

Sustainable regeneration of European brownfield sites

G. Pahlen & S. Glöckner

Montan-Grundstücksgesellschaft mbH, Germany

Abstract

Brownfield regeneration combines the three pillars of sustainable development like hardly any other field of application: economically, by generating development and employment in often deprived urban areas; environmentally, by remediating environmental hazards of the industrial past and saving previously undeveloped open space; socially, by bringing new life to urban areas, offering new opportunities for the communities and generating pride and identification with neighbourhoods, cities and regions. Thus, brownfield regeneration is a key element of sustainable urban development.

Despite this general consensus about the positive impacts of brownfield regeneration on sustainable development, the elements which constitute sustainable brownfield regeneration itself are not so clear: Which requirements do brownfield projects have to meet to be sustainable? Which practices and tools can help to meet these requirements?

The European RTD project RESCUE, Regeneration of European Sites in Cities and Urban Environments, for the first time integrates the principles of sustainability into brownfield regeneration, defining criteria for the sustainable regeneration of industrial brownfield sites in Europe. This paper outlines the content, objectives and intermediate results of RESCUE.

Keywords: brownfield regeneration, sustainable development, urban regeneration, sustainable brownfield regeneration.

1 Brownfield regeneration and sustainable development

The process of industrial change has resulted in the creation of so-called “brownfields” across Europe - particularly in urban and industrialised areas. Brownfield sites represent the heritage of the prosperous phase of



industrial activities. They are in many cases an integral part of a city's structure, instantly affecting the quality of urban life. The problems generated by brownfield sites are manifold: Brownfields are derelict or underused, they have in many cases real or perceived contamination problems, present adverse effects on the quality of urban life and need intervention from outside to be brought back to beneficial use respectively be reintegrated into the economic cycle. Additionally, as they are generated by changing industrial patterns, brownfield sites are coupled with a severe loss of jobs and, as a corollary of this, with the decline of the affected urban quarters and even whole cities. In this context, brownfield sites also have negative impacts on the economic and social situation of the affected regions.

Despite the presence of brownfield sites in often central locations, the development of greenfield sites is ongoing, leading to urban sprawl as a common phenomenon throughout many European regions. The problems generated by urban sprawl are manifold as well: Soil and other often finite natural resources are consumed, bigger distances between home, work and leisure raise traffic volumes, the traditional core cities lose jobs, population, tax income and are often left with bad urban quality. In this context, the reintegration of brownfield sites into the spatial and economic structures is one of the essential elements of sustainable urban development.

But developing brownfield land is a complex issue. In addition to the above mentioned economic, ecologic and social dimensions of the brownfield problem, it also means dealing with the different interests of a variety of stakeholders, including regulators, investors, land owners, developers, consultants, academics, community groups, technology providers and the financial sector. To achieve the potential benefits brownfield regeneration offers for sustainable development, both criteria for sustainable brownfield regeneration in itself and tools to tackle the complex facets of brownfield regeneration in a well balanced manner are needed.

2 The RESCUE project

Started in March 2002, the RESCUE consortium comprises 14 partner institutions from France, Germany, Poland and the UK, representing a wide range of different stakeholder interests and competences in brownfield regeneration. Based on eight case studies in six industrial core regions in France (Nord-Pas de Calais), Germany (Ruhr Area, South of Leipzig Region), Poland (Silesia) and the UK (Derbyshire, Tyne and Wear), RESCUE analyses strengths and weaknesses of the current practice in brownfield regeneration and develops tools for the practical work of real estate owners, planners, architects, engineers and public authorities involved in the complex processes of brownfield projects. The results and findings of RESCUE will be included into an integrated approach which will be presented in the "Manual of sustainable brownfield regeneration in Europe". For further information, please see the RESCUE webpage at www.rescue-europe.com.



3 Criteria for sustainable brownfield regeneration

To realize the full potential brownfield regeneration offers for sustainable urban development, the parameters that influence the degree of sustainability within brownfield regeneration itself have to be developed and understood: Which requirements have to be met by brownfield projects to be regarded as “sustainable”? Which parameters qualify “sustainable” brownfield regeneration processes? Answers on these questions are required by all decision makers striving for sustainable brownfield regeneration, comprising both private developers, local authorities / other regulatory bodies and funding institutions.

