Brown to Green: Sustainable Redevelopment of America's Brownfield Sites

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Executive Summary

The very nature of brownfields revitalization, with its emphasis on infill development, pollution prevention, and environmental remediation, is well suited to advance creative experimentation with sustainable reuse initiatives. Sustainable brownfields redevelopment techniques have the potential to realize substantial energy savings, attain cleaner water, bring about the restoration of ecosystems, and increase diverse economic service and production efficiencies. Initiatives such as the construction of green buildings and alternative building approaches (*e.g.*, green roofs or permeable parking lots), incorporation of green infrastructure and environmentally conscious landscape design, planning for natural open spaces and parks, adoption of water-recycling techniques, and renewable energy systems can all be significant aspects of brownfield reuse projects.

However, perceived higher building costs, antiquated construction codes, and a tradition of water-diverting "greyscape" engineering practices still stand as hurdles to institutionalizing sustainable development. Even though dozens of brownfields reuse projects throughout the United States have demonstrated exemplary strides in environmentally sensitive construction, there is still a need to promote the advancement of sustainable redevelopment.

There is also a need and room for further experimentation and implementation of sustainable and green methodologies: in the construction field, in ecosystem restoration, in stormwater management and water quality improvements, and in the creation of renewable energy sources. With effective policies and appropriate incentives, our nation's brownfields can be transformed from environmental threats to environmental saviors. Great work on the sustainable redevelopment of brownfields is already being done throughout the United States, but that work needs to continue and grow.

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Introduction

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Model Green/Energy-Efficient Buildings

According to a U.S. Department of Energy survey in 2003, the United States had over 4.9 million commercial buildings and 107 million housing units in 2001. The Energy Department also reported in 2003 that our country's millions of structures use 12 percent of the nation's fresh water supply, 88 percent of the potable water, 40 percent of raw materials, 37 percent of all energy, and 68 percent of all electricity (USDOE 1999, 2003; Wedding and Crawford-Brown 2007). In short, America's buildings are taking a toll on the environment. On the other hand, the use of infill brownfields redevelopment coupled with energy-efficient, "green" building design presents a huge opportunity to make larger strides in increasing the sustainability of the built environment.

Successful "Brown-to-Green" Projects in the Built Environment

When walking along the newly constructed neighborhood of South Waterfront in Portland, Oregon, a passerby may hardly take notice of one of the buildings clad with inconspicuous rows of sunshades. To most, the architectural detailing appears to be only a series of awnings for south-facing residents. These awnings, however, are actually a mini-power station—a series of solar panels that are so advanced, on a building so efficient, that they generate more energy than the 16-story building can consume. The solar panels are married to a trombe wall—a sun-facing wall built from material that acts as a thermal mass, which combines with an air space to form a large solar thermal collector (Wikipedia 2001). The solar panels and 6,000-square-foot trombe wall generate approximately 60,000 kWh of electricity and save 36 tons of CO_2 emissions from

entering the atmosphere each year. The building and most of its neighbors in the South Waterfront development are topped with vegetated "eco-roofs," and laced throughout the subdivision is a sequence of landscaped swales engineered to capture and slowly remediate stormwater before entering the nearby Willamette River (South Waterfront 2007). This idyllic "green neighborhood" is Portland's idea of a brownfield reborn.

Portland is not alone in embracing sustainable building concepts in large-scale brownfields redevelopment efforts. In Milwaukee—the heart of mid-America's former manufacturing industry—local officials, citizen partnerships, and developers have teamed up to bring back the region's glory, but this time, the area's former tinge of soot and rust will instead be a nice shade of sustainable green. On the edge of Milwaukee city limits, developers are aiming to restore 200 acres of former industrial land with a massive sustainable building project. Buildings on the site will comply with the Sustainable Design Guidelines set forth by the City of Milwaukee and Menomonee Valley Partnership (MVP) to promote energy-efficient "green" facilities. The redevelopment, coined "Milwaukee Road," will include 70 acres of greenspace designed to help re-establish the area's pre-industrial ecosystems and protect the location from further environmental damage. In addition to considering environmental aspects, developers will contribute to the community and economy by selling parcels to companies offering the most family-supportive jobs -- jobs that entail high wages and health benefits. Upon completion, city officials estimate 1,830 new jobs will be created.

