of Urbanization [5 MIU]

Due to its large scale and number of housing, Zorrotzaurre will reduce both brownfield land in the metropolitan area and development pressure on greenfield land, as it will allow the city to grow significantly within the city and without compromising natural lands. However, for an intervention being planned in the 21st century, the lack in both the program set by the client as in the proposal of green building standards and a sustainable soil remediation hampers Zorrotzaurre's achievement of this goal.

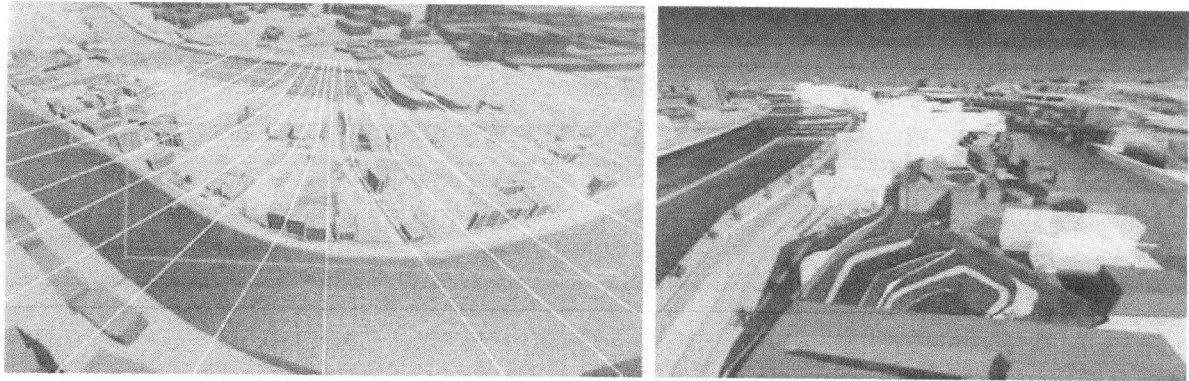


Figure 4.28 Plans of Zorrotzaurre *after*: integration of new and existing buildings

Goal 6: Deal with the Pre-Existing [6 DwPE]

The master plan proposes the restoration and reuse of many of the existing buildings currently on the site. Figure 4.25 shows the integration of these in the new urban fabric in plan [existing buildings in black, new ones in grey], and Figure 4.28 in digital images. On the other hand, dealing with the existing community on the site is more of a challenge, as they are not represented in the Management Commission. However, associated in a community group and highly concerned on the future of the area, they have organized a series of public actions and workshops - the most relevant one, the "Forum for a Sustainable Zorrotzaurre". Last, the area has been acknowledged for a current high level of biodiversity. The design intends to preserve and enhance this through the use of native species in the new green open spaces.

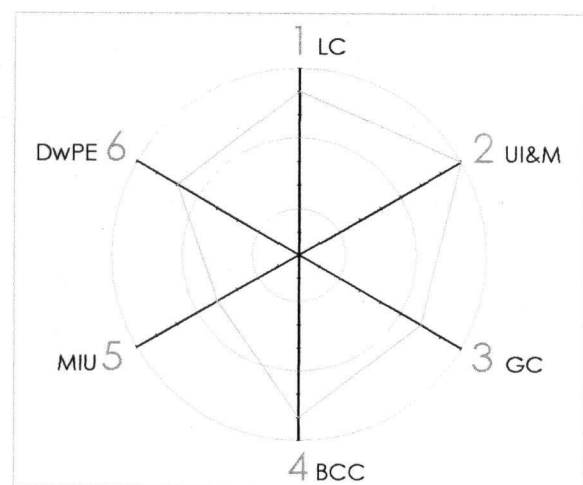


Figure 4.29 Zorrotzaurre evaluation diagram



Figure 4.30 Four major brownfield interventions in the Bilbao Metropolitan Area

4.3 Results and Conclusions

4.3.1 Overall contribution to urban sustainability and quality of life

Together, the four major brownfield interventions taking place presently in Bilbao – Ametzola, Abandoibarra, Galindo and Zorrotzaurre, when all completed, will constitute over 160 hectares of reclaimed brownfield land. This represents about half the total brownfields land identified for the whole metropolitan area when this was first quantified in 1998. But, beyond the site scale, as the separate analyses have shown, these areas have been reused to green, connect and complement the surrounding districts and neighbourhoods, allowing the city to heal and grow within the city. Although the best known internationally is Abandoibarra with the Guggenheim Museum - introducing Bilbao as an example of *Remaking the Image of the City*¹²⁵ - all four are collectively playing an important role in reviving the city.

¹²⁵ Marshall, Richard, Editor, Waterfronts in Post-Industrial Cities, Spon Press, London, USA, Canada, 2001

The diagrams in Figure 4.31 bring together the performance of all four interventions according to the evaluative framework developed in Chapter 3. Figure 4.31 provides a larger picture of the overall strengths and weaknesses in the interventions' achievement of the sites' full potentials to contribute to urban sustainability and quality of life. It indicates a correlation in the achievement of the first three goals, a more uneven performance for building complete communities, and the last two goals as the hardest to achieve.

Goal 1: Improve the Legibility of the City [1 LC]

The four interventions presented have overcome physical barriers that formerly separated either surrounding neighbourhoods, the city from its waterfront, or both. At the same time, the relatively compact developments [i.e. Ametzola 82uph; Zorrotzaurre 92 uph] have provided new open spaces that allow a better spatial understanding of the city.

Goal 2: Improve Urban Integration and Mobility [2 UI&M]

New streets have completed existing, and once disconnected, street networks, favouring pedestrian mobility. All four interventions include new rapid transit connections with the rest of the city [i.e. Ametzola and Galindo: train; Abandoibarra and Zorrotzaurre: tram]. Although Bilbao's bikeway network is still in an early stage, all four interventions include bikeways to contribute to it.

Goal 3: Green the City [3 GC]

Loosening part of the lack of green space within the city, the interventions provide on average a third of each site for greenery, which in total comes to over 540,000m² of green open space to the city. But it is not just an issue of quantity: accessibility within five minute walking distance to green public open spaces larger than one hectare has been granted to the surrounding neighbourhoods [i.e. to 5,000 existing dwelling units in Ametzola; to 15,000 in Abandoibarra; to 8,000 in Galindo].

Goal 4: Build Complete Communities [4 BCC]

The uneven achievement of this goal's potential is due to the differences in the degree of mixture of uses in the interventions and to the amount of new housing and percentage of affordable housing. The mix of uses within each intervention varies depending on the site and the surrounding neighbourhoods' needs, but all four cases guarantee accessibility to goods and services within walking distance to the new dwellings. Together, when completed, the four will have provided the city with new services and amenities, and an overall of 9,000 new dwelling units - 2,000 of these for affordable housing [24%]. Economic revitalization is encouraged through areas for economic activities mostly in Abandoibarra but also in Galindo and Zorrotzaurre.

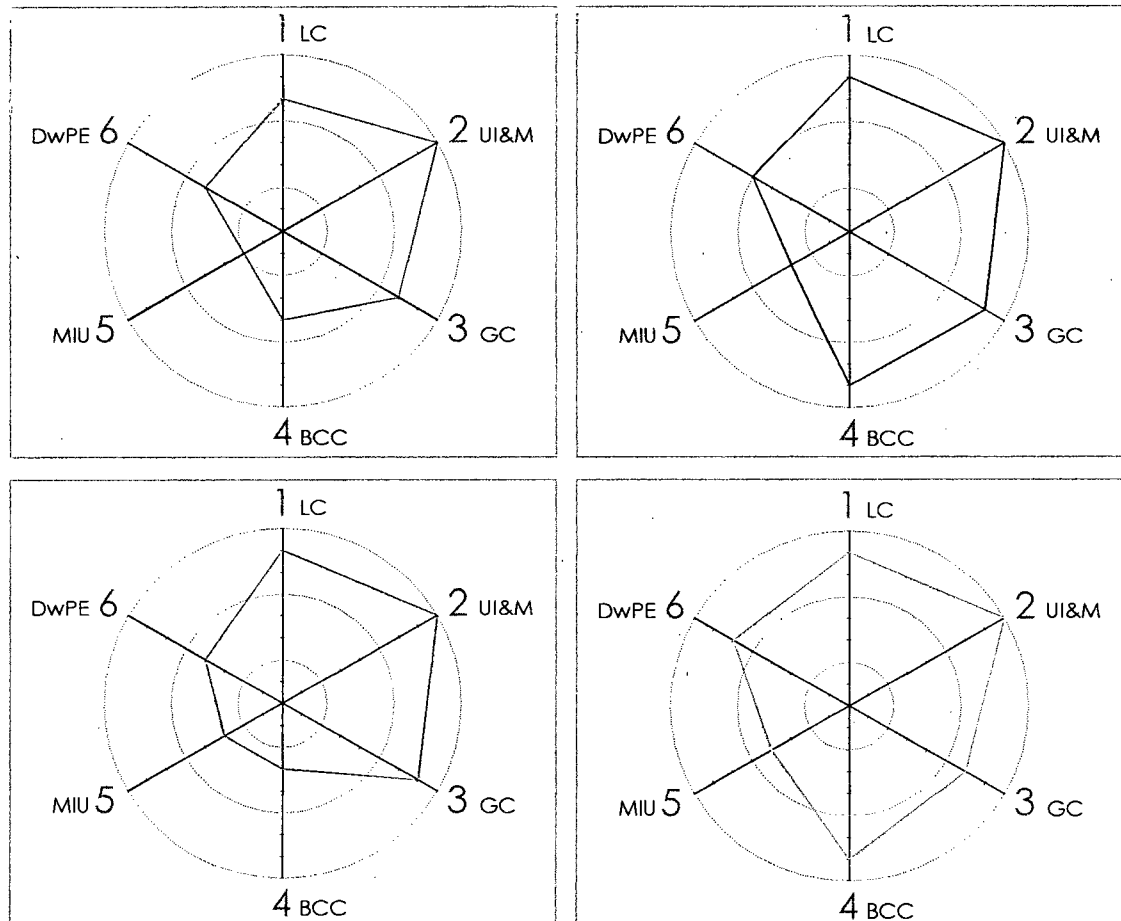


Figure 4.31 Joint evaluation diagram for the four brownfield interventions analysed [top left, Abandoibarra; top right, Galindo [Barakaldo]; bottom left, Ametzola; and bottom right, Zorrotzaurre]

Goal5: Mitigate the Impact of Urbanization [5 MIU]

Mitigating the impact of urbanization is on average the hardest goal to achieve. The main and common factors for this are the lack of green building standards and on-site soil remediation practices in the interventions. The major strengths, however, are the collective reduction of brownfield land in the metropolitan area [50% of the land identified in 1998], and the reduction of pressure on greenfield development. The 9,000 new dwelling units on already urbanized land significantly increases the city's land use efficiency. Had the new housing taken place on greenfield sites in the periphery, with consequent lower densities, it would have occupied up to 4 times as much land – natural land.

Goal 6: Deal with the Pre-Existing [6 DxPE]

All four interventions, to some degree, have reused, restored and integrated existing structures and infrastructures, addressing the former industrial character of the city for the collective memory. The

response to existing biodiversity and green open space has not been very much applicable, as the sites generally [with the exception of Zorrotzaurre] had very little of these. The weakest point identified for this goal is related to the engagement of existing or surrounding communities in the planning process. This is due to the standard set by the framework, acknowledging the lower credit to conventional planning processes. However, on the whole, the reclamation of the riverfront - once booming, then busting and neglected- reflects the intent of reconciliation with the city's industrial past as with the river as its historically natural backbone; generator of urban activity.

4.3.2 Bilbao: Turning the challenge into a tool for urban reviving

In summary, the case of Bilbao shows one way of dealing with the brownfield challenge: turning the challenge into a tool for urban reviving. Going back to the break down used throughout the thesis to understand and address the brownfield challenge [brownfields, their potential, and their contribution], in terms of how brownfields were approached, there were two key elements: At a municipal scale, the understanding of brownfields as an opportunity for future urban growth by the new City Plan. At a regional scale, as the term "brownfield" does not exist in Spanish, it was important to define a term - Industrial Ruins, coined by the Basque Government - and identify the sites.

The sites' highly urban location, general large scale in a city with few open space to grow [as urban growth is not permitted in most of its natural area] and, most important, the strategic location of three of them along the Nervion River, have proved to be important assets in the determination of their potential to contribute to the city, beyond the general exclusive - and limiting - economic factor. In order to go on board in such long-term large-scale process, the metropolitan area had to seek a strong public sector support. In this sense, a critical factor in the whole urban transformation has been the creation of the public company Bilbao Ria 2000, which is developing the first three interventions presented [Abandoibarra, Galindo, and Ametzola].

The four interventions analysed and evaluated provide an idea how brownfield interventions in Bilbao are contributing to urban sustainability and quality of life beyond the site scale. Particularly, the reclamation of the waterfront and reconnection of urban activity back to the river has played a key role. In all, with their strengths and weaknesses, brownfield interventions in Bilbao have provided the physical capability, not only to remake its outward image, but also to contribute to its environmental quality and economic revitalization, as well as to its identity and reconciliation with its industrial past.

5. CONCLUSIONS AND PROPOSAL

Towards a more Sustainable Urban Design

Following the focus in *brownfields - their potential - their contribution* embedded in the conceptual basis, development of the evaluative framework, and application in the case study [Fig. 5.1], this chapter brings together the conclusions about the contribution of brownfield interventions to urban sustainability and quality of life, and presents a proposal to optimize this contribution.

The first part of the chapter argues for a new perspective to the brownfield challenge; a new perspective that rethinks the identification of the sites, the evaluation of their potential, and the optimization of their contribution. Based on the research framework and findings from its application in the case studies, it recognizes the goals and objectives achieved in common practice, and identifies the gaps – or those objectives yet to be achieved - in order to indicate where current practice needs to improve.

In order to address such gaps and optimize the contribution of brownfield interventions to the city, the second part of the chapter proposes the overall thesis framework in the form of a two-track strategy: On the one hand, a series of design recommendations and rules of thumb for brownfield interventions in urban areas, and, on the other, the thesis' evaluative framework as a brownfield intervention sustainability evaluation tool. Both are complementary, as the first is oriented to drive the design towards the achievement of the previously identified goals and objectives, while the latter is set as a means to inform design by evaluating the extent to which the proposed design actually meets these.

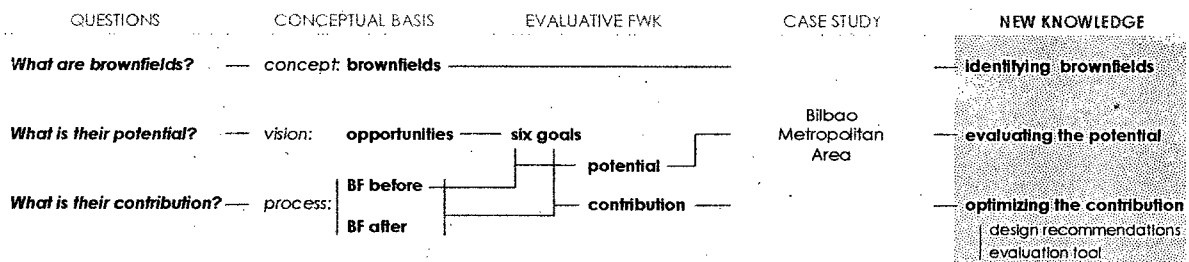


Figure 5.1 Conclusions and proposal as part of the research framework

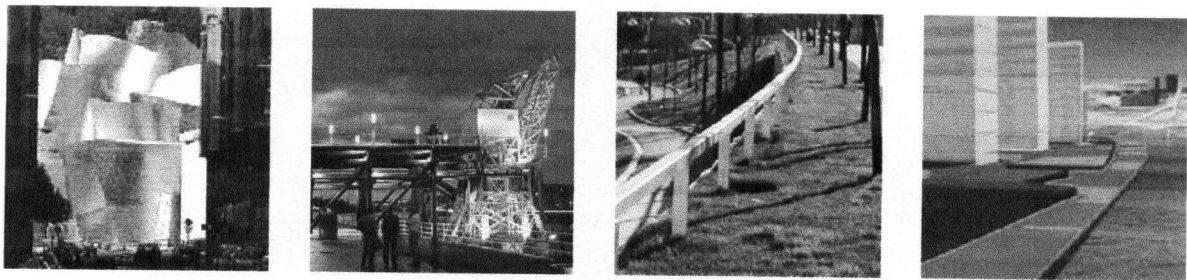


Figure 5.2 Bilbao: contribution of brownfield interventions to the city

5.1 Contribution of Brownfield Interventions to Sustainability and Quality of Life

The primary research question of how the reintegration of derelict land into the social, economic, and environmental context of a city – what the thesis refers to as *brownfield interventions* - contributes to making the city a better place to live by enhancing its sustainability and quality of life, has been addressed by three consecutive lines of thought followed throughout the thesis chapters: the notion of brownfields, their potential, and their contribution [Figure 5.1].

The conceptual basis has explored the concerns around brownfields and the challenge they represent, the opportunities associated with their interventions, and a series of international examples. The next chapter has condensed the many opportunities identified into six goals. Based on a brownfield site's capacity to achieve the goals and then on the brownfield intervention's actual achievement of the goals, it has developed a framework to determine a site's potential and to evaluate its contribution.

The framework has then been applied to four brownfield interventions within the Bilbao Metropolitan Area. This has illustrated how the brownfield challenge was first approached by the city, the potential of the particular sites to enhance the city, and the brownfield interventions' contribution to the city, based on the extent to which the identified potential [articulated through the six goals] was accomplished. The most important assets in the determination of the sites' potential has been their highly urban location, general large scale in a city with few open space to grow, and, most important, the strategic location of three of them along the Nervion River. According to the evaluative framework proposed, the four brownfield interventions have contributed to the city particularly well in terms of improving its legibility and urban integration and mobility and in greening the city [Goals 1,2, and 3]. However, mitigating the external impact of urbanization and dealing with the pre-existing [Goals 5 and 6] present challenges yet to be addressed, and, to a less extent, building complete communities [Goal 4].

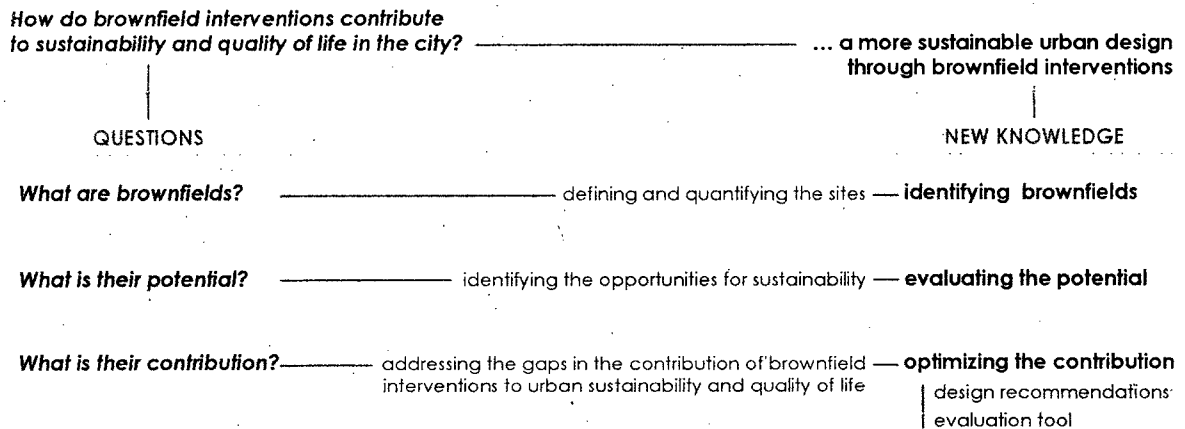


Figure 5.3 A new perspective to the brownfield challenge

The research findings reflect a need for a new perspective to the brownfield challenge. Following the focus on brownfields - *their potential* - *their contribution* [Figure 5.1 and 5.3] this new perspective consists of: First, the identification of the sites in order to more effectively approach the challenge they represent; second, the evaluation of their potential considering their immense yet currently underestimated capacity to heal the city; and third, the optimization of their contribution, since, when the brownfield intervention finally occurs, there are several gaps in the accomplishment of their full potential that indicate where current practice needs to be improved.

5.1.1 Identifying Brownfields

The presence and broad range, creation, and potential reuse of brownfield sites represents a challenge for the post-industrial city that goes beyond the sites themselves to broader notions about the city and the urbanized landscape.

Defining what constitutes a brownfield site is the first step towards a more effective approach to the challenge they represent. Many countries have national scale definitions that reflect common concerns about the state of abandonment of the sites, their potential for new use, and their state of contamination [be it real or perceived]. Although ignored by many of these definitions, special attention should be given to the sites' location within urban areas, where the challenges and opportunities beyond the site scale are more intense. Absent a national definition, it is important for regions or cities tackling the challenge to provide their own.

