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THE MANAGEMENT OF  
**BROWNFIELD**

**RE**  
DEVELOPMENT

A Guidance Note



Europe and Central Asia Region  
Sustainable Development Department

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MANAGEMENT  
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**BROWNFIELDS**  
REDEVELOPMENT

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## List of Acronyms

<b>BFR:</b>	Brownfields Redevelopment
<b>CABERNET:</b>	Concerted Action on Brownfield and Economic Regeneration Network
<b>CEB:</b>	Council of Europe Development Bank
<b>CEE:</b>	Central and Eastern Europe
<b>CERCLA:</b>	The United States Comprehensive Environmental Response, Compensation and Liability Act
<b>EC:</b>	European Community
<b>EIA:</b>	Environmental Impact Assessment
<b>ERDF:</b>	The European Regional Development Fund
<b>ESF:</b>	The European Social Fund
<b>ESPON:</b>	European Spatial Planning Observation Network
<b>IFI:</b>	International Financial Institution
<b>JASPERS:</b>	Joint Assistance in Supporting Projects in European Regions
<b>JEREMIE:</b>	Joint European Resources for Micro to medium Enterprises
<b>JESSICA:</b>	Joint European Support for Sustainable Investment in City Areas
<b>NGO:</b>	Non Governmental Organization
<b>NIMBY:</b>	Not-In-My-Back-Yard
<b>PPP:</b>	Public Private Partnership
<b>TIF:</b>	Tax Increment Financing
<b>UNEP:</b>	United Nations Environment Program

## Executive Summary

This Guidance Note is primarily addressed to local or regional public authorities responsible for the management of brownfields in the transition economies of Central and Eastern Europe. The potential audience may be much wider and include central government agencies, regional development agencies, and public-private entities in charge of urban development projects, in this region and in other countries and cities around the world. The main impetus for this work is to offer perspectives and solutions to one of the many challenges cities are facing - especially in post-socialist emerging market environments, where urban brownfields are a major hurdle to transforming local economies.

Brownfields are understood here as derelict or underused sites with real or perceived contamination problems that create an obstacle to their development potential. As such, these sites represent both a problem and an opportunity. The threat they pose to humans and the environment from poorly contained contamination legacies requires prompt intervention. Thus, the prime motive for dealing with brownfields often stems from an environmental and social imperative. On the other hand, redeveloped brownfields can become nuclei and engines for economic development and an improved quality of life for the cities and communities where they are located.

Some brownfields offer profitable redevelopment opportunities and such projects are often taken on independently by private investors. Examples of privately redeveloped brownfields abound, and there are developers from around the world that have specialized in this kind of projects. This Guidance Note, however, specifically focuses on marginally profitable brownfield sites, which often require a sharing of risks and costs between the public and the private sector. These sites are particularly interesting because with skillful management and creative solutions, authorities can ideally generate economic activity and improve social and environmental conditions, while minimizing the strain on public finances.

Consequently, one of the main goals of this note is to raise awareness about the possibilities of brownfields redevelopment (BFR). Often brownfields are not recognized either as a problem or as an opportunity, and many countries lack the regulatory mechanisms to handle them. Another goal of the note is to offer clear guidance and a practical framework for dealing with brownfields, in a variety of contexts. Following an introductory chapter the note outlines elements of the policy and institutional context that are most

conducive to progress in BFR—including national environmental objectives, soil and groundwater protection laws, brownfields legislation and strategy, land market and urban planning practices and regulations, and other administrative regulations, notably those governing public-private partnership. The remainder of the note is structured corresponding to the four main stages of the BFR process; a) data collection and evaluation; b) pre-feasibility; c) feasibility; d) implementation. Each of these stages includes a number of tasks and activities that are a key part of most BFR projects.

The initial step involves the careful and methodical **collection and evaluation of environmental, economic, and social data**, on and around sites considered for potential redevelopment. Site assessment and investigation are crucial activities and foremost because they establish the physical, chemical and economic facts for the site. These tasks can reveal critical information on the extent of soil, water, and groundwater contamination, determining at an early stage the type and magnitude of liabilities on a site and opening a first perspective on how risks and costs could be managed between the public and the private sectors. These early investigations help in selecting those sites which best fit into a local or regional redevelopment strategy—and identifying others that can only be contained (having no practical redevelopment potential).

The **pre-feasibility** stage usually includes a first assessment of the redevelopment potential of a specific brownfield site, for which the basic facts have been established, and a thorough assessment of potential risks and project hurdles. A fundamental task within this stage is the active inclusion and engagement of surrounding communities and other stakeholders. Besides the environmental and economic feasibility aspects in BFR projects, social issues need to be given due consideration within sustainable urban planning. In every BFR project, it is critical to involve communities and all other concerned parties and to analyze their perspectives and interests early on. Doing so will contribute to improving design and overall outcomes, as well as lower risks.

In the **feasibility** stage a project is defined in more detail and specific preparation started. The design is developed to allow more precise cost estimates and clear understanding of the redevelopment concept. Public and private stakeholders establish their working relationships (if a joint effort is deemed necessary by both sides) and organize the sharing of risks and responsibilities, based on expected outcomes/profits and planned inputs/investments. Often, in BFR projects with significant contamination, public entities finance much of the environmental investigation and remediation (especially if no other owner can be held responsible), and cover at least part of the site's environmental, financial or legal liabilities. This helps to lower the

threshold for private enterprises to take on projects with potential environmental risks. If the brownfield site faces additional challenges such as a weak or volatile real estate market, the authorities can use a number of other financial, fiscal, and planning incentives to encourage private participation. They can also garner support from multiple sources, such as national environmental funds, pan-country entities (e.g. the European Union funds, for member and pre-accession countries), international organizations (e.g. UNEP) and international financial institutions, such as the World Bank. While local authorities can often develop a marginally profitable site on their own with public financing, experience shows that involving the private sector brings benefits by expanding the options and creative capacities for financing, project design, and risk-sharing.

The **implementation** stage for BFR projects differs from that of regular urban development projects in that there is an environmental remediation component, depending on the site's contamination issues and requirements for cleanup work. Careful post-remediation monitoring is necessary. Also, by their nature, BFR projects offer opportunities to establish and test sustainable development practices (e.g. recycling materials from site demolitions, isolation and encapsulation of contaminations, greening of formerly derelict sites).

The annexes contain technical information and data that complement the main text. Annexes 1 and 2 show examples of brownfield mapping in two cities in Europe – Brno, Czech Republic and Leipzig, Germany. Annexes 3, 4, and 5 highlight technical aspects of site investigation and remediation. They are meant to also offer a quick overview of environmental issues and processes that might not be widely known by non-specialists. Annex 6 illustrates three cost-benefit scenarios, comparing BFRs and Greenfield projects, while annex 7 outlines a series of remediation cost scenarios. Annex 8 lists way in which European Union funding can be used by Pre-accession and Member Countries for BFR projects. Annex 9 offers on overview of how the World Bank can help with BFR projects, and a list of brownfields projects in which the World Bank has been involved. In Annex 10, two examples of BFR projects - Bristol, UK and Tilburg, the Netherlands – are described, including the way in which each individual stage identified in this Guidance Note was implemented.

## Chapter 1: Introduction

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**Brownfields** are sites that:

- are derelict and underused
- have known or suspected contamination problems
- are mainly in urban areas
- require intervention to realize redevelopment potential

Brownfields are both a problem and an **opportunity**

Brownfields redevelopment (BFR) projects can eradicate urban blight, speed-up remediation of existent pollution and infuse new economic opportunities

Brownfields can be understood as sites that: “have been affected by the former uses of the sites and surrounding lands; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban area; and require intervention to bring them back to beneficial use”<sup>1</sup>. Many other definitions of brownfields exist – some make concessions to include sites in rural areas, some generally define brownfields as polluted sites. We have used the CABERNET (Concerted Action on Brownfield and Economic Regeneration Network) definition because of its wide acceptance in Europe and because it goes beyond just describing a type of site, acknowledging the need for assessment and remediation, and hinting to the benefits of redevelopment.

Brownfields are predominantly an urban problem and opportunity (although much larger contaminated sites (e.g. mining areas) can be found outside cities), and their redevelopment is particularly *attractive* because:

- sites are often situated in *strategic locations*, within cities that have demand for new housing/office/commercial space;
- they can infuse *new revenue and tax generating activities* on previously unproductive land;
- they can lead to the *eradication of urban blight* and the creation of better neighborhoods and friendlier communities;
- *speed-up cleanup and remediation* of existent pollution and the achievement of higher environmental standards;
- they can *reduce demand for new greenfield development*;
- they can *take advantage of existing infrastructure* (roads, rail, public transit, water, sewage, electricity, etc.);

but, careful consideration should be given to:

- potential *liability issues* further down the road;
- *lack of local expertise* (legal, environmental, fiscal, technical, planning) on BFR issues;
- a *stagnating or shrinking economy* and *lack of market demand* for new development;
- *unclear ownership*, or sites that are in the property of land speculators without (immediate) development interest;
- *unclear legal/administrative situation* regarding investigation and remediation standards;
- potential *community resistance* to proposed projects.

In cities of former transition countries, such as those in Central and Eastern Europe (CEE), addressing brownfields is of particular importance – both due to the extent of such cases and the possibilities

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<sup>1</sup> [www.cabernet.org.uk/index.asp?c=1134](http://www.cabernet.org.uk/index.asp?c=1134)

**CEE cities** are a particularly fertile ground for brownfields redevelopments (BFRs)

their redevelopment poses. Built and expanded around the requirements of a command economy, CEE cities now have to respond to *market economy challenges*. Bedroom neighborhoods have to make place for entertainment and retail venues, amongst a population with higher incomes and a higher appetite for spending. Polluting industries in inner cities have to make place for cleaner office buildings in an economy that is rapidly shifting from industrial production to services. The pressures of suburban development have to be countered with effective reuse of derelict and underused sites in inner cities, while minimizing greenfield development and reducing sprawl for more environmental sustainable cities.

Brownfields redevelopment (BFRs) in CEE cities can become part of the public policy and investment agenda, both at the national and the local level. Even if it is not treated separately (the number of brownfields can vary greatly from one country to another), it can fit within a larger **urban regeneration** effort that could encompass activities varying from façade repainting to entire district(s) redevelopment.

**Focus** is on BFRs that require involvement of local authorities

### Who the Guidance Note is for

While most BFRs are undertaken by private entities in market driven economies, we specifically *target* this Guidance Note at local public and public-private entities in charge of urban development and redevelopment in CEE cities. And, we specifically focus on the type of brownfields that cannot be redeveloped solely by the private sector, but require some form of public-private partnership to be brought back to beneficial use.

Central and regional governments can be active BFR players

Since local governments in CEE countries are at different stages of development (with varying levels of administrative powers), central governments can constitute the first audience for this note. Central governments can also be active BFR players, by doing upfront and nationwide facilitation and advocacy (e.g. through legal/regulatory context setting), by providing financing (e.g. the way the Environmental Protection and Energy Efficiency Fund does for brownfield hotspots in Croatia), through general information and guidance (e.g. by establishing a brownfields inventory), through a national BFR strategy, and possibly through an independent BFR executing agency.

**Local authorities** have to take a *lead role* in managing BFR projects

In addition, regional authorities (e.g. at the province or county level) can serve the above functions at their level of competency, but also get more involved into the project level. Ultimately however, local authorities have to take a lead role in managing BFR projects. The sequence of steps we will discuss in this Note are mainly focused on the project level, and involve public entities (most often local authorities) with an important stake in BFR outcomes (e.g. neighborhood revitalization).

## What the Guidance Note is About

Despite the relatively new nature of the field, there are a number of publications that tackle the complicated nature of BFRs. This guidance note follows in those foot-steps but attempts to sharpen the focus, by looking at how local authorities in CEE can play an active role in redeveloping urban brownfields.

Brownfields can be categorized according to several criteria, depending on the level of contamination and on what their reuse potential is. The CABERNET A-B-C categorization is particularly useful as it focuses on how brownfields can be brought to productive use.

Thus we have:

**A-Sites  
Profitable**

- **Type A Sites** – that can be easily developed by private developers because of: *minimal contamination*, which allows for fast and cost-effective remediation; *good location*, which can enable high profit margins, even when remediation costs are accounted for; *a dynamic and expansive real estate market* and *permissive zoning*, which can outweigh environmental costs by allowing for dense development.

**B-Sites  
Marginally  
Profitable**

- **Type B Sites** – whose redevelopment require a sharing of costs between the public and the private sector (often through a PPP agreement), due to: *moderate to severe contamination*, requiring significant assessment and remediation investments early on in the development process; *poor location* and/or *a sluggish real estate market*, which, when combined with site assessment and remediation costs (even on a site with limited contamination), affect the profit opportunities of a new development.

**C-Sites  
Unprofitable**

- **Type C Sites** – whose redevelopment would require a predominantly public effort, due to severe contamination (e.g. radioactive sites) and/or poor location and a sluggish real estate market (e.g. shrinking cities).

Out of these three categories, **B-sites** are particularly interesting because they have features that make them commercially marginal. Some of these sites may only break even between development costs and profits, with any likely profit achievable from capital growth. In other cases, the preparation costs may exceed the value of the proposed development making it nonviable, but there may be other advantages that could justify incentives to attract private investment. For example, location in a center city, near a cultural heritage site, or in a disadvantaged neighborhood may create strong *social benefits* (externalities). Other *obstacles* present in B-sites may be an information deficit regarding potential contaminations, or ownership issues, both of which may be easier resolved if experienced government agencies become involved.

**B-sites** have features that make them commercially marginal, and require cooperation between the public and private sector

A successful PPP should strike a balance between benefits accrued by the public and the profit of the private side

Thus, B-sites inherently require cooperation between the public and private sector. This cooperation can vary from a simple contractual or financial relationship, to a complex public-private partnership. The complexity of such a relationship should ideally be dictated by a healthy equilibrium between the bottom-line of the private side and the benefits accrued for the locality (e.g. jobs, new investments, cleaner environment, healthier neighborhoods).

Individual BFR phases are, for the most part, iterative and circular

### Structure of Guidance Note

The different phases of the BFRs process are iterative and often circular. There is however a linear logic to the way they can be tackled over time. The first schematic below offers a quick rendition of the major steps managing public entities would have to take into consideration, from project idea to implementation. It also lays out the structure followed in the Guidance Note. The second schematic is a road-map to brownfields redevelopment, developed by the US Environmental Protection Agency, illustrating some major considerations for successful BFRs.

Brownfields redevelopment projects require the participation of many fields, but they are primarily an **urban** and **environmental** issue. This means that all the major BFR steps require the input of urban and environmental specialists, although lawyers, economists, real estate and finance specialists, developers, community groups, and other stakeholders play an important role in the process.

Site assessment and investigation, and market assessment are key parts of the BFR process

**A. Data collection and evaluation** is often the first step. For many local and regional authorities (especially those new to the field), the starting point in managing brownfields is the creation and (continued) maintenance of a brownfields database, including urban planning and environmental information on all the registered sites found within the boundaries of the locality. This involves a thorough *site assessment and investigation* and a thorough *market assessment*. Identifying and contacting site owner(s) is important at this stage, as often this is a legal pre-requisite to performing a more detailed site assessment and investigation. If the level of contamination is severe, posing a potential threat to surrounding neighborhoods, remediation should be sought immediately -- carried out either by the owner of the site or by the local authority, with national and potentially external assistance.

**B. The pre-feasibility stage** involves the development of *preliminary development concepts* and the performance of a *preliminary risk assessment*.

Figure 1: Recommended Planning Sequence for the Development of Brownfields

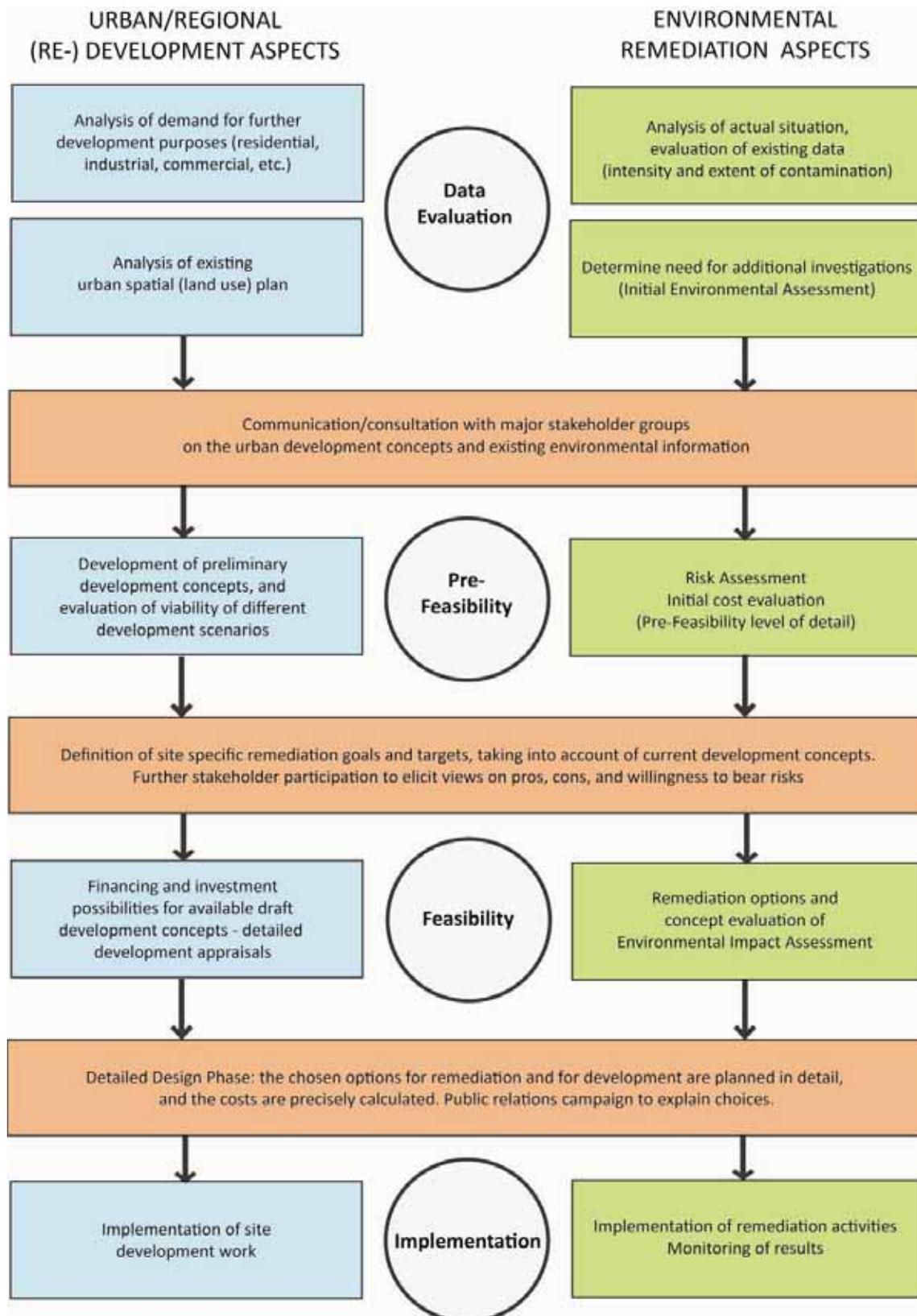
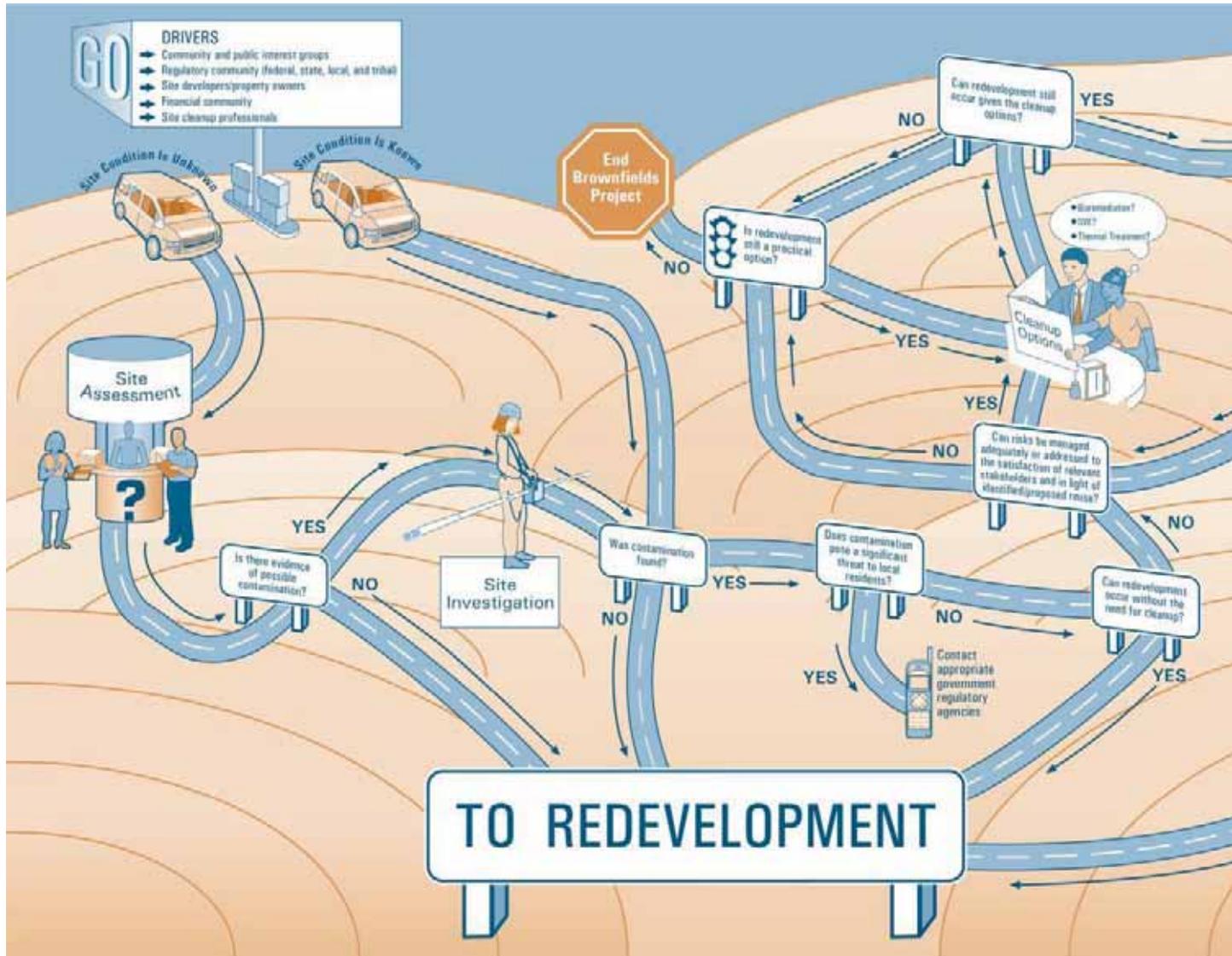


Figure 2: The “Road Map” to Re-Development



Source of figure: United States Environmental Protection Agency, *Road Map to Understanding Innovative Technology Options for Brownfields Clean Up*, Third Edition, Office of Solid Waste and Emergency Response, Washington, D.C., September 2001

Testing economic feasibility of redevelopment scenarios can start early in the process and continue all the way to project inception

Choosing remediation and redevelopment options should only be done after careful analysis of available data, and close consultations with vested stakeholders

Implementation involves an iterative process of remediation and redevelopment

Depending on market conditions, legal restrictions, ownership issues, and extent of contamination, a list of B-sites with clear redevelopment potential should be selected, along with a list of potential sources of (co-)funding for each of them. Potential developers should be identified, and an *initial development appraisal* can be prepared, as a way of testing the economic feasibility of different redevelopment scenarios. This step can be repeated as more data and information becomes available, all the way to actual project inception.

**C. The feasibility stage** goes a step further in the analysis, identifying *financing and investment arrangements* and *remediation and redevelopment options*. The choice for the remediation technology and the redevelopment approach should only be taken after careful consideration of available data, and after in-depth consultation with all vested stakeholders. The process can be started when the site assessment and investigation are performed and can be continued all the way to completion of redevelopment work.

**D. Implementation** involves an iterative process of remediation and redevelopment, and usually also includes monitoring and site marketing. All the preparation can be for naught if remediation and construction schedules do not follow agree-upon deadlines and budgets. Delays can be caused by a number of factors (e.g. new pockets of contamination are discovered), but adequate contingency plans can offer a number of viable responses.

At the end of this Note (Annex 10) two case studies outline the above steps from conception to realization of BFR projects.

The following chapter outlines a number of policy and institutional conditions that can create a conducive environment for sustainable brownfields redevelopment. The way these conditions find their way into the legislative and regulatory framework of individual countries, can vary greatly from case to case. Thus, in countries where brownfields represent a significant issue, policy and institutional requirements are likely to be more stringent than in countries where brownfields are localized. For example, in small countries, only a couple of cities might actually have brownfields in need of redevelopment. In such cases, it may make more sense to take a localized, individual approach, than to draft new legislation to encourage BFRs.

## Chapter 2: Policy and Institutional Context



A **brownfields legislation** should set clear national objectives and standards

BFRs require the input and involvement of specialists from different fields: public administration, urban planning, environment, legal, economics, real estate, finance, and marketing. Although local authorities play a crucial role in spearheading B-type BFRs, most brownfields (A-types) are redeveloped solely by the *private sector*. A crucial role is also played by *the central government*, which provides the appropriate legal and regulatory framework – setting clear environmental standards and objectives, creating basic conditions for land use planning, and determining how financial and fiscal incentives can be offered to private entities.

Given the strong environmental component of BFR projects, clear **environmental objectives** and a strong **regulatory framework** need to be formulated and followed by the central government. A commitment to pollution control and avoidance, to removing health and environmental hazards, and to sustainable development are prerequisites for efficiently addressing brownfields—both to clear the backlog of past brownfield cases and reducing the proliferation of new ones. *The EU Environmental Liability Directive (2004/35/CE)* is a good example in this respect, establishing a framework for preventing and remediating environmental damage, based on the **polluter pays principle**. Whenever private liability is unclear, the individual states take on cleanup responsibilities – especially when contamination poses an immediate or latent (e.g. ground water) threat to human health and/or environment. In the case of *privatizations of state-owned enterprises*, states often take on the liability for pollution caused prior to privatization.

In developed countries, rigorous **soil protection laws** have stimulated real progress in addressing BFRs. In the US, The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as *the Superfund Law*, has been crucial in bringing BFRs into public consciousness and funding the clean-up of most seriously polluted sites. In Germany, *the Bodenschutzgesetz* set the stage for successful BFRs, and inspired similar soil protection laws in other European countries. *The EU Soil Framework Directive* (currently in proposal form) will have to be transposed in the legislation of EU Member Countries and will serve as a guideline for Pre-accession Countries. Among others, this directive gives strict guidelines for inventorying, assessing, and remediating sites with contamination that pose a significant threat to human health and/or to the environment.