As in Portland and Milwaukee, brownfields stakeholders nationwide have acknowledged the impact buildings have on the environment and are beginning to demonstrate creativity and passionate environmental stewardship in the redevelopment of former commercial and industrial buildings. For example, in the previously mentioned Portland South Waterfront project, the emissions savings of the "sunshade" building are equivalent to taking 407 cars off the road (South Waterfront 2007). Only a few years ago, the former brownfield site was not only a blighted wasteland on the edge of the city, but also an environmental threat to the adjacent Willamette River. Today, the former industrial site is a hip mixed-use development boasting cutting-edge energy-efficient buildings and engineered landscapes that self-remediate 90 percent of the site's stormwater in natural, "bio-retention" cells.

Sustainable brownfields reuse projects have been around for several years. Montgomery Park, an early reuse success story in Baltimore, Maryland, transformed a 1.2 million-square-foot urban eyesore into one of the most environmentally friendly office buildings in the region. The green building attributes include 75 percent waste minimization during the deconstruction/construction phase, 50 percent savings in energy cost, 33 percent savings in lighting cost (day lighting sensors, low-mercury fluorescent bulbs), 50 percent reduction in stormwater runoff, low water and rainwater recycling bathroom fixtures, a green vegetative roof, zero/low VOC sealants, and workstations containing mostly recycled and sustainable materials and 100 percent recycled carpet (Nishida 2002). Today, Montgomery Park is workplace for thousands of Baltimore area residents. Tenants include the Maryland Department of the Environment, Maryland Lottery, M&T Bank, and others.

In New York, developers are making the connection between affordable housing, brownfields reuse, and park space. As part of the city's affordable housing initiative, a massive brownfield-

to-sustainable-greenfield project is currently underway in the Bronx. A 60,000-acre linear-shaped lot is being transformed into a series of green-roofed, eco-friendly buildings connected by parks and open spaces. The project, coined Via Verde ("green way"), is being designed to include a series of passive, productive, and recreational parks and gardens. These open spaces, open to every unit, provide more than just aesthetic value; the greenery adds insulation and reduces stormwater runoff (Brake 2007) in the dense urban core.

These four sites (South Waterfront, Milwaukee Road, Montgomery Park, and Via Verde) are prime examples of mixed-use developments incorporating numerous aspects of sustainable development. The projects either recycle or naturally remediate stormwater, use energy-saving building designs, and "green-up" former greyscapes. However, in some cases, the best reuse of a brownfield might not be a commercial, residential, or even mixed-use project. The following sections elucidate brownfield opportunities that do not include the construction or remodeling of buildings. Instead, the site itself can become a sustainable energy plant or even a much-needed natural ecosystem with urban zones.

Ecosystem Restoration and Improved Water Quality: Brownfield to Greenfield

Many European and Canadian cities have recognized the importance of recreating natural ecosystems through the "greening" of former industrial sites. In the text *Green Urbanism: Lessons Learned from European Cities,* the author, Timothy Beatley, points out that Vienna has dedicated 50 percent of the city's land area to greenspace, and Zurich about 25 percent. Graz maintains 53 percent of its city land as greenspace (forest and agriculture). Berlin preserves about 10,000 hectares (18 percent of the city) as woodland, and Helsinki crowns an extensive park and woodland system with a massive, 11-kilometer-long, central park that extends from the urban outskirts well into the heart of the city. In Western Europe, greening examples are countless, and a dedication to open space is normal and not limited to a few progressive cities (Beatley 2000).

Beatley points out that historically there has been a notion that things are either *urban* or *natural*. On the contrary, he states, "Cities can be fundamentally greener and more natural… They can, moreover, be re-envisioned to operate and function in natural ways -- they can be restorative, re-nourishing, and replenishing of nature, and in short like natural ecosystems: cities like *forests,* like *prairies*, like *wetlands* (Beatley 2000)." However, the inclusion of natural ecosystems has been an afterthought in most American planning decisions. American cities tend to focus public dollars on brownfield reuse projects that add direct economic benefits, such as job creation or neighborhood gentrification, and not open space projects (De Sousa 2004). Public sector agencies work hand-in-hand with private sector developers to build office complexes, condominiums, and even sports complexes out of brownfield sites, but only a small percentage of vacant industrial lands are converted to greenspace (Mayors 2006).