The case of Bilbao illustrates this: The Spanish Government has no specific term other than *contaminated sites*, which involves a wide variety of sites whose characteristics may have to do nothing with other

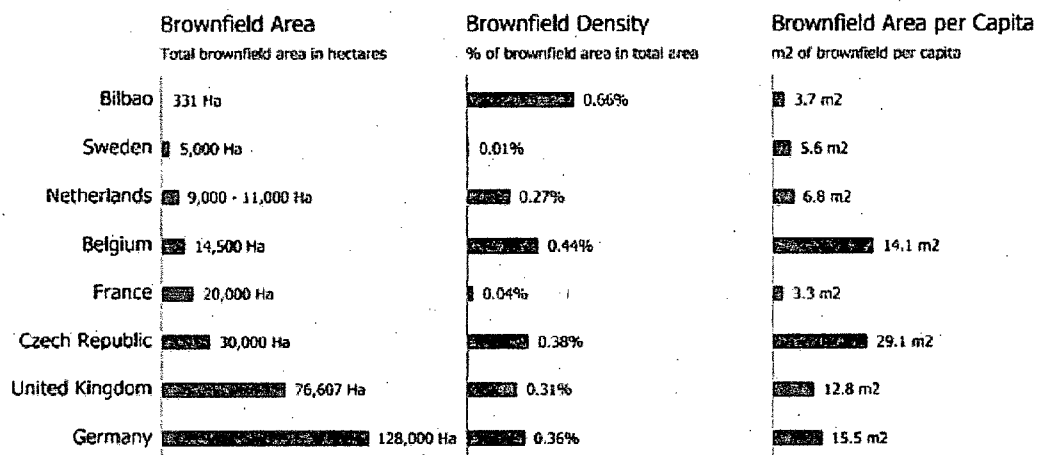


Figure 5.4 Comparisons of brownfield area, brownfield density and brownfield area per capita

inherent characteristics of brownfields [i.e. state of abandonment or potential for new use]. In this context, the Basque Government coined the term *Industrial Ruins* to introduce the notion of degradation and potential for new use to differentiate the sites from the rest of contaminated sites.

Once the term is defined the sites need to be identified. Due to their vast range in size, the common measure of number of sites is not enough to provide a clear picture of what the sites represent to the city. In this sense, brownfield area is the critical indicator to be able to monitor the production and reclamation of brownfields [brownfield flow], to set targets, and to establish comparisons. Figure 5.4 illustrates comparisons that can occur when data about brownfield area is available, such as brownfield density and brownfield area per capita.

5.1.2 Evaluating their potential

An economic factor is generally both the cause for the creation of brownfields as the reason for them to remain in such state, preventing them from being turned back into a beneficial use. Brownfield sites face different interests and obstacles often addressed solely from a purely economic point of view. As a result, site's circumstances such as contamination or an existing community on the site are often referred to as "economic liabilities" rather than as environmental or social issues.

This exclusively economic-based point of view when looking at brownfields underestimates their full potential. Distilled into six goals, this thesis recognizes how brownfield interventions hold numerous social, economic, and environmental opportunities to contribute to the city's sustainability and quality of life. The physical analysis of the four examples in Bilbao illustrate different ways in which brownfield

interventions improve the legibility of the city and its integration and mobility, repairing the city fabric and reconnecting its networks; green in the city through new urban parks; build complete communities by introducing new uses that complement existing ones; mitigate the impact of urbanization, allowing growth within already urbanized areas versus taking over natural areas; and, last, deal with the pre-existing, offering a reconciliation with an often neglected past.

In this context, Table 5.1 summarizes the thesis framework's proposal to evaluate of the potential in brownfield sites based on its capacity to fulfill such goals, illustrating the relevance of certain key site conditions to a site's capacity to achieve the goals, and thus to contribute to urban sustainability and quality of life. Table 3.2 *Determining the Potential of Brownfield Sites* provides a finer grain within the different conditions [i.e. within location, if the site is urban, suburban, or non-urban].

Given the criticality of economic viability for a brownfield intervention - or so-called *redevelopment* - to take place, there is a need to consider the whole set of opportunities in the viability study or evaluation of the sites' potential; a need to overcome the limited and limiting economic factor. Many countries, at different administrative levels, are already developing incentives to overcome the economic risks associated with brownfield interventions, mostly through policies and public funding programs. One of the major lessons learned from the example of Bilbao is how the potential of the sites was valued as a means to accommodate urban growth and regenerate a city in crisis, and how, given this meant such a long-term large-scale process, their intervention was made possible through a strong collaborative public support that involved many different administrations.

	Goal 1 LC	Goal 2 UI&M	Goal 3 GC	Goal 4 BCC	Goal 5 MIU	Goal 6 DwPE
1 Scale						
2 Location						
3 Shape						
4 Former use						
5 Structures						
6 Infrastructures						
7 Contamination						
8 Biodiversity						
9 Green open space						
10 Economic activity						
11 Comm. concern						
12 Land ownership						

Table 5.1 Summary table of key site attributes and goals

The potential to achieve each of the six goals may be favoured or hindered by the site's attributes or conditions. The grey lines indicate the relevance of a site's key attributes [left] to its potential to achieve the six goals [above].

5.1.3 Optimizing their contribution

The evaluative framework's ultimate purpose is to evaluate the contribution of brownfield interventions to the city's sustainability and quality of life based on the extent to which the proposed goals are achieved. According to the framework, the four interventions studied in Bilbao have contributed to the city particularly well in terms of improving its legibility and urban integration and mobility as well as in greening the city [Goals 1,2, and 3]. However, mitigating the external impact of urbanization and dealing with the pre-existing [Goals 5 and 6] remain as challenges yet to be addressed – the main gaps where practice needs to be improved – and, to less extent, building complete communities [Goal 4] too.

Figure 5.5 shows the four case studies from Bilbao [highlighted with grey dotted lines] together with the mostly built form-based interventions from the preliminary international brownfield intervention review that served determine the credits or evaluation ranges in the framework. Figure 5.5 illustrates the different magnitudes of the contribution [poor, moderate, or good] of each of the interventions to *green the city* [left], based on the percentage of green open space they provide, and to *build complete communities* [right], based on the housing [orange] and space for economic activities [blue] they provide. The figures show there is room in many interventions to shift from moderate to good.

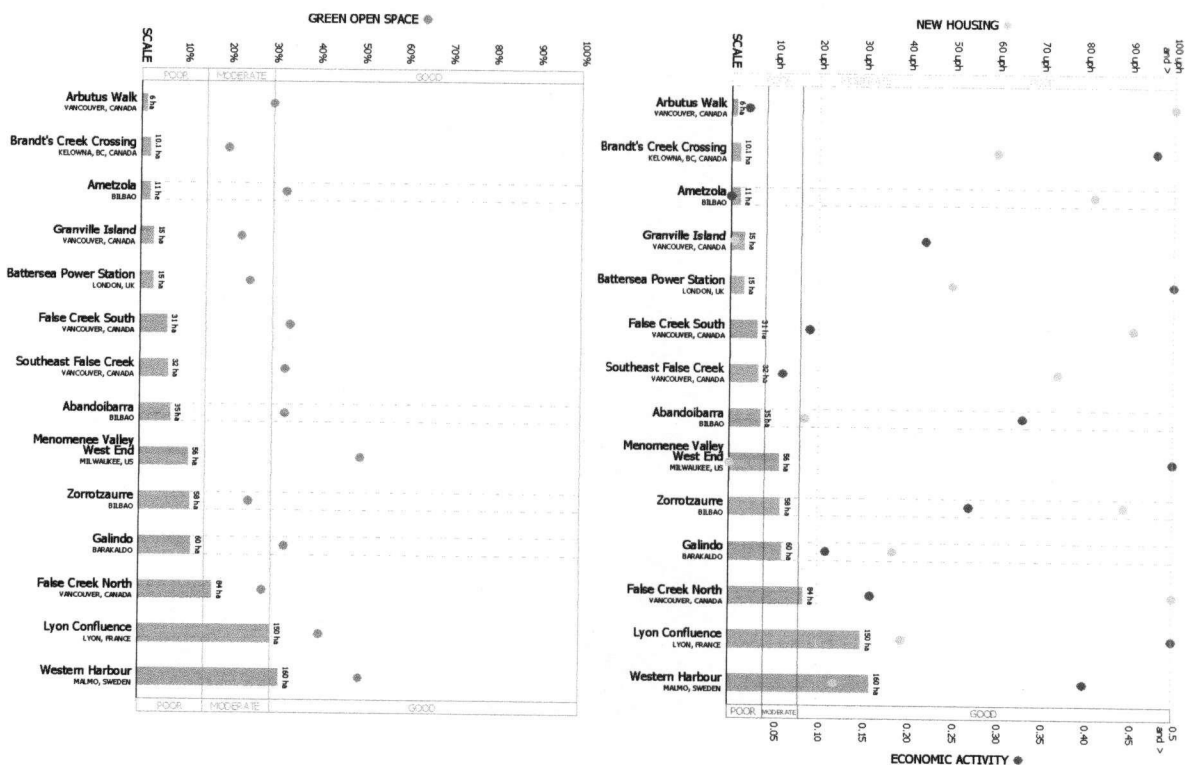


Figure 5.5 Contribution of brownfield interventions to green the city and build complete communities. The dots situated in poor, moderate, and good ranges indicate the magnitude of contribution of the different brownfield interventions to green the city [left] and build complete communities [right].

Based on the overall achievement of the goals and objectives by the four case studies in Bilbao evaluated with the framework, Table 5.1 acknowledges the objectives *met* [those well achieved] and highlights the objectives *to be met* [those moderately or poorly achieved]. Following the same colour code, on the left is a reference to the case study that informed the framework, divided into mostly built form-based interventions [NBHDS], and mostly open space-based ones [PARKS].

Conceptual basis	Evaluative framework		Case Study
16 case studies	Goals	Objectives	Bilbao case studies
NBHDS	1 Improve the Legibility of the City	1 Enhance the existing and surrounding urban fabric 2 Increase the compactness of the urban fabric 3 Increase the diversity of the urban fabric 4 Reveal the area's site specific natural features	Goal 1: good good moderate good good
	2 Improve Urban Integration and Mobility	1 Enhance the existing and surrounding street network 2 Enhance the existing and surrounding pedestrian network 3 Enhance the existing and surrounding transit network 4 Promote other non motorized modes of transportation	Goal 2: good good good good good
	3 Green the City	1 Improve the environmental quality of public open space 2 Increase the quantity of green open space 3 Improve the accessibility to green public open space 4 Include other environmental features [i.e. stormwater management, recycling facilities, urban agriculture]	Goal 3: good good good good moderate
	4 Build Complete Communities	1 Increase housing availability 2 Increase housing affordability and social integration 3 Improve accessibility to services and amenities 4 Encourage economic revitalization	Goal 4: moderate good moderate good good
	5 Mitigate the Impact of Urbanization	1 Reduce brownfield land in the metropolitan area 2 Reduce pressure on greenfield development 3 Reduce contaminated soil in the metropolitan area 4 Include green building practices or standards	Goal 5: moderate good moderate poor poor
	6 Dealing with the Pre-Existing	1 Reuse, restore and integrate existing structures and infrastructures 2 Engage the community in the decision-making process 3 Preserve and enhance existing biodiversity and green open space 4 Address the site's former use[s] through design	Goal 6: moderate moderate poor good moderate
PARKS			

Table 5.2 Summary table of objectives *met* and objectives *to be met* in the brownfield interventions studied. The colour range [from light to dark] indicates the interventions' overall degree of achievement of the objective [from good to poor]. Objectives *met* are those well achieved, and *to be met*, those moderately or poorly achieved.

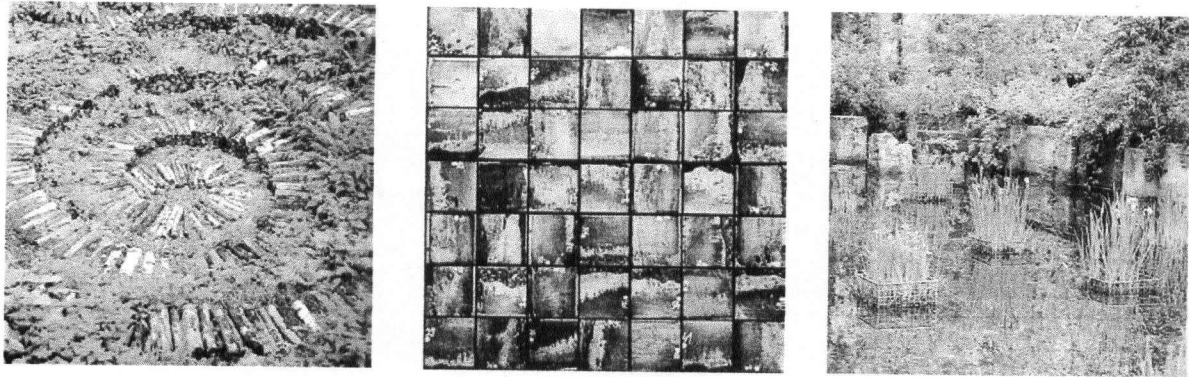


Figure 5.6 Design details in Duisburg Nord Park

5.2 Proposal for a more Sustainable Urban Design through Brownfield Interventions

Building on the overall thesis framework, the thesis proposes two complementary ways of addressing the gaps or opportunities *to be met* revealed in Table 5.2, and, hence optimize the contribution of brownfield interventions to the city. On the one hand, it presents a series of design recommendations for brownfield interventions, intending to drive the design towards the achievement of the framework's goals and objectives. On the other hand, it suggests the evaluative framework used in the case study of Bilbao as a brownfield intervention sustainability evaluation tool that can inform design by the extent to which the design actually meets the proposed goals and objectives.

5.2.1 Design Recommendations for Brownfield Interventions in Urban Areas

The first proposal to optimize the contribution of brownfield interventions to the city by pushing the practice forward consists of a series of design recommendations and rules of thumb for brownfield sites in urban areas. The focus on location within urban areas responds to the findings of how both the challenges and opportunities beyond the site scale are more intense in these locations.

Deriving from the evaluative framework and following the notion of objectives *met* and objectives *to be met* [Table 5.2], the design recommendations are meant to drive the design towards the accomplishment of a site's full potential through the achievement of the proposed goals and objectives. In this sense, for each of the six goals there are four design recommendations. Basically, these have been developed from turning the objective into a recommendation by adding the indicator credit corresponding with a *good* achievement for that objective. With this, the design recommendations can be used as rules of thumb to guarantee that the different aspects of a site's potential are achieved.

Table 5.3 compiles the design recommendations structured by the six goals for brownfield interventions. As not all recommendations apply to all types of interventions, the squares on the right indicate if the recommendation is applicable, according to the site's new use: mostly built form-based [NBHDS] or mostly open space based [PARKS]. Following the same colour code as table 5.2, it also insinuates the degree of difficulty based on the findings from the various case studies.













Goals	Design Recommendations and Rules of Thumb	applicability NBHDS PARKS	
1 Improve the Legibility of the City	<ol style="list-style-type: none"> 1 Complete, complement, and repair the existing and surrounding urban fabric. 2 Provide a change in the gross residential density of the site of at least 40uph. 3 Provide 3 or more new uses than existing. 4 Reveal the area's site specific natural features. 		
2 Improve Urban Integration and Mobility	<ol style="list-style-type: none"> 1 Complete, complement, and reconnect the existing and surrounding street network. 2 Complete, complement, and reconnect the existing and surrounding pedestrian network. 3 Complete, complement, and reconnect the existing and surrounding transit network. 4 Provide bikeways, and, if existing, connect to a broader network. 		
3 Green the City	<ol style="list-style-type: none"> 1 Remediate any contaminated soils and provide at least 1 green public open space [urban park]. 2 Increase the percentage of green open space of the site by at least 30%. 3 Allocate green public open space to increase by 20% the accessibility to it of existing du within 5 min. walking distance [400m] to the site. 4 Provide 2 or more urban design environmental features such as stormwater management, recycling facilities, composting, or urban agriculture. 		
4 Build Complete Communities	<ol style="list-style-type: none"> 1 Increase by at least 20% the number of housing in the area within 5 min. walking distance [400 m] to the site. 2 Increase the percentage of affordable housing on the site by at least 15% [in Spain: at least 50%]. 3 Provide 2 or more new services / amenities to the site and the surrounding area within 400m. 4 Increase by at least 0.08 the gross intensity of economic activity [ratio of floor area for economic activities to total site area]. 		
5 Mitigate the Impact of Urbanization	<ol style="list-style-type: none"> 1 Prioritize the intervention of larger brownfield sites. 2 Provide a change in the gross residential density of the site of at least 40uph. 3 Remediate at least 80% of contaminated soils on the site. 4 Provide greenbuilding standards for the whole intervention. 		
6 Dealing with the Pre-Existing	<ol style="list-style-type: none"> 1 Reuse, restore and integrate existing structures and infrastructures for public use. 2 Provide public participation events and implementation tools. 3 Increase the percentage of green open space of the site by at least 30% including the existing. 4 Address the site's former use[s] through references in the site and building design. 		

Table 5.3 Design recommendations for brownfield sites in urban areas, corresponding to the six goals. The squares on the right indicate the applicability to mostly built-form based interventions [NBHDS] and mostly open space-based ones [PARKS]. The colour range [light to dark] indicates the degree of difficulty to achieve [lighter corresponds to easier, and darker to more difficult], according to the brownfield interventions studied in the research.

5.2.2 Brownfield Intervention Sustainability Evaluation Tool

Complementing the design recommendations, the second proposal to optimize the contribution of brownfield interventions to urban sustainability and quality of life is the evaluative framework developed, which has been informed by both literature-based and case study-based research and tested in different interventions within the Bilbao Metropolitan Area. The framework is proposed as a first iteration of a brownfield intervention sustainability evaluation design.

Usefulness of the framework

Although the development of a more elaborate tool is a point of further an additional research, the evaluative framework, with its goals, objectives, and indicators, has proved useful in different ways.

Framed within the physical realm, the framework covers through the goals and objectives the different social, economic and environmental opportunities associated with brownfield interventions, believing that urban design driven by such rationales can provide the physical capacity to support a more sustainable way of living. With this, the framework addresses one of the gaps identified by the Concerted Action on Brownfield and Economic Regeneration Network [CABERNET] related to brownfield regeneration: the difficulties in evaluating and incorporating sustainable development of brownfield sites in land use planning and urban design¹²⁶.

The visual representation of the framework's evaluation diagram [Figure 5.7] provides a simple way to understand the extent to which a brownfield intervention achieves the six goals, and thus, its contribution to urban sustainability and quality of life. By looking at the achievement of all goals at the same time, the evaluation diagram provides a holistic way of looking at this contribution.

At the same time, the diagram acknowledges the extent to which the brownfield intervention has achieved a specific goal, and at the same time illustrates its gaps, where it could have done better. As a result, the use of the framework as a design tool may be useful for informing design, as, based on physical measurable parameters, it can assess design before it is actually built.

The tool-converted framework complements the design recommendations in that, while these are meant to drive the design towards the achievement of the goals and objectives, the tool is presented as a resource to evaluate the extent to which the proposed design actually meets these goals and objectives.

¹²⁶ CABERNET [Concerted Action on Brownfield and Economic Regeneration Network], List of 12 key issues relevant to the regeneration of brownfield sites, Key Issues for Brownfield Regeneration, 2005 www.cabernet.org.uk

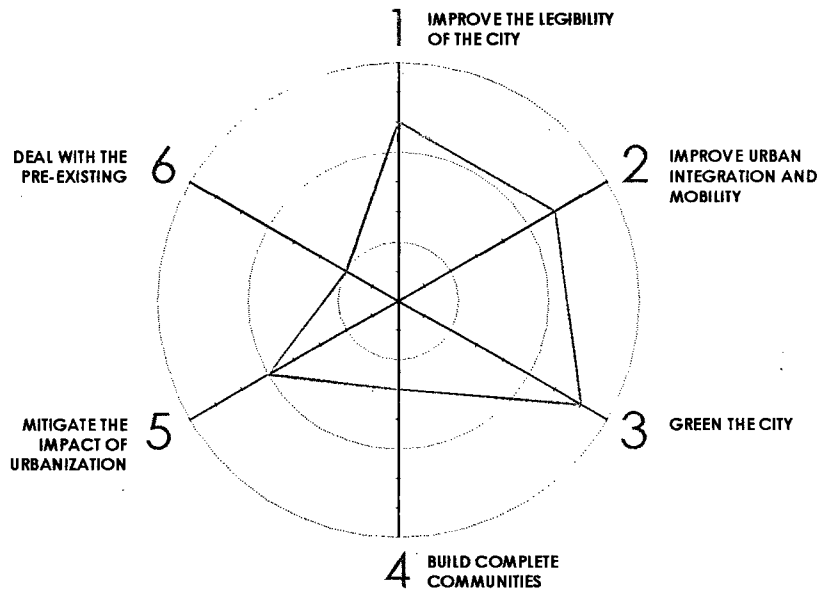


Figure 5.7 Example of the framework's evaluation diagram.

The grey circles indicate the magnitude of achievement of the goals, by establishing three ranges: *poor*, closer to the centre, and *moderate* and *good* as the circles get larger. By showing, at once, the extent to which a brownfield intervention achieves each of the six goals, the diagram provides a holistic view of the intervention's contribution to the city. It also acknowledges both its strengths and its gaps or areas for improvement.

Appendix IV includes the set of six templates or blank scorecards used in the Bilbao case studies. There is one template for each goal, and each contains a description of the goal, and its social, economic, and environmental rationale [according to the opportunities the goals covers], and the four objectives it consists of, each with its indicator and credit.

Limitations to the framework

The interventions in Bilbao for which the framework was targeted were all mostly built-form based interventions. As a result, while the design recommendations proposed are oriented for both built form-based and open space-based interventions, the tool is limited to the first. If applied to a design consisting mainly of an urban park, the tool would express a poor achievement for certain goals, which would lead to a misunderstanding of its contribution to the city. This would be due to the fact that some of the goals and objectives simply do not apply to this type of designs. The focus on mostly built form-based interventions relies in the concern about the continuous urbanization of the planet. It is based on the asset of brownfields to accommodate population growth within already urbanized areas, without compromising natural areas.