A strong **brownfields legislation** may be warranted if the extent of the brownfields problem calls for it. Such legislation should set *clear national objectives and standards* to be followed by public and private actors and by public-private entities. Standards should specify “how

**A brownfield legislation** that has overly protective environmental requirements can be prohibitive for private developers

clean is clean” (that is, set remediation guidelines depending on types of contamination and types of end-uses), and should differentiate between brownfields that pose an immediate health hazard and those where contamination is contained. A brownfield legislation that is *overly protective* (e.g. with “cleaner than clean” standards) will likely be prohibitive for private developers, and will overburden the budgets of localities interested in BFRs. Similarly, requiring the same remediation standards for a new housing project and a new industrial project can be economically counterproductive (remediation standards should be less strict for industrial uses than for housing or recreational uses). Ultimately, clear objectives and standards can eliminate confusion and diminish the possibility of relying on courts to decide who’s liable for what. By the same token, flexibility of standards is key, not just for economic considerations, but also because of advances and innovation in assessment and remediation technologies.

**A BFR strategy** can be helpful in reinterpreting cost and values in public perception

**National brownfields strategies** are often crafted on the foundation of strong brownfields legislation and reflect future remediation and redevelopment objectives. A BFR strategy can be helpful in reinterpreting cost and values in public perception so that demonstrable environmental and community benefits can be offset against costs. Setting up minimum environmental quality standards and other “value for money” benchmarks will allow measurement of the cost and benefit of public sector involvement. In other words, a system will be required to measure the non-financial aspects of redevelopment and incorporate these into the financial appraisals.<sup>2</sup> Examples of brownfields strategies can be found in the US (the US Environment Protection Agency has a standalone Brownfields Program), in Germany (which has a Sustainability Strategy that also addresses BFRs), in England (where the strategy was drafted by a development agency – English Partnerships), and Canada (drafted by the National Round Table on the Environment and the Economy).

**Functional land and property markets** and effective **urban planning** are key in enabling brownfields to be brought back to beneficial use

**Functional land and property markets and effective use of urban planning instruments** are key in all development and redevelopment projects. Functional real estate markets, based on credible land administration infrastructure (cadastres and land registration systems) are the foundation of market economies - they influence investment patterns and can affect city growth and spatial development. Without fluid and transparent land and property markets, it is harder for brownfields to change ownership and convert to new uses. Often, original owners don’t have the means or are unwilling to redevelop their brownfields. The easier it is for them to bring those lands into the real estate market, the faster brownfields can be redeveloped.

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<sup>2</sup> For example, the UK Treasury has developed a “Green Book” with benchmarks for appraising public projects that cannot be evaluated in monetary terms. Available at: [http://www.hm-treasury.gov.uk/data\\_greenbook\\_index.htm](http://www.hm-treasury.gov.uk/data_greenbook_index.htm)

Putting idled and polluted land into productive use can also be encouraged by sound urban planning. For example, flexible land use and zoning laws can create the conditions for making BFRs viable (e.g. by allowing higher densities permitting different land-uses, or changing height restrictions). Related fiscal tools, such as property tax, sale of development rights, or other means of land value capture can help local governments realize fiscal benefits from BFRs, when the necessary legal framework is in place.

Local governments can be more efficient in dealing with BFRs than central governments

In turn, urban planning can be complemented by appropriate amendments to **the administrative law**, setting *responsibilities and tools* for local governments to adequately deal with BFRs. Every brownfield is found within the boundaries of a jurisdiction, and local governments are more motivated to deal with them and to understand their potential. They can also play a crucial role in BFRs by: encouraging realistic land prices; establishing a brownfields information system; taking a lead role in managing contaminated sites; bringing stakeholders together; enabling financial and other risk sharing; reaching out to and engaging communities; monitoring good practices in BFRs; and, promoting on-going and proposed BFR projects.

A clear legislative framework has to exist for successful PPPs to take shape

For local governments to play a lead role in BFRs, central governments have to create an *administrative framework* that encourages localities to take the initiative. For example, derelict and underused industrial facilities still owned by the state and state entities should be passed either under *leasehold or (preferably) ownership* to the jurisdictions where they are located. Similarly, a clear legislative framework has to exist for **successful public-private partnerships** (PPPs) to take place. Especially for B-sites, redevelopment is often not possible without active participation of both the public and private sector. The public authority can take on certain specific functions (e.g. the local government can acquire the land, perform site assessment and remediation, provide needed infrastructure, and then sell the site to a private developer), or may include the offer of financial and fiscal incentives that can fuel cooperation long-term.

Unclear bankruptcy laws hamper redevelopment of brownfields

In addition to legislation directly pertaining to BFRs, there are a host of other measures that can buttress efforts in this area. For example, **streamlined bankruptcy laws** can prevent prolonged idle periods of liquidated properties, and uncertainties regarding ownership. This is often crucial when time is of the essence in the development process. In many countries, unclear bankruptcy laws hamper redevelopment of contaminated sites, even in situations where pollution is a threat to human health and environment.

The possibility to create **independent redevelopment agencies** can also boost urban regeneration efforts. Such agencies can be almost as quick and efficient as the private sector.

### Box 1. The Role of Independent Agencies

Institutional responses to BFRs can vary depending on the extent of the problem and on budgetary means, but many countries have found that independent agencies can be very effective agents in dealing with brownfields, especially when local authorities are slower to respond to the challenge. Setting up independent agencies (whether at the local, regional, or national level) often requires adequate regulatory adjustments, as these agencies take on responsibilities that previously were the prerogative of other institutions. Also, their role and level of involvement can vary greatly, depending on the particular impetus for creating them.

For example, **CzechInvest** is an investment and development agency established in 1992 by the Czech Ministry of Industry and Trade, with the purpose of attracting foreign investment and encouraging the development of the Czech private sector. As a way of attracting investors, CzechInvest collects, manages, and provides (free of cost) information on sites (including brownfields) suitable for investment. In addition, it can act as a liaison between investors and property owners, arrange site visits, and offer assistance with site preparation, financing, and marketing. A database base of all identified brownfields is maintained by the agency, along with pertinent information collected for each individual site. For private companies interested in BFRs, CzechInvest offers assistance with financing, of up to 100% of demolition and remediation costs.

**Treuhand** is an agency that was established in 1990 by the East German Government (and continued after the unification of Germany) with the defined goal of privatizing around 8,500 East German state-owned enterprises. Many Treuhand privatizations represented BFRs, in effect – bringing new development on idle or under-utilized industrial sites. To make the brownfields more economically attractive, the agency offered a series of incentives to investors. For one, site investigation and remediation costs were included in the contracts signed with investors, with Treuhand typically covering 60% of these costs. (There have been cases however, when Treuhand covered up to 90% of environmental costs.) Another incentive used by the agency was a *liability waiver* it offered to investors that were worried about civil or workforce lawsuits. This waiver basically absolved investors of any environmental liabilities that were not their responsibility. By 1994, Treuhand closed operations, although it retained a lot of property and some legal responsibilities, which were ultimately transferred to three successive agencies. One of these, TLG Immobilien, is still managing the remaining state-owned urban and industrial real estate, and is slated for privatization itself.

**English Partnerships** (part of the Homes and Communities Agency as of 2008) is a national regeneration agency that aimed to promote sustainable growth in England, in the face of a decrease in available developable land. As such, the agency worked as the government's specialist advisor on BFRs (drafting the *National Brownfields Strategy* in 2007) and it supported local authorities in the development of local brownfield strategies and skills. It maintained a national brownfields database, and was actively engaged in purchasing and preparing brownfield land (site investigation, demolition, remediation, infrastructure provision) for redevelopment (usually the land was sold to a private developer). English Partnership also worked closely with local governments and with local and regional agencies, often turning over properties it owned to them.

### Box 1. The Role of Independent Agencies (continued)

**Regional development agencies** have a more focused approach than national agencies and can be more actively engaged in bringing brownfields back to economic use. For example, in France, a regional development agency was established in the Nord – Pas de Calais Region. The main motivations for creating the agency were the social and economic challenges the region faced starting with the industrial restructuring of the 1970s. Thus, in the 1980s, Nord – Pas de Calais amassed around 10,000 hectares of industrial brownfields – 50% of the registered brownfields in France. The aim of the agency was to return brownfields to their “zero condition”, which also included the adaptive re-use of industrial heritage buildings for new activities. Between 1989 and 2006, the agency was directly involved in the remediation of 4,752 hectares of brownfield land.

**Local development agencies** can be as varied as the cities where they operate. On the whole however, small cities (or cities with limited budgetary means) are less likely to be able to sustain independent agencies at the local level. They are more often encountered in large cities with complex urban development challenges, and in former industrial towns.

**Independent redevelopment agencies** can be as quick and efficient as the private sector

National and local policy can encourage the beneficial use of brownfield land

The local authority can **assist potential developers** by circulating information about existent brownfields, by encouraging more permissive zoning, and by identifying solutions and experts for individual challenges

Independent agencies often have a clear focus, lean bureaucratic structure, political support, and results-driven nature (see Box 1 examples). These agencies could be set up at the local, regional, or national level, depending on the scale and location of brownfields cases. Higher level organizations can realize economies of scale by pooling portfolios and resources, retaining specialized expertise, and addressing cross-jurisdictional aspects of projects. The agencies can play multiple roles, and are usually most effective when brownfields are an extensive problem that requires targeted attention. But even when a locality has few brownfields it may choose to capture BFR work under the more general umbrella of urban redevelopment.

National and local policies, whether implemented by independent agencies or by local governments, can be directed to promote and facilitate the beneficial use of brownfield land. Examples include:

- *reducing attractiveness of other forms of land (“greenfields”);*
- *streamlining the permitting and authorization processes;*
- *imposing flat-rate taxes on sites that are left idle or underused;*
- *increasing allowable densities for development of brownfield sites, thereby increasing profitability and viability and making the land more attractive to developers;*
- *increasing land values through the planning and zoning process by selectively permitting higher value uses that might instigate regeneration of currently nonviable sites;*
- *introducing gap funding measures to address shortfalls of development values over development costs;*

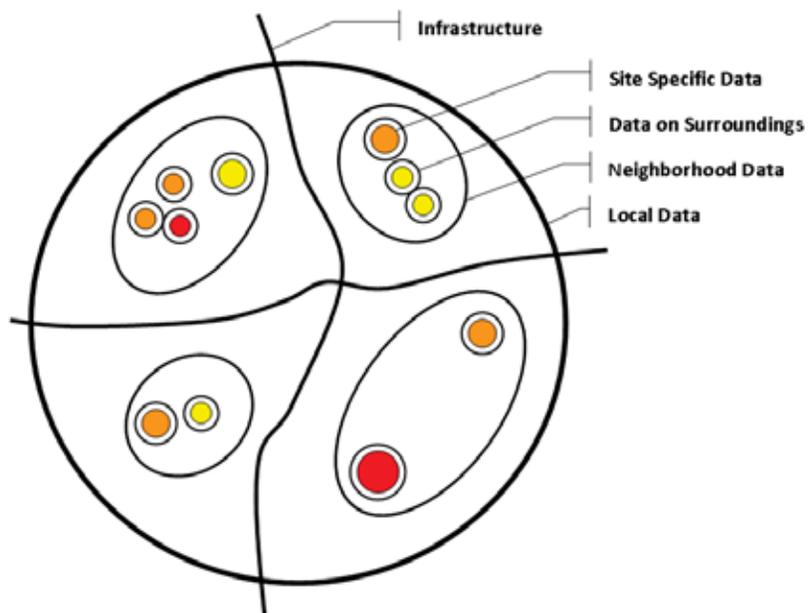
- *reducing development costs* by directly subsidising remediation;
- *assisting developers* by circulating widely the details of available surplus public sector land and the levels of likely subsidy;
- *identifying solutions and experts* that can respond to individual challenges: environmental and technical approaches (site assessment, preparation, and cleanup); legal issues; financial solutions; fiscal implications; project management; political consensus-building.

## Chapter 3: Data Collection and Evaluation

The more relevant data is collected on derelict and underused sites, the better

The first step in tackling BFRs often presupposes the collection, storing, and managing of data on brownfields, and on the potential to assess, remediate, and redevelop those sites. The richer the data, the better outcomes can be achieved. Thus, some sites might have an inherent heritage value and their redevelopment should revolve around preservation or adaptive reuse; some sites might have a high redevelopment potential but be the subject of a tangled and prolonged legal battle over ownership; some sites might be presently undevelopable but future market dynamics might increase their value.

Figure 3: Levels of BFR Data Collection



Urban planning and environmental data should be collected at different levels of aggregation

Urban planning and environmental data should be collected at different levels of aggregation. **Site specific data** can track previous site uses and likely contaminants, current ownership status, legal status, size and location of site, and potential extent of pollution. **Data on immediate surroundings** can identify land-uses and zoning for adjacent sites, and possible restrictions on a future redevelopment (e.g. shade and height restrictions, cultural heritage and historic considerations, the proximity to schools, hospitals, churches, or other city land-marks). Depending on the characteristics of adjacent sites, there will be limitations on what a potential BFR will look like. Thus, a brownfield situated in a town-house neighborhood could hardly fit a skyscraper. **Neighborhood data** can offer clues on the character of the area (e.g. predominantly industrial or residential, poor or wealthy, ethnically divided or homogeneous), on existent links to local infrastructure, and

on neighborhood dynamics (e.g. with lots of new development or generally derelict and underused). Other **local level data** provides city-wide dynamics and trends. The size of the city and its dynamics (growing or shrinking), the size of its market and economic trends, the link to national and international infrastructure (roads, highways, rail, airports), are all important clues in the management of BFRs.

## Managing a Brownfields Database

Layers of collected data should enable local and regional officials to categorize identified brownfields based on their redevelopment potential. In the schematic above, we have color-coded sites according to the CABERNET A-B-C typology. Thus, yellow signifies A-sites (likely profitable and attractive for the private sector), orange indicates B-sites (marginally profitable without public assistance), and red determines C-sites (likely unprofitable). The focus of local authorities, from a redevelopment perspective, should be on B-sites where they can have a catalytic impact— with the caveat that some sites might change status with a change of market and/or environmental conditions. In this respect, data collection should be a **continuous process**, and data quantity and quality should improve as experience in the field is build up.

Color-code brownfields sites.  
For example:

**YELLOW** for A-Sites  
**ORANGE** for B-Sites  
**RED** for C-Sites

Make data on brownfields  
publicly available

If the law permits it, data should be made **publicly available**<sup>3</sup> and, if possible, one office (e.g. an independent redevelopment agency) should be able to offer assistance on the topic. For example, CzechInvest collects and publicly stores information on brownfields identified throughout the Czech Republic.

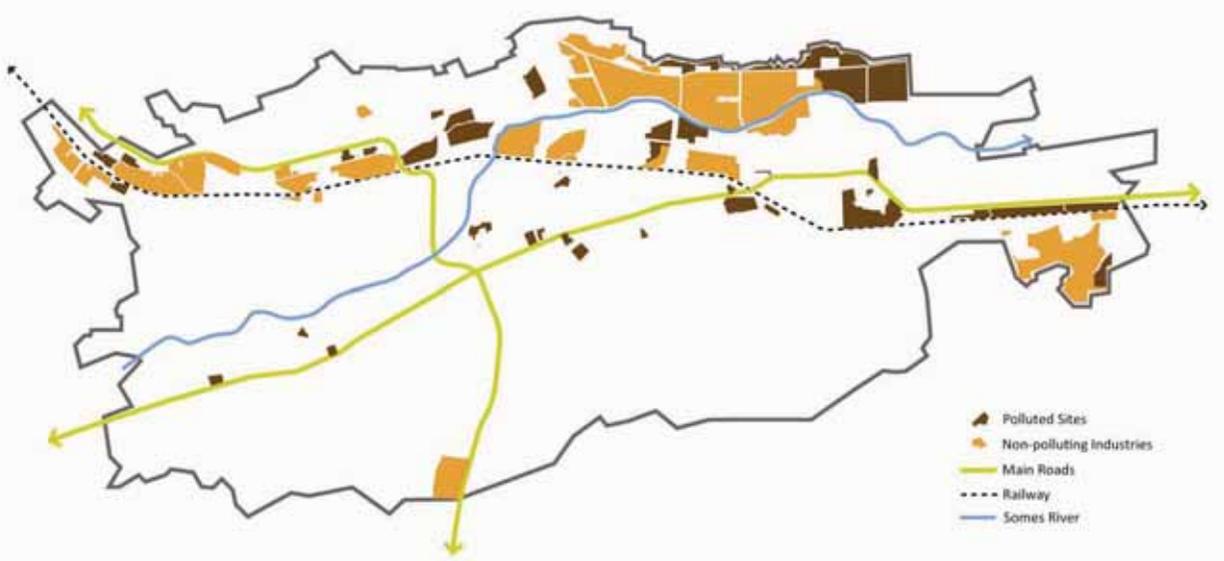
If brownfield inventory is  
lacking, start by cataloging  
industrial sites, along with  
present and past uses, and  
factors that might increase  
or decrease their value

For localities that do not have a brownfields inventory, a good point to start is a mapping of former or idle industrial sites. Once such industrial sites are mapped, historical data and land-use descriptions can be used to identify polluting and non-polluting sources of activity on the site. Furthermore, an on-the-field survey can show whether the industrial sites are currently used or under-used and how the use relates to the city's current or prospective land-use plan, whether there is any visible pollution on these sites, and whether they are situated in a context allowing for easy redevelopment (e.g. in a neighborhood with good location). For example, the City of Cluj-Napoca (Romania) does not have brownfield inventory, but their land-use plans distinguish between non-polluting industries and potentially polluting ones. They also show where these sites are situated in relation to other uses (e.g. housing).

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<sup>3</sup> Providing open access to accurate information on brownfields can reduce the stigma attached to some sites and improve their redevelopment potential, where there are misconceptions about the extent of contamination. Over time, C-sites can become B-sites (as improved remediation technologies or creative financial incentive tools become available), but private developers might stay away from them because they will still be perceived as 'hopeless cases' and the public may resist redevelopment because of exaggerated fears of threats.

Figure 4: Polluted Sites in Cluj-Napoca, Romania



A short walk along Cluj's industrial corridor also indicates that many industrial sites are underused or abandoned, existent industrial spaces do not serve existent market needs, and several of them show visible signs of contamination.

Figure 5: Brownfields in Cluj-Napoca, Romania



Free web-tools can be used for mapping brownfields

If technical capabilities are lacking, even a simple aerial overlay or the use of free web tools (e.g. Google Earth or Bing.com/maps) can help track brownfields. The City of Brno (Czech Republic) uses an aerial map and simple mapping tools to track its brownfields (see Annex 1).

Where more complex GIS tools and specialists are available<sup>4</sup>, brownfield sites can be stored in a dynamic database, with different information attached to each individual site. Information can be gathered by interviewing people that know the sites, by analyzing plans, maps, and aerial photographs, and by looking at previous site studies.

<sup>4</sup> In Annex 2 we have included a map that was provided by the City of Leipzig, including information on the extent of unused space on industrial sites.

## Ownership Identification

Before anything can be done about identified brownfields a clear ownership structure needs to be established and owners contacted. Data collection should ideally permit the establishment of a complete list of site owners, and priority should be given to contacting owners of sites that pose an immediate threat to human health and/or environment.

Brownfields owned by the local authority can be managed more easily

Depending on ownership structure, moving on to the next step can be made easy or difficult. Thus, if property is **owned by the local authority**, performing site assessment and investigation is just a question of local priorities and available funds. If the property is owned by **the central government**, the local authority can look for ways to transfer the property into its own management or possibly engage the central authorities in the remediation and redevelopment.

In most cases, brownfields will be in private ownership

For **privately owned sites**, local authorities have to identify ways to encourage remediation and redevelopment. If site is of strategic importance for city development (e.g. a big infrastructure project), *eminent domain* can be used. A *flat-rate tax* can be imposed on industrial sites that are abandoned or underused (this can force owners to bring the sites into productive use or sell to someone who will). If property poses a health hazard to neighboring communities and/or a risk to critical natural resources (e.g. groundwater), *coercive measures* such as fines and sanctions can be taken to force remediation and cleanup by owners. Otherwise, localities can encourage the formation of a *public-private-partnership*, potentially offering *incentives* for bringing the brownfield(s) to beneficial use.

**Mixed ownerships** are usually most difficult to deal with

If the property **has mixed ownership**, the local authority can bring all parties to the table and attempt to reach a compromise, hopefully moving towards remediation and/or redevelopment. In the process, the local authority can offer pecuniary and/or non-pecuniary incentives (e.g. appealing to their environmental sensibilities and desire to make a social contribution and enhance their reputation) to encourage progress on the project. Often, situation of unclear/disputed ownership are very tough to solve, because of a myriad of problems that might appear along the way (e.g. owner is bankrupt).

If redevelopment is not possible in the short term, push for **intermediate solutions** (e.g. temporary re-greening)

When the possibility to engage in a PPP is restricted, the locality can look for other means to encourage the remediation and redevelopment of contaminated sites. For A-sites, the local authority can work as an *intermediary* between owners and potential developers, by providing the publicly accessible brownfield inventory and key market data. If owners are reluctant to turn over sites to productive use, the local authority can tax idle properties and push for intermediate measures – such as temporary re-greening -- while

promoting longer term solutions. If buildings on brownfield site have structural problems and pose a threat to human safety, the local authority can push for demolition of these buildings at the owner's expense.

Owners often have **unrealistic expectations** for land selling prices

Brownfields often tend to have more owners than greenfields do (with potential disputes over assumption of liability), and many of those owners prefer to leave their sites unused until the real estate market and available remediation technologies permit selling/developing for a good profit. Multiple ownership can also lead to exaggerated expectations for land selling prices, with owners often not being aware of the threats and investments that contaminated sites pose.

*Jugovinil in Kastela (Croatia)* is an example of a brownfield whose remediation and redevelopment has been held up due to complex ownership issues. The 23 ha site is owned by two chemical companies, one of them state-owned, and although the local real estate market is booming cleanup has not started yet.

The contamination pattern at the Jugovinil site is complex, with a mix of different materials, among them weakly radioactive substance. This would require the two owners to take a host of difficult joint-decisions – from site investigation and community engagement methods, to remediation and redevelopment concepts.<sup>5</sup>

Figure 6. Jugovinil Brownfield in Kastela (Croatia)



<sup>5</sup> World Bank. 2009. *Mission Report on Croatia: Brownfield Redevelopment*.

**Environmental audits and risk assessments** can be done in a fairly cost-effective way

Successful BFR projects require the diligent **management of risk**

The cost of dealing with **past environmental liabilities** can be a multiple of property value

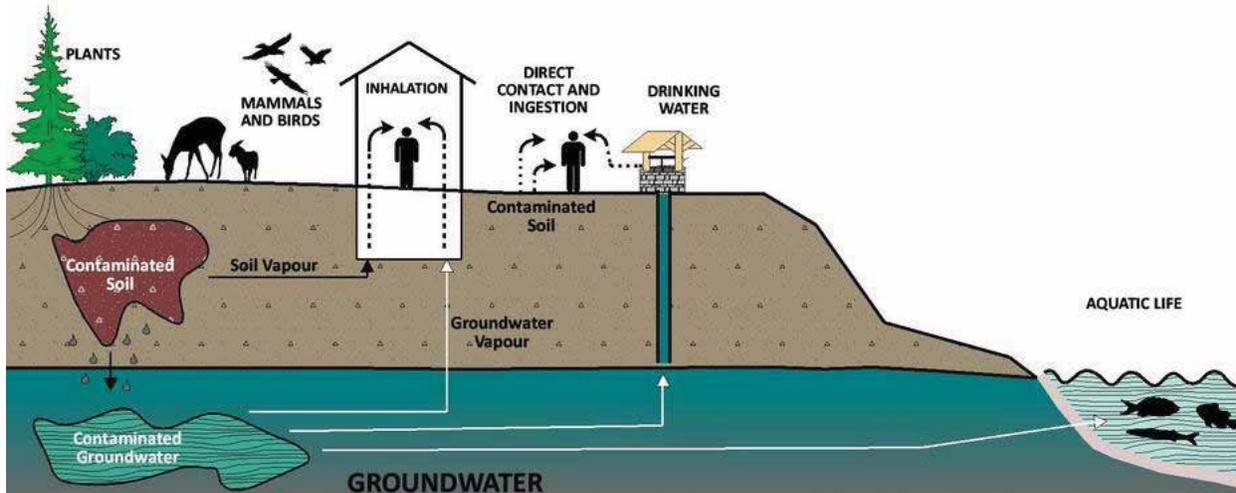
## Site Assessment and Investigation

Depending on site ownership and/or expected risk to health and environment, and in-depth site study should be performed. To begin with, **environmental audits** and **risk assessments** can provide information on environmental hazards, on the extent of pollutant exposure, on the effects on neighboring communities, and on the public's perception on the site. This can be done in a fairly cost-effective way by making use of readily available data. A more thorough and scientific investigation can be done if significant risk to human health is anticipated.

Successful BFR projects require the diligent *management of risk*. One of the main risks affecting economic viability is that of *unknown environmental hazards* resulting from former use of the site. Remediation experiences of former industrial sites have shown that the magnitude of these contaminations can be extraordinary, often aggravated by having crossed property boundaries and harmed third parties. In other cases, the proven contamination is much less serious than had been feared.

The cost of dealing with these *past environmental liabilities* can in some cases be a multiple of the property value, and accurately assessing these costs requires the determination of ecological, physical, geological and hydro-geological site characteristics, as well as type and extent of contaminants. In international practice, environmental site audits aimed at determining the extent and severity of pollution and potential remediation costs, often take place in two broad stages: 1) site assessment and 2) site investigations.

Figure 7. Assessing Risks in BFRs



Adapted from: Canadian Ministry of Municipal Affairs and Housing. 2007. *A Practical Guide to BFRs in Ontario*

**Site assessment** is an initial investigation of existing information on the site

**Site Assessment:** The purpose of this step is to evaluate the potential for contamination at a particular site by collecting and reviewing existing information. The site assessment is an *initial investigation* usually limited to a search of historical records and review of existing data. The review and collection also includes information about past and current environmental conditions and historical uses of the site. The site assessment is a crucial step in the brownfields process, because any further environmental investigation and cleanup will hinge on whether *potential environmental concerns* are identified during that phase. (See Annex 3 for an overview of contaminants likely to be found on different types of brownfields.)

**Site investigation** focuses on confirming, locating, and characterizing potential site contamination

**Site Investigation:** The site investigation phase focuses on confirming *whether any contamination* exists at a site, *locating* any contamination, and *characterizing* the *nature and extent* of that contamination. It is essential that an appropriately detailed study of the site be performed to identify the cause, nature, and extent of contamination and the possible threats to the environment or to any people living or working nearby. The results of the site investigation are used in determining goals for cleanup, quantifying risks, determining acceptable and unacceptable risks, and developing effective cleanup plans that minimize delays or costs in the redevelopment and reuse of property. To ensure that sufficient information is obtained to support future decisions, the potentially applicable cleanup measures and the proposed redevelopment of the site should be considered when identifying data needs during the site investigation. (See Annex 4 for a selection of site investigation technologies.)

Results of site assessment and investigation inform redevelopment options

A site investigation is logically based on the results of the site assessment. The site investigation phase usually includes the analysis of samples of soil and soil gas, groundwater, groundwater vapor, surface water, and residual substances on the brownfield site (e.g. in old tanks, barrels, on heaps). The potential migration pathways of contaminants also are examined during this phase, and a baseline risk assessment is conducted to determine the risk to human health and the environment. The results of the site audit will strongly influence the immediate follow up action for site development. Obviously the larger and more complex the contaminations found on the site, the more time and money will be required to bring the site into a condition fit for redevelopment, and the more residual restrictions on site use might result.