As previously cited, the reuse of idle land for greenspace is already underway in parts of Europe and Canada. Long before the term "brownfield" became part of planning jargon, European cities have been dedicating or reusing idle land for open space. This helps to account for the extensive open space networks developed over the better part of the last century. In the time since actual brownfield projects have been tracked, European cities have continued to demonstrate a

dedication to brownfield-to-greenfield projects. In a five-year window in Britain (1988 to 1993), the number one end-use for brownfields redevelopment was the creation of greenspace. In that time period, England targeted 37 percent of brownfields projects to sport and recreation uses, and Scotland, between 1993 and 2002, reused 21 percent of its derelict land for passive open space or recreation. In the Netherlands, Dutch officials estimate that 10 to 15 percent of the country's brownfields become greenfields (De Sousa 2004).

Since the North American boom of brownfield reuse projects began nearly 20 years ago, the practice of brownfield-to-greenfield has become routine in many of Canada's industrial cities. Toronto, Canada's largest metropolitan area, has especially replicated the green movement of Europe by converting brownfields to park or passive open space. Much like its European cousins, the City of Toronto has been described as a "city within a park." The city boasts over 8,000 hectares (19,800+ acres) of greenspace dispersed throughout more than 1,500 parks. This greenspace coverage accounts for over 12 percent of Toronto's total urban area (De Sousa 2003).

In recent years, a study by Christopher A. De Sousa of the University of Wisconsin-Milwaukee looked at 14 brownfield-to-greenfield projects in Toronto. These projects generated 614 hectares (1,520 acres) of new greenspace. Additionally, all of the projects De Sousa encountered restored ecological habitat and were located "adjacent to, or within, greenway and floodplain areas" (De Sousa 2003).

The reuse of brownfield sites for greening projects in America is not completely absent. On the contrary, many grassroots movements are forming, and a few municipalities have successfully remediated brownfields solely for aesthetic purposes. In Kansas City, for example, idle industrial lands adjacent to the Missouri River have been turned into a large waterfront park with an extensive pedestrian and bicycle trail system. Known as the Riverfront Heritage Trail Park, the project took $22 million and nearly five years to complete (KCMO 2004), and the end result garnered the Phoenix Award, one of the highest accolades a brownfield project can be awarded. Along with greening a blight-stricken urban nuisance and creating a natural riparian buffer between Kansas City and the Missouri River, the project provides a trail network to promote non-motorized transportation (Amekudzi and Fomunung 2004). The Riverfront Heritage Trail Park project was not about job creation or housing development—instead, the park was created for the purpose of naturalization, aesthetics, and the advancement of an ecological link between urban and natural environments.

At the small grassroots level, groups such as the Parks and People Foundation in Baltimore, Maryland, have embraced urban ecology and uncovered correlations between a greener urban environment and the economic well-being of a city. "Restoring of urban watersheds and natural resources is critical to reversing population decline in urban centers such as Baltimore City as people today seek connections with healthy, clean and green environments." (Terralogos 2005) The group has provided evidence that even very small sites can benefit urban ecology. For example, Parks and People initiated a neighborhood project that converted a vacant city lot into a natural stormwater bio-retention site. If similar methodology were applied on a citywide scale, many sewage overflow problems facing aging cities could be mitigated (Parks and People 2004).

One of the largest brownfield-to-ecosystem restoration projects underway in the country today is taking place on the massive 2,200-acre Fresh Kills Landfill in New York. Considered one of the largest landfills in the world, a 30-year transformation process is underway to create a green jewel in the midst of New York City. Major portions of the new design include a world-class large-scale park, and zones dedicated to restoring ecological systems and cultivating a sustainable landscape. The ecological restoration process will include reclaiming and creating new wetlands, grasslands, and woodlands that will offer habitat for wildlife as well as natural open spaces for park visitors.