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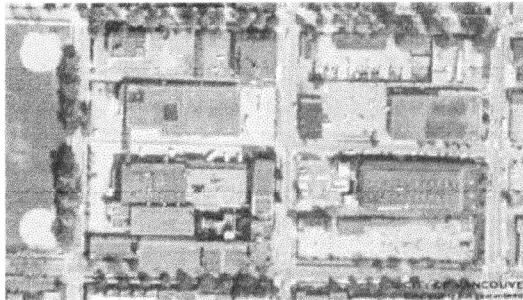
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Appendix I Brownfield Definitions

COUNTRY	TERM	DEFINITION	SOURCE
AUSTRIA	<i>Brownfield</i>	No official definition. Understanding similar to CABERNET definition recognising potential for reuse and with less focus on	Umweltbundesamt Wien (2004); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
BELGIUM	<i>Site d'activité économique désaffecté</i>	Wallonia - <i>Sites d'activité économique désaffectés - SAED</i> : Sites previously dedicated to economic activities and where the current condition is contrary to 'efficient land use'.	Direction Générale des Ressources Naturelles et de l'Environnement (DGRNE) (1999); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
	<i>Brownfield</i>	Flanders - <i>Brownfields</i> : Abandoned or under used industrial sites with an active potential for redevelopment or expansion but where redevelopment or expansion is complicated by a real or perceived environmental contamination.	Openbare Afvalstoffenmaatschappij voor het Vlaamse Gewest (OVAM) (2000); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
CANADA	<i>Brownfield</i>	<i>Brownfield</i> : An abandoned, vacant, derelict or underutilized commercial or industrial property where past actions have resulted in actual or perceived contamination and where there is an active potential for redevelopment.	<i>Cleaning up the past, building the future: a national Brownfield redevelopment strategy for Canada</i> , National Brownfield Redevelopment Strategy Task Force, National Round Table on the Environment and the Economy, Ottawa, 2003
CZECH REPUBLIC	<i>Brownfield</i>	Sites that have been affected by the former uses of the site and surrounding land; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban areas; and require intervention to bring them back to beneficial use.	Czech Brownfield Regeneration Strategy, Progress Report (Czechinvest); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
DENMARK	<i>Brownfield</i>	<i>Brownfield</i> : Land affected by contamination	Danish Environmental Protection Agency (2000); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
FINLAND	—	No recognised definition.	Finnish Environment Institute, EEA (1998) and Finnish Environment Institute (2001); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 200
FRANCE	<i>Terrain abandonné</i>	<i>Terrains abandonnés</i> : Space previously developed; temporarily or definitively abandoned following the cessation of activity; and need to be reclaimed for a future use. Can be partially occupied, derelict, or contaminated.	Ministère de l'Environnement (2001); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
GERMANY	<i>Brachflächen</i>	<i>Brachflächen</i> : Inner city buildings not under use. Inner city areas for redevelopment and refurbishment.	Umweltbundesamt Berlin (2000); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
IRELAND	<i>Derelict land</i>	<i>Derelict land</i> : Land which detracts, or is likely to detract, to a material degree from the amenity, character or appearance of land in the neighbourhood of the land in question because of ruinous structures, neglected condition or presence of waste.	Environmental Protection Agency (2000); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
ITALY	<i>Contaminated Site</i>	<i>Contaminated Site</i> : Site that shows levels of contamination or chemical, physical or biological alteration of soils, sub soils and of superficial or underground water in a way to determine danger for public health or for the natural or built environment.	Italian National Laws 426/98 and 471/99; EEA (1998); Agenzia Nazionale per la Protezione dell'Ambiente (ANPA) (2001) from <i>The Scale and Nature of European Brownfields</i> , CABERNET, 2005
NETHERLANDS	<i>Obsolete Industrial Site</i>	No commonly recognised definition - Obsolete industrial sites.	Ministry Economic Affairs (2000); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
SPAIN	<i>Potentially Contaminated Site</i>	<i>Potentially Contaminated Sites</i> : Non-extractive industrial facilities active or out of use, minery facilities and structures, and uncontrolled wastelands.	Ministerio de Medio Ambiente (2005), <i>Perfil Ambiental de España 2005, Informe Basado en Indicadores</i> (Author's translation of definition)
	<i>Industrial Ruin</i>	<i>Basque Country - Industrial Ruins</i> : The sites, built or not, that having participated in an industrial activity are degraded in such way that a new use is not possible but through a thorough work of recovery.	Definition: Author's translation from IHOBE S.A. for the Basque Government, 1998, <i>Guía Técnica de Criterios Ambientales para la Recuperación de Ruinas Industriales</i> ; Scale data: Basque Government (2001)
SWEDEN	—	No official definition - commonly understood as formerly used land which needs revitalisation (or remediation before going back to the nature).	C. Egelstg (JMAB); Unofficial estimate (C. Egelstg, JMAB, 2004); from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
UNITED KINGDOM	<i>Previously Developed Land</i>	No legal definition. England and Wales - ' <i>previously developed land</i> ' (PDL): land which is or was occupied by a permanent structure (excluding agricultural or forestry buildings), and associated fixed surface infrastructure.	Planning Policy Guidance Note No 3 (PPG3) Housing DETR (2000); Welsh Assembly; from <i>The Scale and Nature of European Brownfields</i> , CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), 2005
	<i>Vacant and Derelict Land</i>	Scotland: <i>Vacant and derelict land</i> .	Scottish Executive National Land Use Database (2004) Scottish Executive (Scottish Vacant and Derelict Land Survey 2003, published 2004); from <i>The Scale and Nature of European Brownfields</i> , CABERNET, 2005
UNITED STATES	<i>Brownfield</i>	<i>Brownfield</i> : 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.	United States environmental Protection Agency, www.epa.gov/brownfields From Public Law 107-118 (H.R. 2699) - "Small Business Liability Relief and Brownfields Revitalization Act" signed into law January 11, 2002

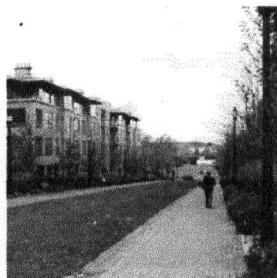
Appendix II International Brownfield Interventions



Molson Brewery, former Carling O'Keefe Brewery 1994



Arbutus Walk 2006



master plan: Durante Kreuk Ltd. Landscape Architects
[Arbutus Greenway and Streetscape Master Plan]
date: completed in 1997

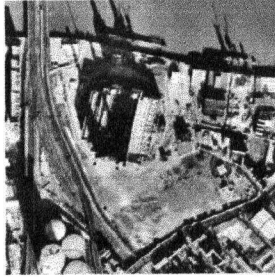
Arbutus Walk is an example of neighbourhood densification within an established single-family neighbourhood.

brownfield **before**

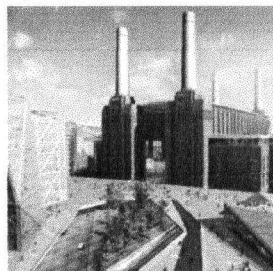
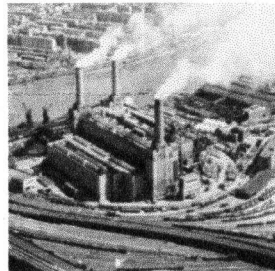
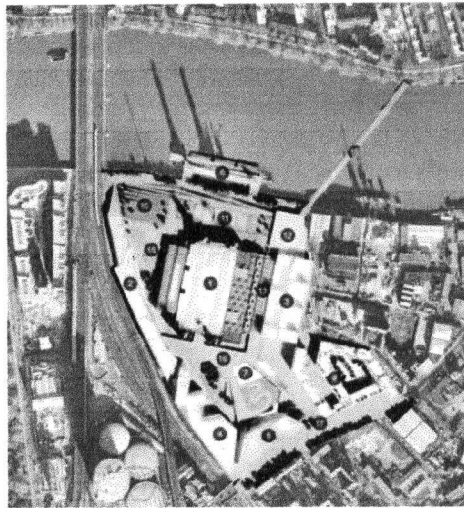
- **scale:** 6 hectares [15 acres]
- **location:** urban
- **shape:** compact; rectangular [4 city blocks]
- **nature:** industrial [brewery]
- **structures:** many [10 buildings]
- **infrastructures:** few [2 streets]
- **contamination:** yes
- **biodiversity:** n/a
- **green open space:** very low
- **economic activity:** derelict [dismantled brewery]
- **community/ concern:** high [initial opposition]
- **land ownership:** single; private [Molson Brewery, previously Carling O'Keefe Brewery]

brownfield **after**

- **new use:** mixed-use [res; com; GPOS]
- **reused structures:** none
- **reused infrastructures:** few [2 streets]
- **remediation:** off- site [excavation and disposal]
- **biodiversity:** n/a
- **green open space:** 30%
- **economic activity:** 994 m²; 0.02
- **community involvement :** high
- **developer:** multiple; public and private [40%, 2.4 ha, developed by Concert Properties Ltd.]
- **new housing:** 1,450 du; 242 uph; 10% affordable



Left: Current state
Below: Project Plan



master plan: Arup AGU

Power Station and Battersea Park station:

Grimshaw with HMKM and UDS

rest of buildings: Arup AGU, UN studio, Benson and Forsyth, Reid Architecture, and Sceno Plus

landscape architects: Gustafson Porter and West 8

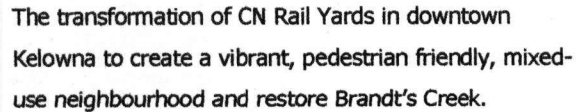
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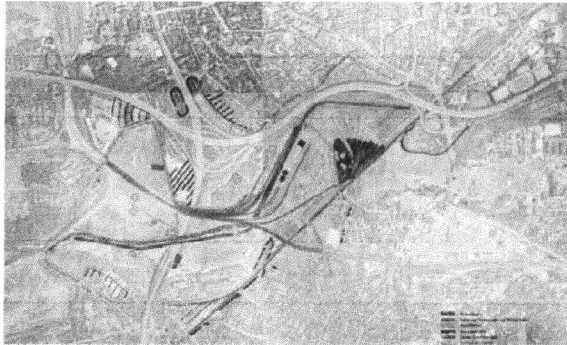
brownfield **before**

- **scale:** 15 hectares [38 acres]
- **location:** urban; waterfront [Thames river]
- **shape:** compact; irregular
- **nature:** industrial [power station]
- **structures:** few; heritage [power station]
- **infrastructures:** few [railway off-site]
- **contamination:** n/a
- **biodiversity:** n/a
- **green open space:** low
- **economic activity:** derelict [plant closed 1982]
- **community/ concern:** high
- **land ownership:** multiple; private [Alton Towers consortium]

brownfield **after**

- **new use:** mixed-use [com; office; res; park]
- **reused structures:** few; heritage [power station]
- **reused infrastructures:** few [railway off-site]
- **remediation:** n/a
- **biodiversity:** n/a
- **green open space:** 25%
- **economic activity:** 647,694 m²; 4.32
- **community involvement :** very low
- **developer:** single; private [The Parkview Group]
- **new housing:** 750 du; 50 uph; GBP

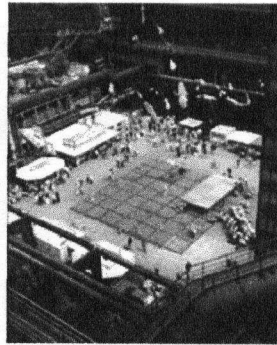
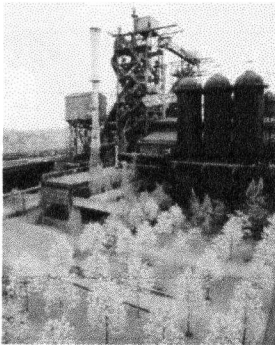




landscape architect: Latz + Partner

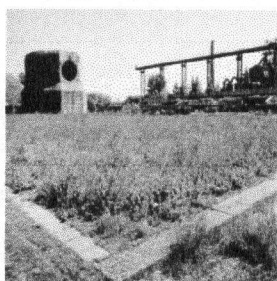
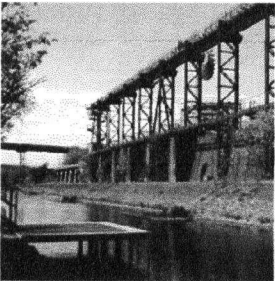
date: plan 1990-2001, park opened in 1994

Duisburg Nord Park is one of the 120 projects of the Emscher Park (IBA) in the Ruhr District whose attempt was to set quality building and planning standards for the environmental, economic and social transformation of an old industrialised region.



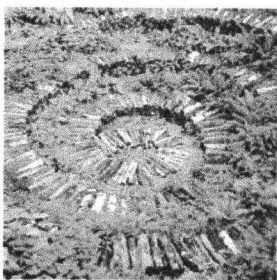
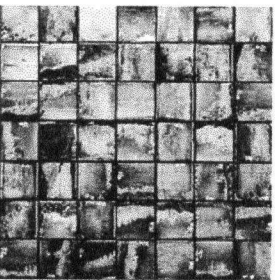
brownfield before

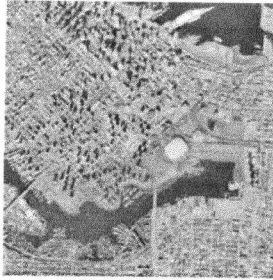
- scale: 230 hectares
- location: suburban
- shape: compact; irregular
- nature: industrial [steel mill, mining & factory]
- structures: many [buildings, tanks, bunkers]
- infrastructures: many [channel, railway]
- contamination: high; heavy metals
- biodiversity: n/a
- green open space: low
- economic activity: derelict; dismantled factory
- community/ concern: n/a
- land ownership: private; Thyssen – Meiderich plant



brownfield after

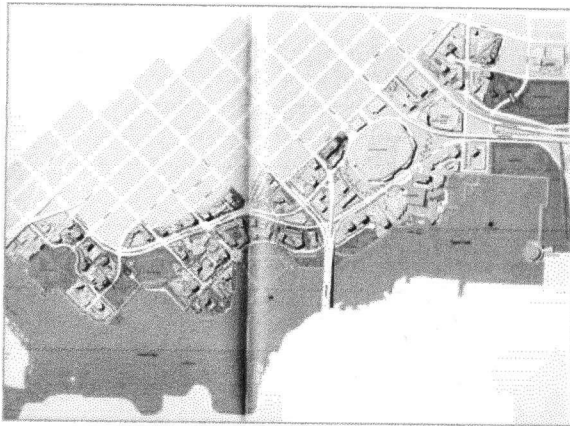
- new use: urban park
- reused structures: many
- reused infrastructures: many
- remediation: on-site [buried, water and plants]
- biodiversity: high; includes reg. endangered species
- green open space: 100%
- economic activity: no
- community involvement : high
- developer: single; public [Land Nordrhein-Westfalen]
- new housing: no





date: 2010 expected completion date

An extension of Downtown Vancouver's fabric to its waterfront through a high-density neighbourhood of 40 residential towers linked by a 3km seawall and 4 parks. CPR's Roundhouse preserved as a community centre.



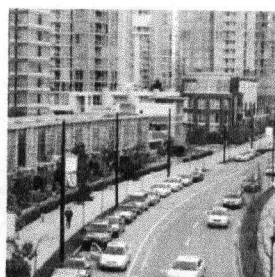
brownfield before

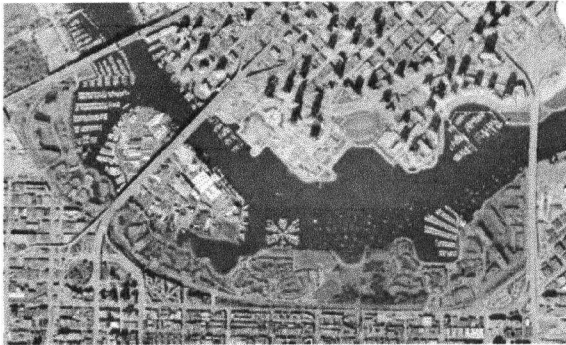
- scale: 84 hectares
- location: urban; waterfront [downtown Vancouver]
- shape: compact; irregular
- nature: infrastructure [former CPR rail yards]
- structures: few [CPR's Roundhouse, & buildings]
- infrastructures: few [streets and rail yards]
- contamination: yes [high/low n/a]
- biodiversity: n/a
- green open space: very low
- economic activity: underused railway
- community/ concern: high [opposition]
- land ownership: single; public; City of Vancouver [from land exchange with CPR and BC government]



brownfield after

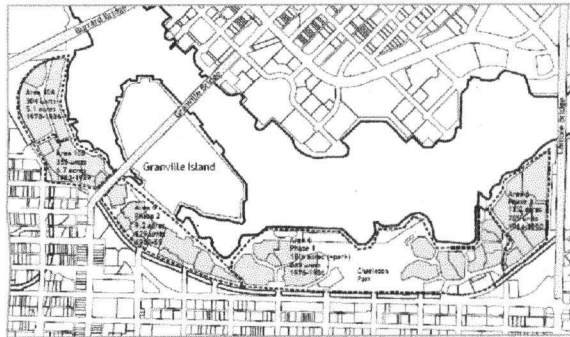
- new use: mixed-use [res; com; office; parks]
- reused structures: few [Roundhouse, & buildings]
- reused infrastructures: few [streets]
- remediation: off-site [before intervention]
- biodiversity: n/a
- green open space: 28%; 237,500m²
- economic activity: 133,933 m²; 0.16
- community involvement : high [co-operative planning model]
- developer: single; private [Concord Pacific]
- new housing: 10,800du; 129up; 15% affordable





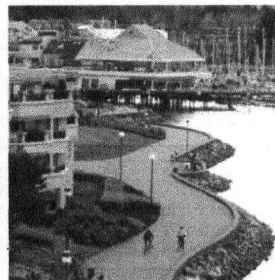
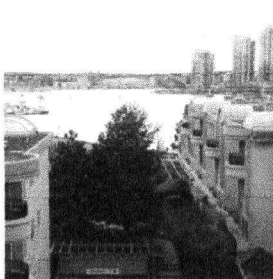
date: completed in 1990

This early transformation of industrial land into a mixed-use mixed-income neighbourhood represented the first public access to False Creek, and a precedent for the following brownfield interventions around it.



brownfield **before**

- scale: 31 hectares
- location: urban; waterfront
- shape: longitudinal; irregular
- nature: industrial
- structures: n/a
- infrastructures: n/a
- contamination: yes [high/low n/a]
- biodiversity: n/a
- green open space: n/a
- economic activity: underused; closing industries
- community/ concern: n/a
- land ownership: single; public; City of Vancouver
[from land exchange with CPR and BC government]



brownfield **after**

- new use: mixed-use [residential; com; GPOS]
- reused structures: n/a [none]
- reused infrastructures: n/a [none]
- remediation: off-site [before intervention]
- biodiversity: high; recreated wildlife habitat
- green open space: 34%; 110.000 m2
- economic activity: 24,750m2; 0.08
- community involvement : n/a
- developer: single; public [City of Vancouver]
- new housing: 2,811du; 91 uph; 37% affordable



landscape architect: Field Operations

date: 2005 Preliminary Master Plan presentation

2007 expected beginning of first phase

Five parks in one. This vast urban park will double Staten Island's greenbelt. Habitat, program and circulation organize the park.