To find answers on these questions, RESCUE for the first time elaborated a definition for “sustainable brownfield regeneration”: “Sustainable Brownfield Regeneration is the management, rehabilitation and return to beneficial use of brownfield land in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations in environmentally sensitive, economically viable, institutionally robust and socially acceptable ways within the particular regional context.” [2].

This still very broad and general definition was further specified to mayor fields of work within brownfield regeneration, defining sustainability objectives for the

- management of contamination and the reuse of soil and debris;
- management of existing buildings and infrastructures;
- land use and urban design on brownfield sites;
- planning processes and methods for citizen participation; and the
- management of brownfield projects.

The following sustainability objectives have been elaborated by RESCUE, representing criteria that have to be met by sustainable brownfield regeneration projects.

3.1 Sustainability criteria for the management of contamination and the reuse of soil and debris

3.1.1 To reduce negative environmental impacts on the site and on the neighbourhood including human health risks

An important objective of a sustainable brownfield development is to improve the environmental situation on the site and in the neighbourhood affected by the site. The environmental amelioration can have a wide range of effects. One of the most direct coherence with the environmental situation is to the health and well being of humans as well as to animals and plants. Harmful substances or noise on or from the site can be a serious threat for human health and can lead to a deterioration of the natural environment.

3.1.2 To minimise waste and maximise recycling and reuse of soil and debris

An important objective of sustainable brownfield regeneration is to apply waste re-use strategies, as suggested by European and International decisions at many



conferences & summits. Most EU countries have adopted such strategies nationally for all waste streams, although the effort on soil re-use is more intensive in countries where soil is seen as a resource/asset rather than a discard/waste. The use of the 'waste hierarchy' decision tool is generally common through Europe. Minimisation of construction and demolition waste (C&D waste) by means of good recycling techniques will speed up the process of brownfield redevelopment, as long as there are no threats to health & safety due to hazardous waste. However, hazardous waste may also be dealt with in the locality (by encapsulation or immobilisation), and therefore reduce external disturbances and risks.

3.1.3 To ensure cost effectiveness and technical feasibility

The handling of the contamination on a brownfield is a typical showcase of balancing sustainability aspects as the amendment of the ecological situation is strongly intertwined with the economical burden (i.e. costs), which depends on the efficiency of the remediation approach. Also a reasonable approach of reusing soil and debris (contaminated or not) can affect considerably the economical and ecological balance of the site development. Experiences have shown [3] that the economical aspect of a project itself is a crucial issue deciding if a brownfield will be redeveloped (and cleaned up) or not.

3.1.4 To improve social acceptance through identification of all stakeholders and risk communication

A good communication is essential to keep the public informed during the different steps of the redevelopment of the site (planning, characterisation, remediation, etc.) and to gather input from their reaction in order to match the regeneration process. The community is concerned not only with the benefits associated with redevelopment (reduction of risk to public health) but also by any potential impact encountered during the restoration process. The social acceptance will highly be related to the manner the risk is presented, interpreted and the level of trust the public places in the project actors. This good communication is a key point for the sustainability of the project.

3.1.5 To provide decision support tools for risk based land management

The use of tools which provide a time- and cost- efficient way for coming to the right decisions in brownfield development proved to be helpful for brownfield projects. Based on well-tried devices and experiences, some of them - e.g. as a kind of expert system - can also be an important help to prevent wrong or inefficient decisions. Using electronic data processing, these tools can also facilitate to manage, communicate and distribute relevant data. Such tools are available for a large range of tasks like risk assessment, process management, technical / economical optimisation or the management, concise presentation and visualisation of data. An objective for sustainable brownfield development is not only the use of available tools but also its intelligent application



3.2 Sustainability criteria for the management of existing buildings and infrastructures

3.2.1 To minimise energy demand and produce renewable energy on the site

The consumption of energy is a major aspect in the context of sustainable development. As existing (heritage) buildings on brownfield sites often do not comply with modern energy standards, energy related aspects are often obstacles for reusing these buildings in a sustainable way. Sustainable brownfield projects therefore have to pay special attention to the consumption of energy.

3.2.2 To minimise water demand and reduce wastewater production

The regeneration of brownfield sites is a process which required a full control of water demands and its consumption. The principles of sustainable water management are related to water conservation. In this context, a sustainable reuse of existing buildings has to take into consideration opportunities to minimise the water demand of the buildings and thus also to reduce the production of waste water.