Site audit results will influence follow up action

Lack of **BFR expertise** is often a problem in developing countries

One of the most difficult challenges in brownfields management is the lack of local or even national expertise in site assessment and investigation. Different technologies are available, but access to them is often limited to more developed regions and countries. It is therefore important to hire experienced environmental consultants for all the technical prep work – a job well-done up front can save a lot of

money down the road. The better quality of information collected, the better understanding of liabilities and true land value will be.

A German environmental company took on the task to assess, investigate, and eventually remediate a former fuel depot in Bucharest, Romania (Figure 8). In the process they used standards imposed by the Romanian law, and made reference to the German Soil Protection Law (*Bodenschutzgesetz*) when they encountered legislative gaps (especially regarding site assessment and remediation standards and provisions for groundwater protection).

*The preliminary environmental audit and risk assessment* indicated that the site was bombed during the Second World War, that it was used as a fuel depot since 1936, that building damages were sustained during the earthquakes of 1940 and 1977, and that signs of soil and groundwater contamination were identified in a previous study. A *preliminary site investigation* was conducted to collect more in-depth data. This included: an aerial analysis of the bombardment; surgery clearance before drilling; the construction of 14 monitoring wells; drilling 2 meter deep boreholes; soil, soil vapor, groundwater, and construction materials samples; and, an analysis of potential contaminants. The collected results warranted a *detailed site investigation*, during which 23 monitoring wells were put in place, 7 meter boreholes were drilled, samples were expanded, and a more thorough environmental analysis was performed.<sup>6</sup>

**Figure 8. PETROM Site in Bucharest (Romania) before start of remediation**



<sup>6</sup> Schock Gabi and Doris Hirschberger. 2007. "Reactivation of Derelict Industrial sites in Romania: A Project of GTZ for Economic and Employment Promotion". Proceedings of the 2<sup>nd</sup> International Conference on Managing Urban Land

## Chapter 4: Pre-feasibility

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Preliminary remediation and redevelopment concepts can be developed once a thorough site audit has been performed.

The outcome of the pre-feasibility phase would commonly be a site-specific **remediation strategy**

Aim to mobilize partners to share financing and risk of the different stages of the project

**Public participation** is critical

Based on the environmental site audit, an initial risk assessment and *initial remediation cost evaluation* can be developed, along with a *preliminary development concept*. This may be accomplished by overlaying the identified contamination pattern with potential redevelopment scenarios, and then identifying and prioritizing/ranking solutions in terms of their remediation requirements. At this stage, involved parties will have to start thinking about how they can balance remediation effort with the value generated by redevelopment (property value and community value).

The outcome of the pre-feasibility phase would commonly be a *site-specific remediation strategy* which, while not yet offering detailed solutions for decontamination or redevelopment, lays out the principal options and broad implications regarding remediation cost and effort, required investment, and potential value generation and return. In this phase, site-specific clean-up criteria will be defined, along with an assessment of the need for additional information. Once the clean-up criteria have been determined for the site, a feasibility study can be initiated to develop and compare technical methodologies and financial implications for achieving these criteria as well as the proposed remedial /redevelopment options.

The pre-feasibility phase also identifies risk sharing and financing options. At this stage the project team would aim to mobilize partners to share financing and risk of the different stages of the project, and identify financing sources. Questions and considerations would include:

- *cost and risk sharing* among the owner, developer, local and/or central government;
- if the local authority is the owner of the site, would it propose to sell or lease the developed property? Are there other ways it could capture increases in property value to compensate for public investments in remediation/site preparation?
- should a formal *public-private partnership entity* be created to manage the BFR project?
- what role could private financiers, including commercial banks and insurance companies play? Insurance can be useful to cover risks of cost overruns and uncertainties related to future liability.

Public participation is critical in the process of identifying and evaluating remediation options. Stakeholder participation should be thorough, open and transparent and the outcomes should be integrated into the strategic options for redevelopment concepts.

Select brownfields with the highest likelihood of being redeveloped

Working on 'easy' BFRs initially, can help build **experience and expertise** in the field

The level of contamination can better predict project costs than site location can predict benefits (market performance can be erratic)

If redevelopment is not immediately possible, identify **interim uses** for the site

## Assessment of Development Potential

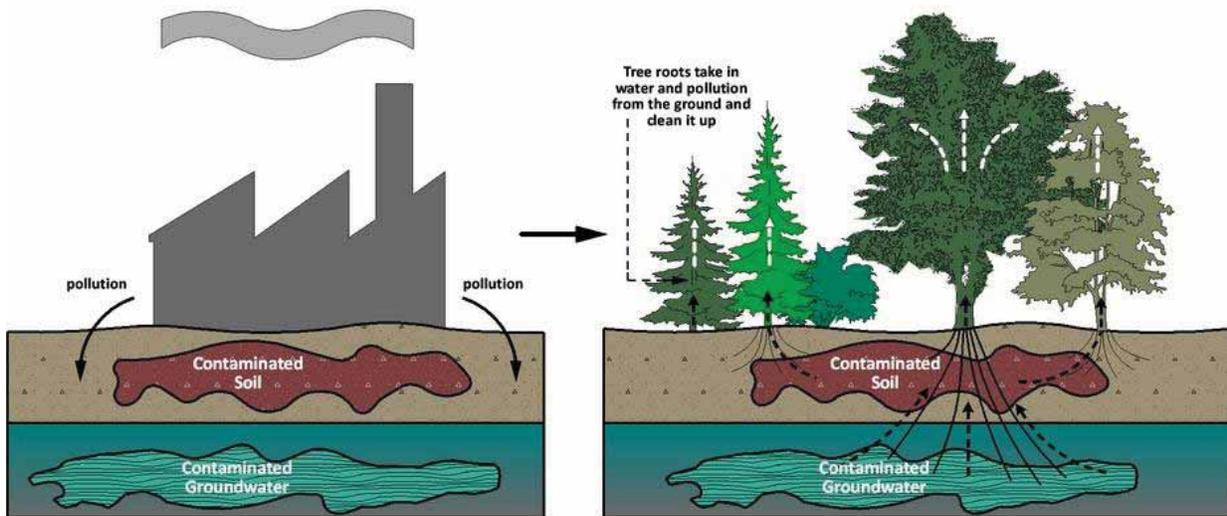
If a reasonably complete list of brownfields (and information on them) has been assembled, the local authority can select the B-sites with the highest market potential – i.e. with the highest likelihood of being redeveloped. Once these are turned to productive use, they can **generate funds** for other BFRs. Dealing with the B-sites that are easier to redevelop can also enable a fast accumulation of **experience and expertise** in the field, and can promote sound environmental practices in the redevelopment of other brownfields.

Priority is often given to sites that have *clear ownership*, preferably without a large number of owners, and preferably in the property of the local authority. Following site assessment and investigation, preference can also be given to sites *without severe contamination issues*, so that remediation costs will be only a small fraction of overall redevelopment costs. Also to be considered in the selection process are sites with *good location* (e.g. with access to infrastructure), especially those that can benefit from a *dynamic real estate market*.

Establishing *development potential* will likely require: some analysis of the local real estate market (e.g. what sells and what not, what are the current vacancy rates, what is the projected rate of development and redevelopment); a socio-economic study of individual neighborhoods and the locality as a whole (demographics, purchasing power, economic make-up, projected investments); an analysis of property taxation receipts over time; a good understanding of financial and fiscal tools available for BFRs; and, an analysis of existent land-use and pertinent urban development plans. In the process, local officials should keep in mind that the level of contamination can better predict project costs than site location can predict benefits (market performance can be erratic). Potential remediation costs can often be more accurately approximated than potential gains from a favorable location or a favorable real estate market.

Sites that have lower market potential are prime candidates for **temporary re-greening** and **phytoremediation**, while they wait to be redeveloped (especially if demolition and removal costs of existing structures is not prohibitive). There is a strong chance that brownfields with low market potential will sit idle for decades before being redeveloped. National and EU environmental funds could be used for cleanup/remediation, and appropriate medium- and long-term **interim uses** can be identified: active and passive parkland, green buffers, or maybe community gardens (where there is no dangerous soil pollution). Assigning such interim uses can have a positive effect on the neighborhood and the locality as a whole (e.g. higher property values, safer and cleaner neighborhoods, a place for recreational activities).

Figure 9. Phytoremediation Process



The *Mlaka (INA Refinery) site in Rijeka* is considered to have one of the highest development potentials of identified Croatian hot-spots. Local and national officials, as well as the site owner, agree that redeveloping this brownfield offers a chance to create access to the sea for the population of Rijeka, and significantly improve the coastal aspect of the city. The site is located in a prime location and promises to be an important source of tax revenue for the city when redeveloped. Obviously, the level of contamination will influence the timing, organization, and approach of the BFR process. Location and economic potential are to some extent dependent on manageable upfront costs.<sup>7</sup>

Figure 10. Mlaka Brownfield in Rijeka (Croatia)



<sup>7</sup> World Bank. 2009. *Mission Report on Croatia: Brownfield Redevelopment*.

A thorough **risk assessment** can prevent 'surprises' further down the road

All BFR projects require careful planning to counter potential risks

**Liability** issues often scare potential BFR stakeholders away

Spending more money early on in the process (e.g. hiring good specialists and covering potential legal loopholes) can save money and energy farther down the road

## Risk Assessment

A careful inventory of potential project hurdles and ways to overcome them will enable the project team to better plan ahead and avoid 'surprises'. Such an analysis should be performed early in the process (e.g. during site assessment and investigation), and energies focused on the BFR projects that have a real chance of being redeveloped in the short- and medium-term.

All BFR projects require careful planning (more than regular projects do) as there are several **risks** that can jeopardize actual implementation. At this stage, it is important to look back at data and knowledge collected in the previous stages and determine how these fit in the project equation.

**Liability** is a particularly important issue. It is considered by many to be the main barrier to successfully redeveloping some brownfields, and it can affect the process in several different ways. For *the owner* of a brownfield, contamination that is a threat to human health and/or the environment can potentially bring with it civil lawsuits or government fines. For *a developer*, liability can mean that future revenues and profitability of redevelopment can be affected by potential legal costs, stemming from people's exposure to contamination that was not removed or identified. For *a lending institution*, potential defaults on a BFR loan can mean that the institution will be stuck with a site it cannot easily resell because of environmental issues. For *an insurance company*, the risks of complicated or unknown pollution are often too high to get them involved in the process. For *a local authority*, liability is often what prevents the redevelopment of its brownfields, as private partners become reluctant to get involved.

**Ownership and legal covenants** bring with them a number of problems. If the site is in private or mixed ownership, the owners might change their minds during the process, bringing the redevelopment to a halt or delaying it. Similarly, an incoherent legal framework can hamper remediation goals and can push costs beyond initial assessments. Changes in the land use plan and/or the development scheme can make the project infeasible for the developer. An unreliable performance of regulators (which could change the 'goal posts' mid-project) can create inconsistencies that affect project efficiency.

To counter ownership and legal covenants hurdles, good legal specialists should be hired, and *solid contracts* should be signed with all vested parties. Government rules and regulations may change mid-project (often with a change of government), but conditions at the time of signing should be kept through project implementation – unless new rules prove to be more favorable.

The market for waste disposal can be volatile (e.g. landfilling fees can go up), pushing up remediation costs.

**NIMBYism** can be an important hurdle to BFR projects

Buildings with inherent **heritage value** should be considered for preservation and/or adaptive re-use

The cost of innovative **remediation technologies** can be high if the number of specialized firms is small

**Potential remediation costs** can vary greatly based on how thorough the site assessment and investigation were, on how the applicable standards are determined, and on the type of contamination and time delays. Thus, there is always a risk that not all pockets of soil and groundwater contamination have been identified, or that pollutants cannot be removed effectively with existent technologies. In the same vein, the market for waste disposal (especially if dig-and-dump remediation techniques are used) can be volatile, or the contamination can reach beyond the site, causing damage to *third parties*.

Solutions to these hurdles should include the efficient use of specialists (especially environment and legal), close consultations with stakeholders, use of adequate insurance instruments, and solid contracts with service providers.

**Social resistance** can often take the form of NIMBYism (Not-In-My-Back-Yard) and opposition from community groups and NGOs. Neighborhood groups can fight for the preservation and/or adaptive re-use of buildings that they consider an integral part of their community, they can oppose new developments or certain type of developments (e.g. high density), or they can oppose decontamination procedures that could affect people's health. Community engagement should therefore be an integral part of the redevelopment process from the outset, and will be discussed more thoroughly later on.

**Industrial heritage** is an area just as new as brownfields redevelopment, and often the desired outcomes of these two processes can be conflicting. In developed countries, and increasingly in developing countries<sup>8</sup>, there is a push towards preserving industrial buildings rather than demolishing them for redevelopment. Many of these buildings do not only have historical value (remnants of an epoch of industrial expansion), but they also have inherent architectural and sentimental value. Often such buildings are preserved as museums or show-cases of a by-gone era, or they are adapted to new uses (housing, commercial, new industrial, office space, artist lofts, etc.).

**Technical feasibility issues** can range from lack of experience in the field with relatively unknown environmental challenges, to a lack of environmental competency in the private sector (especially with innovative assessment and remediation techniques). The cost of employed technologies can easily go up if the number of specialized firms is small. In such a situation, the local authority should draw on specialists and firms with experience in the field, from countries/regions with a mature BFR market and a good record of redevelopment projects.

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<sup>8</sup> For example, in "Bucurestiul Post-Industrial", Liviu Chelcea makes a case against the mindless redevelopment of Bucharest's (Romania) industrial sites, without paying attention to the historical and social aspects.

## Box 2. Adaptive Re-use and BFRs

**Adaptive re-use** of industrial building can go hand-in-hand with brownfields redevelopment, with some buildings being adapted to new uses, while others are demolished for new developments. An interesting case in this respect is found in Vienna's former industrial area (Simmering), where a former gasometer facility was transformed through strategic BFRs and adaptive re-use. Four out of seven methane gas reservoirs have been saved and converted into a mixed-use complex that includes housing units, commercial space, offices, a cinema, and a music hall.

### The Gasometer Complex in Vienna (Austria)



Other times, adaptive re-use can be the preferred alternative and an entire complex can be saved and retrofitted, rather than being redeveloped. An interesting example in this respect is the Grunerlokka Student Dormitory in Oslo (Norway). Built in 1953 as a silo, the 53 meters tall structure was converted into 15 floors of student apartments.

### Grunerlokka Student Dormitory in Oslo (Norway)



**Negative market trends**  
can be pre-empted

**Prospective value of redevelopment** can be affected by a sluggish economy, lack of demand, or restrictions on the property market. A healthy economy is obviously a better breeding ground for BFRs than a stagnant or declining one, and good future prospects will make such projects more likely. However, while the course of the local, national, and global economy can hardly be influenced, negative market trends can be pre-empted by selling/renting space early (even before the development is finished), by responding to present and predicted real estate needs, and by tactically creating demand (e.g. through an aggressive marketing campaign). A team of economists and real estate specialists should therefore be employed early on to help plan out different project phases.

Fears of potential  
**corruption charges** can  
prevent local officials from  
getting involved in BFR  
projects

Potential accusation of **corruption** can affect any type of development project, but BFRs are prime targets because of their inherently complex nature. For example, if the brownfield is owned (or bought up) by the local authority and is remediated to be made more attractive to potential investors, there is a high possibility that some observers will suspect unfair advantage, especially if the transaction is not very transparent. Since it is hard to estimate the increase in land value engendered by the cleanup of existent contamination, it is easy for opponents of a BFR project to claim the land was undervalued when it was sold to a private developer.

In the same vein, champions of BFRs, in an attempt to push as many redevelopments as possible, might end up spending more public money than actually needed. Faced with uncertain costs and potential for accusation of corruption, few local authority officials will want to venture their career on contaminated soil, especially if they perceive the stakes as being low (e.g. no pressure for redevelopment from a potentially un-informed citizenry). In such situations, independent agencies (whose sole focus can be redevelopment projects) could be better suited for the job.

Banks often shy away from  
BFR projects for fear of being  
stuck with contaminated sites  
(and the **liability** that comes  
with them) if lender defaults  
on the loan

**Economic feasibility** can be threatened by a reluctance of lenders and investors to get involved in projects with potential liability issues, and because of strong competition from greenfields. For example, if the developer defaults on a loan, the bank will take on not only the property (offered as a guarantee), but potentially also the liability that comes with it (if site remediation has not been performed). In most instances, unless there is a good experience in the field, banks will prefer to offer loans for greenfield developments, rather than for BFRs. In such situations, and if financial resources are available, the locality should consider offering *loan guarantees* for BFR projects that need an extra boost to succeed on the market.

**When project risks** are well documented and shared with stakeholders in a credible, transparent manner, it becomes possible to assign and share the risks in a fair way

It is important that risk assessment is carried out in a credible and transparent way

The local authority should look for project partners with **BFR experience**

Encourage and nurture BFR innovations

If conflicts should arise, encourage **mediation** rather than litigation

Depending on the number of project hurdles that are likely to be encountered, it might make sense to create an *interdisciplinary steering committee*, composed of the major agencies and participating local stakeholders. Since risk and uncertainty can doom a project, it is important to involve all parties that have an influence on the level of risk and uncertainty. Risks should also be spread-out in an efficient and equitable manner to ensure a quick transition to the redevelopment stage.

A thorough risk assessment during the Pre-feasibility stage makes it possible to work towards appropriate risk sharing and risk assignment (discussed further in the next chapter on Feasibility). It is equally important that risk assessment is carried out in a credible and transparent way, with the findings well documented and shared with all potentially interested parties. Government has a key role in ensuring this, so as to encourage trust and provide a common understanding of the project among interested parties, and a secure basis for political support.

The local authority should look for partners that already have BFR experience. It is thus important that the public sponsors scrutinize the type of projects the developers have worked on, their experience in the field, and the health of their company. A developer without BFR experience will have a tougher time dealing with brownfields related risks. Similarly, a lender without BFR experience is likely to impose harsher conditions on the loans it offers. A strong, growing, and experienced company is likely to get involved in the project for “the right reasons”, and it can bring knowledge to the table that can ultimately make the BFR more successful.

While experience matters, the local authority should not shy away from *BFR innovations* (process related, technological, legal, financial and fiscal), considering the relative novelty of the field and the complexity of dealing with contaminated soil and groundwater. New technologies for dealing with brownfields are being developed every day, and our understanding of the effects of soil and groundwater pollution is continually improved. When warranted, remediation work should be outsourced to specialized and experienced environmental companies.

If conflicts between stakeholders arise down the road, it is best to encourage *mediation* rather than litigation. To prevent this, it is important to outline *clear final and intermediate goals*. This will ensure that all involved stakeholders “are on the same page” and have clearly understood their responsibilities: remediation standards; redevelopment expectations; legal compliance; expected impact on neighborhood and locality; expected return on investment; etc.

### Box 3. The Cherokee Experience

In the US, where BFR experience is more extensive, several developers have specialized in brownfields sites. One of the most known is *the Cherokee Fund*, an investment company that has come up with creative ways of feasibly redeveloping contaminated sites, while safeguarding the environment and the public interest. Cherokee acquires brownfield sites, cleans them up, prepares them for development, and assumes full liability for future contamination problems. Thus, the fund lays the groundwork for other private companies that are interested in investing on the site, and creates stronger links to local government officials and local communities. (More information on the fund can be obtained at: [www.cherokeefund.com](http://www.cherokeefund.com))

In addition, the company often functions as a lender. For example, for the revitalization of an oil refinery in Trieste (Italy), Cherokee offered financing to a leading Italian brownfield remediation firm, covering acquisition, demolition, cleanup, and rezoning costs. The Trieste redevelopment represents one of the largest BFRs undertaken in Italy, and when finished it will position the site as a vibrant nexus for the city (with retail, commercial, and housing opportunities).

*The Armada Development* on the banks of the river Zaan in Amsterdam (Netherlands) is an example that highlights a number of hurdles that had to be overcome. In particular, liability and remediation issues plagued the project and threatened to shut it down. To bring the former paint manufacturing site to beneficial use, the developers applied a *risk-sharing approach*, which ultimately turned the project into a successful one. Risk-sharing is critical for marginally profitable sites, as private entities are reluctant to take on developments with a strong environmental component, and public entities often don't have the financial means and/or expertise to complete such projects. Liability issues can also make it hard to secure funding from the private market, as financial institutions are often afraid to be left with that liability should a developer default on a loan.<sup>9</sup>

Figure 11. Armada Project, Amsterdam (Netherlands)



<sup>9</sup> <http://www.cabernet.org.uk/index.asp?c=1157&cs=13>

Energy and time should mainly be invested in engaging communities around brownfields that have been slated for redevelopment

**Community engagement** can assist in raising the profile of the project

There is often a tendency to focus on 'sites' rather than focusing on 'people' in BFR projects

## Community Engagement

Community engagement should start early on in the process, as soon as brownfields have been identified. Energy and time should be invested in engaging the communities in prioritizing which brownfields should be slated for development, by eliciting community perspectives on their potential economic impact when compared to other local development projects.

Community engagement is vitally important in the planning process and for the successful completion of a BFR project. One of the principles of sustainable development is to involve the community in developing the **vision** for their area, and reflecting their concerns and priorities.

Community involvement can also greatly assist in the process of raising the profile of the project and creating a consensus – so that development can progress smoothly. In the EU, guiding principles for community engagement refer to the Aarhus Convention and are offered through Directive 2003/4/EC on *public access to environmental information*.

Most development projects where the public sector is involved should give a voice to neighboring communities (this is good practice for private sector developers too), but BFRs should be particularly attuned to addressing this issue. For one, the fear of potential negative spillovers (e.g. pollution spreading to neighboring sites in the process of remediation) will likely keep communities wary of remediation work.

### Box 4. Community Engagement Principles in the EU

The **Aarhus Convention** was drafted by the United Nations Economic Commission for Europe, on June 25, 1998 in Aarhus (Denmark). It outlines a series of principles on access to information, public participation in decision-making and access to justice in environmental matters. The convention served as a template for **Directive 2003/4/EC** of the European Parliament and of the Council on public access to environmental information. The impetus of the directive is a belief that “[i]ncreased public access to environmental information and the dissemination of such information contribute to a greater awareness of environmental matters, a free exchange of views, more efficient participation by the public in environmental decision-making and, eventually, to a better environment.

Both the Convention and the Directive are built around three main pillars: 1) **Access to Environmental Information** that allows people to understand what is happening in the environment around them so they can take informed decisions; 2) **Public Participation in Decision Making** that requires public authorities to both listen to the public and actively engage them on matters that directly or indirectly affect them; 3) **Access to Justice** through which “the acts or omissions of the public authority concerned can be reconsidered by that or another public authority or reviewed administratively by an independent and impartial body established by the law.”

There is also a tendency for people involved in BFR projects to focus on ‘sites’ (and issues of environmental sustainability, economic viability, and best practices in construction) rather than focusing on ‘people’.

Thinking about the positive environmental and economic impact of a BFR project, it is easy to forget about the impact the development will have on the people living around it. For example, neighbors who have lived in the area all their lives, may have an emotional attachment to buildings that are about to be demolished. Whether these buildings are derelict or not, they might be at the center of important neighborhood events or happenings, and might be prime candidates for adaptive re-use rather than demolition.

It is also important to know that in cities where property taxes are an important source of revenue for the locality, new developments can increase taxes and rents in their respective neighborhoods and can ultimately lead to **gentrification** – pushing poor people out of their community. Consequently, social issues should be as important as environmental and economic issues in the BFR process, and should be factored in when projects are started. Community engagement is one way to discover, define, and address social issues around a BFR, and people with the right skill set are needed for the job.

Obviously, community engagement can take many forms (see figure below), and different approaches might be called for different types of situations. Regardless of the approach chosen, **independent facilitators** are needed with the skills to manage the process, to facilitate events, and reduce conflict and disputes.

The role of facilitators is critical, especially in situations where the views of particular individuals or interest groups may dominate events. Facilitators can better highlight external constraints that impact the vision and future development of the area.

BFRs could lead to **gentrification** and a host of other social issues

Provide independent facilitators with the right skills to manage the process

**Figure 12. Ladder of Citizen Participation**



Source: Arnstein, Sherry R. 1969. “A Ladder of Citizen Participation”. *Journal of the American Planning Association*, vol. 35 (4), pp. 216-224

Such constraints can include: emerging policies and proposals, planning and environmental restrictions, or remediation and construction limitations. Facilitators can also build a bridge between the community vision, and plans hashed out by local authorities and private developers.

Clarify **aims and objectives** early on in the process

At the outset of the process, facilitators should try to clarify the aims and objectives of the BFR project, and a common agenda should be established. This means that communities should be given the opportunity to participate in drawing up and developing specific plans or policies, and they should be consulted on proposals for development. These communities may include many different interest groups (environmental groups, NGOs, religious groups, etc.) as well as ‘non-expert insiders’ who live in the area. Given the heterogeneous nature of communities, it is important that facilitators establish a **community profile** – by identifying the groups and individuals associated with the project, as well as people who live or have an interest in the area. Some members of the community may be less well equipped to engage in the BFR process, and this should be countered through an inclusive approach and tailored methods. Furthermore, resources should be made available for **capacity building** to enable communities and stakeholders to engage fully in the process.

Foster an inclusive approach and tailored methods

**Community expectations** may be unrealistic and should be managed accordingly

As the process moves along, it is important to realize that **community expectations** may be unrealistic and need to be managed accordingly. Identifying and understanding the needs of groups or individuals who might be difficult to communicate with is a vital element of community engagement. It is therefore important to establish ground rules, set out clear targets, and avoid a reactive pro-forma process. The process should be robust enough to enable the local community to have a voice in how their local area will be developed, and comments should be welcomed on a wide range of issues (not just narrow options worked up by ‘professionals’).

Ensure there is effective and **continuous feed-back**

The **community engagement format** should make consultation widely accessible and should ensure effective and continuous feed-back (e.g. by allowing communities to see how ideas have developed during the various stages and ensure that everyone is aware of the progress made). Failure to fully engage the community (through workshops, training sessions, visioning sessions, fact sheets, community meetings, etc.) can lead to delays in the redevelopment process, litigations, neighborhood backlash, negative media coverage, and disgruntled project partners.

*The Lowry Development in Manchester (UK)* is a good example of how community engagement shaped the vision for the redevelopment of the Salford Quays (closed in 1982). The City of Manchester decided

that involving the surrounding community would not only help dispel neighborhood resistance, but would also help create a development concept with high benefits for the locality. The Lowry Performing Arts Center quickly became a recognized landmark on the city's landscape, and worked as an anchor for further investments in the area: a retail and leisure facility, the War Museum of the North, a regional water-sports center, two major residential developments, and over 10,000 created jobs.<sup>10</sup>

**Figure 13. The Lowry Development in Manchester (UK)**



The London Olympic Village is a massive undertaking that requires the remediation and redevelopment of a large brownfield, surrounded on all sides by diverse communities. A redevelopment on such a scale obviously requires a sensitive and flexible approach to engaging different types of communities. Such “big ticket”, high profile projects have a set dead-line (in this case 2012), sometimes imposed by an external event (such as a global sporting event), which creates an added impetus for all involved stakeholders to sit down, discuss, and find a compromise for outstanding issues.<sup>11</sup>

**Figure 14. The London (UK) Olympic Village (under construction)**



<sup>10</sup> <http://www.cabernet.org.uk/resourcefs/370.pdf>

<sup>11</sup> <http://www.earthexplorer.com/2007-09/geophysics-in-urban-brownfields.asp>

## Chapter 5: Feasibility

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In the feasibility phase, remediation and redevelopment plans are defined with precision, an environmental impact assessment and a mitigation plan are developed (as a way of describing, quantifying, and analyzing the environmental impact of the proposed redevelopment), public-private partnership roles are negotiated, the sharing of risks and benefits among participating parties is decided (based on a thorough development appraisal by the developer, and a clear impact analysis performed by the local authority), and incentive schemes and sources of co-funding are identified.