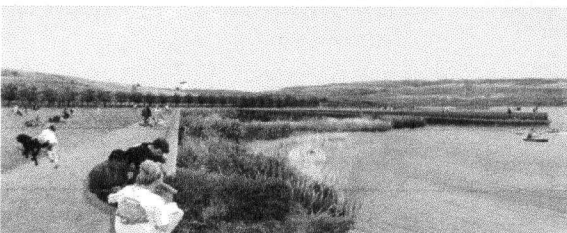
brownfield **before**

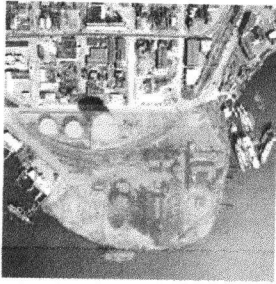
- scale: 890 hectares [2.200 acres]
- location: non-urban; waterfront
- shape: compact; irregular
- nature: 45% landfill, 55% natural
- structures: few [buildings]
- infrastructures: very few [roads]
- contamination: n/a
- biodiversity: high [55% natural]
- green open space: high [55% natural]
- economic activity: no
- community/ concern: n/a
- land ownership: single; public [City of New York]



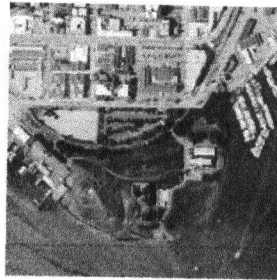
brownfield **after**

- new use: urban park
- reused structures: very few/none
- reused infrastructures: very few [roads]
- remediation: n/a
- biodiversity: high [new and diverse habitat]
- green open space: 100%
- economic activity: no
- community involvement: high
- developer: multiple; public [City and State of NY]
- new housing: no





Seattle Gas Light 1965

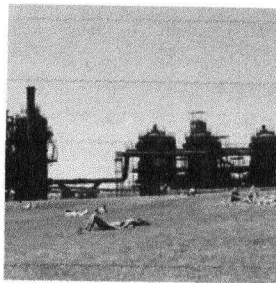


Gas Works Park 2005

landscape architect: Richard Haag

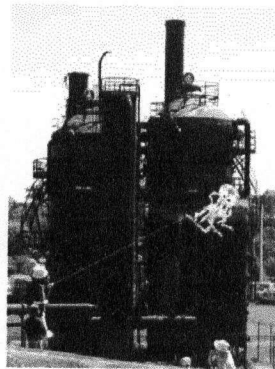
date: 1975 opened to the public

A one hundred year old example of urban transformation: from an ideal lakefront [until 1906], to an industrial site [1906- 1956], to an urban park offering plenty of recreational activities [1976 – today].



brownfield **before**

- scale: 7.7 hectares [19.10 acres]
- location: urban; waterfront
- shape: compact; regular [semicircle]
- nature: industrial [gasification plant]
- structures: many [tanks, structures, buildings]
- infrastructures: few [rail yards]
- contamination: high; state superfund site
- biodiversity: n/a
- green open space: very low
- economic activity: derelict; plant closed in 1956
- community/ concern: high
- land ownership: private; Seattle Gas Light



brownfield **after**

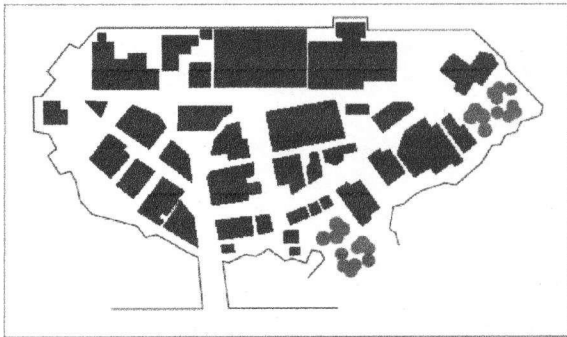
- new use: urban park
- reused structures: many [bdgs, structures, tanks]
- reused infrastructures: few [rail yards]
- remediation: off-site [before intervention] and on-site [buried]; intermittent problems
- biodiversity: n/a
- green open space: 100%
- economic activity: no
- community involvement : high
- developer: single; public [City of Seattle]
- new housing: no



master plan: Hotson Bakker Architects

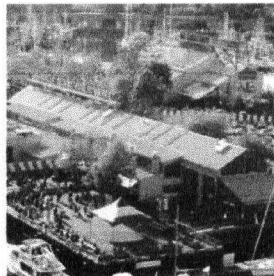
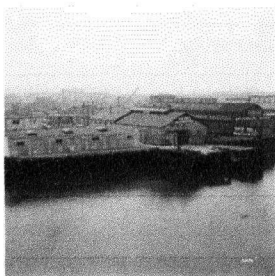
date: completed in 1979

Thirty-year-old transformation of a former industrial site to a mixed-use neighbourhood, highly popular among residents and tourists. Includes sustainable practices.



brownfield **before**

- **scale:** 15 hectares [37 acres]
- **location:** urban; waterfront
- **shape:** compact; regular [triangular]
- **nature:** industrial
- **structures:** many [buildings and structures]
- **infrastructures:** many [streets, rail, wharves]
- **contamination:** yes [high/low n/a]
- **biodiversity:** very low [1970 no sea life]
- **green open space:** low
- **economic activity:** underused; closing industries
- **community/ concern:** n/a
- **land ownership:** single; public; City of Vancouver
[from land exchange with CPR and BC government]

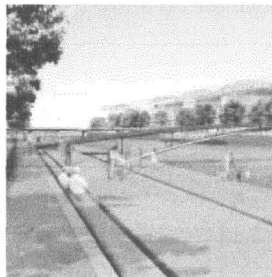
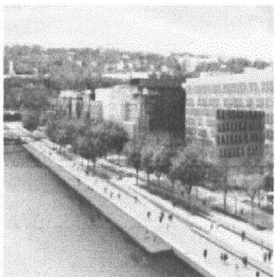
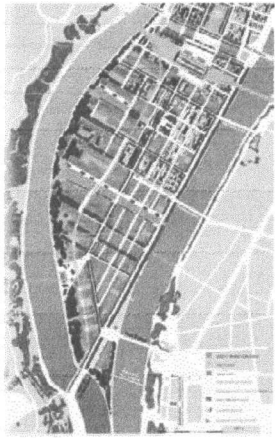


Granville Island in 1922 and in 2005

brownfield **after**

- **new use:** mixed-use [res; com; ind; educ; cultural]
- **reused structures:** many [buildings]
- **reused infrastructures:** many [streets, rail, wharves]
- **remediation:** off-site [before intervention]
- **biodiversity:** high
- **green open space:** [estimated] 23%; 34.000m²
- **economic activity:** [estimated] 33.400m²; 0.22; GBP
- **community involvement :** n/a
- **developer:** public; Granville Island Trust, Government of Canada, Canada Mortgage & Housing Corporation
- **new housing:** 14 du; 0.9 uph





architect: François Grether

landscape architect: Michel Desvigne

date: 1999 project; 2003 approval of 1st phase [41ha];

2015 expected completion 1st phase

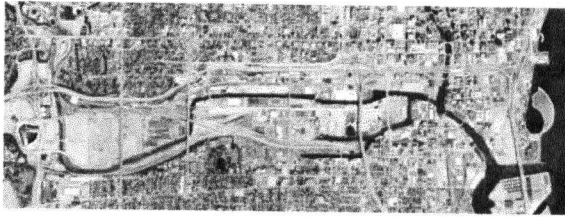
A system of parks allows a flexible occupation as parcels become available for new programs. Importance given to human scale, social housing, green building standards, and the value of Lyon's industrial past.

brownfield before

- **scale:** 150 hectares, 1st phase 41 ha
- **location:** urban; waterfront [downtown Lyon]
- **shape:** longitudinal; irregular
- **nature:** infrastructure [harbour], industrial, residential
- **structures:** many [buildings]
- **infrastructures:** many [docks, rail yards, streets]
- **contamination:** moderate
- **biodiversity:** n/a
- **green open space:** low
- **economic activity:** underused; harbour ceased 1995
- **community/ concern:** n/a
- **land ownership:** n/a

brownfield after

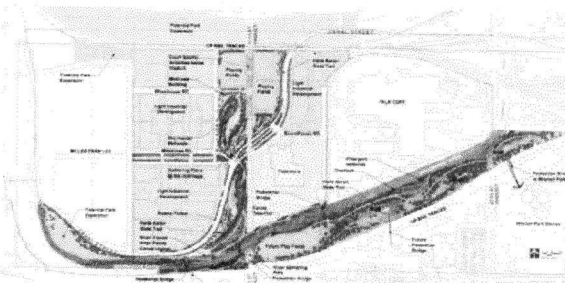
- **new use:** mixed-use [res; com; office; amen; parks]
- **reused structures:** many [buildings as amenities]
- **reused infrastructures:** many [docks, streets]
- **remediation:** n/a [12 months to remediate soils]
- **biodiversity:** n/a
- **green open space:** 41%; 17 ha
- **economic activity:** 1st phase: 210.000 m²; 0.51
- **community involvement:** high
- **developer:** public 36%-private 64% [LyonConfluence]
- **new housing:** 1st phase: 1.600 du; 33% affordable; 23% social; 39 uph; Green Building Standards [GBS]



landscape architect: Wenk Associates

date: 2006 Master Plan; 2010 expected completion date

Industrial use made compatible with a new system of parks, opens spaces, and regional trail connections.



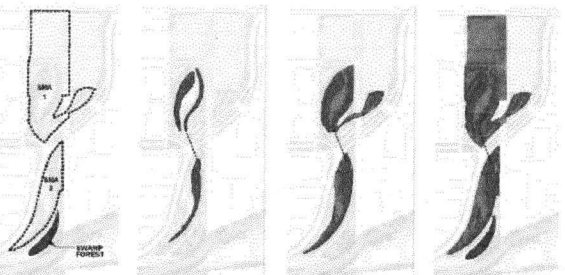
brownfield before

- scale: 56 hectares [140 acres]
- location: urban; waterfront [Menomenee River]
- shape: longitudinal; regular
- nature: industrial and infrastructure; landfill
- structures: many [buildings]
- infrastructures: many [bridges, rail yards, streets]
- contamination: high; petroleum and arsenic
- biodiversity: n/a
- green open space: low
- economic activity: underused [few rail operations]
- community/ concern: n/a
- land ownership: single; private [Milwaukee Road Shops]



brownfield after

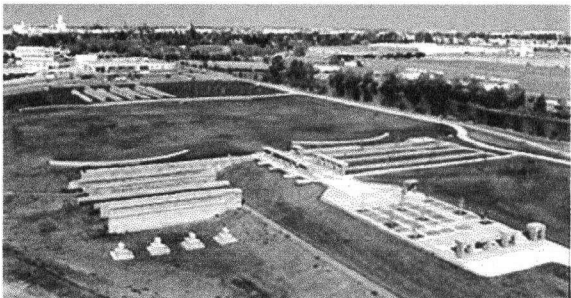
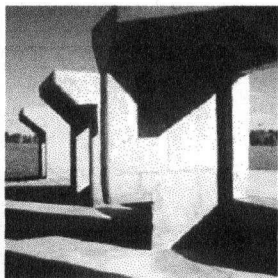
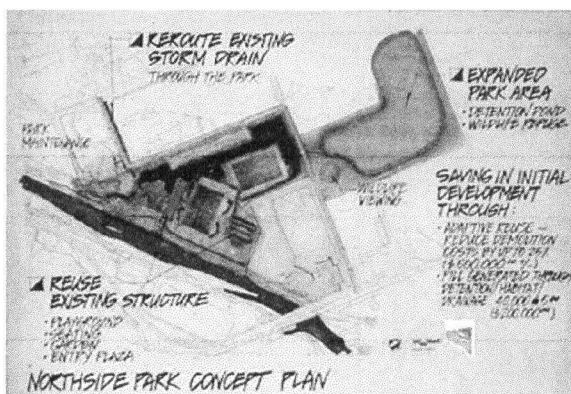
- new use: light industrial and urban park
- reused structures: many [rehabilitated old factories]
- reused infrastructures: many [bridges, rail yards, streets]
- remediation: on-site [7 distinct types of capping]
- biodiversity: high [native plantings, wildlife habitat]
- green open space: 50%; 28 ha park [70 acre park]
- economic activity: [50% site] 280000m²; 0.5
- community involvement: high [charrette]
- developer: single; public-private [Menomenee Valley Partners Inc. MVP]
- new housing: no





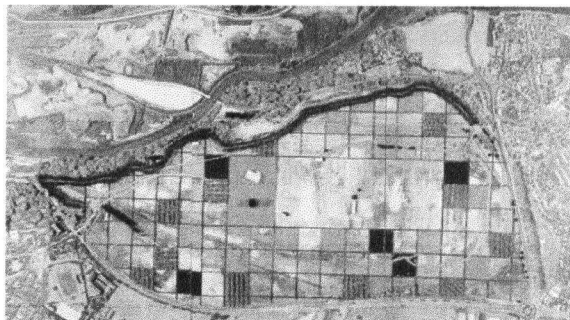
date: 1999; 2001 ASLA Design Merit Award

An abandoned sewage plant transformed into a park in a neighbourhood lacking amenities. Reuses part of the plant structures, celebrating industrial heritage and saving 30% from demolition costs.

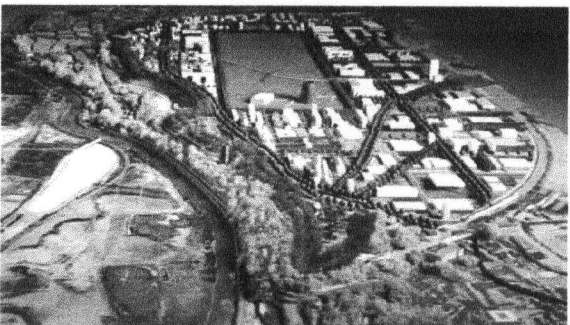
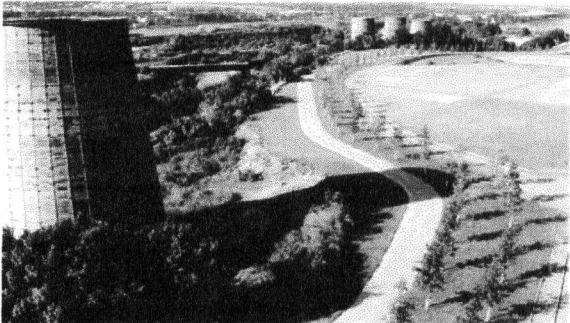
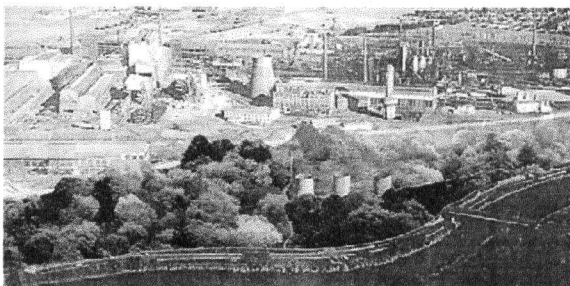


- **scale:** 30 hectares [75 acres]
- **location:** suburban [urban limit]; waterfront [river]
- **shape:** compact; irregular
- **nature:** Infrastructure [sewage system plant]
- **structures:** many [plant structures]
- **infrastructures:** no
- **contamination:** high [heavy metals, hydrocarbons]
- **biodiversity:** n/a
- **green open space:** very low
- **economic activity:** derelict; abandoned sewage plant
- **community/ concern:** n/a
- **land ownership:** single; public [City of Denver]

- **new use:** urban park, armoury, economic activities
- **reused structures:** many [plant structures]
- **reused infrastructures:** no
- **remediation:** off-site [done previous to park works]
- **biodiversity:** high [wetlands / wildlife habitat]
- **green open space:** 100%
- **economic activity:** 30%; 10.000m²; 0.33
- **community involvement :** n/a
- **developer:** single; public [City of Denver]
- **new housing:** no



A 100 x100 metre grid is laid over the landscape to reveal aspects of the terrain otherwise disregarded, and provide the pre-landscape to accommodate future needs.



architect: Dominique Perrault

date: 1994-1997 project development

1999 partial opening of park

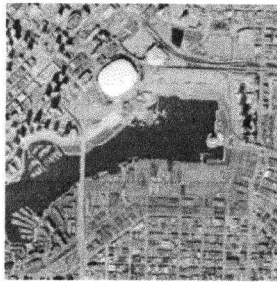
With a program still uncertain, Site Unimetal is conceived as a pre-landscape to accommodate future needs.

brownfield **before**

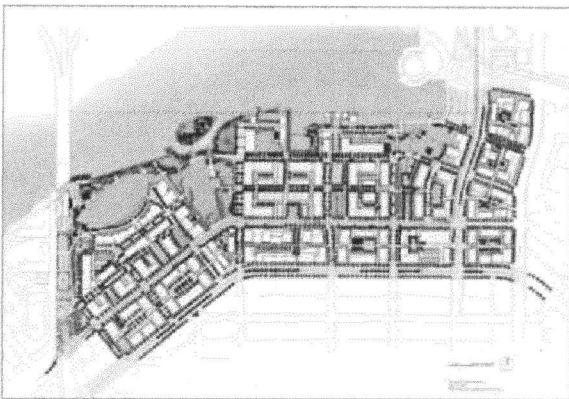
- **scale:** 220 hectares
- **location:** urban; waterfront [river Orle]
- **shape:** compact; irregular
- **nature:** industrial [steel and iron plant]
- **structures:** many [buildings, tanks, structures]
- **infrastructures:** few [roads and railway tracks]
- **contamination:** n/a
- **biodiversity:** n/a
- **green open space:** low
- **economic activity:** derelict; dismantled in the 1990s
- **community/ concern:** high; former workers
- **land ownership:** single; public [District of Greater Caen; until 1996 Metallurgic Society of Normandy SMN]

brownfield **after**

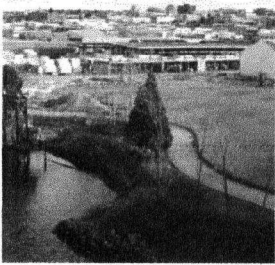
- **new use:** urban park / flexible urban landscape
- **reused structures:** many [tanks, 3 bdgs, refrigeration tower]
- **reused infrastructures:** few [road and rail layout]
- **remediation:** n/a
- **biodiversity:** n/a
- **green open space:** 100% [for the moment]
- **economic activity:** no [for the moment]
- **community involvement :** very low
- **developer:** single; public [District of Greater Caen]
- **new housing:** no [for the moment]



Southeast False Creek 2007



Above: Plan for SEFC; Below: SEFC before [2007] and visions for the future [2010].



date: 2006 Official Development Plan

2010 Expected completion date

A future mixed-use neighbourhood guided by sustainability principles and targets, and also the location for the 2010 Winter Olympics Athletes Village.

brownfield **before**

- scale: 32 hectares [80 acres]
- location: urban; waterfront
- shape: longitudinal; regular
- nature: industrial
- structures: many [buildings; warehouses]
- infrastructures: many [streets; rail tracks; wharves]
- contamination: n/a
- biodiversity: n/a
- green open space: low [narrow shoreline]
- economic activity: underused
- community/ concern: high
- land ownership: multiple; 62% public - private 38%

brownfield **after**

- new use: mixed-use [residential; commercial; office; light industrial; green public open space]
- reused structures: many [buildings]
- reused infrastructures: many [streets; rail tracks reused for streetcar]
- remediation: n/a
- biodiversity: high; reestablishment of wildlife habitat
- green open space: 33%; 104,600 m²
- economic activity: 18.600 m²; 0.06
- community involvement : high; charrette process
- developer: multiple; 62% public [City] - private 38%
- new housing: 7000du; 219uph; 20% affordable; GBS



landscape architect: Gustafson Porter

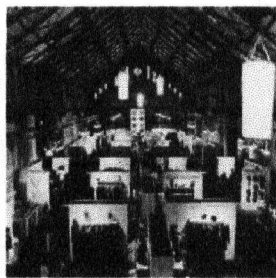
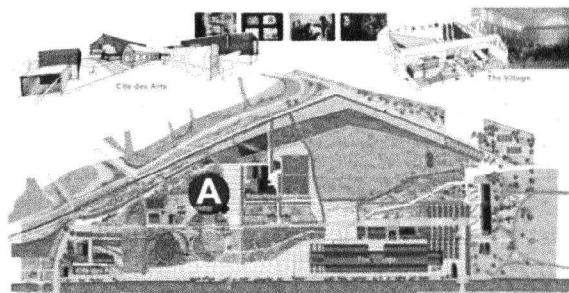
architect: Mecanoo

date: 2003 partial opening; 2004 completion

An example of cultural reuse of historic buildings, a phased on site remediation plan, the visionary ideas of the project team, local government leadership, and community collaboration.

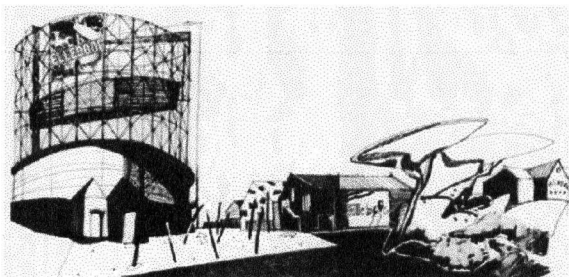
brownfield **before**

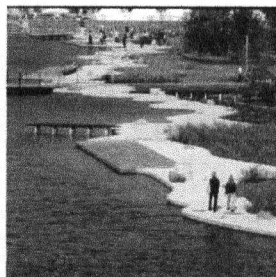
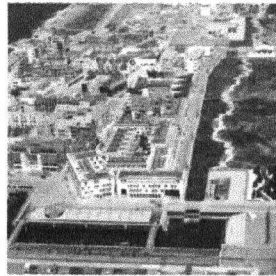
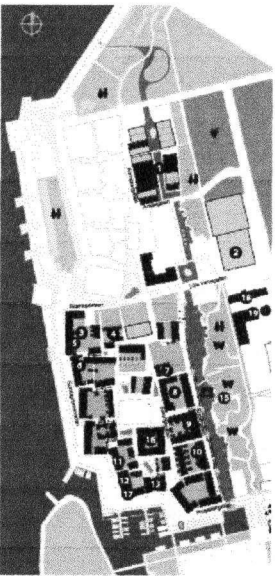
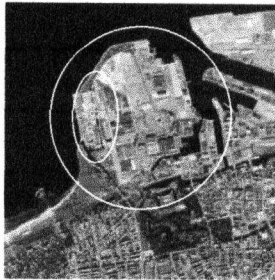
- scale: 14 hectares
- location: urban; waterfront [river]
- shape: compact; regular [triangular]
- nature: industrial [coal-gas plant]
- structures: many [19 buildings & gas tank; 13 herit.]
- infrastructures: few [railway off site]
- contamination: high [heavy metals, VOC, benzene]
- biodiversity: n/a
- green open space: very low
- economic activity: derelict; closed 1967, storage use
- community/ concern: high
- land ownership: public; municipal energy company



brownfield **after**

- new use: mixed-use [cultural; com; urban park]
- reused structures: yes; 19 buildings [13 heritage]
- reused infrastructures: few [railway off site]
- remediation: on-site; all soil retained on site
- biodiversity: high; mixed of native & selected plants
- green open space: 91%; 12.75 ha
- economic activity: 12,500 m²; 0.09
- community involvement : high
- developer: single; public [Stadsteel Westerpark]
- new housing: no





date: 1997 planning process

2001 first stage bo01 completed for the European housing expo "City of Tomorrow"

Former shipbuilding yards transformed into a leading example of environmental mixed-use conurbation that is renewing the city's ties with the sea.

brownfield **before**

- scale: 160 hectares [bo01-25 ha]
- location: urban; waterfront
- shape: compact; irregular [circular]
- nature: industrial [shipbuilding; automobile industry]
- structures: many [buildings, warehouses]
- infrastructures: few [wharfs; streets]
- contamination: low; high in limited areas
- biodiversity: high in the sea line; low in the canal
- green open space: low [a narrow park on NW]
- economic activity: underused [few ind. and offices]
- community/ concern: n/a
- land ownership: single; private [Kockums]

brownfield **after**

- new use: mixed-use [res; office; com; educ; GPOS]
- reused structures: many [buildings, warehouses]
- reused infrastructures: few [wharfs; streets]
- remediation: off-site [removed for treatment]
- biodiversity: high
- green open space: 50%; green space factor: 0.5
- economic activity: [bo01 estimated] 100,000m²; 0.4
- community involvement : n/a
- developer: multiple; public [City of Malmö] and private [Kockums and Saab]
- new housing: [bo01] 600 du; 24 uph; GBS

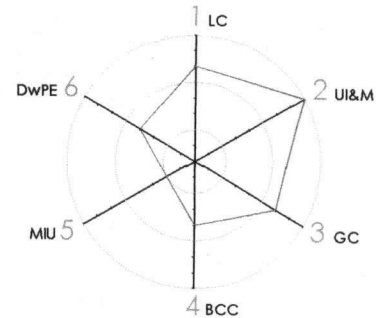
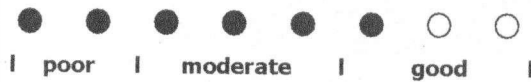
Appendix III Brownfield Interventions in Bilbao:
Abandoibarra, Galindo, Ametzola, Zorrotzaurre

1. GOAL: IMPROVE THE LEGIBILITY OF THE CITY

DESCRIPTION

Improve the city's spatial understanding by enhancing the existing and surrounding urban fabric, increasing its compactness and diversity, and revealing its site-specific physical features.