3.2.3 To minimise waste generation from buildings and civil infrastructure (optimising recycling and reuse)

The minimisation of waste generation is requested by the principles of sustainability. Increasing land prices and reduced availability of suitable disposal option on the site make waste generated from buildings costly and difficult to handle. Therefore, applying recycling techniques should reduce the costs of the redevelopment process. A sustainable waste management on the site has to include the overall reduction of waste, an improved recycling of waste and the avoidance of the hazards to the environment and human health.

3.2.4 To promote cultural and regional identity by industrial heritage

Existing buildings on brownfield sites, often of great architectural value, are constituents of the urban fabric which have great impact on the identity of the citizens. Due to this, sustainable brownfield regeneration projects have to handle this industrial heritage with care, trying reuse existing buildings as far as possible to promote a sense of identity throughout the communities affected by the project.

3.2.5 To find better ways to comply with health and safety regulations for reused buildings and infrastructures

Buildings on brownfield sites have been constructed for purposes different from the intended follow-up uses. Thus it is often difficult to adapt them to modern health and safety standards. This requires innovative ideas to both preserve the heritage value of the buildings and, at the same time, to comply with health and safety regulation.



3.3 Sustainability criteria for land use and urban design on brownfield sites

3.3.1 To promote land use functions that match regional socio-economic demands and needs

In sustainable brownfield regeneration projects, the intended land use function fits into its general context and matches the demands and needs of the respective region. The overall aim of this is to avoid not used / underused developments and to promote developments from which the region benefits. In other words, a sustainable land use function has to be justified by a sufficient demand.

3.3.2 To integrate the reuse of brownfield sites into a regional land management

The long-term success of implementing a resource saving spatial development that gives preference to the regeneration of brownfield sites is crucially depending on a consequent management of spatial development, including the prevention of a surplus supply of development land. In this context, the integration of brownfield regeneration into a *regional land management* is a prerequisite for a resource saving spatial development. 'Regional land management' stands for a coherent and regionally agreed spatial development strategy, indicating where / on which sites which kind of development should take place. Regional land management is a complex task which has to integrate the monitoring, planning and implementation of regional development (and especially brownfield redevelopment) into a systematic approach. Sustainable brownfield projects have to comply with the land management systems which are implemented in the respective regions.

3.3.3 To integrate the reuse of brownfield sites into the urban development

Looking at the level of urban development, this objective aims at promoting a stable and balanced urban structure of different compatible uses, especially short distances between home, work and leisure. Mixed structures cannot only contribute to the reduction of mobility demands. They can also have positive effects on the socio-economic stability and the quality of life within urban areas. As mono-functional urban structures are mainly a result of market processes and legal regulations (protection against immissions), mixed urban structures are often hard to be defended or achieved [4, 5] Due to this, the redevelopment of brownfield sites should follow an integrated urban development strategy or, in other words, it has to fit into the respective social, economical, cultural and architectural urban fabric.

3.3.4 To achieve benefits for and prevent adverse impacts on the local neighbourhood

In the process of deciding upon a suitable land use for a site, it is necessary to consider the local neighbourhood. Sustainability in this context means to define a suitable land use function that enables social, economic and ecological benefits and synergies both for the site itself and the local neighbourhood. Similarly this means to exclude unsustainable or intolerable land uses in order to prevent negative and adverse impacts on the site's neighbourhood.



3.3.5 To generate and safeguard employment and economic development

As brownfield sites are coupled with a severe loss of jobs in the affected regions, their regeneration should provide as many long term jobs as possible in the given regional context. Planning a commercial / industrial land use, the developer / planner should set the stages for the settlement of commercial branches and companies that fit into the regional economic profile and strategy. In the pursuit of sustainability, not only the number of jobs is an important parameter, but also their structure, thus the economic sector the jobs belong to and the qualification which is necessary to do them.

3.3.6 To promote land use functions that suit the natural and man-made environment of the site and its neighbourhood

Land use functions on brownfield sites do not only have to fit into the socio-economic context, but they have to suit the site's natural and man-made preconditions as well. To be sustainable, the future land use function has to refer to possible contamination, existing buildings and infrastructures, the site's topography, (ground-)water conditions, existing green areas and valuable biotopes on the site. In this context, a thorough assessment of the site's natural and man-made potentials and restrictions is essential for the definition of sustainable land use functions.