The precision of the remediation cost can be greatly increased by generating a solid **information base**

Following close consultations with involved stakeholders, the *preferred remediation and redevelopment options* are chosen and further elaborated to define project contents, budget and timeframe. This serves the purpose of: obtaining the construction permit; securing the funds required for investments from private and public sources; providing detailed solutions to technical problems (e.g. the required cleanup technology); creating the basis for tender design and tender documents for procurement. In this phase, the contamination pattern will be characterized with high precision, the site development elaborated in detail (including all main quantities and dimensions, areas and volumes, layouts and appearances of structures and infrastructure), and a *site remediation plan* ready for implementation. This plan will address two types of contaminations and liabilities:

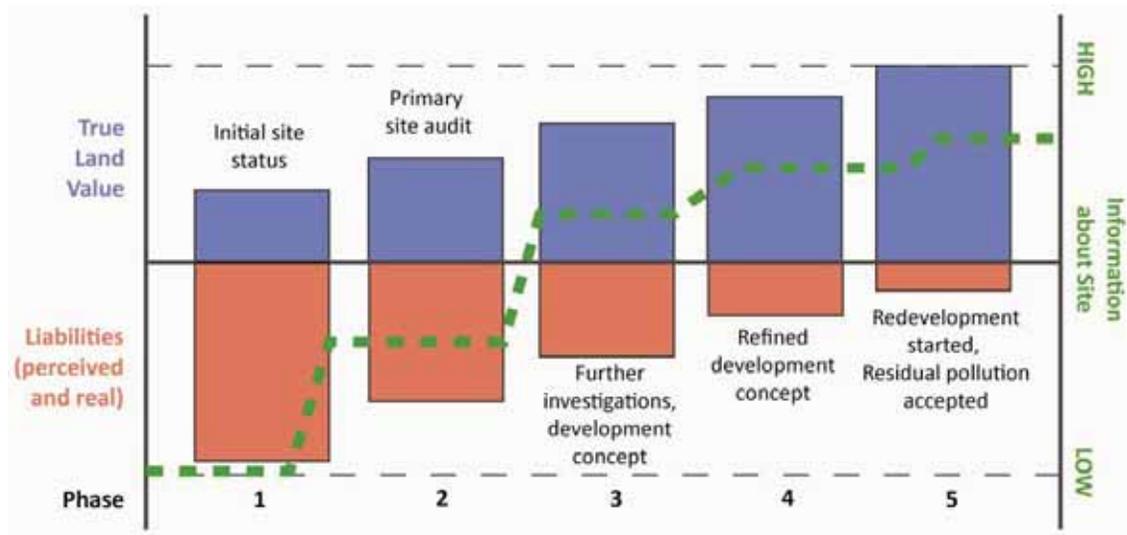
- Those which need to be removed due to the planned construction activities (e.g. because a foundation will be placed in contaminated soil, or waste heaps on the surface need to be cleared to make space for landscaping or structures);
- Those which need to be removed or remediated in situ due to their environmental impact/hazard to public health and safety or environmental common goods. Examples include: a contamination plume in the groundwater, moving off site and threatening water supply systems; a high level contamination under prospective foundations which will be remediated in situ with microbiological methods; or, hazardous substances contained in near surface fill, which might pose a hazard by direct contact or ingestion of dust.

**Developer obligations** should be clearly stated

These measures will commonly be contained in the environmental provisions of the construction permit and thus be compulsory for the developer to implement during site preparation for development. The cost will be calculated as precisely as possible in this phase to allow the balance of the negative assets of the site against the value added by the investment and the prospective revenue generated by site development. This figure is thus one of the fundamental inputs for the

site economic model. The precision of the remediation cost can be greatly increased by generating a solid information base and is essential for site planning and risk management (see figure below).

Figure 15. Added Property Value by Information Generation



An environmental impact assessment takes into account the baseline of the site and analyzes environmental impact of the new development on neighborhood and surroundings

Sustainable development practices should be coupled with innovative cost saving mechanisms

### Environmental Impact Assessment

Initial remediation and redevelopment plans are sharpened by performing an **environmental impact assessment (EIA)**. The EIA takes into account the environmental baseline of the site (investigated and characterized during site assessment and investigation), and analyzes the environmental impact of the planned redevelopment on neighborhood and surrounding jurisdictions. New legislation in most countries is strict about avoiding potential negative impacts on people, but is often less clear on how environmental impacts can be mitigated<sup>12</sup>.

The technical investigation activities related to an EIA are similar to the initial investigations for the environmental site audit described above and in more detail in Annex 4. In fact, much of the information generated at the initial phase may subsequently be used for the EIA. There may be gaps to be closed (e.g. due to new aspects of the development concept), but these could be addressed through supplementary investigations. The information thus generated can be used to encourage sustainable redevelopment practices

<sup>12</sup> The EU offers some guidance on how environmental impact assessment can be done for projects requiring Structural Funds. See, for example, the *Handbook on Environmental Assessment of Regional Development Plans and EU Structural Funds Programmes*.

Sustainability can also mean cost efficiency

*Sustainable development practices*, which have a central role for the environment, are developing fast, but they often have to be coupled with innovative cost saving mechanisms to be adopted by developers. Global BFR experience shows a number of ways in which sustainability can also mean cost efficiency. For example, remediation can be designed to allow for as much soil to be kept on the site. Soil is a valuable commodity and should not be wasted/landfilled unless heavily contaminated. Especially for large projects, where large quantities of soil have to be unearthed, clean soil has to be hauled in at considerable cost.

Local authorities should support a market for demolition materials

Cost savings can also be achieved by placing contaminated soil below parking lots and roadways, by placing utilities above ground to minimize future digging, and by remediating to surrounding levels not 'cleaner-than-clean'. Local governments can also support a *market for demolition materials*. A small profit can be made by recycling these materials, rather than paying large sums for landfilling. Recycled bricks for example can be used for new constructions on the brownfield site, or sold for other development projects.

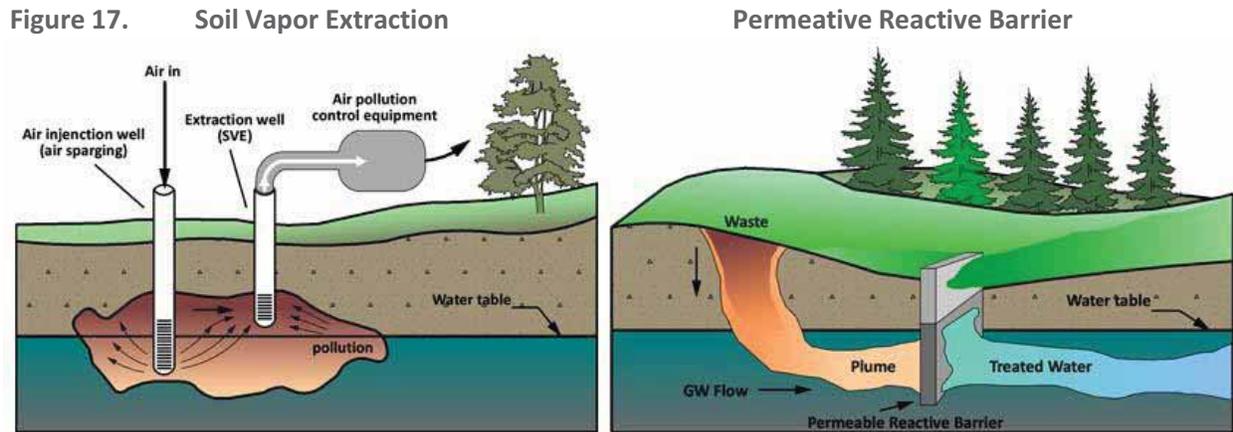
The remediation concept for the *Bucharest PETROM site* (presented earlier), made use of existing Romania regulations and standards pertaining to soil contamination, quality of drinking water, and waste criteria for landfills. There were however no provisions for contaminated groundwater, so reference was made to pertaining German law and to global sustainability practices. In an initial stage, soil was excavated and cleaned, to a depth of 30 cm, and replaced with clean top soil.

Figure 16. Ongoing remediation of Bucharest PETROM Site



Next, a *soil vapor extraction* system was installed to capture volatile hydrocarbons from the soil, released by a bio-airsparging method. Soil vapor extraction is often used in tandem with a *hydraulic barrier* or a *permeable reactive barrier* that prevents pollution present in

groundwater to spread. The hydraulic barrier stops the flow of the water, while the permeable reactive barrier reacts with contaminants in the water, neutralizing or capturing them, and allowing clean water to pass through.<sup>13</sup>



Adapted from US-EPA

In addition to a hydraulic barrier, the groundwater on the PETROM site was continuously treated with multi-stage treatment plants, and systems were put in place for the extraction of floating oil phase.

### Defining a PPP Approach

While public and private collaboration may begin to evolve from the Pre-feasibility stage, it becomes formalized as part of Feasibility. The way a public-private partnership is defined can vary greatly, from joint equity ownership, to a simple contractual relationship, to a complex arrangement in which planning, financing, development, and/or operations are done jointly<sup>14</sup>. Depending on the magnitude and difficulty of the redevelopment, on social and environmental stakes, and on any outstanding legal issues, the local authority might chose to play a bigger part in the project, or to take a back-seat approach.

PPPs can vary greatly, from simple contractual relationships, to complex arrangements

Enlisting the participation of private enterprises can be beneficial for local authorities

Enlisting the participation of private enterprises can help local authorities:

- fill a potential financing gap;
- benefit from the know-how, technologies, and innovative working methods of the private sector;

<sup>13</sup> Schock Gabi and Doris Hirschberger. 2007. "Reactivation of Derelict Industrial sites in Romania: A Project of GTZ for Economic and Employment Promotion". Proceedings of the 2<sup>nd</sup> International Conference on Managing Urban Land

<sup>14</sup> The EU defines PPPs as "a form of cooperation between public authorities and the world of business which aims to ensure the funding, construction, renovation, management or maintenance of [a project], or the provision of a service." (See *The Green Paper on Public-Private Partnerships and Community Law on Public Contracts and Concessions*, 2004).

- make the change from *direct operator*, to *organizer, regulator, and controller*.

Real PPPs require a close **cooperation** between the public and the private side

There are many ways to enlist public and private entities to work together, but real PPPs require a close cooperation between the two sides throughout the entire process. The table below highlights some models of cooperation that can occur between private and public entities working on BFRs.

Sole private or public development often hinges on the ownership issue and may be driven by the need for fast outcomes. This one-party approach is predominantly seen for A-type brownfields, where the upfront remediation is not unduly complex or costly, likelihood of achieving desired returns is high, and where cross-involvement (PPPs) is not seen as necessary. Thus, if a local authority owns an A-type brownfield, it may choose to only involve private entities on a contractual basis for construction work or for (partial) financing.

PPPs should ideally involve a close cooperation between the public and private side through all stages of the redevelopment process

A *Procurement and Concession PPP* has a public entity as the project leader, with certain parts of the process being ‘outsourced’ to private parties on contract. Classical examples of contractual PPPs include projects where the local authority takes the initiative and pays a private entity to do the design, construction, and financing; the public sponsor may ensure the maintenance and operation of the completed redevelopment itself, or engage a private party. A *PPP Alliance*, what the European Commission calls Institutionalized PPPs, may be especially advantageous for B-type brownfields (where profitability is uncertain). A PPP alliance, ideally, fosters a close cooperation between the public and private side through all the stages of the redevelopment process, including risk sharing and financing.

**Table 1. PPPs – Models of Cooperation**

Stage/model	I. Private development	II. Public development	III. Procurement & Concession PPP	IV. PPP Alliance
<b>Initiative</b>	Private	Public	Public	Private, public
<b>Planning</b>	Private, with public assistance	Public	Possibly private	Private, public
<b>Financing</b>	Private, with public assistance	Public, with private assistance	Possibly private	Private, public
<b>Site development</b>	Private	Public	Possibly private	Private, public
<b>Building</b>	Private	Public	Possibly private	Private, public
<b>Operating &amp; maintenance (commercial facilities)</b>	Private	Private, public	Possibly private	Private, public
<b>Maintenance of public facilities</b>	Public	Public	Public	Private, public

Source: Groenendijk, Nico. 2007. “An early assessment of JESSICA: Love at first sight?”, presented at the Second International Conference on Managing Urban Land. Available at: <http://www.cabernet.org.uk/index.asp?c=1127>

Private partners should be selected in a transparent and fair manner

To reap the full benefits of a PPP alliance, it is essential that private partners are selected in a *transparent* and *fair* manner. Thus, if the local authority wishes to implement a specific BFR project it should organize an open **call for competition** for private sector entities that might be interested in such a project. The call for competition should not be limited to local or national operators, but also reach international players if the size warrants. The added effort to advertise a call for competition throughout the country and across country borders should be weighed against potential benefits that can result from a larger selection pool. Thus, experienced international players could introduce to the country new and innovative technologies and processes, and could ensure significant cost-savings through enhanced productivity and faster response times to potential project hurdles. An international reach is particularly important for BFR projects, because of the relative new nature of the field, and because of the lack of experience with such projects in many CEE countries.

Involved parties should reach an **early consensus** on project objectives and task of completion

To ensure that the PPP will be successful, the local authority and the developer should seek to adopt an early *consensus* on project objectives and tasks and reach a mutual understanding on individual responsibilities. It is also important to allow some leeway for compromise in response to stated objectives (e.g. the local government can agree on less stringent but still appropriate cleanup requirements, depending on the end-use of the site; the developer will incorporate affordable housing in the final project, in exchange for higher allowed density, etc.). Thereby, the parties can divide responsibilities and duties based on financial involvement and capacities.

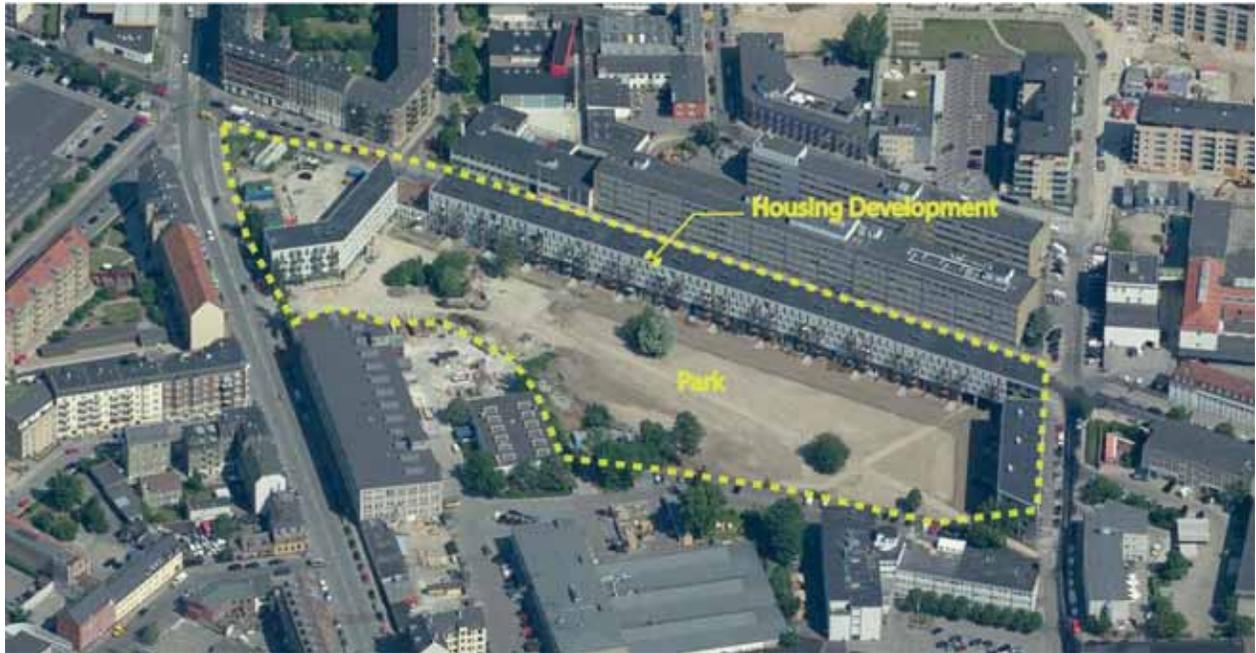
It is easier to deal with **potential complaints** upfront, rather than later in the process

In addition to identifying viable private partners for the project, local authorities should also identify other public and private entities with a potential stake in the project. In this group fall government entities that have permitting or other authority over any aspect of the project, community groups and 'non-expert insiders', and others that could potentially delay or block the project as well as potentially benefit from it. All of these parties should be actively engaged in the process, and offered the opportunity to voice their opinion. It is easier to deal with potential complaints upfront, rather than once the project is underway. Communication lines with vested stakeholders should be open at all time, and one should err on the side of over-communicating.

One of the most dilapidated industrial areas in *Copenhagen (Denmark)*, *Glud am Marstrand*, was targeted for redevelopment, under the umbrella of a partnership between a private developer, local residents, and the neighborhood regeneration project. The end product of the redevelopment was a new park (that the neighborhood pushed for) and new housing (that the developer pushed for). The total

development costs were split between the private partner (69%) and the public partner (31%).<sup>15</sup>

Figure 18. The Glud am Marstrand Development in Copenhagen (Denmark)



Within the EU, Member States and Accession Countries have created *tools to disseminate best-practices for PPPs* (e.g. Tasks Forces in the UK and Italy), offering advice on how to choose a private partner, on how to do the risk assignment, on devising contracts and afferent clauses, on engaging different stakeholders, and on using sources of co-funding, such as Structural Funds. In addition, the European Commission (EC) has launched *The Green Paper on PPPs* (2004) as a way of starting a debate on how best to develop PPPs in a context of “effective competition and legal clarity”.

### Assigning Risks and Sharing Benefits

Once a decision has been reached on the level of involvement of the public and the private side, the two entities have to agree on how they will share risks—as well as benefits. In fact, it is these details that form the partnership “deal”, if an agreement is reached. **Risk assignment** is usually determined by the interests of each side (public and private), and their ability to *assess, control, and cope* with specific risks. For example, the local authority could take on certain liability and offer upfront financial assistance in the audit stage, while the developer takes on a construction loan and insurance. When the risks are

**Risk assignment** is determined by the stakes of the public and private side, and their ability to assess, control, and cope with specific risks

<sup>15</sup> [http://urbact.eu/fileadmin/general\\_library/GTTT\\_Participation.pdf](http://urbact.eu/fileadmin/general_library/GTTT_Participation.pdf)

allocated in this way, it is possible to identify a fair and sustainable way of **sharing the benefits** of the redevelopment.

A balance should be struck between the developer's bottom line and the local authority's need to serve the public interest

Obviously, a balance needs to be struck between the developer's bottom line and the local authority's need to serve the public interest. Ideally, a mutually beneficial solution can be reached, with the private side achieving the highest possible profit, and the local authority generating the highest positive socio-economic impact. What should be avoided, however, is a situation where the public sponsor takes on all the risks while the private investor savors all the benefits (sometimes referred to as "socializing risks and privatizing benefits").

Risk and benefit assignment are informed by the **development appraisal** and the **impact analysis**

To determine their potential position on a proposed BFR project or projects, the local authority should perform an **impact analysis**, and the developer perform a **development appraisal**. Both of these exercises require agreement on the remediation technology to be applied for the expected end use of the site, as well as on a particular redevelopment concept.

**The impact analysis** can involve running a series of remediation and redevelopment scenarios

**The impact analysis** can involve running a series of remediation and redevelopment scenarios. This will enable the identification of the projects with the highest positive impact on the local economy. For example, if the redevelopment presupposes the relocation of an existent local enterprise rather than a new investment, the impact on the economy will be minimal – or, even worse, some disruptions may be caused as a result (although it may still be well justified from an environmental perspective). Similarly, if the development concept focuses on building new housing in the midst of a sluggish housing market, the developer might not be able to cover construction costs.

It is important to account for non-pecuniary risks and benefits in the impact analysis

It is therefore critical to identify a series of scenarios that will allow the project to break even, to determine costs that can be avoided, to find the best uses for identified sources of co-funding, and to determine all non-pecuniary benefits (e.g. the effect of a better environment on the well-being of the people) that can be factored into the equation. It is also important to compare BFR scenarios with similar scenarios on greenfield locations (the three distinct examples offered in Annex 6 can provide some inspiration). This comparison will allow the local authority to think of how BFRs can be made more attractive for developers while ensuring that the positive social impacts (externalities) can be realized. A multi-dimensional impact study should give the local authority an idea about potential spill-overs (positive and negative) a project might have. As with any development project, BFRs can generate externalities that go well beyond the simple bottom-line of the developer (see table below for some likely impacts).

**Table 2. Impacts of BFRs**

<b>Environmental and Energy Impacts</b>	
Site cleanup and reduced risk to public health	In the US, 50,000 sites have completed Voluntary Cleanup Programs (VCP) since the mid-1990s
Responsible growth and saving land from sprawl development	Once acre (~0.40 ha) of redeveloped brownfields has been estimated to conserve 4.5 acres of greenfields sprawl development.
Air quality improvements	Findings of three case studies in the US show that BFRs encourage less car usage than greenfield projects, leading to air emissions reductions of 20% to 40%.
Energy and greenhouse gases	A 2008 study by ULI (Urban Land Institute) shows that BFRs, as an alternative to greenfield development, can lead to a reduction of greenhouse gas emissions of over 30%.
Brownfields and sustainable development	By default, BFRs presuppose the 'recycling' of used sites, and in many cases new construction follows high sustainability standards (e.g. green buildings).
Improved water quality and less run-off	An EPA (the U.S. Environment Protection Agency) study showed that higher building densities achieved through BFRs encourage less run-off per dwelling unit and better water quality.
<b>Economic and Community Impacts</b>	
Employment and investment impacts	The US-EPA reports that, as of March 2008, \$1.3 billion invested through its Brownfields Program have leveraged 48,238 permanent jobs and \$11.3 billion in new investment. Similarly, 80 cities from a U.S. Conference of Mayors survey report the creation of 115,600 permanent jobs through the revitalization of brownfields (around 137 jobs per site).English Partnerships estimates that in England, the redevelopment of 752 ha of brownfield land will generate 6,200 net jobs.
Leveraging investment	The Northeast Midwest Institute (NEMW) estimates that every \$1 of public investment in brownfields can leverage over \$8 of total investment. In Canada, brownfields-related investments (site assessment, cleanup, and preparation) of \$100 million were expected to generate a total impact (direct, indirect, and induced) on the economy of \$375 million.
Leveraging employment	NEMW estimates, based on six case studies, that one permanent job can be created with public investments of \$10,000 to \$13,000. Moreover, if brownfields-related costs are analyzed separately, a permanent job is leveraged by an average of \$5,700 in public costs.
Neighborhood revitalization and property value increase	Several studies have shown that BFRs can trigger property value increases of 5%-15% for properties that are up to 1km from the site. Depending on the case, these impacts can be much higher (especially for idled industrial sites), or lower (e.g. in dilapidated neighborhoods).
<b>Fiscal Impacts</b>	
Direct generation of local tax revenue	A 62 city survey conducted by the U.S. Conference of Mayors found that BFRs generated \$408 million in annual local tax revenue (\$626,000 per site). Furthermore, the survey showed that the redevelopment of remaining brownfields in these cities could generate between \$1.3 and \$3.8 billion in local taxes.
Lower investment in infrastructure	Depending on the case, BFRs require infrastructure building and maintaining costs that are up to 10 times lower than similar costs for greenfield developments.
Transportation externalities	A study conducted in Canada showed that the indirect transport-related costs of greenfield developments are about 3.5 times the indirect costs of BFRs.

Sources: Evans, Paull. 2008. "The Environmental and Economic Impacts of Brownfields Redevelopment". Northeast Midwest Institute; English Partnerships. 2006. The economic impact of recycling brownfield land: <http://www.englishpartnerships.co.uk/landsupplypublications.htm#brownfieldrecommendations>; National Round Table on the Environment and the Economy. (2003). "Cleaning up the past, building the future: A national brownfield redevelopment strategy for Canada." Ottawa, Ontario: NRTEE.

**A development appraisal** is a method used to derive the net land value of a development, much like a cost-benefit analysis

**Project expenditures** need to be shared between involved parties in an equitable manner

Often local authorities will take on site preparation and remediation costs

The public sector's role in **minimizing risk** is critical

**A development appraisal** is a method used to derive the net land value of a development, helping developers decide whether a BFR project is worth the risk or not. The main aim of the development appraisal is to assess the financial viability and feasibility of real estate proposals. In normal circumstances a well developed detailed appraisal will incorporate cash flow spreadsheets for the duration of the construction period. In certain instances these will be a mandatory requirement from commercial bank partners. All relevant stakeholders/parties should be involved where appropriate.

An effective financial development appraisal, in broad terms, has to look at a number of issues affecting the bottom line of the developer. *The potential project income* affects both the profitability of the redevelopment and the developer's ability to repay loans. Among others, it can include: properties for sale, properties for rent/lease, investment yield gross, and gross development value. *Potential project expenditure* needs to be carefully analyzed. Expenditures can include: site purchase cost, site remediation and environmental reclamation, demolition and site clearance, service costs, construction costs, contingency, site investigation fees, land survey fees, insurance, statutory fees, sales and marketing costs, taxes, and finance costs. (See Annexes 6 and 7)

Other issues to be considered in the development appraisal are: current land use; land use earmarked in local plan (if any); building density in surrounding area; proposed building density; planning precedents; car parking policy; proximity to transport infrastructure; proximity to open space; local current land values; and, capacity of existent infrastructure to deal with potentially increased traffic volumes. Often the local authority will take on some of these expenditures (especially site preparation and remediation costs) in an attempt to make the project more appealing for private investors.

In the overall scheme, the public sector's role in *minimizing risk* is critical. The local authority must decide how it wants to share risks and returns with its partners. This decision is instrumental in how the development appraisal is structured. The structure may be determined partly by how much long-term control the public authority would like, or may have to retain over the development. Developers and investors look for *certainty*, as greater certainty makes land more attractive and they are more likely to commit to sites where risk has either been reduced or underwritten by others. But the public sponsor needs to consider carefully how much it needs to commit upfront to create an attractive deal, while not overreaching and taking on more obligations than the project justifies and requires.