GOAL EVALUATION



OBJECTIVES

1.1 ENHANCE THE EXISTING AND SURROUNDING URBAN FABRIC

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between city and river*
after: *City and river reconnected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well



1.2 INCREASE THE COMPACTNESS OF THE URBAN FABRIC

- **Measure:** Change in gross residential density on the brownfield [BF] site in units per hectare [uph]
before: 0 uph after: 17 uph Change: 17 uph
- **Credit:** 0- <20 uph [8dua]; 1- 20-39 uph [8-16dua]; 2- ≥40 uph [16dua]



1.3 INCREASE THE DIVERSITY OF THE URBAN FABRIC

- **Measure:** Change in number of uses within the BF site
before: 1 use after: 5 uses Change: 4 uses
- **Credit:** 0- 0 new uses; 1- 1 or 2 new uses; 2- 3 or more new uses



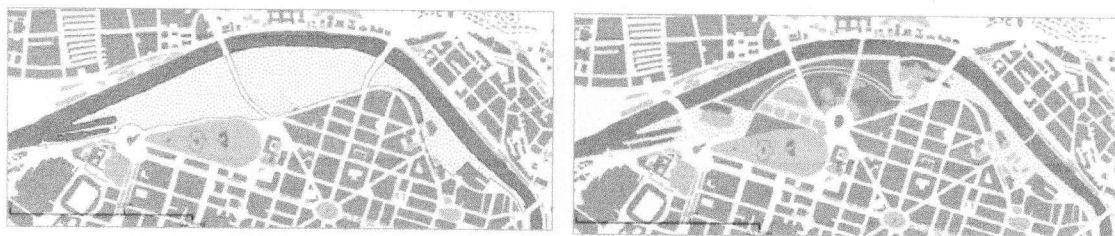
1.4 REVEAL THE AREA'S SITE SPECIFIC NATURAL FEATURES

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Spatial understanding of city context denied*
after: *Reclamation of waterfront provides spatial understanding of city context*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well



GRAPHIC REPRESENTATION

Abandoibarra before and after: new built form and public open space

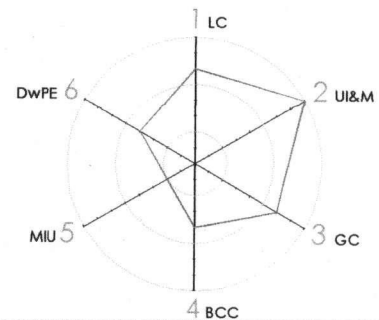


2. GOAL: IMPROVE URBAN INTEGRATION AND MOBILITY

DESCRIPTION

Enhance the existing and surrounding urban networks favouring transit and non-motorized modes of transportation.

GOAL EVALUATION



OBJECTIVES

2.1 ENHANCE THE EXISTING AND SURROUNDING STREET NETWORK

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between city and river*
after: *City and river reconnected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-**well**

2.2 ENHANCE THE EXISTING AND SURROUNDING PEDESTRIAN NETWORK

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between city and river*
after: *City and river reconnected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-**well**

2.3 ENHANCE THE EXISTING AND SURROUNDING TRANSIT NETWORK

- **Measure:** Change in transit affecting the site and the surrounding area within 400m
before: *bus* after: *bus and tram*
- **Credit:** 0- no change; 1- bus / more frequency; 2- **train, tram, subway / more frequency**

2.4 PROMOTE OTHER NON-MOTORIZED MODES OF TRANSPORTATION

- **Measure:** Existence of bikeways
after: *Existence of bikeway connected to a broader network*
- **Credit:** 0- no; 1- yes, but only on the site; 2- **yes, and connected to broader network**

GRAPHIC REPRESENTATION

Abandoibarra before and after: new street, pedestrian, transit and bicycle connections

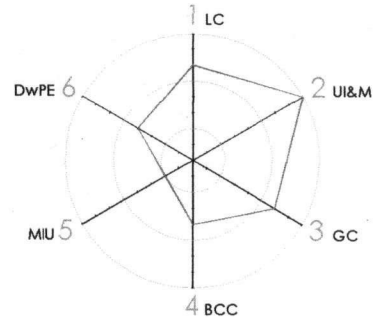
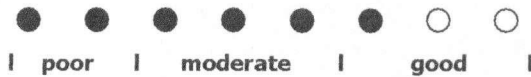


3. GOAL: GREEN THE CITY

DESCRIPTION

Improve the quality, quantity, and accessibility to green public open space. For contaminated sites [real or perceived], restore the sites and any potential environmental hazards.

GOAL EVALUATION



OBJECTIVES

3.1 IMPROVE THE ENVIRONMENTAL QUALITY OF PUBLIC SPACE

- **Measure:** Description of state of contamination and use for public open space [POS] or green POS
before: No GPOS after: Contam. remediated and use for GPOS [3 parks]
- **Credit:** 0- contam. remediated; 1- 0+ use for POS; 2- 0+ use for GPOS [i.e. urban park]

3.2 INCREASE THE QUANTITY OF GREEN OPEN SPACE

- **Measure:** Change in percentage of BF site destined to green open space
before: 0% BF after: 33% Change: 33%
- **Credit:** 0- < 15%; 1- 15-29%; 2- ≥30%

3.3 IMPROVE THE ACCESSIBILITY TO GREEN PUBLIC OPEN SPACE

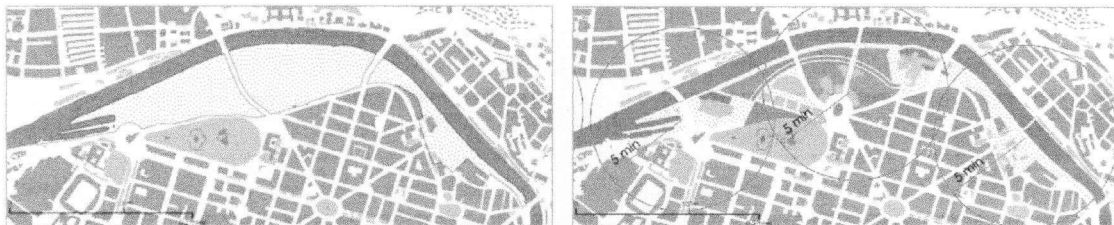
- **Measure:** Change in percentage of du within 5 min. walking distance [400m] to GPOS ≥1ha at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: 50% after: 70% Change: 20%
- **Credit:** 0- < 0% [negative value]; 1- 0-19%; 2- ≥20%

3.4 INCLUDE OTHER ENVIRONMENTAL FEATURES IN THE INTERVENTION

- **Measure:** Description [i.e. recycling, composting, urban agriculture, stormwater management]
before: none after: no information [none]
- **Credit:** 0- none; 1- 1 feature; 2- >1 feature [If no information, default: 0]

GRAPHIC REPRESENTATION

Abandoibarra before and after: new public open spaces within walking distances



4.

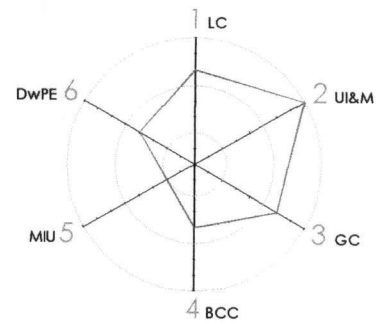
GOAL: BUILD COMPLETE COMMUNITIES

ABANDOIBARRA BILBAO

DESCRIPTION

Improve housing affordability, social integration and accessibility to goods and services, and encourage economic revitalization.

GOAL EVALUATION



OBJECTIVES

4.1 INCREASE HOUSING AVAILABILITY

- Measure: Percentage of change in number of dwelling units at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: 13,472 du after: 14,072 du Change: 600 du; 4%
- Credit: 0- <10%; 1- 10-19%; 2- ≥20%

4.2 INCREASE HOUSING AFFORDABILITY AND SOCIAL INTEGRATION

- Measure: Change in percentage of social/affordable housing on the BF site
before: 0% after: 0% Change: 0%
- Credit: 0- <15%; 1- 15-49%; 2- ≥50%

4.3 IMPROVE ACCESSIBILITY TO SERVICES AND AMENITIES

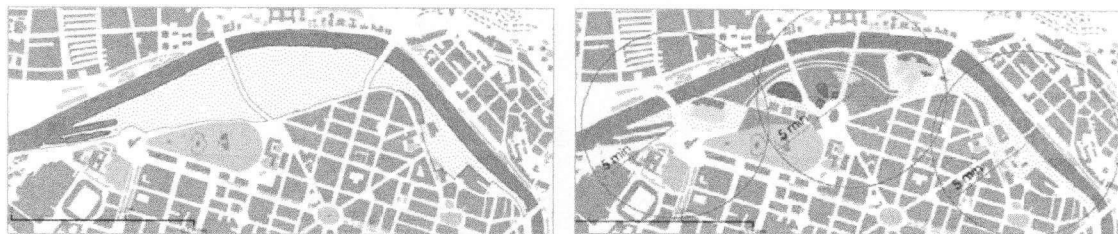
- Measure: Number of new services and amenities at neighbourhood scale [on the BF site and the surrounding area within 400m]
Number and type of new service and amenity: 4: 2 museums, 2 university bdgs, 1 convention centre
- Credit: 0- 0; 1- 1; 2- >1

4.4 ENCOURAGE ECONOMIC REVITALIZATION

- Measure: Change in gross intensity of economic activity as ratio of floor area to BF site area
before: 0 after: 0.33 Change: 0.33
- Credit: 0- <0.04; 1- 0.04-0.07; 2- ≥0.08

GRAPHIC REPRESENTATION

Abandoibarra before and after: new uses within walking distance

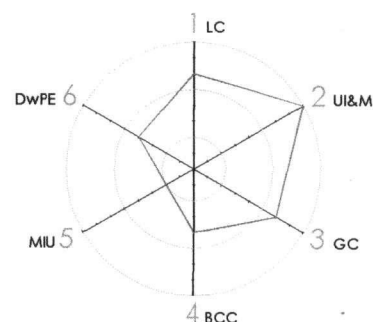
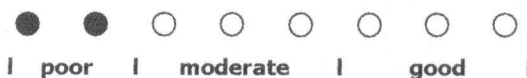


5. GOAL: MITIGATE THE IMPACT OF URBANIZATION

DESCRIPTION

Reduce the city's overall resource consumption and waste generation, with a particular focus on land as a natural resource and soil, water, and air contamination as waste.

GOAL EVALUATION



OBJECTIVES

5.1 REDUCE BROWNFIELD LAND IN THE METROPOLITAN AREA

- **Measure:** Percentage of change in BF land in the metropolitan area [Default: BF site area]
before: 332 ha after: 297 ha Change: 35 ha; 10%
- **Credit:** 0- <1%; 1- 1-9%; 2- ≥10% [Default: 0- BF site < 10ha; 1- 10-29ha; 2- ≥30ha]

5.2 REDUCE PRESSURE ON GREEN FIELD DEVELOPMENT

- **Measure:** Ratio of "Greenfield [GF] Saving" to area of BF site ["GF Saving" obtained by applying a suburban density of 15uph to the number of new dwelling units]
GF saving: 40 ha Ratio of GF saving to BF site: 1
- **Credit:** 0- <2; 1- 2-4; 2- ≥5

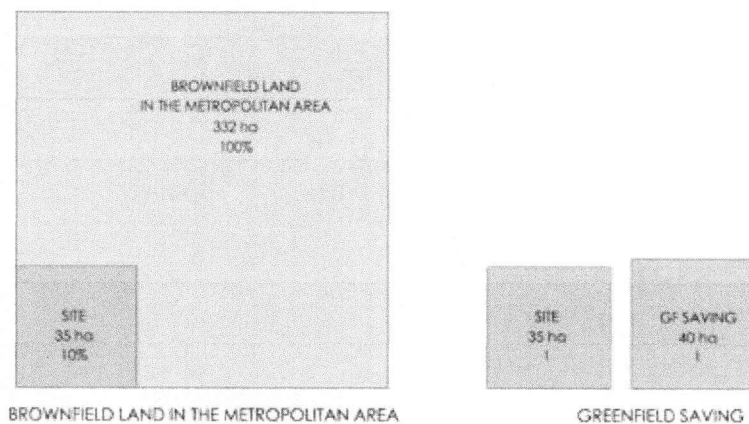
5.3 REDUCE CONTAMINATED SOIL IN THE METROPOLITAN AREA

- **Measure:** Percentage of on-site remediation of the BF site's contaminated soil
On-site remediation: [no information] 0%
- **Credit:** 0- <20%; 1- 20-80%; 2- ≥80% [If no information, default: 0]

5.4 INCLUDE GREEN BUILDING PRACTICES

- **Measure:** Existence of Green Building Practices or Standards
after: none specific
- **Credit:** 0- none; 1- in specific buildings; 2- Green Building Standards for the whole intervention

GRAPHIC REPRESENTATION

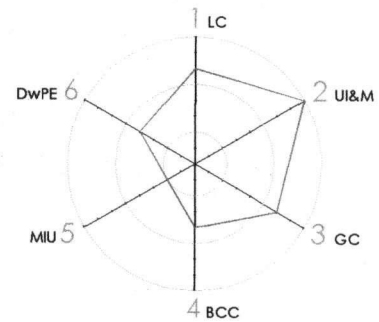


6. GOAL: DEAL WITH THE PRE-EXISTING

DESCRIPTION

Consider, value, and enhance the site's social, cultural, historical, and environmental pre-intervention conditions.

GOAL EVALUATION



OBJECTIVES

6.1 REUSE AND INTEGRATE EXISTING STRUCTURES AND INFRASTRUCTURES

- **Measure:** Number of existing buildings, structures, and infrastructures reused/restored
before: many cranes, 4 warehouses, railway, wharves BF after: 1 crane and wharves
- **Credit:** 0- none; 1- 1,2; 2- ≥3

6.2 ENGAGE THE COMMUNITY IN THE DECISION-MAKING PROCESS

- **Measure:** Type of public participation events [i.e. charrettes, workshops, forums]
Participatory events: [n/a] To be implemented: conventional process
- **Credit:** 0- conventional process; 1- participatory events but not to be implemented; 2- participatory events to be implemented

6.3 PRESERVE AND ENHANCE EXISTING BIODIVERSITY AND GREEN OPEN SPACE

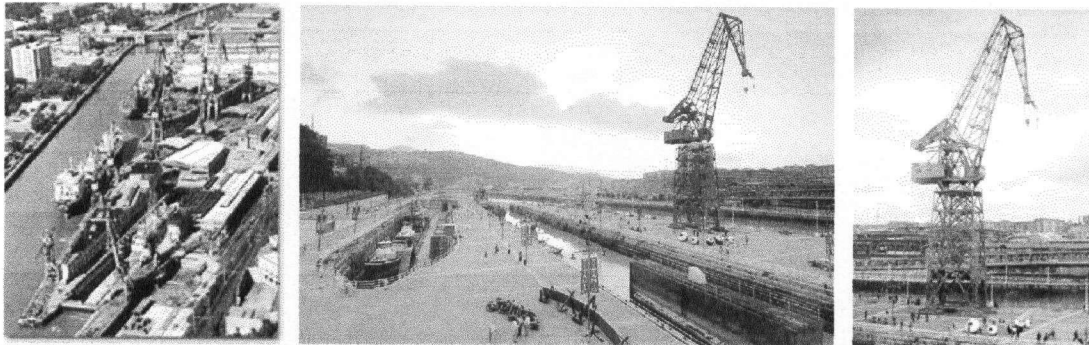
- **Measure:** Same credit as 3.2 [Change in percentage of BF site destined to green open space] as long as the new green open space includes the existing
before: 0% BF after: 33% Change: 33%
- **Credit:** 0- < 15%, or green open space not including the existing; 1- 15-29%; 2- ≥30%

6.4 ADDRESS THE SITE'S FORMER USE[S] THROUGH DESIGN

- **Measure:** Description
References: Facades of Euskalduna Convention Centre and Guggenheim Museum
- **Credit:** 0- Accomplishes the objective poorly/no references; 1- moderately/few; 2- well/many

GRAPHIC REPRESENTATION

Euskalduna Shipbuilding Industry wharves and cranes before and after, reclaimed as public open space

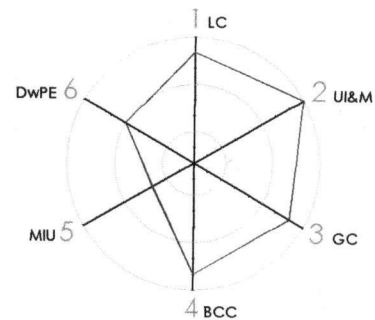


1.

GOAL:

IMPROVE THE LEGIBILITY OF THE CITY**DESCRIPTION**

Improve the city's spatial understanding by enhancing the existing and surrounding urban fabric, increasing its compactness and diversity, and revealing its site-specific physical features.

GOAL EVALUATION**OBJECTIVES****1.1 ENHANCE THE EXISTING AND SURROUNDING URBAN FABRIC**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between city and river*
after: *City and river reconnected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

**1.2 INCREASE THE COMPACTNESS OF THE URBAN FABRIC**

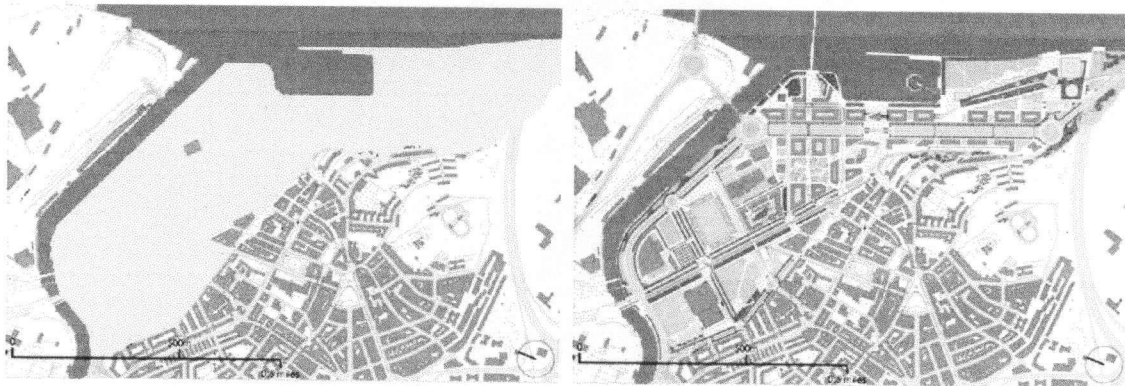
- **Measure:** Change in gross residential density on the brownfield site in units per hectare [uph]
before: 0 uph after: 37 uph Change: 37 uph
- **Credit:** 0- <20 uph [8dua]; 1- 20-39 uph [8-16dua]; 2- ≥40 uph [16dua]

**1.3 INCREASE THE DIVERSITY OF THE URBAN FABRIC**

- **Measure:** Change in number of uses within the brownfield site
before: 1 use after: 5 uses Change: 4 uses
- **Credit:** 0- 0 new uses; 1- 1 or 2 new uses; 2- 3 or more new uses

**1.4 REVEAL THE AREA'S SITE SPECIFIC NATURAL FEATURES**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Spatial understanding of city context denied*
after: *Reclamation of waterfront provides spatial understanding of city context*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

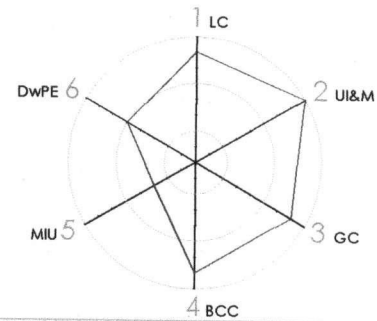
**GRAPHIC REPRESENTATION** Galindo [Barakaldo] before & after: new urban form

2.

GOAL:

IMPROVE URBAN INTEGRATION AND MOBILITY**DESCRIPTION**

Enhance the existing and surrounding urban networks favouring transit and non-motorized modes of transportation.