3.3.7 To save resources

Saving resources is an important contribution to sustainable development. In the context of urban design several issues such as space, energy, water building material have to be addressed.

3.3.8 To increase the permeability of former brownfield sites

As brownfield sites were often 'forbidden land' and not accessible for the public, they were barriers between urban districts for a long time. In order to solve this urban problem the sites should be made accessible for the public and neighbouring city districts should be connected.

3.3.9 To provide access for all means of transport

The sites must be made accessible for all means of transport in adequate measure (car, public transport, bike, foot, air, ferry, etc.) in order to open the planned land use for all population groups and abilities. From a social point of view, accessibility means to encourage not only the main mobile part of the population but also disabled persons to make use of the site. From an economical perspective, opening the site for all population groups improves the chances to market the site by attracting as many potential consumers as possible.

3.3.10 To achieve high urban design quality

It is not easy to assess urban design quality using scientific, quantitative criteria to prove its sustainability. Nevertheless, architecture, urban and landscape design can be addressed in terms of fitting into existing urban structures, having regard to save the environment, creating a convenient neighbourhood, keeping resp. setting an identity and saving the cultural heritage. As a part of sustainable



brownfield redevelopment, this objective assumes not only the idea of saving and conserving the existing urban structures. It includes particularly and necessarily the change and the task to create new suitable urban structures with high quality of the design.

3.3.11 To create and maintain flexibility and flexible urban design

This objective considers primarily the factor ‘time’. Against the background of the fast moving social and commercial development, planning and construction have to respond in a strategic way. In order to avoid the quick demolish the old / build new approach, which consumes a lot of resources and thus is most likely to be unsustainable, it is necessary to anticipate the fast moving development in advance in urban design and architecture. Flexibility in land use and architectural concepts can offer opportunities to react on future changes in the demand.

3.4 Sustainability criteria for planning processes and methods for citizen participation

3.4.1 To obtain a better quality of the information itself

The quality of information plays an essential part in the social acceptability of results in a decision-making process: A choice is acceptable if it is explained, well-argued and understood, and if stakeholders who will be impacted on have the power to question and improve it. Thus, brownfield regeneration projects require a high quality of information and communication to be sustainable.

3.4.2 To obtain a better quality of the information flow inside the decision-making process and a more efficient use of information

Information usually is distributed asymmetrically, which gives informed stakeholders advantages in negotiations. The mode how information asymmetries are used have an impact on the decision finding process and on the acceptability of results by all involved stakeholders. To achieve sustainable results it is obligatory to use information advantages in a fair and open manner. Therefore, it is necessary to create transparency, to allow access to relevant information for all stakeholders, and to establish agreed mechanisms for information transfer.

3.4.3 To have a fairer discussion process and a better resolution of conflicts

Stakeholders’ participation to the decision-making process can improve the management of conflicts because in this case, agreement is preferred to conflict. Cooperation is likely to lead to new solutions, more satisfying for all actors. If stakeholders’ participation starts early in the decision-making process, it can be very fruitful in terms of solving conflicts and contradictions: more open attitudes and pro-active behaviours can be expected, the risk of conflictive situations (effective or potential) decreases; then all the conditions are gathered to avoid to come to a standstill.

3.4.4 To increase the legitimacy of the decision-making process

Traditional “top-down” approaches often lead to a lack of legitimacy: The decision-making process seems to be “seized” by public authorities and experts.



Participative approaches enable stakeholders to perceive if an aspect or a dimension of the project is relevant or not relevant, if the decision-making process is equal or not for them: that is the reason why legitimacy is not only a matter of final result, i.e. the decision itself, but pervades the whole decision-making process. Legitimacy should be conceived as an ideal shape of the decision-making process; a relevant participative approach contributes to reach this quality particularly because it enlightens the illegitimate aspects in the project or the situation. Improved awareness of the legitimacy and equity of the process is a key-step in the social acceptability of the results.

3.4.5 To improve the efficiency of the process in terms of duration and costs

During participatory processes all stakeholders are learning. For the later steps and / or new projects the costs of decision finding will be reduced due to more appropriate solutions, better knowledge about procedures, people being empowered and educated with democratic know how, an increased legitimacy and the chance to accelerate some steps in the process. An important means to improve the efficiency of decision finding is a target orientated procedure. This requires clearly defined objectives, a well structured process, neutral presentation and mediation.