Other brownfield-to-greenfield examples are available throughout the country, but the overall percentage of greening projects is very low. Based on a 2003 survey of municipalities, the United States Conference of Mayors estimated that parkland projects accounted for only 422 brownfields redevelopment end uses. For the sake of comparison, the following table highlights brownfields end uses (Mayors 2006):

Table 1: Brownfields end uses reported by U.S. Conference of Mayors

End Uses for Brownfields Redevelopment Projects as of USCM 2003 Survey	
439	Retail projects
14,189	Housing development
3,992	Mixed use projects
520	Commercial projects
422	Park land projects
1,265	Other

Turning Environmental Tragedy into Eco-Opportunity

As strange as it sounds, one-time environment-threatening brownfields can be transformed into the ideal setting for native habitat, ecosystem restoration, stormwater management, and natural filtration systems enhancing nearby water quality. Long viewed as acres of wasteland suitable only for new brick and mortar development and parking lots, brownfields can actually serve to re-introduce ecosystems and biodiversity into urban and suburban landscapes. Brownfields fraught with contaminated soils usually face two remediation paths: either the contaminated soils need to be removed, or the soils need to be capped. In either case, topping the cap or replacing excavated dirt with rich topsoil can be very expensive. Ironically, shallow, often considered generally "poor" soil conditions are ideal for the hardy plants and grasses native to North America.

Throughout the 19th and early 20th centuries, as the United States shifted from an agrarian to a manufacturing and industrial economy, relatively flat, vast grasslands that were usually near water were the most logical and easiest building sites. With every new invention, the population of urban areas exploded, and new construction haphazardly consumed millions of acres of essential prairie and wetlands. For example, in 1920**,** around the time Henry Ford's mass automobile production was taking hold in Michigan, Dearborn was a small, bucolic community with a population just over 2,400. Within 10 years, Dearborn, the world headquarters of Ford Motor Company, grew by an astonishing 1,998 percent to 50,358 (Census 2005)**.** In the wake of

such growth, tens of thousands of acres of acres of grasslands and wetlands were—seemingly overnight—transformed into streets, parking lots, and rooftops. This rapid buildup made it impossible for native plant and wildlife species to adapt, and entire ecosystems were forever destroyed.

Unfortunately, unsustainable construction patterns have been the norm for decades, and the meadows, grassland, and wetlands of the much of the country have been forever altered. However, changes in American industry and labor market shifts, the stuff brownfields are made of, actually present an opportunity to re-establish some of these lost environments. Grasslands, meadows, and wetlands in close proximity to urban areas were, and can once again be, a critical component of biodiversity. For example, the eastern seaboard is one of the most traveled and important flyways in the world for migratory birds, but sprawling land-use patterns of the last century have decimated the grasslands essential to the migrating birds. Re-creating a small grassland environment from a brownfield site in or near an urban area that falls into migration patterns may actually be as crucial, if not more crucial, to bird and wildlife habitat as preserving larger grasslands outside of the flight patterns.

As a second benefit, replacing brownfields with native grasslands helps mitigate stormwater runoff problems—the "flash hydrology"— of today's impervious urban and suburban landscape. Native specie grasslands of the Northeast are able to slowly absorb and naturally filter about 80 percent of stormwater. On the contrary, an impervious parking lot or built-upon brownfield will sheet or divert 95 percent of the stormwater (unfiltered) to the closest river or stream, causing significant water quality degradation.

The benefits of brownfield-to-greenfield don't stop at ecosystem restoration and water quality improvements. The day-to-day quality of life for people is greatly enhanced with increased open space and parklands. Consider the following points about restoring brownfield sites to recreational space, greenways, natural areas, and other community amenities made by the Minnesota Pollution Control Agency (MPCA 2006):

- Stimulates cleanup of contaminated property.
- Improves adjacent water quality by halting polluted runoff and erosion.
- Adds green plants that produce oxygen and consume carbon dioxide, a major contributor to global climate change.
- Unpaved greenspace allows rainfall, snowmelt, and runoff to infiltrate, which helps recharge the groundwater and reduce the adverse impacts of stormwater.

In addition:

- Greenspace helps maintain biodiversity by providing corridors for migrating species and preserving habitat and a broader gene pool.
- Transforming brownfields to greenspace also enhances the quality of life in communities:
    - Increases open space reserves, providing restful breaks from urban noise, pavement, traffic, and stimulation.
    - Removes unattractive blight and safety hazards that detract from livability.
    - Enhances residential property values by providing amenities that draw people to live and work in their communities.