GOAL EVALUATION**OBJECTIVES****2.1 ENHANCE THE EXISTING AND SURROUNDING STREET NETWORK**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between city and river*
after: *City and river reconnected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

2.2 ENHANCE THE EXISTING AND SURROUNDING PEDESTRIAN NETWORK

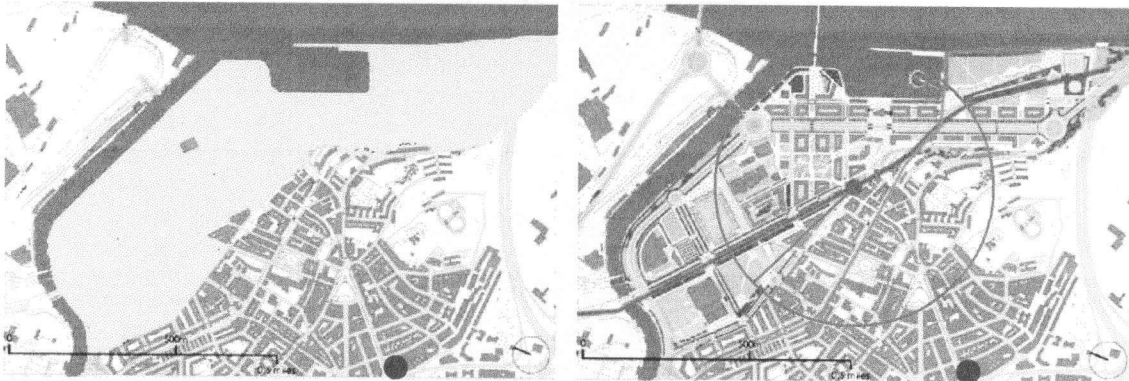
- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between city and river*
after: *City and river reconnected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

2.3 ENHANCE THE EXISTING AND SURROUNDING TRANSIT NETWORK

- **Measure:** Change in transit affecting the site and the surrounding area within 400m
before: *bus, train* after: *bus, train and subway*
- **Credit:** 0- no change; 1- bus / more frequency; 2- train, tram, subway / more frequency

2.4 PROMOTE OTHER NON-MOTORIZED MODES OF TRANSPORTATION

- **Measure:** Existence of bikeways
after: *Existence of bikeway connected to a broader network*
- **Credit:** 0- no; 1- yes, but only on the site; 2- yes, and connected to broader network

GRAPHIC REPRESENTATION Galindo [Barakaldo] before & after: new connections

3.

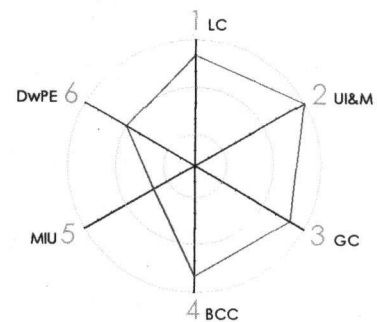
GOAL: GREEN THE CITY

GALINDO BARAKALDO

DESCRIPTION

Improve the quality, quantity, and accessibility to green public open space. For contaminated sites [real or perceived], restore the sites and any potential environmental hazards.

GOAL EVALUATION



OBJECTIVES

3.1 IMPROVE THE ENVIRONMENTAL QUALITY OF PUBLIC SPACE

- **Measure:** Description of state of contamination and use for public open space [POS] or green POS
before: *No GPOS* after: *Contam. remediated and use for GPOS [4 parks]*
- **Credit:** 0- contam. remediated; 1- 0+ use for POS; 2- 0+ use for GPOS [i.e. urban park]

3.2 INCREASE THE QUANTITY OF GREEN OPEN SPACE

- **Measure:** Change in percentage of BF site destined to green open space
before: *0%* after: *33%* Change: *33%*
- **Credit:** 0- < 15%; 1- 15-29%; 2- ≥30%

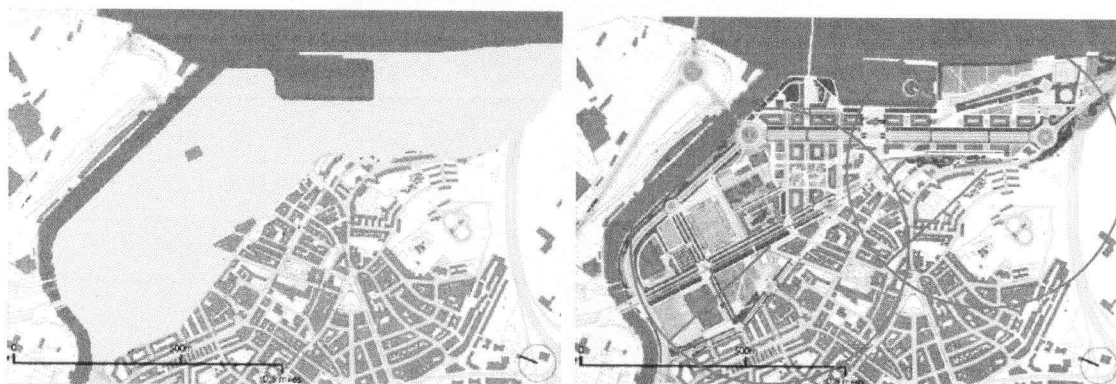
3.3 IMPROVE THE ACCESSIBILITY TO GREEN PUBLIC OPEN SPACE

- **Measure:** Change in percentage of du within 5 min. walking distance [400m] to GPOS ≥1ha at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: *0%* after: *100%* Change: *100%*
- **Credit:** 0- < 0% [negative value]; 1- 0-19%; 2- ≥20%

3.4 INCLUDE OTHER ENVIRONMENTAL FEATURES IN THE INTERVENTION

- **Measure:** Description [i.e. recycling, composting, urban agriculture, stormwater management]
before: *none* after: *pneumatic waste system for recycling*
- **Credit:** 0- none; 1- 1 feature; 2- >1 feature [If no information, default: 0]

GRAPHIC REPRESENTATION Galindo before & after: new green open spaces within walking distance

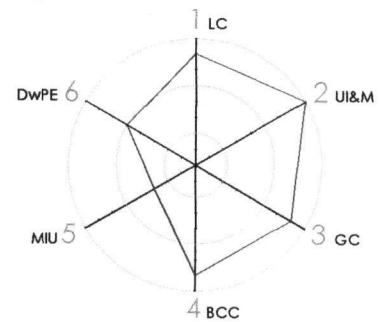


4. GOAL: BUILD COMPLETE COMMUNITIES

DESCRIPTION

Improve housing affordability, social integration and accessibility to goods and services, and encourage economic revitalization.

GOAL EVALUATION



OBJECTIVES

4.1 INCREASE HOUSING AVAILABILITY

- ●
Measure: Percentage of change in number of dwelling units at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: 4240 du after: 6440 du Change: 2200 du; 52%
- **Credit:** 0- <10%; 1- 10-19%; 2- ≥20%

4.2 INCREASE HOUSING AFFORDABILITY AND SOCIAL INTEGRATION

- ○
Measure: Change in percentage of social/affordable housing on the BF site
before: 0% after: 24% Change: 24%
- **Credit:** 0- <15%; 1- 15-49%; 2- ≥50%

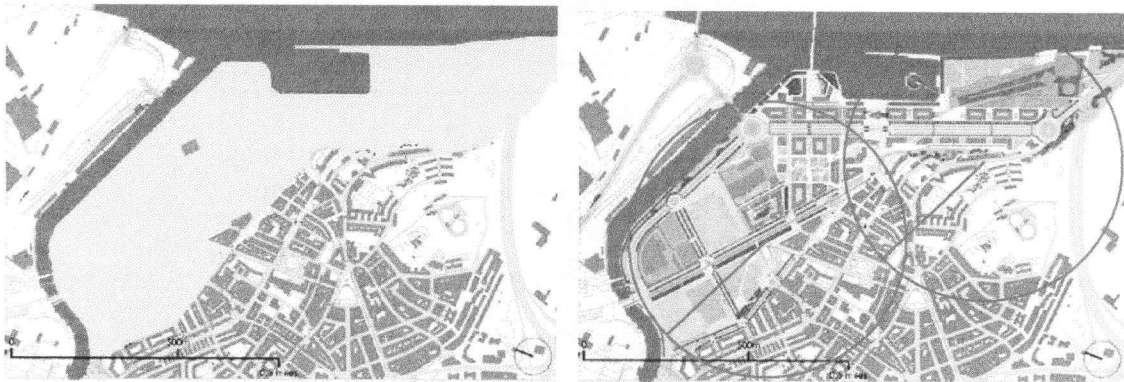
4.3 IMPROVE ACCESSIBILITY TO SERVICES AND AMENITIES

- ●
Measure: Number of new services and amenities at neighbourhood scale [on the BF site and the surrounding area within 400m]
Number and type of new service and amenity: 4: sports and civic centres, soccer field, institutional bldg
- **Credit:** 0- 0; 1- 1; 2- >1

4.4 ENCOURAGE ECONOMIC REVITALIZATION

- ●
Measure: Change in gross intensity of economic activity as ratio of floor area to BF site area
before: 0 after: 0.11 Change: 0.11
- **Credit:** 0- <0.04; 1- 0.04-0.07; 2- ≥0.08

GRAPHIC REPRESENTATION Galindo before & after: new uses within walking distance



5.

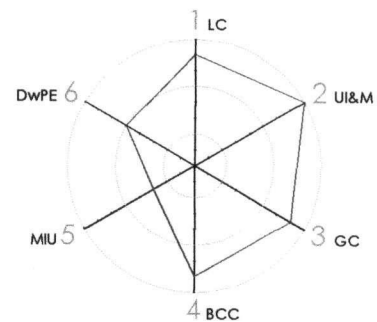
GOAL:

MITIGATE THE IMPACT OF URBANIZATION**DESCRIPTION**

Reduce the city's overall resource consumption and waste generation, with a particular focus on land as a natural resource and soil, water, and air contamination as waste.

GOAL EVALUATION

1 poor 1 moderate 1 good 1

**OBJECTIVES****5.1 REDUCE BROWNFIELD LAND IN THE METROPOLITAN AREA**

- **Measure:** Percentage of change in BF land in the metropolitan area [Default: BF site area]
before: 332 ha after: 272 ha Change: 60 ha; 18%
- **Credit:** 0- <1%; 1- 1-9%; 2- ≥10% [Default: 0- BF site < 10ha; 1- 10-29ha; 2- ≥30ha]

5.2 REDUCE PRESSURE ON GREEN FIELD DEVELOPMENT

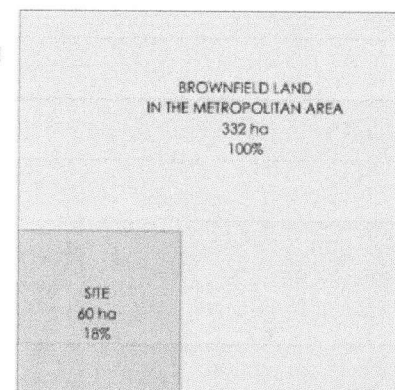
- **Measure:** Ratio of "Greenfield [GF] Saving" to area of BF site ["GF Saving" obtained by applying a suburban density of 15uph to the number of new dwelling units]
GF saving: 147 ha Ratio of GF saving to BF site: 2
- **Credit:** 0- <2; 1- 2-4; 2- ≥5

5.3 REDUCE CONTAMINATED SOIL IN THE METROPOLITAN AREA

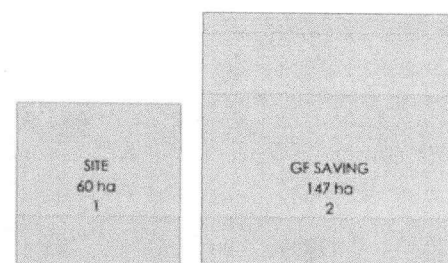
- **Measure:** Percentage of on-site remediation of the brownfield site's contaminated soil
On-site remediation: [no information] 0%
- **Credit:** 0- <20%; 1- 20-80%; 2- ≥80% [If no information, default: 0]

5.4 INCLUDE GREEN BUILDING PRACTICES

- **Measure:** Existence of Green Building Practices or Standards
after: none specific
- **Credit:** 0- none; 1- in specific buildings; 2- Green Building Standards for the whole intervention

GRAPHIC REPRESENTATION

BROWNFIELD LAND IN THE METROPOLITAN AREA



GREENFIELD SAVING

6.

GOAL: DEAL WITH THE PRE-EXISTING

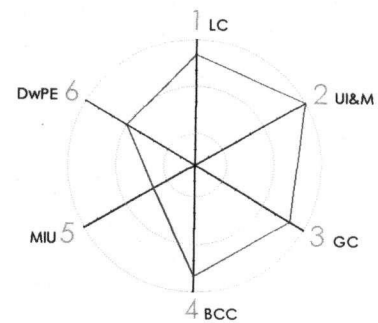
GALINDO BARAKALDO

DESCRIPTION

Consider, value, and enhance the site's social, cultural, historical, and environmental pre-intervention conditions.

GOAL EVALUATION

● ● ● ● ● ○ ○ ○
| poor | moderate | good |



OBJECTIVES

6.1 REUSE AND INTEGRATE EXISTING STRUCTURES AND INFRASTRUCTURES

- **Measure:** Number of existing buildings, structures, and infrastructures reused/restored
before: 1bdg, 1 crane, railway, roads, wharves and bridge after: all but roads
- **Credit:** 0- none; 1- 1,2; 2- ≥3

6.2 ENHANCE THE COMMUNITY IN THE DECISION-MAKING PROCESS

- **Measure:** Type of public participation events [i.e. charrettes, workshops, forums]
Participatory events: [n/a] To be implemented: conventional process
- **Credit:** 0- conventional process; 1- participatory events but not to be implemented;
2- participatory events to be implemented

6.3 PRESERVE AND ENHANCE EXISTING BIODIVERSITY AND GREEN OPEN SPACE

- **Measure:** Same credit as 3.2 [Change in percentage of BF site destined to green open space] as long as the new green open space includes the existing
before: 0% after: 33% Change: 33%
- **Credit:** 0- < 15%, or green open space not including the existing; 1- 15-29%; 2- ≥30%

6.4 ADDRESS THE SITE'S FORMER USE[S] THROUGH DESIGN

- **Measure:** Description
References: Plaza Desierto
- **Credit:** 0- Accomplishes the objective poorly/no references; 1- moderately/few; 2- well/many

GRAPHIC REPRESENTATION

Restored ore-loading facility, Ilgner Building integrated with new buildings, and Plaza Desierto.



1.

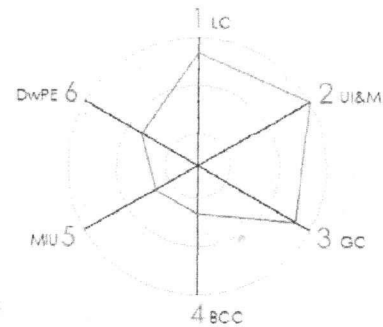
GOAL:

IMPROVE THE LEGIBILITY OF THE CITY**DESCRIPTION**

Improve the city's spatial understanding by enhancing the existing and surrounding urban fabric, increasing its compactness and diversity, and revealing its site-specific physical features.

GOAL EVALUATION

| poor | moderate | good |

**OBJECTIVES****1.1 ENHANCE THE EXISTING AND SURROUNDING URBAN FABRIC**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between neighbourhoods*
after: *Neighbourhoods connected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-**well**

1.2 INCREASE THE COMPACTNESS OF THE URBAN FABRIC

- **Measure:** Change in gross residential density on the brownfield site in units per hectare [uph]
before: *0 uph* after: *82 uph* Change: *82 uph*
- **Credit:** 0- <20 uph [8dua]; 1- 20-39 uph [8-16dua]; 2- **>40 uph [16dua]**

1.3 INCREASE THE DIVERSITY OF THE URBAN FABRIC

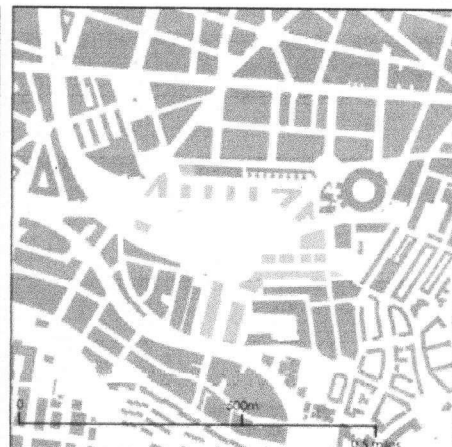
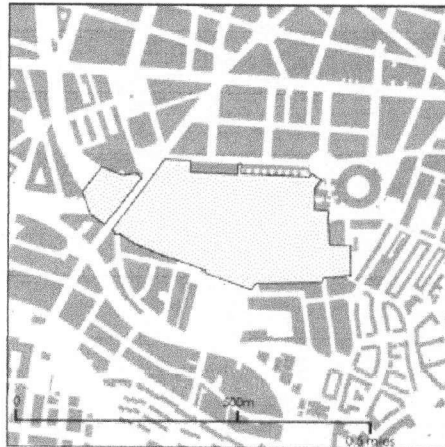
- **Measure:** Change in number of uses within the brownfield site
before: *1 use* after: *3 uses* Change: *2 uses*
- **Credit:** 0- 0 new uses; 1- **1 or 2 new uses**; 2- 3 or more new uses

1.4 REVEAL THE AREA'S SITE SPECIFIC NATURAL FEATURES

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Spatial understanding of city context denied*
after: *Large public open space provides spatial understanding of city context*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-**well**

GRAPHIC REPRESENTATION

Ametzola
before and after:
new urban form and
open space

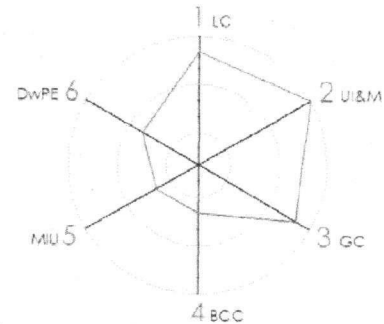


2.

GOAL:

IMPROVE URBAN INTEGRATION AND MOBILITY**DESCRIPTION**

Enhance the existing and surrounding urban networks favouring transit and non-motorized modes of transportation.

GOAL EVALUATION**OBJECTIVES****2.1 ENHANCE THE EXISTING AND SURROUNDING STREET NETWORK**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between neighbourhoods*
after: *Neighbourhoods connected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

2.2 ENHANCE THE EXISTING AND SURROUNDING PEDESTRIAN NETWORK

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Barrier between neighbourhoods*
after: *Neighbourhoods connected*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

2.3 ENHANCE THE EXISTING AND SURROUNDING TRANSIT NETWORK

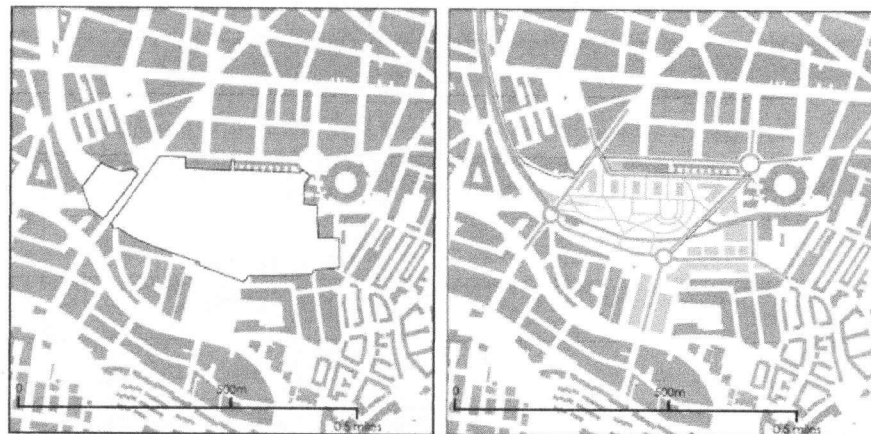
- **Measure:** Change in transit affecting the site and the surrounding area within 400m
before: *bus* after: *bus and train*
- **Credit:** 0- no change; 1- bus / more frequency; 2- train, tram, subway/more frequency

2.4 PROMOTE OTHER NON-MOTORIZED MODES OF TRANSPORTATION

- **Measure:** Existence of bikeways
after: *Existence of bikeway connected to a broader network*
- **Credit:** 0- no; 1- yes, but only on the site; 2- yes, and connected to a broader network

GRAPHIC REPRESENTATION

Ametzola
before and after:
new connections



3.

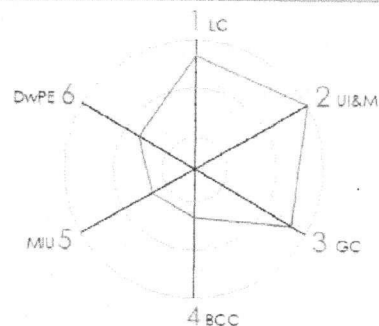
GOAL:
GREEN THE CITY

AMETZOLA BILBAO

DESCRIPTION

Improve the quality, quantity, and accessibility to green public open space. For contaminated sites [real or perceived], restore the sites and any potential environmental hazards.

GOAL EVALUATION



OBJECTIVES

3.1 IMPROVE THE ENVIRONMENTAL QUALITY OF PUBLIC OPEN SPACE

- **Measure:** Description of state of contamination and use for public open space [POS] or green POS
before: No GPOS after: Contam. remediated and use for urban park [36,000m²]
- **Credit:** 0- contam. remediated; 1- 0+ use for POS; 2- 0+ use for GPOS [i.e. urban park]

3.2 INCREASE THE QUANTITY OF GREEN OPEN SPACE

- **Measure:** Change in percentage of BF site destined to green open space
before: 2% after: 33% Change: 31%
- **Credit:** 0- < 15%; 1- 15-29%; 2- ≥30%

3.3 IMPROVE THE ACCESSIBILITY TO GREEN PUBLIC OPEN SPACE

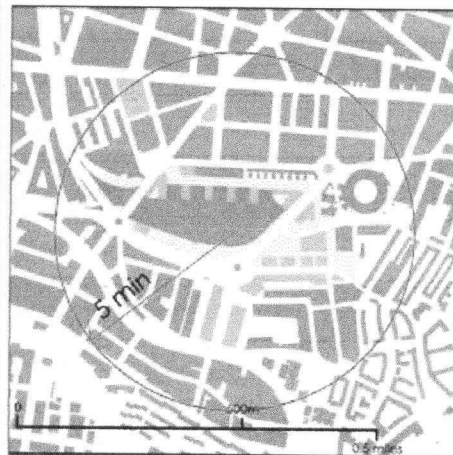
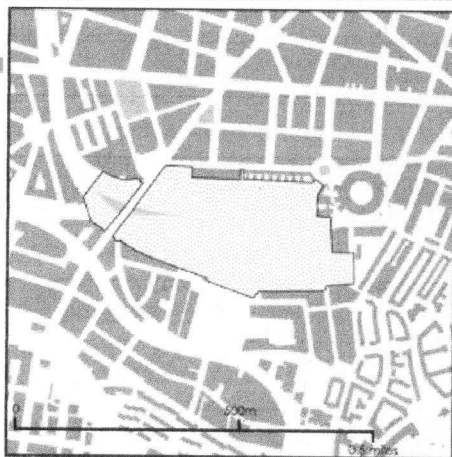
- **Measure:** Change in percentage of du within 5 min. walking distance [400m] to GPOS ≥1ha at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: 0% after: 100% Change: 100%
- **Credit:** 0- < 0% [negative value]; 1- 0-19%; 2- ≥20%

3.4 INCLUDE OTHER ENVIRONMENTAL FEATURES IN THE INTERVENTION

- **Measure:** Description [i.e. recycling, composting, urban agriculture, stormwater management]
before: none after: pneumatic waste system for recycling
- **Credit:** 0- none; 1- 1 feature; 2- >1 feature [If no information, default: 0]

GRAPHIC REPRESENTATION

Ametzola
before and after:
new green open
space within walking
distance



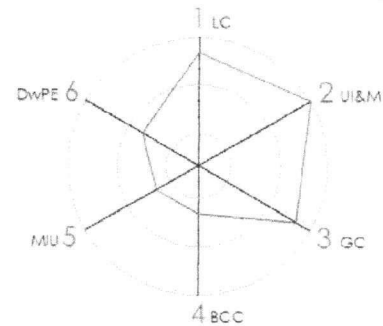
4.