3.4.6 To empower citizens, especially those representing non-organised interests

Empowering means abolishing citizens' feelings of impotence and alienation, producing a civic competence, a "democratic know-how" and reinforcing the global legitimacy of the political system, by developing democratic practices and citizens' involvement in public life.

3.4.7 To delegate responsibility to lower decision level and to stimulate a sense of ownership

Citizen participation calls not only for the allocation of new resources to the local level and their efficient use by the citizens, the concept also demands to fulfil certain duties. The concept of citizen participation aims at involving lower levels into the decision making process and to delegate responsibility to these levels according to the subsidiary principle. Further, it aims to create a sense of ownership among those who take part in the decision making process. This, finally, strengthens the identification of the stakeholders with the process and leads to more appropriate results.

3.5 Sustainability criteria for the management of brownfield projects

3.5.1 To adopt an interdisciplinary project team approach

The regeneration of brownfield sites is a complex process, which consists of a multitude of activities, which involve a diverse team of individuals working within different organisational boundaries. This complexity requires a skilful integration, communication and co-ordination with all project members as one of the most important factors for a successful brownfield regeneration.



3.5.2 To facilitate efficient project delivery

Brownfield redevelopment projects are complex, multi-phase and multi-disciplinary. Efficient project delivery requires special skills, in excess of those normally demanded by routine construction projects. Project control must be exercised from a foundation of understanding of the known factors, with enough flexibility to manage the unexpected factors. All of this expertise must be encompassed within an overall vision of a holistic project that delivers the components of sustainable brownfield redevelopment.

3.5.3 To promote and manage stakeholders participation

Due to the multitude of activities that affect a great number of differing interests and intentions, stakeholder participation is a crucial factor for successful sustainable brownfield regeneration; it raises the acceptance of and satisfaction with the project and assists a smooth project delivery. The task of a brownfield management is to ensure the consideration of all these aspects and to co-ordinate the degree and time of involvement depending on the different phases the brownfield project is in. A strategy for the involvement of stakeholders has to be integrated into the project management plan / quality assurance and quality control procedures plan.

3.5.4 To provide a framework for transparency in decisions, flow of information and improved communication structures

Project managers occupy a unique position within any multi-stakeholder brownfield redevelopment project team. They have the best access to data and information, they co-ordinate the entire process and their role is to deliver the redeveloped “product” to the pre-determined qualities and quantities. The matrix of decisions that are necessary to enable integrated project delivery can have profound impacts on individual or collective stakeholder interests. It is therefore essential that the decisions are demonstrably defensible and justifiable and that the corridors of stakeholder communication are opened, maintained, and utilised to an appropriate extent, frequency and quality.

3.5.5 To protect human health and safety during field work

The adherence to safety regulations on brownfield building sites helps to improve sanitary aspects and safety for the people working on the site and to prevent accidents and work-related health threats as well as to guarantee a trouble-free building process. The identification of risks at an early stage enables the responsible people and assigned companies to plan safety and sanity.

3.5.6 To adopt an approach that integrates social, economical and environmental aspects

The inherent complexity of the brownfield redevelopment process requires an integrated approach to tackle all dimensions of sustainability in a well balanced manner.



4 Conclusions

RESCUE for the first time integrates the principles of sustainability into brownfield regeneration as a particular field of application. In this context, RESCUE identified criteria for sustainable brownfield regeneration projects which are intended to offer support to decision makers such as regulators, policy makers, public administration and government authorities, investors, land owners and developers, consultants, academics, community groups, technology providers and the financial sector.

Furthermore, RESCUE will provide best practice tools for specific tasks in brownfield regeneration which are designed to achieve these sustainability criteria. These tools will finally be developed into an integrated system approach and presented in the "Manual for sustainable brownfield regeneration in Europe". By means of this, RESCUE intends to improve the quality of brownfield regeneration in terms of the sustainability of the built environment and the quality of urban life.

In addition, RESCUE will provide guidance for brownfield policy and funding, including a Sustainability Assessment Tool. The purpose of this tool is to provide funding institutions and other actors with an instrument for the ex-ante assessment and mid-term evaluation of brownfield regeneration projects in terms of sustainability. Moreover, RESCUE will also develop a Virtual Training Centre as an web based training resource for brownfield regeneration.