*The Havnestad Development in Copenhagen (Denmark)* is a good example of a partnership formed between a developer (who also was the owner of the severely contaminated site) and the Municipality of Copenhagen. While no direct monetary incentives were offered, the municipality worked closely with the developer to create a masterplan that made provisions for social amenities (e.g. waterfront access for the general public, and a recreational area to the East of the site), set sustainable development targets, and offered recommendations for the use of architecture, construction materials, and the design of public spaces. The centerpieces of the redevelopment are two reclaimed tower silos, which were transformed into a waterfront landmark with space for offices and housing.<sup>16</sup>

**Figure 19. The Havnestad Development in Copenhagen (Denmark)**



Choosing remediation technologies is contingent on availability and cost-effectiveness

Obviously, choosing remediation technologies is contingent on availability and cost-effectiveness., and on what makes more sense on the ground (e.g. dig-and-dump strategies are more viable in countries where landfilling is cheap, while innovative technologies can be used when contamination issues are complex). Annex 5 indicates some of the most often used remediation technologies and situations where they are most appropriate.

It often happens that final construction costs supersede initial estimates, but if the stakes at hand are important enough, additional funds can be generated to see the project through completion. Stora Mossen (Stockholm, Sweden) is an example of a site where redevelopment *costs superseded estimates* due to poor site characterization, with the developer threatening to pull out of the deal. The project was eventually finished with additional public financing, since the social impact on the community (a new athletics field) was thought to be significant.<sup>17</sup>

<sup>16</sup> <http://www.cabernet.org.uk/resourcefs/366.pdf>

<sup>17</sup> <http://www.cabernet.org.uk/index.asp?c=1157&cs=11>

Figure 20. Stora Mossen Redevelopment (Stockholm, Sweden)



For most B-sites, local authorities have to offer some form of **incentives**

Local practice, national legislation, and cross-country agreements can affect the use of local public incentives

Financial incentives should be used with care in countries where regulatory institutions are not well developed

### Incentives for BFRs

For most B-type BFRs, local authorities have to offer some form of incentives (both pecuniary and non-pecuniary) to attract potential private partners. Since the perceived financial value of B-type sites is less than anticipated costs, local authorities may have to make adjustments to bridge the gap between perceived costs and perceived values.

The way local public funds and resources can be used to stimulate private involvement (and reduce risk for developers) is a matter of local practice, of national legislation, and of cross-country agreements (e.g. EU legislation). Overall, the measures local authorities have at their disposal are more plentiful in the US and Canada than in Europe, in part because of differences in the scope for property related taxation. In the EU, public incentives and subsidies to the private sector are limited by Article 87 on *state aid*, although the regulation has become more permissive in recent years (see box above).

Global experience highlights several ways in which public incentives and subsidies have been used to encourage BFR projects. Thus, localities (at least those with the financial means) can use financial, fiscal, or planning tools to **reduce the cost of financing** for the developer. Common tools include *bonds*, *public financial intermediary institutions* that take on more risks than regular banks, and *loan guarantees* offered for BFR lending.

Such instruments should be used with extreme care in countries where the credit market and financial sector regulatory institutions are not well developed, to avoid distorting the market and creating large contingent liabilities for governments.

### Box 5. State Aid Regulations in the EU

Many champions of BFRs in Europe have pointed out that EU's state aid regulations are rather prohibitive. While the reasoning behind this legislation is sound (it is meant to prevent beggar-thy-neighbor competition between jurisdictions for private investment and development), it also has a series of unintended negative consequences (e.g. lack of interest and investment in certain projects that could benefit communities). To address these shortcomings, the European Commission made some amendments to the legislation, allowing state aid to be used for certain projects and certain types of private entities.

To encourage the development of small and medium-sized enterprises (SMEs) (defined as having 250 or less employees, and €50 million or less annual turnover), certain provisions that favor BFR projects are currently offered:

- *The 'De Minimis' Rule* enables aid of small amounts (up to €200,000 over any period of 3 fiscal years) to be offered to private enterprises, without having to notify the Commission, and without having to enter into any administrative procedure. *State guarantee* of up to €1.5 million can also be used under the 'de minimis' rule. As a way of combating the current economic crisis, the EU has raised the amount of state aid that can be used without the notification of the Commission - €500,000. This new upper threshold can be taken advantage of until the end of 2010.
- *Aid for Environmental Protection* is allowed without notification of the Commission, if disbursed sums don't exceed €7.5 million per undertaking, per investment and if the conditions of the *General Block Exemption Regulation* (GBER) are respected. Under this category, aid for the **remediation of contaminated sites** is permitted, and 100% of eligible costs can be covered. This aid is only permitted in situations in which the polluter cannot be identified, or cannot be made to bear the costs
- *Reductions of, or Exemptions from Environmental Taxes* are allowed if they contribute, directly or indirectly to environmental sustainability, and if they do not undermine the general objective pursued by the tax. Such reductions/exemptions are allowed for period of up to 10 years, if the Community minimum is paid.
- *Regional Aid* is permitted in disadvantaged regions, as long as it contributes to the long-term development of those regions, by creating a more favorable business environment and by attracting new investment.
- *Aid for Environmental Studies* can be offered to private enterprises, and it can cover up to 70% of eligible costs for small companies (less than 51 employees), and 60% respectively for medium-sized companies.

In addition to these categories of aid, local and central authorities in Member Countries can offer other incentives to private enterprises (or larger sums than the limitations imposed above), as long as individual projects are vetted and approved by the Commission. Countries like the UK, the Netherlands, Italy, France, and Greece, have created state aid programs for BFR projects, with a majority of incentives being offered for remediation/cleanup work.

Table 3. Incentives for BFRs

		OBJECTIVE		
		Reduce the Cost of Financing	Improve Cash-Flow	Enhance Investment Climate
APPROACH	<b>Financial</b>	<ul style="list-style-type: none"> <li>• Municipal bonds;</li> <li>• Financial Intermediary Institutions;</li> <li>• Loan Guarantees;</li> <li>• Equity Participation.</li> </ul>	<ul style="list-style-type: none"> <li>• Grants (e.g. for assessment, investigation, and/or for remediation);</li> <li>• Subsidies;</li> <li>• Premiums;</li> <li>• Loans;</li> <li>• Revolving Loan Funds.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Insurance;</li> </ul>
	<b>Planning</b>	<ul style="list-style-type: none"> <li>• Invest in Site Infrastructure;</li> <li>• Community Reinvestment Acts (e.g. require banks and other financial institutions to make investments in distressed communities).</li> </ul>	<ul style="list-style-type: none"> <li>• Infrastructure Investments;</li> <li>• Public Transportation Investments;</li> <li>• Reduce Fees;</li> <li>• Speed-up Bureaucratic Process.</li> </ul>	<ul style="list-style-type: none"> <li>• Zoning;</li> <li>• Land-Use Control;</li> <li>• Infrastructure Investments;</li> <li>• Public Transportation Investments;</li> <li>• Management and Advisory Assistance.</li> </ul>
	<b>Fiscal</b>	<ul style="list-style-type: none"> <li>• Tax Increment Financing (TIFs);</li> <li>• Brownfields Tax Incentive (e.g. remediation costs are made fully tax deductible);</li> <li>• Betterment Levies (i.e. imposing a one-time tax on expected value gain after remediation and redevelopment).</li> </ul>	<ul style="list-style-type: none"> <li>• Tax Abatements;</li> <li>• Tax Exemptions;</li> <li>• Remediation Tax Credits;</li> <li>• Tax Advantaged Zones.</li> </ul>	<ul style="list-style-type: none"> <li>• Special Tax Districts (which have regulation tailored to their particular set of circumstances – e.g. the need for redevelopment).</li> </ul>

For projects that have a clear social and environmental component, local authorities can work on **enhancing the investment climate**, by making a distressed area more attractive for future investments. Some of the tools that are used include *tax increment financing (TIF)*, *special tax districts*, and *zoning and land-use control*. In addition to developer targeted incentives, *environmental insurance* can be offered to lenders.

**Tax Increment Financing** allows local authorities to offer incentives for redevelopment, without committing current local resources

TIFs are particularly popular in the US, as they allow the local authority to offer incentives for redevelopment (e.g. acquiring property, doing site preparation, investing in site infrastructure) based on anticipated land value without committing current local resources. Bonds are usually issued for public investments in the tax increment district (often with a 20 year maturity), and they are expected to be paid back with the extra tax revenue generated by the new development. In effect, future tax money is used for present public investments in the redevelopment. As such, TIFs both reduce the cost of financing for the private developer, and contribute to enhancing the business climate in the tax increment district.

In the EU, offering subsidies, grants, or tax incentives to private entities is restricted (Box 5). Furthermore, in many countries local taxes such as value-based property tax are very limited and rates extremely low, so they cannot be leveraged within incentive packages. However, there are a number of incentives that local authorities can resort to, to attract private investors.

**Revolving Loan Funds** are often used in Europe

For example, in Europe, **revolving loan funds** are very prolific. These can be started with seed capital provided by governments, and used for brownfields remediation and clean-up. As loans are repaid, the fund is replenished and can be used for other clean-up operations. These loans are usually offered with advantageous terms but may have less flexibility than private financing would allow.

**Financially intermediary institutions** can lower risks and increase access to lending

**Financial intermediary institutions** can be established by local or national authorities as a way of creating financing lines for BFR projects. For example, *business development corporations* are publicly chartered banks that generate most of their capital from private sources (e.g. banks and insurance companies). They offer loans to businesses that have difficulties accessing private lending lines because of perceived project risks. As such, business development corporations can work as key financial intermediaries for BFR projects.

Loan guarantees are less expensive than direct public loans

**Loan guarantees** are intended to lower lending costs on loans made by private financial institutions, and they can be offered by a public institution to developers that are investing in a BFR project. By reducing some of the risks that lending institutions assume, developers can have access to easier, and potentially cheaper loans. However, they constitute a contingent liability for the guarantor and should be used with care.

**Zoning changes and land-use controls** are two planning tools that can make BFRs more attractive

**Zoning change** is a planning tool that can enable developers to generate higher revenues and turn an economically unfeasible project into a profitable one. Often times, zoning restrictions (height, shadow, floor-to-area ratios) impede the creation of redevelopment plans that could generate higher returns and offset some site preparation and remediation costs. **Land-use controls** can offer incentives similar to those offered by zoning regulations, with the difference that the municipality can adapt the end land-use of the site in accordance with the findings and requirements of the development appraisal. Thus, a new designation can ensure higher return on the investment and lower costs (e.g. by lowering remediation standards to the level of contamination exposure that is appropriate for the approved land use).

Strategic **infrastructure investments** are one of the most frequently used incentives in BFR projects

**Investments in infrastructure and public transportation** can reduce the cost of financing, improve the cash-flow, and enhance the business climate for developers. They can take a variety of forms, and have a significant impact if carefully planned out. For example, transit

oriented development has been very successful in the US, with private urban investments often clustering around major public transportation hubs. **Management and advisory assistance** can be offered by the local authority to developers that are interested in BFR projects. These can take the form of seminars or workshops, in which BFR related issues (e.g. risks and opportunities) are approached and discussed in the necessary level of detail.

An example of how incentives have and are being used to attract private investment is offered by the City of Elblag (Poland). There, a former military base, with buildings strewn all over the city, has been slated for cleanup and redevelopment by local authorities. After gaining ownership of 441 hectares of land (along with derelict military buildings, contamination from a mechanical plant, and contamination with unexploded ammunition), the municipality drafted a redevelopment plan that included the construction of a wide mix of uses (industrial, office, commercial, housing). Cleanup of existent contamination was assumed by the military, while local authorities worked on putting together an incentives package for private investors. In particular, public funds have been allocated for improving existent and building new infrastructure, and for integrating the site into the public transportation network.<sup>18</sup>

Project financing can be augmented with funds from a variety of sources: EU, central government, private sector, NGOs, and private citizens

### Identifying Sources of (Co-) Funding

For all brownfield sites slated for redevelopment, the local authority should look for potential sources of funding and co-funding that could augment its own pecuniary and non-pecuniary efforts. Depending on the situation of each individual site, and on envisioned end-use, these funds may become available. Fund provenance can be diverse, but can largely be placed in three major categories: funds from the EU and international financial institutions (IFIs) such as the World Bank; funds from the central/regional government; and, funds from the private sector or NGOs. Annex 8 describes a number of EU funding sources that can be used for BFR projects. Annex 9 indicates how the World Bank can assist with BFR projects and lists a number of brownfields remediation projects the organization has spearheaded.

State and federal governments can encourage BFRs through a series of financial, fiscal, logistical, and policy incentives

**State and federal governments** can offer fiscal and financial incentives as discussed in the preceding section for projects of public interest, as a way of attracting private investment and stimulating economic activity. The way these (co-) funding sources are offered and can be accessed varies greatly from country to country, with different ministries or independent agencies taking the lead in stimulating and encouraging BFRs. In the Netherlands, for example, due to the shortage of available greenfields and the high demand for urban sites,

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<sup>18</sup> COVERNET. 2006. *Conversion Handbook for the Baltic Region*. INTERREG III B – Baltic Sea Region

Some countries have regional brownfield redevelopment plans

the central government works closely with provinces and municipalities to promote urban regeneration projects. Severely contaminated sites (hot spots) can receive funding under the country's *Soil Protection Act*, and in 2007, €500 million have been allocated for *urban renewal* projects. Similarly, Italy has allocated €60 million for the reclamation of several hot spots of national importance. Some countries, like Austria, do not have centrally crafted brownfield redevelopment plans. Rather, they create regional programs. For example, the City of Vienna uses two funds (the Vienna Business Promotion Fund and the Vienna Land Provision and Urban Renewal Fund) for the development of industrial and commercial spaces and the development of new housing. The two funds purchase, divide, and make strategic investments on the site, to raise its market value. They also offer subsidies for development projects.

NGOs and citizens can be valuable partners in BFR projects

**Private and NGO (co-) funding** can often be secured when redevelopments address particular problems and areas of interest. For example, a developer might be interested in covering remediation costs on a brownfield site to prevent environmental spillovers to its own site(s) in the vicinity, and/or to raise their property value. (See also PPP section above.) NGOs might push a particular environmental social agenda when financing BFR projects (e.g. funding affordable housing in a poor neighborhood with severe contamination issues). Private funds can also be generated for projects that have a sentimental value for the investor (e.g. expatriate/diaspora funding).

*The City of Leipzig Germany* has an integrated urban regeneration strategy, which includes initiatives for mixed redevelopment of inner-city brownfields. Making use of available EU financing (particularly European Regional Development Funds and URBAN II), the city has redeveloped entire quarters with parks, town houses, economic estates, and social and cultural spaces. One such example is the Karl-Heine-Kanal project, a redevelopment of an old industrial area in the Western part of the city.<sup>19</sup>

Figure 21. BFR on Karl-Heine-Kanal, Leipzig (Germany)



<sup>19</sup> City of Leipzig – Urban Development Department

## Chapter 6: Implementation

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Local authorities have less experience with BFR projects than they do with regular development projects

This is the stage where the shovel meets the dirt. Local authorities usually have a lot of experience with development projects but few have experience redeveloping previously contaminated sites. Thus, officials should pay particular attention to *site supervision* as remediation is carried out. Good practice prescribes close supervision of these works by remediation professionals for several reasons:

Site supervision is essential for cost, quality, and risk management

- to ascertain that remediation goals set (commonly by the licensing authority) for environmental protection purposes, as well as environmental management requirements issued for the site, are adequately fulfilled;
- to ensure that remediation works focus on areas known or found to be contaminated and avoid excavation, handling and processing of materials which, according to the remediation plan, do not require action;
- to detect situations deviating from the planning documents or physical site models, relating either to geology, hydrogeology, underground structures and technological installations, or to the nature and distribution of contaminants, and to initiate appropriate action (closer inspection, supplementary investigations, expansion of remediation activities);
- to ensure due diligence and high technical standards during remediation works and to implement quality control;
- to ascertain construction supervision and cost control;
- to monitor and document the remediation progress and certify achievement of remediation targets for the site.

Site supervision is essential for cost, quality and risk management, documentation and certification of the site's status once clean-up activities have been completed. And, site supervision is a precondition for a meaningful handover certificate for the remediated site, as well as guarantees or warranties for the remediation success.

### Remediation and Redevelopment

The local authority can help the developer by issuing construction approvals in a timely manner, and by using permits and inspections to streamline the process

An estimation of different cost scenarios for remediation work is offered in Annex 9. As far as actual redevelopment is concerned, real estate good practice is well-known and studied. Moreover, the local authority is likely to outsource construction (whether it is a public project or not) to a private developer. And while it will not be directly involved in construction, it can help the developer by issuing construction approvals in a timely manner and by using permits and inspections to streamline the process rather than to slow it down. The local authority should provide planning assistance when needed (e.g. by encouraging sustainable development practices) and should enforce

strict controls when agreed-upon norms and standards are not respected.

Cleanup and construction activities should be combined

To speed up completion time, cleanup and construction activities should be combined insofar as possible. For example, if part of the site has been remediated using a dig-and-dump technique, the resulting hole can be used for starting foundation work on a new building, while remediation on other parts of the site is still going on. Remediation work should proceed as fast as existing pollution allows. This will prevent construction delays and potential cost increases.

Leases for tenants should be sought early in the development process

If possible, leases for potential tenants should be sought early in the development process, as a way to self-fund the development. Ideally, space should be leased as soon as the construction schedule is set. If the local authority has an *affordable housing* component in the development, it should establish rules for leasing and acquiring of available units and prepare a list of eligible candidates. If the property is leased to a strategic investor (e.g. in a tech park), construction schedule should take into consideration move-in requirements and investment schedule of the investor. If the redevelopment will offer public amenities (e.g. a park), an apparatus should be put in place to ensure the space is efficiently used as early as possible (e.g. contracts can be signed with cleaning and landscaping firms). Recycled material from site demolitions should be re-used, as a way of cutting down costs and promoting sustainable practices. The local authority should encourage a *market for recycled materials* by providing a suitable site where these can be stored and commercialized.

If possible, recycle materials from site demolitions

The redevelopment of the *Semanatoarea Industrial Complex in Bucharest (Romania)* offers a good example of staged development, with parts of the site already finished and leased, while others under remediation. This approach allowed the private developer to generate cash-flow for continued work on the site. Remediation and redevelopment of the 42 ha site is being done in a piece-meal fashion, with high-revenue generating buildings (two completed office towers) being finished first, and retail and housing space left for later phases.

Figure 22. Semanatoarea Site in Bucharest (Romania)



## Monitoring and Evaluation

Long term monitoring is necessary, especially in the case of heavily polluted sites

Long-term monitoring is necessary, especially in the case of heavily polluted sites, where remaining contaminants can pose a future threat. Monitoring should start as soon as possible, and continue well through project completion. To counter fear of potential future risks, the local authority could establish **risk funds**, or use **private BFR insurance** as a guarantee to investors that future contamination will be removed. Furthermore, the local authority should strive to limit liability associated with any residual or newly discovered contamination after cleanup.

Some remediation technologies require long-term operation and maintenance

All in all, a cleanup should only be considered closed if a *No Further Action Letter* is issued by competent regulatory agencies. Such a letter is usually issued after completion of remediation and upon a thorough post-development site investigation. Some remedial methods (e.g. pump and treat systems) require long-term operation and maintenance, and as such have to be under constant monitoring and supervision. This task can be taken over by the local authority or left in the care of the property owner, but regular *monitoring reports* should be sent to regulatory agencies.

If property is resold, new owners should be informed of existing restrictions and obligations

If some pollution is purposefully left on site (e.g. through on-site capping), proper measures need to be taken to ensure that access is restricted in case of immediate threat to human health. Redevelopment of still contaminated soil should be done only after proper remediation. In case the property is resold, *institutional controls* should regulate the way liability is transferred, and new owners should be informed of existing restrictions and obligations.

Post-project discussions can generate valuable lessons for future BFRs

Management of redevelopment can continue after project completion through continuous community engagement (e.g. for determining best future/alternative uses of available public spaces) and through continuous mitigation of potential environmental issues.

Once a project is finished it is important that local authorities, along with partners and major stakeholders, get together and discuss what went well and what did not. These discussions can serve as a backdrop for starting other BFR projects, and they can provide valuable lessons for future urban regeneration initiatives.

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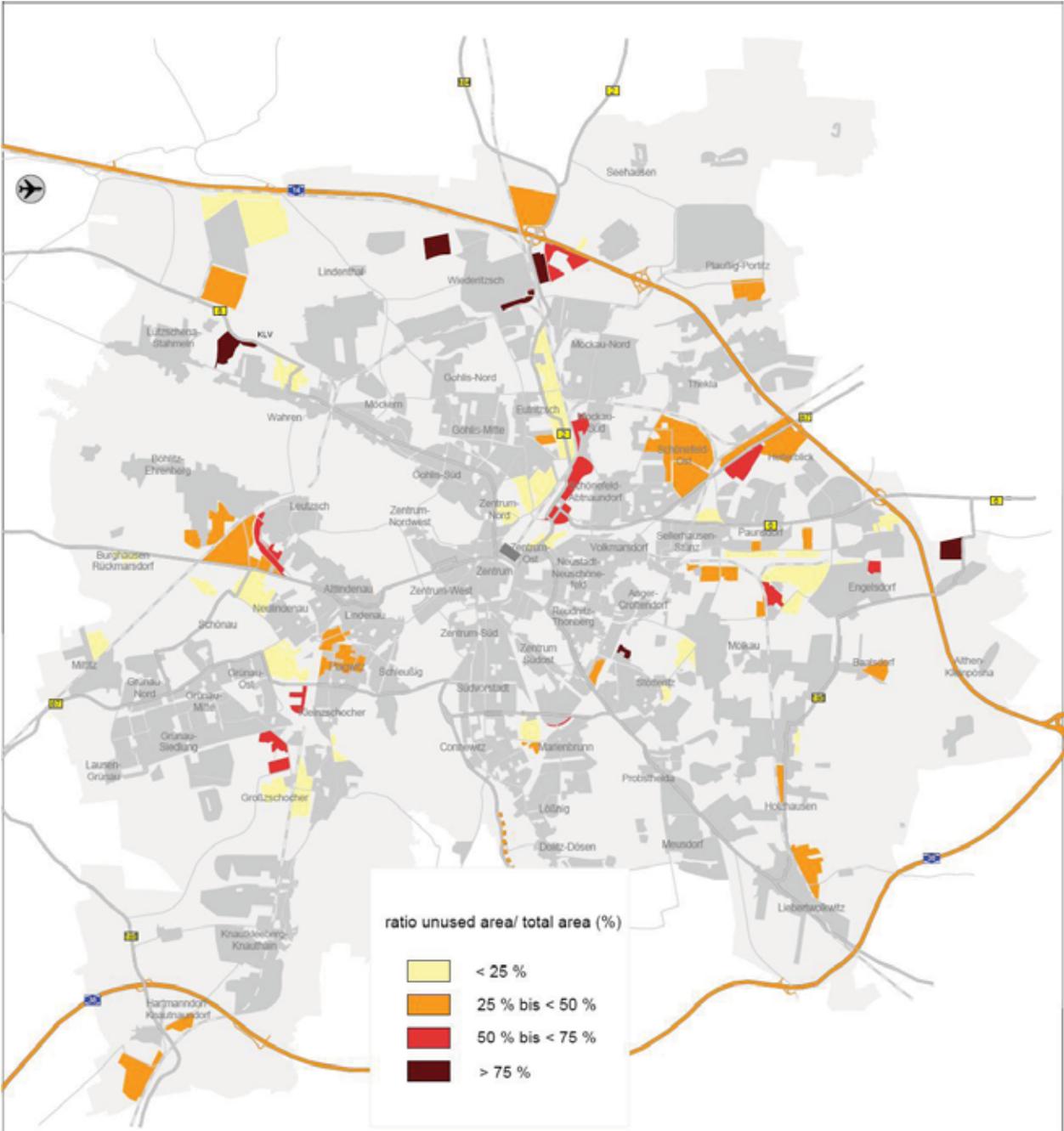
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## Annex 2: City of Leipzig – Unused Area in Industrial Spaces, in 2009



Source: Leipzig City Planning Office/Urban Development Planning

## Annex 3: Contaminants Found at Typical Brownfield Sites

Past Activities Typically Conducted at Brownfield Site	Typical Contaminants
Agriculture	Volatile organic compounds (VOC), arsenic, copper, carbon tetrachloride, ethylene dibromide and methylene chloride, pesticides, insecticides, herbicides, grain, fumigants
Automotive refinishing and repair	Metals and metal dust, various organic compounds, solvents, paint and paint sludges, scrap metal, waste oils
Battery recycling and disposal	Lead, cadmium, acids, nickel, copper, zinc, arsenic, chromium
Chloro-alkali manufacturing	Chlorine compounds, mercury
Coal gasification	Polycyclic aromatic hydrocarbons (PAH), sulfur compounds, cyanide, aluminum, iron, lead, nickel, chromium
Cosmetics manufacturing	Heavy metals, dusts, solvents, acids
Dry cleaning activities	VOCs such as chloroform and tetrachloroethane, various solvents, spot removers, fluorocarbon 113, perchloroethylene
Dye facilities	2-naphthylamine, 4-aminobiphenyl, benzidine
Electroplating operations	Various metals such as cadmium, chromium, copper, nickel, and cyanide
Glass manufacturing	Arsenic, lead
Herbicide manufacturing and use	Dioxin, metals, herbicides
Hospitals	Formaldehyde, radionuclides, photographic chemicals, solvents, mercury, ethylene oxide, chemotherapy chemicals
Incinerators	Dioxin, various municipal and industrial waste, ash, ordnance compounds, metals
Landfills—municipal and industrial	Metals, VOCs, polychlorinated biphenyls (PCB), ammonia, methane, household products and cleaners, pesticides, hydrogen sulfide
Leather manufacturing	Toluene, benzene
Machine shops/metal fabrication	Metals, VOCs, dioxin, beryllium, degreasing agents, solvents, waste oils
Manufactured gas plant	Non-halogenated VOCs and non-halogenated semi-volatile organic compounds (SVOC) such as PAHs and carcinogenic PAHs, including naphthalene, phenanthrene, anthracene, chrysene, and benzo(a)pyrene
Marine maintenance industry	Solvents, paints, cyanide, acids, VOC emissions, heavy metal sludges, degreasers
Munitions manufacturing	Lead, explosives, copper, antimony, unexploded ordnance (UXO)
Paint/ink manufacturing	Metals (such as chromium, cadmium, lead, and zinc), VOCs, chloroform, ethyl benzene, solvents, paints, inks
Pesticide manufacturing	VOCs, arsenic, copper, pesticides, insecticides, herbicides, fungicides, xylene, chlorinated organic compounds, solvents
Petroleum refining and reuse	Petroleum hydrocarbons; benzene, toluene, ethylbenzene, and xylene (BTEX); fuels; oil and grease
Pharmaceutical manufacturing	Lead, various organic chemicals, organic solvents
Photographic manufacturing and uses	Silver bromide, methylene chloride, solvents, photographic products
Plastics manufacturing	Polymers, phthalates, cadmium, solvents, resins, chemical additives, VOCs
Printing industry	Silver, solvents, acids, waste oils, inks and dyes, photographic chemicals
Railroad yards	Petroleum hydrocarbons, VOCs, BTEX, solvents, fuels, oil and grease, lead, PCBs, PAHs, phthalates, carbazole, dieldrin, dibenzofurans
Research and educational institutions	Inorganic acids, organic solvents, metals and metal dust, photographic waste, waste oil, paint, heavy metals, pesticides
Scrap metal operations	Metals (such as lead and nickel), PCBs, dioxin, transformers
Semiconductor manufacturing	Metals, VOCs, carbon tetrachloride, degreasing agents, solvents
Smelter operations	Metals (such as lead, copper, and arsenic)
Underground storage tanks	Petroleum hydrocarbons, gasoline, diesel fuel, BTEX, MTBE, solvents, metals, POLs
Wood pulp and paper manufacturing	Chlorinated organic compounds, dioxins, furans, chloroform, resin acids
Wood preserving	Creosote, pentachlorophenol (PCP), arsenic, chromium, copper, PCBs, PAHs, beryllium, dioxin, wood preservatives, zinc, petroleum hydrocarbons

Source: EPA. 2001. Road Map to Understanding Innovative Technology Options for Brownfields Investigation and Cleanup.