GOAL:
BUILD COMPLETE COMMUNITIES
DESCRIPTION

Improve housing affordability, social integration and accessibility to goods and services, and encourage economic revitalization.

GOAL EVALUATION

● ● ● ○ ○ ○ ○ ○
 | poor | moderate | good |

**OBJECTIVES****4.1 INCREASE HOUSING AVAILABILITY**

- ● **Measure:** Percentage of change in number of dwelling units at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: 4563 du after: 5463 du Change: 900 du; 20%
- **Credit:** 0- <10%; 1- 10-19%; 2- ≥20%

4.2 INCREASE HOUSING AFFORDABILITY AND SOCIAL INTEGRATION

- ○ **Measure:** Change in percentage of social/affordable housing on the BF site
before: 0% after: 17% Change: 17%
- **Credit:** 0- <15%; 1- 15-49%; 2- ≥50%

4.3 IMPROVE ACCESSIBILITY TO SERVICES AND AMENITIES

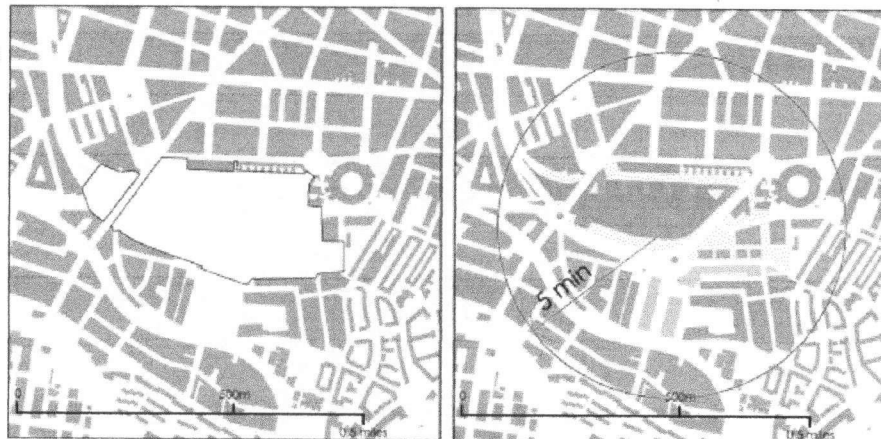
- ○ **Measure:** Number of new services and amenities at neighbourhood scale [on the BF site and the surrounding area within 400m]
Number and type of new service and amenity: none
- **Credit:** 0- 0; 1- 1; 2- >1

4.4 ENCOURAGE ECONOMIC REVITALIZATION

- ○ **Measure:** Change in gross intensity of economic activity as ratio of floor area to BF site area
before: 0 after: 0 Change: 0
- **Credit:** 0- <0.04; 1- 0.04-0.07; 2- ≥0.08

GRAPHIC REPRESENTATION

Ametzola
 before and after:
 new uses within
 walking distance



5.

GOAL:

MITIGATE THE IMPACT OF URBANIZATION

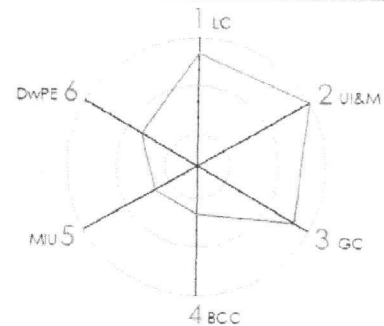
DESCRIPTION

Reduce the city's overall resource consumption and waste generation, with a particular focus on land as a natural resource and soil, water, and air contamination as waste.

GOAL EVALUATION



| poor | moderate | good |



OBJECTIVES

5.1 REDUCE BROWNFIELD LAND IN THE METROPOLITAN AREA

- **Measure:** Percentage of change in BF land in the metropolitan area [Default: BF site area]
before: **332 ha** after: **321 ha** Change: **11ha; 3%**
- **Credit:** 0- <1%; 1- 1-9%; 2- ≥10% [Default: 0- BF site < 10ha; 1- 10-29ha; 2- ≥30ha]

5.2 REDUCE PRESSURE ON GREEN FIELD DEVELOPMENT

- **Measure:** Ratio of "Greenfield [GF] Saving" to area of BF site ["GF Saving" obtained by applying a suburban density of 15uph to the number of new dwelling units]
GF saving: **60 ha** Ratio of GF saving to BF site: **5**
- **Credit:** 0- <2; 1- 2-4; 2- ≥5

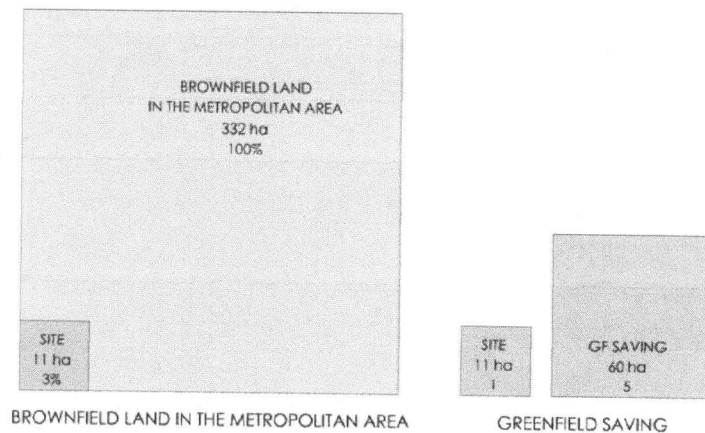
5.3 REDUCE CONTAMINATED SOIL IN THE METROPOLITAN AREA

- **Measure:** Percentage of on-site remediation of the brownfield site's contaminated soil
On-site remediation: **[no information] 0%**
- **Credit:** 0- <20%; 1- 20-80%; 2- ≥80% [If no information, default: 0]

5.4 INCLUDE GREEN BUILDING PRACTICES

- **Measure:** Existence of Green Building Practices or Standards
after: **none specific**
- **Credit:** 0- none; 1- in specific buildings; 2- Green Building Standards for the whole intervention

GRAPHIC REPRESENTATION



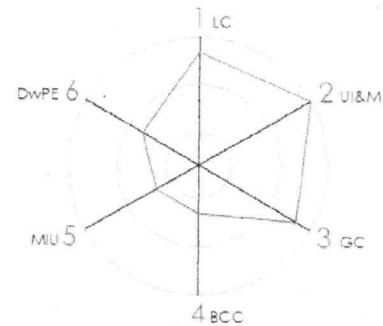
6. GOAL: DEAL WITH THE PRE-EXISTING

DESCRIPTION

Consider, value, and enhance the site's social, cultural, historical, and environmental pre-intervention conditions.

GOAL EVALUATION

● ● ● ● ○ ○ ○ ○
 | poor | moderate | good |



OBJECTIVES

6.1 REUSE AND INTEGRATE EXISTING STRUCTURES AND INFRASTRUCTURES

- **Measure:** Number of existing buildings, structures, and infrastructures reused/restored
before: railway and 3 freight stations after: railway
- **Credit:** 0- none; 1- 1,2; 2- ≥3

6.2 ENGAGE THE COMMUNITY IN THE DECISION-MAKING PROCESS

- **Measure:** Type of public participation events [i.e. charrettes, workshops, forums]
Participatory events: [n/a] To be implemented: conventional process
- **Credit:** 0- conventional process; 1- participatory events but not to be implemented;
 2- participatory events to be implemented

6.3 PRESERVE AND ENHANCE EXISTING BIODIVERSITY AND GREEN OPEN SPACE

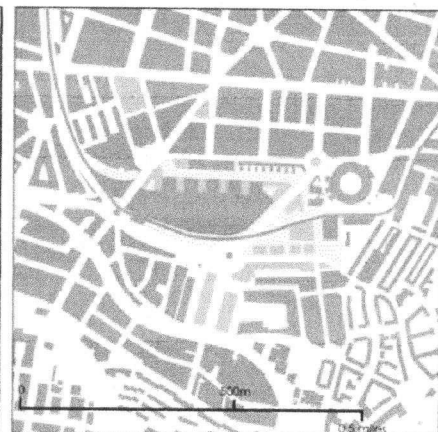
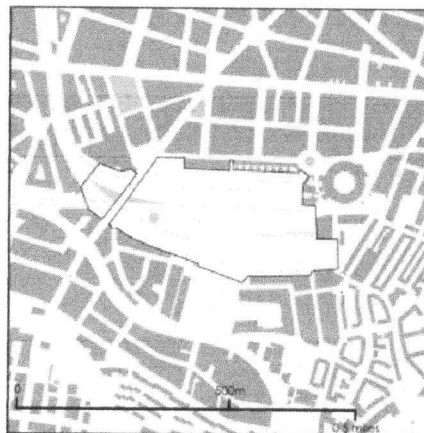
- **Measure:** Same credit as 3.2 [Change in percentage of BF site destined to green open space] as long as the new green open space includes the existing
before: 2% after: 33% Change: 31%
- **Credit:** 0- < 15%, or green open space not including the existing; 1- 15-29%; 2- ≥30%

6.4 ADDRESS THE SITE'S FORMER USE[S] THROUGH DESIGN

- **Measure:** Description
- **References:** *train station*
- **Credit:** 0- Accomplishes the objective poorly/no references; 1- moderately/few; 2- well/many

GRAPHIC REPRESENTATION

Ametzola
 before and after:
 reuse of the train for
 passenger use



1.

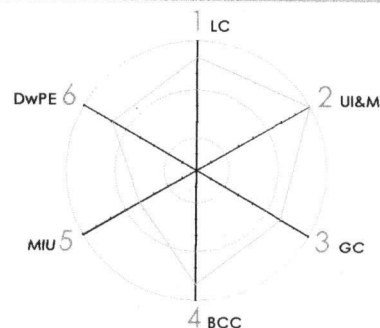
GOAL:

IMPROVE THE LEGIBILITY OF THE CITY**DESCRIPTION**

Improve the city's spatial understanding by enhancing the existing and surrounding urban fabric, increasing its compactness and diversity, and revealing its site-specific physical features.

GOAL EVALUATION

1 poor | moderate | good |

**OBJECTIVES****1.1 ENHANCE THE EXISTING AND SURROUNDING URBAN FABRIC**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Isolated neighbourhood*
after: *Neighbourhood reconnected to surrounding neighbourhoods*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

1.2 INCREASE THE COMPACTNESS OF THE URBAN FABRIC

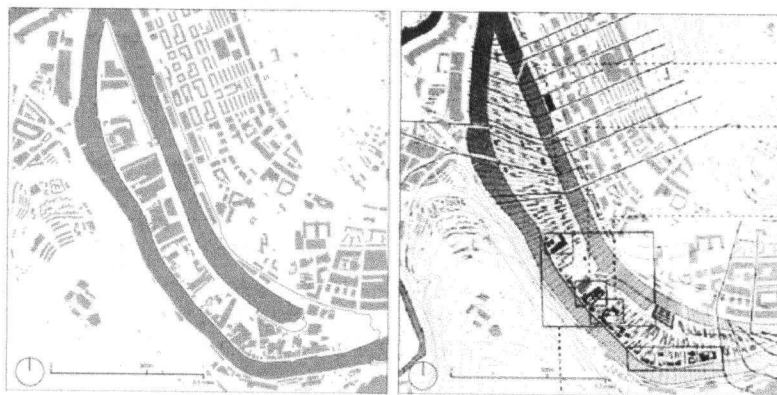
- **Measure:** Change in gross residential density on the brownfield [BF] site in units per hectare [uph]
before: 3 uph after: 92 uph Change: 89 uph
- **Credit:** 0- <20 uph [8dua]; 1- 20-39 uph [8-16dua]; 2- ≥40 uph [16dua]

1.3 INCREASE THE DIVERSITY OF THE URBAN FABRIC

- **Measure:** Change in number of uses within the BF site
before: 3 uses after: 5 uses Change: 2 uses
- **Credit:** 0- 0 new uses; 1- 1 or 2 new uses; 2- 3 or more new uses

1.4 REVEAL THE AREA'S SITE SPECIFIC NATURAL FEATURES

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Little connection between two shores*
after: *Shores connected, and connection of site to river*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

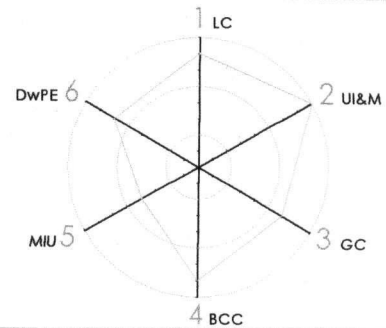
GRAPHIC REPRESENTATION Zorrotzaurre before and after: new urban form

2.

GOAL:

IMPROVE URBAN INTEGRATION AND MOBILITY**DESCRIPTION**

Enhance the existing and surrounding urban networks favouring transit and non-motorized modes of transportation.

GOAL EVALUATION**OBJECTIVES****2.1 ENHANCE THE EXISTING AND SURROUNDING STREET NETWORK**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Weak street network*
after: *Enhanced street network*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

**2.2 ENHANCE THE EXISTING AND SURROUNDING PEDESTRIAN NETWORK**

- **Measure:** Description before and after intervention at neighbourhood scale
before: *Weak pedestrian network*
after: *Enhanced pedestrian network*
- **Credit:** 0- Accomplishes the objective poorly; 1-moderately; 2-well

**2.3 ENHANCE THE EXISTING AND SURROUNDING TRANSIT NETWORK**

- **Measure:** Change in transit affecting the site and the surrounding area within 400m
before: *bus* after: *bus and tram*
- **Credit:** 0- no change; 1- bus / more frequency; 2- train, tram, subway / more frequency

**2.4 PROMOTE OTHER NON-MOTORIZED MODES OF TRANSPORTATION**

- **Measure:** Existence of bikeways
after: *Existence of bikeway connected to a broader network*
- **Credit:** 0- no; 1- yes, but only on the site; 2- yes, and connected to broader network

**GRAPHIC REPRESENTATION**

Zorrotzaurre after: new street, pedestrian, transit, and bicycle connections



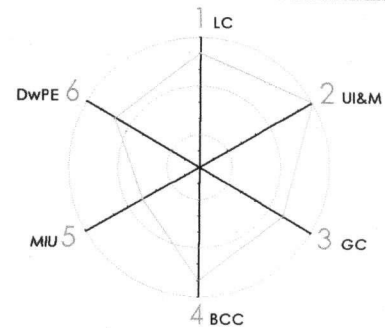
3.

GOAL:
GREEN THE CITY

DESCRIPTION

Improve the quality, quantity, and accessibility to green public open space. For contaminated sites [real or perceived], restore the sites and any potential environmental hazards.

GOAL EVALUATION



OBJECTIVES

3.1 IMPROVE THE ENVIRONMENTAL QUALITY OF PUBLIC SPACE

- **Measure:** Description of state of contamination and use for public open space [POS] or green POS
before: *Little GPOS [1 park 0.5ha]* after: *Contam. remed. and use for GPOS [3 parks]*
- **Credit:** 0- contam. remediated; 1- 0+ use for POS; 2- 0+ use for GPOS [i.e. urban park]

3.2 INCREASE THE QUANTITY OF GREEN OPEN SPACE

- **Measure:** Change in percentage of BF site destined to green open space
before: *8%* after: *33%* Change: *25%*
- **Credit:** 0- < 15%; 1- 15-29%; 2- ≥30%

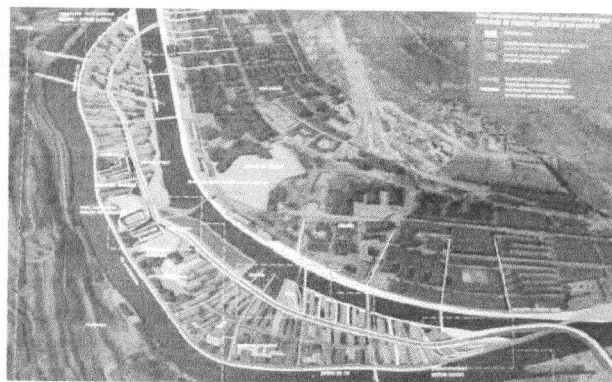
3.3 IMPROVE THE ACCESSIBILITY TO GREEN PUBLIC OPEN SPACE

- **Measure:** Change in percentage of du within 5 min. walking distance [400m] to GPOS ≥1ha at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: *10%* after: *40%* Change: *30%*
- **Credit:** 0- < 0% [negative value]; 1- 0-19%; 2- ≥20%

3.4 INCLUDE OTHER ENVIRONMENTAL FEATURES IN THE INTERVENTION

- **Measure:** Description [i.e. recycling, composting, urban agriculture, stormwater management]
before: *none* after: *stormwater management*
- **Credit:** 0- none; 1- 1 feature; 2- >1 feature [If no information, default: 0]

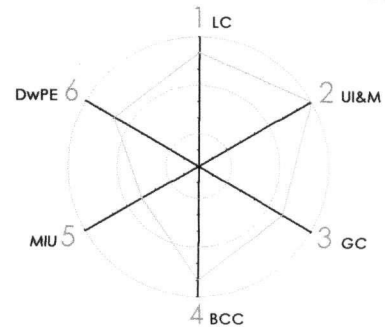
GRAPHIC REPRESENTATION Zorrotzaurre before and after: new public open spaces



4.

GOAL:
BUILD COMPLETE COMMUNITIES
DESCRIPTION

Improve housing affordability, social integration and accessibility to goods and services, and encourage economic revitalization.

GOAL EVALUATION**OBJECTIVES****4.1 INCREASE HOUSING AVAILABILITY**

- **Measure:** Percentage of change in number of dwelling units at a neighbourhood scale [on the BF site and the surrounding area within 400m]
before: 10,805 du after: 16,105 du Change: 5,300 du; 49%
- **Credit:** 0- <10%; 1- 10-19%; 2- ≥20%

4.2 INCREASE HOUSING AFFORDABILITY AND SOCIAL INTEGRATION

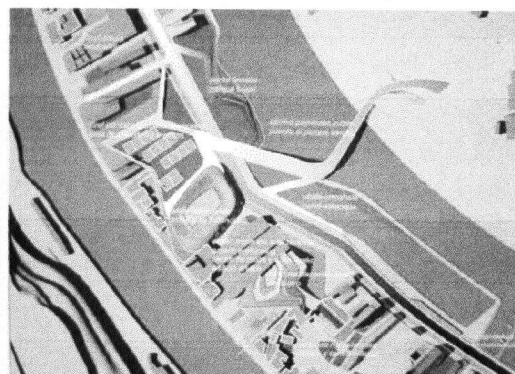
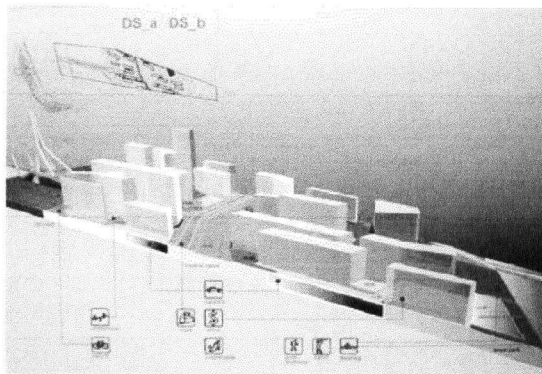
- **Measure:** Change in percentage of social/affordable housing on the BF site
before: 0% after: 28% Change: 28%
- **Credit:** 0- <15%; 1- 15-49%; 2- ≥50%

4.3 IMPROVE ACCESSIBILITY TO SERVICES AND AMENITIES

- **Measure:** Number of new services and amenities at neighbourhood scale [on the BF site and the surrounding area within 400m]
Number and type of new service and amenity: many: sports centre, 2 university bdgs, and others
- **Credit:** 0- 0; 1- 1; 2- >1

4.4 ENCOURAGE ECONOMIC REVITALIZATION

- **Measure:** Change in gross intensity of economic activity as ratio of floor area to BF site area
before: 0 after: 0.27 Change: 0.27
- **Credit:** 0- <0.04; 1- 0.04-0.07; 2- ≥0.08

GRAPHIC REPRESENTATION Zorrotzaurre after: new uses integrated with existing buildings

5.