Acknowledgements

RESCUE is a research project supported by the European Commission under the 5th Framework Programme contributing to the implementation of Key Action no 4: "The city of tomorrow and cultural heritage" within the "Energy, Environment and Sustainable Development" programme [1]. The financial support of the Commission is gratefully acknowledged. The work presented in this paper represents the combined efforts of all of the project partners. This distribution of workloads and the contributions of all the RESCUE partners is highlighted and fully acknowledged, with thanks.

The paper is presented by MGG Montangrundstücksgesellschaft as the project coordinator on behalf of the RESCUE consortium, in particular its editorial board with the following partners:

Mr. Jürgen Brüggemann, MGG Montan-Grundstücksgesellschaft mbH, Essen, Germany, rescue@mgg.de; Mr. Detlef Grimski, Umweltbundesamt / Federal Environmental Agency, Berlin, Germany, detlef.grimski@uba.de; Dr. Claus Kogelheide, Ruhr-Universität Bochum - ZEFIR Zentrum für interdisziplinäre Ruhrgebietsforschung, Bochum, Germany, claus.kogelheide@ruhr-uni-bochum.de; Dr. Uwe Ferber, Projektgruppe Stadt + Entwicklung, Ferber, Graumann und Partner, Leipzig, Germany, info@projektstadt.de; Mr. David Edwards, ExSite Projects, Leeds, United Kingdom, exSite@btinternet.com; Dr. Paul Nathanail, University of Nottingham, Scheme - School of chemical environmental & mining engineering, Nottingham,



United Kingdom, paul.nathanail@nottingham.ac.uk; Prof. Hywel Thomas, University of Wales Cardiff, Geoenvironmental Research Centre, Cardiff, United Kingdom, ThomasHR@cardiff.ac.uk; Mr. Yves Dhau-Decuypere, MBM - Mission Bassin Minier Nord-Pas de Calais, Oignies, France, ydhau@missionbassinminier.org; Mr. François Blanchard, BRGM – Bureau de Recherches Géologiques et Minières, Environment and Process Division Orléans, France, f.blanchard@brgm.fr; Prof. Isam Shahrour, Université des Sciences et Technologies de Lille, Laboratoire de Sédimentologie et Géodynamique, Villeneuve D'Ascq, France, isam.shahrour@eudil.fr; Dr. Włodzimierz Sokol, CMI Central Mining Institute, National Centre for Implementation of Cleaner Production, Katowice, Poland, w.sokol@wfosigw.katowice.pl; Mr. Artur Komor, Municipality of Bytom, Department of Strategy, Foreign Cooperation and Promotion, Bytom, Poland, euro@um.bytom.pl; Mrs. Iwona Balinska, Municipality of Sosnowiec, Office of City Promotion and International Cooperatio, Sosnowiec, Poland, bpz.fundusze@um.sosnowiec.pl.

References

- [1] European Commission, Energy, environment and sustainable development, <http://www.cordis.lu/eesd/>.
- [2] RESCUE Work Package 1, *Development of an Analytical Sustainability Framework for the Context of Brownfield Regeneration in France, Germany, Poland and the United Kingdom*, Project Deliverable, 2003.
- [3] Umweltbundesamt, *Handlungsempfehlungen für ein effektives Flächenrecycling*, Berlin, 1999; http://www.umweltbundesamt.de/altlast/web1/deutsch/3_1_1.htm.
- [4] Sieverts, T., *Zwischenstadt*, Braunschweig, pp.45ff, 1997.
- [5] Hall, P. & Pfeiffer, U., Urban 21. *Der Expertenbericht zur Zukunft der Städte*, Stuttgart, pp. 429ff, 2000.
- [6] Ferber, U. & Grimski, D., *Brownfields and redevelopment of urban areas*, Austrian Federal Environment Agency, 2002 on behalf of CLARINET, available on <http://www.clarinet.at>.
- [7] Ferber, U. & Grimski, D. & Pahlen, G., *RESCUE – Sustainable regeneration of brownfield sites in cities and urban environments*, Conference Proceedings ConSoil 2003.
- [8] Millar, K. & Lowe, J. & Grimski, D. & Nathanail, P. & Ferber, U., *CABERNET: Enhancing European opportunities for sustainable brownfield regeneration*, Conference Proceedings ConSoil 2003.