Examples of Brownfield to Park-Space Projects

- Crosby Lake Business Park, St. Paul, MN—Former petroleum tank "farm" of Texaco. The site is 40 acres; 30 acres will be leased by the port for light industrial use. The remaining 10 acres will be open space, managed by the St. Paul Parks and Recreation Department for general public access. (Initial cleanup funding of $1 million came from Texaco and the remaining $6.2 million was raised from port authority bonds(TPL 2006)
- Sixth Avenue and 15th St. Community Garden, NY—A 12,500-square-foot former gas station has been transformed into a community garden on a corner lot in the rapidly developing South Park Slope area of Brooklyn, NY. It is one of the few community gardens developed on private property in New York City. (NYC Department of Sanitation provided clean fill for the site. Anonymous donor providing funding for the Trust for Public Land to purchase the site.) (TPL 2006)
- Columbia River Tire Site, Boston, MA— Former 13,726-square-foot site of a dry cleaner located in a commercial area but adjacent to a community garden. The site is contaminated with four types of polynuclear aromatic hydrocarbons in very low concentration levels. The current plan is to remove and dispose of the 100 to 600 tons of contaminated soil, depending on what is found underneath the building after demolition. The proposed end use is a greenway bordering the Neponset River. (Most of funding provided through the U.S. Environmental Protection Agency (EPA) enforcement action.) (TPL 2006)

Examples of Federal Policy Relevant to Transforming Brownfields into Parks

- Groundwork USA Program: The Groundwork USA program is currently a dual agency program operating under the EPA Brownfields Program and the National Parks Service. Groundwork USA works to improve disadvantaged communities by establishing community trusts that focus on transforming brownfields and vacant lots into parks and green neighborhood assets. The program provides initial funding of $200,000 to selected Groundwork (GW) communities.
    - Example of Groundwork USA Project in 2008: *Manchester Street Park, aka Covanta Site*, Lawrence, MA
      History: The site, a five-plus-acre brownfield, was most recently a municipal incinerator, which has been demolished. It is located on the Spicket River at Stevens Pond.
      Reuse: A signature park is being planned as a link in the Spicket River Greenway.
      Role of GW Lawrence: Project catalyst, advocate and manager, site ownership negotiation, community involvement and outreach, fundraising, pre-development work, including brownfield issues, remediation planning, site design, and construction.
      Partners: State of Massachusetts, City of Lawrence, Covanta Energy, Arlington and Tower Hill Neighborhoods
      Funding: MA Urban River Grant, MA Urban Self Help Grant, Covanta Energy, City of Lawrence, EPA Brownfields Cleanup Grant
      Status: Conceptual plan for park is completed [2008] (Evans 2008)

- Urban Park and Recreation Recovery Program: The Urban Park and Recreation Recovery (UPARR) program was established in November 1978 by Public Law 95-625, authorizing $725 million to provide matching grants and technical assistance to economically distressed urban communities. The purpose of the program is to provide direct federal assistance to urban localities for rehabilitation of critically needed recreation facilities. The law also encourages systematic local planning and commitment to continuing operation and maintenance of recreation programs, sites, and facilities. Only cities and urban counties meeting established criteria are eligible for assistance.
    - Accomplishments: From 1978 through 2002, the UPARR program awarded nearly $272 million for 1,461 grants to 380 local jurisdictions in 43 states, the District of Columbia, and Puerto Rico. UPARR grants provided recreation opportunities for all ages, all ethnic groups, people with and without disabilities, senior citizens to at-risk youth, latchkey children, and young adults. Grants can be used to transform vacant and blighted land.
    - Program Status: UPARR is subject to Congressional appropriations and has not been funded since 2002.