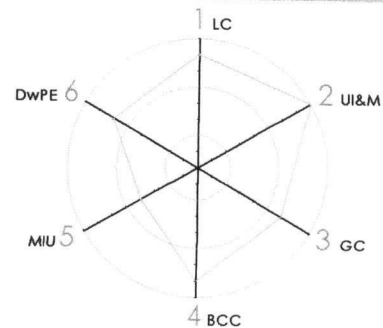
GOAL:

MITIGATE THE IMPACT OF URBANIZATION**DESCRIPTION**

Reduce the city's overall resource consumption and waste generation, with a particular focus on land as a natural resource and soil, water, and air contamination as waste.

GOAL EVALUATION

● ● ● ● ○ ○ ○ ○
 | poor | moderate | good |

**OBJECTIVES****5.1 REDUCE BROWNFIELD LAND IN THE METROPOLITAN AREA**

- **Measure:** Percentage of change in BF land in the metropolitan area [Default: BF site area]
before: 332 ha after: 274 ha Change: 58 ha; 17%
- **Credit:** 0- <1%; 1- 1-9%; 2- ≥10% [Default: 0- BF site < 10ha; 1- 10-29ha; 2- ≥30ha]

5.2 REDUCE PRESSURE ON GREEN FIELD DEVELOPMENT

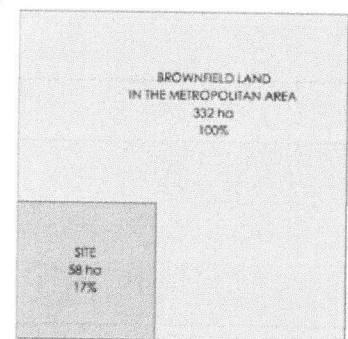
- **Measure:** Ratio of "Greenfield [GF] Saving" to area of BF site ["GF Saving" obtained by applying a suburban density of 15uph to the number of new dwelling units]
GF saving: 353 ha Ratio of GF saving to BF site: 6
- **Credit:** 0- <2; 1- 2-4; 2- ≥5

5.3 REDUCE CONTAMINATED SOIL IN THE METROPOLITAN AREA

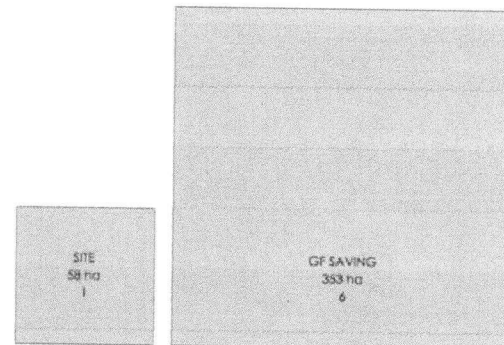
- **Measure:** Percentage of on-site remediation of the BF site's contaminated soil
On-site remediation: [no information] 0%
- **Credit:** 0- <20%; 1- 20-80%; 2- ≥80% [If no information, default: 0]

5.4 INCLUDE GREEN BUILDING PRACTICES

- **Measure:** Existence of Green Building Practices or Standards
after: none specific
- **Credit:** 0- none; 1- in specific buildings; 2- Green Building Standards for the whole intervention

GRAPHIC REPRESENTATION

BROWNFIELD LAND IN THE METROPOLITAN AREA



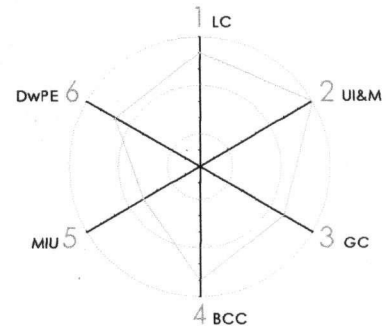
GREENFIELD SAVING

6. GOAL: DEAL WITH THE PRE-EXISTING

DESCRIPTION

Consider, value, and enhance the site's social, cultural, historical, and environmental pre-intervention conditions.

GOAL EVALUATION



OBJECTIVES

6.1 REUSE AND INTEGRATE EXISTING STRUCTURES AND INFRASTRUCTURES

- **Measure:** Number of existing buildings, structures, and infrastructures reused/restored
before: res & ind bdgs [some heritage], streets & open spaces after: bdgs, streets & open spaces
- **Credit:** 0— none; 1- 1,2; 2- ≥3

6.2 ENGAGE THE COMMUNITY IN THE DECISION-MAKING PROCESS

- **Measure:** Type of public participation events [i.e. charrettes, workshops, forums]
Participatory events: workshops and public forum To be implemented: no
- **Credit:** 0— conventional process; 1- **participatory events but not to be implemented;**
2- participatory events to be implemented

6.3 PRESERVE AND ENHANCE EXISTING BIODIVERSITY AND GREEN OPEN SPACE

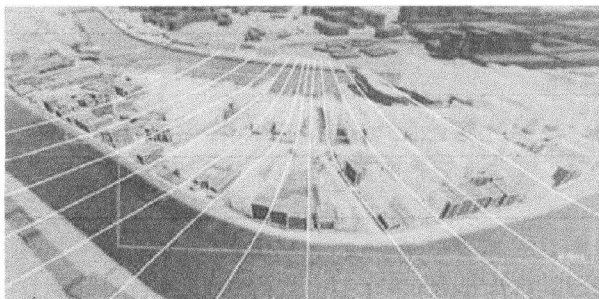
- **Measure:** Same credit as 3.2 [Change in percentage of BF site destined to green open space] as long as the new green open space includes the existing
before: 8% after: 33% Change: 25%, including native plant material
- **Credit:** 0— < 15%, or green open space not including the existing; 1- 15-29%; 2- ≥30%

6.4 ADDRESS THE SITE'S FORMER USE[S] THROUGH DESIGN

- **Measure:** Description
References: Strategy for integrating industrial patrimony
- **Credit:** 0— Accomplishes the objective poorly/no references; 1- moderately/few; 2- well/many

GRAPHIC REPRESENTATION

Digital images integrating industrial patrimony and other existing buildings [dark] with new ones [light]



**Appendix IV Brownfield Intervention
Sustainability Evaluation Tool**

1.	GOAL	IMPROVE THE LEGIBILITY OF THE CITY
DESCRIPTION Improve the city's spatial understanding by enhancing the existing and surrounding urban fabric, increasing its compactness and diversity, and revealing its site-specific physical features.		
RATIONALE <ul style="list-style-type: none"> Social: To enhance social diversity, integration and interaction; satisfy needs for open space, housing, amenities and services; and alleviate unemployment by creating and retaining jobs. Economic: To increase economic productivity and complement existing economic activities, create and retain jobs, and provide economic benefits through tax revenues and real estate. Environmental: To discourage the use of the private vehicle, reducing CO2 emissions and fossil fuel consumption, and to improve land efficiency. 		
OBJECTIVES		
<div style="display: flex; justify-content: space-between;"> <div> 1.1 ENHANCE THE EXISTING AND SURROUNDING URBAN FABRIC <ul style="list-style-type: none"> Indicator: Description before and after intervention at neighbourhood scale <i>before:</i> _____ <i>after:</i> _____ Credit: 0- Accomplishes the objective poorly; 1-moderately; 2-well Graphic representation: map </div> <div style="text-align: right;"> <input type="radio"/> <input type="radio"/> </div> </div>		
<div style="display: flex; justify-content: space-between;"> <div> 1.2 INCREASE THE COMPACTNESS OF THE URBAN FABRIC <ul style="list-style-type: none"> Indicator: Change in gross residential density on the brownfield [BF] site in units per hectare [uph] <i>before:</i> _____ <i>uph</i> <i>after:</i> _____ <i>uph</i> <i>Change:</i> _____ <i>uph</i> Credit: 0- <20 uph [8dua]; 1- 20-39 uph [8-16dua]; 2- ≥40 uph [16dua] Graphic representation: map </div> <div style="text-align: right;"> <input type="radio"/> <input type="radio"/> </div> </div>		
<div style="display: flex; justify-content: space-between;"> <div> 1.3 INCREASE THE DIVERSITY OF THE URBAN FABRIC <ul style="list-style-type: none"> Indicator: Change in number of uses within the BF site <i>before:</i> _____ <i>uses</i> <i>after:</i> _____ <i>uses</i> <i>Change:</i> _____ <i>uses</i> Credit: 0- 0 new uses; 1- 1 or 2 new uses; 2- 3 or more new uses Graphic representation: map </div> <div style="text-align: right;"> <input type="radio"/> <input type="radio"/> </div> </div>		
<div style="display: flex; justify-content: space-between;"> <div> 1.4 REVEAL THE AREA'S SITE SPECIFIC NATURAL FEATURES <ul style="list-style-type: none"> Indicator: Description before and after intervention at neighbourhood scale <i>before:</i> _____ <i>after:</i> _____ Credit: 0- Accomplishes the objective poorly; 1-moderately; 2-well Graphic representation: map </div> <div style="text-align: right;"> <input type="radio"/> <input type="radio"/> </div> </div>		
<div style="display: flex; justify-content: space-between; align-items: center;"> <div> OVERALL GOAL EVALUATION </div> <div style="text-align: center;"> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </div> <div style="display: flex; justify-content: space-between; width: 80%;"> poor moderate good </div> </div>		

2.	GOAL	IMPROVE URBAN INTEGRATION AND MOBILITY
DESCRIPTION Enhance the existing and surrounding urban networks favouring transit and non-motorized modes of transportation.		
RATIONALE <ul style="list-style-type: none"> Social: To enhance social diversity, integration and interaction providing the required accessibility to satisfy needs for open space, housing, amenities and services. Economic: To increase accessibility to economic activity to the public as customers, consumers, and employees. Environmental: To reduce distances and discourage the use of the private vehicle, reducing CO2 emissions and fossil fuel consumption. 		
OBJECTIVES		
2.1 ENHANCE THE EXISTING AND SURROUNDING STREET NETWORK		<input type="radio"/> <input type="radio"/>
<ul style="list-style-type: none"> Indicator: Description before and after intervention at neighbourhood scale <i>before:</i> _____ <i>after:</i> _____ Credit: 0- Accomplishes the objective poorly; 1- moderately; 2-well Graphic representation: map 		
2.2 ENHANCE THE EXISTING AND SURROUNDING PEDESTRIAN NETWORK		<input type="radio"/> <input type="radio"/>
<ul style="list-style-type: none"> Indicator: Description before and after intervention at neighbourhood scale <i>before:</i> _____ <i>after:</i> _____ Credit: 0- Accomplishes the objective poorly; 1- moderately; 2-well Graphic representation: map 		
2.3 ENHANCE THE EXISTING AND SURROUNDING TRANSIT NETWORK		<input type="radio"/> <input type="radio"/>
<ul style="list-style-type: none"> Indicator: Change in transit affecting the site and the surrounding area within 400m <i>before:</i> _____ <i>after:</i> _____ Credit: 0- no change; 1- bus / more frequency; 2- train, tram, subway / more frequency Graphic representation: map 		
2.4 PROMOTE OTHER NON-MOTORIZED MODES OF TRANSPORTATION		<input type="radio"/> <input type="radio"/>
<ul style="list-style-type: none"> Indicator: Existence of bikeways <i>after:</i> _____ Credit: 0- no; 1- yes, but only on the site; 2- yes, and connected to a broader network Graphic representation: map 		
<div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div> OVERALL GOAL EVALUATION </div> <div style="text-align: center;"> <div style="display: flex; justify-content: center; gap: 10px;"> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </div> <div style="display: flex; justify-content: center; gap: 10px; margin-top: 5px;"> poor moderate good </div> </div> </div>		

3.	GOAL	GREEN THE CITY
DESCRIPTION Improve the quality, quantity, and accessibility to green public open space. For contaminated sites [real or perceived], restore the sites and any potential environmental hazards.		
RATIONALE <ul style="list-style-type: none"> Social: To satisfy the needs for open space, ease the concern about real or perceived contamination, and reduce potential risks for human health. Economic: To reduce development costs through the use of permeable surfaces and soil remediation practices. Environmental: To improve soil, water and air quality, enrich urban biodiversity, and to increase the quantity, accessibility, and connectivity of green space. [Secondary: to reduce waste through recycling and composting, and to improve food security with urban agriculture] 		
OBJECTIVES		
<div style="display: flex; justify-content: space-between;"> <div> 3.1 IMPROVE THE ENVIRONMENTAL QUALITY OF PUBLIC OPEN SPACE </div> <div style="text-align: right;">○ ○</div> </div> <ul style="list-style-type: none"> Indicator: Description of state of contamination and use for public open space [POS] or green POS <i>before:</i> _____ <i>after:</i> _____ Credit: 0- contam. remediated; 1- 0+ use for POS; 2- 0+ use for GPOS [i.e. urban park] Graphic representation: map 		
<div style="display: flex; justify-content: space-between;"> <div> 3.2 INCREASE THE QUANTITY OF GREEN OPEN SPACE </div> <div style="text-align: right;">○ ○</div> </div> <ul style="list-style-type: none"> Indicator: Change in percentage of BF site destined to green open space <i>before:</i> _____ % <i>after:</i> _____ % <i>Change:</i> _____ % Credit: 0- < 15%; 1- 15-29%; 2- ≥30% Graphic representation: map 		
<div style="display: flex; justify-content: space-between;"> <div> 3.3 IMPROVE THE ACCESSIBILITY TO GREEN PUBLIC OPEN SPACE </div> <div style="text-align: right;">○ ○</div> </div> <ul style="list-style-type: none"> Indicator: Change in percentage of du within 5 min. walking distance [400m] to GPOS ≥1ha at a neighbourhood scale [on the BF site and the surrounding area within 400m] <i>before:</i> _____ % <i>after:</i> _____ % <i>Change:</i> _____ % Credit: 0- < 0% [negative value]; 1- 0-19%; 2- ≥20% Graphic representation: map 		
<div style="display: flex; justify-content: space-between;"> <div> 3.4 INCLUDE OTHER ENVIRONMENTAL FEATURES </div> <div style="text-align: right;">○ ○</div> </div> <ul style="list-style-type: none"> Indicator: Number of features and description [i.e., recycling facilities, composting, urban agriculture, stormwater management] <i>after:</i> _____ Credit: 0- none; 1- 1 feature; 2- >1 feature [If no information, default: 0] Graphic representation: map or site images 		
<div style="display: flex; justify-content: space-between; align-items: center;"> <div> OVERALL GOAL EVALUATION </div> <div style="text-align: center;"> <div style="display: flex; justify-content: center; gap: 10px;"> ○ ○ ○ ○ ○ ○ ○ ○ </div> <div style="display: flex; justify-content: center; gap: 10px;"> poor moderate good </div> </div> </div>		

4.	GOAL: BUILD COMPLETE COMMUNITIES
DESCRIPTION Improve housing affordability, social integration, and accessibility to goods and services, and encourage economic revitalization.	
RATIONALE <ul style="list-style-type: none"> Social: To enhance social diversity, integration and interaction; satisfy needs for open space, housing, amenities and services; and alleviate unemployment by creating and retaining jobs. Economic: To increase economic productivity and complement existing economic activities, create and retain jobs, provide economic benefits through tax revenues and real estate, and increase accessibility to economic activity. Environmental: To discourage the use of the private vehicle, reducing CO2 emissions and fossil fuel consumption, and to improve land efficiency. 	
OBJECTIVES	
<div style="display: flex; justify-content: space-between;"> <div> 4.1 INCREASE HOUSING AVAILABILITY <ul style="list-style-type: none"> Indicator: Percentage of change in number of dwelling units at a neighbourhood scale [on the BF site and the surrounding area within 400m] <i>before: _____ du after: _____ du Change: _____ du; _____ %</i> Credit: 0- <10%; 1- 10-19%; 2- ≥20% Graphic representation: map </div> <div style="text-align: right;">○ ○</div> </div>	
<div style="display: flex; justify-content: space-between;"> <div> 4.2 INCREASE HOUSING AFFORDABILITY AND SOCIAL INTEGRATION <ul style="list-style-type: none"> Indicator: Change in percentage of social/affordable housing on the BF site <i>before: _____ % after: _____ % Change: _____ %</i> Credit: 0- <15%; 1- 15-49%; 2- ≥50% Graphic representation: map </div> <div style="text-align: right;">○ ○</div> </div>	
<div style="display: flex; justify-content: space-between;"> <div> 4.3 IMPROVE ACCESSIBILITY TO SERVICES AND AMENITIES <ul style="list-style-type: none"> Indicator: Number of new services and amenities at neighbourhood scale [on the BF site and the surrounding area within 400m] <i>Number and type of new service and amenity _____</i> Credit: 0- 0; 1- 1; 2- >1 Graphic representation: map </div> <div style="text-align: right;">○ ○</div> </div>	
<div style="display: flex; justify-content: space-between;"> <div> 4.4 ENCOURAGE ECONOMIC REVITALIZATION <ul style="list-style-type: none"> Indicator: Change in gross intensity of economic activity as ratio of floor area to BF area <i>before: _____ after: _____ Change: _____</i> Credit: 0- <0.04; 1- 0.04-0.07; 2- ≥0.08 Graphic representation: map </div> <div style="text-align: right;">○ ○</div> </div>	
<div style="display: flex; justify-content: space-between; align-items: center;"> <div> OVERALL GOAL EVALUATION </div> <div style="text-align: center;"> <div style="display: flex; justify-content: center; gap: 10px;"> ○ ○ ○ ○ ○ ○ ○ ○ </div> <div style="display: flex; justify-content: center; gap: 10px; margin-top: 5px;"> poor moderate good </div> </div> </div>	

5.

GOAL

MITIGATE THE IMPACT OF URBANIZATION

DESCRIPTION

Reduce the city's overall resource consumption and waste generation, with a particular focus on land as a natural resource and soil, water, and air contamination as waste.

RATIONALE

- **Social:** To ease the concern about real or perceived contamination and reduce potential risks for human health.
- **Economic:** To reduce development costs through the use of permeable surfaces and soil remediation practices.
- **Environmental:** To improve soil, water and air quality, improve land efficiency by reducing 'development pressure' on natural areas [greenfield sites], and reduce overall energy consumption.

OBJECTIVES

5.1 REDUCE BROWNFIELD LAND IN THE METROPOLITAN AREA ☐ ☐

- **Indicator:** Percentage of change in BF land in the metropolitan area [Default: BF site area]
before: _____ ha after: _____ ha Change: _____ ha; _____ %
- **Credit:** 0- <1%; 1- 1-9%; 2- ≥10% [Default: 0- BF site < 10ha; 1- 10-29ha; 2- ≥30ha]
- **Graphic representation:** map

5.2 REDUCE PRESSURE ON GREENFIELD DEVELOPMENT ☐ ☐

- **Indicator:** Ratio of "Greenfield [GF] Saving" to area of BF site ["GF Saving" obtained by applying a suburban density of 15uph to the number of new dwelling units]
GF saving: _____ ha Ratio of GF saving to BF site: _____
- **Credit:** 0- <2; 1- 2-4; 2- ≥5
- **Graphic representation:** chart

5.3 REDUCE CONTAMINATED SOIL IN THE METROPOLITAN AREA ☐ ☐

- **Indicator:** Percentage of on-site remediation of the BF site's contaminated soil
On-site remediation: _____ %
- **Credit:** 0- <20%; 1- 20-80%; 2- ≥80% [If no information, default: 0]
- **Graphic representation:** chart

5.4 INCLUDE GREEN BUILDING PRACTICES ☐ ☐

- **Indicator:** Existence of Green Building Practices or Standards
after: _____
- **Credit:** 0- none; 1- in specific buildings; 2- Green Building Standards for the whole intervention
- **Graphic representation:** images [If no information, default: 0]

OVERALL GOAL EVALUATION

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

| poor | moderate | good |

6

GOAL

DEAL WITH THE PRE-EXISTING**DESCRIPTION**

Consider, value, and enhance the site's social, cultural, historical, and environmental pre-intervention conditions. These may vary from remaining structures and infrastructures, to existing biodiversity, to a community within the site or to a larger community concerned about the site.

RATIONALE

- **Social:** To contribute to a collective reconciliation with a decayed and neglected past, and promote community involvement and engagement in the decision-making process.
- **Economic:** To reduce development costs by the potential reuse of existing structures and infrastructures, and from the use of permeable surfaces and soil remediation practices.
- **Environmental:** To reduce the resource consumption by the potential reuse of existing structures and infrastructures, restore the hydrological balance, and enrich urban biodiversity.

OBJECTIVES**6.1 REUSE AND INTEGRATE EXISTING STRUCTURES AND INFRASTRUCTURES** ☐ ☐

- **Indicator:** Number of existing buildings, structures, and infrastructures reused/restored
before: _____ *after:* _____
- **Credit:** 0- none; 1- 1,2; 2- ≥ 3
- **Graphic representation:** map, images

6.2 ENGAGE THE COMMUNITY IN THE DECISION-MAKING PROCESS ☐ ☐

- **Indicator:** Type of public participation events [i.e. charrettes, workshops, forums]
Participatory events: _____ *To be implemented:* _____
- **Credit:** 0- conventional process; 1- participatory events but not to be implemented;
2- participatory events to be implemented
- **Graphic representation:** chart, maps resulting from events

6.3 PRESERVE AND ENHANCE EXISTING BIODIVERSITY AND GREEN OPEN SPACE ☐ ☐

- **Indicator:** Same credit as 3.2 [Change in percentage of BF site destined to green open space] as long as the new green open space includes the existing
before: _____% *after:* _____% *Change:* _____%
- **Credit:** 0- < 15%, or green open space not including the existing; 1- 15-29%; 2- $\geq 30\%$
- **Graphic representation:** map

6.4 ADDRESS THE SITE'S FORMER USE[S] THROUGH DESIGN ☐ ☐

- **Indicator:** Description/Number of references to the former use[s] in site and building designs
References to former use[s]: _____
- **Credit:** 0- Accomplishes the objective poorly/no references; 1- moderately/few; 2- well/many
- **Graphic representation:** site images

OVERALL GOAL EVALUATION

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

| poor | moderate | good |