## Annex 4: Site Assessment and Investigation Technologies

I. Non-Invasive Assessment Technologies			
Applications	Strengths	Weaknesses	Typical Costs <sup>1</sup>
<b>Infrared Thermography (IR/T)</b>			
<ul style="list-style-type: none"> <li>• Locates buried underground storage tanks (USTs).</li> <li>• Locates buried leaks from USTs.</li> <li>• Locates buried sludge pits.</li> <li>• Locates buried nuclear and nonnuclear waste.</li> <li>• Locates buried oil, gas, chemical and sewer pipelines.</li> <li>• Locates buried oil, gas, chemical and sewer pipeline leaks.</li> <li>• Locates water pipelines.</li> <li>• Locates water pipeline leaks.</li> <li>• Locates seepage from waste dumps.</li> <li>• Locates subsurface smoldering fires in waste dumps.</li> <li>• Locates unexploded ordinance on hundreds or thousands of acres.</li> <li>• Locates buried landmines.</li> </ul>	<ul style="list-style-type: none"> <li>• Able to collect data on large areas very efficiently. (Hundreds of acres per flight)</li> <li>• Able to collect data on long cross country pipelines very efficiently (300-500 miles per day.)</li> <li>• Low cost for analyzed data per acre unit.</li> <li>• Able to prescreen and eliminate clean areas from further costly testing and unneeded rehabilitation.</li> <li>• Able to fuse data with other techniques for even greater accuracy in more situations.</li> <li>• Able to locate large and small leaks in pipelines and USTs. (Ultrasonic devices can only locate small, high pressure leaks containing ultrasonic noise.)</li> <li>• No direct contact with objects under test is required. (Ultrasonic devices must be in contact with buried pipelines or USTs.)</li> <li>• Has confirmed anomalies to depths greater than 38 feet with an accuracy of better than 80%..</li> <li>• Tests can be performed during both daytime and nighttime hours.</li> <li>• Normally no inconvenience to the public.</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot be used in rainy conditions.</li> <li>• Cannot be used to determine depth or thickness of anomalies.</li> <li>• Cannot determine what specific anomalies are detected.</li> <li>• Cannot be used to detect a specific fluid or contaminant, but all items not native to the area will be detected.</li> </ul>	<ul style="list-style-type: none"> <li>• Depends upon volume of data collected and type of targets looked for.</li> <li>• Small areas &lt;1 acre: \$1,000-\$3,500.</li> <li>• Large areas&gt;1,000 acres: \$10 - \$200 per acre.</li> </ul>
<b>Ground Penetrating Radar (GPR)</b>			
<ul style="list-style-type: none"> <li>• Locates buried USTs.</li> <li>• Locates buried leaks from USTs.</li> <li>• Locates buried sludge pits.</li> <li>• Locates buried nuclear and nonnuclear waste.</li> <li>• Locates buried oil, gas, chemical and sewer pipelines.</li> <li>• Locates buried oil and chemical pipeline leaks.</li> <li>• Locates water pipelines.</li> <li>• Locates water pipeline leaks.</li> <li>• Locates seepage from waste dumps.</li> <li>• Locates cracks in subsurface strata such as limestone.</li> </ul>	<ul style="list-style-type: none"> <li>• Can investigate depths from 1 centimeter to 100 meters+ depending upon soil or water conditions.</li> <li>• Can locate small voids capable of holding contamination wastes.</li> <li>• Can determine different types of materials such as steel, fiberglass or concrete.</li> <li>• Can be trailed behind a vehicle and travel at high speeds.</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot be used in highly conductive environments such as salt water.</li> <li>• Cannot be used in heavy clay soils.</li> <li>• Data are difficult to interpret and require a lot of experience.</li> </ul>	<ul style="list-style-type: none"> <li>• Depends upon volume of data collected and type of targets looked for.</li> <li>• Small areas &lt;1 acre: \$3,500 - \$5,000.</li> <li>• Large areas &gt; 10 acres: \$2,500 - \$3,500 per acre</li> </ul>

<b>Electromagnetic Offset Logging (EOL)</b>			
<ul style="list-style-type: none"> <li>• Locates buried hydrocarbon pipelines.</li> <li>• Locates buried hydrocarbon USTs.</li> <li>• Locates hydrocarbon tanks.</li> <li>• Locates hydrocarbon barrels.</li> <li>• Locates perched hydrocarbons.</li> <li>• Locates free floating hydrocarbons.</li> <li>• Locates dissolved hydrocarbons.</li> <li>• Locates sinker hydrocarbons.</li> <li>• Locates buried well casings.</li> </ul>	<ul style="list-style-type: none"> <li>• Produces 3D images of hydrocarbon plumes.</li> <li>• Data can be collected to depth of 100 meters.</li> <li>• Data can be collected from a single, unlined or nonmetal lined well hole.</li> <li>• Data can be collected within a 100 meter radius of a single well hole.</li> <li>• 3D images can be sliced in horizontal and vertical planes.</li> <li>• DNAPLs can be imaged.</li> </ul>	<ul style="list-style-type: none"> <li>• Small dead area around well hole of approximately 8 meters.</li> <li>• This can be eliminated by using 2 complementary well holes from which to collect data.</li> </ul>	<ul style="list-style-type: none"> <li>• Depends upon volume of data collected and type of targets looked for.</li> <li>• Small areas &lt; 1 acre: \$10,000 - \$20,000</li> <li>• Large areas &gt; 10 acres: \$5,000 - \$10,000 per acre</li> </ul>
<b>Magnetometer (MG)</b>			
<ul style="list-style-type: none"> <li>• Locates buried ferrous materials such as barrels, pipelines, USTs, and buckets.</li> </ul>	<ul style="list-style-type: none"> <li>• Low cost instruments can be used that produce results by audio signal strengths.</li> <li>• High cost instruments can be used that produce hard copy printed maps of targets.</li> <li>• Depths to 3 meters. 1 acre per day typical efficiency in data collection.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-relevant artifacts can be confusing to data analyzers.</li> <li>• Depth limited to 3 meters.</li> </ul>	<ul style="list-style-type: none"> <li>• Depends upon volume of data collected and type of targets looked for.</li> <li>• Small areas &lt; 1 acre: \$2,500 - \$5,000</li> <li>• Large areas &gt; 10 acres: \$1,500 - \$2,500 per acre</li> </ul>
<p><sup>1</sup>Costs based on 1997 dollars  UST: Underground Storage Tank  DNAPL: A dense nonaqueous phase liquid  Source: U.S. EPA. 2001. Technical Approaches to Characterizing and Cleaning up Brownfield Sites. (EPA/625/R-00/009), Washington DC.</p>			

## II. Soil and Subsurface Sampling Tools

Technique/Instrumentation	Soil	Ground Water	Relative Cost per Sample**	Sample Quality
<b>Drilling Methods</b>				
Cable Tool	X	X	Mid-range expensive	Soil properties will most likely be altered
Casing Advancement	X	X	Most expensive	Soil properties will likely be altered
Direct Air Rotary with Rotary Bit Downhole Hammer	X	X	Mid-range expensive	Soil properties will most likely be altered
Direct Mud Rotary	X	X	Mid-range expensive	Soil properties may be altered
Directional Drilling	X	X	Most expensive	Soil properties may be altered
Hollow-Stem Auger*	X	X	Mid-range expensive	Soil properties may be altered
Jetting Methods	X	X	Least expensive	Soil properties may be altered
Rotary Diamond Drilling	X	X	Most expensive	Soil properties may be altered
Rotating Core	X		Mid-range expensive	Soil properties may be altered
Solid Flight and Bucket Augers	X	X	Mid-range expensive	Soil properties will likely be altered Soil properties will most likely not be altered
Sonic Drilling	X	X	Most expensive	Soil properties may be altered
Split and Solid Barrel*	X		Least expensive	Soil properties will most likely not be altered
Thin-Wall Open Tube*	X		Mid-range expensive	Soil properties will most likely not be altered
Thin-Wall Piston/Specialized Thin Wall	X		Mid-range expensive	Soil properties will most likely not be altered
<b>Direct Push Methods</b>				
Cone Penetrometer	X	X	Mid-range expensive	Soil properties may be altered
Driven Wells		X	Mid-range expensive	Soil properties may be altered
<b>Hand-Held Methods</b>				
Augers	X	X	Least expensive	Soil properties may be altered
Rotating Core	X		Mid-range expensive	Soil properties may be altered
Scoop, Spoons, and Shovels*	X		Least expensive	Soil properties may be altered
Split and Solid Barrel*	X		Least expensive	Soil properties may be altered Soil properties will most likely not be altered
Thin-Wall Open Tube*	X		Mid-range expensive	Soil properties will most likely not be altered
Thin-Wall Piston Specialized Thin Wall	X		Mid-range expensive	Soil properties will most likely not be altered
Tubes	X		Least expensive	Soil properties will most likely not be altered

\*Most commonly used field techniques

\*\* Actual price ranges may vary significantly from country to country, and from project to project.

Source: U.S. EPA. 2001. Technical Approaches to Characterizing and Cleaning up Brownfield Sites. (EPA/625/R-00/009)

### III. Groundwater Sampling Tools

Technique/Instrumentation	Contaminants**	Relative Cost per Sample	Sample Quality
<b>Portable Groundwater Sampling Pumps</b>			
Bladder Pump*	SVOCs, PAHs, metals	Mid-range expensive	Liquid properties will most likely not be altered
Gas-Driven Piston Pump	SVOCs, PAHs, metals	Most expensive	Liquid properties will most likely not be altered by sampling
Gas-Driven Displacement Pumps	SVOCs, PAHs, metals	Least expensive	Liquid properties will most likely not be altered by sampling
Gear Pump	SVOCs, PAHs, metals	Mid-range expensive	Liquid properties may be altered
Inertial-Lift Pumps	SVOCs, PAHs, metals	Least expensive	Liquid properties will most likely not be altered
Submersible Centrifugal Pumps	SVOCs, PAHs, metals	Most expensive	Liquid properties may be altered
Submersible Helical-Rotor Pump	SVOCs, PAHs, metals	Most expensive	Liquid properties may be altered
Suction-Lift Pumps*	SVOCs, PAHs, metals	Least expensive	Liquid properties may be altered
<b>Portable Grab Samplers</b>			
Bailers*	VOCs, SVOCs, PAHs, metals	Least expensive	Liquid properties may be altered
Pneumatic Depth-Specific Samplers	VOCs, SVOCs, PAHs, metals	Mid-range expensive	Liquid properties will most likely not be altered
<b>Portable In-Situ Groundwater Sampler/Sensors</b>			
Cone Penetrometer Samplers	VOCs, SVOCs, PAHs, metals	Least expensive	Liquid properties will most likely not be altered
Direct Drive Sampler	VOCs, SVOCs, PAHs, metals	Least expensive	Liquid properties will most likely not be altered
Hydropunch*	VOCs, SVOCs, PAHs, metals	Mid-range expensive	Liquid properties will most likely not be altered
<b>Fixed In-Situ Groundwater Samplers</b>			
Multilevel Capsule Samplers	VOCs, SVOCs, PAHs, metals	Mid-range expensive	Liquid properties will most likely not be altered
Multiple-Port Casings	VOCs, SVOCs, PAHs, metals	Least expensive	Liquid properties will most likely not be altered
Passive Multilayer Samplers	VOCs	Least expensive	Liquid properties will most likely not be altered

\*Most commonly used field techniques

\*\***VOCs**: Volatile Organic Carbons; **SVOCs**: Semivolatile Organic Carbons; **PAHs**: Polyaromatic Hydrocarbons

Source: U.S. EPA. 2001. Technical Approaches to Characterizing and Cleaning up Brownfield Sites. (EPA/625/R-00/009), Washington DC.

## Annex 5: Remediation Technologies

Tools	Description	Comments
<b>Containment Technologies</b>		
Capping	Used to cover buried waste materials to prevent migration. Consist of a relatively impermeable material that will minimize rainfall infiltration. Waste materials can be left in place. Requires periodic inspections and routine monitoring. Contaminant migration must be monitored periodically.	Costs associated with routine sampling and analysis may be high. Long-term maintenance may be required to ensure impermeability. May have to be replaced after 20 to 30 years of operation. May not be effective if groundwater table is high. Usually used for contamination with metals and cyanide, the cost per square foot of this technology can range between \$11-\$40 per square foot (psf).
Subaqueous capping	In-situ capping presupposes the placement of a subaqueous covering cap of clean isolating material over an in-situ deposit of contaminated material. Caps may be constructed of clean sediments, sand, gravel, or may involve a more complex design with geotextiles, liners and multiple layers.	This is a potentially economical and effective way of remediating contaminated sediment. It is however a fairly complex method and requires careful design, construction, and monitoring.
Permeable reactive barriers	This is a relatively simple remediation method that involves the placement of reactive material in the subsurface, where a plume (a column of fluid moving through another) of contaminated groundwater must move through as it flows. The reactive barrier separates the contaminant from the water, letting only clean water through.	Permeable reactive barriers have generated interest due to a perceived good cost-benefit ratio and the potential to mitigate the spread of contaminants that have proven difficult and expensive to manage with other clean-up methods.
Sheet piling	Steel or iron sheets are driven into the ground to form a subsurface barrier. Low-cost containment method. Used primarily for shallow aquifers.	Not effective in the absence of a continuous aquitard. Can leak at the intersection of the sheets and the aquitard or through pile wall joints. Not contaminant specific, this technology can cost from \$8 to \$17 per square foot
Grout curtain	Not effective in the absence of a continuous aquitard. Can leak at the intersection of the sheets and the aquitard or through pile wall joints.	Difficult to ensure a complete curtain without gaps through which the plume can escape; however new techniques have improved continuity of curtain. Not contaminant-specific, this technology can cost from \$6 to \$14 psf.
<b>Ex-Situ Technologies</b>		
Haul-bury/Dig-and-dump	When legally permitted, contaminated soil and demolition debris are hauled to an buried in construction material dumps so property can be reused. Widely practiced.	Hauling and burial costs are very high. Expensive to sort out previously buried material. Landfilling costs vary greatly from place to place.
Composting	Controlled microbiological process by which biodegradable hazardous materials in soils are converted to innocuous, stabilized byproducts. Typically occurs at temperatures ranging from 50° to 55°C (120° to 130°F). May be applied to soils and lagoon sediments. Maximum degradation efficiency is achieved by maintaining moisture content, pH, oxygenation, temperature, and the carbon-nitrogen ratio.	Substantial space is required. Excavation of contaminated soils is required and may cause the uncontrolled release of volatile organic compounds. Composting results in a volumetric increase in material and space required for treatment. Metals are not treated by this method and can be toxic to the microorganisms. The distance from the contaminated site to the nearest disposal facility will affect cost, as well as the amount of soil and type of contaminant that need to be treated.

Pyrolysis	A thermal treatment technology that uses chemical decomposition induced in organic materials by heat in the absence of oxygen. It transforms hazardous organic materials into gaseous components, small amounts of liquid, and a solid residue (coke) containing fixed carbon and ash.	Specific feed size and materials handling requirements affect applicability or cost at specific sites. Requires drying of the soil to achieve a low soil moisture content (<1%). Highly abrasive feed can potentially damage the processor unit. High moisture content increases treatment costs. Treated media containing heavy metals may require stabilization. May produce combustible gases, including carbon monoxide, hydrogen and methane, and other hydrocarbons. If the off-gases are cooled, liquids condense, producing an oil/tar residue and contaminated water.
Precipitation	Involves the conversion of soluble heavy metal salts to insoluble salts that will precipitate. Precipitate can be physical methods such as clarification or filtration. Often used as a pretreatment for other treatment technologies where the presence of metals would interfere with the treatment processes. Primary method for treating metal-laden industrial wastewater.	Contamination source is not removed. The presence of multiple metal species may lead to removal difficulties. Discharge standard may necessitate further treatment of effluent. Metal hydroxide sludges must pass TCLP criteria prior to land disposal. Treated water will often require pH adjustment.
UV oxidation	Destruction process that oxidizes constituents in wastewater by the addition of strong oxidizers and irradiation with UV light. Practically any organic contaminant that is reactive with the hydroxyl radical can potentially be treated. The oxidation reactions are achieved through the synergistic action of UV light in combination with ozone or hydrogen peroxide. Can be configured in batch or continuous flow models, depending on the throughput rate under consideration.	The aqueous stream being treated must provide for good transmission of UV light (high turbidity causes interference). Metal ions in the wastewater may limit effectiveness. VOCs may volatilize before oxidation can occur. Off-gas may require treatment. Costs may be higher than competing technologies because of energy requirements. Handling and storage of oxidizers require special safety precautions. Off-gas may require treatment.
Removal of hot spots	After systematic site testing, material well above state-mandated limits can be removed off site; other material can be treated on site.	Good strategy for minimizing costs.

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### In-Situ Technologies

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No treatment/Natural attenuation	In many cases, limited contamination should be left alone. If contamination has been tested, levels are below state-mandated limits, and contaminants are nonvolatile, they may be left in place.	Useful for very low to moderate contamination. Acceptance by lenders is an issue. The limited amount of contamination, if removed, could disrupt ecosystems more than if the property were left undisturbed.
Encapsulation	Encapsulation methods for completely covering hazardous asbestos in buildings can be used for contaminated property when soil below is clay or prevents groundwater contamination. Property surface is paved and made available for limited use (such as parking lots). Method should not be considered when soil is contaminated by a volatile substance. Extensive assessment necessary. Accepted practice in several states.	Low to moderate cost. Moderate risk with proper assessment, analysis, and planning. Bank acceptance an issue. May require deed restrictions.

Biological treatment/bioremediation	To promote cleanup without removing the soil, biodegradation breaks down contamination through the application of specific microbes or communities of microbes to the soil. The application of microbes is tested on the property before full treatment. Field conditions such as oxygen levels, pH, and temperature must be extensively monitored to sustain growth of the microbes. Good alternative for large tracts of land.	Moderate to high cost, including costs for laboratory modeling, field testing, sampling and monitoring, and the microbes themselves. Appropriate for petroleum products.
Bioventing	Stimulates the natural in-situ biodegradation of volatile organics in soil by providing oxygen to existing soil microorganisms. Oxygen commonly supplied through direct air injection. Uses low air flow rates to provide only enough oxygen to sustain microbial activity. Volatile compounds are biodegraded as vapors and move slowly through the biologically active soil.	Low soil-gas permeability. High water table or saturated soil layers. Vapors can build up in basements within the radius of influence of air injection wells. Low soil moisture content may limit biodegradation by drying out the soils. Low temperatures slow remediation. Chlorinated solvents may not degrade fully under certain subsurface conditions. Vapors may need treatment, depending on emission level and state regulations.
Soil vapor extraction	Process removes volatile organic compounds from soils that are undisturbed or have been excavated in large piles (only to the water table). Air is injected into the ground, transferring volatile materials from the soil to the air. Air stream removes contaminants from the soil or water for further processing.	Moderate cost, including sampling and monitoring costs. Difficulty removing all volatile organic compounds. Collected contamination must be treated or disposed of properly.
Six-phase soil heating	Six-phase soil heating is an in-situ thermal technology for the remediation of contamination of soil and groundwater. The process splits conventional electricity into six electrical phases for the electrical resistive heating of soil and groundwater. Each electrical phase is delivered to one of six electrodes placed in a hexagonal array. The voltage gradient between phases causes an electrical current to flow through the soil and groundwater. Resistivity causes the temperature to rise. As the soil and groundwater are heated uniformly to the boiling point of water, the water becomes steam, stripping volatile and semivolatile contaminants from the pore spaces. In addition, removal of the soil moisture increases the air permeability of the soils, which can further increase the rate at which contaminants are removed.	This technology was developed to remediate soils contaminated with volatile and semi-volatile organic compounds. It is designed to enhance the removal of contaminants from the subsurface during soil vapor extraction, and is especially suited to sites where contaminants are tightly bound to clays. Target zones to be treated would most likely be above the water table, but a thicker treatment zone could be addressed by hydraulically lowering the water table with pumping wells.
Oxidation/Chemical reduction	New in-situ oxidation technologies have become popular for remediation of a wide range of soil and groundwater contaminants. Remediation by chemical oxidation involves the injection of strong oxidants such as hydrogen peroxide, ozone gas, potassium permanganate or persulfates. Oxygen gas or ambient air can also be injected as a more mild approach.	One disadvantage of this approach is the possibility of less contaminant destruction by natural attenuation if the bacteria which normally live in the soil prefer a reducing environment. The injection of gasses into the groundwater may also cause contamination to spread faster than normal depending on the site's hydrogeology. Another disadvantage may be the blocking of permeability by sedimentation of iron ochre.

SEAR - surfactant enhanced aquifer remediation	Also known as solubilization and recovery, the surfactant enhanced aquifer remediation process involves the injection of hydrocarbon mitigation agents or specialty surfactants into the subsurface to enhance desorption.	Used usually in geologic formations that allow delivery of hydrocarbon mitigation agents or specialty surfactants, this approach provides a cost effective and permanent solution to sites that have been previously unsuccessful utilizing other remedial approaches. This technology is also successful when utilized as the initial step in a multi faceted remedial approach utilizing SEAR then in-situ Oxidation, bioremediation enhancement, or soil vapor extraction.
Solidification and stabilization	Solidification/stabilization is a remediation/treatment technology that relies on the reaction between a binder and soil to stop/prevent or reduce the mobility of contaminants. Stabilization involves the addition of reagents to a contaminated material (e.g. soil or sludge) to produce more chemically stable constituents. Solidification involves the addition of reagents to a contaminated material to impart physical/dimensional stability to contain contaminants in a solid product and reduce access by external agents (e.g. air, rainfall).	Solidification/stabilization work has a good track record across the world but also a set of serious deficiencies related to durability of solutions and potential long-term effects. CO2 emission due to the use of cement is a major obstacles to the widespread use of this method. Other obstacles include: the relatively low cost and widespread use of haul/bury techniques; the lack of authoritative technical guidance on stabilization/solidification; uncertainty over the durability and rate of contaminant release from stabilization/solidification-treated material; experiences of past poor practice in the application of cement stabilization processes used in waste disposal in the 1980s and 1990s; and, a residual liability associated with immobilized contaminants remaining on-site, rather than their removal or destruction.
Land treatment/land farming	Treatment involves applying uncontaminated soil to a contaminated area at a controlled rate and then mixing the soils in the subsurface area. Uses biological, physical, and chemical processes that naturally degrade and immobilize contaminated wastes. Agriculture principles are used to hasten bacterial growth, such as adding nutrients, aerating the soil, adjusting the pH, and controlling moisture. Wastes removed may include volatile and semivolatile organic compounds and heavy metals. Heavy metals absorbed by soil particles.	Moderate cost, including the cost of new soil, and sampling and monitoring costs.
Phytoremediation	Phytoremediation includes the use of plants and natural processes to remediate or stabilize hazardous wastes in soil, sediments, surface water, or groundwater. By acting as filters or traps, plants can degrade organic pollutants, extract metal contaminants, or contain and stabilize the movement of contaminants.	It is a cost-effective technology that can be used in the clean-up of a variety of sites, although it is most useful at sites at which shallow, low levels of contamination are present. Not the best alternative where development time constraints are pressing.
Electrokinetics	Electrokinetics is a process that removes or captures heavy metals, radionuclides, and selected volatile organic pollutants from saturated or unsaturated sands, silts, fine-grained clays, and sediments. Electrodes are placed on each side of the contaminated soil mass, and direct current is applied. Conditioning fluids may be added or circulated at the electrodes to enhance the electrochemistry of the process.	It is a technology that is still in an experimental scale, but several bench-scale and pilot-scale laboratory studies have been completed for the removal of lead, uranium, and thorium from kaolinite.
Hot air injection	With hot air injection, hot air is injected below the contaminated zones to heat contaminated soil. The heating enhances the release of contaminants from the soil matrix so they can be extracted and captured for further treatment.	Its use is limited to some type of contaminants.

Vitrification	In-situ vitrification is a soil treatment technology that stabilizes metal and other inorganic contaminants in place at very high temperatures. Soils and sludges are fused to form a stable glass and crystalline structure with very low leaching characteristics.	This technology has been successfully used to process municipal solid waste ininerator ash, fly ash or bottom ash, asbestos-containing materials and various slag materials.
Laser separation	Separates chemical and radioactive contaminants from metals in bulk and surface sources. A pulsed laser beam precisely removes the contaminated layer of a metal while high-efficiency particulate air filters capture the removed particles and prevent them from resettling on the cleaned area.	Very-high-cost method currently being tested. When operational, will improve safety, create less secondary waste and no hazardous chemicals, reduce volume of waste, reduce costs of decontamination, and allow valuable metals to be reused.

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### Mixed Technologies

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Pump and treat	Solution involves pumping fluids into a containment area and collecting them and contaminated groundwater for future treatment. Wells are used for pumping, drainage tile collection systems or waste ponds for recovering fluids. Water is usually pumped in, but a variety of solvents can be added to the system, depending on the contaminants. Solvents used bind with the contaminants for easier transport with water for off-site disposal. For petroleum-contaminated sites this material is usually activated carbon in granular form.	High cost. Uncertain length of treatment. Frequent monitoring required. Depending on geology and soil type, pump and treat may be a good method to quickly reduce high concentrations of pollutants. It is more difficult to reach sufficiently low concentrations to satisfy remediation standards, due to the equilibrium of absorption (chemistry)/desorption processes in soil.
Absorption	The addition of absorbent materials (such as hay, sawdust, cement, kiln dust, fly ash, furnace slag, and clay minerals like zeolite, bentonite, and kaolinite) to the soil promotes the absorption of contamination like a sponge. Mixtures of soil and absorption materials must be combined carefully so soil's integrity is not destroyed.	Low to moderate cost (although absorbent materials may be expensive). Volatile materials must be removed.
Air stripping	Used for remediation of groundwater contaminated with volatile organic compounds, such as solvents. Passes air through the water to improve the transfer between the air and water and its gaseous and liquid phases. Water from contaminated area pumped into the top of a tower packed with plastic objects as air is blown through the bottom. Volatile material adheres to surface of plastic objects. Technology suited for lower concentrations of volatile organic compounds. Spray systems, tray towers, diffused aeration, or mechanical aeration can substitute for packed towers.	High costs of designing specific solution for contaminated property. Design and assessment must be done case by case. Appropriate for petroleum products.
Partial encapsulation (capping)	Most undesirable contamination removed, while less contaminated soil is contained under clay, building structures, or plastic barrier covered with soil. Users of surface soil protected, but lower soils may be affected.	State regulators and lenders may not accept this solution in all cases. Barriers may have finite effective life. Groundwater may be affected. May require deed restrictions.