Riverfront Ecosystem Restoration and Park Examples in the United States

River Restoration Projects

Waterfront brownfields are often some of the most difficult, yet most important from an ecological standpoint, to remediate and reclaim. However, many communities have taken or are taking on the challenge. Similar to the Kansas City/Missouri River example discussed in the previous section, along the banks of the Snohomish River in Evert, Washington, a strong link between environmental restoration, park space, *and* economic development is being forged. At a 225-acre industrial zone flanking the Snohomish River, state and local officials have adopted a plan to work with developers to transform over half of the brownfield site (115 acres) into wetlands, parks, and trails. The trail network within the natural area will include bird-watching posts, interpretive signs, and salmon run viewing points. The trails will also tie into the major commercial component of the brownfield reuse project. One hundred ten acres of the site will be dedicated to economic development. The developer is seeking LEED Gold certification on the project, which is planned to include up to one million square feet of retail space, 1,000 units of housing, and a 100-room hotel. As of the time of this research, the developers are in the early stages of construction, but the future of the project promises to be a win for water quality, ecosystem restoration, and the economy.

Other notable projects involving the transformation of waterfront brownfields to restored ecosystems include:

- Cleanup and remediation of stream in New London, Connecticut (as part of Pfizer Corporation redevelopment of a brownfield):
    - The New London Mills site, adjacent to the Shaw's Cove waterfront, was a brownfield site formerly used for various industries, including a printing press manufacturer, an armaments manufacturer, and a linoleum mill. As part of reusing the site, the Pfizer Corporation completed extensive environmental

restoration of the waterfront and created a new public access point to the shoreline.

- Ruddiman Creek dredging (contaminated sediment removal) and shoreline restoration project near Lake Muskegon, Michigan:
    - The Ruddiman Creek watershed covers approximately 5.6 square miles in Muskegon County, Michigan. The three branches of the creek flow into Ruddiman Pond, which is located adjacent to McGraft Park, a popular suburban park. Area residents, including children, play in and around the creek branches and in the pond (Larsen 2001). Great Lakes Legacy Act funds and monies from the Clean Michigan Environmental Bond financed the contaminated sediment dredging, remediation, and restoration of the pond and Ruddiman Creek. Project cost was approximately $13.5 million, and 90,000 cubic yards of contaminated mud were removed (Cannon 2006).

Case Study on Large-scale Ecosystem Restoration: Milltown Dam Removal—Remediation, Restoration, and Redevelopment in Montana

Today, as the Clark Fork River flows through Missoula, Montana, it is nearly impossible to view the stream in summer months and not see an angler casting a dry-fly off the bow of a drift-boat. While manning the oars, the boat's guide need only worry about steering the craft to avoid the flock of kayakers surfing on *Brennan's Wave*—a whitewater park consisting of a set of class III-IV waves.

Floating down the Clark Fork River hasn't always been so easy and enjoyable. *Brennan's Wave* was itself an aquatic brownfield. Just five years ago, the whitewater "Disneyland" for kayaking enthusiasts was a treacherous diversion dam—a concrete and rusted re-bar impediment that made passage at low water levels impossible. Plus, even more significant barriers existed a few miles upstream: two dams completely blocked the waterway at the confluence of the Blackfoot and Clark Fork Rivers. A century ago, in 1908, an electric generating facility—the Milltown Dam—was built on the Clark Fork River to provide power for the growing industrial needs of the Missoula valley. Shortly after, less than a mile upstream from its confluence with the Clark Fork at the Milltown Dam, a major wood mill—the Bonner Mill—dammed the Blackfoot to divert river-transported timber and provide power for the massive lumber producer. The barriers not only made it impossible for recreationalists to freely float either the Blackfoot or the Clark Fork Rivers, but the dams also became a major environmental and ecological threat to an entire region.

The Milltown Dam backed up contaminated sediments emanating from decades of mining activities in western Montana. As a result, 120 miles of the Clark Fork River have been classified as an EPA Superfund site. Behind the dam were approximately 6.6 million cubic yards of contaminated sediments. After decades of buildup, arsenic in the sediments polluted the local drinking water aquifer, and the release of copper in the sediments threatened downstream fish and other aquatic life.

As part of a multi-year effort that included the EPA, state government, environmental science firms, and an outpouring of citizen input, the Bonner Dam has been removed, and a diversion channel has been built around the Milltown Dam. By the winter of 2008, the century-old power

generators and outbuildings had been demolished, and as of the time of this research, the Milltown Dam spillway is being removed.