Soil washing/steam stripping	Many volatile and semi-volatile organic compounds found in low concentrations can be removed by the application of steam. This technique requires flushing or injecting water into contaminated areas; water is then drawn off into a vacuum steam stripper, which removes the organic contaminants. This process can treat only contaminants that are highly soluble in water.	Low to moderate cost, including sampling costs. Availability of equipment a factor. Generally works best on petroleum contamination.
Incineration	Burning substances on site or off site	Unpopular with neighbors.
Injection wells	An injection well is a device that places fluid underground into porous rock formations, such as sandstone or limestone, or into or below the shallow soil layer.	Injection can be a safe and inexpensive option for the disposal of unwanted and often hazardous industrial byproducts.
Thermal desorption	Low temperatures (20 0°F to 90 0°F) are used to remove organic contaminants from soils and sludges. Off-gases are collected and treated. Requires treatment system after heating chamber. Can be performed on site or off site.	Cannot be used to treat heavy metals, with exception of mercury. Contaminants of concern must have a low boiling point. Transportation costs to off-site facilities can be expensive. Treatment costs can range between \$50 to \$300 per ton of soil.
Selective on-site burial	Highly contaminated but non-mobile and inert contaminated material can be concentrated on site and buried. Areas where contamination was removed are then available for use. Areas used to store contaminated material could be used for roadways and landscaped sites.	Low cost - saves expense of hauling and burying material. Market acceptance an issue. May be appropriate for nonvolatile substances. Deed restrictions may apply.

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Sources: Simons, Robert A. 1998. Turning Brownfields into Greenbacks. ULI; ABC GmbH; U.S. EPA. 2001. Technical Approaches to Characterizing and Cleaning up Brownfield Sites (EPA/625/R-00/009); U.S. EPA. 2001. Road Map to Understanding Innovative Technology Options for Brownfields Investigation and Cleanup (3rd Edition) (EPA 542-B-01-001).

## Annex 6. Cost-Benefit Scenarios for Three BFRs and Greenfield Projects<sup>1</sup>

Factor	Retail Project	
	Brownfield	Greenfield
<b>Land Use Information</b>		
Lot Size (acres)	10 (435,600 square feet)	10 (435,600 square feet)
Floor/Area Ratio	0.25	0.25
Building Area (square feet)	108,900	108,900
Number of Current Owners	10	1
<b>Development Cost Information</b>		
<i>Land Acquisition Cost</i>	\$871,200 (\$2 psf)	\$1,742,400 (\$4 psf)
<i>Site Preparation Costs</i>		
Remediation (one-half the site at \$5 psf)	\$1,089,000	\$0
Other site preparation (\$2 psf of land)	\$871,200	\$871,200
<i>Construction Costs</i>		
Building hard costs	\$5,445,000 (\$50 psf of building)	\$5,445,000 (\$50 psf of building)
Other (shrink)	\$163,400 (3%)	\$54,500 (1%)
<i>Soft Costs</i>		
Legal	\$100,000	\$20,000
Other soft costs (architect, planner)	\$250,000	\$250,000
Environmental consultants	\$100,000	\$5,000
Construction loan/ carrying costs	\$400,000	\$300,000
Subtotal	\$9,289,800	\$8,688,100
Developer's fee (5%)	\$464,500	\$434,400
<b>Total Development Costs (TDC)</b>	<b>\$9,754,300</b>	<b>\$9,122,500</b>
<b>TDC psf</b>	<b>\$89.57</b>	<b>\$83.77</b>
<b>Operating Cash Flow</b>		
Number of Tenants	20	20
Market Rent	\$1,089,000 (\$10 psf NNN)	\$1,306,800 (\$12 psf NNN)
Market Vacancy	12%	6%
Security Costs	\$108,900 (\$1 psf)	\$27,225 (\$0.25 psf)
Environmental Monitoring	\$50,000	\$0
<b>Net Operating Income (NOI)</b>	<b>\$799,400</b>	<b>\$1,201,200</b>
<b>Financing and Investment</b>		
Value (NOI/0.1)	\$7,994,000	\$12,012,000
Loan Amount (loan-to-value ratio)	\$4,796,400 (.60)	\$8,408,400 (.70)
Debt Service (15 years at 10%)	\$630,600	\$1,105,500
Debt Service Coverage Ratio	1.27 (OK)	1.09 (OK)
Before-Tax Cash Flow	\$168,800	\$95,700
Equity Requirement	\$4,957,900	\$733,200
Return on Equity	3.4%	13.0%
Site Preparation Time	18 months	6 months
Future Liability	Unknown	None
Indemnification Letter from Seller?	Yes	No

Source: Simons, Robert A. 1998. Turning Brownfields into Greenbacks. ULI

Note: Real estate terminology is explained two pages down. PSF = per square foot

Industrial Project				
Factor	Brownfield		Greenfield	
<b>Land Use Information</b>				
Lot Size (acres)	10	(435,600 square feet)	10	(435,600 square feet)
Floor/Area Ratio	0.35		0.25	
Building Area (square feet)	152,460		152,460	
Number of Current Owners	4		1	
<b>Development Cost Information</b>				
<i>Land Acquisition Cost</i>	\$217,800	(\$0.50 psf)	\$609,800	(\$1.40 psf)
<i>Site Preparation Costs</i>				
Remediation (one-half the site at \$5 psf)	\$1,089,000		\$0	
Other site preparation (\$1 psf of land)	\$435,600		\$435,600	
<i>Construction Costs</i>				
Building hard costs	\$4,878,700	(\$32 psf of building)	\$4,878,700	(\$32 psf of building)
Other (shrink)	\$146,400	(3%)	\$48,800	(1%)
<i>Soft Costs</i>				
Legal	\$50,000		\$20,000	
Other soft costs (architect, planner)	\$250,000		\$250,000	
Environmental consultants	\$100,000		\$5,000	
Construction loan/ carrying costs	\$400,000		\$300,000	
Subtotal	\$7,567,500		\$6,547,900	
Developer's fee (5%)	\$378,400		\$327,400	
<b>Total Development Costs (TDC)</b>	<b>\$7,945,900</b>		<b>\$6,875,300</b>	
<b>TDC psf</b>	<b>\$52.12</b>		<b>\$45.10</b>	
<b>Operating Cash Flow</b>				
Number of Users	3		3	
Market Rent	\$724,200	(\$10 psf NNN)	\$838,500	(\$5.50 psf NNN)
Market Vacancy	10%		7%	
Security Costs	\$76,200	(\$0.50 psf)	\$38,100	(\$0.25 psf)
Environmental Monitoring	\$50,000		\$0	
<b>Net Operating Income (NOI)</b>	<b>\$525,600</b>		<b>\$741,700</b>	
<b>Financing and Investment</b>				
Value (NOI/0.1)	\$5,256,000		\$7,417,000	
Loan Amount (loan-to-value ratio)	\$3,679,200	(.70)	\$5,933,600	(.80)
Debt Service (20 years at 9%)	\$403,000		\$650,000	
Debt Service Coverage Ratio	1.3	(OK)	1.15	(OK)
Before-Tax Cash Flow	\$122,600		\$91,700	
Equity Requirement	\$4,266,700		\$941,700	
Return on Equity	2.9%		9.7%	
Site Preparation Time	18 months		6 months	
Future Liability	Unknown		None	
Indemnification Letter from Seller?	Yes		No	

Source: Simons, Robert A. 1998. Turning Brownfields into Greenbacks. ULI

Housing Project				
Factor	Brownfield		Greenfield	
<b>Land Use Information</b>				
Lot Size (acres)	10	(435,600 square feet)	10	(435,600 square feet)
Dwelling Units (3.5/acre)	35		35	
Floor/Area Ratio	0.23		0.23	
Final Lot Size (square feet)	12,450		12,450	
Number of Current Owners	20		1	
<b>Development Cost Information</b>				
<i>Land Acquisition Cost</i>	\$108,900	(\$0.25 psf)	\$435,600	(\$1 psf)
<i>Site Preparation Costs</i>				
Remediation (one-half the site at \$5 psf)	\$1,089,000		\$0	
Other site preparation (\$1 psf of land)	\$435,600		\$435,600	
<i>Construction Costs</i>				
Building hard costs	\$0		\$0	
Other (shrink)	\$13,100	(3%)	\$4,400	(1%)
<i>Soft Costs</i>				
Legal	\$100,000		\$20,000	
Other soft costs (architect, planner)	\$20,000		\$20,000	
Environmental consultants	\$100,000		\$5,000	
Construction loan/ carrying costs	\$140,000		\$25,000	
Subtotal	\$2,006,600		\$945,600	
Developer's fee (5%)	\$100,300		\$47,300	
<b>Total Development Costs (TDC)</b>	<b>\$2,106,900</b>		<b>\$992,900</b>	
<b>TDC psf</b>	<b>\$4.84</b>		<b>\$2.28</b>	
<b>Development Sales</b>				
Number of Lots Sold	35		35	
Lot Sale Price (15% of total house)	\$22,500	(\$150,000)	\$33,750	(\$225,000)
Revenue from Sales	\$787,500		\$1,181,200	
Security Costs during Sales	\$25,000		\$0	
Environmental Monitoring	\$50,000		\$0	
<b>Net Income from Lot Sales</b>	<b>\$712,500</b>		<b>\$1,181,200</b>	
<b>Profit and Return on Investment</b>				
Number of Lots Sold	35		35	
Net Income from Lot Sales	\$712,500		\$1,181,200	
Development Costs	\$2,106,900		\$992,900	
Net Profit (Loss)	(\$1,394,400)		\$188,300	
Equity Requirement	\$1,671,300		\$557,300	
Return on Equity	(83.4%)		33.8%	
Site Preparation Time	18 months		6 months	
Future Liability	Unknown		None	
Indemnification Letter from Seller?	Yes		No	

Source: Simons, Robert A. 1998. Turning Brownfields into Greenbacks. ULI

<sup>1</sup> It is obvious that on a pure financial assessment, the above comparisons illustrate that greenfield projects are typically more attractive to investors than BFRs. It is often the positive externalities of BFRs (social and environmental benefits to society which may be non-pecuniary) that can justify a public role to balance the private attractiveness of the two kinds of projects. Such public measures may include fiscal or financial subsidies, regulatory interventions (such as increase in the allowed development density), and sharing of specific risks.

**Annex 6 continued:  
REAL ESTATE TERMINOLOGY**

**Net Operating Income**

Net Operating Income (NOI) is calculated using the actual gross rental income minus a factor for vacancy, usually 5 percent or the actual vacancy rate if it is higher. A rental figure with a vacancy factor built in is then increased by any ancillary income the property generates. The building may have a laundry room generating income, garage space that has its own income flow, or a roof that can be rented out to a cellular phone company for antenna placement. This additional income is added to the rental figure. This total is called the Effective Gross Income (EGI). The next step is to look at the expense side of the equation. All of the fixed expenses, taxes, insurance, utilities, etc. should be totaled along with any variable expenses. A management fee factor of 5 to 10 percent should be used (even if management is done in-house). A one-tenant commercial property will have a lower management cost than a 200-unit apartment house, although the EGI could easily be similar. Subtracting the total of all these expenses from the EGI yields the NOI. That is, Net Operating Income = Effective Gross Income - Expenses

**Debt Coverage Ratio**

The Debt Coverage Ratio is the relationship between the annual debt service (the annual payment on borrowed money) and the NOI, i.e. the NOI divided by the monthly debt payment. The type of property, the track record of the investor, and the comfort level of the lender will determine what Debt Coverage Ratio will be set for the project. This ratio seldom is allowed to drop below 1.25. This actually means for every dollar of annual debt payment, there is \$1.25 of NOI available to pay it.

**Cap Rate**

The cap rate is a ratio of the purchase price and the NOI. This rate is then compared to other similar properties in the area. Comparing sale prices alone, as you would with single-family homes, is problematic because of differences in rent roll and operating expenses. These factors can vary greatly from one property to another, making a sales comparison difficult or inaccurate. The cap rate, based on NOI, accounts for income and expense variations among properties. If the NOI of the property is \$50,000 and the cap rate for this type of property is approximately 0.1, then market value for the property should be \$500,000. The \$50,000 NOI is divided by the cap rate of 0.1. If the investor believes that property improvements can increase the NOI up to \$60,000, the value can be increased from \$500,000 to \$600,000.

**Break-Even Ratio**

When looking at the financing on a project, both the investor and the lender need to know what the minimum percentage of projected income is needed for the project to break even. The lower the percentage, the stronger the project is. The calculation is a simple ratio. The numerator is the sum of all fixed and variable expenses and the debt payment (the factor for replacement of reserves is not included). The numerator is divided by the gross rental income yielding the fraction of income needed to break even.

**Cash on Cash Return**

Any investor, no matter how large or small, will need to know what yield he is getting on his investment. Take the annual NOI, subtract the annual debt payment, and then divide it by the cash investment of the investor. This is the Return on Investment (ROI), that is:  $\text{Return on Investment (ROI)} = (\text{Annual Net Operating Income [NOI]} - \text{Annual Debt Payment}) / \text{Cash Investment}$ . The lender will also be interested in this number. If the return is not reasonable, the lender will question the investor's commitment to the project.

**Loan-to-Value (LTV) Ratio**

This is the relationship between the appraised value and the loan amount. The LTV is used in conjunction with the other 5 variables, Net Operating Income, Debt Coverage Ratio, Cap Rate, Break Even Ratio, and Cash on Cash Return, in finalizing the feasibility of the project. If the investor is putting 25 percent down on the project and the debt coverage ratio or the break-even ratio is too low, then the price is too high. With strong ratios (higher down payments), it is possible to find a source of funds that will consider a higher mortgage amount.

**Triple Net (NNN) Lease**

A lease in which, in addition to the rent, the tenant is required to pay for property taxes, insurance and maintenance.

**Indemnification**

Contractual provision in which one party will reimburse the other party for settlements or judgments on claims arising from the contract.

## Annex 7. Remediation Cost Scenarios

### Cost Estimate for Cleanup Option 1: Excavation and Off-site Disposal (Risk-Based Approach)

Item/Description	Unit	Unit Cost (\$)	Industrial Quantity	Industrial Cost (\$)
<b>Site Preparation</b>				
Demolish reinforced concrete	CY	51.06	100	5,106
Demolish existing building	CF	0.06	60,000	3,600
Load and haul debris	CY	3.57	1,000	3,570
Fertilize, seed, and spring surface soil	SY	1.10	1,350	1,485
<b>Preparation Subtotal</b>				<b>13,761</b>
<b>UST Decommissioning</b>				
Excavate and load on trailer, 3000-gallon	Each	465.00	7	3,255
Remove sludge	Each	172.00	7	1,204
Dispose of sludge	Gallon	2.45	200	490
Known leaking UST excavation	Each	465.00	1	465
Haul tank to salvage dump, 100 mile RT	Each	525.00	7	3,675
<b>UST Subtotal</b>				<b>9,089</b>
<b>Site Earthwork</b>				
1-CY hydraulic excavator	CY	3.14	600	1,884
Loading into truck	CY	1.55	600	930
Backfill, unclassified fill, 6-inch lift, offsite	CY	7.35	675	4,961
<b>Earthwork Subtotal</b>				<b>7,775</b>
<b>Sampling, Testing, and Analysis</b>				
Soli lab analysis: TCLP metals	Sample	693.81	5	3,469
Soli lab analysis: BTEX	Sample	123.69	10	1,237
Soli lab analysis: PAHs	Sample	298.37	10	2,984
Soli lab analysis: metals, each (8)	Sample	148.41	5	742
<b>Analytical Subtotal</b>				<b>8,432</b>
<b>Disposal</b>				
Transportation 100-mile RT, 20-CY loads	Mile	3.38	3,000	10,140
Waste stream evaluation fee	Each	494.71	1	495
Low-temperature thermal desorption	Ton	69.41	810	56,222
Dump charges for construction debris	CY	18.42	1,000	18,420
Landfill nonhazardous waste disposal	CY	44.00	600	26,400
<b>Disposal Subtotal</b>				<b>111,677</b>
<b>Total Cost</b>				<b>150,734</b>

**Notes:**

Note that these figures are provided purely for illustration. Actual costs vary greatly depending on particular local conditions and remediation alternatives. Unit costs were obtained from the ECHOS Environmental Restoration Unit Cost Book and vendor price quotes.

Hazardous waste disposal at Class I Landfill.  
Soil density is assumed to be 100 pounds/CF.

**BTEX:** Benzene, ethylbenzene, toluene, and xylenes; **CF:** Cubic Foot; **CY:** Cubic Yard; **ECHOS:** Environmental cost handling options and solutions; **PAH:** Polycyclic aromatic hydrocarbons; **RT:** Round trip; **SY:** Square yard; **TCLP:** Toxicity characteristic leaching procedure; **UST:** Underground storage tank.

Source: U.S. EPA. 1999. "Cost Estimating Tools and Resources for Addressing Sites Under the Brownfields Initiative" (EPA/625/R-99/001).

### Cost Estimate for Cleanup Option 2: Excavation and Off-site Treatment and Disposal

Item/Description	Unit	Unit Cost (\$)	Industrial Quantity	Industrial Cost (\$)	Residential Quantity	Residential Cost (\$)
<b>Site Preparation</b>						
Demolish reinforced concrete	CY	51.06	100	5,106	100	5,106
Demolish existing building	CF	0.06	60,000	3,600	60,000	3,600
Load and haul debris	CY	3.57	1,000	3,570	1,000	3,570
Fertilize, seed, and spring surface soil	SY	1.10	1,350	1,485	0	0
<b>Preparation Subtotal</b>				<b>13,761</b>		<b>12,276</b>
<b>UST Decommissioning</b>						
Excavate and load on trailer, 3000-gallon	Each	465.00	7	3,255	7	3,255
Remove sludge	Each	172.00	7	1,204	7	1,204
Dispose of sludge	Gallon	2.45	200	490	200	490
Known leaking UST excavation	Each	465.00	1	465	1	465
Haul tank to salvage dump, 100 mile RT	Each	525.00	7	3,675	7	3,675
<b>UST Subtotal</b>				<b>9,089</b>		<b>9,089</b>
<b>Site Earthwork</b>						
1-CY hydraulic excavator	CY	3.14	1,200	3,768	3,600	11,304
Loading into truck	CY	1.55	1,200	1,860	3,600	5,580
Backfill, unclassified fill, 6-inch lift, offsite	CY	7.35	1,425	10,474	4,450	32,708
<b>Earthwork Subtotal</b>				<b>16,102</b>		<b>49,592</b>
<b>Sampling, Testing, and Analysis</b>						
Soli lab analysis: TCLP metals	Sample	693.81	5	3,469	5	3,489
Soli lab analysis: BTEX	Sample	123.69	10	1,237	10	1,237
Soli lab analysis: PAHs	Sample	298.37	10	2,984	10	2,984
Soli lab analysis: metals, each (8)	Sample	148.41	5	742	5	742
Total petroleum hydrocarbons	Sample	116.67	0	0	10	1,167
<b>Analytical Subtotal</b>				<b>8,432</b>		<b>9,619</b>
<b>Disposal</b>						
Transportation 100-mile RT, 20-CY loads	Mile	3.38	3,000	10,140	16,000	54,080
Waste stream evaluation fee	Each	494.71	1	495	2	989
Low-temperature thermal desorption	Ton	69.41	810	56,222	2,025	140,555
Dump charges for construction debris	CY	18.42	1,000	18,420	1,000	18,420
Landfill nonhazardous waste disposal	CY	44.00	1,200	52,800	1,500	66,000
Landfill hazardous waste disposal	Ton	233.32	0	0	2,835	661,462
<b>Disposal Subtotal</b>				<b>111,677</b>		<b>941,507</b>
<b>Total Cost</b>				<b>159,041</b>		<b>1,022,062</b>

Source: U.S. EPA. 1999. "Cost Estimating Tools and Resources for Addressing Sites Under the Brownfields Initiative" (EPA/625/R-99/001).

**Cost Estimate for Cleanup Option 3: Excavation, On-site Bioremediation (Landfarming) and Off-site Disposal**

Item/Description	Unit	Unit Cost (\$)	Industrial Quantity	Industrial Cost (\$)	Residential Quantity	Residential Cost (\$)
<b>Site Preparation</b>						
Demolish reinforced concrete	CY	51.06	100	5,106	100	5,106
Demolish existing building	CF	0.06	60,000	3,600	60,000	3,600
Load and haul debris	CY	3.57	1,000	3,570	1,000	3,570
Fertilize, seed, and spring surface soil	SY	1.10	450	495	0	0
<b>Preparation Subtotal</b>				<b>12,771</b>		<b>12,276</b>
<b>UST Decommissioning</b>						
Excavate and load on trailer, 3000-gallon	Each	465.00	7	3,255	7	3,255
Remove sludge	Each	172.00	7	1,204	7	1,204
Dispose of sludge	Gallon	2.45	200	490	200	490
Known leaking UST excavation	Each	465.00	1	465	1	465
Haul tank to salvage dump, 100 mile RT	Each	525.00	7	3,675	7	3,675
<b>UST Subtotal</b>				<b>9,089</b>		<b>9,089</b>
<b>Site Earthwork</b>						
1-CY hydraulic excavator	CY	3.14	1,200	3,768	3,600	11,304
Loading into truck	CY	1.55	1,200	1,860	3,600	5,580
Backfill, unclassified fill, 6-inch lift, offsite	CY	7.35	0	0	2,600	19,110
<b>Earthwork Subtotal</b>				<b>5,628</b>		<b>35,994</b>
<b>Sampling, Testing, and Analysis</b>						
Soli lab analysis: TCLP metals	Sample	693.81	5	3,469	5	3,469
Soli lab analysis: BTEX	Sample	123.69	10	1,237	10	1,237
Soli lab analysis: PAHs	Sample	298.37	10	2,984	10	2,984
Soli lab analysis: metals, each (8)	Sample	148.41	5	742	5	742
Total petroleum hydrocarbons	Sample	116.67	0	0	10	1,167
<b>Analytical Subtotal</b>				<b>8,432</b>		<b>9,598</b>
<b>Disposal</b>						
Transportation 100-mile RT, 20-CY loads	Mile	3.38	0	0	10,500	35,490
Waste stream evaluation fee	Each	494.71	0	0	1	495
Dump charges for construction debris	CY	18.42	1,000	18,420	1,000	18,420
Landfill hazardous waste disposal	Ton	233.32	0	0	2,835	661,462
<b>Disposal Subtotal</b>				<b>18,420</b>		<b>715,867</b>
<b>Onsite Bioremediation</b>						
Land treatment, 2 feet deep	Acre	8,762.22	0.40	3,505	0.50	1,752
Backfill, unclassified fill, 6-inch lift, onsite	CY	4.78	1,500	7,170	1,800	8,604
<b>Onsite Bioremediation Subtotal</b>				<b>10,675</b>		<b>10,356</b>
<b>Total Cost</b>				<b>65,015</b>		<b>793,180</b>

Source: U.S. EPA. 1999. "Cost Estimating Tools and Resources for Addressing Sites Under the Brownfields Initiative" (EPA/625/R-99/001).

## Annex 8. Sources of EU Funding for BFR Projects

EU Pre-accession countries can use **IPA funds** for BFR projects

**EU funds** offer a wide array of possibilities for European countries. For countries aspiring to join the EU, *the Instrument for Pre-Accession (IPA)* is an all-encompassing mechanism that provides funds for a variety of projects, including BFRs (under the Regional Development Priority Area). IPA funds are designed to help Candidate Countries (currently FYR Macedonia, Croatia, and Turkey) be prepared for full implementation of the Community Acquis at the time of accession, while Potential Candidates (Albania, Bosnia and Herzegovina, Montenegro, and Serbia including Kosovo as defined by UN Security Council Resolution 1244) are helped to make progress in that direction.

EU Member countries can access Structural and Cohesion Funds

*Structural Funds* and *the Cohesion Fund* are at the disposal of Member Countries, with €277 billion allocated for Structural Funds projects, and €70 for Cohesion Fund projects, in the 2007-2013 planning period. Structural Funds can be accessed for a range of projects, with the aim of bringing poor regions (with GDP/capita lower than 75% of the EU average) closer to European average development levels. The Cohesion Fund can be accessed by countries whose GDP/capita is below 90% of the EU average (currently, New Member States, along with Greece and Portugal), for environmental and transport projects. Environmental Cohesion Funds are to be used primarily for drinking-water supply, treatment of wastewater, and disposal of solid waste, but certain BFR components (e.g. remediation of large brownfield sites) can also be included.

EU's **Regional Operational Programmes** offer the widest array of funds that can be used for BFR and BFR-related projects by New Member Countries

Structural Funds have two main components: The European Regional Development Fund (ERDF) and The European Social Fund (ESF). The ERDF in particular can be accessed for BFR projects, as it supports programs that address regional development, economic change, and enhanced competitiveness. For this purpose, Operational Programmes (OPs) at the regional level have to be developed, and they have to reflect the investment priorities of the respective regions. Although regions have some flexibility in devising their OPs, their priorities have to be consistent with national priorities (set out in the National Strategic Reference Framework) and have to receive approval from the European Commission before they can be implemented. Thus, within member countries, Regional OPs tend to be relatively unitary, but they can vary substantially (in design and expected outcomes) from country to country.

For example, in Romania, *Priority Axis 4.2 of the Regional OP (ROP)* offers funding (around €200 million for the 2007-2013 planning period) specifically for BFR projects spearheaded by local authorities. *ROP 1.1* offers funding for integrated urban development plans, which can have a BFR component, and *ROP 2.1* offers funding for infrastructure projects that would make a BFR site more attractive. *OP Enhancement*

Structural funds for BFR projects are aimed both at local authorities and private enterprises

*of Economic Competitiveness* provides funding for private enterprises. These can be used by industrial enterprises for remediation projects of their own sites, or could be used by developers for the remediation and redevelopment of A-type brownfields. *OP Environment* offers funding for the rehabilitation of polluted sites (under public ownership) with a high risk for human health and the environment. These funds can be used for inventories and categorizations, expert consultation, project preparation, risk analysis, land ownership cohesion, decontamination and environmental damage removal, infrastructure construction, planting, and best practice exchange.

Several BFR projects in the EU have been completed with **URBAN** financing

*The URBAN Community Initiative* was an instrument encompassed within the EU Cohesion Policy, aimed at the regeneration of urban areas and neighborhoods in crisis. URBAN II was the successor of URBAN, and consisted of 70 programs implemented across the EU between 2001 and 2006, offering €728 million in ERDF money. Local authorities have played a crucial role in implementing those projects, and several BFRs have been completed with URBAN II financing. For the 2007-2013 planning period, the URBAN II initiative was expanded to reflect EU's increased interest in urban areas.