The industrial cleanup effort upstream from Missoula, a community of roughly 95,000, is a voluminous testament to the "three R's" of successful brownfields work: Remediation, Restoration, and Redevelopment. This innovative cleanup will:

- Remove the Bonner Dam, Milltown Dam, and Milltown Powerhouse;
- Excavate approximately 2.2 million cubic yards of the most highly contaminated sediments in the Milltown Reservoir;
- Restore the Milltown drinking water supply in as little as a decade;
- Allow unrestricted fish passage; and
- Return the Clark Fork and Blackfoot Rivers to a more natural and free-flowing state.

Federal Policy Relevant to Waterfront Restoration Efforts

As of December 2008, there are several federal programs providing funding specifically for waterfront restoration efforts, but none are directly aimed at nationwide remediation and restoration of brownfields located in riparian zones.

Examples of current federal programs for ecosystem restoration along waterfronts:

- The Great Lakes Legacy Act, originally signed into law in 2002 and reauthorized by the 110th Congress in 2008, provides a 65 percent federal match for cleanup and restoration efforts of Great Lakes Areas of Concern located within the United States. The Legacy Act is intended to address contaminants and contaminated sediments in harbor and tributary areas of the Great Lakes basin. In total, 43 Great Lakes Areas of Concern have been indentified in the United States and Canada; 31 are within the United States and qualify for Legacy Act grant funds.
- The Coastal Zone Management Act (CZMA) was passed by Congress in 1972. Congress recognized the importance of meeting the challenge of continued growth in the coastal zone and created a program to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone [including the Great Lakes]." Programs enacted under CZMA are administered by NOAA's Office of Ocean and Coastal Resource Management. Coastal zone enhancement, management, and administrative matching grants are available to coastal states.
    - In the 110th Congress, two bills (HR 5451 and S 1579) were introduced to reauthorize CZMA. The bills did not pass the legislative branch prior to the conclusion of the 110th Congress.
    - Draft legislation is currently being prepared by both the Coastal States Organization and NOAA. These organizations hope to introduce legislation to reauthorize the Coastal Zone Management Act early in 2009. Some of the goals of the draft legislation will be maintaining, restoring, and enhancing habitats and biodiversity; conserving critical areas through land acquisition; and avoiding, minimizing, or mitigating impacts on coastal resources and water quality from development, pollution, nutrient loading, and climate change.
- The NOAA Brownfields/Portfields Pilot Program is a federal interagency effort that focuses on the redevelopment of brownfields in port and harbor areas, with emphasis on development

of environmentally sound port facilities. NOAA and its federal partners assist the designated portfields pilot ports revitalize waterfront areas, improve marine transportation, and protect and restore coastal habitat. Through the NOAA brownfields program, the agency provides technical assistance and grants for cleanup and redevelopment in order to improve public access to the waterfront, protect and restore coastal habitat, and revitalize waterfronts.

- The American Heritage Rivers initiative was enacted in 1997 to provide innovative assistance to riverside communities seeking federal assistance and other resources to meet the unique challenges of riparian restoration projects. The initiative's goal is to "lend a helping hand" to navigating often cumbersome federal programs without placing new regulations on property owners, state, local, and tribal governments.
    - Fourteen rivers have been designated as American Heritage Rivers: Blackstone and Woonasquatucket Rivers (MA, RI); Connecticut River (CT, VT, NH, MA); Cuyahoga River (OH); Detroit River (MI); Hanalei River (HI); Hudson River (NY); Lower Mississippi River (LA, TN); New River (NC, VA, WV); Potomac River (DC, MD, PA, VA, WV); Rio Grande River (TX); St. Johns River (FL); Upper Mississippi River (IA, IL, MN, MO); Upper Susquehanna and Lackawanna Rivers (PA); and Willamette River (OR).