In addition to direct disbursements of funds, the EU has created a series of programs that look to offer non-pecuniary support to urban development projects:

The EU has established a number of **technical assistance and cooperation** programs that have been used to improve knowledge of BFRs

- *URBACT* represents the network of URBAN II projects, established as a platform for cities to exchange information and experience on best-practices in sustainable urban development. *URBACT II* is an extension of URBACT in the 2007-2013 planning period, adding themes of social cohesion, growth, and employment. It receives around €53 million from the ERDF.
- *ESPON* is a program of studies on spatial planning that can offer local authorities a scientific platform for research on territorial development.
- *The INTERREG IV C* programme was launched in 2007 with the aim of facilitating the exchange of experience and best practice between regional and local authorities throughout Europe.<sup>20</sup>

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<sup>20</sup> COVERNET, for example, was established under the auspices of the INTERREG III B Baltic Sea Region programme (2003-2006), enabling 12 countries from the Baltic Sea region and the Czech Republic, to exchange and spread knowledge about their urban regeneration experience. The *Handbook on Redevelopment of Waste and Brownfield Sites* was an INTERREG III C project that brought together the BFR experience of four countries: Poland, the Netherlands, the UK, and Italy. *The Brownfield European Regeneration Initiative* (BERI) is a transnational knowledge sharing network formed under the auspices of INTERREG III C, with partners from different EU cities.

New regulations for the 2007-2013 planning period allow managing authorities of Structural Funds to finance a wide array of public-private partnerships. At the same time, the EU has tried to streamline management procedures of funds earmarked for urban development projects. Thus, Structural Funds can now be used to support financial engineering instruments, such as *holding funds*, *loan funds*, and *sustainable urban development funds*. To facilitate the implementation of these financial engineering instruments a series of initiatives have been launched, of which two -- JESSICA and JASPERS -- have direct application to BFR projects.

JESSICA grants can be used by local authorities in the EU to set up **revolving loan funds** for BFRs

*JESSICA* (Joint European Support for Sustainable Investment in City Areas) is a continuation of the URBAN II efforts, and part of the 2007-2013 policy planning period. It represents an initiative of the European Commission, in cooperation with the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB), to finance urban renewal and development projects through **targeted loan financing**. Within the JESSICA framework, local authorities can leverage resources for PPPs (without affecting public finance and debt), and at the same time they can access the expertise (financial, technical, and managerial) of the EIB and the CEB. Loans can thus be offered to developers, especially in situations in which private lending is not readily available. Local authorities can use JESSICA grants to establish *revolving loan funds*, to be used specifically for BFR projects or, more generally, for urban renewal and development projects.

JASPERS offers assistance for preparation of investment projects requiring EU funding

*JASPERS* (Joint Assistance in Supporting Projects in European Regions) offers assistance to Member States for the 2007-2013 planning period, helping them identify and prepare projects for potential EU funding. It involves a partnership between the European Commission, the EIB, and the European Bank for Reconstruction and Development (EBRD), and targets primarily large projects supported by EU funds. For environmental projects the minimum funding requirement is €25 million.

## Annex 9. Working with the World Bank

The World Bank can provide financial and nonfinancial support to BFR projects

The World Bank (WB) is an international financial institution that aims to i) build an appropriate climate for investment, jobs, and sustainable development, so that economies will grow and welfare will improve, and ii) invest in and empower poor people to participate in development. As such, the WB has engaged in a myriad of development projects all over the world, and is continually looking to employ the latest knowledge and approaches to particular development topics. WB participation in BFR projects can take many forms.<sup>21</sup> Below are outlined some examples and avenues for potential involvement.

WB lending terms are competitive and can help mobilize other co-financing

**Loans** to public sector entities are the main development tool used by the WB, and require an agreement with the country's Ministry of Finance for a sovereign guarantee. IBRD lending terms are competitive (IDA credits are highly concessional), and the presence of a WB loan can help mobilize other co-financing from local or international markets. WB loans are of two basic types: specific investment loans, and development policy loans (quick disbursing budget support for an agreed reform agenda). Both types of loans can be made to central or to subnational government entities.

The WB can provide partial credit and partial risk guarantees

The WB also provides **partial credit guarantees**, which can help reduce the public sector entity's cost of borrowing, and **partial risk guarantees**, to mitigate the political and government performance risk associated with a privately funded project or PPP. Limited **grant funding** is also available through trust funds managed by the WB, especially for capacity building and to promote special innovations. The WB's sister organization, the International Finance Corporation (IFC), provides **equity participation** as well as loans and guarantees to private sector companies, and to public sector entities at the subnational level without a sovereign guarantee.

The WB offers a variety of analytic and advisory services for project development and support

The WB can provide technical advice through project implementation, as well as tailored advice on development issues of importance to the client. **Analytic and Advisory Services** offered by the WB can take many shapes (research, analysis, and technical assistance), and serve both as a platform to help strengthen policy and institutions, and to

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<sup>21</sup> The World Bank Group is an umbrella term for five institutional branches: the International Bank for Reconstruction and Development (**IBRD**), the original institution commonly referred to (and referred to here) as the "World Bank", which makes market-based loans to the public sector; the International Development Association (**IDA**), which provides long term, low interest credits to the poorest countries; the International Finance Corporation (**IFC**), Multilateral Investment Guarantee Agency (**MIGA**) and the International Centre for the Settlement of Investment Disputes (**ICSID**). The branches can provide complementary support to different aspects and partners in investment activities.

The WB has experience in brownfield remediation

assist in the design of sound investments. Analytic and advisory work can be on a grant basis, fee-based (reimbursable technical assistance), or funded through project loans. Such nonlending assistance can, for example, help client governments to prepare policy and institutional reforms, advise on environmental regulations and practices, prepare and structure PPP arrangements, and help in monitoring the execution of PPP contract schemes.

In Romania, the WB has an extensive mine closure program

The World Bank has a number of projects in Europe and Central Asia (completed or under implementation) that deal with brownfield and hotspot remediation (see following table). For example, in **Romania** the WB has an extensive mine closure program, through which 200 of 540 unprofitable mines were slated for thorough environmental cleanup and prepared for alternative economic uses. Remediation measures include: acid water treatment, measures to prevent contamination of subterranean aquifers, permanently sealing all mine openings, preventing gas leakage, demolition of surface buildings and structures, environmental cleanup of surface lands, rehabilitation of waste dumps, collection and treatment of polluted water, and treatment of surface oils.

In Bulgaria, the WB has helped the government remediate past pollution at a large state-owned company

A pilot project in **Bulgaria** helped to develop best-practices for addressing past *environmental damages* and *environmental liabilities* in the process of privatization. In particular, the project supported the Government of Bulgaria in remediating past pollution and improving environmental management practices at a large state-owned company – the MDK Copper Smelter. These activities were expected to facilitate private investment in the company and positively impact the future environmental performance of the plant.

KE Kosovo is working with the WB to remediate contamination related to dumping of ashes

The Energy Corporation of **Kosovo** (KEK) is working with the World Bank to remediate contamination related to dumping of ashes, and free up land for community development purposes. In addition, the WB is helping the KEK build capacity for continued clean-up and environmental good practice in mining operations.

In Azerbaijan, the WB has helped perform site assessments on polluted land surrounding the capital Baku

Site assessments conducted under the auspices of a World Bank project in the Absheron Peninsula (**Azerbaijan**), indicated that contamination (primarily oil pollution) around the capital Baku poses serious constraints to the future development of the country's main urban center. As can be seen in the figure below, the city of Baku is surrounded by a ring of pollution, and many communities reside very close or directly next to contaminated land. Remediating existing brownfields is therefore an imperative – both for environmental and social reasons as well as economic reasons, since the population of the city along with its economy are expanding fast and new housing, office, industrial spaces are needed.

Figure 23. Polluted Land on Absheron Peninsula (Azerbaijan)



The WB is supporting an urban renewal project in Rijeka, Croatia

In the coastal city of Rijeka (Croatia), the Second Rijeka Gateway Project is supporting the integration of port development, connections to road corridors, and enhancement of the city waterfront as one project starting from 2009. A component of the project is helping to facilitate urban renewal as conceived in the city’s master plan, by enabling the relocation of port storage activities from a choice waterfront site, thereby freeing the land for public and/or commercial uses.

## Annex 9 (continued): World Bank Brownfield/Hotspot Remediation Projects in Europe and Central Asia

Country/Location	World Bank Lending Instrument	Other Financiers	Project Name	Key Issues	Impl
Albania/Montenegro	\$4.55 million IBRD	\$ 4.55 million GEF, \$15.21 from Other Sources	Albania/Montenegro Lake Skhoder Integrated Facility(P084605)	Remediation of hazardous site in the vicinity of KAP Aluminium Plant in Podgorics (Montenegro); red mud and other waste issues.	Minis (Alba Touri
Azerbaijan	\$20 million IDA	Government of Azerbaijan	Urgent Investment Loan (P055155)	Soil remediation - Mercury Contamination	Com
Bulgaria	\$16 million IBRD	MDK Company	Environmental Remediation Pilot Project (P033965)	Stabilization of waste lagoon at MDK copper smelter; disposal of contaminated soil and waste; improve slag tailings and storage; rehabilitate old slag dump.	MDK
Bulgaria	\$50 million IBRD Policy Adjustment Loan		Environment and Privatization Support Adjustment (P052927)	Policy reforms to integrate environment issues into privatization and accelerate implementation of EU IPPC Directive	Minis and V
Croatia	\$122.5 million IBRD	\$5.8 million Government of Croatia	Rijeka Gateway Project II (P102365)	Shifting port activities to new areas and converting freed space into urban areas.	Port
Kazakhstan	\$40 million IBRD	\$27 million Government	Nura River Cleanup (P059803)	Cleanup of mercury contamination in river; strengthening water monitoring; support water resources planning	State Water
Kazakhstan	\$24 million IBRD	\$15.8 million Government	UST-Kamengorsk Environmental Remediation	Remediation of air, water, and soil contamination from heavy industry including toxic heavy metals	Minis
Kosovo	\$5 million IDA Grant		Clean-up and Land Reclamation Project	Remediation of Ash storage; soil remediation at Coal Gasification Site	Energ Kos
Kyrgyz Republic	Linked to larger IDA Disaster Prevention Project	\$1.0 million GEF	Hazard Mitigation	Remediation/containment of uranium tailings ponds; improve soil and water monitoring capacity	Minis Emer
Moldova	\$6.35 million GEF Grant-POPs	\$3.7 million Government of Moldova	POPs Stockpiles Management and Destruction (P090037)	Demonstration of safe packaging and storage of obsolete pesticides and PCBs; institutional capacity building	Minis Natu
Romania	\$120 million IBRD	\$29.6 million Government	Mine Closure, Environment and Socioeconomic (P087807)	Environmental remediation of closed mines	Minis Com
Romania	\$150 million IBRD	\$46 million Government; \$5 million GEF	Hazard Mitigation (P075163)	Containment and Remediation of industrial operations with potential for spills or release of hazardous substances to river catchment areas	Minis and V

IDA - International Development Association

IBRD - International Bank for Reconstruction and Development

## Annex 10. BFR Examples

### Bristol, Harbourside (UK)



Harbourside has a fragmented ownership structure, but benefits from a good location

Bristol Harbourside is made up of 22.7 hectares of idled and underused warehouses, railway yards, and industrial facilities. The site is situated in a prime location in the heart of the city, and is owned by the Bristol City Council, British Gas Properties, Lloyds Bank, and other smaller leaseholders. Despite the existent contamination on the site, it was considered to be of critical importance to the future sustainable development of the city. Thus, starting in 1975, when commercial activity in the port stopped, the City Council in partnership with a number of vested stakeholders, took on the remediation and redevelopment of the area.

Brownfields data in the UK is collected and managed by a central agency

#### Data Collection and Evaluation

Redeveloping brownfields requires that adequate data is available for the site – if for no other reason, than to know that the site is actually a brownfield. In England, data on brownfields was assembled and managed at the national level by English Partnerships (*The National Land Use Database of Previously Developed Land and Buildings – NLUD-PDL*), and its duties have been recently taken over by another central agency – Communities and Local Government (CLG). According to a recent report published by CLG, there were 152 hectares of brownfield land in Bristol, in 2007.

Local authorities in Bristol realized that a participatory approach to redevelopment was crucial for the success of the project

The Bristol City Council worked closely with English Partnerships not only on building and maintaining the brownfields database, but also on remediating and redeveloping some of its derelict and underused sites – Harbourside included. Throughout the process, local authorities realized that a participatory approach, and active engagement of vested stakeholders, was crucial to the hoped success of the project. One of the first challenges they faced was bringing all owners together around a shared vision.

Different owners had different intentions for the site

It was obvious from the start that different owners had different intentions for the parcels they owned, or no intentions at all. Lloyds Bank, for example, was one of the first land holders to start a redevelopment project, and it was interested in increasing the value of its investment by promoting other redevelopment projects around the site. British Rail turned part of the land it owned over to the City Council, and sold part of it speculatively to third parties. This meant that local authorities had to deal with new private interests that were added to the mix – private interests that had to be matched with public interest in the area. Other owners chose to hold on to their sites up to the actual commencement of the redevelopment process, hoping to profit from increased land values (enabled by remediation and redevelopment on adjacent sites). Eventually, the City Council negotiated an agreement with these owners, so it could construct an accurate financial appraisal.

Owners understood early on that they would have more to win by working together, than by competing with each other

Reaching a compromise among all stakeholders required extensive site data collection, to correctly portray potential remediation and redevelopment costs. Thus, thorough site assessment and investigation indicated that cleanup costs would range somewhere between £4 and £10 million. This, coupled with major physical constraints, low residual land values, and the inertia of institutional ownership, lead all owners to understand that the only way they could realize benefits from their land would require them working together.

### **Pre-Feasibility**

It is important to prevent an environment of mutual distrust between the public and private side

Since the redevelopment potential of Harbourside was considered to be substantial, local authorities managed to rally together stakeholders that stood to profit directly or indirectly from new investment in the area. Getting to that point however, required them to dispel a climate of mutual distrust prevalent among many potential investors, and a national perception that the City was difficult to deal with (Bristol was considered a “socialist enclave” in a country dominated by the conservative Thatcher government). Ultimately, the overall boom of the 1980s helped reduce the reticence of private investors, and cooperation with local authorities was soon seen as critical in realizing the full potential of the site.

Public sentiment, on the other side, was more difficult to deal with. The general perception of citizens and local communities was that a prime city site was turned over to greedy, profit-seeking developers. In addition, there was a small community still living on the site, and a number of small businesses still employed people there. Thus, a group of community members and concerned individuals resisted initial Council plans to close the City Docks. In time, this group coagulated in a series of concerted efforts to guard the interests of people living there, and to promote good environmental stewardship. Some of these groups included the Bristol Civic Society, Bristol Visual

Community engagement was crucial for the successful redevelopment of Harbourside

Environmental Group, Clifton and Hotwells Improvement, and they were in turn supported by quasi-professional/commercial interest groups (e.g. City Docks Ventures).

From the start, local authorities realized how important it is to actively engage surrounding communities and different interest groups. Consequently, early accommodations were made for leisure and cultural facilities, which became a central part of redevelopment plans. Minority interests continued to challenge proposed plans, but targeted amendments to those plans managed to avoid major impediments. Furthermore, instead of taking a defensive approach, local authorities decided to engage communities more proactively: through newsletters, permanent exhibitions, information leaflets, on-site signage, school tours, design charrettes, and a “Citizens Panel”. This approach enabled the City Council to reach a consensus with neighborhood groups, and to ultimately garner much broader support.

### Feasibility

To ensure that the site vision would be accomplished, the City Council formed a tight partnership with the other landowners, as well as with other key stakeholders, developers, businesses, operators, and funders. Thus, *The Harbourside Sponsors’ Group* was set-up by the landowners to facilitate a joint Development Framework. A Draft Local Plan was subsequently written (highlighting the socio-economic context of the site, and other planning issues) and the Harbourside Design Forum was put in place to offer advice on urban design and architectural issues.

The development concept took into consideration the opinions, wishes, and idea of community groups and individuals

With this framework in place, a leading developer of sustainable communities was selected – Crest Nicholson. The developer was tasked to come up with an innovative development design that took into consideration the opinions of surrounding communities, and the city citizenry at large. Crest Nicholson also took on the risk of masterplan preparation (which required active community engagement), as well as subsequent design fees. Furthermore, they agreed to deliver certain public benefits within a determined timescale, and to allow landowners to regain their sites if construction was not kept within a certain schedule. In return, they were offered sole development rights.

The developer offered to fund the entire development, including public realm and highway infrastructure, and resorted to private financing for the commercial development component. It also offered to create an endowment fund for the maintenance of the public realm.

National funding enabled the development of public amenities

The City Council offered a series of modest incentives to help the process along. For example, a windfall sum<sup>22</sup> from a lease restructuring was used for minor project groundwork. Also, local public funds were allocated for establishing the development framework, for initiating the project, and for appointing consultants to advise on specific aspects.

Risks associated with remediation work were shared by all landowners

English Partnerships and the National Lottery Fund provided part of the necessary funding for an ambitious non-commercial leisure scheme and for necessary site infrastructure. The rest of the funding was provided by individual landowners (commensurate with the size of their land holding), from land-sale receipts.

The risks associated with the remediation work were shared by all landowners. Thus, British Gas took on remediation planning, as well as the de-commissioning of a gas storage facility. In addition, it provided an Environmental Impact Assessment that was approved by the Environmental Agency and the Local Authority. An Environmental Impact Study was carried out prior to that, to determine development constraints (e.g. site capacities, traffic impact, historic context, socio-economic context, surrounding environment). Remediation work was funded by Secondsite Properties, and costs were to be recuperated from disposal of the site to the developer. The remediation consultants took on liability for the remediated site, and insurance covered the residual risk.

Redevelopment followed best practices in sustainable and innovative design

## Implementation

From the start, the redevelopment was expected to follow best practices in sustainability and innovative construction methods. Early redevelopment projects were focused more on inward investment and job creation, with little attention paid to good design. Having the benefit of the Harbourside Design Forum starting 1994, the City Council looked for advice on good urban design and architectural matters, and developed a design toolkit to ensure consistent design practices.

Ultimately, the redevelopment comprised an entire new quarter, with a variety of uses (housing, office, commercial, entertainment, retail, hotel, and parking), and it led to the creation of an estimated 4,000 new jobs<sup>23</sup>. Sustainable solutions were incorporated in the construction of all buildings, and included best-practices such as: the use of harbor water for cooling, green roofs, sustainable drainage systems, reduced parking levels, and flexible building forms. Best

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<sup>22</sup> At the time, local government regulation required that 50% of money received from land sales to be used for repaying the local authority's debts.

<sup>23</sup> See site post-development in the image above.

practices were applied both for new construction, and for the rehabilitation of buildings that were kept on site.

Several buildings were adapted for new uses rather than being demolished

Thus, a number of structures with architectural merit were not demolished, but adapted for new uses. For example, old warehouses and goods sheds were converted into business and leisure space, while some of the former gas company buildings (although heavily contaminated and derelict) were retained for reuse due to their historical value.

Landmark new buildings were key features of the redevelopment plan

Landmark new buildings added character and distinctiveness to the project, and were key features of the redevelopment plan. Two of these included the Lloyds TSB regional headquarters, and the new waterfront apartment blocks at the Point. Other key features of the masterplan were generous public spaces.

Public spaces created a welcoming environment for all people living in Bristol

Public spaces applied innovative design solutions and were intended to be inviting to the general public. They were designed to give people a sense that a key part of the city center was redeveloped for them too. New public spaces included waterfront walkways, public squares, a new pedestrian bridge, and a new Central Promenade with water features, new trees, lighting features and seating, food kiosks and internet information screens.

Whenever possible, traditional materials were reclaimed from the site and reused for new construction. Other features of the quayside infrastructure (e.g. bollards, railway lines, cranes) were also kept in-situ.

## Tilburg, Volt/Phoenix (The Netherlands)



Tilburg has a large student population and an eclectic and dynamic economy

Several businesses were still active on the Volt/Phoenix site when redevelopment plans were being hashed out

The City of Tilburg has set-up a system for collecting and evaluating site-specific data

Tilburg is a medium-sized city situated in Southern Holland. Dominated by the textile industry up to 1960s, the city has morphed into a business and service center, with a large student population and an eclectic and dynamic economy. Its population of over 200,000 is growing faster than the national average (8.8% as opposed to 4% between 1997 and 2005), and given the high demand for urban space, local authorities have become actively engaged in BFR projects.

The Volt/Phoenix is one of those BFR projects. Occupying around 11 hectares close to the city center, the site housed an industrial complex owned by Philips. After the electronics giant ceased activity there, the site remained idle for 10 years. Subsequently, space was leased out to a host of private and non-profit entities. At the time redevelopment plans were being formulated, several entities were operating on the site: storage companies, small shops, a go-kart center, and small start-ups.

### Data Collection and Evaluation

To promote and encourage the redevelopment of brownfields, the City of Tilburg has set-up a complex system for integrating environmental themes into spatial plans. The tools thus developed enabled the collection and evaluation of site-specific data, and sped-up the decision-making process. These include: the Environmental Profile Process; the Sustainable Building Tool (GPR); and, the Industrial Estate Atlas.

The Environmental Profile Process makes use of a GIS application for collecting environmental data on brownfield sites. The data thus collected is then discussed among specialists from different fields, and challenges and priorities are identified. Priorities are defined based on six major environmental themes (water, energy, material-use, waste,

health, and living quality), and are organized into a matrix. The matrix also includes stated ambitions and appropriate actions, an overview of identified indicators, and links to the Sustainable Building Tool (GPR).

The GPR is a software package that uses the six major environmental themes and data input from previous examples to provide suggestions for sustainable and innovative practices in building design. It is meant to offer planners, developers, and designers a platform for adopting environmentally sustainable development practices.

Data on brownfields is made available to the general public

The Industrial Estate Atlas gathers and organizes GIS data on all the brownfields in Tilburg, and makes that data available to the general public. Site-specific information can be accessed in different formats: printed booklet; digitally accessible reports; and, web-based GIS maps.

In the case of the Volt/Phoenix site, local authorities determined that the redevelopment focus should be on energy efficiency, noise reduction measures, and smart working and living combinations. Thus, new construction would have to score higher on the GPR scale, and specific environmental targets would have to be followed (e.g. sustainable water and energy use).

### **Pre-Feasibility**

The site was considered to have a high redevelopment potential

The interesting thing about the Volt/Phoenix site is that it was, somewhat uncharacteristically, identified as a brownfield even while several firms were still operational there (see image above). Given its prime location and the contamination found on site, the City considered that the area had both a high development potential, and that it would be a priority among city-wide redevelopment projects.

Four City departments are tasked with engaging various groups of stakeholder

However, with the area being an active employer, the City had to make sure to actively engage communities, businesses, and other stakeholders, from the start of the process. To do this, local authorities drew on four city departments. These departments used area-specific strategies to engage different groups of stakeholders. Professional staff working there have built organizational and personal links to stakeholder networks, and can easily reach out to vested interest groups and individuals.

Local public participation regulation encourages active public participation in new developments

In addition to dedicated departments, the City of Tilburg also has a special public participation regulation. According to this regulation, groups and individuals affected by certain development projects have the right to participate in every area of municipal policy. The mayor and the alderman usually reach out to concerned members of the public and invite them to actively participate in the planning process.

Community ideas can generate adequate solutions to unique problems

Invited stakeholders are provided with information on the project, and the information itself is conveyed in an easy-to-understand and engaging way. The idea is to both give communities a voice, and to generate bottom-up innovative ideas for the redevelopment. These ideas can not only lead to a higher acceptance of the project by surrounding communities, but they can generate adequate solutions to unique problems, as all BFR project are inherently different and require somewhat tailored approaches.

A Communication Plan sets out the City's communication strategy with vested stakeholders

For larger BFR projects, the City puts together a Communication Plan, detailing the way communication should take place throughout the process. At least every three months, the plan is reviewed and potential new issues are brought to the forefront. The plan details when, where, and with whom the communication should take place (e.g., it identifies target groups and alternatives for engaging them, and sets up a specific communication strategy). It is considered to be complementary to the local public participation regulation.

In a partnership, site owners often have a stronger bargaining power

### **Feasibility**

Since the Volt/Phoenix site was considered to be a top priority for the City, initial plans reserved a budget for land acquisition. However, negotiations fell through with the landowner, and the site ended up being sold to a private investor – KDO Vastgoedontwikkeling. KDO realized that the redevelopment of the site would be much easier with the City on its side, but it also knew that it would have a stronger bargaining power if it fully owned the land.

Local authorities changed their strategy accordingly, and worked with KDO on forming a PPP. The investor was initially hesitant, as it saw a PPP as being overly restrictive. Consequently, an agreement was signed between the two sides, with a series of concessions being made for local authorities. One of the provisions included in the agreement required that part of the land now owned by KDO would become public space (upon redevelopment), and be transferred for maintenance and upkeep to the City of Tilburg.

The PPP approach emulated a model used in Nantes, France

As the process moved along, circumstances changed, and the two parties ended up taking a more participatory approach. This entailed the developer becoming part of the REVIT consortium (a network of European cities that received EU funding for knowledge sharing, under the auspices of INTERREG III B), and committing to a larger investment than originally planned. The PPP approach that was ultimately adopted emulated a model used in the redevelopment of another REVIT site (Ile de Nantes in France). The knowledge and experience shared through the REVIT network increased project efficiency and allowed for speedier decision-making. REVIT also generated funding that allowed involved parties to reduce financial risk.

Local authorities have established themselves as valuable partners for the developer

By generating local and outside funding, by bringing in expertise, and by making the planning process easier, local authorities have established themselves as valuable partners for the developers. They were also crucial in enabling the project to move at a steady pace, and to have a more public friendly face. Also, despite not having ownership of the site itself, the City pushed for the adoption of a series of sustainable development practices (e.g. adaptive reuse of historical buildings and integration within surrounding neighborhood).

The Dutch Soil Protection Act sets remediation standards

### Implementation

Remediation of the Volt/Phoenix site started shortly after the PPP approach and risk assignment were determined. Clean-up work followed standards set in the Dutch Soil Protection Act, with soil quality being restored to its original state. Site assessment and investigation costs were covered by the locality, while actual remediation costs were covered by the developer.

The City pushed for the adaptive reuse of a series of industrial heritage buildings

Construction costs fell also on the private investor, but a series of technical feasibility studies were contracted by the City. These studies have created a platform for the renovation of industrial heritage buildings found on the site. The first improvement of this kind was the conversion of a former monastery into residential space and a park. The former Academy of Journalism was also renovated and turned into office space.

People in the community helped monitor the project

Buildings without inherent heritage value were demolished, and redevelopment of new spaces began. In a first stage, new housing and innovative working areas were created. These developments were complemented by new site infrastructure and underground parking, and upon leasing they generated cash-flow for the project coffers.

Throughout the construction process, people in the old Broekhaven neighborhood (which surrounded the site) were actively involved, and were called upon to help monitor the project as cleanup and construction began.



**Brownfields** can be understood as sites that: “have been affected by the former uses of the sites and surrounding lands; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban area; and require intervention to bring them back to beneficial use”. Their redevelopment is particularly *attractive* because:

- sites are often situated in *strategic locations*, within cities that have demand for new housing/office/commercial space;
- they can stimulate *new fiscal revenue-generating activities* on previously unproductive land;
- they can lead to the *eradication of urban blight and upgrading of the local neighborhood*;
- the projects involve *cleanup and remediation* of existent pollution and the achievement of higher environmental standards;
- they can *reduce demand for new greenfield development*;
- they can *take advantage of existing infrastructure* (roads, rail, public transit, water, sewage, electricity, etc.).

In sum, brownfields redevelopment can contribute to a healthier urban economy, employment generation, stronger communities, and a sustainable local environment.



**Europe and Central Asia Region**  
Sustainable Development Department