Proposed New Legislation for Waterfront Brownfields

Representative Louise Slaughter (D-NY) introduced legislation in the 110th Congress to create a grant mechanism designed to offset the high costs and the unique ecological circumstances associated with waterfront brownfields. The bill (HR 5469), *"a bill to provide grants for the revitalization of waterfront brownfields,"* proposes the following:

- Amends the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund law) to require the president to establish a grant program for the revitalization of waterfront brownfield sites. Authorizes such grants to be used for reuse planning, site characterization and assessment, or remediation at waterfront brownfields sites, including the integration of activities related to the design and implementation of water quality improvements, low-impact development approaches, green infrastructure, remediation and management of sediments, or flood damage prevention associated with brownfields remediation and reuse.
- Authorizes the EPA Administrator to provide training, research, and technical assistance to individuals and organizations to facilitate waterfront brownfields revitalization.
- Authorizes funding for brownfields revitalization for FY2008-FY2012.
- Requires the EPA Administrator to establish and serve as chairperson of a task force on waterfront brownfields revitalization that shall identify: (1) funding and technical assistance resources; (2) barriers to and solutions for revitalization; and (3) methods to coordinate interagency efforts.

Brownfield Uses for Alternative Energy

Brownfield-to-Wind Farm Case Study

The closing of the Buffalo-area behemoth Bethlehem Steel mill was but another chapter in the city's heart-wrenching story of decline. Once home to 573,000 people and a brilliant testament

to American ingenuity and productivity, Buffalo has lost 55 percent of its population and is burdened with one of the nation's highest rates of abandoned properties and brownfield sites (Glaeser 2007; Belson 2007). When the Bethlehem Steel mill began to shut its doors in Buffalo's neighboring town of Lackawanna, New York, it left behind a blighted Superfund site—80 years worth of iron and steel slag and industrial waste—pock-marking the shores of Lake Erie. However, today site is active again; no longer a giant steel mill, instead, it is home to giants—giant windmills. Six months after the 153-foot blades of the site's eight windmills started turning in 2006, the brownfield was declared clean enough to be removed from the CERCLA/Superfund list.

The American Wind Energy Association reports that wind-generated electricity currently accounts for less than one percent of the electricity produced in the United States—about 25 billion kWh. However, the potential for wind-generated electricity in the United States is estimated at 10,777 billion kWh annually. That is roughly three times the electricity currently generated in the United States today (AWEA 2006). Identifying brownfield sites in areas appropriate for wind-generated power stations throughout the country, as was done in Lackawanna, unites sustainable energy with environmental remediation: another win-win for former industrial regions of the country.

The "Brightfield" Case Study

A brightfield is an abandoned or contaminated property (brownfield) redeveloped to use solar technology. The U.S. Department of Energy created a Brightfields program to enable communities to transform idle, unproductive assets into aesthetically pleasing properties that generate both clean energy and revenue for the community (Ribeiro 2007).

The brightfield concept has been epitomized in Brockton, Massachusetts, a town 25 miles south of Boston perhaps most known for its industrial roots. Near Brockton's downtown lies a 27-acre brownfield site, one of the legacies of former industry. Contamination of the soils called for placement of a relatively shallow membrane cap, which made most redevelopment ideas virtually impossible. Rather than leaving the property lie fallow, the U.S. Department of Energy's Brightfields program helped conceptualize Massachusetts' largest array of photovoltaic cells and the nation's largest brownfield-to-brightfield project. The once barren acreage is now a 425-kilowatt electricity plant that, when compared to conventional fossil fuels, accounts for an annual reduction of 589,570 pounds of carbon dioxide and other emissions (Ribeiro 2007).

Conclusion

Environmentally mindful building products and construction techniques are gaining a foothold nationwide, and brownfield reuse sites have been leading examples of sustainable redevelopment. But there is still room and need for further experimentation and implementation of sustainable and green methodologies: in the construction field, in ecosystem restoration, in stormwater management and water quality improvements, and in the creation of renewable energy sources.

With effective policies and appropriate incentives, our nation's brownfields can be transformed from environmental threats to environmental saviors. Great work on the sustainable redevelopment of brownfields is already being done throughout the United States, but that work

needs to continue and grow. A recent Brookings Institution publication estimated that there are "5 million acres of abandoned industrial sites in cities alone—roughly the same amount of land occupied by 60 of the country's largest cities" (Vey 2007). This acreage does not need to represent urban blight and public health hazards. The millions of acres of brownfields are the opportunity to be the next Brockton Brightfields, Lackawanna Wind Farms, Kill Fields eco-parks, and Portland South Waterfronts.

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